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# ENVIRONMENTAL APPENDIX

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## NORFOLK HARBOR NAVIGATION IMPROVEMENTS MEETING AREA VALIDATION REPORT/ SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT

VIRGINIA

APPENDIX C

2021



U.S. Army Corps  
of Engineers  
Norfolk District



THE PORT OF  
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## Detailed Discussion of Environmental Compliance

### **National Environmental Policy Act of 1969, as amended, 42 U.S.C. 4321 et seq.**

The NEPA requires that all Federal agencies use a systematic, interdisciplinary approach to protect the human environment. NEPA requires the preparation of an EA for those Federal actions that do not cause a significant impact but do not qualify for a categorical exclusion. As previously stated, the USACE focused this SEA on the issues most relevant to the environment and the decision-making process. For a description of the agency, tribal, and public coordination completed to date and information on the NEPA scoping that was completed, please refer to the Section 1.9, Public, Resource Agency, and Tribal Coordination. A 30-day agency, tribal, and public review of the SEA was completed on [INSERT DATE]. All comments/edits have been addressed in the Final SEA and the comment responses are provided in the Final SEA. The Final SEA, including all appendices and supporting documentation, fulfills the requirements of the NEPA for the Norfolk Harbor Validation Study, pursuant to the 40 CFR 1500-1508 NEPA regulations, published in the Federal Register, Volume 85, Number 137, dated July 16, 2020. Upon completion of the Final SEA, which is signified by the signing of the Finding of No Significant Impact, the project will be in full compliance with the NEPA.

### **Clean Water Act**

The USACE will obtain a Water Quality Certification (WQC) from the VDEQ, pursuant to the Clean Water Act (CWA). Per a letter from Mr. David Paylor, Director of the VDEQ, to Colonel Jason Kelly, dated October 2, 2015, the VDEQ does not require a WQC for dredging or overboard disposal, provided a Federal Consistency Determination is obtained pursuant to the CZMA.

This SEA contains sufficient information to demonstrate that the Recommended Plan is in compliance with the CWA. All dredged material placement actions will comply with the Commonwealth of Virginia water quality standards and Commanders Policy WRD-01 which governs operation of CIDMMA. Prior to commencement of construction, dredged material will undergo evaluation procedures including chemical and biological testing in accordance with Federal guidance and regulations to provide information to reach a factual determination concerning Clean Water Act, Section 404 requirements (40 CFR 230.11) and applicable state water quality standards.

### **Federal Coastal Zone Management Act, 16 U.S.C. 1451 et seq.**

The CZMA requires each Federal agency activity performed within or outside the coastal zone (including development projects) that affects land or water use, or natural resources of the coastal zone to be carried out in a manner which is consistent to the maximum extent practicable, i.e. fully consistent, with the enforceable policies of approved state management programs unless full consistency is prohibited by existing law applicable to the Federal agency.

The Virginia Coastal Management Program was established under the guidelines of the national Coastal Zone Management Act (1972) as a state-Federal partnership to comprehensively manage coastal resources. The VDEQ is the designated state coastal management agency and is responsible for the implementation of the state's Coastal Management Program. Implementation includes the direct regulation of impacts to coastal resources within the critical areas of the state including coastal waters, tidelands, beaches and beach dune systems; and indirect certification authority over Federal actions and state permit decisions within the eight coastal counties.

The goals of the Virginia Coastal Management Program are attained by enforcement of the policies of the State as codified within the Virginia Code of Regulations. "Policy" or "policies" of the Virginia Coastal Management Program means the enforceable provisions of present or future applicable statutes of the Commonwealth of Virginia. In accordance with the CZMA, it has been determined that the proposed deepening of the Federal navigation channel would be carried out in a manner that is fully consistent with the enforceable policies of the Virginia CMP (The Federal Consistency Determination with the CZMA is provided in Appendix C). Coordination requesting concurrence with the FCD was submitted to the VDEQ on October 15, 2021.

#### **Clean Air Act, as amended, 42U.S.C. 7401 et seq.**

Following the revocation of the 1997 Ozone NAAQS, the Hampton Roads Intrastate AQCR was in full attainment of all NAAQS. However, based on *South Coast Air Quality Management District v. Environmental Protection Agency*, 882 F. 3d 1138 (D.C. Cir. 2018), AQCRs that were redesignated to attainment (i.e., maintenance areas) for revoked NAAQS are now required to prepare a second maintenance plan. The USEPA has recommended that general conformity procedures be followed for the 1997 NAAQS for Ozone in the Hampton Roads Intrastate AQCR, for which the region was previously in "maintenance." Based upon USEPA's recommendation, USACE prepared a general conformity applicability analysis and a RONA demonstrating that the emissions caused by this project are *de minimis* and will not interfere with the state's plans to attain and maintain national ambient standards for air quality. A general conformity determination is not required. The recommended RONA and the emissions analysis are included in the Environmental Appendix C. By undertaking this general conformity applicability analysis, USACE does not commit to preparing such analyses for future projects in the Hampton Roads Intrastate AQCR.

#### **U.S. Fish and Wildlife Coordination Act, 16 U.S.C.661-666(c)**

Coordination with the U.S. Fish and Wildlife Service and the Commonwealth of Virginia is complete. A Fish and Wildlife Coordination Act Report was prepared by the U.S. Fish and Wildlife Service for the Norfolk Harbor Navigation Improvements GRR/EA in 2018, and the USFWS has provided correspondence that it remains valid for this Supplemental EA and the preparation of a new FWCA Report is not required.

#### **Endangered Species Act, Section 7**

As the previous Biological Opinion completed by NMFS in 2018 addressed the Meeting Area 1 effects to threatened and endangered species and no additional species or critical habitats have been listed in the Action Area since the previous consultation, no additional consultation with NMFS is required for this Validation Study/Supplemental EA.

While the previous informal ESA, Section 7 consultation with the USFWS did address the Meeting Area 1 effects, consultation was reinitiated for the Validation Study/SEA because there were changes in the Official Species List. Informal, ESA Section 7 consultation with the USFWS has been reinitiated and is ongoing. For a description of the ESA, Section 7 Affect Findings, please refer to the Environmental Consequences, Special Status Species Section.

**Magnuson-Stevens Fishery Conservation and Management Act (MSA),  
16 U.S.C.1801 et seq.**

This Act requires Federal action agencies to consult with the NMFS if a proposed action may affect EFH. The Coordination with the NMFS was completed previously for the Norfolk Harbor Navigation Improvements GRR/EA. The EFH listing for this Validation Study/Supplemental EA was less inclusive than the previous one but with similar types of impacts as the dredging methodologies and dredged material placement sites remain unchanged. On October 14, 2021, USACE submitted a re-initiation of consultation request and supplemental EFH information to NMFS for this Validation Study/Supplemental EA, with similar findings as the previous EFH Assessment. Negligible to minor, adverse impacts to some EFH is anticipated, however no impacts are anticipated to substantively impact EFH. Consultation is ongoing.

**Anadromous Fish Conservation Act, 16 U.S.C. 757, et seq.**

The project considered habitat impacts to the anadromous fish listed below in Table 1. USACE coordination with NMFS is ongoing regarding potential impacts to anadromous fish, however the finding is the same as it was for the Norfolk Harbor Navigation Improvements GRR/EA: Mitigation would not be required for the negligible to minor, adverse effects on these species due to water quality changes and/or habitat displacement.

Table 1. Anadromous Fish

<b>Common Name</b>	<b>Scientific Name</b>
Atlantic sturgeon	<i>Acipenser oxyrinchus</i>
Alewife	<i>Alosa pseudoharengus</i>
American shad	<i>Alosa sapidissima</i>
Blueback herring	<i>Alosa aestivalis</i>
Hickory shad	<i>Alosa mediocris</i>
Striped bass	<i>Morone saxatilis</i>
Yellow perch	<i>Perca flavescens</i>

**Marine Mammal Protection Act, 16 U.S.C. 1631 et seq.**

The MMPA prohibits the take of marine mammals including the West Indian manatee, and all cetaceans found in the ROI. The project is being coordinated with USFWS and NMFS. No Incidental Take Authorization from the NMFS is anticipated with implementation of the Preferred Alternative.

**Section 106 and 110(f) of the National Historic Preservation Act, 16 U.S.C. 470 et seq.**

The NHPA of 1966 (as amended) sets federal policy for historic preservation. Section 106 of the NHPA and its implementing regulations at 36 CFR Part 800, require the lead Federal agency to assess the potential effects of an undertaking on historic properties that are within the proposed undertaking's APE. Undertaking means a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license or approval (36 CFR § 800.16(y).) Historic properties are properties listed in or eligible for listing in the National Register of Historic Places (NRHP)

and include prehistoric and historic districts, sites, structures, buildings, or objects. The APE is defined as “the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist” (36 C.F.R. § 800.16(d)).

The USACE evaluated the potential for adverse impacts of the proposed undertaking to archaeological and historic resources. A Programmatic Agreement (PA) was executed in June 2017, that stipulated measures for the identification, NRHP eligibility evaluation, and treatment of historic properties potentially affected by the undertaking. Stipulation IV of the PA states that if changes in the project scope that may alter the APE occur, the USACE shall consult with the State Historic Preservation Officer (SHPO that is Virginia Department of Historic Resources (DHR)) and other consulting parties pursuant to 36 CFR § 800.2 through § 800.5. The proposed Meeting Area 1 was not included in the APE defined by the PA, thus USACE consulted with the SHPO separately for the undertaking. See Section 2.19 for a description of the proposed undertaking.

According to USACE and DHR records, the entire new APE has had previous Phase I archaeological survey using remote sensing. Four areas were identified as potential shipwrecks and recorded as sites 44NR0051, 44NR0053, 44NR0054 and 44NR0055. The NRHP eligibility of the four sites is unevaluated and their locations are confidential per Section 304 of the NHPA. In addition, the eastern extent of the previously recorded DHR Site No. 114-5471 Civil War Battle of Hampton Roads (Battle of the Ironclads) that is potentially eligible for the NRHP for its association with important events in history (Criterion A) is in the western APE. This area is also noted by the National Park Service’s American Battlefield Protection Program as potentially eligible for the NRHP

The four potential shipwreck sites would be avoided by the undertaking, and standard specifications for avoidance would be included in the design plans for 44NR0054 and 44NR0055 that are closest to proposed dredging and associated slopes. Although dredging for Meeting Area 1 could have a visual impact to site 114-5471 with the dredge and equipment, it would be temporary and short-term, and result in no adverse effect per 36 CFR § 800.5(b).

Tribal coordination and consultation with the SHPO are ongoing.

### **Resource Conservation and Recovery Act, as amended, 42 U.S.C. 6901 et seq.**

The Resource Conservation and Recovery Act (RCRA) RCRA controls the management and disposal of hazardous waste. “Hazardous and/or toxic wastes”, classified by the Resource Conservation and Recovery Act (RCRA), are materials that may pose a potential hazard to human health or the environment due to quantity, concentration, chemical characteristics, or physical characteristics.

According to the GRR/EA, in order to determine the dredged material suitability from the Thimble Shoals Channel for placement at DNODS, a marine sediment evaluation was conducted within the channel for at DNODS. It included twelve sampling locations, including USEPA-approved reference sites are located in Willoughby Bank and in the Atlantic Ocean. Testing was completed in 2009 and again in 2014. Surficial sediment was collected at 10 locations west of the CBBT and three locations were sampled east of the CBBT (EA Engineering, Science, and Technology, Inc. 2015b).

Testing in 2009 confirmed LPC compliance for all phases of TSC dredged material including liquid phase, liquid and suspended particulate phase, and solid phase. Dredged material testing

in 2013 indicated that sediments were not significantly different with 2009 findings for physical characteristics and chemical concentrations. As a result USEPA did not request the 2013 data to be evaluated to determine LPC compliance. USEPA concurred that the dredged material was suitable for placement at DNODS for the concurrence period.

Nevertheless, the testing that was completed for Thimble Shoal West (TSC-W), in 2018, indicated that the sediments met the criteria for disposal at NODS or DNODS; and concurrence is valid until July 20, 2022. Therefore, dredging within the ROI of this project is not anticipated to generate material with chemical contamination based on historical testing in the proposed dredged areas and all required testing will be completed in accordance with MPRSA prior to any dredged material placement.

### **Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. 9601 et seq.**

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or Superfund) governs the liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and the cleanup of inactive hazardous substance disposal sites.

There are no CERCLA/Superfund sites bordering or within the ROI for this project.

### **Marine Protection, Research and Sanctuaries Act**

The Act has two essential aims: to regulate intentional ocean disposal of materials, and to authorize any related research. While the MPRSA regulates the ocean dumping of waste and provides for a research program on ocean dumping, it also provides for the designation and regulation of marine sanctuaries.

Ocean dredged material placement is regulated under Section 103 of the Marine Protection Resources and Sanctuaries Act of 1972, Public Law 92-532 (MPRSA). The law states that any proposed placement of dredged material into ocean waters must be evaluated through the use of criteria published by the USEPA in Title 40 of the Code of Federal Regulations, Parts 220-228 (40 CFR 220-228). The primary purpose of Section 103 of the MPRSA is to limit and regulate adverse environmental impacts of ocean placement of dredged material. Dredged material proposed for ocean placement must comply with 40 CFR 220-228 (Ocean Dumping Regulations) and 33 CFR 320-330 and 335-338 (USACE Regulations for discharge of dredged materials into waters of the U.S.) prior to being issued an ocean placement permit. The technical evaluation of potential contaminant-related impacts that may be associated with ocean placement of dredged material is conducted in accordance with 40 CFR 220-228, the Ocean Testing Manual, and the Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore.

All dredged material for ocean disposal sites will be tested for LPC standards as established by the MPRSA. Materials from dredge activities are expected to be placed at DNODS; however materials could be placed at NODS and/or at CIDMMA, depending upon future capacity constraints. All required testing for placement at these authorized locations will be followed and confirmed during PED.

### **Executive Order 11988, Floodplain Management**

This EO states that Federal agencies shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and

to restore and preserve the natural and beneficial values served by floodplains in carrying out agency responsibilities. The proposed project would have only negligible and temporary impacts to the floodplain, due to the potential for dredged material to be placed at Craney Island Dredged Material Management Area (CIDMMA).

#### **Executive Order 11990, Protection of Wetlands**

This EO directs all Federal agencies to minimize the destruction, loss, or degradation of wetlands; and preserve and enhance the natural beneficial values of wetlands in the conduct of the agency's responsibilities. No direct or indirect impacts to jurisdictional wetlands are anticipated with implementation of this project.

#### **Executive Order 13112, Invasive Species**

Under this EO, the introduction of invasive species has been evaluated in Section 6.22. The project would not induce the introduction or spread of invasive species.

#### **Executive Order 12898, Federal Actions to Address Environmental Justice**

In accordance with this EO, the USACE has determined that no group of people would bear a disproportionately high share of adverse environmental consequences resulting from the proposed work.

#### **Executive Order 13045, Protection of Children from Environmental and Safety Risks**

This EO ensures that all Federal actions address the unique vulnerabilities of children. In accordance with this EO, the USACE has determined that no children would bear a disproportionately high share of adverse environmental consequences resulting from the proposed work.

#### **Migratory Bird Treaty Act, 16 U.S.C. 703 et seq.; Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds**

This Act makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations. Temporary to permanent impacts to migratory birds would range from adverse to beneficial effects that would range from a negligible to a minor level of impact.

## Air Emission Estimates

This appendix provides detailed information on the calculations of air emissions associated with the Proposed Action. Conclusions from this analysis can be found in Section 6.11 (Air Quality) of the Supplemental Environmental Assessment.

### 1. Emissions Determination

The Proposed Action would result in air emissions from the operation of propulsion and auxiliary motors of harbor craft vessels for the duration of the project. The type and quantity of emissions depend on each emission source and the time during which the source is operated. Section 1.1 (Emission Sources) lists the assumptions underlying the analysis with regard to source types and duration for each source for the duration of the project. Section 1.2 (Methodology) identifies the methodology used to evaluate the emissions for the different types of sources. Table 1.0 displays the results of the estimated project emissions. The Proposed Action duration is estimated to take approximately two years (17.57 months) to complete the new work dredging of Meeting Area 1 (MA1). Due to seasonal dredging restrictions, the maximum hopper dredging duration per year is 9.51 months for the Proposed Action. Therefore, for this analysis, it is assumed that year one of construction will utilize the maximum duration of 9.51 months, and year two will utilize the remaining 8.05 months to complete the project. It is also assumed that the turtle trawler would operate a maximum of seven days a month on average. This is a single occurrence deepening project with future maintenance events expected to occur every three to four years.

#### 1.1. Emission Sources

**Table 1.0: Year One MA1 Construction Equipment**

Equipment	Engine Horsepower	Engine kW	Operating Hours
Large Hopper Dredge	9000hp Main Engine	6711.3	6961.32
	3000hp Dredge Pump	2237.1	6961.32
	1000hp Auxiliary Engine	745.7	6961.32
Crew Boat	400hp Main Engine	298.28	1863.96
	80hp Auxiliary Equipment	59.656	1863.96
Survey Boat	400hp Main Engine	298.28	1863.96
	80hp Auxiliary Equipment	59.656	1863.96
Turtle Trawler	500hp Main Engine	372.85	798.84
	80hp Auxiliary Equipment	59.656	798.84

**Table 1.1: Year Two MA1 Construction Equipment**

<b>Equipment</b>	<b>Engine Horsepower</b>	<b>Engine kW</b>	<b>Operating Hours</b>
Large Hopper Dredge	9000hp Main Engine	6711.3	5899.92
	3000hp Dredge Pump	2237.1	5899.92
	1000hp Auxiliary Engine	745.7	5899.92
Crew Boat	400hp Main Engine	298.28	1579.76
	80hp Auxiliary Equipment	59.656	1579.76
Survey Boat	400hp Main Engine	298.28	1579.76
	80hp Auxiliary Equipment	59.656	1579.76
Turtle Trawler	500hp Main Engine	372.85	677.04
	80hp Auxiliary Equipment	59.656	677.04

## 1.2. Methodology

### 1.2.1. Equipment Operations and Emissions

The estimates of equipment emissions were developed based on the engine power, engine load factor, estimated hours of usage, and the emission factor for each pollutant based on the United States Environmental Protection Agency’s (USEPA) *Port Emissions Inventory Guidance* (The Guidance) published in September 2020. The Guidance focuses on port-related diesel emissions from various mobile source sectors. The harbor craft source sector was used for this emissions analysis as it is most relevant to the dredging operations of the Proposed Action. The Guidance defines the harbor craft source sector as “...all commercial marine vessels that are not considered in the ocean-going vessels (OGV) sector, such as tugboats and work boats. Unlike OGV, harbor craft typically spend most of their operating time in or near a single port or region” (USEPA 2020).

The engine tier established for the emissions estimates was established utilizing Table B.1 of The Guidance (Category 1 and 2 Engine Tiers). The power range of the harbor craft proposed to complete the Proposed Action were in the range of Engine Tier 4 for the large hopper dredge and Engine Tier 3 for the other equipment listed. Utilizing the Tier 3 and Tier 4 power range of the harbor craft, emission factors for the criteria pollutants were obtained from Table H.7 (Average Harbor Craft Emission Factors by Engine Tier 3 and 4) of The Guidance (USEPA September 2020).

The USEPA recommends the following formula to calculate harbor craft base year emissions from both propulsion and auxiliary engines for each vessel of the Proposed Action (Equation 4.1):

$$E = P \times LF \times A \times EF$$

Where:  $E$  = per vessel emissions (g)  
 $P$  = engine power (kW)  
 $LF$  = engine load factor (unitless)  
 $A$  = engine operating activity (h)  
 $EF$  = emission factor (g/kWh)

Except for the emission factor designated for each criteria pollutant based on Tier 3 and 4 engines, each of the above parameters model a specific emissions source from the Proposed Action and thus changed for each vessel. Table 1.2 show the parameters associated with each vessel and emission factors used to develop the estimated emission inventory for the Proposed Action.

### 1.2.2. Marine Vessel Operations and Emissions

USEPA’s methodologies and default marine vessel input parameters and emissions factors available in The Guidance were used to predict emissions from vessels. The Guidance was used to determine the harbor craft source sector as the classification of the marine vessels used during the dredging activities associated with the Proposed Action. Section 4 of the Guidance, “Harbor Craft” was used to determine the emissions inventory of the Proposed Action.

### 1.2.3. Combined Emissions

The combined emissions per year of the Proposed Action under the Action Alternative (construction of MA1 and ocean disposal at DNODS) are shown in Table 1.3.

The total emissions for the MA1 project under the No Action Alternative (the baseline) were calculated by combining the inventory from the most recent Hampton Roads area reporting criteria emissions inventory from the Virginia Department of Environmental Quality (*VADEQ* 2019). This information is presented in Table 1.4.

The increase in emissions associated with the Action Alternative relative to the No Action Alternative (the baseline) is shown in Table 1.5.

MA1 Validation Study/EA – Air Emission Estimates

	Equipment	Engine HP	Engine kW	Operating Hours	Default Harbor Craft Engine Load Factors (Table 4.4)	Nox	PM10	PM2.5	VOC	CO	CO2	SO2	Pb*
						4.749214	0.082975	0.080486	0.124798	0.918732	679.47	0.006246	1.01E-05
Year 1	Large Hopper Dredge	9000hp Main Engine	6711.3	6961.32	0.66	1.3	0.03	0.0291	0.124798	0.918732	679.47	0.006246	3.64E-06
		3000hp Dredge Pump	2237.1	6961.32	0.66	1.3	0.03	0.0291	0.124798	0.918732	679.47	0.006246	3.64E-06
		1000hp Auxiliary Engine	745.7	6961.32	0.43	4.749214	0.082975	0.080486	0.124798	0.918732	679.47	0.006246	1.01E-05
	Crew Boat	400hp Main Engine	298.28	1863.96	0.45	4.749214	0.082975	0.080486	0.124798	0.918732	679.47	0.006246	1.01E-05
		80hp Auxiliary Equipment	59.656	1863.96	0.43	4.749214	0.082975	0.080486	0.124798	0.918732	679.47	0.006246	1.01E-05
	Survey Boat	400hp Main Engine	298.28	1863.96	0.45	4.749214	0.082975	0.080486	0.124798	0.918732	679.47	0.006246	1.01E-05
		80hp Auxiliary Equipment	59.656	1863.96	0.43	4.749214	0.082975	0.080486	0.124798	0.918732	679.47	0.006246	1.01E-05
	Turtle Trawler	500hp Main Engine	372.85	798.84	0.52	4.749214	0.082975	0.080486	0.124798	0.918732	679.47	0.006246	1.01E-05
		80hp Auxiliary Equipment	59.656	798.84	0.43	4.749214	0.082975	0.080486	0.124798	0.918732	679.47	0.006246	1.01E-05
	Year 2	Large Hopper Dredge	9000hp Main Engine	6711.3	5899.92	0.66	1.3	0.03	0.0291	0.124798	0.918732	679.47	0.006246
3000hp Dredge Pump			2237.1	5899.92	0.66	1.3	0.03	0.0291	0.124798	0.918732	679.47	0.006246	3.64E-06
1000hp Auxiliary Engine			745.7	5899.92	0.43	4.749214	0.082975	0.080486	0.124798	0.918732	679.47	0.006246	1.01E-05
Crew Boat		400hp Main Engine	298.28	1579.76	0.45	4.749214	0.082975	0.080486	0.124798	0.918732	679.47	0.006246	1.01E-05
		80hp Auxiliary Equipment	59.656	1579.76	0.43	4.749214	0.082975	0.080486	0.124798	0.918732	679.47	0.006246	1.01E-05
Survey Boat		400hp Main Engine	298.28	1579.76	0.45	4.749214	0.082975	0.080486	0.124798	0.918732	679.47	0.006246	1.01E-05
		80hp Auxiliary Equipment	59.656	1579.76	0.43	4.749214	0.082975	0.080486	0.124798	0.918732	679.47	0.006246	1.01E-05
Turtle Trawler		500hp Main Engine	372.85	677.04	0.52	4.749214	0.082975	0.080486	0.124798	0.918732	679.47	0.006246	1.01E-05
		80hp Auxiliary Equipment	59.656	677.04	0.43	4.749214	0.082975	0.080486	0.124798	0.918732	679.47	0.006246	1.01E-05

\*Pb= Lead is considered a Hazardous air pollutant (HAP). Emission factors for HAPs are calculated by multiplying the appropriate basis emission factor by the fraction listed in Table D.1.32 of The Guidance. Therefore, the Lead emission factor was calculated by using the basis emission factor of PM2.5 multiplied by the fraction listed in Table D.1.32 (0.000125).

	Equipment	Engine HP	Engine kW	Operating Hours	Per Vessel Emissions (g)	Nox	PM10	PM2.5	VOC	CO	CO2	SO2	Pb*
						40085336.93	925046.24	897294.8	3848131	28328986	20951372220	192594.6	112.16186
Year 1	Large Hopper Dredge	9000hp Main Engine	6711.3	6961.32	13361778.98	308348.75	299098.3	1282710	944295.33	6983790740	64198.21	37.387285	
		3000hp Dredge Pump	2237.1	6961.32	10600978.07	185213	179657.2	278568.4	2050751.51	1516681827	13942.04	22.457146	
		1000hp Auxiliary Engine	745.7	6961.32	1188214.85	20759.672	20136.94	31223.45	229859.3	169997886.9	1562.699	2.5171181	
	Crew Boat	400hp Main Engine	298.28	1863.96	227081.0603	3967.4041	3848.394	43928.6662	5967.148	43928.6662	32488485.05	298.6491	0.4810492
		80hp Auxiliary Equipment	59.656	1863.96	1188214.85	20759.672	20136.94	31223.45	229859.3	169997886.9	1562.699	2.5171181	
	Survey Boat	400hp Main Engine	298.28	1863.96	227081.0603	3967.4041	3848.394	43928.6662	5967.148	43928.6662	32488485.05	298.6491	0.4810492
		80hp Auxiliary Equipment	59.656	1863.96	735561.574	12851.226	12465.73	19328.8	142293.852	105236787.1	967.3848	1.558216	
	Turtle Trawler	500hp Main Engine	372.85	798.84	97320.4544	1700.316	1649.312	2557.349	18826.5712	13923636.45	127.9925	0.206164	
		80hp Auxiliary Equipment	59.656	798.84									
						Year One Maximum Emissions (g)	67711567.83	1482613.7	1438136	5505677	40531429.2	29975977955	275552.9
					Year One Maximum Emissions (lb)	149278.2767	3268.5998	3170.543	12137.92	89356.3994	66085640.52	607.4895	0.3963179
					Year One Maximum Emissions (ton)	74.63913833	1.6342999	1.585272	6.068962	44.6781997	33042.82026	0.303745	0.0001982
Year 2	Large Hopper Dredge	9000hp Main Engine	6711.3	5899.92	33973482.2	784003.44	760483.3	3261402	24009634.8	17756893806	163229.5	95.060417	
		3000hp Dredge Pump	2237.1	5899.92	11324494.07	261334.48	253494.4	1087134	8003211.6	5918964602	54409.84	31.686806	
		1000hp Auxiliary Engine	745.7	5899.92	8984635.461	156973.37	152264.6	236094.8	1738071.21	1285431707	11816.28	19.03308	
	Crew Boat	400hp Main Engine	298.28	1579.76	1007046.445	17594.423	17066.64	26462.78	194812.404	144078124.9	1324.432	2.1333304	
		80hp Auxiliary Equipment	59.656	1579.76	192457.7651	3362.4897	3261.625	5057.33	37230.8149	27534930.54	253.1137	0.4077031	
	Survey Boat	400hp Main Engine	298.28	1579.76	1007046.445	17594.423	17066.64	26462.78	194812.404	144078124.9	1324.432	2.1333304	
		80hp Auxiliary Equipment	59.656	1579.76	192457.7651	3362.4897	3261.625	5057.33	37230.8149	27534930.54	253.1137	0.4077031	
	Turtle Trawler	500hp Main Engine	372.85	677.04	623409.7041	10891.786	10565.06	16381.72	120598.155	89191220.2	819.8866	1.3206331	
		80hp Auxiliary Equipment	59.656	677.04	82481.89931	1441.067	1397.839	2167.427	15956.0635	11800684.52	108.4773	0.1747299	
						Year Two Maximum Emissions (g)	57387511.75	1256558	1218862	4666220	34351558.3	25405508130	233539.1
					Year Two Maximum Emissions (lb)	126517.6561	2770.2328	2687.127	10287.24	75732.1324	56009491.33	514.8649	0.3358909
					Year Two Maximum Emissions (ton)	63.25882807	1.3851164	1.343564	5.143621	37.8660662	28004.74567	0.257432	0.0001679

\*Pb= Lead is considered a Hazardous air pollutant (HAP). Emission factors for HAPs are calculated by multiplying the appropriate basis emission factor by the fraction listed in Table D.1.32 of The Guidance. Therefore, the Lead emission factor was calculated by using the basis emission factor of PM2.5 multiplied by the fraction listed in Table D.1.32 (0.000125).

Criteria Pollutant	NOx	PM10	PM2.5	VOC	CO	SO2
2019 Emissions (tons)	3810.16	1322.85	529.26	3718.33	3237.58	1189.98

Criteria Pollutant	NOx	PM10	PM2.5	VOC	CO	SO2
2019 Emissions (tons)	3810.16	1322.85	529.26	3718.33	3237.58	1189.98
Year 1 Proposed Actions (tons)	74.63914	1.6343	1.585272	6.068962	44.6782	0.303745
Year 1 Net Increase (tons)	3884.799	1324.484	530.8453	3724.399	3282.258	1190.284
Year 2 Proposed Actions (tons)	63.25883	1.385116	1.343564	5.143621	37.86607	0.257432
Year 2 Net Increase (tons)	3873.419	1324.235	530.6036	3723.474	3275.446	1190.237

## 2. Clean Air Act Conformity

The 1990 amendments to the Clean Air Act require Federal Agencies to ensure that their actions conform to the appropriate State Implementation Plan in a nonattainment area. The State Implementation Plan provides for implementation, maintenance, and enforcement of the National Ambient Air Quality Standards (NAAQS); it includes emission limitations and control measures to attain and maintain the NAAQS. Conformity to a State Implementation Plan, as defined in the Clean Air Act, means conformity to the plan’s purpose of reducing the severity and number of violations of the NAAQS to achieve the standards. The federal agency responsible for a Proposed Action is required to determine if its Proposed Action conforms to the applicable State Implementation Plan.

The USEPA has developed two sets of conformity regulations; federal actions are differentiated into transportation projects and non-transportation-related projects:

- Transportation projects, which are governed by the “transportation conformity” regulations (40 C.F.R. Parts 51 and 93), effective on December 27, 1993, and revised on August 15, 1997.
- Non-transportation projects which are governed by the “general conformity” regulations (40 C.F.R. Parts 6, 51 and 93) described in the final rule for *Determining Conformity of General Federal Actions to State or Federal Implementation Plans* published in the *Federal Register* on November 30, 1993. The general conformity rule became effective January 31, 1994 and was revised on March 24, 2010.

Since the Proposed Action evaluated in this EA is not a transportation project, the general conformity regulation applies.

### 2.1. Attainment and Nonattainment Areas

The General Conformity Rule applies to federal actions occurring in air basins designated as nonattainment for the NAAQS or in attainment areas subject to maintenance plans (maintenance areas). Federal actions occurring in air basins that are in attainment with the NAAQS are not subject to the conformity rule. The designation of nonattainment is based on the violations of the NAAQS. Maintenance areas are areas that have been re-designated as

attainment from a previous nonattainment status and have established a maintenance plan with measures to control emissions to ensure the air quality standards are maintained.

There are six criteria pollutants for which the USEPA has established NAAQS: carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), ozone (O<sub>3</sub>), inhalable particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>), and lead (Pb).

Under the Action Alternative, the project area within the Thimble Shoal Federal Navigation Channel is located in the Air Quality Control Region (AQCR) known as Hampton Roads Intrastate ACQR in Virginia (40 CFR 81.93) and is a part of the Norfolk-Virginia Beach-Newport News (Hampton Roads), VA Marginal Maintenance Area for the 1997 ozone NAAQS. The Hampton Roads area is in attainment for all other NAAQS. Although the 1997 ozone standard has been revoked, maintenance areas for that standard must still demonstrate compliance with it for 20 years. This requirement is based on the 2018 South Coast Air Quality Management Region versus EPA Court Decision and subsequent EPA guidance. The Hampton Roads Area was redesignated to attainment for the 1997 ozone NAAQS on June 1, 2007, which would be the point at which the maintenance timeline would start. This includes conducting conformity determinations for projects within those areas, and Hampton Roads is one such area. Therefore, a conformity applicability analysis was completed to estimate the emission totals of the criteria pollutants associated with the Proposed Action.

**2.2. De Minimis Emission Levels**

To focus general conformity requirements on those federal actions with the potential to have significant air quality impacts, threshold (*de minimis*) rates of emissions were established in the final rule. A formal conformity determination is required when the annual net total of direct and indirect emissions of a criteria pollutant or its precursors from a federal action occurring in a nonattainment or maintenance area would equal or exceed the applicable annual *de minimis* level for that pollutant. Table 2.0 shows the *de minimis* threshold levels for each pollutant.

**Table 2.0: Annual *de minimis* Criteria Pollutant Levels for Maintenance Areas**

Pollutant	Maintenance Area Limits (tons/year) 40 CFR 93.153(b)(2)
NOx	100
PM10	100
PM2.5	100
VOC Inside Transport Region / Outside Transport Region	50/100
CO	100
CO2	-
SO2	100
Pb	25

**2.3. Compliance Analysis**

A conformity applicability analysis was conducted for the activity for the Action Alternative according to the guidance provided by 40 CFR Parts 6, 51, and 93, Determining Conformity

of General Federal Actions to State or Federal Implementation Plans, (USEPA 1993 and 2010). The analysis was performed to determine whether a formal conformity analysis would be required.

Pursuant to the General Conformity Rule, all reasonably foreseeable emissions (both direct and indirect) associated with a federal action must be quantified and compared to the applicable annual *de minimis* levels. The conformity analysis must take into account the direct and indirect net emissions from mobile and stationary sources. Direct emissions are emissions of a criteria pollutant or its precursors that are caused or initiated by the federal action and occur at the same time and place as the action. Indirect emissions occur later in time or farther from the action; they must be included in the analysis if the following conditions are met:

- That are caused or initiated by the federal action and originate in the same nonattainment or maintenance area but occur at a different time or place as the action;
- The federal agency can practicably control the emissions and has continuing program responsibility to maintain control;
- The emissions caused by the federal action are reasonably foreseeable;
- For which the agency has continuing program responsibility.

Indirect emissions from this federal action are not reasonably foreseeable, and not controlled by the federal agency. Therefore, indirect emissions were not evaluated for this applicability analysis.

The General Conformity Rule requires that the federal action's emissions be compared with baseline emissions on an annual basis. For this Proposed Action, the No Action Alternative, which would amount to not performing the MA1 construction and subsequent dredged material transport for ocean disposal. Therefore, the most recent calendar year emissions reporting represents the baseline (USEPA December 2020). Table 1.5 of this appendix displays the minimal significance of the potential net increase of criteria pollutant emissions from the Action Alternative to the Hampton Roads Area.

For ozone maintenance areas, *de minimis* levels have been established for both ozone precursors: NO<sub>x</sub> and VOC, on the presumption that NO<sub>x</sub> and VOC reductions will contribute to reductions in O<sub>3</sub> formation. The applicable *de minimis* level is 100 tons per year of NO<sub>x</sub> and VOC, respectively.

Table 2.2 shows the proposed project's net emissions of NO<sub>x</sub> and VOC associated with the Action Alternative based on the estimates detailed in Section 1 (Emissions Determination) of this appendix in accordance to 40 CFR 93.153(b)(2).

**Table 2.2: Project Emissions of NO<sub>x</sub> and VOC**

Project Action	Project Emissions (tons/year)	
	VOC	NO <sub>x</sub>
Year 1 Construction Emissions	6.07	74.64
Year 2 Construction Emissions	5.14	63.26
<i>De Minimis Level</i>	100	100

Based on this analysis of NO<sub>x</sub> and VOC emissions performed in conjunction with the Final Rule of *Determining Conformity of Federal Actions to State or Federal Implementation Plans*, (USEPA 1993 and 2010), the Proposed Action would not require a formal conformity determination. The total net emissions under the Action Alternative show no exceedance of the applicable *de minimis* criteria of 100 tons per year for VOC and NO<sub>x</sub>. Therefore, the Proposed Action would have minimal air quality impacts and would not require a formal conformity determination. A Record of Non-Applicability is included as an Appendix of this Environmental Assessment.

References:

U.S. Environmental Protection Agency. (1993 and 2010). 40 C.F.R. Parts 6, 51, and 93. *Determining conformity of federal actions to state or federal implementation plans*. Federal Register. November 30, 1993. Revisions to Parts 51 and 93 April 5, 2010. Federal Register.

United States Environmental Protection Agency (USEPA) (September 2020). *Ports emissions inventory guidance: methodologies for estimating port-related and goods movement mobile source emissions*. EPA-420-B-20-046.

United States Environmental Protection Agency (USEPA) (December 2020). *General conformity training module 3.2: emissions calculations*. <https://www.epa.gov/general-conformity/general-conformity-training-module-32-emissions-calculations>

Virginia Department of Environmental Quality (VADEQ). (2019). *Annual point source criteria pollutant emissions*. <https://www.deq.virginia.gov/air/air-quality-monitoring-assessments/air-quality-reports>

**Clean Air Act – General Conformity Rule Record of Non-Applicability  
Norfolk Harbor Navigation Improvements Meeting Area Validation Report/Supplemental  
Environmental Assessment, Hampton Roads, Virginia**

Section 176(c) (42 U.S.C. § 7506) of the Clean Air Act (CAA) requires Federal agencies to ensure that emissions from Federal actions will conform to state implementation plans (SIP) designed to maintain an attainment designation for air pollutants as defined by the National Ambient Air Quality Standard (NAAQS). The conformity rule applies to Federal actions which cause emissions in areas designated as nonattainment under Section 107 of the CAA and maintenance areas established under Section 157A of the CAA. The Environmental Protection Agency's (USEPA's) General Conformity Regulations also exempt certain categories of actions from the conformity determination requirement.

The Norfolk Harbor and Channels consists of a network of multiple channel and anchorage elements that provide deep draft access from the Atlantic Ocean into the Port of Virginia. The harbor in which the Port of Virginia is located covers a 25 square-mile area and serves a variety of private marine terminals, state-owned marine terminals, and federal maritime/military facilities located within the cities of Norfolk, Newport News, Portsmouth, Chesapeake, and Hampton in southeastern Virginia.

The purpose of the Norfolk Harbor Navigation Improvements Meeting Areas Project is to improve the operational efficiency of commercial vessels currently using and projected to use the Norfolk Harbor and Channels. The need for this project arises from inefficiencies currently experienced by commercial vessels within the existing Norfolk Harbor and Channels as industry adoption toward larger vessels has necessitated periodic establishment of one-way traffic within channels that normally support two-way traffic.

Updated forecasted fleet inventory and economic data is now available which warrants the reevaluation of expanding the existing, approved meeting area (Meeting Area 2) with an additional meeting area (Meeting Area 1), where two-way traffic of larger vessels can be accommodated. Compared to the forecast used during for the 2018 Norfolk Harbor Navigation Improvements General Reevaluation Report/Environmental Assessment (GRR/EA), ocean carriers have more rapidly transitioned to the ultra large container vessels than the forecast predicted, warranting a reassessment of the of the Meeting Area 1 (MA1).

The Preferred Alternative for the Norfolk Harbor Navigation Improvements Meeting Area Validation Report/Supplemental Environmental Assessment (SEA) consists of constructing and maintaining the MA1 including disposal of the dredged material. The proposed MA1 would consist of a widened area of the Thimble Shoal Channel that is approximately located in a 5.1 mile (statute mile)-long area west of the Chesapeake Bay Bridge Tunnel. The channel widening would consist of dredging 200 additional feet along the north and south channel edges of the existing 1,000 ft wide Thimble Shoal Channel to create a 1,400 ft wide meeting area with a required depth of -56 feet Mean Lower Low Water to accommodate two-way traffic for larger vessels.

Dredged material placement/disposal would be anticipated to typically occur at the Dam Neck Ocean Disposal Site (DNODS) but could also occur at the Craney Island Dredged Material Management Area, the Norfolk Ocean Disposal Site (NODS), and/or upland disposal sites for this project (if needed). The Proposed Action was selected as the Preferred Alternative in accordance with the National Environmental Policy Act of 1969 (NEPA) (42 United States Code [USC] 4331 et seq.), the regulations of the President's Council on Environmental Quality (CEQ) that implement NEPA procedures (40 Code of Federal Regulations [CFR] 1500-1508) as outlined in the Norfolk Harbor Navigation Improvements Meeting Area Validation Report/SEA.

The MA1 project location is on the outward bounds of the Thimble Shoal Federal Navigation Channel which is located in the Air Quality Control Region (AQCR) known as Hampton Roads Intrastate ACQR in Virginia (40 CFR 81.93) and is a part of the Norfolk-Virginia Beach-Newport News (Hampton Roads), VA Marginal Maintenance Area for the 1997 ozone NAAQS. The Hampton Roads area is in attainment for all other NAAQS. Although the 1997 ozone standard was revoked, maintenance areas for that standard must still demonstrate compliance with it for 20 years. This requirement is based on the 2018 South Coast Air Quality Management District versus USEPA and subsequent USEPA interpretation of the decision. The Hampton Roads Area was redesignated to attainment for the 1997 ozone NAAQS on June 1, 2007, the point at which the maintenance timeline started. This includes conducting conformity analyses and potentially air conformity determinations for projects within those areas. Therefore, a conformity applicability analysis was completed to estimate the emission totals of the criteria pollutants associated with the Proposed Action.

The Proposed Action would result in air emissions from the operation of the propulsion motors of harbor craft vessels, as well as auxiliary motors onboard each vessel. The USEPA's *Ports Emissions Inventory Guidance* (published in year 2020) was utilized to estimate the equipment emissions based on the estimated hours of usage and emission factors for each motorized source. Section 6.11 and the Conformity Applicability Analysis (Appendix C) in the Norfolk Harbor Navigations Improvements Meeting Area Validation Report/SEA illustrate the estimated emission totals for each criteria pollutant and describes the methodology used to develop these estimates. The estimates were found to be below *de minimis* threshold levels in accordance to 40 CFR 93.153(b)(2) for maintenance areas, therefore the Action Alternative does not require a formal General Conformity Determination.

The potential direct and indirect emissions from the Norfolk Harbor Navigation Improvements Meeting Area Project were considered, and the following conclusion has been made:

The action is entirely outside of and will not cause any direct or indirect emissions in any nonattainment or maintenance area [see 40 CFR 93.153(b)].

The total direct and indirect emissions are below *de minimis* levels [40 CFR 93.153(c)(1) for the exemption, but for the applicable levels see 40 CFR 93.153(b)(1) for nonattainment areas or 40 CFR 93.153(b)(2) for maintenance areas].

The following *de minimis* exemption to the conformity requirements applies: 40 CFR Part 93.153(c)(2)(ix) "Maintenance dredging and debris disposal where no new depths are required, applicable permits are secured, and disposal will be at an approved disposal site".

The action is on the agency's "presumed to conform" list at: [USEPA regulation describing the "presumed to conform" process see 40 CFR 93.153(f)].

The facility has a facility-wide emissions budget approved by the State as a part of the SIP, and the emissions from the proposed action are within the budget.

To the best of my knowledge the information provided is correct and accurate. I concur in the finding that the proposed action meets the exemptions stated above and thus will conform to the SIP.

11/12/2021

Date

Digitally signed by  
HAMOR, MICHELLE L. 1051765563  
Date: 2021.11.12 16:03:53 -05'00'

Michelle L. Hamor, CFM  
Chief, Planning and Policy Branch

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# **NORFOLK HARBOR NAVIGATION IMPROVEMENTS MEETING AREA VALIDATION STUDY/SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT**

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## **SECTION 404 (b)(1) EVALUATION**

**U.S. Army Corps of Engineers  
Norfolk District  
803 Front Street  
Norfolk, Virginia 23510**

**November 3, 2021**



**U.S. Army Corps  
of Engineers  
Norfolk District**

**SECTION 404 (b) (1) EVALUATION  
NORFOLK HARBOR NAVIGATION IMPROVEMENTS MEETING AREA  
VALIDATION STUDY/SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT, VIRGINIA**

**I. INTRODUCTION**

This report describes how the U.S. Army Corps of Engineers (USACE), the lead federal agency for construction and maintenance of the Norfolk Harbor Navigation Improvements Meeting Area Validation Study/Supplemental Environmental Assessment (EA), will achieve full compliance with Section 404 of the Clean Water Act of 1977 (Public Law 95-217).

The 404(b)(1) guidelines in 40 Code of Federal Regulations (CFR) 230 contain the substantive criteria for evaluation of proposed discharges of dredged or fill material under Section 404. The principle behind the criteria is that no discharge of dredged or fill material is permitted that would result in unacceptable adverse effects to the aquatic ecosystem. Compliance with the guidelines is evaluated by reviewing the proposed discharge with respect to the four restrictions in 40 CFR 230.10. These restrictions state that:

- No discharge shall be permitted if there is a practicable alternative which would have less adverse impacts on the aquatic ecosystem.
- No discharge shall be permitted if it violates state water quality standards, violates toxic effluent standards or prohibitions under Section 307 of Act, or jeopardizes the continued existence of threatened or endangered species as identified under the Endangered Species Act of 1973.
- No discharge shall be permitted which will cause or contribute to the significant degradation of waters of the United States (U.S.).
- No discharge shall be permitted unless appropriate and practicable steps have been taken to minimize potential adverse impacts to the aquatic ecosystem.

**II. PROJECT DESCRIPTION**

**A. Location**

Norfolk Harbor is located in the southeastern portion of the Commonwealth of Virginia at the southern end of the Chesapeake Bay, midway on the Atlantic Seaboard, approximately 170 miles south of Baltimore, Maryland, and 220 miles north of Wilmington, North Carolina. The Harbor is formed by the confluence of the James, Nansemond, and Elizabeth Rivers.

The project occurs on subaqueous land, which is owned by the Commonwealth of Virginia and the Craney Island Dredged Material Management Area (CIDMMA). There is 100 feet of federally owned subaqueous bottom extending from the existing CIDMMA shoreline. CIDMMA is owned and operated by the USACE. A future dredged material placement site, the Craney Island Eastern Expansion (CIEE) will be

initially owned and operated by the USACE. The Virginia Marine Resources Commission manages subaqueous lands in Virginia. The open ocean disposal sites are in federal ownership.

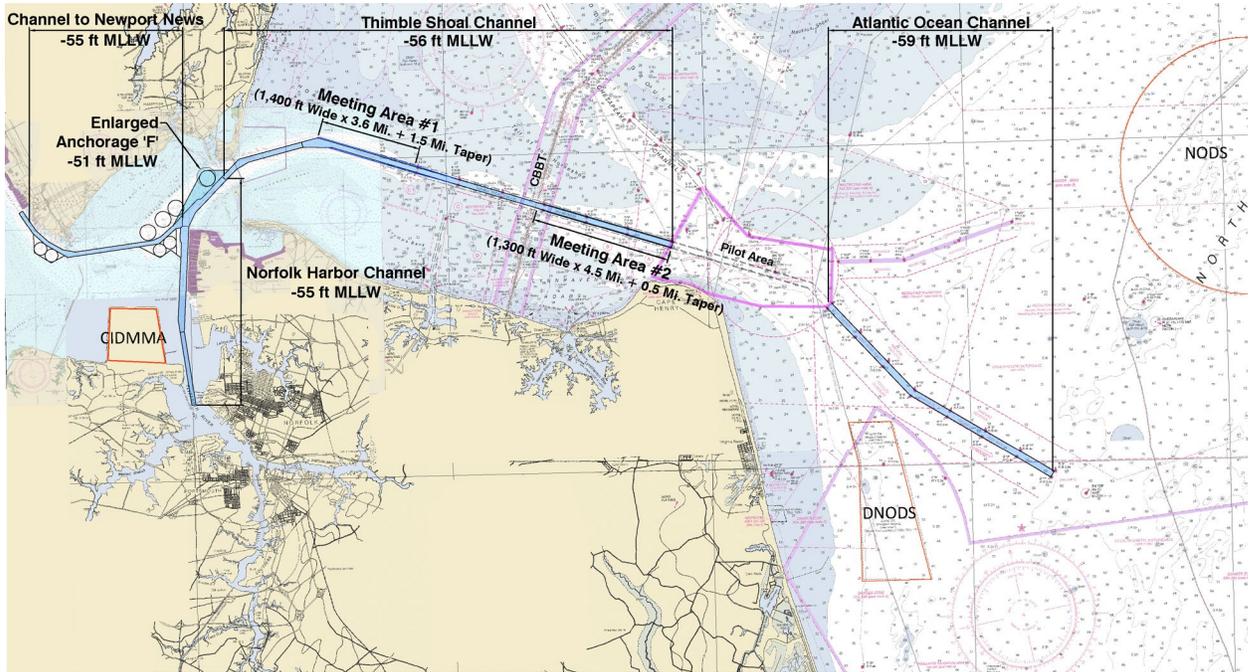


Figure 1. Norfolk Harbor and Channels Project Segments with approved project depths. Miles provided in statute miles.



Figure 2. Meeting Areas at the Thimble Shoal. The previous Norfolk Harbor Navigation Improvements GRR/EA Recommended Plan (Preferred Alternative) only included the Meeting Area 2. With the Norfolk Harbor Validation Study/Supplemental Environmental Assessment, Meeting Area 1 is being proposed as an additional meeting area.

The scope of the Validation Report/Supplemental EA is limited to the dredging of material at the proposed Meeting Area 1 and placement of materials at the CIDMMA (Figure 1; Figure 2).

## **B. Description of Proposed Work**

The Preferred Alternative for the Norfolk Harbor Navigation Improvements Meeting Area Validation Study/Supplemental EA consists of constructing and maintaining the Meeting Area 1 including disposal of the dredged material. The proposed Meeting Area 1 would consist of a widened area of the Thimble Shoal Channels that is approximately located in a 5.1 mile (statute mile)-long area west of the Chesapeake Bay Bridge Tunnel (Figure 1; Figure 2). The channel widening would consist of dredging 200 additional feet along the north and south channel edges of the existing 1,000 ft wide Thimble Shoal Channel to create a 1,400 ft wide meeting area with a required depth of 56 feet to accommodate two way traffic for larger vessels. Existing conditions and geotechnical analyses of the area indicate side slopes of approximately 3H:1V are typical. As final design of the Preferred Alternative is ongoing, features may vary slightly prior to construction.

Dredged material placement/disposal could occur at the CIDMMA, the Dam Neck Ocean Disposal Site (DNODS), the Norfolk Ocean Disposal Site (NODS), and/or upland disposal sites for this project (if needed). It is anticipated that the DNODS placement would likely be the preferred dredged material placement option. While dredged material will be evaluated for beneficial use opportunities, the characteristics of the dredged material in vicinity of the Meeting Area 2 segment historically have not been suitable for typical projects in the region (which are generally seeking more sandier material). Portions of the dredged areas may be suitable for beneficial use projects and beneficial use projects would be coordinated separately from this project. General operation and maintenance of the CIDMMA will continue with or without implementation of the Preferred Alternative.

One important consideration in the impact analysis is that the actual dredged depths can be deeper than the required channel depths. Required depths do not necessarily indicate the maximum, potential dredging depths which may also include Advanced Maintenance Dredging (1 foot), Paid Allowable Overdepth Dredging (2 feet), and Non-Pay Allowable Overdepth dredging (2 feet) for the Norfolk Harbor Project. We refer to required depths throughout the text but in terms of the environmental impact analysis (affect determination), the estimated maximum, potential impact depths and dredging volumes will be used. For Meeting Area 1, a maximum depth of 61 feet was used to reflect these factors.

Dredges used for construction and maintenance of the Preferred Alternative would include hopper dredges, hydraulic cutterhead dredges, as well as mechanical

dredges. Channel bed leveling equipment may also be used to flatten the channel bottom following dredging.

In the future, with or without implementation of the Preferred Alternative, vessel calls are anticipated to increase as compared to current conditions. However, when comparing the future with or without the project, there would be less vessel calls in the future with project as compared to the future without project because the existing, larger ships in the fleet would carry more goods, thus requiring fewer vessel calls to transport the same amount of goods.

Table 1 provides a summary of the approximate maximum dredging volumes and durations with implementation of the Preferred Alternative.

Table 1. Summary of the approximate maximum dredging volumes, and durations with implementation of the Preferred Alternative, Meeting Area 1 based on a maximum depth of 61 feet.

Segment	Required Depth (feet, MLLW)	Estimated Construction					Estimated Maintenance (50 Years)		Estimated Construction and Maintenance (50 Years)	
		Estimated Maximum Depth (feet, MLLW)	Estimated Maximum Dredging Volume- all allowable and nonpay (cubic yards)	Estimated Maximum Dredging Duration (months)	Estimated Total Land Disturbance - Maximum (square feet)	Change/Delta (increase) in Land Disturbance - Maximum (square feet)	Estimated 50 Year Total of Maintenance Volume (cubic yards)	Estimated 50 Year Total - Maintenance Dredging Duration (months)	Estimated Maximum Volume-Total Allowable and Non-pay + Maintenance Volume (cubic yards)	Estimated Maximum Construction + 50-year Maintenance Dredging Duration (months)
Thimble Shoal Channel Meeting Area 1 (5.1 miles that are 200 feet north and south of the existing Thimble Shoal Channel)	-56	-61	6,170,000	18 <sup>A</sup>	11,863,428	11,863,428	2,607,750	36	8,777,750	54

<sup>A</sup>18 months is active dredging duration based on one large hopper dredge being assigned to the project. Duration of work will extend across at least one 2.5 month-long voluntary seasonal dredging restriction that could extend the total duration to approximately 21 months.

Construction is anticipated to begin in approximately 2023 but is contingent on funding availability. Construction of the Meeting Area 1 will take approximately two years to complete. Maintenance dredging is anticipated to occur approximately every three to four years; after the deepening, this may accelerate to every two to three years.

Maintenance dredging may occur on an accelerated schedule based on shoaling conditions in the channel resulting from storm events or a delayed schedule depending on funding availability. Maintenance dredging will take approximately three months to complete and will be contingent on the type and size of the dredge used. Maintenance dredging may occur at any time of the year, however, to the maximum practical extent possible, dredging using a hopper dredge will not occur during September 1 - November 15 to reduce potential impacts to sea turtles.

Dredging operations may be active 24 hours per day, seven days per week, though two to three times per day, a hopper dredge will suspend dredging to transit to the disposal area, which represents a round trip transit time of four to five hours per trip.

The number of future vessel calls to Norfolk Harbor is projected to increase over time due to the projected increase in future cargo tonnage under both without and with-project conditions. The projected amount of future cargo would not be affected by implementation of the project, but the number of projected future vessel calls would be fewer under the with-project condition. Under the with-project condition, the deeper channel would allow some vessels to load more cargo (increasing vessel draft deeper than the existing 47-foot restriction) and would allow for the use of larger vessels.

Currently and under without-project conditions, the largest vessels using Norfolk Harbor require a one-way traffic restriction when transiting. This restriction causes some vessels to be delayed (either waiting at the dock or waiting out at sea) while the large vessel is transiting the channel. After the large vessel has finished its transit, the other vessels can enter the channel. Under with project conditions with a wider channel provided by Meeting Area 1, the one-way restriction would be reduced, resulting in fewer vessel delays.

Dredged material placement at the open ocean disposal sites will not require Section 404 of the Clean Water Act of 1977 concurrence, as it is not under Commonwealth of Virginia jurisdiction. The open ocean disposal sites are regulated under the Marine, Protection, Research and Sanctuaries Act of 1972 (MPRSA) and disposal is regulated through the U.S. Environmental Protection Agency (USEPA).

Dredged material testing is performed to determine its suitability for placement at CIDMMA and to assist with making factual determinations regarding the effect of the dredged material discharge on the aquatic ecosystem and compliance with 404(b)(1) Guidelines. Discharge of return flow (effluent and surface runoff) from a confined disposal facility, such as the CIDMMA, to waters of the U.S. is specifically defined as a dredged material discharge under the Clean Water Act. Dredged material testing is performed to determine its suitability for placement at CIDMMA and to assist with making factual determinations regarding the effect of the dredged material discharge on the aquatic ecosystem and compliance with 404(b)(1) Guidelines. Dredged material testing is performed in accordance with the Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual, Inland Testing Manual (USEPA 1998).

Dredged material meeting sediment testing requirements for placement at the CIDMMA is placed in the Craney Island Rehandling Basin (CIRB) or directly in one of the containment cells at CIDMMA. Material is transported to the placement site by hydraulic pipeline if hydraulically dredged or by barge/scow if mechanically dredged to be bottom dumped in CIRB or directly pumped out into a containment cell at CIDMMA. In the future, after the completion of the construction of the CIEE, some of the dredged material may be placed in this site as well.

On the west side of the CIDMMA, each containment area has two primary spillways, each with four, 36-inch diameter outlet pipes. The pipes discharge effluent from the CIDMMA into the Elizabeth River. The east side is higher in elevation, where material flows downslope to the west, depositing the heaviest particles first. The spillways allow the release of water after the sediments from the dredged material have settled out. In general, under typical pumping operations, it can take up to five days to reach a working pool level with three feet of freeboard. Spillway stop-logs (boards) are used to control water levels during pumping operations. Dredged material placed at CIDMMA is evaluated to determine compliance with CWA Section 404(b)(1) and CDIMMA facility requirements prior to commencement of dredging activities. During dredged material placement operations the effluent (dredged material discharge to waters of the U.S.) is monitored to ensure only clarified effluent is released. The effluent is visually inspected a minimum of six times per day at each operating spillway, approximately once every four hours. Effluent may be discharged whether the contractor is “pumping” or not. If at any time it is visually apparent that effluent other than clarified water is being released from CIDMMA, the effluent Total Suspended Solids is sampled and then immediate action is taken at the spillway to reduce the amount of suspended solids in the effluent by increasing the water retention time. Total Suspended Solids testing in effluent are conducted at a minimum twice daily, approximately every 12-hours at each operating spillway. The testing is to ensure that dredged material placement operations are conducted in a manner to confine solids to the placement site to the maximum extent practicable in accordance with the Commander's Policy WRD-01 for operation of the CIDMMA (USACE 2013).

Dredged material which meets sediment and elutriate testing requirements for placement at the CIDMMA may be placed in the CIRB or directly in one of the containment cells at CIDMMA. Appropriate water column and whole sediment bioassay testing may be conducted based on results of sediment and elutriate chemistry results. Material would be transported to the upland containment cells at CIDMMA by hydraulic pipeline if hydraulically dredged or by barge/scow if mechanically dredged and bottom dumped in CIRB or directly hydraulically off-loaded and pumped into a containment cell at CIDMMA.

The lifecycle of CIDMMA will be determined by the USACE ability to continue to raise containment dikes based on dike foundation strengths while maintaining the required factor of safety for dike stability. Containment dikes are maintained to create additional dredged material storage capacity through the beneficial use of dredged material placed at the CIDMMA. Unimproved perimeter roads are maintained with suitable dredged material to ensure access to the facility for operation and maintenance. Maintenance of the containment dikes and access roads includes the excavation or borrow of dredged material and redeposit of the material to maintain and build the additional containment capacity. Currently, dikes range in height from +35 to +45 Mean Lower Low Water (MLLW). Spillway lifecycles including maintenance and replacement occur as required as containment dikes are raised to accommodate new capacity. Spillway maintenance may require replacement of discharge pipes, outfall structures and associated rip-rap aprons. Containment cells

are actively de-watered of dredged material effluent and runoff to maximize the dredged material drying and consolidation to maximize the life of the facility. The excavation and redeposit of dredged material for containment dike maintenance, dewatering containment cells of dredged material effluent and runoff, and maintenance of spillway structures are considered ongoing maintenance activities which include dredged material discharges at CIDMMA consistent with 40 CFR 232.2(1).

Maintenance of the proposed project will occur over a 50 year project timeline. The project construction is anticipated to begin in 2023 but would be contingent on the availability of federal and nonfederal sponsor funding.

### **C. Authority and Purpose**

Section 201 of the Water Resources Development Act (WRDA) of 1986 (Public Law 99-662) authorized the construction of the 55-foot Norfolk Harbor and Channels, Virginia, Project, as described in House Document 99-85, dated July 18, 1985, entitled “Norfolk Harbor and Channels, Virginia.” The authority states, as follows:

*“The project for navigation, Norfolk Harbor and Channels, Virginia: Report of the Chief of Engineers, dated November 20, 1981, at a total cost of \$551,000,000, with an estimated first Federal cost of \$256,000,000 and an estimated first non-Federal cost of \$295,000,000, including such modifications as the Secretary determines to be necessary and appropriate for mitigation of any damage to fish and wildlife resources resulting from construction, operation, and maintenance of each segment of the proposed project. The Secretary, in conjunction with appropriate Federal, State, and local agencies, shall study the effects that construction, operation, and maintenance of each segment of the proposed project will have on fish and wildlife resources and the need for mitigation of any damage to such resources resulting from such construction, operation, and maintenance.”*

This Norfolk Harbor Navigation Improvements Project is authorized under Section 216 of the Flood Control Act of 1970 (Public Law 91-611), which authorizes the review of completed projects in the interest of navigation and related purposes to determine the feasibility of further port deepening.

The WRDA 2018 further authorized additional modifications to the Thimble Shoal Channel Widening that were detailed in the “Report to Congress on Future Water Resources Development” that was submitted to Congress.

#### **D. Description of Material**

**1. General Characteristics of Proposed Fill Material** – Dredged Material is composed of a heterogeneous mixture of silt, clay, and sand.

**a. Quantities of Fill Material** – Please refer to Table 1. These quantities originate from project dredging activities in Sewell's Point to Lambert's Bend, Anchorage F, and the Newport News Channels (Table 1). The project construction is anticipated to begin in approximately 2023 and following construction, channel depths would be maintained over the 50 year lifecycle of the project.

#### **2. Source of Material**

All suitable dredged material from Thimble Shoal Channel is anticipated to be transported and deposited at the DNODS and regulated under MPRSA; however, could also potentially be disposed at the CIDMMA or NODS if needed. The ocean disposal sites are designated by the USEPA, and the USACE has permitting authority under Section 103 of the MPRSA. The transport of dredged material for the purpose of ocean disposal at these designated sites is regulated under Section 103 of the MPRSA.

#### **E. Description of Proposed Discharge Sites**

**1. Location of the Sites** – CIRB and spillways at the CIDMMA that discharge to the Elizabeth River.

**2. Size of Wetland Sites** – No jurisdictional wetlands are located in the CIRB or at the CIDMMA effluent discharge sites; tidal wetlands occur along some portions of the shoreline adjacent to the federal channel. However, these would not be impacted by implementation of the Preferred Alternative.

**3. Type of Aquatic Resources** – A variety of benthic fauna such as sponges, sea squirts, seas stars, and barnacles and infauna that burrow into bottom sediments such as worms (primarily polychaetes and nematodes), clams, and other tunneling organisms have the potential to occur at the discharge site.

**4. Timing and Duration of Discharge** – Please refer to the Project Description.

#### **F. Description of Disposal Method**

**1. Dredging-** Material that meets Clean Water Act requirements and facility suitability criteria may be placed at the CIDMMA. Historically, materials originating in the Norfolk Harbor Entrance Channel, Norfolk Harbor Reach,

Craney Island Reach, and Newport News Channel have been accepted as suitable for placement at CIDMMA. Although not expected, if any dredged material exceeds the acceptance criteria of CIDMMA, it would be deposited at an approved upland disposal site(s) including but not limited to the permitted solid waste facilities below:

- Charles City County Landfill
- CFS, Tri-City Regional Landfill & Recycling Center
- John C. Holland Enterprises Landfill
- Southeastern Public Service Authority (SPSA) Regional Landfill
- Portsmouth City Craney Island Landfill
- Bethel Landfill
- King and Queen Sanitary Landfill

Additionally, the following permitted soil processing services may be used if necessary:

- Port Tobacco/Weanack Land, LLC (also can accept some dredged material)
- Clearfield MMG, Inc. Soil Recycling

### **III. FACTUAL DETERMINATIONS**

#### **A. Physical Substrate Determination**

##### **1. Substrate Elevation and Slope**

The elevation of the CIDMMA effluent discharge site consists of a shallow area with gradual sloping. Wetlands that occur along the shoreline flanking the federal navigation channel and along the CIDMMA are located in shallow elevations with gradual slopes.

##### **2. Comparison of Fill Material and Substrates at Discharge Sites**

The substrate at the CIDMMA effluent discharge site would be similar in composition to the material dredged from the federal navigation channel. However, there will be some variability in the percentage of sand, silt, and clay with the dredged material as compared to the substrate at the effluent discharge site.

##### **3. Dredged/Fill Material Movement**

No expected movement will take place. Dredged material will be placed in an upland containment cell and will not mix with substrate.

##### **4. Physical Effects on Benthos**

No anticipated effects to benthos are anticipated from clarified effluent discharges from the CIDMMA. Effluent discharges will be visually monitored and regularly tested for Total Suspended Solids. Any effects to Total Suspended Solid Concentrations are expected to be localized and temporary and will have negligible to minor effects to water quality.

## **5. Erosion and Accretion Patterns**

No expected changes to erosion or accretion patterns will result from this project.

## **6. Actions Taken to Minimize Impacts.**

Actions will comply with the Commonwealth of Virginia water quality standards and Commanders Policy WRD-01 which governs operation of CIDMMA. Prior to commencement of construction, dredged material will undergo evaluation procedures including chemical and biological testing in accordance with federal guidance and regulations to provide information to reach a factual determination concerning Clean Water Act, Section 404 requirements (40 CFR 230.11) and applicable state water quality standards. During construction effluent discharged from the CIDMMA will be managed in accordance with Commander's Policy WRD-01 to maximize the retention of suspended solids minimizing migration of contaminants through the effluent pathway beyond the boundaries of the disposal site. Historically, effluent water quality studies have reported average Total Suspended Solids concentrations of 95 mg/l or less.

To facilitate water quality management, each containment area within the CIDMMA has two primary spillways. These facilities allow for the removal of the solids from the discharge water and is anticipated to result in a water discharge that has temporary, negligible to minor impacts to water quality because of increased Total Suspended Solids and turbidity.

## **B. Water Circulation, Fluctuation, and Salinity Determinations.**

### **1. Water**

No significant changes in the clarity, color, and quality of the Elizabeth River are anticipated at the effluent discharge point.

- a. **Salinity** – No effect to salinity is anticipated from the discharges.
- b. **Water Chemistry** – No effect to water chemistry is anticipated from the discharges.
- c. **Clarity** – Increased Total Suspended Solids and turbidity at the discharge sites would result in localized and temporary impacts to water quality that are negligible to minor.
- d. **Color** – No anticipated effect to water color is anticipated from the discharges.
- e. **Odor** – No anticipated effect to odor levels from the discharges.
- f. **Taste** – No anticipated effect.

- g. **Dissolved Gas Levels** – No anticipated effect to dissolved gas levels is anticipated from the discharges.
- h. **Nutrients** – No anticipated effect to nutrient concentrations are anticipated at from the discharges.
- i. **Eutrophication** – No eutrophication within the Elizabeth River is anticipated from the discharges.

**2. Current Patterns and Circulation.**

- a. **Current Patterns and Flow** – No effects are anticipated from the discharges.
- b. **Velocity** – No effects are anticipated from the discharges.
- c. **Stratification** – No effects are anticipated from the discharges.
- d. **Hydrologic Regime** – No effects are anticipated from the discharges.
- e. **Aquifer Recharge** – No effects are anticipated from the discharges.

**3. Normal Water Level Fluctuations** – No effects are anticipated from the discharges.

**4. Salinity Gradients** – No effects are anticipated from the discharges.

**5. Actions that will be taken to minimize impacts** – None necessary as no effects from the discharges are anticipated.

**C. Suspended Particulate/Turbidity Determinations.**

**1. Suspended particulates and turbidity level**

Localized and temporary adverse effects to water quality from increased Total Suspended Solids and turbidity are anticipated from the CIRB and CIDMMA effluent discharge sites. Total Suspended Solids and turbidity levels will quickly return to ambient conditions after discrete discharges from scows/barges in the CIRB and from CIDMMA effluent discharges after consideration of disposal site dilution and dispersion.

**2. Effects on chemical and physical properties of the water column**

a. **Light Penetration** – Any effect to light penetration from increased Total Suspended Solids and turbidity resulting from effluent discharges would result in a temporary, negligible to minor impact.

**b. Dissolved Oxygen** – No effect to Dissolved Oxygen levels are anticipated from the discharges.

**c. Toxic Metals and Organics** – To determine whether dredged material is suitable for placement at CIDMMA, or will be required to be disposed at an approved upland disposal facility, dredged material is tested for contaminants in accordance with the Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.- Testing Manual, Inland Testing Manual (USEPA 1998), USACE Manual, Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities – Testing Manual (2003); and the USACE (2013) Commander's Policy Memorandum WRD-01 Deposition of Dredged Material and Use of the Craney Island Dredged Material Management Area, Norfolk Harbor, Virginia. Therefore, sediments containing toxic metals and organics that exceed acceptance or water quality standards will not be placed at the CIDMMA. Therefore, the discharges will not result in the release of unacceptable chemical contaminants to the CIRB or the Elizabeth River.

**d. Pathogens** – No anticipated pathogens will be release from the discharges.

**e. Aesthetics** – Discharges are not anticipated to effect water column aesthetics other than increased Total Suspended Solids and turbidity that will have a temporary, negligible to minor impact on water quality.

**3. Effects on Biota**

**a. Primary Production, Photosynthesis** – There are no anticipated effects to primary producers from the discharges.

**b. Suspension/Filter Feeders** – There are no anticipated effects to suspension/filter feeders from the discharges.

**b. Sight Feeders** - There are no anticipated effects to sight feeders from the discharges.

**4. Action to Minimize Impacts.**

Dredged material will be tested and the data used to make factual determinations with regard to dredged material discharge requirements of CWA, Section 404, CIDMMA facility requirements, and applicable state water quality standards. Effluent discharged from the CIDMMA

will be monitored for Total Suspended Solids consistent with Commanders Policy WRD-01 to ensure the release of clarified effluent only. Historically, effluent water quality studies have reported average total suspended solids concentrations of 95 mg/l or less. Contaminated sediments that dredged material testing indicates will not comply with CWA, Section 404(b)1, CIDMMA facility requirements, or state water quality standards may be managed with additional engineering processes to ensure sediment and associated sediment pore water retained in the dredging process will comply with the guidelines, standards, and alternate disposal facility requirements.

**D. Contaminant Determination**

**1. Evaluation of the Biological Availability of Possible Contaminants in the Fill Material**

**a. Physical Characteristics of the Fill Material**

The dredged material is composed of a heterogenous mixture of silt, clay, and sand.

**b. Hydrography in Relation to Known or Suspected Sources of Contamination** – No known sources of contamination in the proposed locations.

**c. Results from Previous Testing of the Material or Similar Material in the Vicinity of the Project** – All materials from these project locations have met MPRSA Section 103 Limiting Permissible Concentration (LPC) criteria, Clean Water Act Section 404 Standards and CIDDMA acceptance criteria.

**d. Known, Substantive Sources of Persistent Pesticides from Land Runoff or Percolation** – There are no recorded incidences.

**e. Spill Records for Petroleum Products or Designated Hazardous Substances** – There are records of petroleum and contaminant releases in the vicinity of the project area.

**f. Other Public Records of Significant Introduction of Contaminants from Industries, Municipalities or Other Sources** - There are records of petroleum and contaminant releases in the vicinity of the project area.

**g. Known Existence of Substantial Deposits of Substances Which Could Be Released in Harmful Quantities by Man-Induced Discharges** – Dredging within the Norfolk Harbor Navigation Improvements Project Area could have the potential to generate material with contamination that exceeds Clean Water

Act Section 404(b)(1) requirements and the acceptance criteria of CIDMMA. Contaminated dredged material that is unsuitable for placement at the CIDMMA will need to be managed with an engineered process to ensure compliance of dredged material discharges and disposal at an approved upland site(s).

**2. Contaminant Determination**

To determine whether dredged material is suitable for placement at CIDMMA, or will be required to be disposed at an approved upland disposal facility, dredged material is tested for contaminants in accordance with the Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.- Testing Manual, Inland Testing Manual (USEPA 1998), USACE Manual, Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities – Testing Manual (2003); and the USACE (2013) Commander’s Policy Memorandum WRD-01 Deposition of Dredged Material and Use of the Craney Island Dredged Material Management Area, Norfolk Harbor, Virginia

**E. Aquatic Ecosystem and Organism Determinations**

**1. Effects on Plankton**

No impacts to plankton are anticipated from the CIRB or CIDMMA effluent discharges.

**2. Effects on Benthos**

No impacts to benthos are anticipated from the CIRB or CIDMMA effluent discharges.

**3. Effects on Nekton**

No impacts to nekton are anticipated from the CIRB or CIDMMA effluent discharges.

**4. Effects on Aquatic Food Web**

No impacts to the aquatic food web are anticipated from the CIRB or CIDMMA effluent discharges.

**5. Effects on Special Aquatic Sites**

**a. Sanctuaries and Refuges** – No sanctuaries or refuges will be impacted from the CIDMMA effluent discharges.

**b. Wetlands** – There are no anticipated impacts to jurisdictional wetlands. No wetland mitigation would be required.

**c. Mudflats** – There are no anticipated direct impacts to mudflats. No mudflat mitigation would be required.

**d. Vegetated Shallows** – There would be no anticipated impacts to vegetated shallows. No compensatory mitigation would be required.

**e. Riffle and Pool Complexes** - No impacts to riffle or pool complexes will occur; the project does not affect any streams.

## **6. Effects on Threatened and Endangered Species**

Affect determinations for federally listed species that have the potential to occur in the Action Area are provided below in Table 2 and Table 3. A Bald Eagle Act Determination is provided in Table 3 as well. Implementation of the Preferred Alternative may affect and is likely to adversely affect the Atlantic Sturgeon and green, Kemp's Ridley, and loggerhead sea turtles under the jurisdiction of the National Oceanographic and Atmospheric Administration/National Marine Fisheries Service (NMFS) from potential entrainment and interactions with dredging equipment. Sea turtle relocation trawling, if conducted, could also result in potential adverse effects to sea turtles (green, Kemp's Ridley, and loggerhead) and the Atlantic sturgeon under the jurisdiction of the NMFS. Discharge of dredged material to the CIRB and discharges of effluent from the CIDMMA are not anticipated to cause any adverse effects to federally listed species. There is no critical habitat for the Atlantic Sturgeon in the Action Area for this limited evaluation of the Meeting Area 1 and CIDMMA.

Table 2. Summary of the Endangered Species Act, Section 7 Affect Findings for Species Under the Jurisdiction of the National Marine Fisheries Service

<b>Species / Resource Name</b>	<b>Endangered Species Act Section 7 Determination</b>	<b>Notes / Documentation</b>
Atlantic sturgeon (All DPS)	May Affect, Likely to Adversely Affect	Entrainment from hopper dredging may result in injury and mortality. Collisions with dredging vessels would be unlikely. Dredging would result in a temporary loss and impact to prey species. Dredging may result in a disturbance effect where sturgeon leave the Action Area from the increased levels of Total Suspended Solids, turbidity, and noise. Sea turtle relocation trawling could result in sturgeon captures causing a temporary stress effect.
Shortnose sturgeon	May Affect, Not Likely to Adversely Affect	There is no documented occurrence of the shortnose sturgeon in the ROI and this species would not be anticipated to occur in the ROI/Action Area; any potential effects would be discountable.
Blue whale, fin whale, north Atlantic right whale, sei, and sperm whale	May Affect, Not Likely to Adversely Affect	Collisions with dredging vessels would be unlikely based on their low operating speeds. Dredging may impact prey species and cause whales to leave the Action Area from the dredging turbidity plume and noise disturbances. Any potential effects would be insignificant.
Sea turtles: green (North Atlantic DPS), Kemp's ridley sea turtle, and loggerhead sea turtle (Northwest Atlantic DPS)	May Affect, Likely to Adversely Affect	Entrainment in hopper dredging may result in injury and incidental take. Dredging may impact prey species and cause sea turtles to leave the Action Area from the dredging turbidity plume. Relocation trawling could result in injury, incidental take, or a temporary stress effect. There is no sea turtle nesting in the Region of Influence (ROI)/Action Area.

Species / Resource Name	Endangered Species Act Section 7 Determination	Notes / Documentation
Hawksbill sea turtle	May Affect, Not Likely to Adversely Affect	There is no documented occurrence of the hawksbill sea turtle in the Action Area and there is no preferred habitat for this species in the Action Area. This species would not be anticipated to occur in the Action Area. Any potential effects would be discountable.
Leatherback sea turtle	May Affect, Not Likely to Adversely Affect	Due to their large size and swimming capabilities, dredge entrainment or interactions would not be anticipated. There may be some temporary disturbance effects from plumes from dredging operations. Any potential effects would be insignificant.

Table 3. Summary of the Endangered Species Act, Section 7 Affect Findings for Species and Bald Eagle Determination Under the Jurisdiction of the U.S. Fish and Wildlife Service

Species / Resource Name	ESA Section 7 / Eagle Act Determination	Notes / Documentation
American alligator	No Effect	There is no documented occurrence of the American alligator in the Action Area and there is no preferred habitat for this species in the Action Area. This species would not be anticipated to occur in the Action Area.
Eastern black rail	May Affect, Not Likely to Adversely Affect	The presence of this species in the Action Area at the Craney Island would be considered a highly rare occurrence. Any potential effects from dredged material placement at Craney Island would be discountable.
Piping plover, red knot, and roseate turn	May Affect, Not Likely to Adversely Affect	The project may slightly impact flight and foraging behaviors but would have an insignificant impact.
Red-cockaded woodpecker	No Effect	There is no habitat for this species in the Action Area and therefore, this species would not be anticipated to occur in the Action Area.
West Indian manatee	May Affect, Not Likely to Adversely Affect	Manatees would be transient species and would not likely occur in the Action Area. Effects would be discountable.
Northern long-eared bat and Indiana bat	No Effect	No suitable foraging or roosting habitat is located in the Action Area. There are no known hibernacula in the Action Area. The project would not be anticipated to affect flights if they occur in this area.
Sea turtles: green, hawksbill, Kemp's ridley,	No Effect (within the jurisdiction of the U.S. Fish and Wildlife Service)	There is no nesting habitat in the ROI/Action Area.

Species / Resource Name	ESA Section 7 / Eagle Act Determination	Notes / Documentation
leatherback, and loggerhead		
Seabeach amaranth	No Effect	There is no documented occurrence of seabeach amaranth in the Action Area and there is no preferred habitat for this species in the Action Area. This species would not be anticipated to occur in the Action Area.
Northeastern beach tiger beetle	No Effect	There is no documented occurrence of the northeastern tiger beetle in the Action Area. This species would not be anticipated to occur in the ROI.
Bald eagle	Unlikely to disturb nesting bald eagles. Does not intersect with eagle concentration area	There is a solitary nest documented at the northwestern outskirts of the Craney Island (The Center for Conservation Biology 2021). Foraging may be temporarily disturbed during project construction. Any potential impacts to nesting or foraging would be anticipated to be temporary and insignificant.
Monarch butterfly (candidate species)	May Affect, Not Likely to Adversely Affect	Craney Island would not be anticipated to provide preferable foraging or breeding habitat based on the dominant vegetation types in the Action Area. Any potential disturbance effects from dredged material placement operations at the CIDMMA would be insignificant.

**7. Effects on Other Wildlife**

No adverse impacts to wildlife would be anticipated from the CIDMMA effluent discharges.

**8. Actions to Minimize Impacts**

Dredged material will be tested and the data used to make factual determinations with regard to dredged material discharge requirements of CWA, Section 404, CIDMMA facility requirements,

and applicable state water quality standards. Effluent discharged from the CIDMMA will be monitored for Total Suspended Solids consistent with Commander's Policy WRD-01 (USACE 2013) to ensure the release of clarified effluent only. Contaminated sediments that dredged material testing indicates would not comply with CWA, Section 404(b)1, CIDMMA facility requirements, or state water quality standards may be managed with additional engineering processes to ensure sediment and associated sediment pore water retained in the dredging process will comply with the guidelines, standards, and alternate disposal facility requirements.

**F. Proposed Disposal Site Determinations**

**1. Mixing Zone Determination**

- a. Depth of Water at the Disposal Site** – CIRB depths may range between 10 feet MLLW and 42 feet MLLW. The depth of the CIDMMA effluent discharge site ranges from approximately 3 feet MLLW to 6 feet MLLW.
- b. Current Velocity** - Variable, the velocity within the Elizabeth River, Hampton Roads, lower Chesapeake Bay, and Atlantic Ocean is dependent on the tides.
- c. Degree of Turbulence** – Negligible
- d. Water Column Stratification** – Negligible
- e. Discharge Vessel Speed and Direction** – Slow, wake speeds are typical of vessel traversing this area.
- f. Rate of Discharge** – Dredged material placed by hydraulic method may not exceed a rate of 22,500 cubic yards in a 24-hour period. The user may request higher production rates if it can be demonstrated or determined that effluent water quality will be maintained. Depending on the duration and the amount of material being dredged, the discharge pipe may be required to be moved during the dredged cycle. Dikes shall be constructed, raised, extended, and maintained by the user to contain the materials.
- g. Dredged Material Characteristics** – Sediment composed of a heterogeneous mixture of sand, silt, and clay.

**Number of Discharges Per Unit of Time** – Discharges would occur at intervals throughout the construction and maintenance period.

**2. Disposal Site and Size**

The CIDMMA, is the USACE's upland disposal site, which is near the northern limits of the project. The CIDMMA has been in continuous use since 1957, serving the navigation dredging needs of the Norfolk Harbor. The CIDMMA is a 2,500 acre site. Frequent placement and subsequent consolidation results in varying topography throughout the site. The existing dikes that contain dredged material have elevations ranging from 36 feet to 40 feet, but based on analysis of dike stability, dikes could be raised to approximately 50 feet.

Although not anticipated, any dredged material that is unsuitable for CIDMMA will need to be dewatered in accordance with federal and state water quality requirements and taken to existing upland disposal site(s). In the future an expansion cell will be created to the CIDMMA, the CIEE. This site may also be used in the future for dredged material placement.

### **3. Actions to Minimize Adverse Discharge Effects**

To determine whether dredged material is suitable for placement at CIDMMA, or will be required to be disposed at an approved upland disposal facility, dredged material is tested for contaminants in accordance with the Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.- Testing Manual, Inland Testing Manual (USEPA 1998), USACE Manual, Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities – Testing Manual (2003); and the USACE (2013) Commander's Policy Memorandum WRD-01 Deposition of Dredged Material and Use of the Craney Island Dredged Material Management Area, Norfolk Harbor, Virginia.

In addition, effluent discharged from the CIDMMA will be monitored for Total Suspended Solids in accordance with the USACE (2013) Commander's Policy WRD-01 to ensure the release of clarified effluent only. Previous monitoring of effluent discharges has reported average Total Suspended Solid concentrations of 95 mg/l or less. Contaminated sediments that dredged material testing indicates will not comply with CWA, Section 404(b)1, CIDMMA facility requirements, or state water quality standards may be managed with additional engineering processes to ensure sediment and associated sediment pore water retained in the dredging process will comply with the guidelines, standards, and alternate disposal facility requirements.

### **4. Determination of Compliance with Applicable Water Quality Standards**

The Clean Water Act, 401 review will be done concurrently with the Coastal Zone Management Federal Consistency Review by the Virginia Department of Environmental Quality (VDEQ). Per written

correspondence provided by the VDEQ in 2015 (letter from David Paylor, VDEQ to Colonel Kelly, USACE), no additional Virginia Water Protection Permit is required for aquatic dredging projects.

5. **Potential Effects on Human Use Characteristics**
  - a. **Municipal and Private Water Supply** – The proposed project would not affect municipal or private water supplies.
  - b. **Recreational and Commercial Fisheries** – There would be no anticipated effect to recreational or commercial fisheries resulting from the CIRB or CIDMMA effluent discharges.
  - c. **Water-Related Recreation** – There would be no anticipated effect to recreation.
  - d. **Aesthetics of the Aquatic Ecosystem** – There would be no anticipated effect to the aesthetic quality of the aquatic ecosystem other than temporary, negligible to minor increases in Total Suspended Solids and turbidity from the CIDMMA effluent discharges.
  - e. **Parks, National and Historical Monuments, National Seashores Wilderness Areas Research Sites, and similar Preserves** – There would be no effect.
  - f. **Determination of Secondary Effects on Aquatic Ecosystems**  
None anticipated.

#### IV. **FINDINGS OF COMPLIANCE OR NONCOMPLIANCE WITH THE RESTRICTIONS ON DISCHARGE**

##### A. **Adoption of the Section 404(b)(1) Guidelines to this Evaluation**

No significant adaptations of the guidelines were made relative to this evaluation.

##### B. **Evaluation of the Availability of Practicable Alternatives to the Proposed Discharge Sites Which Would Have Less Adverse Impacts on the Aquatic Environment**

A series of alternatives were evaluated during plan formulation and no practicable alternative to the Preferred Alternative was identified.

**C. Compliance with Applicable State Water Quality Standards**

Dredged material will be tested in accordance with federal guidance and regulations and the data will be used to make a factual determination with regard to dredged material discharge requirements of CWA, Section 404, CIDMMA facility requirements, and applicable state water quality standards. A 401 Water Quality Certification will be obtained from the Virginia Department of Environmental Quality prior to construction.

**D. Compliance with Applicable Toxic Effluent Standards or Prohibitions under Section 307 of the Clean Water Act**

Section 307 of the Clean Water Act establishes limitation or prohibitions on the discharge materials containing certain toxic pollutants. Contaminated dredged material that exhibits acute toxicity will be managed for alternate disposal at a permitted upland facility. Dredged materials identified for alternate disposal may be managed with additional engineering processes to ensure contaminated sediment and associated sediment pore water retained in the dredging process will comply with the 404 guidelines, standards, and alternate disposal facility requirements.

Dredged material that are determined to be suitable for the CIDMMA would not contain these toxins because the dredged material will be tested prior to any placement at the CIDMMA, and therefore the project complies with Section 307.

**E. Compliance with the Endangered Species Act of 1973**

Please refer to the section above regarding compliance with the Endangered Species Act of 1973.

**F. Compliance with Specific Measures for Marine Sanctuaries Designated by the Marine Protection, Research, and Sanctuaries Act of 1972**

Dredged material from the project will be evaluated and considered for transport for the purpose of ocean disposal in accordance with the MPRSA. Dredged material that is determined to be suitable for ocean disposal with USEPA concurrence may be considered for transport for the purpose of ocean disposal at designated ocean disposal sites.

**G. Evaluation of the Extent of Degradation of Waters of the United States**

**1. Significant Adverse Effects on Human Health and Welfare**

- a. Municipal and Private Water Supplies** – The project would not affect municipal or private water supplies.
- b. Recreational or Commercial Fisheries** - There would be no anticipated effects to fisheries from the CIDMMA effluent discharges.
- c. Plankton** – There would be no anticipated effects to plankton from the discharges.
- d. Fish** – There would be no anticipated effects to fish from the discharges.
- e. Shellfish** – There would be no anticipated effects to shellfish resources from the discharges.
- f. Wildlife** - There would be no anticipated effects to wildlife from the discharges.
- g. Special Aquatic Sites** – There would be no effect to Special Aquatic Sites. No compensatory mitigation for Special Aquatic Sites would be required.

**2. Significant Adverse Effects on Life Stages of Aquatic Life and Other Wildlife Dependent on Aquatic Ecosystem**

There would be no significant, adverse effects on any life stages or aquatic or other wildlife that is dependent on the aquatic ecosystem.

**3. Significant Adverse Effect on Aquatic Ecosystem Diversity, Productivity, and Stability**

There would be no significant, adverse impacts on aquatic ecosystem diversity, productivity, and stability

**4. Significant Adverse Effect on Recreational, Aesthetic, and Economic Values**

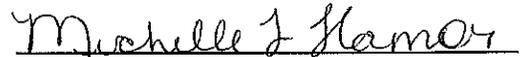
There are no significant, adverse impacts to recreational, aesthetic, or economic values.

**H. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem**

Appropriate steps to minimize potential adverse impacts from any discharges on aquatic systems have been incorporated.

**I. Finding**

The proposed discharges of fill material are specified as complying with the requirements of the 404(b)(1) Guidelines, with the inclusion of appropriate and practicable conditions as identified herein to minimize pollution or adverse effects on the aquatic ecosystem. These conditions will be attached and made part of the project record.



Michelle Hamor  
Chief, Planning and Policy Branch  
Norfolk District, USACE

## References

The Center for Conservation Biology. 2021. Bald Eagle Nest Locator. Retrieved from . Date retrieved 15 October 2021.

U.S. Fish and Wildlife Service. 2021. Information for Planning and Conservation Database. Retrieved from <https://ecos.fws.gov/ipac/>. Date retrieved 15 October 2021.

U.S. Army Corps of Engineers. 2013 (USACE). Deposition of Dredged Material and Use of the Craney Island Dredged Material Management Area, Norfolk Harbor, Virginia.

U.S. Army Corps of Engineers. 1983. Dredging and Dredged Material Disposal. Engineer Manual 1110-2-5025, Office, Chief of Engineers, Washington, DC.

U.S. Environmental Protection Agency (USEPA). 1998. Evaluation of dredged material proposed for discharge in waters of the U.S. – testing manual, inland testing manual. Prepared by Environmental Protection Agency, Office of Water, Office of Science and Technology, Washington, D.C. and Department of the Army, U.S. Army Corps of Engineers, Operations, Construction, and Readiness Division, Washington, D.C.

**From:** [Logalbo, Alicia M CIV USARMY CENAO \(USA\)](#)  
**To:** [VDEQ REVIEW \(eir@deq.virginia.gov\)](#)  
**Cc:** [Shunfenthal, Jennifer C CIV \(USA\)](#); [Perdue, Katherine S CIV CENAO CENAD \(USA\)](#); [Koelsch, Kimberly C CIV USARMY CENAO \(USA\)](#); [Schulte, David M CIV CENAO CENAD \(USA\)](#)  
**Subject:** Request for CZMA Federal Consistency Review and Concurrence Determination  
**Date:** Friday, October 15, 2021 4:07:00 PM  
**Attachments:** [CZMA\\_20211015.pdf](#)  
[Enclosure 1 project description 20211015.pdf](#)

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To Whom It May Concern,

Attached for submission is a Coastal Zone Management Act (CZMA) Federal Consistency Determination for the Norfolk Harbor Navigation Improvements Meeting Area Validation Study/Supplemental Environmental Assessment including a project description (attached as Enclosure 1). This is a federal project where the lead agency is the U.S. Army Corps of Engineers, Norfolk District and the project sponsor is the Virginia Port Authority. We are requesting a review and CZMA Federal Consistency concurrence letter based on the information submitted in this email. If you have any questions or need any additional information, please contact me at: [Alicia.Logalbo@usace.army.mil](mailto:Alicia.Logalbo@usace.army.mil) or cell phone at: 757-335-8075. We are requesting if at all possible the consistency review be completed prior to the 60 day mandated timeline as we have an expedited schedule for this project. Thank you for your assistance.

Alicia Logalbo

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**NORFOLK HARBOR NAVIGATION  
IMPROVEMENTS MEETING AREA  
VALIDATION  
STUDY/SUPPLEMENTAL  
ENVIRONMENTAL ASSESSMENT**

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**Coastal Zone Management Act Federal  
Consistency Determination**

**Norfolk District  
803 Front Street  
Norfolk, Virginia 23510**

**October 15, 2021**



**U.S. Army Corps  
of Engineers  
Norfolk District**

**COASTAL ZONE MANAGEMENT ACT  
FEDERAL CONSISTENCY DETERMINATION**

**NORFOLK HARBOR NAVIGATION IMPROVEMENTS MEETING AREA VALIDATION  
STUDY/SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT**

**PROJECT DESCRIPTION:** The purpose of this Federal Consistency Determination is to ensure compliance of the Norfolk Harbor and Channels Navigation Improvements Meeting Area Validation Study/Environmental Assessment in the Port of Virginia with the Coastal Zone Management Act (CZMA).

Please see Enclosure 1 for background information on the project and also a project description including maps of the proposed project area.

**PROPERTY CLASSIFICATION:** The project site is zoned as submerged lands in the dredging and dredged material management open water sites. Submerged lands at the dredging sites are owned by the Commonwealth of Virginia. The Craney Island Dredged Material Management Area (CIDMMA) is in federal ownership and is managed by the U.S. Army Corps of Engineers (USACE). The offshore disposal sites are in federal ownership.

**IMPACTS TO RESOURCES/USES OF THE COASTAL ZONE:** See Summaries below.

**DETERMINATION:** In accordance with Section 307 of the Coastal Zone Management Act (CZMA) and the CZMA Federal Consistency Regulation – 15 C.F.R. Part 930, the Norfolk District, the USACE determined that the proposed project would be undertaken in a manner consistent to the maximum extent practicable with the enforceable policies of the Commonwealth of Virginia's Coastal Zone Management Program.

**ENFORCEABLE POLICIES**

The Virginia Coastal Zone Management Program (CZMP) contains the below enforceable policies (A-I).

**I. Tidal and Non-Tidal Wetlands**

The purpose of the wetlands management program is to preserve tidal wetlands, prevent their despoliation, and accommodate economic development in a manner consistent with wetlands preservation. The tidal wetlands program is administered by the VMRC (Virginia Code §28.2-1301 through §28.2-1320). The Virginia Water Protection Permit program administered by the DEQ includes protection of wetlands --

both tidal and non-tidal. This program is authorized by Virginia Code § 62.1-44.15.5 and the Water Quality Certification requirements of §401 of the Clean Water Act of 1972.

*Consistency Analysis*

There would be no impacts to jurisdictional wetlands or seagrass with implementation of the project.

Implementation of the proposed project would be fully consistent with the Tidal and Non-Tidal Wetlands enforceable policy.

## **II. Subaqueous Lands**

The management program for subaqueous lands establishes conditions for granting or denying permits to use state-owned bottomlands based on considerations of potential effects to marine and fisheries resources, wetlands, adjacent or nearby properties, anticipated public and private benefits, and water quality standards established by the Virginia Department of Environmental Quality Water Quality Division. The program is administered by the Virginia Marine Resource Commission (Virginia Code §28.2-1200 through §28.2-1213).

*Consistency Analysis*

No permit from the Virginia Marine Resources Commission (VMRC) would be required for this project, as the dredging and dredged material placement activities are not within the jurisdiction of the VMRC.

\*Note that if beneficial placement of dredged material is conducted separately from this project, a permit from VMRC would be required for that respective project.

The proposed project would be fully consistent with the Subaqueous Lands enforceable policy.

## **III. Dunes and Beaches**

Dune protection is carried out pursuant to the Coastal Primary Sand Dune Protection Act and is intended to prevent destruction or alteration of primary dunes. This program is administered by the Marine Resources Commission (Virginia Code §28.2-1400 through §28.2-1420) for the City of Newport News.

*Consistency Analysis*

This project would not impact sand dunes.

The proposed project would be fully consistent with the Dunes and Beaches enforceable policy.

#### **IV. Chesapeake Bay Preservation Areas**

State-local cooperative program administered by DEQ's Water Division and 84 localities in Tidewater, Virginia established pursuant to the Chesapeake Bay Preservation Act (Virginia Code §§ 62.1-44.15:67 through 62.1-44.15:79) and Chesapeake Bay Preservation Area Designation and Management Regulations (Virginia Administrative Code 9 VAC 25-830-10 *et seq.*)

##### *Consistency Analysis*

There is no Resource Protection Area (RPA) in the area impacted by this project. Therefore, this project would not impact the Chesapeake Bay Preservation Act RPA.

The proposed project would be fully consistent with the Chesapeake Bay Preservation Areas enforceable policy.

#### **V. Marine Fisheries**

The program stresses the conservation and enhancement of finfish and shellfish resources and the promotion of commercial and recreational fisheries to maximize food production and recreational opportunities. This program is administered by the Virginia Marine Resources Commission (VMRC) (Virginia Code §28.2-200 through §28.2-713) and the Virginia Department of Game and Inland Fisheries (VDGIF) (Virginia Code §29.1-100 through §29.1-570).

##### *Consistency Analysis*

The proposed project would result in minor, adverse impacts on fishery resources including localized negative effects on water quality, decreases in Dissolved Oxygen, increased turbidity, and Total Suspended Solids/turbidity in the water column. Mobile species would move out of the area and return once dredging has been completed. There would be a temporary loss of prey for benthic species. Additionally, resources could become entrained or injured during dredging operations and dredged material placement. However, these impacts would be minor and would not be anticipated to impact any fishery populations.

The proposed project would be fully consistent with the Marine Fisheries enforceable policy.

#### **VI. Wildlife and Inland Fisheries**

The program ensures that activities affecting wildlife and inland fisheries shall not negatively impact the Commonwealth's efforts in conserving, protecting, replenishing, propagating and increasing of the supply of game birds, game animals, fish and other wildlife of the Commonwealth, including fish or wildlife listed as threatened or endangered by the Department of Wildlife Resources Board, the use of drugs on vertebrate wildlife, and nonindigenous aquatic nuisance, predatory, or undesirable species. This program is administered by the Virginia Department of Wildlife Resources

(Virginia Code §§ 29.1-501 through §29.1-575; 4 VAC §§ 15-20-130 through §§ 15-290-60)

*Consistency Analysis*

Dredging and dredged material placement/disposal operations that may affect egg, larval, juvenile, and adult life stages of fishes include direct removal or burial, turbidity/siltation effects, shifts in dissolved oxygen and salinity, entrainment, visual and noise disturbances, and alteration of habitat would continue. The impacts to fish resources and habitat would be adverse, temporary and negligible to minor. No substantive adverse impacts to fish or fish habitat are anticipated. No population level impacts to any managed fish species or associated prey species would be anticipated.

Dredging and dredged material/placement would have disturbance effects to wildlife and further dredged material placement/disposal at the CIDMMA would provide additional habitat for some wildlife species. Temporary to permanent impacts to wildlife that would range from adverse to beneficial impacts that are negligible to minor would be anticipated.

The proposed project would be fully consistent with the Wildlife and Inland Fisheries enforceable policy.

**VII. Plant Pests and Noxious Weeds**

The program applies to activities affecting quarantines established for pests by the Board of Agriculture and Consumer Services (BACS) or the Commissioner of Agriculture and Consumer Services, the importation of regulated articles proclaimed a menace to public health by BACS, and plant pests and noxious weeds. The program is administered by Virginia Department of Agriculture and Consumer Services (VDACS) (Virginia Code §§ 3.2-700 through 3.2-804; 2 VAC §§ 5-315-10 through -440-110):

*Consistency Analysis*

This project would not cause the spread of plant pests or noxious weed species.

The proposed project would be fully consistent with the Plant Pests and Noxious Weeds enforceable policy.

**VIII. Commonwealth Lands**

The program applies to activities on state-owned lands managed by VDWR and the VDCR to include the free passage of anadromous and other migratory fish, the removal of coastal resources from Back Bay, encroachments into game refuges, tampering with DWR owned or operated aquatic and terrestrial habitats, and fire use, hunting and fishing, feeding wildlife, boating and vehicle use in state parks. The program is administered by VDWR (Virginia Code § 29.1-103(10) through -554; 4 VAC §§ 15-20-90 through -320-100) and VDCR (4 VAC §§ 5-30-70 through -422).

*Consistency Analysis*

Implementation of the proposed project would be fully consistent with the Commonwealth Lands enforceable policy.

**IX. Point Source Air Pollution**

The program implements the Federal Clean Air Act to provide a legally enforceable State Implementation Plan for the attainment and maintenance of the National Ambient Air Quality Standards. This program is administered by the State Air Pollution Control Board (Virginia Code §10.1-1300 through 10.1-1320).

*Consistency Analysis*

In the future, with or without implementation of the Preferred Alternative, vessel calls are anticipated to increase, as compared to current conditions. However, when comparing the future with or without the project, there would be less vessel calls in the future with project as compared to the future without project because the existing, larger ships in the fleet would carry more goods, thus requiring fewer vessel calls to transport the same amount of goods.

There would be minor air pollution increases from construction equipment and vessel operations; these increases will be below de minimis levels. The Hampton Roads Intrastate Air Quality Control Region is in attainment with all National Ambient Air Quality Standards. For these reasons, no conformity analysis is required for this project.

The proposed project would be fully consistent with the Point Source Air Pollution enforceable policy.

**X. Point Source Water Pollution**

The point source program is administered by the State Water Control Board pursuant to Virginia Code §62.1-44.15. Point source pollution control is accomplished through the implementation of the National Pollutant Discharge Elimination System (NPDES) permit program established pursuant to §402 of the federal Clean Water Act and administered in Virginia as the VPDES permit program. The Water Quality Certification requirements of §401 of the Clean Water Act of 1972 is administered under the Virginia Water Protection Permit program.

*Consistency Analysis*

This project would not generate point source discharges subject to Section 402 of the Clean Water Act. Dredged material discharges are regulated under Section 404/401 of the Clean Water Act or Section 103 of the MPRSA and are exempt from NPDES regulations per 40 CFR 122.3. In accordance with the 02 October 2015 letter concerning the "Regulation of Dredging and Aquatic Resources Restoration Activities Conducted by the U.S. Army Corps of Engineers in Commonwealth of Virginia Waters," the USACE is requesting Clean Water Act (CWA) Section 401 Water Quality Certification through this determination for dredged material discharges resulting from construction and maintenance of the Norfolk Harbor Navigation Improvements Meeting Area Validation

Study. The transport of dredged material for the purpose of ocean disposal at the Dam Neck Ocean Disposal Site (DNODS) and the Norfolk Ocean Disposal Site (NODS) would be regulated under Section 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA) consistent with 33 CFR 324.3(2). “Federal agencies are not required to obtain and provide certification of compliance with effluent limitations and water quality standards from state or interstate pollution control agencies in connection with activities involving the transport of dredged material for dumping into ocean waters beyond territorial sea.”

The proposed project would be fully consistent with Point Source Water Pollution enforceable policy.

## **XI. Non-point Source (NPS) Water Pollution**

Virginia's Erosion and Sediment Control Law requires soil-disturbing projects to be designed to reduce soil erosion and to decrease inputs of chemical nutrients and sediments to the Chesapeake Bay, its tributaries, and other rivers and waters of the Commonwealth. This program is administered by DEQ (Virginia Code §62.1-44.15:51 *et seq.*).

### *Consistency Analysis*

Project activities would comply with Clean Water Act (CWA), Section 402. Regulated nonpoint source discharges are not anticipated from project activities. Discharges would consist of CWA, Section 404 dredged material discharges at the specified discharge site in the waters of the U.S., runoff, and overflow from the contained land disposal, and redeposit of dredged material including excavated materials incidental to mechanized land-clearing, ditching, channelization, and other excavation [33 CFR 323.2(D)]. Best management practices consistent with the technical guidance for erosion and sediment control would be incorporated into the project design to mitigate erosion potential of placed dredged material.

The proposed project would be fully consistent with the Non-point Source Water Pollution enforceable policy.

## **XII. Shoreline Sanitation**

The purpose of this program is to regulate the installation of septic tanks, set standards concerning soil types suitable for septic tanks, and specify minimum distances that tanks must be placed away from streams, rivers, and other waters of the Commonwealth. This program is administered by the Department of Health (Virginia Code §32.1-164 through §32.1-165).

### *Consistency Analysis*

This project involves no septic tanks; therefore, adherence to this program is not applicable to the proposed project.

The proposed project would be fully consistent with the Shoreline Sanitation enforceable policy.

## **ADVISORY POLICIES FOR GEOGRAPHIC AREA OF PARTICULAR CONCERN**

### **a. Coastal Natural Resource Areas**

These areas are vital to estuarine and marine ecosystems and/or are of great importance to areas immediately inland of the shoreline. Such areas receive special attention from the Commonwealth because of their conservation, recreational, ecological, and aesthetic values. These areas are worthy of special consideration in any planning or resources management process and include the following resources: Wetlands, aquatic spawning, nursery, feeding grounds, coastal primary sand dunes, barrier islands, significant wildlife, habitat areas, public recreation areas, sand and gravel resources, and underwater historic sites.

#### *Consistency Analysis*

There would be no significant impacts to Coastal Natural Resource Areas as a result of the implementation of the project.

### **b. Coastal Natural Hazard Areas**

This policy covers areas vulnerable to continuing and severe erosion and areas susceptible to potential damage from wind, tidal, and storm related events including flooding. New buildings and other structures should be designed and sited to minimize the potential for property damage due to storms or shoreline erosion. The areas of concern are as follows: Highly erodible areas, coastal high hazard areas, including floodplains.

#### *Consistency Analysis*

There are no structures or buildings that are vulnerable to continuing and severe erosion and are susceptible to potential damage from wind, tidal, and storm related events including flooding.

### **c. Waterfront Development Areas**

These areas are vital to the Commonwealth because of the limited number of areas suitable for waterfront activities. The areas of concern are as follows: commercial ports, commercial fishing piers, and community waterfront.

#### *Consistency Analysis*

The project area is located in subaqueous land and federal land and does not include commercial ports, commercial fishing piers, or community waterfronts.

## **ADVISORY POLICIES FOR SHOREFRONT ACCESS PLANNING AND PROTECTION**

### **a. Virginia Public Beaches**

Approximately 25 miles of public beaches are located in the cities, counties, and towns of Virginia exclusive of public beaches on state and federal land. These public shoreline areas will be maintained to allow public access to recreational resources.

#### *Consistency Analysis*

The project would not impact any Virginia public beaches.

### **b. Virginia Outdoors Plan (VOP)**

Planning for coastal access is provided by the DCR in cooperation with other state and local government agencies. The Virginia Outdoors Plan (VOP), which is published by the Department, identifies recreational facilities in the Commonwealth that provide recreational access. The VOP also serves to identify future needs of the Commonwealth in relation to the provision of recreational opportunities and shoreline access. Prior to initiating any project, consideration should be given to the proximity of the project site to recreational resources identified in the VOP.

#### *Consistency Analysis*

There are no recreational facilities located in the project area.

### **c. Parks, Natural Areas, and Wildlife Management Areas**

Parks, wildlife management areas, and natural areas are provided for the recreational pleasure of the citizens of the Commonwealth and the nation by local, state, and federal agencies. The recreational values of these areas should be protected and maintained.

#### *Consistency Analysis*

There are no parks, natural areas or wildlife management areas located within the project area.

### **d. Waterfront Recreational Land Acquisitions**

It is the policy of the Commonwealth to protect areas, properties, lands, or any estate or interest therein, of scenic beauty, recreational utility, historical interest, or unusual features which may be acquired, preserved, and maintained for the citizens of the Commonwealth.

#### *Consistency Analysis*

This project would not limit the ability of the Commonwealth of Virginia in any way to acquire, preserve, or maintain waterfront recreational lands.

**e. Waterfront Recreational Facilities**

This policy applies to the provision of boat ramps, public landings, and bridges which provide water access to the citizens of the Commonwealth. These facilities shall be designed, constructed, and maintained to provide points of water access when and where practicable.

*Consistency Analysis*

This project does not involve the design, construction, or maintenance of any boat ramps, public landings, or bridges.

**f. Waterfront Historic Properties**

The Commonwealth has a long history of settlement and development, and much of that history has involved both shorelines and near-shore areas. The protection and preservation of historic waterfront properties is primarily the responsibility of the Department of Historic Resources. Buildings, structures, and sites of historical, architectural, and/or archaeological interest are significant resources for the citizens of the Commonwealth. It is the policy of the Commonwealth and the Virginia CZM Program to enhance the protection of buildings, structures, and sites of historical, architectural, and archaeological significance from damage or destruction when practicable.

*Consistency Analysis*

No waterfront historic properties would be affected by this project.

**DETERMINATION**

Based upon the following information, data, and analysis, the USACE, finds that the Norfolk Harbor and Channels Navigation Improvements Meeting Area Validation Study/Supplemental EA is consistent to the maximum extent practicable with the enforceable policies of the Virginia Coastal Zone Management Program.

Pursuant to 15 CFR Section 930.41, the Virginia Coastal Zone Management Program has 60 days from receipt of this letter in which to concur with or object to this Consistency Determination, or to request an extension under CFR section 930.41 (b). Virginia's concurrence will be presumed if its response is not received by the U.S. Army Corps of Engineers on the 60<sup>th</sup> day from receipt of this determination.

October 15, 2021  
Date

**Alicia Logalbo** Digitally signed by Alicia Logalbo  
Date: 2021.10.15 15:53:10 -04'00'  

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Alicia Logalbo  
Norfolk District, U.S. Army Corps of Engineers  
Planning and Policy Branch  
Chief, Environmental Analysis Section

# **NORFOLK HARBOR NAVIGATION IMPROVEMENTS MEETING AREA VALIDATION STUDY/SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT PROJECT DESCRIPTION**

## **1.0 INTRODUCTION, PURPOSE, AND NEED**

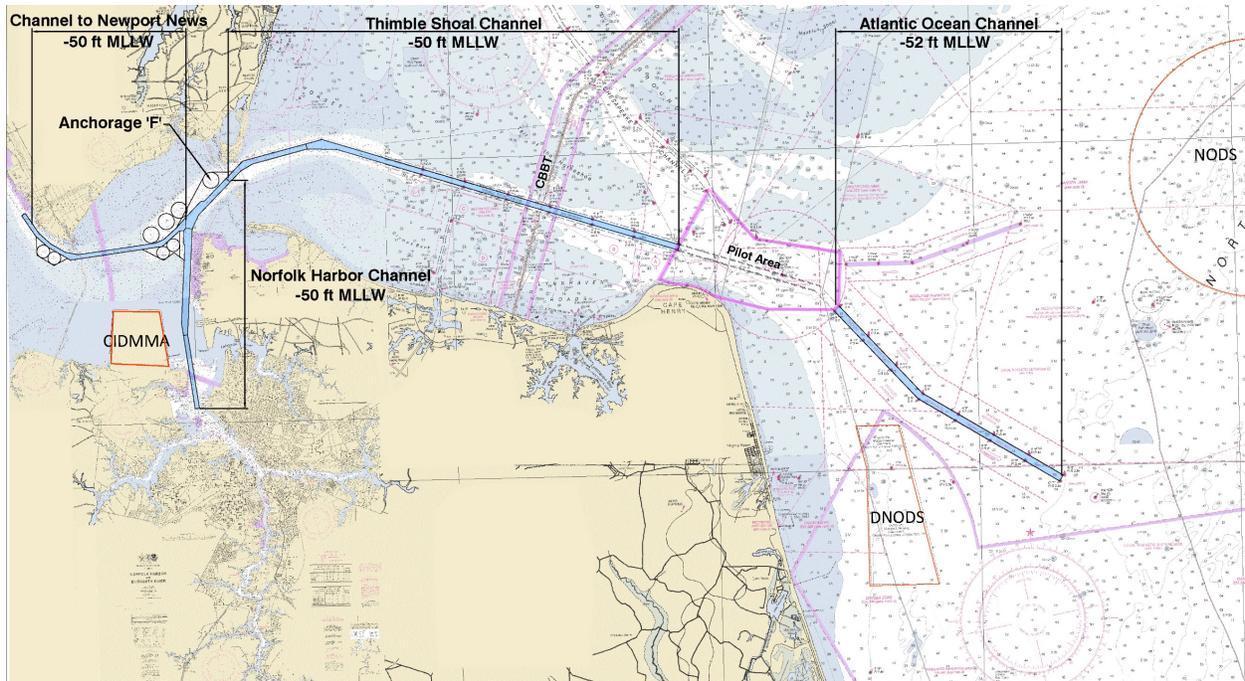
The Norfolk Harbor and Channels consists of a network of multiple channel and anchorage elements that provide deep draft access from the Atlantic Ocean into the Port of Virginia. The harbor in which the Port of Virginia is located covers a 25 square-mile area and serves a variety of private marine terminals, state-owned marine terminals, and federal maritime/military facilities located within the cities of Norfolk, Newport News, Portsmouth, Chesapeake, and Hampton in southeastern Virginia.

The purpose of the Norfolk Harbor Navigation Improvements Meeting Area Validation Study is to improve the operational efficiency of commercial vessels currently using and projected to use the Norfolk Harbor and Channels. The need for this project arises from inefficiencies currently experienced by commercial vessels within the existing Norfolk Harbor and Channels as industry adoption toward larger vessels has necessitated periodic establishment of one-way traffic within channels that normally support two-way traffic.

Updated forecasted fleet inventory and economic data is now available which warrants the reevaluation of expanding the existing, approved meeting area (Meeting Area 2) with an additional meeting area (Meeting Area 1), where two-way traffic of larger vessels can be accommodated. Compared to the forecast used during for the 2018 Norfolk Harbor Navigation Improvements General Reevaluation Report/Environmental Assessment (GRR/EA), ocean carriers have more rapidly transitioned to the ultra large container vessels than the forecast predicted, warranting a reassessment of the of the Meeting Area 1. The proposed Meeting Area 1 would consist of a widened area of the Thimble Shoal Channels that is approximately located in a 5.1 mile (statute mile)-long area west of the Chesapeake Bay Bridge Tunnel. The widening would consist of approximately 200 additional feet located north of the existing Thimble Shoal Channel and an additional 200 feet south of the existing Thimble Shoal Channel.

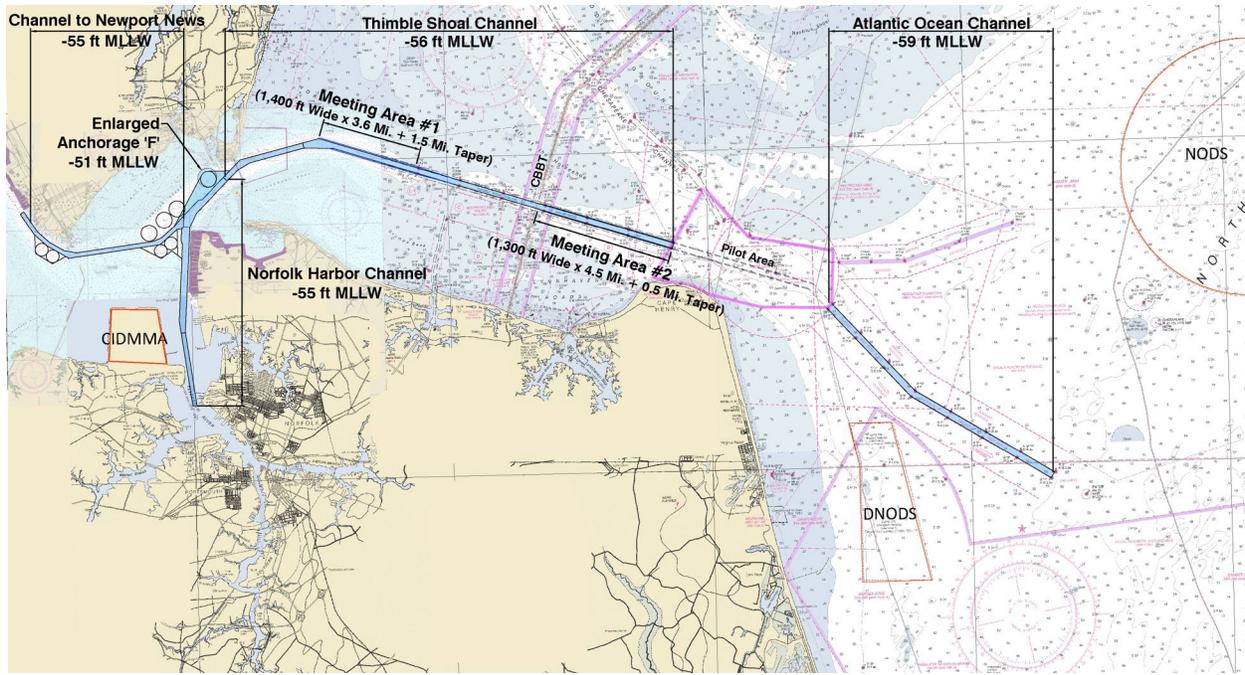
## **2.0 PROJECT SCOPE**

The Norfolk Harbor Project is a single purpose deep draft navigation project that consists of a network of federally improved channels extending from the Atlantic Ocean, through the Chesapeake Bay, and into the Port of Virginia (**Figure 1**).



**Figure 1.** The existing Norfolk Harbor and Channels from the Atlantic Ocean Channel to the Lamberts Bend. Dredged material placement/disposal sites are also depicted. CIDMMA = Craney Island Dredged Material Management Area; DNODS = Dam Neck Ocean Disposal Site; NODS = Norfolk Ocean Disposal Site

Originally authorized in the Water Resources Development Act (WRDA) of 1986 and as further defined by the 2018 Norfolk Harbor Navigation Improvements GRR/EA, the authorized and approved project includes a system of two-way, full-width channels to a depth of 55 feet in the Norfolk Harbor, 56 feet in the Thimble Shoal Channels, 55 feet in the Newport News Channel and 59 feet in the Atlantic Ocean Channel (**Figure 2**)



**Figure 2.** Norfolk Harbor and Channels Project Segments with approved project depths. Miles provided in statute miles.

Since the original authorization by WRDA, the project has been constructed in separable elements based on the needs of the port community and the financial capability of the nonfederal sponsor, the Virginia Port Authority, agent of the Commonwealth of Virginia:

- The 50 Foot Outbound Element was completed in 1989
- The 50 Foot Anchorage was completed in 1999.
- The 50 Foot Inbound Element was completed in 2007.
- The deepening of the Thimble Shoal Channel to 56 feet as described in the Norfolk Harbor Navigation Improvements GRR/EA is currently underway.

The approved project also includes Meeting Area 2, a widening of the Thimble Shoal Channel east of the Chesapeake Bay Bridge Tunnel to 1,300 feet, widening of Anchorage F to 3,620 feet and the associated modification of the Approach Area, and deepening of Anchorage F to 51 feet. The approved project includes disposal of dredged material at the Dam Neck Ocean Disposal Site (DNODS), the Norfolk Ocean Disposal Site (NODS), and the Craney Island Dredged Material Management Area (CIDMMA).

The scope of this validation study is limited to a reevaluation of the construction and maintenance of Meeting Area 1 and disposal of material dredged from the Meeting Area 1. This meeting area was partially evaluated in the approved Norfolk Harbor Navigation Improvements GRR/EA but was not included in the Recommended Plan (Preferred Alternative); only Meeting Area 2 was included in the approved Norfolk Harbor Navigation Improvements GRR/EA. However, Meeting Area 1 is being reevaluated due to ongoing concerns about the inefficiencies experienced by commercial vessels and due to changes in the fleet forecast and associated economic benefits of the project.

## **2.1 CURRENT NORFOLK HARBOR PROJECT DREDGING AND DREDGED MATERIAL PLACEMENT/DISPOSAL PRACTICES**

### **Atlantic Ocean Channel**

The Atlantic Ocean Channel, off the eastern coast of Virginia (**Figure 2**), was authorized by the WRDA of 1986. The WRDA authorized the U.S. Army Corps of Engineers (USACE) to construct the Atlantic Ocean Channel which consists of a channel 11.1 miles long, 1,300 feet wide, and 57 feet deep<sup>1</sup>. As part of the 50-foot inbound construction effort in 2006, the channel was deepened to provide for a required depth and width of 52 feet and 1,300 feet, respectively.

The Atlantic Ocean Channel is part of the Port of Virginia and Baltimore system of channels, and is the segment providing access for all ships calling on port facilities, naval bases, and shipyards in the Hampton Roads, York River and Baltimore areas. All commercial tonnage entering and leaving the Ports of Virginia and Baltimore pass through this channel. The channel is currently maintained to a full width and a required depth of 52 feet to enable loaded colliers, container ships and military vessels to transit the channel with ship drafts as great as 47 feet (45 ft with no tide restrictions).

Material is typically dredged via hopper dredge from this channel. Dredged material is placed at DNODS. Dredged material is largely fine sand that has also been beneficially used for the Virginia Beach Hurricane Protection project and the Craney Island Eastern Expansion (CIEE) Project. Due to periodic use as a sand source, maintenance dredging has not been required.

Per the Norfolk Harbor Navigation Improvements GRR/EA, deepening of the Atlantic Ocean Channel to a required depth of approximately 59 feet was approved.

### **Thimble Shoal Channel**

The Thimble Shoal Channel is located in the southern part of the Chesapeake Bay, just off the shoreline of Norfolk and Virginia Beach, east of the CIDMMA (**Figure 2**). This project was originally authorized by the River and Harbor Act of 1917. The original authorized channel dimensions were 13.4 miles long, 1,000 feet wide, between the 55 foot contours, to a depth of 55 feet. The channel has been maintained to a required depth of 50 feet. Thimble Shoal Channel extends from the deep water to the east of Hampton Roads to the deep water at the mouth of the Chesapeake Bay.

Material dredging is typically via hopper dredging. Dredged material is placed at the DNODS. The sediments of Thimble Shoal Channel to the west of the Chesapeake Bay Bridge Tunnel are predominantly clays and silts, for which beneficial use projects have not been identified. In contrast, sediments in the eastern portion of channel are largely fine to medium-grained sand and the segment is a common source of material for beach nourishment projects.

Per the Norfolk Harbor Navigation Improvements GRR/EA, deepening of the Thimble Shoal Channel to a required depth of approximately 56 feet was approved. This also included approval of Meeting Area 2 which consists of a widening of the Thimble Shoal Channel east of the Chesapeake Bay Bridge Tunnel to approximately 1,300 feet. Construction of the Thimble Shoal Channel to a depth of 56 feet is currently underway but not yet completed.

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<sup>1</sup> Please note that depths described in this document are provided in Mean Lower Low Water (MLLW).

Per the WRDA 2018, additional widening of the Thimble Shoal Channel was authorized as long as the modifications do not exceed the maximum 902 cost limitations of the previously approved project. Therefore, we are reassessing the need for an additional meeting area, Meeting Area 1 in the Norfolk Harbor Navigation Improvements Meeting Area Validation Study/Supplemental EA.

### **Channel to Newport News and Anchorages**

The Channel to Newport News and associated Newport News anchorages segment of the Norfolk Harbor Project (**Figure 2**) is authorized to 55 feet deep by 800 feet wide from Norfolk Harbor Channel in Hampton Roads to Newport News and the Newport News Anchorages. However, the channel has been maintained to a required depth of 50 feet. Material dredging is via hydraulic and/or mechanical dredging methods. Material dredged from this area is typically placed at the CIDMMA.

Per the Norfolk Harbor Navigation Improvements GRR/EA, deepening of the Newport News Channel was approved to a required depth of approximately 55 feet.

### **Norfolk Harbor Channel - Sewells Point to Lamberts Bend and Norfolk Harbor Anchorages**

The Sewells Point to Lamberts Bend reach of the Norfolk Harbor Project is located in Norfolk between Sewells Point and Lamberts Bend (**Figure 2**). This segment of the project is approximately eight miles long and varies in width between 800 feet to 1,200 feet. This reach also consists of: Anchorage F, Sewells Point East Anchorage (includes the Naval Maneuvering Area and Approach Areas), Sewells Point West Anchorage and (Approach Area), Anchorage G, and all approach areas.

The authorized project dimensions for this reach include a channel 55 feet deep and 1,200 feet wide from that depth in Hampton Roads to a point approximately 6.0 miles upstream from the Hampton Roads Bridge-Tunnel; thence 55 feet deep and 800 feet wide to Lambert Point. The Sewells Point to Lamberts Bend Channel is currently maintained to a required depth of 50 feet from the 55-foot contour in Hampton Roads (near the Hampton Roads Bridge Tunnel) to Lamberts Point.

Material is dredged from this area via hydraulic cutterhead pipeline dredge and/or a clamshell dredge. Material dredged from this area is then placed at the CIDMMA. The consistency of the dredged material in the Sewells Point to Lamberts Bend Channel is primarily silt and clay for which beneficial use projects have not been identified.

Per the Norfolk Harbor Navigation Improvements GRR/EA, deepening of the Norfolk Harbor and Channel as well as the Norfolk Harbor and Channels Entrance Area was approved to a required depth of approximately 55 feet. Per the Norfolk Harbor Navigation Improvements GRR/EA, the following was also approved:

- Widening Anchorage F to approximately 3,620 feet and associated modifications of the Approach Area; and
- Deepening Anchorage F to a required depth of approximately 51 feet.

### **Dam Neck Ocean Disposal Site**

The DNODS is located three nautical miles east of Virginia Beach (Figure 1). The DNODS area was first utilized as an ocean placement site in 1967. This ocean placement site was designated by the administrator of the U.S. Environmental Protection Agency (USEPA) in March of 1988. The DNODS runs parallel to Virginia Beach, covering about eight square nautical miles. Water depths at DNODS vary between 31 to 49 feet deep. The remaining DNODS capacity is estimated to be about 63 million cubic yards. The site is the primary dredged material disposal site for the Thimble Shoal Channel, Cape Henry Channel, and Atlantic Ocean Channel. Only material that meets ocean dumping criteria will be disposed at this site.

### **Norfolk Ocean Disposal Site**

The NODS (Figure 1) was officially designated as an ocean placement site in 1993, pursuant to Section 102 (c) of the Marine Protection, Research, and Sanctuaries Act of 1972 (as amended, 33 U.S.C. 1401 *et seq*). This ocean placement site was designated by the administrator of the USEPA in December of 1986. The site is authorized to receive new work and maintenance dredged material from the lower Chesapeake Bay. This site is also authorized to receive appropriate dredged material from the Thimble Shoal, Cape Henry, Atlantic Ocean Channel, Hampton Roads, and York Spit channels. An Environmental Impact Statement, titled: "Final Environmental Impact Statement for the Designation of an Ocean Dredged Material Disposal Site Located Offshore Norfolk Virginia" was finalized in November of 1992.

The center of the NODS is located 17 nautical miles from Virginia Beach. Water depths near the center of the site vary between 65 to 80 feet. Up to approximately 250 million cubic yard of dredged material from dredging projects (public and private) may be disposed at the site over the next 49 years. The quantity of material to be placed at the site depends on the quality of the dredged material. As with DNODS, only material that meets ocean dumping criteria will be disposed at this site.

### **Craney Island Dredged Material Management Area**

The CIDMMA is located in the City of Portsmouth in the eastern portion of the Atlantic Coastal Plain and adjacent to the confluence of the James River, Elizabeth River, and Nansemond River, and is in close proximity to the Chesapeake Bay and the Atlantic Ocean. The CIDMMA is a 2,500 acre confined disposal facility in the Hampton Roads area of Virginia. The CIDMMA was authorized by the River and Harbor Act of 1946 and constructed from 1956-1958. The federally owned facility is operated by USACE and is used by private interests, local municipalities, federal and Commonwealth of Virginia government agencies for the disposal of dredged material from Norfolk Harbor and its adjacent waterways.

Dredged material is received in two different ways at the CIDMMA. It is either pumped directly into one of three upland containment cells or it is deposited in the rehandling basin and then pumped into the facility. The Craney Island Rehandling Basin is a large deeper area off the southeast shoreline of the island that can be filled with material and then dredged once filled. Since it began operation, the CIDMMA has received, on average, 3.5 million cubic yards of dredged material per year. However, there have been several years when it has received more than 10 million cubic yards.

At present, the USACE estimates that the facility has a realistic timeline lasting until 2030. However, this may change as newer technologies and/or new management techniques are employed at the facility.

## **2.2 DREDGING AND DREDGED MATERIAL PLACEMENT PRACTICES FOR THE PREFERRED ALTERNATIVE, MEETING AREA 1**

The Preferred Alternative for the Norfolk Harbor Navigation Improvements Meeting Area Validation Study/Supplemental EA consists of constructing and maintaining the Meeting Area 1 including disposal of the dredged material. The proposed Meeting Area 1 would consist of a widened area of the Thimble Shoal Channels that is approximately located in a 5.1 mile (statute mile)-long area west of the Chesapeake Bay Bridge Tunnel (**Figure 2**). The channel widening would consist of dredging 200 additional feet along the north and south channel edges of the existing 1,000 ft wide Thimble Shoal Channel to create a 1,400 ft wide meeting area with a required depth of 56 feet to accommodate two way traffic for larger vessels. Existing conditions and geotechnical analyses of the area indicate side slopes of approximately 3H:1V are typical. As final design of the Preferred Alternative is ongoing, features may vary slightly prior to construction.

Dredged material placement/disposal could occur at the CIDMMA, DNODS, the NODS, and/or upland disposal sites for this project (if needed). It is anticipated that the DNODS placement would likely be the preferred dredged material placement option. While dredged material will be evaluated for beneficial use opportunities, the characteristics of the dredged material in vicinity of the Meeting Area 1 segment historically have not been suitable for typical projects in the region (which are generally seeking more sandier material). Portions of the dredged areas may be suitable for beneficial use projects and beneficial use projects would be coordinated separately from this project. General operation and maintenance of the CIDMMA will continue with or without implementation of the Preferred Alternative.

One important consideration in the impact analysis is that the actual dredged depths can be deeper than the required channel depths. Required depths do not necessarily indicate the maximum, potential dredging depths which may also include Advanced Maintenance Dredging (1 foot), Paid Allowable Overdepth Dredging (2 feet), and Non-Pay Allowable Overdepth dredging (2 feet) for the Norfolk Harbor Project. We refer to required depths throughout the text but in terms of the environmental impact analysis (affect determination), the estimated maximum, potential impact depths and dredging volumes will be used. For Meeting Area 1, a maximum depth of 61 feet was used to reflect these factors.

Dredges used for construction and maintenance of the Preferred Alternative would include hopper dredges, hydraulic cutterhead dredges, as well as mechanical dredges. Channel bed leveling equipment may also be used to flatten the channel bottom following dredging.

In the future, with or without implementation of the Preferred Alternative, vessel calls are anticipated to increase as compared to current conditions. However, when comparing the future with or without the project, there would be less vessel calls in the future with project as compared to the future without project because the existing, larger ships in the fleet would carry more goods, thus requiring fewer vessel calls to transport the same amount of goods.



**Figure 3.** Meeting Areas at the Thimble Shoal. The previous Norfolk Harbor Navigation Improvements GRR/EA Recommended Plan (Preferred Alternative) only included the Meeting Area 2. With the Norfolk Harbor Validation Study/Supplemental Environmental Assessment, Meeting Area 1 is being proposed as an additional meeting area.

Table 1 summarizes the approximate maximum dredging volumes, and durations with implementation of the Preferred Alternative, Meeting Area 1 based on a maximum depth of 61 feet.

Table 1 – Summary of Meeting Area 1 dredging volumes and durations

Segment	Required Depth (feet, MLLW)	Estimated Construction					Estimated Maintenance (50 Years)		Estimated Construction and Maintenance (50 Years)	
		Estimated Maximum Depth (feet, MLLW)	Estimated Maximum Dredging Volume- all allowable and nonpay (cubic yards)	Estimated Maximum Dredging Duration (months)	Estimated Total Land Disturbance - Maximum (square feet)	Change/Delta (increase) in Land Disturbance - Maximum (square feet)	Estimated 50 Year Total of Maintenance Volume (cubic yards)	Estimated 50 Year Total - Maintenance Dredging Duration (months)	Estimated Maximum Volume-Total Allowable and Non-pay + Maintenance Volume (cubic yards)	Estimated Maximum Construction + 50-year Maintenance Dredging Duration (months)
Thimble Shoal Channel Meeting Area 1 (5.1 miles that are 200 feet north and south of the existing Thimble Shoal Channel)	-56	-61	6,170,000	18 <sup>A</sup>	11,863,428	11,863,428	2,607,750	36	8,777,750	54

<sup>A</sup>18 months is active dredging duration based on one large hopper dredge being assigned to the project. Duration of work will extend across at least one 2.5 month-long voluntary seasonal dredging restriction that could extend the total duration to approximately 21 months.

### 2.3 PROJECT SCHEDULE AND DREDGING FREQUENCIES

Construction is anticipated to begin in approximately 2023 but is contingent on funding availability. Construction of the Meeting Area 1 will take approximately two years to complete. Maintenance dredging is anticipated to occur approximately every three to four years; after the deepening, this may accelerate to every two to three years.

Maintenance dredging may occur on an accelerated schedule based on shoaling conditions in the channel resulting from storm events or a delayed schedule depending on funding availability. Maintenance dredging will take approximately three months to complete and will be contingent on the type and size of the dredge used. Maintenance dredging may occur at any time of the year, however, to the maximum practical extent possible, dredging using a hopper dredge will not occur during September 1 - November 15 to reduce potential impacts to sea turtles. Dredging operations may be active 24 hours per day, 7 days per week, though two to three times per day, a hopper dredge will suspend dredging to transit to the disposal area, which represents a round trip transit time of 4 to 5 hours per trip.

## **2.4 FUTURE CONDITIONS**

The number of future vessel calls to Norfolk Harbor is projected to increase over time due to the projected increase in future cargo tonnage under both without and with-project conditions. The projected amount of future cargo would not be affected by implementation of the project, but the number of projected future vessel calls would be fewer under the with-project condition. Under the with-project condition, the deeper channel would allow some vessels to load more cargo (increasing vessel draft deeper than the existing 47-foot restriction) and would allow for the use of larger vessels.

Currently and under without-project conditions, the largest vessels using Norfolk Harbor require a one-way traffic restriction when transiting. This restriction causes some vessels to be delayed (either waiting at the dock or waiting out at sea) while the large vessel is transiting the channel. After the large vessel has finished its transit, the other vessels can enter the channel. Under with project conditions with a wider channel provided by Meeting Area 1, the one-way restriction would be reduced, resulting in fewer vessel delays.



# COMMONWEALTH of VIRGINIA

## DEPARTMENT OF ENVIRONMENTAL QUALITY

Street address: 629 East Main Street, Richmond, Virginia 23219

Mailing address: P.O. Box 1105, Richmond, Virginia 23218

[www.deq.virginia.gov](http://www.deq.virginia.gov)

Molly Joseph Ward  
Secretary of Natural Resources

David K. Paylor  
Director

(804) 698-4000  
1-800-592-5482

October 2, 2015

Colonel Jason E. Kelly  
U.S. Army Corps of Engineers  
Norfolk District  
803 Front Street  
Norfolk, Virginia 23510

Colonel Edward P. Chamberlayne  
U.S. Army Corps of Engineers  
Baltimore District  
City Crescent Building  
10 South Howard Street  
Baltimore, Maryland 21201

**RE: Regulation of Dredging and Aquatic Resource Restoration Activities Conducted by the U.S. Army Corps of Engineers in Commonwealth of Virginia Waters**

Dear Colonel Kelly and Colonel Chamberlayne:

The Department of Environmental Quality (DEQ) appreciates the long-standing role that the U.S. Army Corps of Engineers (the Corps) has played as the federal agency responsible for the Nation's navigation system. The Corps' navigation projects include waterway channels, anchorages, turning basins, locks and dams, harbor areas, protective jetties and breakwaters, and the maintenance of harbor access channels for commerce, recreation, and naval activities. My purpose in writing is to clarify when dredging and aquatic resource restoration activities conducted by the U.S. Army Corps of Engineers are under our statutory authority. Virginia Water Protection (VWP) permit regulations do not specifically define "maintenance dredging." DEQ permits for various types of dredging are governed by the VWP permit regulations (9 VAC 25-210 *et seq.*) as well as Chapters 12 and 13 of Title 28.2 of the Code of Virginia.

Colonel Jason E. Kelly  
Colonel Edward P. Chamberlayne  
September 29, 2015

### **Dredging Activities:**

While the Commonwealth of Virginia holds submerged aquatic lands in the public trust, DEQ acknowledges the National benefits of commerce, recreation, and naval operations. Maintenance dredging undertaken by the Corps of an existing Federal Navigation Channel already has, or should have, a Federal Consistency Determination (FCD) concurrence from DEQ. An approved FCD from DEQ means that a Corps dredging project is consistent with all of the Enforceable Policies, including nontidal wetlands. For these projects, no VWP permit or permit fee will be required; including reissuance of any expired VWP permit. For Corps capital dredging projects that do not have a FCD, any water quality or habitat concerns will be identified and addressed through the FCD process, and no further VWP permit or permit fee will be required. As the lead Federal agency, it is the Corps' responsibility to submit the necessary FCD information to DEQ's Office of Environmental Impact Review for review prior to undertaking the project. Other Corps dredging projects (i.e., those projects undertaken by the Corps, or where the Corps would otherwise be viewed as "an applicant" or "a permittee") will also follow this decision process. Overboard disposal of dredge materials associated with Corps dredging projects will not require a VWP permit or permit fee. DEQ's regulatory decision process does not eliminate the need, if appropriate, for other permits from the Virginia Marine Resources Commission (VMRC) or other federal, state, or local regulations and ordinances.

Through State Water Control Law and the Virginia Coastal Program, DEQ is responsible for maintaining the water quality and coastal resources for the Commonwealth. Should there be any alleged violations of state water quality standards from these types of projects, DEQ will investigate the matter through our normal enforcement processes, and work with the Corps to correct any identified deficiencies.

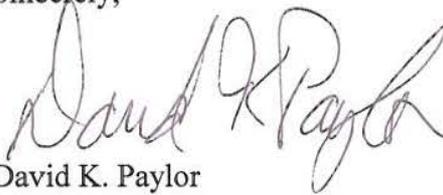
### **Aquatic Resource Restoration Activities**

DEQ agrees with and supports restoration of habitat to improve aquatic species, which will provide an overall benefit to water quality. While many of these types of projects do not impact State Waters, some projects do impact State Waters, albeit for a greater good. DEQ will review Corps restoration projects on a case-by-case basis to determine if a VWP permit will be required. If a permit is required, no permit fee will be assessed. DEQ's regulatory decision process does not eliminate the need, if appropriate, for other permits from the VMRC or other federal, state, or local regulations and ordinances. A FCD will be required if the project meets the appropriate criteria.

I hope this helps to clarify when permits from DEQ will or will not be required for dredging and aquatic resource restoration projects. Should you have specific, project-related questions, please contact Mr. Dave Davis at 804-698-4105 or [dave.davis@deq.virginia.gov](mailto:dave.davis@deq.virginia.gov).

Colonel Jason E. Kelly  
Colonel Edward P. Chamberlayne  
September 29, 2015

Sincerely,



David K. Paylor

cc: Mr. Tony Watkinson, VMRC Habitat Division  
Ms. Bettina R. Sullivan, DEQ Office of Environmental Impact Review  
DEQ Regional VWP Permit Managers

COMMONWEALTH OF VIRGINIA  
DEPARTMENT OF ENVIRONMENTAL QUALITY  
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Colonel Jason E. Kelly  
U.S. Army Corps of Engineers  
Norfolk District  
803 Front Street  
Norfolk, Virginia 23510

**From:** [Logalbo, Alicia M CIV USARMY CENAO \(USA\)](mailto:Logalbo, Alicia M CIV USARMY CENAO (USA))  
**To:** [virginiafieldoffice@fws.gov](mailto:virginiafieldoffice@fws.gov)  
**Cc:** [Shunfenthal, Jennifer C CIV \(USA\)](mailto:Shunfenthal, Jennifer C CIV (USA)); [Koelsch, Kimberly C CIV USARMY CENAO \(USA\)](mailto:Koelsch, Kimberly C CIV USARMY CENAO (USA)); [Schulte, David M CIV CENAO CENAD \(USA\)](mailto:Schulte, David M CIV CENAO CENAD (USA)); [Perdue, Katherine S CIV CENAO CENAD \(USA\)](mailto:Perdue, Katherine S CIV CENAO CENAD (USA))  
**Subject:** Self-Certification Letter Reinitiation of Consultation for Norfolk Harbor Navigation Improvements  
**Date:** Friday, October 15, 2021 10:54:00 PM  
**Attachments:** [BA\\_USFWS\\_20211015.pdf](#)  
[Appendix A Species List\\_Virginia Ecological Services Field Office \(1\).pdf](#)  
[USFWS Consultation Ltr\\_20211014.pdf](#)  
[online project review certification SIGNED.pdf](#)

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To Whom It May Concern,

Attached is a letter requesting reinitiation of ESA, Section 7 consultation with the USFWS for the Norfolk Harbor Navigation Improvements as we have a project scope addition and also because additional species have been added to the Official Species List. Please contact me via email at: [Alicia.Logalbo@usace.army.mil](mailto:Alicia.Logalbo@usace.army.mil) or via cell phone at: 757-335-8075 if you have any questions or need any additional information. I have attached the Biological Assessment, Official Species List, and the completed Self-Certification Letter (as all findings are either No Effect or May Affect, Not Likely to Adversely Affect). In accordance with the USFWS Virginia Field Office procedures, if we do not receive a response within 60 days we will assume concurrence with the affect findings described in the attached Biological Assessment. Thank you.

Alicia Logalbo

Alicia Logalbo  
Norfolk District, U.S. Army Corps of Engineers  
Planning and Policy Branch  
Chief, Environmental Analysis Section  
803 Front Street  
Norfolk, VA 23510

(757) 201-7210 office

(757) 335-8075 cell

[Alicia.Logalbo@usace.army.mil](mailto:Alicia.Logalbo@usace.army.mil)



DEPARTMENT OF THE ARMY  
US ARMY CORPS OF ENGINEERS  
NORFOLK DISTRICT  
FORT NORFOLK  
803 FRONT STREET  
NORFOLK VA 23510-1011

October 15, 2021

SUBJECT: Request to re-initiate Endangered Species Act, Section 7 consultation due to change in project scope and additional listed species, Norfolk Harbor and Channels Navigation Improvements

Troy Anderson  
U.S. Fish and Wildlife Service  
6669 Short Lane,  
Gloucester, VA 23061

Dear Mr. Anderson:

The U.S. Army Corps of Engineers previously completed informal Endangered Species Act (ESA), Section 7 consultation with the U.S. Fish and Wildlife Service for the Norfolk Harbor Navigation Improvements Project in 2018. The U.S. Army Corps of Engineers (USACE) requests to re-initiate ESA, Section 7 consultation for the Norfolk Harbor Navigation Improvements Project due to an expansion of the project scope and to assess effects to the eastern black rail which has been listed since the previous consultation was completed. In addition, the monarch butterfly has been listed as a candidate species since the last consultation was completed so we are also requesting consultation on this species as well. We are requesting the reinitiation of consultation be limited to the project expansion and also the additional species requiring consultation. The expansion is an additional, proposed Meeting Area 1, which was not fully evaluated in the Biological Assessment/consultation that was completed in 2018. The proposed Meeting Area 1 would consist of widening the existing Thimble Shoal Channel along an approximately 5.1 mile-long area west of the Chesapeake Bay Bridge Tunnel. The widening would consist of approximately 200 additional feet located north of the existing Thimble Shoal Channel and an additional 200 feet south of the existing Thimble Shoal Channel. The dredged material would be anticipated to be placed of at the Dam Neck Ocean Disposal Site but could also potentially be placed at the Norfolk Ocean Disposal Site or the Craney Island Dredged Material Management Area. A project description of the proposed Meeting Area 1 Preferred Alternative is provided in the attached updated Biological Assessment.

To clarify, the 2018 Biological assessment is still valid but we are updating the 2018 Biological Assessment to include the proposed Meeting Area 1 and to include the eastern black rail and the monarch butterfly in the effects determination. We also evaluated additional species on the Official Species List that have a No Effect finding as well. Effects to threatened and endangered species with Meeting Area 1 are similar to those described in the 2018 Biological Assessment due to the adjacent location of Meeting Area 1 to that already covered in the 2018 Biological Assessment and because the dredging methods and dredged material placement areas for Meeting Area 1 are as those described for the 2018 Biological Assessment.

Implementation of the Preferred Alternative, Meeting Area 1 would have the same effects to the species already described in the 2018 Biological Assessment. Best management practices as described in the 2018 Biological Assessment (and also included in the updated Biological Assessment) would be implemented to avoid and minimize impacts to threatened and endangered species to the maximum, practical extent.

The USACE is currently conducting a validation study and preparing a Supplemental Environmental Assessment to fully assess the effects of the proposed additional Meeting Area 1; a required part of this USACE study process is to complete required environmental compliance which includes the ESA Section 7 consultation with the USFWS. The USACE requests that ESA, Section 7 consultation for the Norfolk Harbor and Channels Navigation Improvements Project be reinitiated upon receipt of this letter and that the information provided in this letter serve as the supplemental information required for the consultation. Should you have any additional questions please contact me at [Alicia.Logalbo@usace.army.mil](mailto:Alicia.Logalbo@usace.army.mil) or (757) 335-8075. If we do not receive a response within 60 days we will assume concurrence with our ESA, Section 7 findings. Thank you.

Sincerely,

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Alicia Logalbo  
Chief, Environmental Analysis Section  
Planning and Policy Branch  
U.S. Army Corps of Engineers, Norfolk District

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**NORFOLK HARBOR NAVIGATION  
IMPROVEMENTS & NORFOLK  
HARBOR NAVIGATION  
IMPROVEMENTS MEETING AREA  
VALIDATION STUDY**

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**BIOLOGICAL ASSESSMENT  
SUBMITTED TO THE U.S. FISH AND  
WILDLIFE SERVICE**

**U.S. Army Corps of Engineers, Norfolk District  
803 Front Street  
Norfolk, Virginia 23510**

**October 15, 2021**



**U.S. Army Corps  
of Engineers  
Norfolk District**

## **1.0 INTRODUCTION AND BACKGROUND**

### **1.1 INTRODUCTION, PURPOSE, AND NEED**

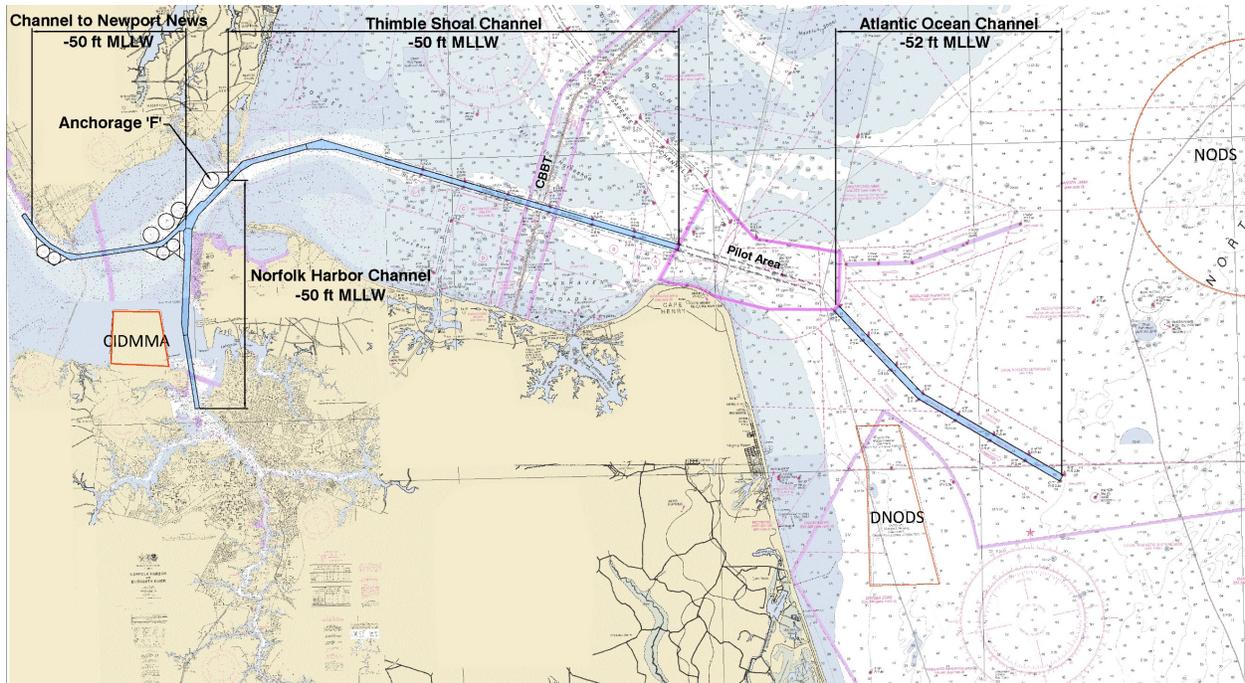
The Norfolk Harbor and Channels consists of a network of multiple channel and anchorage elements that provide deep draft access from the Atlantic Ocean into the Port of Virginia. The harbor in which the Port of Virginia is located covers a 25 square-mile area and serves a variety of private marine terminals, state-owned marine terminals, and federal maritime/military facilities located within the cities of Norfolk, Newport News, Portsmouth, Chesapeake, and Hampton in southeastern Virginia.

The purpose of the Norfolk Harbor Navigation Improvements Meeting Area Validation Study is to improve the operational efficiency of commercial vessels currently using and projected to use the Norfolk Harbor and Channels. The need for this project arises from inefficiencies currently experienced by commercial vessels within the existing Norfolk Harbor and Channels as industry adoption toward larger vessels has necessitated periodic establishment of one-way traffic within channels that normally support two-way traffic.

Updated forecasted fleet inventory and economic data is now available which warrants the reevaluation of expanding the existing, approved meeting area (Meeting Area 2) with an additional meeting area (Meeting Area 1), where two-way traffic of larger vessels can be accommodated. Compared to the forecast used during for the 2018 Norfolk Harbor Navigation Improvements General Reevaluation Report/Environmental Assessment (GRR/EA), ocean carriers have more rapidly transitioned to the ultra large container vessels than the forecast predicted, warranting a reassessment of the of the Meeting Area 1. The proposed Meeting Area 1 would consist of a widened area of the Thimble Shoal Channels that is approximately located in a 5.1 mile (statute mile)-long area west of the Chesapeake Bay Bridge Tunnel. The widening would consist of approximately 200 additional feet located north of the existing Thimble Shoal Channel and an additional 200 feet south of the existing Thimble Shoal Channel.

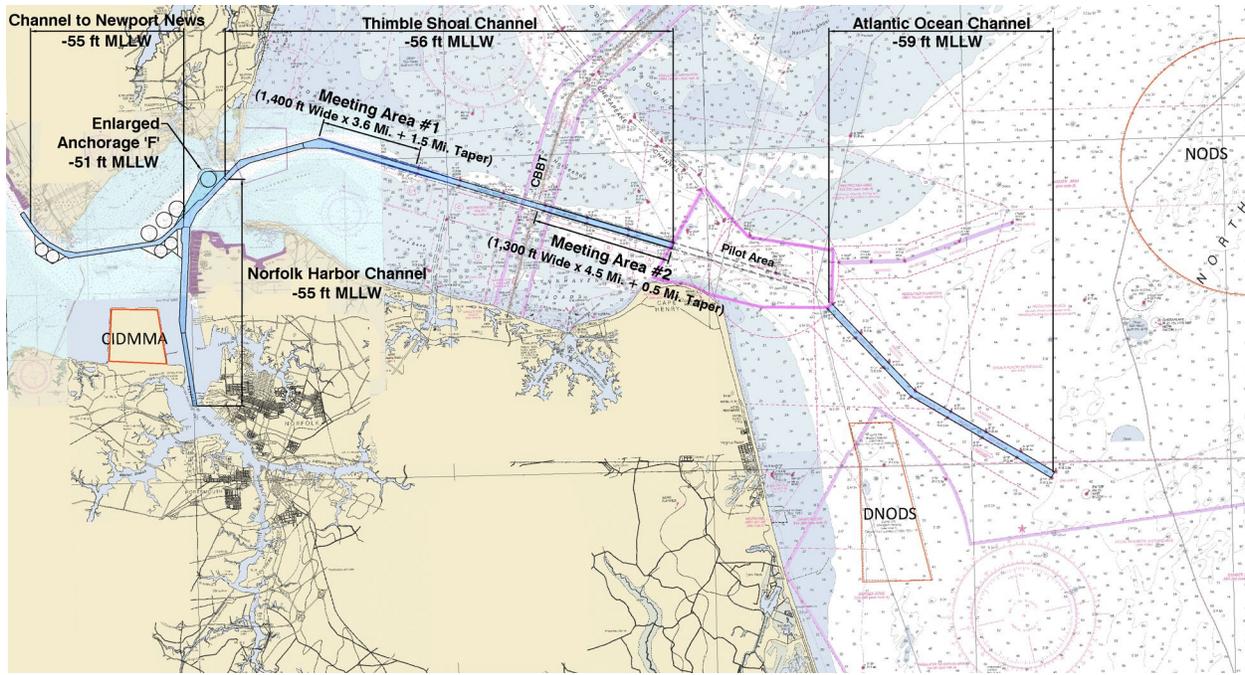
### **1.2 PROJECT SCOPE**

The Norfolk Harbor Project is a single purpose deep draft navigation project that consists of a network of federally improved channels extending from the Atlantic Ocean, through the Chesapeake Bay, and into the Port of Virginia (**Figure 1**).



**Figure 1.** The existing Norfolk Harbor and Channels from the Atlantic Ocean Channel to the Lamberts Bend. Dredged material placement/disposal sites are also depicted. CIDMMA = Craney Island Dredged Material Management Area; DNODS = Dam Neck Ocean Disposal Site; NODS = Norfolk Ocean Disposal Site

Originally authorized in the Water Resources Development Act (WRDA) of 1986 and as further defined by the 2018 Norfolk Harbor Navigation Improvements GRR/EA, the authorized and approved project includes a system of two-way, full-width channels to a depth of 55 feet in the Norfolk Harbor, 56 feet in the Thimble Shoal Channels, 55 feet in the Newport News Channel and 59 feet in the Atlantic Ocean Channel (**Figure 2**)



**Figure 2.** Norfolk Harbor and Channels Project Segments with approved project depths. Miles provided in statute miles.

Since the original authorization by WRDA, the project has been constructed in separable elements based on the needs of the port community and the financial capability of the nonfederal sponsor, the Virginia Port Authority, agent of the Commonwealth of Virginia:

- The 50 Foot Outbound Element was completed in 1989
- The 50 Foot Anchorage was completed in 1999.
- The 50 Foot Inbound Element was completed in 2007.
- The deepening of the Thimble Shoal Channel to 56 feet as described in the Norfolk Harbor Navigation Improvements GRR/EA is currently underway.

The approved project also includes Meeting Area 2, a widening of the Thimble Shoal Channel east of the Chesapeake Bay Bridge Tunnel to 1,300 feet, widening of Anchorage F to 3,620 feet and the associated modification of the Approach Area, and deepening of Anchorage F to 51 feet. The approved project includes disposal of dredged material at the Dam Neck Ocean Disposal Site (DNODS), the Norfolk Ocean Disposal Site (NODS), and the Craney Island Dredged Material Management Area (CIDMMA).

The scope of this validation study is limited to a reevaluation of the construction and maintenance of Meeting Area 1 and disposal of material dredged from the Meeting Area 1. This meeting area was partially evaluated in the approved Norfolk Harbor Navigation Improvements GRR/EA but was not included in the Recommended Plan (Preferred Alternative); only Meeting Area 2 was included in the approved Norfolk Harbor Navigation Improvements GRR/EA. However, Meeting Area 1 is being reevaluated due to ongoing concerns about the inefficiencies experienced by commercial vessels and due to changes in the fleet forecast and associated economic benefits of the project.

### **1.3 CURRENT NORFOLK HARBOR PROJECT DREDGING AND DREDGED MATERIAL PLACEMENT/DISPOSAL PRACTICES**

#### **Atlantic Ocean Channel**

The Atlantic Ocean Channel, off the eastern coast of Virginia (**Figure 2**), was authorized by the WRDA of 1986. The WRDA authorized the U.S. Army Corps of Engineers (USACE) to construct the Atlantic Ocean Channel which consists of a channel 11.1 miles long, 1,300 feet wide, and 57 feet deep<sup>1</sup>. As part of the 50-foot inbound construction effort in 2006, the channel was deepened to provide for a required depth and width of 52 feet and 1,300 feet, respectively.

The Atlantic Ocean Channel is part of the Port of Virginia and Baltimore system of channels, and is the segment providing access for all ships calling on port facilities, naval bases, and shipyards in the Hampton Roads, York River and Baltimore areas. All commercial tonnage entering and leaving the Ports of Virginia and Baltimore pass through this channel. The channel is currently maintained to a full width and a required depth of 52 feet to enable loaded colliers, container ships and military vessels to transit the channel with ship drafts as great as 47 feet (45 ft with no tide restrictions).

Material is typically dredged via hopper dredge from this channel. Dredged material is placed at DNODS. Dredged material is largely fine sand that has also been beneficially used for the Virginia Beach Hurricane Protection project and the Craney Island Eastern Expansion (CIEE) Project. Due to periodic use as a sand source, maintenance dredging has not been required.

Per the Norfolk Harbor Navigation Improvements GRR/EA, deepening of the Atlantic Ocean Channel to a required depth of approximately 59 feet was approved.

#### **Thimble Shoal Channel**

The Thimble Shoal Channel is located in the southern part of the Chesapeake Bay, just off the shoreline of Norfolk and Virginia Beach, east of the CIDMMA (**Figure 2**). This project was originally authorized by the River and Harbor Act of 1917. The original authorized channel dimensions were 13.4 miles long, 1,000 feet wide, between the 55 foot contours, to a depth of 55 feet. The channel has been maintained to a required depth of 50 feet. Thimble Shoal Channel extends from the deep water to the east of Hampton Roads to the deep water at the mouth of the Chesapeake Bay.

Material dredging is typically via hopper dredging. Dredged material is placed at the DNODS. The sediments of Thimble Shoal Channel to the west of the Chesapeake Bay Bridge Tunnel are predominantly clays and silts, for which beneficial use projects have not been identified. In contrast, sediments in the eastern portion of channel are largely fine to medium-grained sand and the segment is a common source of material for beach nourishment projects.

Per the Norfolk Harbor Navigation Improvements GRR/EA, deepening of the Thimble Shoal Channel to a required depth of approximately 56 feet was approved. This also included approval of Meeting Area 2 which consists of a widening of the Thimble Shoal Channel east of the Chesapeake Bay Bridge Tunnel to approximately 1,300 feet. Construction of the Thimble Shoal Channel to a depth of 56 feet is currently underway but not yet completed.

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<sup>1</sup> Please note that depths described in this document are provided in Mean Lower Low Water (MLLW).

Per the WRDA 2018, additional widening of the Thimble Shoal Channel was authorized as long as the modifications do not exceed the maximum 902 cost limitations of the previously approved project. Therefore, we are reassessing the need for an additional meeting area, Meeting Area 1 in the Norfolk Harbor Navigation Improvements Meeting Area Validation Study/Supplemental EA.

### **Channel to Newport News and Anchorages**

The Channel to Newport News and associated Newport News anchorages segment of the Norfolk Harbor Project (**Figure 2**) is authorized to 55 feet deep by 800 feet wide from Norfolk Harbor Channel in Hampton Roads to Newport News and the Newport News Anchorages. However, the channel has been maintained to a required depth of 50 feet. Material dredging is via hydraulic and/or mechanical dredging methods. Material dredged from this area is typically placed at the CIDMMA.

Per the Norfolk Harbor Navigation Improvements GRR/EA, deepening of the Newport News Channel was approved to a required depth of approximately 55 feet.

### **Norfolk Harbor Channel - Sewells Point to Lamberts Bend and Norfolk Harbor Anchorages**

The Sewells Point to Lamberts Bend reach of the Norfolk Harbor Project is located in Norfolk between Sewells Point and Lamberts Bend (**Figure 2**). This segment of the project is approximately eight miles long and varies in width between 800 feet to 1,200 feet. This reach also consists of: Anchorage F, Sewells Point East Anchorage (includes the Naval Maneuvering Area and Approach Areas), Sewells Point West Anchorage and (Approach Area), Anchorage G, and all approach areas.

The authorized project dimensions for this reach include a channel 55 feet deep and 1,200 feet wide from that depth in Hampton Roads to a point approximately 6.0 miles upstream from the Hampton Roads Bridge-Tunnel; thence 55 feet deep and 800 feet wide to Lambert Point. The Sewells Point to Lamberts Bend Channel is currently maintained to a required depth of 50 feet from the 55-foot contour in Hampton Roads (near the Hampton Roads Bridge Tunnel) to Lamberts Point.

Material is dredged from this area via hydraulic cutterhead pipeline dredge and/or a clamshell dredge. Material dredged from this area is then placed at the CIDMMA. The consistency of the dredged material in the Sewells Point to Lamberts Bend Channel is primarily silt and clay for which beneficial use projects have not been identified.

Per the Norfolk Harbor Navigation Improvements GRR/EA, deepening of the Norfolk Harbor and Channel as well as the Norfolk Harbor and Channels Entrance Area was approved to a required depth of approximately 55 feet. Per the Norfolk Harbor Navigation Improvements GRR/EA, the following was also approved:

- Widening Anchorage F to approximately 3,620 feet and associated modifications of the Approach Area; and
- Deepening Anchorage F to a required depth of approximately 51 feet.

### **Dam Neck Ocean Disposal Site**

The DNODS is located three nautical miles east of Virginia Beach (Figure 1). The DNODS area was first utilized as an ocean placement site in 1967. This ocean placement site was designated by the administrator of the U.S. Environmental Protection Agency (USEPA) in March of 1988. The DNODS runs parallel to Virginia Beach, covering about eight square nautical miles. Water depths at DNODS vary between 31 to 49 feet deep. The remaining DNODS capacity is estimated to be about 63 million cubic yards. The site is the primary dredged material disposal site for the Thimble Shoal Channel, Cape Henry Channel, and Atlantic Ocean Channel. Only material that meets ocean dumping criteria will be disposed at this site.

### **Norfolk Ocean Disposal Site**

The NODS (Figure 1) was officially designated as an ocean placement site in 1993, pursuant to Section 102 (c) of the Marine Protection, Research, and Sanctuaries Act of 1972 (as amended, 33 U.S.C. 1401 *et seq*). This ocean placement site was designated by the administrator of the USEPA in December of 1986. The site is authorized to receive new work and maintenance dredged material from the lower Chesapeake Bay. This site is also authorized to receive appropriate dredged material from the Thimble Shoal, Cape Henry, Atlantic Ocean Channel, Hampton Roads, and York Spit channels. An Environmental Impact Statement, titled: "Final Environmental Impact Statement for the Designation of an Ocean Dredged Material Disposal Site Located Offshore Norfolk Virginia" was finalized in November of 1992.

The center of the NODS is located 17 nautical miles from Virginia Beach. Water depths near the center of the site vary between 65 to 80 feet. Up to approximately 250 million cubic yard of dredged material from dredging projects (public and private) may be disposed at the site over the next 49 years. The quantity of material to be placed at the site depends on the quality of the dredged material. As with DNODS, only material that meets ocean dumping criteria will be disposed at this site.

### **Craney Island Dredged Material Management Area**

The CIDMMA is located in the City of Portsmouth in the eastern portion of the Atlantic Coastal Plain and adjacent to the confluence of the James River, Elizabeth River, and Nansemond River, and is in close proximity to the Chesapeake Bay and the Atlantic Ocean. The CIDMMA is a 2,500 acre confined disposal facility in the Hampton Roads area of Virginia. The CIDMMA was authorized by the River and Harbor Act of 1946 and constructed from 1956-1958. The federally owned facility is operated by USACE and is used by private interests, local municipalities, federal and Commonwealth of Virginia government agencies for the disposal of dredged material from Norfolk Harbor and its adjacent waterways.

Dredged material is received in two different ways at the CIDMMA. It is either pumped directly into one of three upland containment cells or it is deposited in the rehandling basin and then pumped into the facility. The Craney Island Rehandling Basin is a large deeper area off the southeast shoreline of the island that can be filled with material and then dredged once filled. Since it began operation, the CIDMMA has received, on average, 3.5 million cubic yards of dredged material per year. However, there have been several years when it has received more than 10 million cubic yards.

At present, the USACE estimates that the facility has a realistic timeline lasting until 2030. However, this may change as newer technologies and/or new management techniques are employed at the facility.

## **2.0 PROJECT DESCRIPTION: DREDGING AND DREDGED MATERIAL PLACEMENT PRACTICES FOR THE PREFERRED ALTERNATIVE, MEETING AREA 1**

The Preferred Alternative for the Norfolk Harbor Navigation Improvements Meeting Area Validation Study/Supplemental EA consists of constructing and maintaining the Meeting Area 1 including disposal of the dredged material. The proposed Meeting Area 1 would consist of a widened area of the Thimble Shoal Channels that is approximately located in a 5.1 mile (statute mile)-long area west of the Chesapeake Bay Bridge Tunnel (**Figure 2**). The channel widening would consist of dredging 200 additional feet along the north and south channel edges of the existing 1,000 ft wide Thimble Shoal Channel to create a 1,400 ft wide meeting area with a required depth of 56 feet to accommodate two way traffic for larger vessels. Existing conditions and geotechnical analyses of the area indicate side slopes of approximately 3H:1V are typical. As final design of the Preferred Alternative is ongoing, features may vary slightly prior to construction.

Dredged material placement/disposal could occur at the CIDMMA, DNODS, the NODS, and/or upland disposal sites for this project (if needed). It is anticipated that the DNODS placement would likely be the preferred dredged material placement option. While dredged material will be evaluated for beneficial use opportunities, the characteristics of the dredged material in vicinity of the Meeting Area 1 segment historically have not been suitable for typical projects in the region (which are generally seeking more sandier material). Portions of the dredged areas may be suitable for beneficial use projects and beneficial use projects would be coordinated separately from this project. General operation and maintenance of the CIDMMA will continue with or without implementation of the Preferred Alternative.

One important consideration in the impact analysis is that the actual dredged depths can be deeper than the required channel depths. Required depths do not necessarily indicate the maximum, potential dredging depths which may also include Advanced Maintenance Dredging (1 foot), Paid Allowable Overdepth Dredging (2 feet), and Non-Pay Allowable Overdepth dredging (2 feet) for the Norfolk Harbor Project. We refer to required depths throughout the text but in terms of the environmental impact analysis (affect determination), the estimated maximum, potential impact depths and dredging volumes will be used. For Meeting Area 1, a maximum depth of 61 feet was used to reflect these factors.

Dredges used for construction and maintenance of the Preferred Alternative would include hopper dredges, hydraulic cutterhead dredges, as well as mechanical dredges. Channel bed leveling equipment may also be used to flatten the channel bottom following dredging.

In the future, with or without implementation of the Preferred Alternative, vessel calls are anticipated to increase as compared to current conditions. However, when comparing the future with or without the project, there would be less vessel calls in the future with project as compared to the future without project because the existing, larger ships in the fleet would carry more goods, thus requiring fewer vessel calls to transport the same amount of goods.



**Figure 1.** Meeting Areas at the Thimble Shoal. The previous Norfolk Harbor Navigation Improvements GRR/EA Recommended Plan (Preferred Alternative) only included the Meeting Area 2. With the Norfolk Harbor Validation Study/Supplemental Environmental Assessment, Meeting Area 1 is being proposed as an additional meeting area.

Table 1 summarizes the approximate maximum dredging volumes, and durations with implementation of the Preferred Alternative, Meeting Area 1 based on a maximum depth of 61 feet.

**Table 1.** Summary of Meeting Area 1 estimated dredging volumes and durations

Segment	Required Depth (feet, MLLW)	Estimated Construction					Estimated Maintenance (50 Years)		Estimated Construction and Maintenance (50 Years)	
		Estimated Maximum Depth (feet, MLLW)	Estimated Maximum Dredging Volume- all allowable and nonpay (cubic yards)	Estimated Maximum Dredging Duration (months)	Estimated Total Land Disturbance - Maximum (square feet)	Change/Delta (increase) in Land Disturbance - Maximum (square feet)	Estimated 50 Year Total of Maintenance Volume (cubic yards)	Estimated 50 Year Total - Maintenance Dredging Duration (months)	Estimated Maximum Volume-Total Allowable and Non-pay + Maintenance Volume (cubic yards)	Estimated Maximum Construction + 50-year Maintenance Dredging Duration (months)
Thimble Shoal Channel Meeting Area 1 (5.1 miles that are 200 feet north and south of the existing Thimble Shoal Channel)	-56	-61	6,170,000	18 <sup>A</sup>	11,863,428	11,863,428	2,607,750	36	8,777,750	54

<sup>A</sup>18 months is active dredging duration based on one large hopper dredge being assigned to the project. Duration of work will extend across at least one 2.5 month-long voluntary seasonal dredging restriction that could extend the total duration to approximately 21 months.

## 2.1 PROJECT SCHEDULE AND DREDGING FREQUENCIES

Construction is anticipated to begin in approximately 2023 but is contingent on funding availability. Construction of the Meeting Area 1 will take approximately two years to complete. Maintenance dredging is anticipated to occur approximately every three to four years; after the deepening, this may accelerate to every two to three years.

Maintenance dredging may occur on an accelerated schedule based on shoaling conditions in the channel resulting from storm events or a delayed schedule depending on funding availability. Maintenance dredging will take approximately three months to complete and will be contingent on the type and size of the dredge used. Maintenance dredging may occur at any time of the year, however, to the maximum practical extent possible, dredging using a hopper dredge will not occur during September 1 - November 15 to reduce potential impacts to sea turtles. Dredging operations may be active 24 hours per day, 7 days per week, though two to three times per day, a hopper dredge will suspend dredging to transit to the disposal area, which represents a round trip transit time of 4 to 5 hours per trip.

## **2.2 FUTURE CONDITIONS**

The number of future vessel calls to Norfolk Harbor is projected to increase over time due to the projected increase in future cargo tonnage under both without and with-project conditions. The projected amount of future cargo would not be affected by implementation of the project, but the number of projected future vessel calls would be fewer under the with-project condition. Under the with-project condition, the deeper channel would allow some vessels to load more cargo (increasing vessel draft deeper than the existing 47-foot restriction) and would allow for the use of larger vessels.

Currently and under without-project conditions, the largest vessels using Norfolk Harbor require a one-way traffic restriction when transiting. This restriction causes some vessels to be delayed (either waiting at the dock or waiting out at sea) while the large vessel is transiting the channel. After the large vessel has finished its transit, the other vessels can enter the channel. Under with project conditions with a wider channel provided by Meeting Area 1, the one-way restriction would be reduced, resulting in fewer vessel delays.

## **3.0 OFFICIAL SPECIES LIST**

The official species list for the Norfolk Harbor Navigation Improvements Meeting Area Validation Study/EA is provided in Appendix A. Table 2 provides a listing of the federally listed species under the jurisdiction of the USWFS with the potential to occur in the Action Area.

Although it was listed in the IPaC we did not include the American alligator (*Alligator mississippiensis*) in Table 2 as there is no habitat for this species in the Action Area and therefore, this species would not be anticipated to occur in the Action Area. Because there would be no effects to this species it is not discussed in detail in this Biological Assessment.

Although it was listed in the IPaC we did not include the red cockaded woodpecker (*Picoides borealis*) in Table 2 as there is no habitat for this species in the Action Area and therefore, this species would not be anticipated to occur in the Action Area. The dominant vegetation types at the CIDMMA include wetland vegetation comprised mainly of emergent cordgrass (*Spartina alterniflora* and *Spartina patens*), Phragmites (*Phragmites australis*) and panicum grass (*Panicum spp.*) and therefore would not be anticipated to provide adequate foraging or nesting habitat for the redcockaded woodpecker. Because there would be no effects to this species it is not discussed in detail in this Biological Assessment.

Although it was listed in the IPaC we did not include the hawksbill sea turtle (*Eretmochelys imbricata*) in Table 2 as there is no documented occurrence of the hawksbill sea turtle in the Action Area and there is no preferred habitat for this species in the Action Area. Because there would be no effects to this species it is not discussed in detail in this Biological Assessment.

The remaining listed sea turtles in Table 2 do not nest in the Action Area but have the potential to occur in the open water habitat of the Action Area outside the jurisdiction of the USFWS. Because there would be no effects to listed sea turtles in the jurisdiction of the USFWS it is not discussed in detail in this Biological Assessment.

Although it was listed in the IPaC we did not include the northeastern tiger beetle (*Cicindela dorsalis dorsalis*) in Table 2 as there is no documented occurrence of the northeastern tiger beetle in the Action Area and there is no preferred habitat for this species in the Action Area. Because there would be no effects to this species it is not discussed in detail in this Biological Assessment.

**Table 2.** Federally listed and candidate species under the jurisdiction of the U.S. Fish and Wildlife Service known or with the potential to occur in the Action Area (USFWS 2021a).

<b>Taxonomic Category/Common Name</b>	<b>Scientific Name</b>	<b>Status</b>	<b>Critical Habitat</b>
<b>Birds</b>			
Eastern black rail	<i>Laterallus jamaicensis ssp. jamaicensis</i>	T	N
Piping plover	<i>Charadrius melodus</i>	T	Y*
Red knot	<i>Calidris canutus rufa</i>	T	N
Roseate tern	<i>Sterna dougallii</i>	E	N
<b>Mammals</b>			
Indiana bat	<i>Myotis sodalis</i>	E	Y*
Northern long-eared bat	<i>Myotis septentrionalis</i>	T	N
West Indian manatee	<i>Trichechus manatus</i>	T	Y*
<b>Reptiles</b>			
Green sea turtle (North Atlantic DPS)	<i>Chelonia mydas</i>	T	Y*
Hawksbill sea turtle	<i>Eretmochelys imbricata</i>	E	
Kemp's ridley sea turtle	<i>Lepidochelys kempii</i>	E	N
Leatherback sea turtle	<i>Dermochelys coriacea</i>	E	Y*
Loggerhead sea turtle (Northwest Atlantic DPS)	<i>Caretta caretta</i>	T	Y*
<b>Insects</b>			
Monarch butterfly	<i>Danaus plexippus</i>	C	N

DPS = Distinct Population Segment; T = Threatened; E = Endangered; Y = Yes; N = No; C = Candidate ^Species status is reported as it pertains to the DPS/Action Area; \*Critical Habitat not located in Action Area

#### **4.0 EFFECTS DETERMINATION**

This section provides an overview and reasoning for the species affect findings. The Summary Species Conclusion Table for the Norfolk Harbor Navigation Improvements & Norfolk Harbor Navigation Improvements Meeting Area Validation Study/Environmental Assessment Summary Species Conclusion Table (within the jurisdiction of the U.S. Fish and Wildlife Service) is provided in Table 3.

## **4.1 CRITICAL HABITAT**

There is no critical habitat under the jurisdiction of the USFWS designated in the Action Area. Therefore, there would be no effects to critical habitat.

## **4.2 BIRDS**

### **4.2.1 EASTERN BLACK RAIL**

The eastern black rail has the potential to migrate through the Action Area and potentially stop over at the Craney Island. However, the presence of the eastern black rail at the CIDMMA has been an extremely rare occurrence. No reported nesting of the eastern black rail has occurred at the Craney Island.

Watts (2016) noted a possible eastern black rail detection that was not confirmed at Craney Island in 1994. The eastern black rail was detected along the vegetated wet slope microhabitat (mixed Phragmites) along the north road on Craney Island in June 2017. The observation was auditory only, and the calls were confirmed by species experts that same year (2017). No visual observations have occurred. The last confirmed call was in the summer of 2017. Monitoring for the species has been conducted every season since, however it has not been relocated as of yet. Species experts have visited the site with Coastal Virginia Wildlife Observers in attempt to relocate the species, but they have not been successful as of yet. In addition, USACE environmental staff has been unsuccessful in further observations.

Therefore, based on the very limited detections of this species and the absence of this species in recent survey data at Craney Island, the presence of this eastern black rail would be considered to be a rare and unlikely occurrence; any potential effects to the eastern black rail would be anticipated to be discountable.

*Therefore, the implementation of the Preferred Alternative may affect, but is not likely to adversely affect eastern black rail.*

### **4.2.2 PIPING PLOVERS, RED KNOTS, AND ROSEATE TERNS**

Piping plovers, red knots, and roseate terns have the potential to forage, rest, and/or migrate through the Action Area but do not currently breed in the Action Area. Although piping plovers previously nested at the CIDMMA, the nesting habitat there has degraded and is not currently suitable for piping plover nesting. No future plans to resume the nesting management program to improve the nesting habitat are anticipated. The noise and temporary turbidity plume caused by dredging and dredged material placement actions and CIDMMA maintenance may cause these bird species to move away from the disturbance; however, we would expect this to be a negligible to minor, and temporary impact that would not substantially impact their long-term foraging or breeding success. The dredging and dredged material placement/disposal operations would have a temporary, negligible to minor adverse impact to benthic invertebrates and fish. This could potentially impact some of the prey species of the piping plovers, red knots, and roseate terns. The shifts in salinity, temperature, and sea level rise all have the potential to result in shifts in prey species availability which could also cause detrimental effects to these species. However, because of the already disturbed nature of the majority of the Action Area and the amount of other available habitat for prey species, we would not anticipate the Maximum Action Alternative to have any substantial impact on any prey invertebrate or fish populations.

Another potential threat to this species is injury or incidental take resulting from Munitions of Explosive Concern/Unexploded Ordinance (MEC/UXO) detonation or contact with contaminants leaching from MEC/UXO that occur in the Action Area. However, we would not anticipate this to be a substantial threat as the USACE deploys MEC/UXO screening devices on dredges where there is risk of MEC/UXO detonation.

With implementation of the Preferred Alternative, the increased dredging and dredged material placement would cause more potential disturbances to listed birds in the Action Area. If listed avian species were in the Action Area we would anticipate a slight increase in disturbance effects that would range from negligible to minor impacts (birds temporarily moving away from the impact area) from implementation of the Preferred Alternative. We would not anticipate that this would substantively impact any potential foraging that could occur in the Action Area and surrounding areas.

Virginia Port growth is anticipated to increase throughout the next 50 years and a new port facility is planned, which may increase the number of vessels transiting the Norfolk Harbor and Channels. Additional development including planned transportation projects could increase avian disturbance impacts. However, implementation of the Preferred Alternative is not anticipated to substantially contribute to those increased impacts to listed avian species.

The loss of barriers and beach nesting breeding and foraging habitat anticipated with sea level rise has the potential to impact these species although the level of impact is relatively uncertain. However, substantial cumulative impacts resulting from implementation of the Preferred Alternative with the impacts of climate change is not anticipated. No substantive cumulative impacts of implementation the Preferred Alternative with other projects are anticipated.

*Therefore, the implementation of the Preferred Alternative may affect, but is not likely to adversely affect the piping plover, the red knot, or the roseate tern.*

## **4.3 MAMMALS**

### **4.3.1 NORTHERN LONG-EARED BAT AND INDIANA BAT**

The Action Area is restricted to subtidal habitat and the Craney Island. These areas would not provide suitable roosting or nesting habitat for the northern long-eared bat or the Indiana Bat. There is no known hibernacula or roosting sites in the Action Area (USFWS 2021c). It is unknown if the bat species migrate through the Action Area, however, this seems unlikely as this would not be their preferred nesting or foraging habitat. Even if flights did occur in the Action Area, it is not anticipated that implementation of the Preferred Alternative would impact any flight patterns.

*Therefore, implementation of the Preferred Alternative is anticipated to have no effect on the northern long-eared bat or the Indiana Bat.*

### **4.3.2 WEST INDIAN MANATEE**

Because the west Indian manatee is so unlikely to occur in the Action Area, it is unlikely there would be any interactions or impacts to this species. There is no data indicating that dredging, or dredged material placement, or turtle trawling relocation efforts has ever impacted any

manatees. The presence of a west Indian manatee in the Action Area would be considered a rare and temporary occurrence. Because there is no Submerged Aquatic Vegetation in the Action Area, there is no foraging habitat for manatees. Because the west Indian manatee is not anticipated to occur in the Action Area, any effects would be discountable. No substantive cumulative impacts of implementation the Preferred Alternative with other projects are anticipated.

*Therefore, the implementation of the Preferred Alternative may affect, but is not likely to adversely affect the West Indian Manatee.*

## **5.0 INSECT**

### **5.1 MONARCH BUTTERFLY**

The monarch butterfly (*Danaus plexippus*) has the potential to occur at and migrate through the CIDMMA with its mixture of upland and wetland vegetation habitats. However, the predominant vegetation at the CIDMMA would consist of cordgrass, Phragmites, and panicum. Therefore, based on the dominant vegetation in the Action Area we would not consider this to be preferred foraging or breeding habitat for the monarch butterfly. Dredged material placement effects at the CIDMMA may have a disturbance effect to monarch butterflies; however, any potential effects would be anticipated to be insignificant. No substantive cumulative impacts of implementation the Preferred Alternative with other projects are anticipated.

*Therefore, the implementation of the Preferred Alternative may affect, but is not likely to adversely affect the monarch butterfly.*

### **5.2 ALTERNATE MONITORING METHODS FOR UNEXPLODED ORDINANCE/MUNITIONS OF EXPLOSIVE CONCERN SCREENING**

The UXO/MEC special screening are installed on dragheads to prevent or minimize the entrainment of UXO/MEC materials that may be present in the navigation channel or borrow area. Unexploded Ordinance/Munitions of Explosive Concern have been recovered during hopper dredging operations in Atlantic Ocean Channel, Thimble Shoals Channel, Cape Henry Channel, and the Thimble Shoals Surround Borrow Area. The current specification for UXO/MEC screening on hopper dredge requires UXO/MEC special screening with screen openings no larger than 1.25 inch by 6-inch openings to prevent the passage of any material greater than 1.25 inch diameter.

**Table 3.** Norfolk Harbor Navigation Improvements & Norfolk Harbor Navigation Improvements Meeting Area Validation Study/Environmental Assessment Summary Species Conclusion Table (within the jurisdiction of the U.S. Fish and Wildlife Service).

Species / Resource Name	Species/Habitat Present in Action Area	Sources of Information	ESA Section 7 / Eagle Act Determination	Project Elements that Support Determination
American alligator	No	No documented occurrence of this species in Action Area	No Effect	There is no documented occurrence of the American alligator in the Action Area and there is no preferred habitat for this species in the Action Area. This species would not be anticipated to occur in the Action Area.
Eastern black rail	Not likely – would be a highly rare and unlikely occurrence.	IPaC (USFWS 2021a); Watts (2016); Craney Island Avian Survey Data 2017-2021	May Affect, Not Likely to Adversely Affect	The presence of this species in the Action Area at the Craney Island would be considered a highly rare occurrence. Any potential effects from dredged material placement at Craney Island would be discountable.
Piping plover, red knot, and roseate turn	Yes	IPaC (USFWS 2021a)	May Affect, Not Likely to Adversely Affect	The project may slightly impact flight and foraging behaviors but would have a negligible to minor impact. Any potential effects would be insignificant.
Red-cockaded woodpecker	No	Vegetation types in the CIDMMA	No Effect	There is no preferred foraging or nesting habitat for this species in the Action Area and therefore, this species would not be anticipated to occur in the Action Area.

Species / Resource Name	Species/Habitat Present in Action Area	Sources of Information	ESA Section 7 / Eagle Act Determination	Project Elements that Support Determination
West Indian manatee	Yes	IPaC (USFWS 2021a)	May Affect, Not Likely to Adversely Affect	Manatees would be transient species and would not likely occur in the Action Area. Effects would be discountable.
Northern long-eared bat and Indiana bat	No	IPaC (USFWS 2021a); NLEB Winter Habitat and Roost Tree Map (USFWS 2021c)	No Effect	No suitable foraging or roosting habitat is located in the Action Area. There are no known hibernacula in the Action Area. The project would not be anticipated to affect flights if they occur in this area.
Sea turtles: green, Kemp's ridley, leatherback, and loggerhead	No – not within the jurisdiction of the USFWS	IPaC (USFWS 2021a)	No Effect (within the jurisdiction of the U.S. Fish and Wildlife Service)	There is no nesting habitat in the Action Area.
Hawksbill sea turtle	No – not within the jurisdiction of the USFWS	IPaC (USFWS 2021a)	No Effect (within the jurisdiction of the U.S. Fish and Wildlife Service)	There is no nesting habitat in the Action Area. There is no documented occurrence of the hawksbill sea turtle in the Action Area and there is no preferred habitat for this species in the Action Area. This species would not be anticipated to occur in the Action Area.
Seabeach amaranth	No	No documented occurrence of this species in Action Area	No Effect	There is no documented occurrence of seabeach amaranth in the Action Area and there is no preferred habitat for this species in the Action Area. This species

Species / Resource Name	Species/Habitat Present in Action Area	Sources of Information	ESA Section 7 / Eagle Act Determination	Project Elements that Support Determination
				would not be anticipated to occur in the Action Area.
Northeastern beach tiger beetle	No	No documented occurrence of this species in Action Area	No Effect	There is no documented occurrence of the northeastern tiger beetle in the Action Area. This species would not be anticipated to occur in the Action Area.
Bald eagle	Yes	The Center for Conservation Biology (2021)	Unlikely to disturb nesting bald eagles.	There is one reported bald eagle nest from 2021 that occurred on the outskirts of the Northwest portion of Craney Island. However, based on the distance from the dredged material placement operations, any potential effects would be anticipated to be insignificant.
Monarch butterfly (Candidate species)	Yes – has the potential to occur in the Action Area	IPaC (USFWS 2021a)	May Affect, Not Likely to Adversely Affect	Monarch butterflies have the potential to occur at Craney Island. However, the Craney Island would not be anticipated to provide preferable foraging or breeding habitat based on the dominant vegetation types in the Action Area. Any potential disturbance effects from dredged material placement operations at the CIDMMA would be insignificant.

Species / Resource Name	Species/Habitat Present in Action Area	Sources of Information	ESA Section 7 / Eagle Act Determination	Project Elements that Support Determination
Critical Habitat	No critical habitat is present	IPaC (USFWS 2021a); VAFO CH Map Tool (USFWS 2021b)	Not Applicable	Not Applicable

\*Please note impact findings and determination are limited to those within the jurisdiction of the USFWS.

## References

The Center for Conservation Biology. 2021. Bald Eagle Nest Locator. Retrieved from .  
Date retrieved 15 October 2021.

U.S. Fish and Wildlife Service. 2021a. Information for Planning and Conservation Database.  
Retrieved from <https://ecos.fws.gov/ipac/>. Date retrieved 15 October 2021.

U.S. Fish and Wildlife Service. 2021b. Critical Habitat Map Tool.  
<https://fws.maps.arcgis.com/apps/Viewer/index.html?appid=f6e84e675ba1461b8ae6a351adea1429>.  
Date retrieved 15 October 2021.

U.S. Fish and Wildlife Service. 2021c. NLEB Winter Habitat and Roost Tree Map. Retrieved  
from [https://dgif-  
virginia.maps.arcgis.com/apps/webappviewer/index.html?id=32ea4ee4935942c092e41ddcd19  
e5ec5](https://dgif-virginia.maps.arcgis.com/apps/webappviewer/index.html?id=32ea4ee4935942c092e41ddcd19e5ec5). Date retrieved 15 October 2021.

Watts, B. D. 2016. Status and distribution of the eastern black rail along the Atlantic and Gulf  
Coasts of North America. The Center for Conservation Biology Technical Report Series,  
CCBTR-16-09. College of William and Mary/Virginia Commonwealth University, Williamsburg,  
VA. 148 pp



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Consultation Code: 05E2VA00-2018-SLI-1002

Event Code: 05E2VA00-2022-E-00950

Project Name: Norfolk Harbor and Channels Navigation Improvements

Subject: Updated list of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Any activity proposed on National Wildlife Refuge lands must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered

species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

<http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF>

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan ([http://www.fws.gov/windenergy/eagle\\_guidance.html](http://www.fws.gov/windenergy/eagle_guidance.html)). Additionally, wind energy projects should follow the wind energy guidelines (<http://www.fws.gov/windenergy/>) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm>; <http://www.towerkill.com>; and <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html>.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
  - USFWS National Wildlife Refuges and Fish Hatcheries
-

## Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

### **Virginia Ecological Services Field Office**

6669 Short Lane  
Gloucester, VA 23061-4410  
(804) 693-6694

This project's location is within the jurisdiction of multiple offices. Expect additional species list documents from the following office, and expect that the species and critical habitats in each document reflect only those that fall in the office's jurisdiction:

### **Raleigh Ecological Services Field Office**

Post Office Box 33726  
Raleigh, NC 27636-3726  
(919) 856-4520

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## Project Summary

Consultation Code: 05E2VA00-2018-SLI-1002

Event Code: Some(05E2VA00-2022-E-00950)

Project Name: Norfolk Harbor and Channels Navigation Improvements

Project Type: DREDGE / EXCAVATION

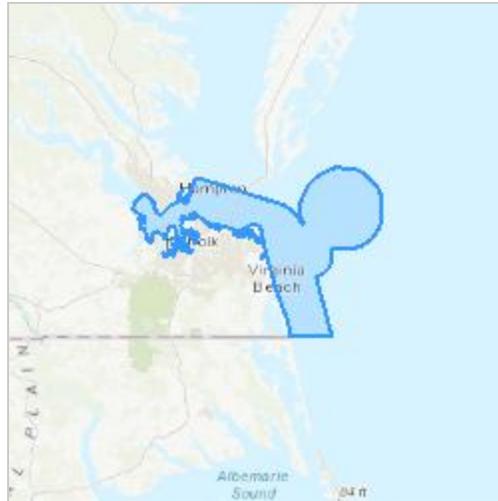
Project Description: The Norfolk Harbor and Channels project is a single purpose deep draft navigation project located in Hampton Roads, a 25 square mile natural harbor serving the port facilities in the cities of Norfolk, Newport News, Portsmouth, Chesapeake, and Hampton. The project consists of a network of federally improved channels extending from the Atlantic Ocean, through the Chesapeake Bay, and into the Port of Hampton Roads. Since the Water Resources Development Act (WRDA) of 1986, the project has been constructed in separable elements based on the needs of the port community and the financial capability of the non-federal sponsor, the Virginia Port Authority, agent of the Commonwealth of Virginia. The Preferred Alternative consists of constructing and maintaining the following features:

- Deepening the Atlantic Ocean Channel to a required depth of approximately 59 feet;
- Deepening the Thimble Shoal Channel to a required depth of approximately 56 feet;
- Deepening the Norfolk Harbor Channel to a required depth of approximately 55 feet;
- Deepening the Norfolk Harbor Entrance Channel to a required depth of approximately 55 feet;
- Deepening the Newport News Channel to a required depth of approximately 55 feet;
- Widening the Thimble Shoal Channel east of the Chesapeake Bay Bridge Tunnel to approximately 1,300 feet;
- Widening Anchorage F to approximately 3,620 feet and associated modifications of the Approach Area; and
- Deepening Anchorage F to a required depth of approximately 51 feet.

Project Location:

Approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/@36.83596423577028,-75.83101365322412,14z>

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Counties: North Carolina and Virginia

## Endangered Species Act Species

There is a total of 16 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries<sup>1</sup>, as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

## Mammals

NAME	STATUS
Northern Long-eared Bat <i>Myotis septentrionalis</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/9045">https://ecos.fws.gov/ecp/species/9045</a>	Threatened
West Indian Manatee <i>Trichechus manatus</i> There is <b>final</b> critical habitat for this species. The location of the critical habitat is not available. <b><i>This species is also protected by the Marine Mammal Protection Act, and may have additional consultation requirements.</i></b> Species profile: <a href="https://ecos.fws.gov/ecp/species/4469">https://ecos.fws.gov/ecp/species/4469</a>	Threatened

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## Birds

NAME	STATUS
<p>Eastern Black Rail <i>Laterallus jamaicensis ssp. jamaicensis</i>            No critical habitat has been designated for this species.            Species profile: <a href="https://ecos.fws.gov/ecp/species/10477">https://ecos.fws.gov/ecp/species/10477</a></p>	Threatened
<p>Piping Plover <i>Charadrius melodus</i>            Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered.            There is <b>final</b> critical habitat for this species. The location of the critical habitat is not available.            Species profile: <a href="https://ecos.fws.gov/ecp/species/6039">https://ecos.fws.gov/ecp/species/6039</a></p>	Threatened
<p>Red Knot <i>Calidris canutus rufa</i>            There is <b>proposed</b> critical habitat for this species. The location of the critical habitat is not available.            Species profile: <a href="https://ecos.fws.gov/ecp/species/1864">https://ecos.fws.gov/ecp/species/1864</a></p>	Threatened
<p>Red-cockaded Woodpecker <i>Picoides borealis</i>            No critical habitat has been designated for this species.            Species profile: <a href="https://ecos.fws.gov/ecp/species/7614">https://ecos.fws.gov/ecp/species/7614</a></p>	Endangered
<p>Roseate Tern <i>Sterna dougallii dougallii</i>            Population: Northeast U.S. nesting population            No critical habitat has been designated for this species.            Species profile: <a href="https://ecos.fws.gov/ecp/species/2083">https://ecos.fws.gov/ecp/species/2083</a></p>	Endangered

## Reptiles

NAME	STATUS
American Alligator <i>Alligator mississippiensis</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/776">https://ecos.fws.gov/ecp/species/776</a>	Similarity of Appearance (Threatened)
Green Sea Turtle <i>Chelonia mydas</i> Population: North Atlantic DPS There is <b>final</b> critical habitat for this species. The location of the critical habitat is not available. Species profile: <a href="https://ecos.fws.gov/ecp/species/6199">https://ecos.fws.gov/ecp/species/6199</a>	Threatened
Hawksbill Sea Turtle <i>Eretmochelys imbricata</i> There is <b>final</b> critical habitat for this species. The location of the critical habitat is not available. Species profile: <a href="https://ecos.fws.gov/ecp/species/3656">https://ecos.fws.gov/ecp/species/3656</a>	Endangered
Kemp's Ridley Sea Turtle <i>Lepidochelys kempii</i> There is <b>proposed</b> critical habitat for this species. The location of the critical habitat is not available. Species profile: <a href="https://ecos.fws.gov/ecp/species/5523">https://ecos.fws.gov/ecp/species/5523</a>	Endangered
Leatherback Sea Turtle <i>Dermochelys coriacea</i> There is <b>final</b> critical habitat for this species. The location of the critical habitat is not available. Species profile: <a href="https://ecos.fws.gov/ecp/species/1493">https://ecos.fws.gov/ecp/species/1493</a>	Endangered
Loggerhead Sea Turtle <i>Caretta caretta</i> Population: Northwest Atlantic Ocean DPS There is <b>final</b> critical habitat for this species. The location of the critical habitat is not available. Species profile: <a href="https://ecos.fws.gov/ecp/species/1110">https://ecos.fws.gov/ecp/species/1110</a>	Threatened

## Insects

NAME	STATUS
Monarch Butterfly <i>Danaus plexippus</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/9743">https://ecos.fws.gov/ecp/species/9743</a>	Candidate
Northeastern Beach Tiger Beetle <i>Cicindela dorsalis dorsalis</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/8105">https://ecos.fws.gov/ecp/species/8105</a>	Threatened

## Flowering Plants

NAME	STATUS
Seabeach Amaranth <i>Amaranthus pumilus</i> No critical habitat has been designated for this species. Species profile: <a href="https://ecos.fws.gov/ecp/species/8549">https://ecos.fws.gov/ecp/species/8549</a>	Threatened

## Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

# USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the [National Wildlife Refuge](#) system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

The following FWS National Wildlife Refuge Lands and Fish Hatcheries lie fully or partially within your project area:

FACILITY NAME	ACRES
BACK BAY NATIONAL WILDLIFE REFUGE <a href="https://www.fws.gov/refuges/profiles/index.cfm?id=51510">https://www.fws.gov/refuges/profiles/index.cfm?id=51510</a>	8,652.128



# United States Department of the Interior



## FISH AND WILDLIFE SERVICE

Virginia Field Office  
6669 Short Lane  
Gloucester, VA 23061

Date:

### **Self-Certification Letter**

Project Name:

Dear Applicant:

Thank you for using the U.S. Fish and Wildlife Service (Service) Virginia Ecological Services online project review process. By printing this letter in conjunction with your project review package, you are certifying that you have completed the online project review process for the project named above in accordance with all instructions provided, using the best available information to reach your conclusions. This letter, and the enclosed project review package, completes the review of your project in accordance with the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA). This letter also provides information for your project review under the National Environmental Policy Act of 1969 (P.L. 91-190, 42 U.S.C. 4321-4347, 83 Stat. 852), as amended. A copy of this letter and the project review package must be submitted to this office for this certification to be valid. This letter and the project review package will be maintained in our records.

The species conclusions table in the enclosed project review package summarizes your ESA conclusions. These conclusions resulted in:

- “no effect” determinations for proposed/listed species and/or proposed/designated critical habitat; and/or
- Action may affect the northern long-eared bat; however, any take that may occur as a result of the Action is not prohibited under the ESA Section 4(d) rule adopted for this species at 50 CFR § 17.40(o) [as determined through the Information, Planning, and Consultation System (IPaC) northern long-eared bat assisted determination key]; and/or
- “may affect, not likely to adversely affect” determinations for proposed/listed species and/or proposed/designated critical habitat.

We certify that use of the online project review process in strict accordance with the instructions provided as documented in the enclosed project review package results in reaching the appropriate determinations. Therefore, we concur with the determinations described above for proposed and listed species and proposed and designated critical habitat. Additional coordination with this office is not needed.

Candidate species are not legally protected pursuant to the ESA. However, the Service encourages consideration of these species by avoiding adverse impacts to them. Please contact this office for additional coordination if your project action area contains candidate species.

Should project plans change or if additional information on the distribution of proposed or listed species, proposed or designated critical habitat becomes available, this determination may be reconsidered. This certification letter is valid for 1 year.

Information about the online project review process including instructions and use, species information, and other information regarding project reviews within Virginia is available at our website [http://www.fws.gov/northeast/virginiafield/endspecies/project\\_reviews.html](http://www.fws.gov/northeast/virginiafield/endspecies/project_reviews.html). If you have any questions, please contact Troy Andersen of this office at (804) 824-2428.

Sincerely,

A handwritten signature in blue ink that reads "Cynthia A. Schulz". The signature is written in a cursive style and is placed on a light blue rectangular background.

Cindy Schulz  
Field Supervisor  
Virginia Ecological Services

Enclosures - project review package

**From:** [Thompson, Julie](#)  
**To:** [Logalbo, Alicia M CIV USARMY CENAO \(USA\)](#)  
**Subject:** [Non-DoD Source] FWCA Consultation for Norfolk Harbor Navigation Improvements  
**Date:** Tuesday, October 19, 2021 11:48:24 AM

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Hi Alicia, based on the information you provided on Meeting Area 1, which would be an expansion of the Norfolk Harbor Navigation Improvement project area, the Service does not need to prepare a new Planning Aid Report and FWCA letter for the project. While the project has been expanded we would consider impacts to fish and wildlife resources to be similar to what we provided in our report and letter to you in 2018. Re-running an IPAC report for listed species impacts is recommended, and we understand that you have an official species list and are working with the VAFO to make sure the expanded project does not require formal consultation under Section 7 of ESA.

Julie A. Slacum  
Division Chief, Strategic Resource Conservation  
177 Admiral Cochrane Drive  
Annapolis, MD. 21401  
410-573-4595 Office  
410-215-0260 Cell

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**From:** Logalbo, Alicia M CIV USARMY CENAO (USA) <Alicia.M.Logalbo@usace.army.mil>  
**Sent:** Tuesday, October 19, 2021 10:59 AM  
**To:** Thompson, Julie <julie\_thompson@fws.gov>  
**Subject:** RE: [EXTERNAL] FWCA Consultation for Norfolk Harbor Navigation Improvements

**Julie,**  
**Great – will call soon!**  
**Alicia**

Alicia Logalbo  
Norfolk District, U.S. Army Corps of Engineers  
Planning and Policy Branch  
Chief, Environmental Analysis Section  
803 Front Street  
Norfolk, VA 23510

(757) 201-7210 office  
(757) 335-8075 cell

[Alicia.Logalbo@usace.army.mil](mailto:Alicia.Logalbo@usace.army.mil)

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**From:** Thompson, Julie <julie\_thompson@fws.gov>  
**Sent:** Tuesday, October 19, 2021 9:09 AM

**To:** Logalbo, Alicia M CIV USARMY CENAO (USA) <Alicia.M.Logalbo@usace.army.mil>  
**Subject:** [Non-DoD Source] Re: [EXTERNAL] FWCA Consultation for Norfolk Harbor Navigation Improvements

I am available at 11am. You can call 410-215-0260.

Julie A. Slacum  
Division Chief, Strategic Resource Conservation  
177 Admiral Cochrane Drive  
Annapolis, MD. 21401  
410-573-4595 Office  
410-215-0260 Cell

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**From:** Logalbo, Alicia M CIV USARMY CENAO (USA) <[Alicia.M.Logalbo@usace.army.mil](mailto:Alicia.M.Logalbo@usace.army.mil)>  
**Sent:** Tuesday, October 19, 2021 8:46 AM  
**To:** Thompson, Julie <[julie\\_thompson@fws.gov](mailto:julie_thompson@fws.gov)>; Guy, Chris <[chris\\_guy@fws.gov](mailto:chris_guy@fws.gov)>  
**Cc:** Andersen, Troy M <[troy\\_andersen@fws.gov](mailto:troy_andersen@fws.gov)>  
**Subject:** RE: [EXTERNAL] FWCA Consultation for Norfolk Harbor Navigation Improvements

**Julie,**  
**Are you available to discuss today at 11 am? Do you want me to call your office phone? Thank you in advance for your assistance!**  
**Alicia**

Alicia Logalbo  
Norfolk District, U.S. Army Corps of Engineers  
Planning and Policy Branch  
Chief, Environmental Analysis Section  
803 Front Street  
Norfolk, VA 23510

(757) 201-7210 office  
(757) 335-8075 cell

[Alicia.Logalbo@usace.army.mil](mailto:Alicia.Logalbo@usace.army.mil)

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**From:** Logalbo, Alicia M CIV USARMY CENAO (USA)  
**Sent:** Monday, October 18, 2021 2:31 PM  
**To:** Thompson, Julie <[julie\\_thompson@fws.gov](mailto:julie_thompson@fws.gov)>; Guy, Chris <[chris\\_guy@fws.gov](mailto:chris_guy@fws.gov)>  
**Cc:** Andersen, Troy M <[troy\\_andersen@fws.gov](mailto:troy_andersen@fws.gov)>  
**Subject:** RE: [EXTERNAL] FWCA Consultation for Norfolk Harbor Navigation Improvements

Julie,

Thank you so much for the email. I just reinitiated consultation with USFWS namely because the eastern black rail was listed since the last consultation and also because of the monarch butterfly candidate species that was also proposed since the last consultation. For both of these species we came to a Not Likely to Adversely Affect Finding (for effects to the rail we described these as discountable and for effects to the monarch butterfly we described these as insignificant). Attached is a copy of the updated Biological Assessment I just submitted to the Virginia Field Office. (There was also some species added that we came to a No Affect Determination and also some species added that we had already included in our last consultation even though they were not on the past Official Species List.) Do you have any time to discuss this week? Thank you in advance!

Alicia

Alicia Logalbo  
Norfolk District, U.S. Army Corps of Engineers  
Planning and Policy Branch  
Chief, Environmental Analysis Section  
803 Front Street  
Norfolk, VA 23510

(757) 201-7210 office

(757) 335-8075 cell

[Alicia.Logalbo@usace.army.mil](mailto:Alicia.Logalbo@usace.army.mil)

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**From:** Thompson, Julie <[julie\\_thompson@fws.gov](mailto:julie_thompson@fws.gov)>

**Sent:** Monday, October 18, 2021 1:02 PM

**To:** Guy, Chris <[chris\\_guy@fws.gov](mailto:chris_guy@fws.gov)>; Logalbo, Alicia M CIV USARMY CENAO (USA) <[Alicia.M.Logalbo@usace.army.mil](mailto:Alicia.M.Logalbo@usace.army.mil)>

**Cc:** Andersen, Troy M <[troy\\_andersen@fws.gov](mailto:troy_andersen@fws.gov)>

**Subject:** [Non-DoD Source] Re: [EXTERNAL] FWCA Consultation for Norfolk Harbor Navigation Improvements

Alicia-I don't think we need to look at the project again but the Project Manager should go into IPAC once again to make sure there are still no endangered species issues.

Julie A. Slacum

Division Chief, Strategic Resource Conservation

177 Admiral Cochrane Drive  
Annapolis, MD. 21401  
410-573-4595 Office  
410-215-0260 Cell

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**From:** Guy, Chris <[chris\\_guy@fws.gov](mailto:chris_guy@fws.gov)>  
**Sent:** Monday, October 18, 2021 12:57 PM  
**To:** Logalbo, Alicia M CIV USARMY CENAO (USA) <[Alicia.M.Logalbo@usace.army.mil](mailto:Alicia.M.Logalbo@usace.army.mil)>  
**Cc:** Andersen, Troy M <[troy\\_andersen@fws.gov](mailto:troy_andersen@fws.gov)>; Thompson, Julie <[julie\\_thompson@fws.gov](mailto:julie_thompson@fws.gov)>  
**Subject:** Re: [EXTERNAL] FWCA Consultation for Norfolk Harbor Navigation Improvements

I am no longer with CBFO, as I have taken the Bay program Liaison position full time. I am forwarding your e-mail to Julie Slacum, who will be taking over my role until a suitable replacement is found. I will continue to support Julie in these projects as time and need allow. Julie is copied on this email and the two of you should connect directly.

If you need anymore from me , give me a call, I always enjoy our conversations.

Christopher P. Guy  
Habitat Goal Implementation Team Coordinator and Service liaison to the Chesapeake Bay Program  
Chesapeake Bay Field Office  
177 Admiral Cochrane Drive  
Annapolis, Md 21401  
410-573-4529 (office)  
443-758-8628 (cell)

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**From:** Logalbo, Alicia M CIV USARMY CENAO (USA) <[Alicia.M.Logalbo@usace.army.mil](mailto:Alicia.M.Logalbo@usace.army.mil)>  
**Sent:** Thursday, October 14, 2021 10:56 PM  
**To:** Guy, Chris <[chris\\_guy@fws.gov](mailto:chris_guy@fws.gov)>  
**Cc:** Andersen, Troy M <[troy\\_andersen@fws.gov](mailto:troy_andersen@fws.gov)>  
**Subject:** [EXTERNAL] FWCA Consultation for Norfolk Harbor Navigation Improvements

**This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.**

Chris,  
I hope you are doing well. Previously a FWCAR was prepared by the USFWS Chesapeake Bay Field Office in 2018 for the Norfolk Harbor Navigation Improvements Project (attached is the Final FWCAR

Report for your reference). That consultation work is still valid, however, we are planning to add an additional Meeting Area 1. Meeting Area 1 would be a widening of the Thimble Shoal Channel west of the Chesapeake Bay Bridge Tunnel. The widening would extend the existing Thimble Shoal Channel 200 feet to the north and 200 feet to the south for an approximate 5.1-mile distance. This is being considered due to changes in the fleet inventory and inefficiencies in cargo transport and the need for two-way traffic due to the larger container ships in the Port of Virginia.

Attached is a project description of the proposed Meeting Area 1. While the proposed Meeting Area 1 would increase dredging volumes (the increased dredging volumes with Meeting Area 1 are provided in the attached project description) and dredging durations, the anticipated impacts to fish and wildlife species would be similar to those already described in the Final 2018 FWCAR Report. This is because impacts of dredging and dredged material placement of the adjacent Thimble Shoal Channel were analyzed in the previous consultation. The dredging methodologies and dredged material placement sites would be as those previously described in the 2018 FWCAR Report.

I would like to discuss whether an additional FWCAR Report will be required or if the existing FWCAR Report and additional information I provided will suffice for the FWCA consultation. It is our opinion that the previous 2018 FWCAR Report is sufficient and adequately captures the potential impacts to fish and wildlife resources. However, if you feel otherwise, I would like to discuss this week if possible. Thank you.

Alicia

Alicia Logalbo  
Norfolk District, U.S. Army Corps of Engineers  
Planning and Policy Branch  
Chief, Environmental Analysis Section  
803 Front Street  
Norfolk, VA 23510

(757) 201-7210 office  
(757) 335-8075 cell

[Alicia.Logalbo@usace.army.mil](mailto:Alicia.Logalbo@usace.army.mil)

**From:** [Logalbo, Alicia M CIV USARMY CENAO \(USA\)](#)  
**To:** [Thompson, Julie](#); [Guy, Chris](#)  
**Cc:** [Andersen, Troy M](#)  
**Subject:** RE: [EXTERNAL] FWCA Consultation for Norfolk Harbor Navigation Improvements  
**Date:** Monday, October 18, 2021 2:30:00 PM  
**Attachments:** [Appendix A Species List\\_Virginia Ecological Services Field Office \(1\).pdf](#)  
[BA\\_USFWS\\_20211015.pdf](#)  
[online project review certification SIGNED.pdf](#)  
[USFWS Consultation Ltr\\_20211014.pdf](#)

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Julie,

Thank you so much for the email. I just reinitiated consultation with USFWS namely because the eastern black rail was listed since the last consultation and also because of the monarch butterfly candidate species that was also proposed since the last consultation. For both of these species we came to a Not Likely to Adversely Affect Finding (for effects to the rail we described these as discountable and for effects to the monarch butterfly we described these as insignificant). Attached is a copy of the updated Biological Assessment I just submitted to the Virginia Field Office. (There was also some species added that we came to a No Affect Determination and also some species added that we had already included in our last consultation even though they were not on the past Official Species List.) Do you have any time to discuss this week? Thank you in advance!

Alicia

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Norfolk District, U.S. Army Corps of Engineers  
Planning and Policy Branch  
Chief, Environmental Analysis Section  
803 Front Street  
Norfolk, VA 23510

(757) 201-7210 office  
(757) 335-8075 cell

[Alicia.Logalbo@usace.army.mil](mailto:Alicia.Logalbo@usace.army.mil)

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**From:** Thompson, Julie <[julie\\_thompson@fws.gov](mailto:julie_thompson@fws.gov)>  
**Sent:** Monday, October 18, 2021 1:02 PM  
**To:** Guy, Chris <[chris\\_guy@fws.gov](mailto:chris_guy@fws.gov)>; Logalbo, Alicia M CIV USARMY CENAO (USA) <[Alicia.M.Logalbo@usace.army.mil](mailto:Alicia.M.Logalbo@usace.army.mil)>  
**Cc:** Andersen, Troy M <[troy\\_andersen@fws.gov](mailto:troy_andersen@fws.gov)>  
**Subject:** [Non-DoD Source] Re: [EXTERNAL] FWCA Consultation for Norfolk Harbor Navigation

Improvements

Alicia-I don't think we need to look at the project again but the Project Manager should go into IPAC once again to make sure there are still no endangered species issues.

Julie A. Slacum  
Division Chief, Strategic Resource Conservation  
177 Admiral Cochrane Drive  
Annapolis, MD. 21401  
410-573-4595 Office  
410-215-0260 Cell

---

**From:** Guy, Chris <[chris\\_guy@fws.gov](mailto:chris_guy@fws.gov)>  
**Sent:** Monday, October 18, 2021 12:57 PM  
**To:** Logalbo, Alicia M CIV USARMY CENAO (USA) <[Alicia.M.Logalbo@usace.army.mil](mailto:Alicia.M.Logalbo@usace.army.mil)>  
**Cc:** Andersen, Troy M <[troy\\_andersen@fws.gov](mailto:troy_andersen@fws.gov)>; Thompson, Julie <[julie\\_thompson@fws.gov](mailto:julie_thompson@fws.gov)>  
**Subject:** Re: [EXTERNAL] FWCA Consultation for Norfolk Harbor Navigation Improvements

I am no longer with CBFO, as I have taken the Bay program Liaison position full time. I am forwarding your e-mail to Julie Slacum, who will be taking over my role until a suitable replacement is found. I will continue to support Julie in these projects as time and need allow. Julie is copied on this email and the two of you should connect directly.

If you need anymore from me , give me a call, I always enjoy our conversations.

Christopher P. Guy  
Habitat Goal Implementation Team Coordinator and Service liaison to the Chesapeake Bay Program  
Chesapeake Bay Field Office  
177 Admiral Cochrane Drive  
Annapolis, Md 21401  
410-573-4529 (office)  
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---

**From:** Logalbo, Alicia M CIV USARMY CENAO (USA) <[Alicia.M.Logalbo@usace.army.mil](mailto:Alicia.M.Logalbo@usace.army.mil)>  
**Sent:** Thursday, October 14, 2021 10:56 PM  
**To:** Guy, Chris <[chris\\_guy@fws.gov](mailto:chris_guy@fws.gov)>  
**Cc:** Andersen, Troy M <[troy\\_andersen@fws.gov](mailto:troy_andersen@fws.gov)>  
**Subject:** [EXTERNAL] FWCA Consultation for Norfolk Harbor Navigation Improvements

**This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.**

Chris,

I hope you are doing well. Previously a FWCAR was prepared by the USFWS Chesapeake Bay Field Office in 2018 for the Norfolk Harbor Navigation Improvements Project (attached is the Final FWCAR Report for your reference). That consultation work is still valid, however, we are planning to add an additional Meeting Area 1. Meeting Area 1 would be a widening of the Thimble Shoal Channel west of the Chesapeake Bay Bridge Tunnel. The widening would extend the existing Thimble Shoal Channel 200 feet to the north and 200 feet to the south for an approximate 5.1-mile distance. This is being considered due to changes in the fleet inventory and inefficiencies in cargo transport and the need for two-way traffic due to the larger container ships in the Port of Virginia.

Attached is a project description of the proposed Meeting Area 1. While the proposed Meeting Area 1 would increase dredging volumes (the increased dredging volumes with Meeting Area 1 are provided in the attached project description) and dredging durations, the anticipated impacts to fish and wildlife species would be similar to those already described in the Final 2018 FWCAR Report. This is because impacts of dredging and dredged material placement of the adjacent Thimble Shoal Channel were analyzed in the previous consultation. The dredging methodologies and dredged material placement sites would be as those previously described in the 2018 FWCAR Report.

I would like to discuss whether an additional FWCAR Report will be required or if the existing FWCAR Report and additional information I provided will suffice for the FWCA consultation. It is our opinion that the previous 2018 FWCAR Report is sufficient and adequately captures the potential impacts to fish and wildlife resources. However, if you feel otherwise, I would like to discuss this week if possible. Thank you.

Alicia

Alicia Logalbo  
Norfolk District, U.S. Army Corps of Engineers  
Planning and Policy Branch  
Chief, Environmental Analysis Section  
803 Front Street  
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Marine mammal species in stranding records from Virginia, 1988-2013. Threatened and endangered species and documented occurrences of marine mammals in the Region of Influence per survey and/or marine stranding data are also indicated (Aschettino et al. 2017-2015; Swingle et al. 2017-2010; Barco and Swingle 2014).

<b>Taxonomic Category/Common Name</b>	<b>Scientific Names</b>	<b>Strandings</b>
<b>Baleen Whales</b>		
Bryde's whale	<i>Balaenoptera brydei</i>	historic
Fin whale <sup>^*</sup>	<i>Balaenoptera physalus</i>	11
Humpback whale <sup>^</sup>	<i>Megaptera novaeangliae</i>	33
Minke whale <sup>^</sup>	<i>Balaenoptera acutorostrata</i>	9
Northern right whale <sup>^*</sup>	<i>Eubalena glacialis</i>	4
Sei whale <sup>^*</sup>	<i>Balaenoptera borealis</i>	2
<b>Delphinids</b>		
Atlantic spotted dolphin	<i>Stenella frontalis</i>	4
Atlantic white-sided dolphin	<i>Lagenorhynchus acutus</i>	14
Bottlenose dolphin <sup>^</sup>	<i>Tursiops truncatus</i>	1,593
Clymene dolphin	<i>Stenella clymene</i>	C. Potter, pers. Comm
Common dolphin <sup>^</sup>	<i>Delphinus delphis</i>	98
Long-finned pilot whale <sup>^</sup>	<i>Globicephala melas</i>	14
Melon headed whale	<i>Peponocephala electra</i>	2
Pantropical spotted dolphin	<i>Stenella attenuata</i>	historic
Pygmy killer whale <sup>^</sup>	<i>Feresa attenuata</i>	3
Risso's dolphin <sup>^</sup>	<i>Grampus griseus</i>	22
Rough toothed dolphin	<i>Steno bredanensis</i>	14
Short-finned pilot whale <sup>^</sup>	<i>Globicephala macrorhynchus</i>	7
Striped dolphin <sup>^</sup>	<i>Stenella coeruleoalba</i>	16
<b>Other toothed whales</b>		
Cuvier's beaked whale	<i>Ziphius cavirostris</i>	historic
Dwarf sperm whale	<i>Kogia sima</i>	10
Gervais' beaked whale	<i>Mesoplodon europaeus</i>	6
Harbor porpoise <sup>^</sup>	<i>Phocoena phocoena</i>	318
Pygmy sperm whale	<i>Kogia breviceps</i>	24
Sowerby's beaked whale	<i>Mesoplodon bidens</i>	2

<b>Taxonomic Category/Common Name</b>	<b>Scientific Names</b>	<b>Strandings</b>
Sperm whale*^	<i>Physeter macrocephalus</i>	1
True's beaked whale	<i>Mesoplodon mirus</i>	1
<b>Pinnipeds</b>		
Grey seal^	<i>Halichoerus grypus</i>	15
Harbor seal^	<i>Phoca vitulina</i>	82
Harp seal^	<i>Pagophilus groenlandica</i>	38
Hooded seal	<i>Cystophora cristata</i>	12
<b>Sirenians</b>		
West Indian manatee*	<i>Trichechus manatus</i>	annual sightings
<p>*Species is Federally listed in Virginia under the protection of the Endangered Species Act.  ^Documented to occur in the Region of Influence based on survey and/or stranding data.  'Historic' refers to published accounts for the species. For these species, no animals were documented in the Virginia stranding record from 1988-2013</p>		

# Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act

and the Bald and Golden Eagle Protection Act

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described [below](#).

## RELATED LINKS

[Birds of Conservation Concern](#)

[Measures for avoiding and minimizing impacts to birds](#)

[Nationwide conservation measures for birds](#)

The birds listed below are birds of particular concern either because they occur on the [USFWS Birds of Conservation Concern](#) (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ [below](#). This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the [E-bird data mapping tool](#) (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found [below](#).

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

## PROBABILITY OF PRESENCE SUMMARY

### THUMBNAILS LIST

- NAME / LEVEL OF CONCERN  
BREEDING SEASON
- 

- [American Kestrel](#) *Falco sparverius paulus*
- 

BCC - BCR  
Breeds Apr 1 to Aug 31

---

- [American Oystercatcher](#) *Haematopus palliatus*
- 

BCC Rangewide (CON)

Breeds Apr 15 to Aug 31

---

- Bald Eagle*Haliaeetus leucocephalus*
- 

Non-BCC Vulnerable  
Breeds Sep 1 to Aug 31

---

- Black Scoter*Melanitta nigra*
- 

Non-BCC Vulnerable  
Breeds elsewhere

---

- Black Skimmer*Rynchops niger*
- 

BCC Rangewide (CON)  
Breeds May 20 to Sep 15

---

- Black-billed Cuckoo*Coccyzus erythrophthalmus*
- 

BCC Rangewide (CON)  
Breeds May 15 to Oct 10

---

- Blue-winged Warbler*Vermivora pinus*
- 

BCC - BCR  
Breeds May 1 to Jun 30

---

- Bobolink*Dolichonyx oryzivorus*
- 

BCC Rangewide (CON)  
Breeds May 20 to Jul 31

---

- Brown Pelican*Pelecanus occidentalis*
- 

Non-BCC Vulnerable  
Breeds Jan 15 to Sep 30

---

- Canada Warbler*Cardellina canadensis*
- 

BCC Rangewide (CON)  
Breeds May 20 to Aug 10

---

- Cerulean Warbler*Dendroica cerulea*
- 

BCC Rangewide (CON)  
Breeds Apr 26 to Jul 20

---

- Common Eider*Somateria mollissima*
- 

Non-BCC Vulnerable  
Breeds Jun 1 to Sep 30

- 
- Common Loongavia immer

Non-BCC Vulnerable  
Breeds Apr 15 to Oct 31

---

- Cory's ShearwaterCalonectris diomedea

BCC Rangewide (CON)  
Breeds elsewhere

---

- Double-crested Cormorantphalacrocorax auritus

Non-BCC Vulnerable  
Breeds Apr 20 to Aug 31

---

- DovekieAlle alle

Non-BCC Vulnerable  
Breeds elsewhere

---

- Eastern Whip-poor-willAntrostomus vociferus

BCC Rangewide (CON)  
Breeds May 1 to Aug 20

---

- Golden EagleAquila chrysaetos

Non-BCC Vulnerable  
Breeds elsewhere

---

- Great ShearwaterPuffinus gravis

Non-BCC Vulnerable  
Breeds elsewhere

---

- Gull-billed TernGelochelidon nilotica

BCC Rangewide (CON)  
Breeds May 1 to Jul 31

---

- Hudsonian GodwitLimosa haemastica

BCC Rangewide (CON)  
Breeds elsewhere

---

- Kentucky WarblerOporornis formosus

BCC Rangewide (CON)  
Breeds Apr 20 to Aug 20

---

- King RailRallus elegans

---

BCC Rangewide (CON)  
Breeds May 1 to Sep 5

---

- Le Conte's Sparrow*Ammodramus leconteii*
- 

BCC Rangewide (CON)  
Breeds elsewhere

---

- Lesser Yellowlegs*Tringa flavipes*
- 

BCC Rangewide (CON)  
Breeds elsewhere

---

- Long-tailed Duck*Clangula hyemalis*
- 

Non-BCC Vulnerable  
Breeds elsewhere

---

- Marbled Godwit*Limosa fedoa*
- 

BCC Rangewide (CON)  
Breeds elsewhere

---

- Prairie Warbler*Dendroica discolor*
- 

BCC Rangewide (CON)  
Breeds May 1 to Jul 31

---

- Prothonotary Warbler*Protonotaria citrea*
- 

BCC Rangewide (CON)  
Breeds Apr 1 to Jul 31

---

- Purple Sandpiper*Calidris maritima*
- 

BCC Rangewide (CON)  
Breeds elsewhere

---

- Razorbill*Alca torda*
- 

Non-BCC Vulnerable  
Breeds Jun 15 to Sep 10

---

- Red Phalarope*Phalaropus fulicarius*
- 

Non-BCC Vulnerable  
Breeds elsewhere

---

- Red-breasted Merganser*Mergus serrator*
- 

Non-BCC Vulnerable

Breeds elsewhere

---

- Red-headed Woodpecker *Melanerpes erythrocephalus*
- 

BCC Rangewide (CON)  
Breeds May 10 to Sep 10

---

- Red-necked Phalarope *Phalaropus lobatus*
- 

Non-BCC Vulnerable  
Breeds elsewhere

---

- Red-throated Loon *Gavia stellata*
- 

Non-BCC Vulnerable  
Breeds elsewhere

---

- Ring-billed Gull *Larus delawarensis*
- 

Non-BCC Vulnerable  
Breeds elsewhere

---

- Royal Tern *Thalasseus maximus*
- 

Non-BCC Vulnerable  
Breeds Apr 15 to Aug 31

---

- Ruddy Turnstone *Arenaria interpres morinella*
- 

BCC - BCR  
Breeds elsewhere

---

- Rusty Blackbird *Euphagus carolinus*
- 

BCC - BCR  
Breeds elsewhere

---

- Short-billed Dowitcher *Limnodromus griseus*
- 

BCC Rangewide (CON)  
Breeds elsewhere

---

- Sooty Tern *Onychoprion fuscatus*
- 

Non-BCC Vulnerable  
Breeds Mar 10 to Jul 31

---

- Surf Scoter *Melanitta perspicillata*
- 

Non-BCC Vulnerable  
Breeds elsewhere

- 
- Swallow-tailed Kite *Elanoides forficatus*

BCC Rangewide (CON)  
Breeds Mar 10 to Jun 30

---

- White-winged Scoter *Melanitta fusca*

Non-BCC Vulnerable  
Breeds elsewhere

---

- Willet *Tringa semipalmata*

BCC Rangewide (CON)  
Breeds Apr 20 to Aug 5

---

- Wilson's Plover *Charadrius wilsonia*

BCC Rangewide (CON)  
Breeds Apr 1 to Aug 20

---

- Wilson's Storm-petrel *Oceanites oceanicus*

Non-BCC Vulnerable  
Breeds elsewhere

---

- Wood Thrush *Hylocichla mustelina*

BCC Rangewide (CON)  
Breeds May 10 to Aug 31

---

**Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.**

**What does IPaC use to generate the migratory birds potentially occurring in my specified location?**

**What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?**

**How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?**

**What are the levels of concern for migratory birds?**

**Details about birds that are potentially affected by offshore projects**

**What if I have eagles on my list?**

**Proper Interpretation and Use of Your Migratory Bird Report**

**From:** [Logalbo, Alicia M CIV USARMY CENAO \(USA\)](#)  
**To:** [David OBrien - NOAA Federal](#)  
**Cc:** [Karen Greene](#); [Schulte, David M CIV CENAO CENAD \(USA\)](#); [Shunfenthal, Jennifer C CIV \(USA\)](#); [Koelsch, Kimberly C CIV USARMY CENAO \(USA\)](#)  
**Subject:** RE: [Non-DoD Source] Reinitiation of EFH Consultation for Norfolk Harbor and Channels Deepening  
**Date:** Friday, October 15, 2021 4:22:00 PM  
**Attachments:** [EFH Consultation Ltr 20211013.pdf](#)  
[Enclosure 1 Appendix H Final EFH 2018 EFH Assessment 20180427.pdf](#)  
[Enclosure 2 project description 20211015.pdf](#)  
[Enclosure 3 EFH 20211015.pdf](#)  
[Enclosure 4 Fig 10 20211015.pdf](#)

---

Dave,

As we discussed yesterday, attached is the request for reinitiation of the Essential Fish Habitat Consultation for the Norfolk Harbor Navigation Improvements due to an expansion of the project scope. Attached is the letter request for reinitiation as well as the relevant enclosures that are needed for the consultation. Thank you in advance for your review. If there is any way possible we would greatly appreciate an expedited review as this project is on an expedited schedule. If you have any questions or need any additional information, please contact me via email at: [Alicia.Logalbo@usace.army.mil](mailto:Alicia.Logalbo@usace.army.mil) or via cell phone at: 757-335-8075. Thank you again.

Alicia

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DEPARTMENT OF THE ARMY  
US ARMY CORPS OF ENGINEERS  
NORFOLK DISTRICT  
FORT NORFOLK  
803 FRONT STREET  
NORFOLK VA 23510-1011

October 15, 2021

SUBJECT: Request to re-initiate Essential Fish Habitat consultation due to change in project scope, Norfolk Harbor Navigation Improvements

Dave O'Brien  
NOAA Fisheries  
Marine Habitat Resource Specialist/Virginia Field Office  
1375 Greate Rd.  
P.O. Box 1346  
Gloucester Point, VA 23062

Dear Mr. O'Brien:

The U.S. Army Corps of Engineers (USACE) requests to re-initiate Essential Fish Habitat (EFH) consultation for the Norfolk Harbor Navigation Improvements Project due to an expansion of the project scope. The expansion is an additional, proposed Meeting Area 1, which was not fully evaluated in the EFH Assessment/consultation that was completed in 2018 (The 2018 Norfolk Harbor Navigation Improvements Essential Fish Habitat Assessment is provided as Enclosure 1.). The proposed Meeting Area 1 would consist of widening the existing Thimble Shoal Channel along an approximately 5.1 mile-long area west of the Chesapeake Bay Bridge Tunnel. The widening would consist of approximately 200 additional feet located north of the existing Thimble Shoal Channel and an additional 200 feet south of the existing Thimble Shoal Channel. The dredged material would be anticipated to be disposed of at the Dam Neck Ocean Disposal Site but could also potentially be disposed at the Norfolk Ocean Disposal Site or the Craney Island Dredged Material Management Area. A project description of the proposed Meeting Area 1 Preferred Alternative is provided in Enclosure 2.

The purpose of this letter is to serve as our EFH consultation re-initiation request and also to serve as a supplement to our EFH Assessment previously submitted in 2018 (Enclosure 1). To clarify, the 2018 EFH assessment is still valid but we are supplementing the 2018 EFH Assessment to include the potential impacts from the proposed Meeting Area 1. Impacts to EFH with Meeting Area 1 are as those described in the 2018 EFH Assessment due to the similarity in sediment type as well as the immediate adjacent location of Meeting Area 1 to the Thimble Shoals Channel impact analysis already covered in the 2018 EFH Assessment. The dredging methods and dredged material disposal areas for Meeting Area 1 are as those described for the 2018 EFH Assessment. The supplemental information for the Meeting Area 1 to the 2018 EFH Assessment is the following:

- (1) Enclosure 2, Table 1 provides the additional dredging volumes for the Meeting Area 1.
- (2) The EFH list from the EFH Mapper for the Meeting Area 1 is provided as Enclosure 3. The EFH for the Meeting Area 1 is a less inclusive list than the EFH described in

- the 2018 EFH Assessment as the Meeting Area 1 is limited to the area of effect resulting from the Meeting Area 1 and the dredged material placement sites.
- (3) Attached is an updated Figure 10 that provides the estimated dredging buffer distances for the Meeting Area 1 in addition to the other Norfolk Harbor Navigation Improvements project areas from the 2018 EFH Assessment.

Implementation of the Preferred Alternative, Meeting Area 1, may adversely impact EFH due to increased Total Suspended Solid/turbidity levels, sedimentation, direct removal of habitat, and underwater noise from dredging and dredged material placement. Best management practices as described in the 2018 EFH Assessment (Enclosure 1) would be implemented to avoid and minimize impacts to EFH to the maximum, practical extent. The USACE concludes that implementation of the Preferred Alternative is anticipated to result in minor, adverse impacts to EFH, managed species, and their prey. Effects to Habitat Areas of Particular Concern (HAPC) for the sandbar shark are also expected to be adverse and minor. Impacts would largely be temporary, though minor changes in salinity and dissolved oxygen may be permanent. However, no substantial adverse impacts to EFH including the HAPC for the sandbar shark would be anticipated and best management practices will aid in reducing potential impacts. For a thorough description of the anticipated direct, indirect, and cumulative impacts to EFH, please refer to the 2018 EFH Assessment (Enclosure 1).

The USACE is currently conducting a validation study and preparing a Supplemental Environmental Assessment to fully assess the effects of the proposed additional Meeting Area 1; a required part of this USACE study process is to complete required environmental compliance which includes the EFH consultation. The USACE requests that EFH consultation for the Norfolk Harbor Navigation Improvements Project be reinitiated upon receipt of this letter and that the information provided in this letter serve as the supplemental information required for the consultation. Should you have any additional questions please contact me at [Alicia.Logalbo@usace.army.mil](mailto:Alicia.Logalbo@usace.army.mil) or (757) 335-8075. If we do not receive a response within 30 days we will assume concurrence with our EFH findings. Thank you.

Sincerely,

Alicia Logalbo

Digitally signed by Alicia  
Logalbo  
Date: 2021.10.15 16:13:37 -04'00'

Alicia Logalbo  
Chief, Environmental Analysis Section  
Planning and Policy Branch  
U.S. Army Corps of Engineers, Norfolk District

Cc: Karen Green, NOAA Fisheries

---

# **NORFOLK HARBOR NAVIGATION IMPROVEMENTS**

---

## **ESSENTIAL FISH HABITAT ASSESSMENT**

**Submitted To:**

**National Oceanographic and Atmospheric Administration  
National Marine Fisheries Service  
Greater Atlantic Field Office**

**U.S. Army Corps of Engineers  
Norfolk District  
803 Front Street  
Norfolk, Virginia 23510**

**April 27, 2018**



**US Army Corps  
of Engineers®**

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## 1.0 INTRODUCTION

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The purpose of this document is to present the findings of the Essential Fish Habitat (EFH) assessment conducted for the construction and maintenance of the Norfolk Harbor Navigation Improvements Project (Norfolk Harbor Project), as required by the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (Magnuson-Stevens Act), as amended through 1996 (MSA). The Norfolk Harbor Project consists of multiple channel and an anchorage elements in Chesapeake Bay. The objectives of this EFH Assessment are to describe in detail how the actions of dredging and dredged material placement may affect EFH, federally managed species and their prey, designated by the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) and the regional Fisheries Management Council (FMC) for the Region of Influence (ROI) of the project. The FMC, with assistance from NOAA Fisheries, is required to delineate EFH in fisheries management plans for all federally managed fisheries to conserve and enhance those habitats. The EFH is defined in the MSA as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.”

## 2.0 PURPOSE, AND NEED

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The Norfolk Harbor Project consists of a network of multiple channel and anchorage elements that provide two-way, full-width navigation from the Atlantic Ocean into the Port of Hampton Roads. The natural harbor in which the Port of Hampton Roads facilities are located covers a 25 square-mile area and serves the cities of Norfolk, Newport News, Portsmouth, Chesapeake, and Hampton in southeastern Virginia. The project consists of a network of federally improved channels extending from the Atlantic Ocean through the Chesapeake Bay and into the Port of Hampton Roads (Figure 1).

The purpose of the Norfolk Harbor Project is to improve the operational efficiency of commercial vessels currently using the Norfolk Harbor and commercial vessels projected to use the harbor in the future. The need for this project arises from inefficiencies currently experienced by commercial vessels in Norfolk Harbor. These inefficiencies are projected to continue in the future.

## 3.0 PROJECT SCOPE

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The Norfolk Harbor Project is a single-purpose, deep-draft navigation project located in Hampton Roads, a 25 square-mile natural harbor serving the port facilities in the cities of Norfolk, Newport News, Portsmouth, Chesapeake, and Hampton. The project consists of a network of federally improved channels extending from the Atlantic Ocean through Chesapeake Bay and into the Port of Hampton Roads (Figure 1). Since the Water Resources Development Act (WRDA) of 1986, the project has been constructed in separable elements based on the needs of the port community and the financial capability of the non-federal sponsor, the Virginia Port Authority, an agent of the Commonwealth of Virginia. The 50 Feet Outbound Element was completed in 1989; the 50 Feet Anchorage in 1999; and 50 Feet Inbound Element in 2007. The current authorized project includes a system of two-way, full-width channels to a depth of 55 feet in the Norfolk Harbor and Thimble Shoal Channels and 57 feet in the Atlantic Ocean Channel.

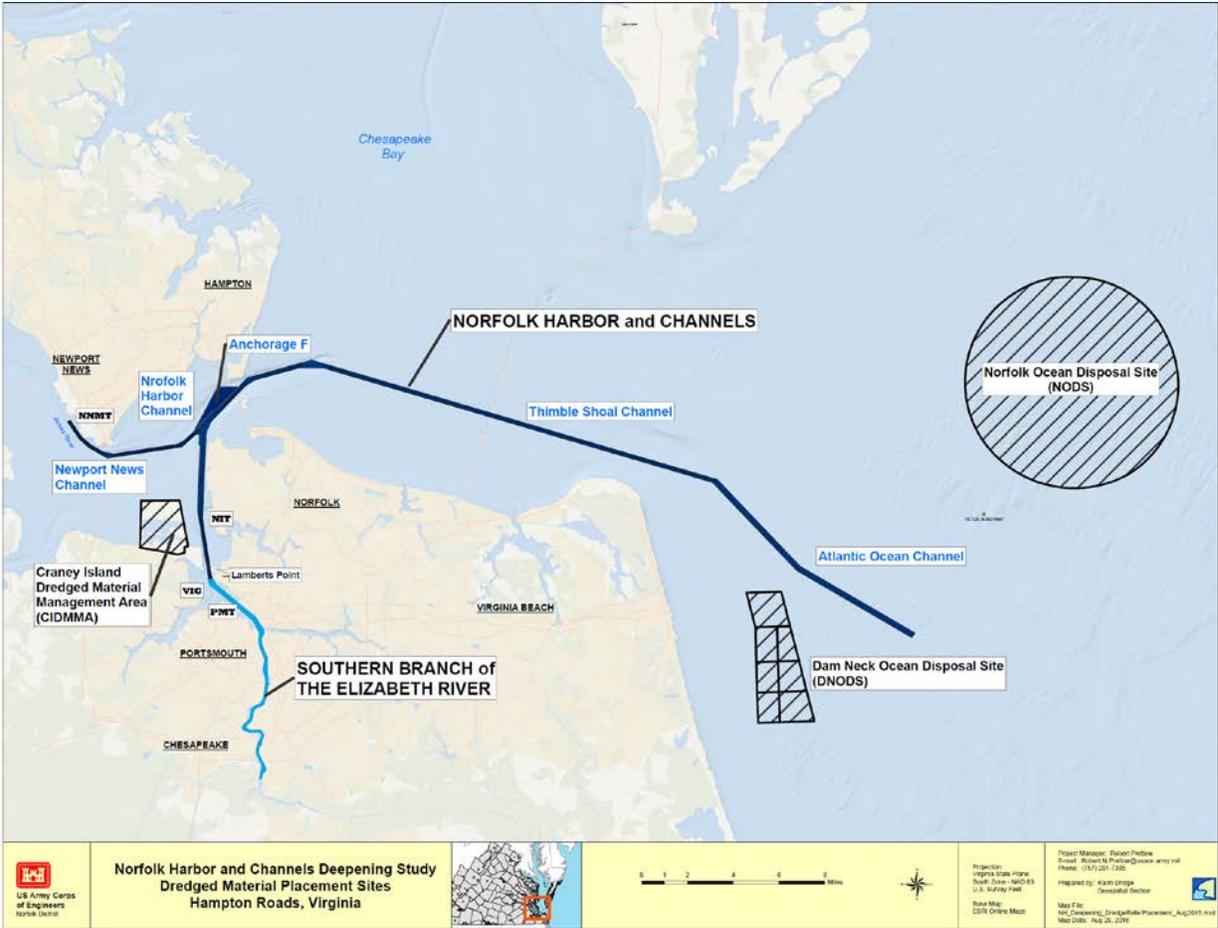


Figure 1. Location of the Norfolk Harbor (dark blue) that is the subject of this Essential Fish Habitat Assessment. Location of the Norfolk Harbor and Channels outside of the Region of Influence for this project is shown for reference (light blue).

### 3.1 Current Norfolk Harbor Project Dredging and Dredged Material Placement/Disposal Practices

#### **Atlantic Ocean Channel**

The WRDA authorized the U.S. Army Corps of Engineers (USACE) to construct the Atlantic Ocean Channel (AOC) which consists of a channel 11.1 miles long, 1,300 feet wide, and 57 feet deep. Please note that depths described in this document are provided in Mean Lower Low Water (MLLW). As part of the 50-foot inbound construction effort in 2006, the channel was deepened to provide for a required depth and width of 52 feet and 1,300 feet, respectively. The AOC project is part of the Port of Virginia and Baltimore system of channels and is the segment providing access for all ships calling on port facilities, naval bases, and shipyards in the Hampton Roads, York River, and Baltimore areas. All commercial tonnage entering and leaving the Ports of Virginia and Baltimore pass through this channel. The channel is currently maintained to a full width and a required depth of 52 feet to enable loaded colliers, container ships, and military vessels to transit the channel with ship drafts as great as 50 feet.

This channel is typically dredged via hopper dredge and placed at Dam Neck Ocean Disposal Site (DNODS). Dredged material also has been used for beneficial uses for the Virginia Beach Hurricane Protection project and the Craney Island Eastern Expansion (CIEE) Project. The sediment composition in this channel segment is largely fine sand (85%) with some silt (15%). The channel has been utilized as a sand borrow source for hurricane protection projects and port development projects; therefore, maintenance has not been required.

### ***Thimble Shoal Channel***

Thimble Shoal Channel is located in the southern Chesapeake Bay, just off shore of Norfolk and Virginia Beach and east of the Craney Island Dredged Material Management Area (CIDMMA). The authorized channel dimensions are 13.4 miles long, 1,000 feet wide between the 55 foot contours, and 55 feet deep. Although the channel is authorized to be dredged to 55 feet, the channel is currently maintained to a required depth of 50 feet. Thimble Shoal Channel extends from the deep water to the east of Hampton Roads to the deep water at the mouth of the Chesapeake Bay.

This channel is typically dredged via hopper dredging with placement at DNODS. The sediments of Thimble Shoal Channel to the west of the Chesapeake Bay Bridge Tunnel are predominantly clays and silts (50-75%). In contrast, sediments in the eastern portion of channel are largely fine to medium grained sand (75-90%). Approximately 2,000,000 cubic yards of material is dredged every 10 years from Thimble Shoal Channel.

### ***Channel to Newport News and Anchorages***

The Channel to Newport News and associated Newport News anchorages segment of the Norfolk Harbor is authorized to 55 feet deep by 800 feet wide from Norfolk Harbor Channel in Hampton Roads to Newport News and the Newport News Anchorages. However, the channel is currently maintained to a required depth of 50 feet removing approximately 800,000 cubic yards every four years.

This channel may be dredged by hydraulic cutterhead and/or mechanical dredging methods. Material dredged from this area is then typically placed by pipeline at CIDMMA or placed on a barge/scow and transported for placement at the Craney Island Rehandling Basin (CIRB).

### ***Norfolk Harbor Channel - Sewells Point to Lamberts Bend and Norfolk Harbor Anchorages***

The Sewells Point to Lamberts Bend reach of the Norfolk Harbor is located in Norfolk between Sewells Point and Lamberts Point. This segment of the project is approximately eight miles long and varies in width between 800 feet to 1,200 feet. This reach also consists of: Anchorage F, Sewells Point East Anchorage (includes the Naval Maneuvering Area and Approach Areas), Sewells Point West Anchorage and (Approach Area), Anchorage G, and all approach areas.

The authorized project dimensions for this reach include a channel 55 feet deep and 1,500 feet wide from that depth in Hampton Roads to a point approximately 6.0 miles upstream from the Hampton Roads Bridge-Tunnel; thence 55 feet deep and 800 feet wide to Lambert Point. The Sewells Point to Lamberts Bend Channel is currently maintained to a required depth of 50 feet from the 55-foot contour in Hampton Roads (near the Hampton Roads Bridge Tunnel) to Lamberts Point.

This channel may be dredged by hydraulic cutterhead and/or mechanical dredging methods. Material dredged from this area is then placed by pipeline at CIDMMA or placed on barge/scow and transported for placement at the CIRB. The composition of dredged material from Sewells Point to Lamberts Bend Channel is primarily silt and clay (85%) with some sand (15%). The composition of Elizabeth River sediment is predominantly clay in the Town Point area of Norfolk;

however, sediments become increasingly more coarse and sandy as one travels south along the Elizabeth River (towards Chesapeake). In the southernmost areas of the Southern Branch of the Elizabeth River, sediments are predominantly fine-grained and composed of at least 61% silt and clay.

### ***Dam Neck Ocean Disposal Site***

The DNODS is located three nautical miles east of Virginia Beach. This site was first utilized as an ocean placement site in 1967. This ocean placement site was designated by the administrator of the U.S. Environmental Protection Agency (USEPA) in March of 1988. The DNODS, which runs approximately parallel to Virginia Beach, covers about eight square nautical miles. Water depths at DNODS vary between 31 to 49 feet deep. The remaining DNODS capacity is estimated to be about 63 million cubic yards. The site is the primary dredged material disposal site for Thimble Shoals Channel, Cape Henry Channel, and Atlantic Ocean Channel.

### ***Norfolk Ocean Disposal Site***

The Norfolk Ocean Disposal Site (NODS) was officially designated as an ocean placement site in 1993, pursuant to Section 102 (c) of the Marine Protection, Research, and Sanctuaries Act of 1972 (as amended, 33 U.S.C. 1401 *et seq*). This ocean placement site was designated by the administrator of the USEPA in December of 1986. The site is authorized to receive new work and maintenance dredged material from the lower Chesapeake Bay. This site is also authorized to receive appropriate dredged material from Thimble Shoal, Cape Henry, Atlantic Ocean, Hampton Roads, and York Spit channels. An Environmental Impact Statement titled, "Final Environmental Impact Statement for the Designation of an Ocean Dredged Material Disposal Site Located Offshore Norfolk Virginia," was finalized in November of 1992.

The center of NODS is located 17 nautical miles from Virginia Beach. Water depths near the center of the site vary between 43 to 85 feet. Up to approximately 250 million cubic yards of dredged material from dredging projects (public and private) may be disposed at the proposed site over the next 49 years. The quantity of material to be placed at the site depends on the quality of the dredged material. Only material that meets ocean dumping criteria will be disposed at the designated site. This includes unconsolidated fine to medium grain sands, silts, and clays.

### ***Craney Island Dredged Material Management Area***

The CIDMMA is located in the City of Portsmouth in the eastern portion of the Atlantic Coastal Plain, adjacent to the confluence of the James River, Elizabeth River, and Nansemond River and is in close proximity to Chesapeake Bay and the Atlantic Ocean. The CIDMMA is a 2,500 acre confined disposal facility that was constructed by USACE and completed in 1957 in the Hampton Roads area of Virginia. The federally owned facility is operated by USACE and is used by private interests, local municipalities, federal and Commonwealth of Virginia government agencies for the disposal of dredged material from Norfolk Harbor and its adjacent waterways.

Dredged material is received in two different ways at the CIDMMA. It is either pumped directly into one of three upland containment cells or it is deposited in the rehandling basin. The CIRB is a large deeper area off the southeast shoreline of the island that can be used for dredged material placement and is dredged approximately every three years once filled. Since it began operation, the CIDMMA as received, on average, 3.5 million cubic yards of dredged material per year. There have been several years when it has received more than 10 million cubic yards. The amount of material received by CIDMMA may change as newer technologies and/or new management techniques are employed at the facility.

## 3.2 Dredging and Dredged Material Placement Practices for the Preferred Alternative

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This EFH Assessment was developed to describe potential impacts to EFH and managed species and their prey that could occur from implementation of the Preferred Alternative (the Action Alternative). The Preferred Alternative consists of constructing and maintaining the following features:

- Deepening of Atlantic Ocean Channel to a required depth of approximately 59 feet;
- Deepening of Thimble Shoal Channel to a required depth of approximately 56 feet;
- Deepening the Norfolk Harbor Channel to a required depth of approximately 55 feet;
- Deepening the Norfolk Harbor Entrance Channel to a required depth of approximately 55 feet;
- Deepening of the Newport News Channel to a required depth of approximately 55 feet;
- Widening of the Thimble Shoal Channel east of the Chesapeake Bay Bridge Tunnel to approximately 1,300 feet;
- Widening Anchorage F to approximately 3,620 feet and associated modifications of the Approach Area;
- Deepening Anchorage F to a required depth of approximately 51 feet; and
- The existing 10 feet of sand cover over the Chesapeake Bay Bridge Tunnel in the Thimble Shoal Channel would be reduced to approximately five feet. The materials covering the tunnel would be sand or potentially sand and rock.

The Preferred Alternative includes construction and maintenance of these features. Dredged material placement/disposal could occur at the DNODS, the NODS, the CIDMMA, and/or upland disposal sites for this project (if needed). Portions of the dredged areas may be suitable for beneficial use projects and beneficial use projects would be coordinated separately from this project. General operation and maintenance of the CIDMMA will continue with or without implementation of the Preferred Alternative

It should also be noted that channel deepening in itself may also lead to some side sloping and widening of the channel; however, we estimate that these impacts would increase the width of channels by no more than approximately 30 feet from the toe of each side of the channel. As optimization of the Preferred Alternative is ongoing, actual project depths and project deepening and widening features may vary slightly prior to construction.

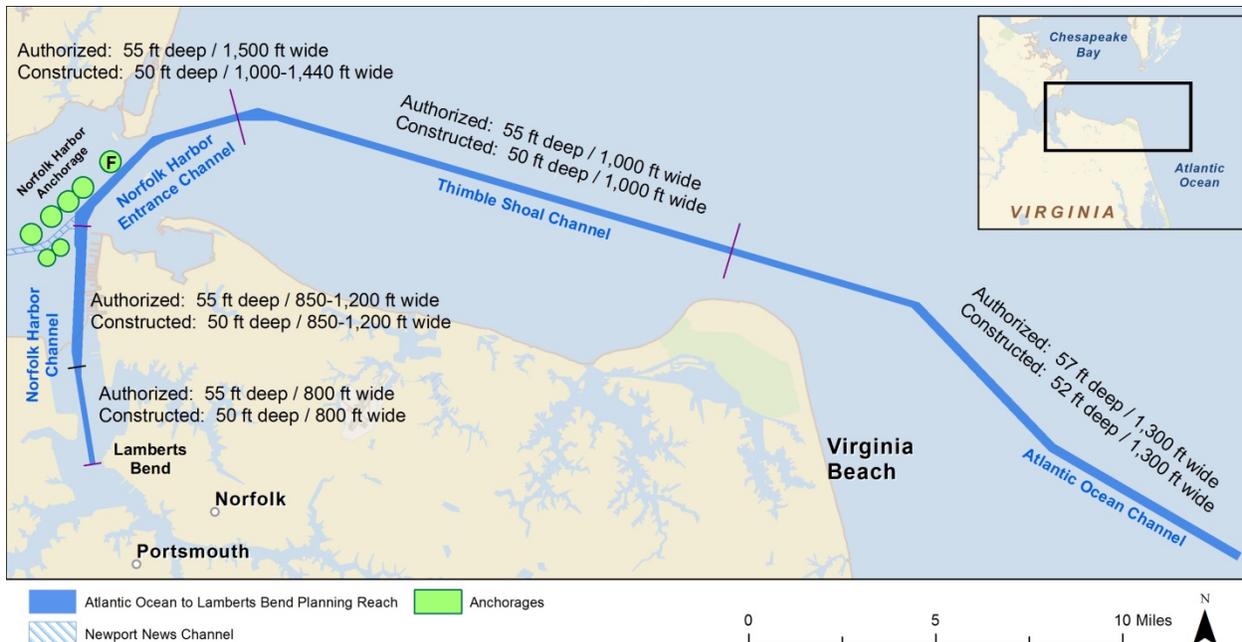
The project construction is anticipated to begin in approximately 2023 and, following construction, channel depths would be maintained over the 50 year lifecycle of the project.

One important consideration important in the impact analysis is that the actual dredged depths can be deeper than the required channel depths. Required depths do not necessarily indicate the maximum potential dredging depths, which may also include Advanced Maintenance Dredging (1 foot), Paid Allowable Overdepth Dredging (2 feet), and Non-Pay Allowable Overdepth dredging (2 feet) for the Norfolk Harbor Project. Please see Table 1 for an approximate estimate of estimated maximum potential dredging depths that account for the overdepth and advanced maintenance dredging with implementation of the Preferred Alternative. For the purpose of this EFH Assessment we refer to required depths throughout the text but in terms of the environmental impact analysis (affect determination), the estimated maximum potential impact depths and dredging volumes will be used (Table 1).

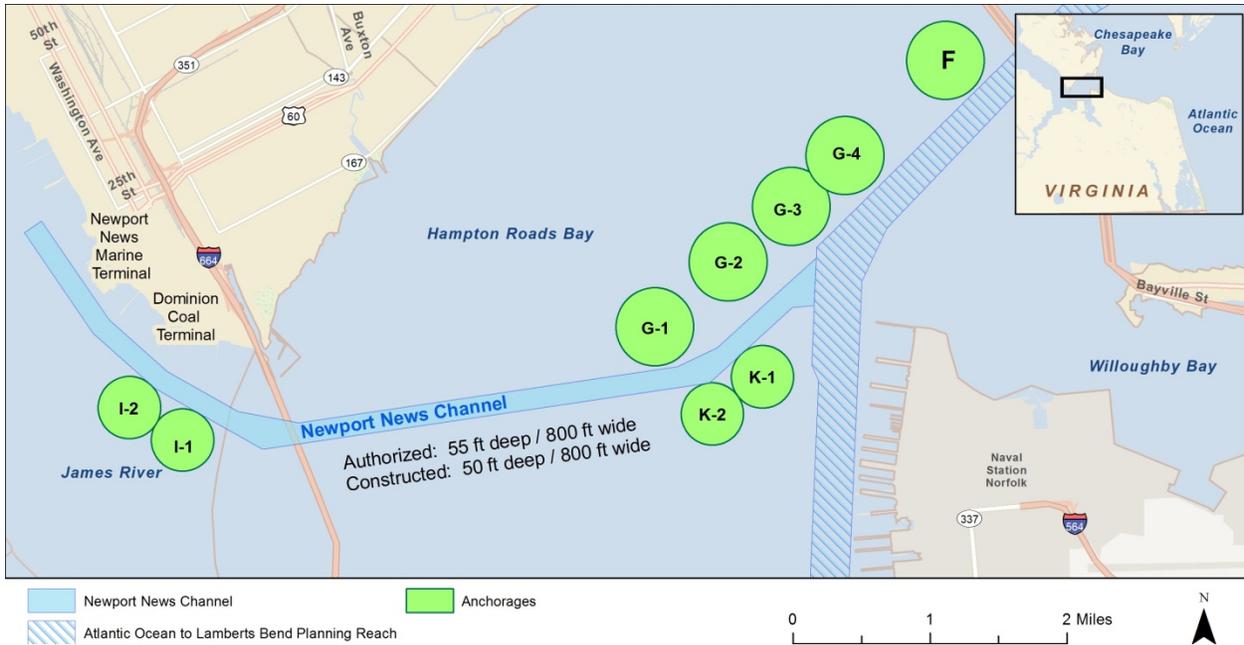
Dredges used for construction and maintenance of the Preferred Alternative would include hydraulic hopper and cutterhead dredges, as well as mechanical dredges.

In the future, with or without implementation of the Preferred Alternative, vessel calls are anticipated to increase as compared to current conditions. However, when comparing the future with or without the project, there would be less vessel calls in the future with project as compared to the future without project because the existing, larger ships in the fleet would carry more goods, thus requiring a smaller number of ships to transport the same amount of goods.

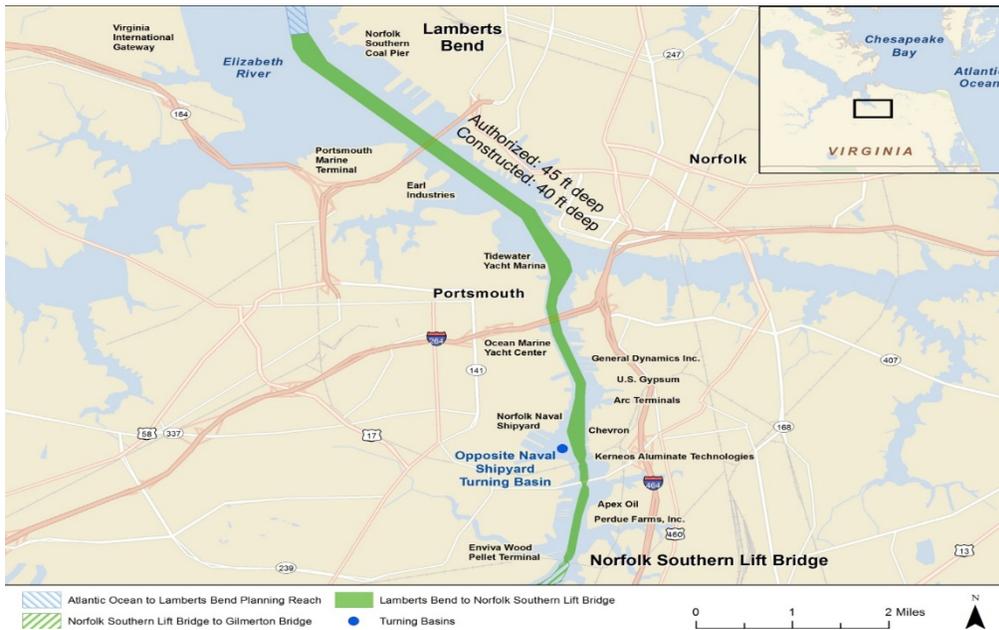
Although deepening of the Norfolk Harbor and Channels south of Lambert’s Bend is not included in the Preferred Alternative for the Norfolk Harbor Project, we have included Figures 4 – 6 for reference as deepening south of Lambert’s Bend to the Chesapeake Extension in the Elizabeth River in is being considered in a separate project (Elizabeth River and Southern Branch Navigation Improvements Project). The feasibility study for the Elizabeth River and Southern Branch Navigation Improvements Project is also ongoing at this time.



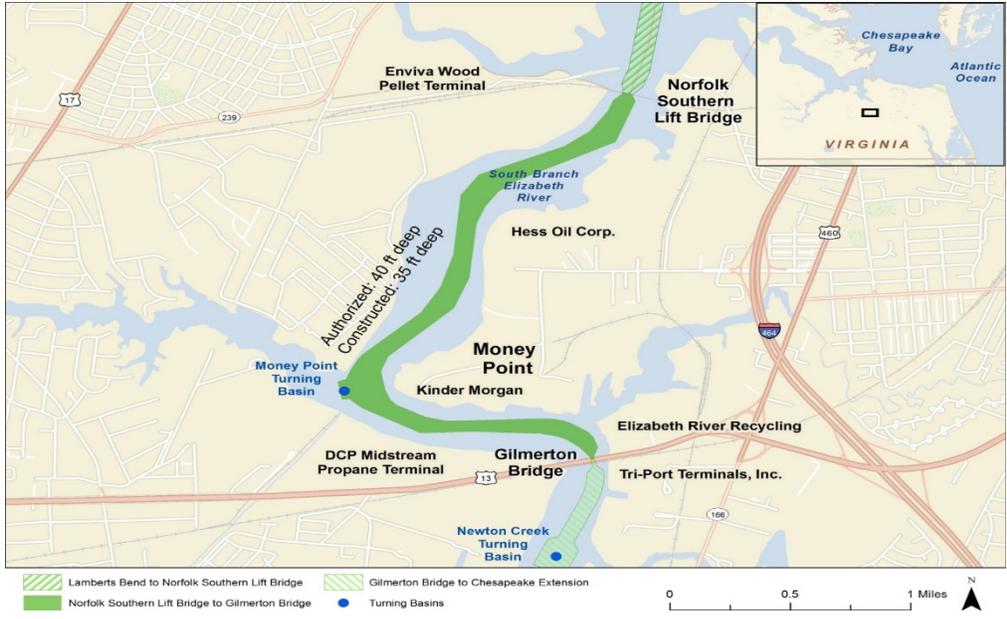
**Figure 2. Segment 1 includes Atlantic Ocean Channel, Thimble Shoal Channel, and Norfolk Harbor Channel. Authorized dredging depths and the existing dredging depths that have been constructed to date are depicted.**



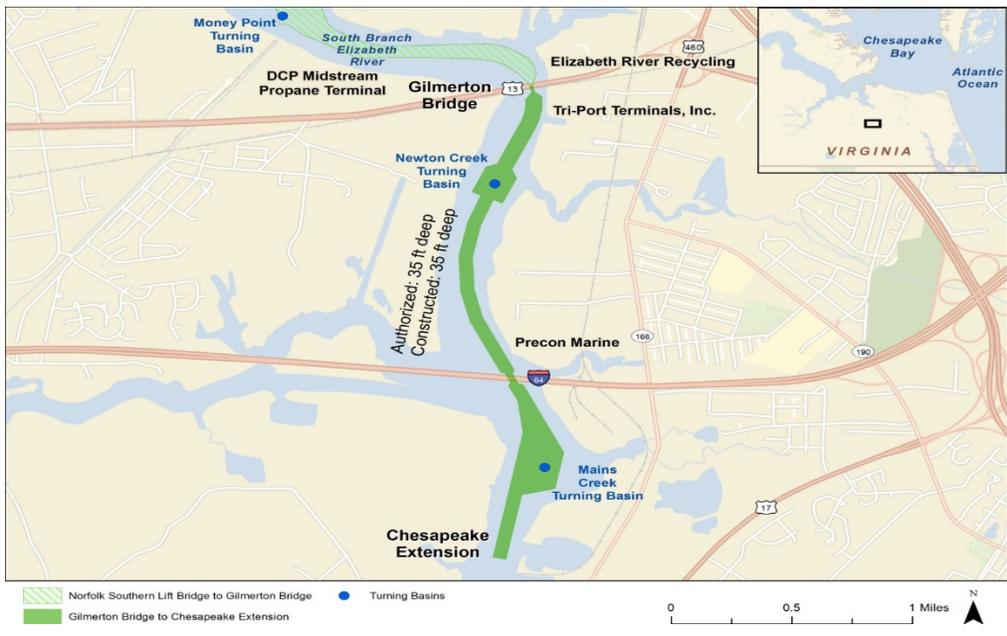
**Figure 3. Segment 2 is Newport News Channel. The authorized dredging depth and the existing dredging depth that has been constructed to date is depicted. Anchorages are also shown for reference. Deepening of Anchorage F has been considered for this project.**



**Figure 4. Elizabeth River and Southern Branch Navigation Improvements Project from Lambert's Bend to the Norfolk Southern Lift Bridge.**



**Figure 5. Elizabeth River and Southern Branch Navigation Improvements Project from the Norfolk Southern Lift Bridge to the Gilmerton Bridge.**



**Figure 6. Elizabeth River and Southern Branch Navigation Improvements Project from the Gilmerton Bridge to the Chesapeake Extension.**



**Table 1. Summary of estimated dredging durations and volumes over the lifecycle of the No Action/Future Without Project Alternative and the Preferred Alternative (Action Alternative) for the Norfolk Harbor Navigation Improvements Project**

Alternative	Required Depth (feet)	Estimated Construction					Estimated Maintenance (50 Years)		Estimated Construction and Maintenance (50 Years)	
		Estimated Maximum Depth (feet)	Estimated Maximum Dredging Volume- all allowable and nonpay (cubic yards)	Estimated Maximum Dredging Duration (months)	Estimated Total Land Disturbance - Maximum (square feet)	Change/Delta (increase) in Land Disturbance - Maximum (square feet)	Estimated 50 Year Total of Maintenance Volume (cubic yards)	Estimated 50 Year Total - Maintenance Dredging Duration (months)	Estimated Maximum Volume-Total Allowable and Non-pay + Maintenance Volume (cubic yards)	Estimated Maximum Construction + 50-year Maintenance Dredging Duration (months)
NAA/FWOP-Segment 1 Atlantic Ocean Channel	52	57	2,152,820	6	76,166,690	0	8,217,950	33	10,370,770	39
NAA/FWOP-Segment 1 Thimble Shoals Channel	50	55	4,371,193	14	114,682,571	0	16,278,850	140	20,650,043	154
NAA/FWOP-Segment 1 Sewells Point to Lamberts Bend	50	55	4,460,147	4	52,664,951	0	36,681,500	68	41,141,647	72
NAA/FWOP-Segment 1 Anchorage F	50	55	210,956	2	24,930,676	0	6,851,800	14	7,062,756	15
NAA/FWOP-Segment 2 Newport News Channel	50	55	1,658,438	1	27,157,981	0	5,481,200	13	7,139,638	14
<b>Total</b>			<b>12,853,553</b>	<b>26</b>	<b>295,602,869</b>		<b>73,511,300</b>	<b>268</b>	<b>86,364,853</b>	<b>295</b>
PA-Segment 1 Atlantic Ocean Channel	59	64	16,074,736	42	78,738,613	2,571,924	15,191,112	62	31,265,848	104
PA-Segment 1 Thimble Shoals Channel	56	61	18,069,823	57	119,644,916	4,962,345	24,331,540	210	42,401,363	267
PA-Segment 1 Thimble Shoals Channel Meeting Area 2 (1,300 feet)	56	61	3,072,847	10	13,693,000	13,693,000	2,000,744	17	5,073,591	27
PA-Segment 1 Sewells Point to Lamberts Bend	55	60	12,147,318	11	57,012,805	4,347,854	42,346,689	78	54,494,008	89
PA-Segment 1 Anchorage F - 3,620 feet	51	56	2,522,500	19	27,984,077	3,053,401	6,858,836	14	9,381,336	33
PA-Segment 2 Newport News Channel	55	60	4,906,284	4	29,272,754	2,114,772	6,676,305	16	11,582,589	19
<b>Total</b>			<b>56,793,508</b>	<b>143</b>	<b>326,346,166</b>	<b>30,743,297</b>	<b>97,405,226</b>	<b>397</b>	<b>154,198,734</b>	<b>539</b>

NAA/FWOP=No Action Alternative, Future Without Project; PA=Preferred Alternative

### 3.3 Project Schedule and Dredging Frequencies

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Construction is anticipated to begin in approximately 2023 but is contingent on funding availability. Construction (all channels and Anchorage F) of the Norfolk Harbor Project will take approximately 3.5 to four years to complete. Maintenance dredging is anticipated to occur on the approximate schedule below and is contingent on funding availability.

- Atlantic Ocean Channel: approximately every 3-4 years; after the deepening, this may accelerate to every 2-3 years;
- Thimble Shoals Channel: approximately every 2-3 years;
- Norfolk Harbor Channel: approximately every 12-15 months;
- Newport News Channel: approximately every 2 years;
- Anchorage F: approximately every 5 years.

Maintenance dredging may occur on an accelerated schedule if there is an imminent need (for example, storm-related shoaling) or a delayed schedule depending on funding availability. Maintenance dredging will take approximately three to six months to complete and will be contingent on the type and size of the dredge used. Construction may occur at any time of the year; however, to the maximum practical extent possible, construction will not occur during September 1 - November 14 to reduce potential impacts to sea turtles. In general, construction operations will average approximately 18 hours per day at any time of the day or night. For approximately 6 hours per day, construction operations may involve equipment maintenance and personnel shifts.

### 3.4 Region of Influence/Action Area

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The ROI or Action Area is defined as those areas to be impacted directly or indirectly by the federal action and not merely the immediate area involved in the action. The ROI or Action Area consists of the areas transited by dredging vessels/equipment, areas of navigation channel dredged and Anchorage F, and dredged material management/disposal sites. The ROI or Action Area includes the area of anticipated circulation patterns shifts and potential water quality impacts. The geographic extent of water quality impacts is dependent upon factors such as the type of dredging equipment, the dredging depth, and environmental conditions like wind and currents (USACE 1983).

## 4.0 ESSENTIAL FISH HABITAT

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The 1996 amendments to the Magnuson-Stevens Act set forth a mandate for NOAA Fisheries Service, regional Fisheries Management Councils (FMC), and other Federal agencies to identify and protect EFH of economically important marine and estuarine fisheries. To achieve this goal, suitable fish habitats need to be maintained. The entrance channel to the Norfolk Harbor Project starts in the mouth of Chesapeake Bay, at the eastern end of the Atlantic Ocean Channel. The project then continues west along the southern half of the Chesapeake Bay to the Lambert's Point at the Elizabeth River.

Essential Fish Habitats in the Action Area were identified by utilizing the EFH – Data Inventory, available at <https://www.habitat.noaa.gov/protection/efh/newInv/index.html> (updated 02 February 2018), and for species without GIS data available, the *Omnibus Essential Fish Habitat Amendment 2* (updated 25 October 2017) was utilized (NMFS 2018; NMFS 2017a; NMFS 2017f). A conservative five mile buffer was created around each of the channels, and then based on the

NMFS GIS mapping for HMS and Greater Atlantic species and maps for species not included in the GIS data, life stages for managed species in the Action Area were identified in each of the channel segments, ocean disposal sites, and Anchorage F (Table 2) (NMFS 2018; NMFS 2017a; NMFS 2017f).

**Table 2. Fish species and associated life stages with Essential Fish Habitat with the potential to occur in the affected area of the Norfolk Harbor Project (NMFS 2017a; NMFS 2017e; NFMFS 2014b).**

Life Stage and Species	Location of Dredging and Potential Dredge Type*						
	Atlantic Ocean Channel	Thimble Shoal Channel	Norfolk Harbor Entrance Channel	Norfolk Harbor Channels	Channel to Newport News	Anchorage F	Placement Sites
E = Eggs; L = Larvae; J = Juvenile; A = Adult; N = Neonate; n/a = not found; HAPC = Habitat Area of Particular Concern	H, CSD, M	H, CSD, M	H, CSD, M	H, CSD, M	CSD, M	CSD, M	Ocean Disposal (NODS & DNODS)
<b>Atlantic Highly Migratory Species</b>							
albacore tuna ( <i>Thunnus alaguna</i> )	J	J	n/a	n/a	n/a	n/a	J
bluefin tuna ( <i>Thunnus thynnus</i> )	J, A	A	n/a	n/a	n/a	n/a	J, A
skipjack tuna ( <i>Katsuwonus pelamis</i> )	A	A	n/a	n/a	n/a	n/a	J, A
yellowfin tuna ( <i>Thunnus albacores</i> )	J	J	n/a	n/a	n/a	n/a	J
<b>Coastal Demersal Fishes</b>							
black sea bass ( <i>Centropristus striata</i> )	L, J, A	L, J, A	J, A	J, A	J, A	J, A	L, J, A
monkfish ( <i>Lophius americanus</i> )	n/a	n/a	n/a	n/a	n/a	n/a	E, L
red drum ( <i>Stotomus chrysops</i> )	J, A	J, A	J, A	L, J, A	n/a	J, A	J, A
red hake ( <i>Urophycis chuss</i> )	E, L, J	E, L, J, A	J, A	n/a	n/a	n/a	E, L, J
scup ( <i>Stenotomous chrysops</i> )	J, A	J, A	J, A	J, A	J, A	J, A	J, A
summer flounder ( <i>Paralichthys dentatus</i> )	E, L, J, A	J, A	L, J, A	L, J, A	L, J, A	L, J, A	E, L, J, A
surf clam ( <i>Spisula solidissima</i> )	J	n/a	n/a	n/a	n/a	n/a	J, A
whiting/silver hake ( <i>Merluccius bilinearis</i> )	n/a	n/a	n/a	n/a	n/a	n/a	J
windowpane flounder ( <i>Scophthalmus aquosus</i> )	E, L, J, A	E, L, J, A	J, A	J, A	J, A	J, A	E, L, J, A
witch flounder ( <i>Glyptocephalus cynoglossus</i> )	E	E	n/a	n/a	n/a	n/a	E, L
yellowtail flounder ( <i>Limanda ferrunginea</i> )	L	L	n/a	n/a	n/a	n/a	L
<b>Coastal Pelagic Fishes</b>							
Atlantic butterfish ( <i>Peprilus triacanthus</i> )	E, L, J, A	E, L, J, A	E, L, J, A	E, L, J, A	E, L, J, A	E, L, J, A	E, L, J, A
Atlantic mackerel ( <i>Scomber scombrus</i> )	J, A	n/a	n/a	n/a	n/a	n/a	J, A
Atlantic sea herring ( <i>Clupea harengus</i> )	A	A	n/a	n/a	n/a	n/a	J, A

Life Stage and Species	Location of Dredging and Potential Dredge Type*						
	Atlantic Ocean Channel	Thimble Shoal Channel	Norfolk Harbor Entrance Channel	Norfolk Harbor Channels	Channel to Newport News	Anchorage F	Placement Sites
E = Eggs; L = Larvae; J = Juvenile; A = Adult; N = Neonate; n/a = not found; HAPC = Habitat Area of Particular Concern	H, CSD, M	H, CSD, M	H, CSD, M	H, CSD, M	CSD, M	CSD, M	Ocean Disposal (NODS & DNODS)
<b>Coastal Pelagic Fishes Continued</b>							
bluefish ( <i>Pomatomus saltarix</i> )	J, A	J, A	J, A	J, A	J, A	J, A	E, L, J, A
cobia ( <i>Rachycentron canadum</i> )	E, L, J, A	E, L, J, A	n/a	n/a	n/a	n/a	E, L, J, A
king mackerel ( <i>Scomberomorus cavalla</i> ) and Spanish mackerel ( <i>Scomberomorus maculatus</i> )	E, L, J, A	E, L, J, A	n/a	n/a	n/a	n/a	E, L, J, A
longfin inshore squid ( <i>Loligo pealeii</i> )	E	E	n/a	n/a	n/a	n/a	E, J, A
northern shortfin squid ( <i>Illex illecebrosus</i> )	J	J	n/a	n/a	n/a	n/a	J
<b>Sharks</b>							
angel shark ( <i>Squatina dumeril</i> )	N, J, A	N, J, A	n/a	n/a	n/a	n/a	N, J, A
Atlantic sharpnose shark ( <i>Rhizopriondon terranovae</i> )	J, A	J, A	J, A	J, A	J, A	J, A	J, A
blacktip shark (Atlantic stock) ( <i>Carcharhinus limbatus</i> )	J, A	J, A	n/a	n/a	n/a	n/a	J, A
common thresher shark ( <i>Alopias vulpinus</i> )	N, J, A	N, J, A	n/a	n/a	n/a	n/a	N, J, A
dusky shark ( <i>Carcharhinus obscurus</i> )	N	N	n/a	n/a	n/a	n/a	N, J, A
sand tiger shark ( <i>Carcharia taurus</i> )	N, J, A	N, J, A	N, J, A	N, J, A	N, J, A	N, J, A	N, J, A
sandbar shark ( <i>Carcharhinus plumbeus</i> )	N, J, A	N, J, A	N, J	J	N, J	N, J	N, J, A
sandbar shark ( <i>Carcharhinus plumbeus</i> )*	HAPC	HAPC	HAPC	HAPC	HAPC	HAPC	HAPC
scalloped hammerhead shark ( <i>Sphyrna lewini</i> )	n/a	n/a	n/a	n/a	n/a	n/a	J, A
smooth dogfish ( <i>Mustelus canis</i> )	N, J, A	N, J, A	n/a	n/a	n/a	n/a	N, J, A
spiny dogfish ( <i>Squalus acanthias</i> )	J**, A	J**, A	n/a	n/a	n/a	n/a	J**, A
tiger shark ( <i>Galeocerdo cuvieri</i> )	J, A	J, A	n/a	n/a	n/a	n/a	J, A
<b>Skates</b>							
winter skate ( <i>Leucoraja ocellata</i> )	J	J, A	J, A	J, A	n/a	J, A	J
little skate ( <i>Leucoraja erinacea</i> )	J	J, A	J, A	J, A	n/a	J, A	J

Life Stage and Species	Location of Dredging and Potential Dredge Type*						
	Atlantic Ocean Channel	Thimble Shoal Channel	Norfolk Harbor Entrance Channel	Norfolk Harbor Channels	Channel to Newport News	Anchorage F	Placement Sites
E = Eggs; L = Larvae; J = Juvenile; A = Adult; N = Neonate; n/a = not found; HAPC = Habitat Area of Particular Concern	H, CSD, M	H, CSD, M	H, CSD, M	H, CSD, M	CSD, M	CSD, M	Ocean Disposal (NODS & DNODS)
<b>Skates Continued</b>							
clearnose skate ( <i>Raja eglanteria</i> )	J, A	J, A	J, A	J, A	n/a	J, A	J, A
<b>Managed by Endangered Species Act (ESA)</b>							
Atlantic sturgeon ( <i>Acipenser oxyrinchus</i> )	J**, A	J**, A	J**, A	J**, A	J**, A	J**, A	J**, A

\*H = Hopper Dredge; CSD = Cutterhead Suction Dredge; M = Mechanical Dredge; If deemed necessary, all channels have the potential to be dredged via mechanical dredging. Placement for the Atlantic Ocean and Thimble Shoal Channels could be at NODS, DNODS, CIDMMA, or upland. For the Norfolk Harbor Channels, Channel to Newport News, and Anchorage F, disposal could occur at the CIDMMA, NODS, or upland.

\*\* J indicates subadult life stage for Atlantic sturgeon and spiny dogfish

## 4.1 Water column

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The water column is the medium which connects all aquatic habitats and can act as a corridor between differing essential habitats for managed species. Many managed species rely on different portions of the water column for different life stages. The Preferred Alternative for the NHC Deepening project will consist of actions in the water column that may affect surface, pelagic, and benthic EFH.

### 4.1.1 Surface Waters

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Surface waters are all waters naturally open to the atmosphere; this includes seas and estuaries. Oceanic and estuarine surface waters are subject to frequent shifts in wind direction and speed, temperature, and salinity. This EFH is generally used by the egg and larval life stages of many fish species, and surface currents aid in the distribution of planktonic fishes throughout a given habitat range. This EFH occurs in the ROI, as dredge vessels transiting to and from dredging locations must move through both estuarine and marine surface waters.

Managed species with EFH in surface waters of the ROI include the egg and/or larval life stages for monkfish, whiting, windowpane flounder, witch flounder, and yellowtail flounder.

### 4.1.2 Pelagic Waters

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Pelagic waters for EFH refers to habitat and associated managed species in the water column as opposed to the sea floor; this EFH generally occurs anywhere from the surface to 1,000 meters. Pelagic waters make up the habitat located between surface and benthic waters, and its variable depths and temperatures provide habitat for the vast majority of both estuarine and marine managed fish species. The egg, larval, juvenile and adult life stages for numerous managed species occur in pelagic waters. In the ROI, managed species with EFH in pelagic waters include, but are not limited to, Atlantic sea herring, monkfish, bluefish, butterfish, longfin inshore squid, and northern shortfin squid.

This broad EFH also includes oceanic, high salinity surf zones EFH for red drum and coastal migratory pelagics, ocean-side water from surf to shelf break and from the Gulf Stream shoreward EFH for coastal migratory pelagics, and spawning area above adult habitat and additional pelagic environment for demersal species. Additionally, pelagic waters are EFH managed shark species and HAPC for the sandbar shark.

### 4.1.3 Benthic Waters

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Benthic waters provide EFH for managed demersal species. Demersal species are those fishes living in close relation with the bottom and depending on it. Cods, groupers, crabs, and lobsters are demersal resources. Managed species with EFH for one or more life stage in benthic waters include, but are not limited to, Atlantic herring, red hake, whiting, windowpane flounder, witch flounder, black sea bass, longfin inshore squid, scup, summer flounder, and surf clams.

The composition of benthic substrates affect EFH for managed species; some EFH consists of areas composed of soft muddy and/or sandy substrates, while other benthic EFH may be composed of reefs or other shelter providing structures. Within the action area, sand, Mud, mixture of sand and mud are the most commonly occurring benthic substrates, and adjacent to the ROI, there is oyster rubble.

#### 4.1.3.1 Reef Structures

Virginia's Artificial Reef Program, managed by Virginia Marine Resources Commission (VMRC) has installed artificial reefs adjacent to the ROI that provide habitat for many benthic organisms. (VMRC 2016a). Found east of the Monitor Merrimac Bridge Tunnel (see Figure 8), adjacent to Newport News Channel, the Middle Ground Artificial Reef is located approximately 3,100 feet from the channel at the mouth of the James River. The reef encircles the Newport News Middle Ground Lighthouse with a ring of reef structures, concrete rubble, buoy sinkers, piling and pier sections extending radially 200 to 1,000 feet from the lighthouse. The reef sits at a depth of -22 feet with a profile of two to four feet (VMRC 2016b) and acts as a designated Broodstock Sanctuary providing seed clams for the lower James River.

The mouth of the Lafayette River borders Norfolk Harbor Channel and is located across from CIDMMA. Public oyster grounds or Chesapeake Baylor Grounds are located adjacent to the Channel and surrounding CIDMMA. Within the Lafayette River proper, there are few public oyster grounds and minimal private leases. The river has been closed to wild commercial oyster harvest since the 1930s due to poor water quality. All oysters in the Lafayette River are protected from harvest. The river was surveyed in 2015 and documented to contain 46 acres of relict oyster reef and 22 acres of oyster restoration reef projects (Lafayette Oyster Working Group 2016). These reefs are outside the ROI.

The eastern oyster does not prefer the depths or salinities in the other locations or areas adjacent to the ROI. The Atlantic Ocean Channel, NODS, and DNODS have salinities greater than 30 ppt and depths in excess of 40 feet and, therefore, these locations do not contain suitable oyster habitat.

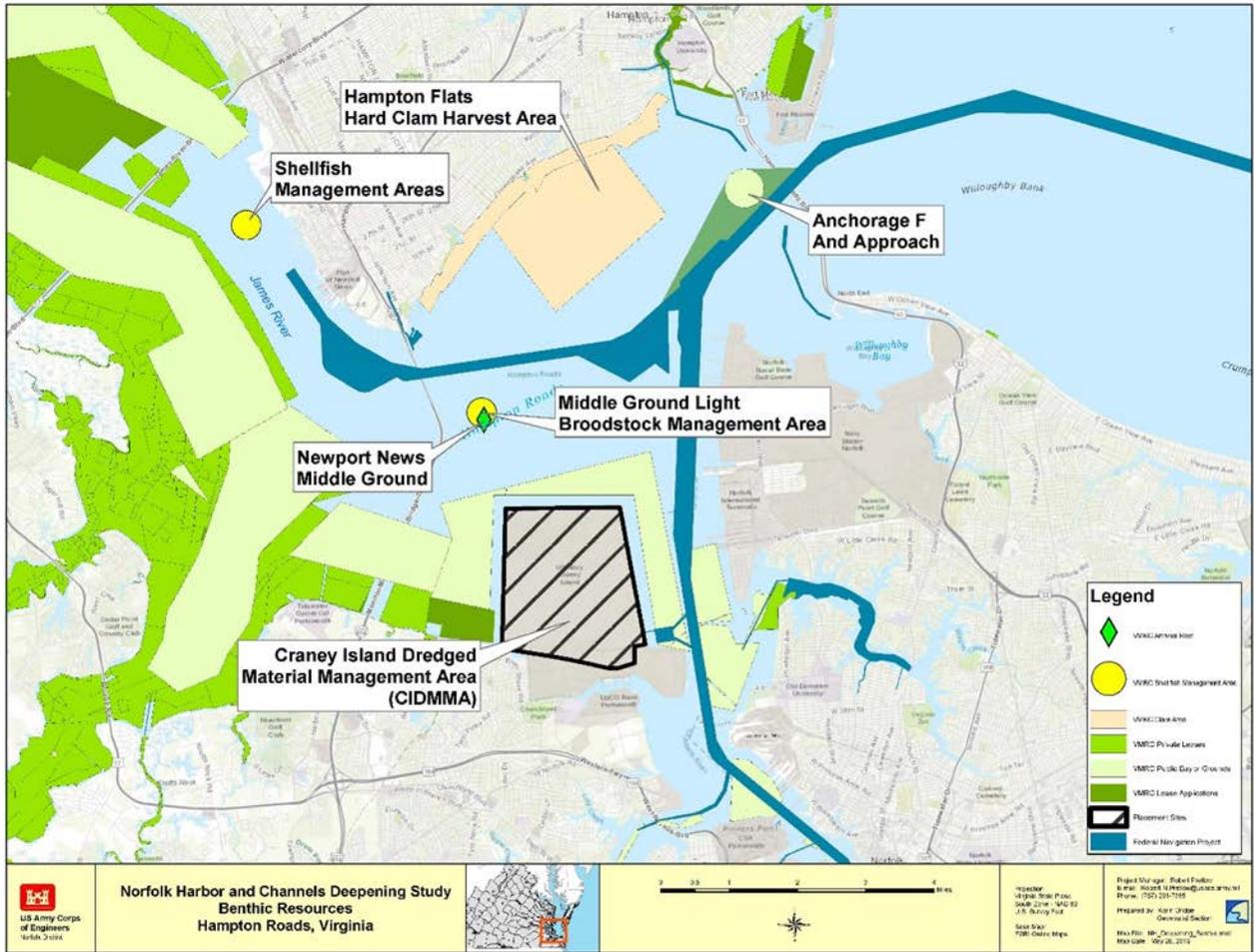
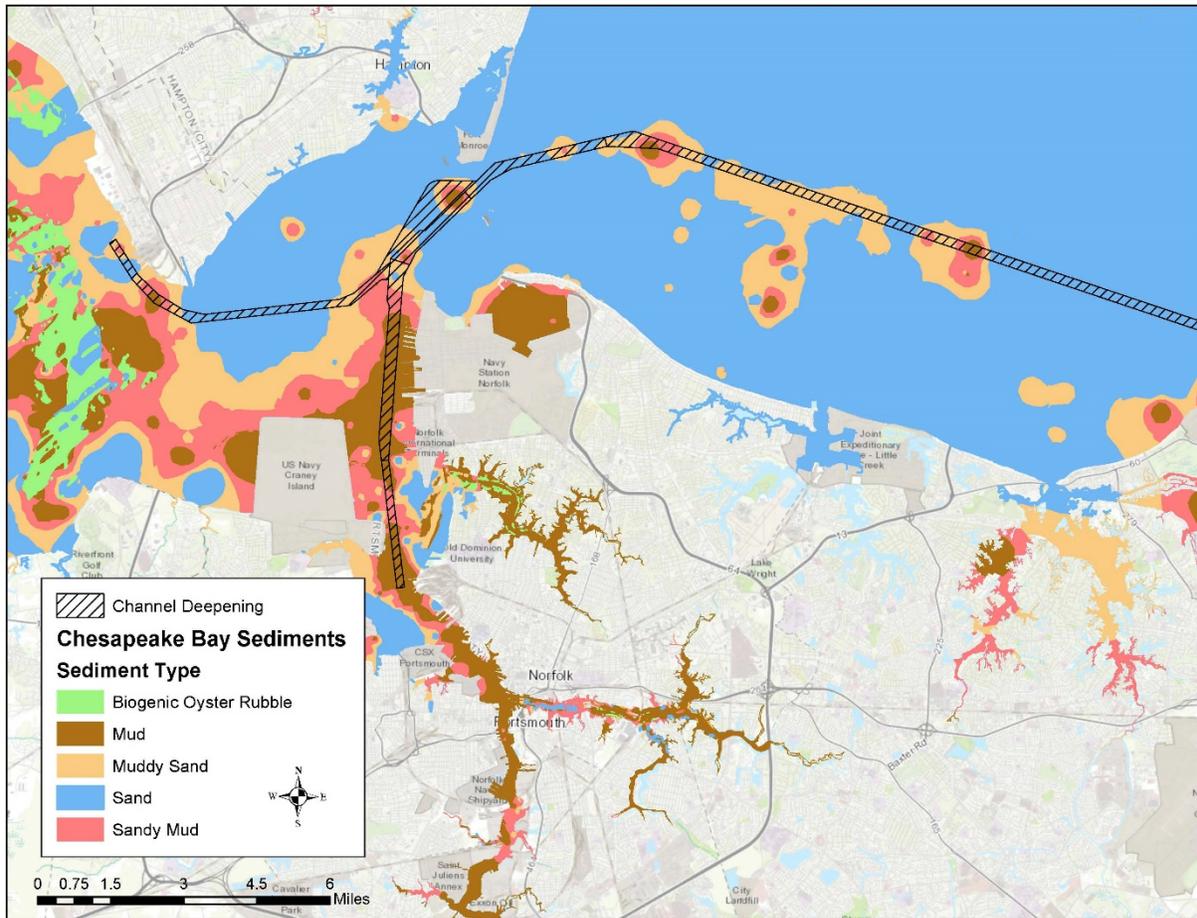


Figure 8. Norfolk Harbor Benthic Resources.

#### 4.1.3.1 Unconsolidated Bottom (Fine Grained Sediments and Sand)

This EFH consists of soft estuarine or marine sediments inhabited by a diverse assemblage of invertebrates that serve as prey to demersal fishes. Unconsolidated sediments are loose materials, ranging from clay to sand to gravel, which allow water to easily flow between sediment particles (USGS 2017). Due to their form, these sediments are typically very mobile in response to wave and current conditions, and lack stable surfaces for extensive vegetation or animal attachment. Changes in type or amount of sediment supply, energy of wave and currents, and changes in water quality drive the biodiversity within this EFH. In the ROI, the majority of the sediments are composed of sand, mud, and combinations of varying proportions of sand and mud (Figure 8).



**Figure 9. Benthic sediment types found within and adjacent to the ROI; data is limited to the Chesapeake Bay, but it is assumed that similar sediment types are present in offshore channels (Thimble Shoals and Atlantic Ocean Channels) (NOAA-CBo 2014).**

## 4.2 Submerged Aquatic Vegetation (SAV)

Submerged aquatic vegetation (SAV) is important in Virginia waters for certain life stages of many fish species (Terceiro 2006; Love and May 2007; Phillips et al. 1989). SAV can be found throughout areas of the Chesapeake Bay and its tidal tributaries. Submerged Aquatic Vegetation is a critical food and habitat source for a wide variety of waterfowl, shellfish, and fish species. Submerged Aquatic Vegetation provides a complex refuge that serves as nursery and juvenile habitat for many fish species and provides increased prey availability (Fisher and Willis 2000).

Areas with SAV coverage consistently have both a larger abundance of individuals of a given species and a greater diversity of fish species than non-vegetated areas (Orth and Heck 1980). The use of SAV by fish species is most prevalent during the summer months when water temperatures are higher and dissolved oxygen is lower (Love and May 2007; Orth and Heck 1980). The increased use of SAV directly corresponds with the increased biomass produced by the plants during the spring and early summer months. Increased SAV coverage and biomass also directly coincide with the proliferation of fish larvae within the Chesapeake Bay. In the

Chesapeake Bay, fish larvae of all species are most numerous between March and August, with the highest density in May (Cowan and Birdsong 1985).

The most recent (2015) SAV survey by the Virginia Institute of Marine Science (VIMS) indicates that SAV is not present in any of the projects segments, including the Elizabeth River. In addition, no SAV would be found within areas indirectly impacted by the project within the ROI. The absence of SAV within the ROI can impact both the presence and the abundance of early life stages of species in a given area. Implementation of the Preferred Alternative will not affect SAV presence/absence in the ROI.

This EFH is not evaluated further in this document.

### 4.3 Wetlands

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Wetlands are defined by the Clean Water Act regulations as, “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas” (USEPA 2016). Estuary environments can be altered with the combined stress of inundation, desiccation, and changes in salinity. These conditions limit the types of vegetation that can survive within the ROI, and the plant communities within this dynamic ecosystem have evolved the capacity to thrive in the ever-changing environment (Perry et al. 2001).

Wetlands are resources that combine shallow water, high levels of nutrients, and primary productivity, which is ideal for the development of organisms that form the base of the food web and provide foraging sites for fish, amphibians, shellfish and insects. Dead plant leaves and stems break down in the water to form detritus, which feeds many small aquatic insects, shellfish and small fish that are food for larger predatory fish, reptiles, amphibians, birds and mammals. Many species of birds and mammals rely on wetlands for food, water, and shelter, especially during migration and breeding.

Over the course of many years of development and industry, shorelines have been built up, bulkheaded, or were filled to facilitate development; and large industrial and military deep water access piers and marine terminals have been constructed adjacent to the ROI. The entire navigation channel system within the ROI is subtidal, and classified as Estuarine and Marine Deepwater by U.S. Fish and Wildlife Service. The channel in the ROI ranges in depth from -35 to -55 feet MLLW and thus, is too deep to support wetland vegetation.

Tidal marsh exists only in portions of the shoreline fringing the CIDMMA. Within those areas, the entire habitat transition from open water, through salt marsh, to the adjacent uplands is generally less than 20 feet wide. The wetland fringes are typically comprised of dense, often mono-specific stands of smooth cordgrass (*Spartina alterniflora*), and occur at elevations between mean low water (MLW) and mean high water (MHW). The reed grass community, found further upslope of MHW in various areas, is dominated by the invasive reed grass (*Phragmites australis*). Both community types are considered estuarine wetlands. Upslope of these emergent wetlands and along the banks are saltbush communities dominated by marsh elder (*Iva frutescens*), groundsel tree (*Baccharis hamifolia*), and Chesapeake Bayberry (*Morella pensylvanica*). The USACE regularly treats reed grass via aerial application to help control its spread at the CIDMMA and adjacent areas.

Emergent wetland vegetation may form temporarily from time to time within the existing CIDMMA facility, as it is periodically altered by dredged material from various current dredging projects,

and as that material settles and/or is managed. However, these are inadvertently created wetland vegetation sites and no jurisdictional wetlands are located within the confines of the CIDMMA itself.

The Preferred Alternative will not result in any impacts to jurisdictional wetlands, therefore this EFH is not further evaluated in the document.

## 5.0 MANAGED FISH SPECIES

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The seasonal and year-round locations of the designated EFH for the managed fisheries are described below. The EFH determination is based on species distribution and habitat range.

### 5.1 Albacore Tuna

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The Norfolk Harbor Project occurs in an area designated EFH for the juvenile life stage for albacore tuna. Juveniles of this species (fish up to 90 centimeters in fork length) are generally found off the east coast of the United States from Cape Hatteras, North Carolina to Cape Cod, Massachusetts (NMFS 2009). In the Action Area, juveniles may be foraging or migrating through the Atlantic Ocean Channel, Thimble Shoal Channel, or ocean disposal sites.

Albacore are a highly migratory pelagic fish that generally range from 40° to 45°N to 40°S in the western Atlantic Ocean (NMFS 2009). Smaller individuals of this species tend to form aggregations; aggregations of albacore may also contain individuals from other species such as skipjack, yellowfin and bluefin tuna. Albacore tuna forage from epipelagic to mesopelagic waters down to depths of 500 meters (Consoli et al. 2008). This species, as well as other tuna species, are considered opportunistic feeders and, as such, consume a wide variety of fishes and invertebrates (NMFS 2009).

### 5.2 Angel Shark

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The proposed dredging and placement actions occur in an area designated as EFH for neonate, juvenile, and adult life stages of the angel shark. Within the project footprint, angel sharks may be found in the Atlantic Ocean Channel, Thimble Shoal Channel, or in ocean disposal sites.

The angel shark a benthic-dwelling shark with a flattened body resembling a ray (NMFS 2009). The diet of this species is largely made up of benthic organisms, including crustaceans and mollusks, though they also consume various fish species. This species inhabits coastal waters along the east coast of the United States from Massachusetts to the Florida Keys, the Gulf of Mexico, and the Caribbean. Angel sharks reach maturity between 90 and 105 centimeters total length and are ovoviviparous, giving birth to live young (NMFS 2009). At birth, the pups measure between 28 and 30 centimeters in total length (NMFS 2009). In the Mid-Atlantic region, EFH for both juvenile and adult angel sharks ranges from Cape Lookout, North Carolina to the mid-coast of New Jersey (NMFS 2009).

### 5.3 Atlantic Butterfish

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Essential fish habitat for all four life stages (egg, larvae, juvenile, and adult) of the Atlantic butterfish occurs in all channels proposed to be dredged as well as ocean disposal sites. The proposed dredging occurs within an area designated as. Pelagic waters over the continental shelf are essential habitat for this species, and each life stage has a depth preference. Butterfish eggs are found from near-shore waters to depths of 600 feet, the larvae are collected in depths between 33 and 6,000 feet, while juveniles and adults are found between 33 and 1,200 feet. Preferred

water temperature for each life stage also varies. Eggs have been found at water temperatures between 11° and 17°C; larval butterfish are found in temperatures varying from about 9° to 19°C. Juvenile and adult fish are generally found at temperatures between 3° and 28°C (NMFS 2014). Juvenile and adult butterfish are pelagic and overwinter along the 100 fathom contour of the continental shelf from late autumn through early spring. The diet of the Atlantic butterfish is largely composed of plankton (MAFMC and NOAA Fisheries 2011). Both juveniles and adults are common in the high salinity and mixing zones of estuaries from Massachusetts Bay to the Mid-Atlantic during warmer months.

## 5.4 Atlantic Mackerel

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The Atlantic Ocean Channel, Thimble Shoal Channel, and ocean disposal sites fall within designated EFH for juvenile and adult Atlantic mackerel. Atlantic mackerel can reach lengths up to 26 cm after two years of growth, and after 6 years of growth, they can reach lengths between 39 and 40 cm (Studholme et al. 1999). Adults of this species are highly mobile and form aggregates where individuals come together and school diurnally (Studholme et al. 1999). Temperature regimes for juveniles can range from 4-22°C, while adults can be found in a slightly narrower range, from 4-16°C. Both life stages are found throughout the water column from the water's surface to depths up to 340 meters and 380 meters for juveniles and adults, respectively (Studholme et al. 1999).

Atlantic mackerel are opportunistic feeders that can feed passively by filter feeding on plankton or actively by individual selection of organisms (Studholme et al. 1999). Juveniles tend to feed on small pelagic mollusks and small crustaceans, such as copepods, amphipods, mysid shrimp and decapod larvae; adults tend to consume the same food as juveniles, though their prey items can be larger.

## 5.5 Atlantic Sea Herring

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The proposed dredging areas fall within designated EFH for juvenile and adult life stages of Atlantic sea herring. Adults of this species may be found in the Atlantic Ocean Channel, Thimble Shoals Channel, and ocean disposal sites, while juveniles may be found in only ocean disposal sites. Atlantic sea herring are a pelagic, schooling species that can be found in both the eastern and western Atlantic Ocean. In the western Atlantic Ocean, Atlantic sea herring are found from Labrador, Canada to North Carolina. Chesapeake Bay is at the southern limit of the Atlantic sea herring's range, so abundance of this species is relatively low compared to more northern locations. Within the Chesapeake Bay, adults are most commonly found in high salinity waters. Adults will enter some portions of the Bay itself but will only occur in waters with salinity above 28 ppt (Reid et al. 1999). This species migrates seasonally over long distances between winter and spring/summer habitats, and each Atlantic sea herring population follows a different migration pattern.

Atlantic sea herring can live up to 15 years and reach a maximum size of 14 inches (Atlantic Herring 2015). This species reaches sexual maturity at about four years of age. Spawning occurs in highly saline waters over sand, small stone, or gravel substrates. Spawning typically occurs between August and November, and timing varies depending on the stock the fish belong to, with earlier spawning occurring in northern stocks.

The diet of adult Atlantic sea herring includes euphausiids, chaetognaths, amphipods, and copepods (Reid et al. 1999). Schools of Atlantic sea herring are strongly correlated with the occurrence of their preferred prey species, as they closely follow their food sources.

## 5.6 Atlantic Sharpnose Shark

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All channels proposed to be dredged as well as both ocean disposal sites lie within designated EFH for juvenile and adult Atlantic sharpnose sharks. The Atlantic sharpnose shark is a small shark commonly found along the Atlantic coastline from the Bay of Fundy, Canada to the Yucatan Peninsula, Mexico (Parsons 2006). This is a highly migratory, pelagic species that generally resides in warm-temperate to tropical waters of the South Atlantic Ocean and Gulf of Mexico. Atlantic sharpnose sharks seasonally migrate toward warmer waters, traveling north and inshore in the summer and south and offshore in the winter. Atlantic sharpnose sharks are not commonly found in the Chesapeake Bay, but they can occasionally be found in the summer months.

Atlantic sharpnose sharks are a fast-growing species that reach maturity at two to three years of age and a maximum length of about four feet (Murdy and Musick 2013; Castro, Woodyly, and Brudek 1999). This species is known for its opportunistic feeding habits, consuming a variety of species found within benthic-pelagic waters (Smith and Link 2010). Sharpnose sharks predominantly consume small fish, but their diet also includes crustaceans, squid, shrimp, and other invertebrates (Castro 2011). Adults spawn in the late spring and summer in areas of the south Atlantic Ocean and Gulf of Mexico.

## 5.7 Atlantic Sturgeon\*

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Atlantic sturgeon that are spawned in U.S. rivers or are captive progeny of Atlantic sturgeon that were spawned in U.S. rivers are listed under the ESA as five Distinct Population Segments (DPSs). The five DPSs are: the Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs. The ranges of the five DPSs overlap and extend from Canada to Cape Canaveral, Florida. Atlantic sturgeon can be found in major rivers, estuaries, bays, and coastal waters along the eastern seaboard of the United States. Chesapeake Bay is known to be used by all five DPSs. The Gulf of Maine DPS was federally listed as threatened and the rest were listed as endangered on February 6, 2012 (NOAA 2016a).

The Atlantic sturgeon is an anadromous bony fish distinguishable from other fishes by five rows of bony scutes along the length of its body, a protrusible mouth, and heterocercal tail. They are slow-growing and late-maturing and have been recorded to reach up to 16 feet in length and 60 years of age. They are bottom feeders that suck food into a ventrally-located protruding mouth. The diet of adult and subadult Atlantic sturgeon includes mollusks, gastropods, amphipods, annelids, decapods, isopods, and fish. (NMFS 2012).

Spawning for the Chesapeake Bay DPS is only known to occur in the James River. It may occur in other tributaries of Chesapeake Bay, but this has not been confirmed. Spawning migrations generally occur during April and May in Mid-Atlantic systems, and water temperature plays a primary role in triggering the timing. Male sturgeon begin upstream spawning migrations when waters reach approximately 6°C (43°F) and remain on spawning grounds through the spawning season. Females begin spawning migrations when temperatures are reach 12 - 13°C (54 - 55°F), make rapid spawning migrations upstream, and quickly depart following spawning. Spawning is believed to occur in flowing water between the salt front of the estuaries and the fall line of large rivers, when and where optimal flows are 46 - 76 centimeters/second and depths are 3 - 27 meters. Sturgeon eggs are deposited on hard bottom substrate such as cobble, coarse sand, and bedrock. At temperatures of 20°C and 18°C, hatching occurs approximately 94 and 140 hours, respectively, after egg deposition. Larval Atlantic sturgeon are assumed to inhabit the same riverine or estuarine areas where they were spawned. Studies show that egg and larvae through age two sturgeon occur in low salinity waters; as such, no eggs, larvae, or young of the year are likely to occur in the Action Area. However, older fish are more salt-tolerant and occur

in higher salinity waters as well as low salinity waters. Atlantic sturgeon may remain in the natal estuary for months to years before migrating to open ocean as subadults (NMFS 2012).

Adults will pass through the northern limits of the Action Area as they move to the James River to spawn in the spring and then again as they return to the ocean. Subadults could be present in or near the Action Area year-round but are less likely to be present in the winter months when individuals would be at overwintering areas, which are not known to occur in the Action Area. (NMFS 2012).

Historically, this species had range-wide declines due to overfishing and the caviar market. Currently, the most significant threat for all five DPSs is by-catch in fisheries. Other significant threats are vessel strikes, poor water quality, water availability, dams, and dredging. Records show that 11 Atlantic sturgeon were struck by vessels between 2005 and 2007 in the James River, which is northwest of the Action Area (NMFS 2012).

In 2017 NMFS designated Critical Habitat for the Gulf of Maine, New York Bight, and Chesapeake Bay DPSs of Atlantic sturgeon in the Federal Register. These locations are in Maine, New York, New Jersey, Pennsylvania, Maryland, and Virginia. The locations in Virginia include the Potomac, Rappahannock, York, and James Rivers out to their confluence with Chesapeake Bay. The critical habitat intersects the Action Area for this project due to the location of the Newport News Channel, which is located in Hampton Roads Harbor and the mouth of the James River. This area is depicted on the map entitled, "Chesapeake Bay, Unit 5, James River" (Federal Register 81 FR 20057).

\*Atlantic sturgeon are an ESA managed species, there is no designated EFH. This species was included for informational purposes.

## 5.8 Blacktip Shark (Atlantic Stock)

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The Atlantic Ocean Channel, Thimble Shoal Channel, and ocean disposal sites fall within designated EFH for juvenile and adult blacktip sharks. Most adults and juveniles of this are characterized by the presence of black tips on their fins. Juveniles range from 69-155 cm in total length, while adults reach lengths greater than or equal to 155 cm in total length. From the coast of Virginia, south to Florida, juveniles are known to inhabit shallow coastal waters to the 25 meter isobath and adults inhabit waters from the shoreline to the 200 meter isobath.

## 5.9 Black Sea Bass

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The proposed dredging occurs within EFH for larval, juvenile, and adult life stages of the black sea bass. Larval black sea bass may occur in the Atlantic Ocean Channel, Thimble Shoal Channel, and ocean disposal areas, while juvenile and adult black sea bass may occur in any of the proposed channels to be dredged as well as the ocean disposal locations.

Larval black sea bass are demersal and tend to settle in waters with temperatures ranging from 13° to 21°C (Steimle et al. 1999b). Juvenile black sea bass occur at a wide variety of temperatures and depths. Juveniles are usually associated with hard bottom habitats, including shellfish grounds, seagrass beds, and man-made structure in areas with predominantly sand or shell substrate. Adult black sea bass are found in either natural or man-made structured habitats with sand and shell as the preferred substrate (NMFS 2014). Juvenile young-of-year migrate to warmer waters offshore or more southerly waters to overwinter. Juveniles migrate to inshore and northerly as waters warm above 6°C. Adults reside in estuaries from May through October and are generally found in deeper waters offshore during the winter months (Steimle et al. 1999b).

## 5.10 Bluefin Tuna

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The proposed dredging site occurs within an area designated as EFH for the juvenile and adult life stages for bluefin tuna. Adults of this species may be found in the Atlantic Ocean Channel, Thimble Shoals Channel, and in ocean disposal sites, whereas juveniles may occur in the Atlantic Ocean Channel and ocean disposal sites.

In the western North Atlantic, bluefin tuna range from 45°N to 0° (Collette and Nauen 1983). Bluefin tuna migrate seasonally from spawning grounds in the Gulf of Mexico to feeding grounds of the northeast U.S. coast. This species is generally epipelagic, forming aggregations with skipjack tuna. Bluefin tuna are opportunistic feeders, and adults are known to feed on a variety of schooling fishes, cephalopods, and benthic invertebrates; silver hake, Atlantic mackerel, Atlantic herring, krill, sandlance, and squid are all known prey items of the bluefin tuna (Dragovich 1969; Mathews et al 1977; Estrada et al 2005). Bluefin tuna can reach lengths up to 300 centimeters (NMFS 2009). EFH for the juvenile life stage of this species ranges from waters south of Cape Hatteras, North Carolina to Cape Cod, Massachusetts (NMFS 2009).

## 5.11 Bluefish

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The proposed dredging site occurs within an area designated as EFH for all life stages of bluefish. Adults and juveniles may be found in any of the proposed channels to be dredged or ocean disposal sites, while eggs and larvae may be encountered in ocean disposal sites. This species is the sole representative of the family Pomatomidae and is closely related to jacks, pompanos, and roosterfish (USACE 2014). Bluefish inhabit the continental shelf waters of temperate zones and is commonly found in large bays and estuaries. Generally, juvenile bluefish occur in Mid-Atlantic estuaries from May through October; adults enter estuaries beginning in April (NMFS 2014). Both adults and juveniles are opportunistic feeders and will forage on available food. The adults and juveniles prefer warm water temperatures (above 14 - 16°C) and migrate south of Cape Hatteras in the winter months. Juveniles are generally found in salinities ranging from 23 to 33 ppt but can tolerate salinities as low as 3 ppt. Adults generally prefer salinities greater than 25 ppt. Bluefish eggs are generally found in the open ocean at temperatures ranging from 18° to 22°C and salinities greater than 31 ppt. Larvae are most often found at the edge of the continental shelf in waters ranging from 18° to 24°C and salinities from 30 to 32 ppt (Fahay et al. 1999). Typically, eggs and larval bluefish are not found in Chesapeake Bay; they most frequently occur greater than 55 km offshore (Fahay et al. 1999). Juvenile bluefish, however, are abundant in Chesapeake Bay mainstem (Fahay et al. 1999).

## 5.12 Clearnose Skate

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The proposed action occurs within an area as designated EFH for the juvenile and adult life stages of the clearnose skate. These life stages may be found in the Atlantic Ocean Channel, Thimble Shoal Channel, Norfolk Harbor Entrance Channel, Norfolk Harbor Channels, Anchorage F, and ocean disposal sites. This is a small species, with lengths averaging between 49 and 60 centimeters, and is characterized by the translucent tissue on either side of the rostrum (Fitz and Daiber 1963; Smith 1997). The dorsal surface of the clearnose skate is tan to dark brown with darker spots and bars and has medially located boney spines that extend the length of the tail (Smith 1997). EFH for juvenile and adult life stages of this species is found across much of the Atlantic seaboard, ranging from the Gulf of Maine to the Cape Hatteras, North Carolina (NMFS 2017b). Juvenile clearnose skates are found from near-shore waters to depths approximately 500 meters, while adults are found from near-shore waters to approximately 400 meters in depth (NMFS 2017b). Both the juvenile and adult life stages are found at temperatures between 9 and 30°C, though, in more southern areas of their range, optimal temperatures for clearnose skates

are between 19° and 30°C (NMFS 2017b). Both juveniles and adults are found in areas with either soft or gravel substrate. The preferred diet of the clearnose skate consists of crustaceans, bivalves, polychaetes, squids, and fishes (Stehmann and McEachran 1978).

Currently, no data is available regarding habitat associations or the distribution of the egg life stage for this species.

### 5.13 Cobia

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The proposed project areas is designated as EFH for all life stages of cobia. These life stages may occur in the Atlantic Ocean Channel, Thimble Shoal Channel, and ocean disposal sites. The cobia is a warm water, pelagic fish found throughout Chesapeake Bay. Spawning and juvenile cobia inhabit high salinity bays, estuaries, and seagrass beds. Adults prefer structures that interrupt open water, such as pilings, buoys, and anchored boats. Adults are also found inshore in bays and inlets. Cobia are opportunistic feeders, generally consuming crustaceans and small fish. Cobia have been known to spawn in shallow estuaries bays with 6 – 9 meters water depth. This species prefers warm water temperatures, usually greater than 27°C, and salinity ranging from 12 to 20 ppt. Juveniles and adults tend to migrate to the southern portions of the Bay and offshore during the colder winter months.

### 5.14 Common Thresher Shark

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The proposed dredging project area lies within essential habitat for neonatal, juvenile, and adult life stages of the common thresher shark. The EFH for these life stages may be found in the Atlantic Ocean Channel, Thimble Shoal Channel, and ocean disposal sites. This species commonly occurs in warm and temperate waters and is found in both coastal and oceanic waters, though it is thought to be most abundant near land (Strasburg 1958). The common thresher shark is believed to reach maturity between three to seven years of age. This species of shark is viviparous, giving birth to live young, usually having litters of four to six pups (Mancini and Amorim 2006; Castro 1983).

At this time, insufficient data is available to differentiate EFH by size classes; therefore, EFH is the same for all life stages (neonate/young-of-year, juveniles, and adults). In the Atlantic Ocean, EFH for this species is found in localized areas off the mid-east coast of Florida, Georgia, South Carolina, and the Gulf of Maine, and from North Carolina through Cape Cod.

### 5.15 Dusky Shark

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The proposed dredging project area lies within essential habitat for neonate, juvenile and adult life stages of the dusky shark. The EFH for the neonate life stage occurs in the Atlantic Ocean Channel, Thimble Shoal Channel, and ocean disposal sites, whereas the juvenile and adult EFH occurs in just the ocean disposal sites.

The dusky shark can reach up to four meters in length. Similar to many elasmobranchs, female dusky sharks give birth to live young. They usually reproduce every three years and typically have litters of six to 14 pups. This species typically eats fish, including smaller elasmobranchs, including other sharks, skates, and rays, though other prey, such as squid and sea turtles, are taken on occasion. In the North Atlantic, they range from Georges Bank through the Gulf of Mexico and prefer warm waters. Due to this temperature preference, more northern populations migrate seasonally. Dusky sharks prefer oceanic salinities and are not commonly found in estuaries, instead inhabiting waters from the coast to the outer continental shelf and adjacent pelagic waters. It is not a common shark, and its slow reproductive rate makes it vulnerable to overexploitation.

EFH for early juveniles (fish up to 115 centimeters in total length) includes very shallow coastal waters, inlets, and estuaries to the 25 meter isobaths. The EFH for late juveniles includes coastal and pelagic waters between 25 - 200 meter isobaths and shallow coastal waters, inlets, and estuaries to the 200 meter isobath (NMFS 2014).

## 5.16 King Mackerel

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The proposed project area is designated as EFH for all life stages of king mackerel. The EFH for all life stages for this species occurs in the Atlantic Ocean Channel, Thimble Shoals Channel, and ocean disposal locations. King mackerel are solitary, open-ocean inhabitants found in the upper portion of the water column in ocean environments along beaches and in the outer waters of estuaries. They primarily feed on estuarine species, such as the bay anchovy and Atlantic menhaden. King mackerel are concentrated off the coast of the Carolinas in the spring, summer, and fall, and migrate south for the winter. Virginia is generally considered the northernmost extent for the Atlantic coastal group of king mackerel.

## 5.17 Little Skate

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The proposed action occurs within an area designated as EFH for the juvenile and adult life stages for the little skate. The EFH for juveniles of this species occur in the the Atlantic Ocean Channel, Thimble Shoal Channel, Norfolk Harbor Entrance Channel, Norfolk Harbor Channel, Anchorage F, and ocean disposal sites. The EFH for adults of this species is found in the Thimble Shoal Channel, Norfolk Harbor Entrance and Channels, and Anchorage F. This is a small species, with average adult lengths ranging from 32 to 43 centimeters, and is typically light brown with darker spots on the ventral surface (Richard et al. 1963). This species is oviparous, meaning females lay eggs. EFH for the egg life stage ranges from Georges Bank to the Mid-Atlantic Bight, while EFH for juvenile and adult life stages range from Georges Bank to Cape Hattaras, North Carolina (NMFS 2017c). Little skate eggs are generally found at depths less than 27 meters, while juveniles and adults can be found from near-shore waters to depths of 137 meters (NMFS). Eggs are generally found in water greater than 7°C, while juveniles prefer water between 4° and 15°C, and adults can tolerate temperatures from 2° to 15°C (NMFS 2017c).

Little skates prefer benthic substrates composed primarily of sand or gravel, where they can effectively forage on benthic prey species. Their diet is largely composed of benthic organisms, including crabs, shrimp, polychaetes, sea squirts, and mollusks, though little skates are also known to consume squid and bony fishes (Murdy et al. 1997).

## 5.18 Longfin Inshore Squid

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The Atlantic Ocean Channel, Thimble Shoal Channel, and ocean disposal sites occur within designated as EFH for the egg life stage of the longfin inshore squid. Essential habitat for juvenile, and adult life stages occurs in the ocean disposal sites. The long finned squid is a pelagic schooling cephalopod ranging from Newfoundland, Canada to the Gulf of Venezuela (NEFSC 2011). This species is short-lived, not likely living more than one year; individuals grow fast and mature when mantle length reaches approximately 16 centimeters (NEFSC 2011).

Spawning occurs year-round, with a peak in the spring and summer months in bays and shallow coastal areas (Cargnelli et al. 1999). Egg masses are laid in clusters on the benthos or fixed to objects, such as rocks and aquatic vegetation (Cargnelli et al. 1999; NEFSC 2011). After hatching and a short period of maturation, juvenile long finned squid migrate offshore in the fall to overwinter in deeper waters (Cargnelli et al. 1999). In the spring, adult and juvenile long finned squid migrate inshore.

The diet of adult and juvenile long finned squid consists primarily of crustaceans, polychaetes, small fish, and other squid (Cargnelli et al. 1999).

### 5.19 Monkfish

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The proposed dredging site occurs within an area designated as EFH for the egg and larval life stages of monkfish; the EFH for these life stages occurs in the ocean disposal sites. This species is a benthic angler fish ranging from the northern Gulf of St. Lawrence to Cape Hatteras, North Carolina (Armstrong et al. 1992). It has a eurybathic distribution, from the tide line to 840 meters in depth and can be found abundantly in waters ranging from 7° to 11°C on the continental slope off Virginia (Armstrong et al. 1992). Monkfish are found in a variety of substrates, including sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud (NMFS 1998).

Monkfish eggs are contained in a long, thin sheet of gelatinous material, which can be thought of as a veil, that are generally found when sea surface temperatures are below 18°C and at water depths ranging from 15 to 1000 meters. Larvae, however, prefer water temperatures at 15°C and water depths from 25 to 1000 meters (NMFS 1998). Both larvae and egg veils are seen most frequently from March to September (NMFS 1998).

### 5.20 Northern Shortfin Squid

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The proposed project area is designated as EFH for the juvenile life stage of the northern shortfin squid; the EFH for juveniles is found in the Atlantic Ocean Channel, Thimble Shoal Channel, and ocean disposal sites. This cephalopod species is highly migratory, moving from Newfoundland, Canada to Cape Hatteras, North Carolina during the winter months (Hendrickson and Holmes 2004). The diet of this species is composed largely of fish and crustaceans, though larger individuals may feed on smaller northern shortfin squid. Juvenile shortfin squid are found in waters over the continental shelf and oceanic waters. This species can be found above the continental shelf in temperatures ranging from 14.3° to 16.3°C, though they are also found in Nova Scotia in temperatures from 5° to 6°C (Hendrickson and Holmes 2004). Shortfin squid are found in salinities ranging from 32 to 36 ppt, depending on the season, and are most abundant at depths ranging from 101 to 303 meters (Hendrickson and Holmes 2004).

### 5.21 Red Drum

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The proposed project area is designated as EFH for the larval, juvenile, and adult life stages of red drum. The EFH for juveniles and adults of this species occurs in the Atlantic Ocean Channel, Thimble Shoal Channel, Norfolk Harbor Entrance and Channels, Anchorage F, and ocean disposal sites. Essential habitat for the larval life stage occurs in the Norfolk Harbor Channels. Juvenile red drum body color is silvery while mature adult fish are coppery brown or red. The species is identified by one large black spot near the base of its caudal fin. Red drum inhabit coastal estuaries and move into deeper waters, either offshore or near the mouth of bays and inlets, to spawn (Holt 2008). Juveniles tend to swim in shallow waters, while adults travel in schools in bays and coastal environments.

Red drum are known to occur in a variety of habitats to a depth of 50 meters. These habitats include tidal freshwater, estuarine emergent vegetated wetlands (flooded saltmarshes, brackish marsh, tidal creeks), estuarine scrub/shrub (mangrove fringe), submerged rooted vascular plants (seagrasses), oyster reefs/ shell banks, unconsolidated bottom (soft sediments), high salinity oceanic surf zones, and artificial reefs (NMFS 2014).

### 5.22 Red Hake

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The action is located within areas designated as EFH for the egg, larval, and juvenile, and adult life stages of red hake. Essential habitat for egg, larval and juvenile life stages occurs in the Atlantic Ocean Channel, Thimble Shoal Channel, and ocean disposal sites. Additional EFH for juveniles and adults occurs in the Thimble Shoal Channel and Norfolk Harbor Entrance Channel. Red hake are relatively short-lived, demersal gadoid species that inhabit the Atlantic coastline from southern Newfoundland, Canada (Gulf of St. Lawrence) to North Carolina (Steimle et al. 1999a). The life span of red hake is typically eight years with a maximum of 14 years. A typical red hake grows to about 50 centimeters long with a maximum of 63 centimeters in length. Both sexes reach maturity by two years of age, with southern populations maturing earlier.

The preferred substrate for red hake is loose mud or soft sand. They feed on a variety of benthic species, including crustaceans, invertebrates, squid, crabs, and other fish species (Smith and Link 2010; Steimle et al. 1999a). Their diet changes seasonally depending on food availability.

Red hake seasonally migrate from cold, offshore deep waters (below 100 meters) to warmer, shallow waters to spawn. In the spring and summer months, red hake are commonly found in the top 100 meters of the water column as they migrate onshore towards their spawning grounds (Steimle et al. 1999a). In the winter months, red hake can be found in deeper waters, below 100 meters, along the edge of the continental shelf.

Spawning occurs along the continental shelf between May and November in southern New England and in the Georges Bank area (Traver and Col 2006), and peak spawning occurs from May through June. Spawning occurs at water temperatures between 5° and 10°C. Eggs and larval red hake are planktonic and very buoyant. Larvae remain planktonic for one to two months until they descend to the benthos. Juvenile red hake have a commensal relationship with sea scallops (*Placopecten magellanicus*); juveniles use the scallops for shelter and take refuge in and amongst the shells (Steiner et al. 1982).

## 5.23 Sandbar Shark

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The Action Area is located within a designated Habitat Area of Particular Concern (HAPC) for neonate and juvenile life stages of the sandbar shark. Essential habitat for neonates and juveniles of this species can be found in all channels to be dredged as well as ocean disposal sites. Adults of this species have EFH in the Atlantic Ocean Channel, Thimble Shoal Channel, and ocean disposal sites. This species is the principle species caught in the commercial shark fishery of the U.S. Atlantic coast and is also important recreationally; however, the stock is considerably depleted. Sandbar sharks, like many other elasmobranchs are viviparous, or bare live young.

Female sandbar sharks grow to be about three meters in length, while males can reach lengths up to two meters. They typically roam in small groups segregated by sex in coastal waters. This species migrates seasonally to avoid overwintering in cold, northern waters; although they can range from Cape Cod to the western Gulf of Mexico, individuals are not found north of the Carolinas in the winter months. The preferred diet of sandbar sharks includes menhaden, bluefish, mackerel, crabs, and skates.

Local waters are considered HAPC because lower Chesapeake Bay is one of the most important nursery grounds for this species on the U.S. East Coast; large numbers of female sharks give birth in the area, and the lower Eastern Shore and Chesapeake Bay are important nursery grounds for neonates and juveniles (Ellis and Musick 2007; Grubbs 1995; Heist et al. 1995). Neonate and juvenile sandbar sharks have EFH in waters of the lower Chesapeake Bay ranging in temperature from 15-30°C, salinities from 15-35 ppt, and waters ranging in depth from 0.8-23 meters deep; these environmental conditions are present within the Action Area,

particularly in the late spring, summer, and early fall. The preferred substrate for juveniles consists of sand, mud, shell, and rock.

## 5.24 Sand Tiger Shark

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All proposed channels to be dredged as well as ocean disposal sites lie within EFH designated for neonate, juvenile, and adult sand tiger sharks. This shark species inhabits the east coast of the U.S. from the Gulf of Maine to the Gulf of Mexico. They are also found in all warm temperate seas, except for in the eastern Pacific. They prefer shallow waters (less than about 15 meter) in coastal and estuarine areas. Sand tiger sharks prefer structured benthic habitats, such as shipwrecks. Annually, they migrate north during the spring and south during the fall over long distances (Kneebone et al. 2014). The diet of the sand tiger shark is dominated by small fishes, followed by crustaceans, mollusks, and other small prey (Gelsleichter et al. 1999).

Sand tiger sharks can reach a maximum length of about 10 feet. Males reach sexual maturity at six to seven years of age and about six feet long. Females reach sexual maturity at nine to 10 years of age and about seven feet long (Murdy and Musick 2013). This species is ovoviviparous, so there is no larval life stage. Litters are small, with only two pups every other year.

## 5.25 Scalloped Hammerhead Shark

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The ocean disposal sites are located within EFH designated for juvenile and adult scalloped hammerhead sharks. The scalloped hammerhead is a circumglobal species that inhabits coastal warm, temperate, and tropic seas. They are a common species found in a wide variety of depths, from the surface and intertidal areas to depths of 275 meters (Miller et al. 2013). During the warmer months, large schools of scalloped hammerheads migrate north along the Atlantic coast. During the summer months, they can be found from New York to the tropics and can be found near the mouth of the Chesapeake Bay. Then, in the fall, they migrate south again to the warmer waters of Florida and the Gulf of Mexico.

Scalloped hammerheads can reach a maximum length of approximately four meters but are generally about three meters in length (Murdy and Musick 2013). The diet of scalloped hammerheads includes sting rays, crabs, shrimp, lobsters, and other benthic organisms. Scalloped hammerheads are viviparous and produce litters averaging 15 - 31 pups per litter. Pupping occurs along the Atlantic coast south of Cape Hatteras to Florida and in the Gulf of Mexico. Nursery habitats for the scalloped hammerhead are found in shallow coastal waters (Castro et al. 1999).

## 5.26 Scup

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All proposed channels to be dredged as well as ocean disposal sites lie within designated EFH for juvenile and adult scup. Scup are a migratory, schooling species primarily found along the Atlantic seaboard between Massachusetts and North Carolina. The geographic distribution and abundance of this species is highly correlated to water temperature (Terceiro and Sheperd 1994). Scup perform long distance migrations annually; their migrations are triggered by changes in water temperature. During the spring and summer months, adults and juveniles are found either within estuaries or inshore. As the water temperature drops in the fall and winter, scup move from estuaries to deeper waters near the continental shelf (Beutel and Skrobe 2004; Terceiro and Shepard 1994). Scup are not found in areas where water temperatures fall below 6°C. However, their preferred temperature limit is at the 7°C isotherm. Juvenile and adult scup typically reside near the bottom of the water column in temperatures between 6° and 27°C.

Scup are a temperate species, and reside in a variety of habitats including rocky substrates, mussel beds, mud, shell fragments, and sand to silty sand (Steimle et al. 1999c). Juvenile scup feed on a variety of polychaetes, amphipods, fish eggs and larvae, and crustaceans. Adults include larger prey in their diets, like small fish and squid (Steimle et al. 1999c). During the warmer months, scup feed heavily in estuaries to prepare for migration.

## 5.27 Skipjack Tuna

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The Action Area is located within EFH for the juvenile and adult life stage of the skipjack tuna; EFH for adults is located in the Atlantic Ocean Channel, Thimble Shoal Channel, and ocean disposal sites, whereas EFH for juveniles occurs only in the ocean disposal sites. This species is a highly migratory, pelagic fish that is found in waters around the world; the western Atlantic stock of this species can be found from Newfoundland, Canada to Brazil (Vinnichenko 1996; Collette and Nauen 1983). This species can reach lengths up to 108 centimeters and reaches sexual maturity around one to 1.5 years of age (NMFS 2009). Like other tuna species, the skipjack is an opportunistic feeder known to prey upon other readily available fish species, cephalopods, and crustaceans (NMFS 2009). Skipjack tend to aggregate in areas associated with convergences and other hydrographic discontinuities; they are also associated with birds, drifting objects, whales, sharks, and other tuna species (Collette and Nauen 1983; ICCAT 1997). Juvenile skipjack tuna (less than 45 centimeters fork length) are found in the Atlantic off the coast of Georgia, South Carolina, and North Carolina to Maryland; from Delaware to Cape Cod; and the southern east coast of Florida through the Florida Keys (NMFS 2009).

## 5.28 Smooth Dogfish

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The ROI is located within EFH for all life stages of the smooth dogfish. The EFH for all life stages occurs in the Atlantic Ocean Channel, Thimble Shoal Channel, and ocean disposal sites. The smooth dogfish is a commonly occurring species in the Atlantic Ocean that ranges from Massachusetts to northern Argentina (NMFS 2010). They are primarily demersal sharks, typically found in near-shore waters to depths up to 200 meters (Compagno 1984). Smooth dogfish are a migratory species, congregating in waters between southern North Carolina and Chesapeake Bay in the winter, and then moving along the coast when bottom waters warm up to temperatures between 6° and 21°C (NMFS 2010). The diet of this species is largely composed of crustaceans, including crabs and lobsters; however, smooth dogfish are also known to consume boney fishes, including menhaden (NMFS 2010; Compagno 1984).

The maximum size of smooth dogfish is 150 centimeters, with males being smaller and maturing at approximately two to three years of age and females being larger and maturing between four and seven years of age (NMFS 2010). The gestation period for smooth dogfish is between 11 and 12 months with litters of 3 - 18 pups (NMFS 2010). Marsh creeks within the Mid-Atlantic Bight are particularly important nursery habitat areas for pups during the summer months, as this is where rapid growth and maturation occurs (NMFS 2010).

## 5.29 Spanish Mackerel

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The Atlantic Ocean Channel, Thimble Shoal Channel, and ocean disposal sites are designated as EFH for all life stages of Spanish mackerel. Spanish mackerel inhabit coastal waters but are known to come closer to shore towards the outer reaches of estuaries. They primarily feed on estuary-dependent species such as the bay anchovy and Atlantic menhaden. Spanish mackerel are migratory, generally moving north each spring, spending summer in the northern part of their range (Mid-Atlantic), and migrating south in the fall where they overwinter off South Florida.

Spanish mackerel prefer water temperatures greater than 26°C and salinities between 30 and 36 ppt.

### 5.30 Spiny Dogfish

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The proposed project area is designated as EFH for adult and sub-adult life stages of the spiny dogfish. Essential habitats for these life stages are found in the Atlantic Ocean Channel, Thimble Shoal Channel, and ocean disposal sites. The spiny dogfish is small, with the maximum length ranging from 100 to 124 centimeters and a maximum weight of 7-10 kg, but has characteristic shark-like features (Jensen n.d.). Spiny dogfish can live between 20 and 30 years. Additionally, spiny dogfish are known to be a schooling species that migrate between inshore summer locations and offshore wintering locations. In the western Atlantic, the spiny dogfish can be found in waters ranging from the Nova Scotia, Canada to the southern tip of Florida.

The adult and juvenile spiny dogfish are known to live at a variety of depths and habitat types. Juveniles are most often found at depths between 11 and 500 meters but are primarily found at depths greater than 50 meters (Stehlik 2007). Adults are evenly distributed at depths ranging from one to 500 meters in the summer months and from 21 to 40 meters in the fall (Stehlik 2007).

The diet of both juvenile and adult spiny dogfish consists largely of crustaceans, cephalopods, fishes, polychaetes, and jellyfish (Stehlik 2007). Adults eat larger prey items, while juveniles mostly consume smaller food items. A large proportion of prey items consumed by dogfish are benthic animals, so it has been suggested that dogfish spend a portion of their time foraging on the benthos. Habitats where this species have been found include soft sediments (sand, mud, sand-mud mixture), rock outcrops, and the edges of continental shelves.

The spiny dogfish is ovoviviparous, meaning the eggs hatch inside the pregnant female, and she subsequently births pups. Spiny dogfish mate in the winter and birth litters of 3 – 11 pups after a nearly two-year gestational period (Jensen n.d.).

### 5.31 Summer Flounder

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The proposed project area occurs within EFH for the egg, larval, juvenile, and adult stages of summer flounder. Essential Habitat for all life stages occurs in the Atlantic Ocean Channel and ocean disposal sites; the larval, juvenile, and adult life stages have EFH in all channels proposed to be dredged as well as ocean disposal sites. The eggs of summer flounder are commonly found at depths ranging from 10 to 70 meters, depending on the season, and are most abundant within 45 km of shore off the coast of New York and New Jersey (Packer et al. 1999). Larval and juvenile summer flounder are commonly found in a wide variety of habitats, with the juveniles preferring a sandy/mixed substrate over a mud/silt substrate. Adults are most commonly found in sandy substrates but are also present in a variety of substrates with both mud and sand, including marsh creeks, seagrass beds, and sand flats. The summer flounder's optimal salinity range is between 10 and 30 ppt.

In general, summer flounder larvae are most abundant nearshore (12 - 50 miles from shore) at depths between 9 and 70 meters. They are most frequently found in the southern part of the Mid-Atlantic Bight from November to May. Juveniles inhabit estuarine habitats, including salt marsh creeks, seagrass beds, mudflats, and open bay areas, which are used as nursery areas. Juveniles prefer water temperatures greater than 3°C. Adult flounder are found in shallow coastal and estuarine waters during warmer months and move offshore to the outer continental shelf at depths of about 152 meters during the colder months (NMFS 2014). Fall migration of flounder out of the Chesapeake Bay begins in October.

Burying behavior of summer flounder is affected by substrate type, water temperature, tides, salinity concentrations, and the presence or absence of prey species; while they do not tend to seek cover in vegetated areas, there is an “edge effect” in which flounder bury themselves close to vegetation and relief structure to ambush prey. This species is a bottom-dwelling predator, relying on its flattened body, agility, sharp teeth, and ability to change color and pattern on its dorsal surface. Small fishes, squid, worms, shrimp, and other crustaceans make up the bulk of the summer flounder’s diet. Summer flounder can live up to 20 years with females living longer and growing larger than males (up to 95 centimeters total length) (USACE 2014).

### 5.32 Surf Clam

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The ROI is designated as EFH for juvenile and adult surf clams. Essential habitat for adults occurs in the ocean disposal locations, whereas EFH for juveniles occurs in the Atlantic Ocean Channel and ocean disposal locations. The surf clam is known to inhabit the continental shelf from the lower edge of the intertidal zone to a depth of about 146 meters (480 feet) (Yancy and Welch 1968). The habitat range of the clam is generally from the Gulf of St. Lawrence to the Chesapeake Bay; this species requires highly saline waters of at least 29 ppt (Yancy and Welch 1968).

Surf clams are often found on sand, gravel, shells, shell fragments, and various fine sediments; however, they are most commonly found on hard bottomed substrates, such as coarse sand and gravel (Yancy and Welch 1968).

Unlike many shellfish, the surf clam is not hermaphroditic; this species requires gametes from both male and female clams to reproduce. Surf clams mature for one year after setting and reach full sexual maturity during their second year (Ropes 1980). Mating is a synchronous broadcast event, typically occurring in the spring and summer months, where both the males and females release their gametes into the water column (Ropes 1980; Yancy and Welch 1968).

### 5.33 Tiger Shark

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The Atlantic Ocean Channel, Thimble Shoal Channel, and ocean disposal sites lie within EFH designated for juvenile and adult life stages of the tiger shark. Tiger sharks are one of the larger species of shark that lives in warm waters of the deep-ocean and shallow coastal areas (Castro et al. 1999). They are apex predators in the tropical and warm-temperature habitats in which they reside. Tiger sharks conduct seasonal migrations that are strongly correlated with water temperatures and the movements of their prey (Heithaus 2001). They are most abundant in areas with warmer water temperatures. In the Chesapeake Bay area, notable prey items include sea turtles, marine mammals, and other smaller sharks.

In the Atlantic, adults reach sexual maturity at 10 years of age and about 209 centimeters total length. After maturation, they can live up to 16 years with a total length of 381 centimeters (Castro et al. 1999). Tiger sharks have large litters averaging 40 - 70 pups. Pups are thought to be born in areas south of Cape Hatteras and possibly in Florida. Nursery areas for tiger sharks are presumed to be offshore, but specific areas have not been identified. Young juvenile tiger sharks are rarely observed in the Virginia region (Bransetter et al. 1987).

### 5.34 Whiting/Silver Hake

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The ocean disposal sites are located within EFH for the juvenile live stage for whiting. This species of fish is distributed over the continental shelf in the western Atlantic Ocean from the Gulf of St. Lawrence to Cape Fear, North Carolina (Morse et al. 1999). The diet of whiting consists primarily of fish, crustaceans, and squids, and larger, older whiting tend to be solely piscivores

(Morse et al. 1999). Whiting are fast-swimming, schooling fish that migrate due to changing water temperatures. In the fall, when temperatures begin to decline, adult and juvenile whiting migrate to deeper waters of the continental shelf; as waters warm in the spring, they return to shallow waters to spawn (Morse et al. 1999).

Whiting spawn over a wide array of temperatures and depths. In the Mid-Atlantic, newly spawned eggs have been collected at surface water temperatures ranging from 13° and 22°C (Fahay 1974). Spawning takes place year-round; however, spawning events are focused in the Mid-Atlantic Bight in January and in southern New England in October (Morse et al. 1999).

The eggs produced from spawning events are pelagic and hatch after about two days (at 20°C) of drifting in the ocean. The larvae produced are also pelagic and drift in the water column at depths averaging between 50 and 130 meters for about two months (Morse et al. 1999). They descend to the benthos as juveniles. Whiting tend to prefer water depths greater than 20 meters and water temperatures ranging from 3° to 19°C, depending on the season (Morse et al. 1999).

### 5.35 Windowpane Flounder

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The Action Area is located within EFH for all life stages of the windowpane flounder. Essential Habitat for juveniles and adults is found in all channels proposed to be dredged as well as ocean disposal sites. The EFH for egg and larval life stages can be found in the Atlantic Ocean Channel, Thimble Shoal Channel, and ocean disposal sites. Windowpane flounder are a fast-growing, left-eyed flounder that inhabit near-shore waters, estuaries, and the continental shelf in the northwest Atlantic Ocean. This species is most plentiful from Georges Bank to the Chesapeake Bay, though they are known to occur from the Gulf of St. Lawrence to Florida. Windowpane flounder are most abundant in shallow waters (1 - 2 meters) over sandy, sandy/silty, or muddy substrates. However, they can be found anywhere from shallow shoreline areas to a depth of about 60 meters (Hendrickson 2006). Adults tend to be found in waters with temperatures below 26.8°C with salinity ranging from three to six ppt (NMFS 2014).

The diet of adult windowpane flounder consists of small crustaceans and a multitude of fish larvae, including their own species (Chang et al. 1999). Predators of this species include black sea bass, thorny skate, goosefish, Atlantic cod, spiny dogfish, weakfish, and summer flounder.

Egg and larval windowpane flounder can be found in waters less than 70 meters deep with an average surface temperature of less than 20°C. Windowpane eggs are found in surface waters, while larvae are most abundant in pelagic waters (NMFS 1998). Larvae and egg abundance in the middle Atlantic are observed from February to November with peaks in May and October (NMFS 1998).

Windowpane flounder can reach a maximum length of 45 centimeters (Miller et al. 1991). Adults reach sexual maturity at three to four years of age and about 22 centimeters long, and they spawn along the near-shore coastal shelf during the spring and summer months in the Chesapeake Bay region. Spawning occurs along the bottom in water between 9° and 13.5°C (Chang et al. 1999).

### 5.36 Winter Skate

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The ROI is located within EFH for the juvenile, and adult life stages of the winter skate. Essential habitat for the juvenile and adult life stages occurs in the Thimble Shoal Channel, Norfolk Harbor Entrance and Channels, and Anchorage F; additional EFH for the juvenile life stage occurs in the Atlantic Ocean Channel and ocean disposal sites. This species of skate generally ranges in size from 73 to 76 centimeters but have been documented to reach sizes up to 110 centimeters total length (Robins and Ray 1986). The coloration of the dorsal surface of the winter skate is light tan to brown with numerous dark spots. Their diet is composed of benthic species such as dollarfish,

as well as other fishes and squid. The range for the juvenile and adult life stages extends from Cape Cod Bay on Georges Bank to North Carolina (NMFS 2017d). The juvenile life stage is found from the shoreline to a depth of approximately 400 meters but are most abundant at depths less than 111 meters (NMFS 2017d). Juveniles tolerate temperatures ranging from -1.2° to 21 °C but prefer water between 4° and 16°C (NMFS 2017d). The adult life stage is found from shoreline to a depth of 371 meters but are most commonly found at depths less than 111 meters; adults are found water from -1.2° to 20°C with greater abundance from 5° to 15°C(NMFS 2017d).

Currently, no data is available with regard to habitat associations or the distribution of the egg life stage for this species.

### 5.37 Witch Flounder

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The proposed dredging project area lies within an area designated as EFH for the egg and larval life stages of witch flounder. The EFH for eggs is found in the Atlantic Ocean Channel, Thimble Shoal Channel, and ocean disposal sites, while EFH for larvae is found in only the ocean disposal sites. The witch flounder is a small-mouthed, right-eyed fish that can be found in the western Atlantic from Cape Hatteras, North Carolina to Labrador, Canada. Witch flounder are a slow-growing species that can live up to 30 years and reach a maximum size of 78 centimeters total length (Miller et al. 1991). Witch flounder are a deep-water species that can be found as deep as 1,500 meters. This species is strongly correlated with mud/silt, muddy-sand, and clay substrates and rarely inhabits other substrate types (Wigley and Col 2006).

In the Chesapeake Bay region, witch flounder spawn between April and August with peak spawning during May and June. Spawning occurs in large aggregations in areas of cold water (0 - 10°C). Spawning takes place near the benthos, but the eggs released are pelagic and neutrally buoyant; eggs are generally found at depths of 30 - 150 meters in water ranging from 4° to 12°C (Cargnelli et al. 1999). Larvae are typically found at depths of 10 - 210 meters and temperatures ranging from 4° to 13°C.

### 5.38 Yellowfin Tuna

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The Atlantic Ocean Channel, Thimble Shoal Channel, and ocean disposal sites are located within EFH for the juvenile life stage of yellowfin tuna. Yellowfin tuna are circumglobal in tropical and temperate waters; in the Atlantic, they range from 45°N to 40°S (NMFS 2009). This species is an epipelagic, oceanic species, found in waters between 18° and 31°C (NMFS). They are highly migratory and can often be found in schools of mixed tuna species, including skipjack and bigeye tuna. Yellowfin tuna are opportunistic feeders and consume a variety of fishes and invertebrates (NMFS 2009). Juvenile yellowfin tuna are often found closer to shore than adults (ICCAT 1994).

The EFH for the yellowfin tuna is found in central Gulf of Mexico from the Florida Panhandle to southern Texas. It is also found along the east coast from Florida to Cape Cod and south of Puerto Rico.

### 5.39 Yellowtail Flounder

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The Atlantic Ocean Channel, Thimble Shoal Channel, and ocean disposal sites are located within EFH for the larval life stage of yellowtail flounder. Yellowtail flounder are a fast-growing, demersal species found in the western Atlantic from the Gulf of St. Lawrence to Chesapeake Bay. This species reaches maturity between two and four years age in southern habitats (Johnson et al. 1999). Yellowtail flounder are most commonly found in waters off northern New England and Canada between 20 and 40 meters in depth (Legault and Cadrin 2006). The diet of this species includes a variety of small benthic invertebrates including crustaceans, mollusks, annelids, and

echinoderms (Pitt 1970). Yellowtail flounder will preferentially reside on loose sand or sandy-mud sediments where their benthic prey is abundant. However, yellowtail have also been documented to reside on sand and gravel substrates which are frequently found in shallow waters along the continental shelf (Johnson et al. 1999).

Spawning occurs in water temperatures from 5° to 12°C (Johnson et al. 1999). Yellowtail flounder will spawn between March and August, with peaks in May for New England populations and June for Newfoundland/Canada populations. The eggs are fertilized on the benthos and then float to warmer surface waters to develop (Legault and Cadrin 2006). It takes nearly two months for the eggs to hatch; after hatching, larvae settle on the benthos.

## 6.0 PREY SPECIES

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### **Benthic Invertebrates**

The typical Chesapeake Bay ecosystem includes benthic communities of epifauna (organisms that live attached to surfaces on the Bay bottom), such as oysters, sponges, sea squirts, seas stars, and barnacles. Infauna are benthic animals that burrow into bottom sediments like worms, clams, and other tunneling organisms.

Benthic communities have varied roles in the Bay ecosystem. Filter feeders such as clams, oysters, and sponges clarify and clean the waters of the Bay through their biological processes that remove particulate matter and potentially toxic materials, providing for a healthy marine environment. As primary and secondary consumers, these organisms pass the energy of primary producers (phytoplankton) to higher levels of the food web. Many benthic species are food sources for managed species and their prey.

#### Clam Resources

The hard clam (*Mercenaria mercenaria*), a bivalve mollusk, is common in the Chesapeake Bay and lower James River. It can be found in waters with salinities greater than 25 ppt (Whetstone et al. 2005) and intertidally to 60 feet in depth (CBP 2016). This commercial species occurs naturally along the Atlantic Coast from Canada to Florida, and is increasingly harvested in Virginia's Bay waters. In addition to their economic value, the hard clam plays an important role as a filter feeder and nutrient cyler, while also serving as an important prey species for gulls, tautogs, waterfowl, cownose rays, blue crabs, and oyster drill. It is considered an important commercial species in the Chesapeake Bay and is found in the Norfolk Harbor and Channels (Mann et al. 2005).

#### Oyster Resources

The eastern oyster (*Crassostrea virginica*) is considered an important commercial fishery in Chesapeake Bay. Eastern oysters prefer brackish or salt water with a depth of two to approximately 26 feet. This fishery has declined over the years due to overharvesting, pollution, disease, and loss of habitat. In recent years, programs have been implemented to increase eastern oyster populations. The eastern oyster does not prefer the depths or salinities in the many locations of the ROI (i.e. the Atlantic Ocean Channel, NODS, DNODS), as salinities are greater than 30 ppt and the depths are in excess of 40 feet, and, therefore, these locations do not contain suitable oyster habitat.

### **Herring**

The general term for the group of fish referred to as herring encompasses several fish species (herring, shad, and anchovies) from the order Clupeiformes. In the Chesapeake Bay, the family

Clupeidae is represented by the following species: *Alosa pseudoharengus* (alewife, big-eye, or branch herring), *Alosa aestivalis* (blueback herring or glut herring), *Alosa sapidissima* (American or white shad), *Alosa mediocris* (hickory shad), *Brevoortia tyrannus* (Atlantic menhaden), *Dorosoma cepedianum* (gizzard shad), and *Dorosoma petenense* (threadfin shad). The family Engraulidae is represented by the *Anchoa mitchilli* (bay anchovy). All of the *Alosa spp.* are anadromous and found throughout all portions of the Chesapeake Bay.

Alewife runs occur from March through April and demersal eggs are spawned in fresh or tidal waters that have slow moving currents. *Alosa aestivalis* spawn in waters at about 21°C. Larvae and juveniles use the upper tributaries of the Chesapeake Bay from fresh water to brackish water. *Alosa pseudoharengus* eggs hatch in about six days at 16°C. The young and adult of both species use mid-estuarine areas in the summer and return to the deeper oceanic waters in the winter. They are predominantly plankton feeders (diatoms, copepods) but also feed on shrimp, insects, small fish, squid, and fish eggs. *Alosa sapidissima* usually appear in the upper rivers as early as February and spawn through April, usually in tidal fresh water. Most shad ascend the rivers when water temperatures are between 13° and 19°C. Spawning grounds are in tidal fresh waters over shallow flats with fine gravels or sandy bottoms. The eggs are large and demersal. The eggs hatch after 12 - 15 days of water temperatures at 11°C. After spawning, the adults leave Chesapeake Bay in June and return to coastal waters. Young *A. sapidissima* remain in the Chesapeake Bay and its tributaries throughout the warmer months. Yearlings have been known to reside in the Chesapeake Bay's deeper waters or migrate to oceanic waters in the winter. Immature shad remain at sea for three to six years or until they reach maturity. Although shad spend the majority of their lives at sea, adult and juvenile herring are known to occur in the project area due to spawning migrations and the subsequent migration of adults and juveniles to the ocean. Juveniles mainly feed on copepods and also feed on mysid shrimp as they mature. Adults feed on copepods, ostracods, amphipods, mysids, isopods, insects, algae, and small fish. This species is highly influenced by water temperature throughout several life stages.

## 6.1 Atlantic menhaden (*Brevoortia tyrannus*)

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Atlantic menhaden are a pelagic, obligate filter-feeding species found along the Atlantic seaboard from Nova Scotia to Jupiter Inlet, Florida. Menhaden are a commercially important resource in Chesapeake Bay (Wenner and Sedberry 1989). Menhaden feed primarily on phytoplankton and small crustaceans (Lewis and Peters 1994). Atlantic menhaden are seasonally abundant in the Chesapeake Bay region, particularly during the winter and spring. During the summer months, Atlantic menhaden are not common in the estuary (Wenner and Sedberry 1989).

Atlantic menhaden spawn in the ocean from March to May and again in September and October in the northern part of its range. Their eggs are demersal and usually hatch within 48 hours. Larvae migrate from the ocean to the upper portions of the estuary during the spring months. Juveniles typically migrate to sea in the fall after spending their first year in the estuary. Menhaden are found in Chesapeake Bay throughout the year but are more abundant in the winter and the spring (Wenner and Sedberry 1989). Large numbers of menhaden may congregate along shoaled areas in coastal bays and estuaries in the summer and move to deeper ocean waters as the temperatures cool.

## 6.2 Bay Anchovy (*Anchoa mitchilli*)

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The bay anchovy is a year round resident species found in all parts of the Chesapeake Bay and its tributaries. The bay anchovy is typically found near the surface in open water habitats (Orth and Heck 1980). Within the Chesapeake Bay, the bay anchovy is one of the most abundant fish species, providing an important food base for many piscivorous species (Jung and Houde 2003).

Spawning occurs over a wide salinity range, with peak spawning at 13 - 15 ppt. The spawning season is approximately from April to October, with the greatest number of eggs being produced in July and August. The eggs are demersal. This species moves to deeper waters off Chesapeake Bay and its lower tributaries during the winter months or when water temperatures fall below 14°C).

### 6.3 Silversides (*Menidia menidia*)

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The geographic range of the silverside extends from Nova Scotia and the Magdalen Islands, Canada to Volusia County, Florida. Silversides are found throughout the Chesapeake Bay region, but rarely enter freshwater habitats. Silversides prefer tidal creeks with submerged grasses but will move to deeper channel waters in the winter. Larvae and juveniles are most abundant in areas with relatively low salinity (1 – 14 ppt). Even so, it is possible that all life stages, especially adults, may be present in the project area due to this species' abundance in Chesapeake Bay.

The diets of both juvenile and adult silversides consist of a variety of copepods, insects, worms, mollusk larvae, algae, diatoms, mysids, cladocerans, detritus, and amphipods (Orth and Heck 1980; Fay et al. 1983). Silversides provide an important forage species for striped bass, Atlantic mackerel, and bluefish. Silversides reach maturity by age one, with most adults not surviving to two years of age (Fay et al. 1983).

The spawning season for silversides is between April and August, with an average of four or five spawning events during the season (Fay et al. 1983). They spawn in schools around shallow, pooled areas of water along the low tide area. The eggs are sticky with filaments so they have a tendency to cling to vegetation and one another. They are protected from many predators by their shallow water habitat.

### 6.4 Blue Crab (*Callinectes sapidus*)

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The blue crab is an important benthic prey source for a variety of predators, including striped bass (Manooch 1973, Walter and Austin 2003, Walter et al. 2003), American eel (Wenner and Musick 1975), Atlantic croaker (Overstreet and Heard 1978a, Overstreet and Heard 1978b), and red drum (Jaworski 1972, Bass and Avault 1975, Scharf and Schlicht 2000, Guillory and Prejean 2001). They can tolerate a wide range of salinity in Chesapeake Bay from lower Bay waters (up to 32 ppt) to the upper reaches of its tributaries (Tan and Van Engel 1966, Ballard and Abbott 1969, Tagatz 1971, Guerin and Stickle 1992). Mating occurs from May through October in tributaries and middle and upper Bay waters (Van Engel 1958), peaking in July and August (McConaugha et al. 1983, Epifanio et al. 1984, Jones et al. 1990, Epifanio 1995). Gravid females extrude fertilized eggs as a mass, called a sponge, from their aprons (Pyle and Cronin 1950). As the embryos in the sponge develop, female crabs. They then migrate towards the mouth of Chesapeake Bay as the embryos develop to spawn in these high-salinity waters, while males remain in the less saline waters (Van Engel 1958, Millikin and Williams 1984, McConaugha 1988). Eggs hatch most successfully at salinities of 20 to 32 ppt (Sandoz and Rogers 1944, Costlow and Bookhout 1959, Davis 1965), and planktonic blue crab larvae, or zoeae, develop in coastal waters above the continental shelf (Epifanio et al. 1989, Epifanio 2007). After about six to eight weeks and several molts, zoeae metamorphose into benthic megalopae, which reinvade the Bay (Epifanio and Garvine 2001), and eventually undergo metamorphosis into the juvenile stage after reaching nursery grounds (Metcalf and Lipcius 1992, Etherington and Eggleston 2000). Megalopae and juveniles migrate up Chesapeake Bay and into all of its tributaries (DeVries et al. 1994, Forward et al. 1997, 2003). Adult crabs of both sexes overwinter in the muddy bottoms of deeper channels (Van Engel 1958, Schaffner and Diaz 1988), while juveniles more often overwinter in shallower areas (Van Engel 1958).

According to the 2014 Chesapeake Bay Blue Crab Advisory Report, the start of the 2014 crabbing season saw 68.5 million adult female crabs in the Bay. This number is based on the results of the winter dredge survey, and is tracked by the Bay Program as an indicator of Bay health. There is a designated VMRC Virginia Blue Crab Sanctuary located within portions of the ROI. Geographic locations (Figure 2-31) extend into the Atlantic Ocean Channel and along the Atlantic Ocean beaches. The Blue Crab Sanctuary regulations restrict commercial and recreational harvest of blue crabs between the months of May through September. In the VIMS Trawl Survey Catch Summary for January 1955 through December 2017, approximately 234,862 male blue crabs were caught accounting for 1.06% of the catch and 194, 566 females were surveyed representing 0.88% of the catch.

## 6.5 Spot (*Leiostomus xanthurus*)

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Spot are widely abundant throughout the Atlantic coast from Massachusetts to Florida (Wenner and Sedberry 1989). Spot are an important food source to some species of piscivorous birds and fish species such as spotted sea trout (*Cynoscion nebulosus*) and striped bass (*Morone saxatilis*) (Phillips et al. 1989). Spot are epibenthic feeders that consume a wide variety of polychaetes, copepods, decapods, nematodes, bivalves, siphons, and diatoms (Clarke and Wilbur 2000; Chao and Musick 1977; Phillips et al. 1989). Although spot are tolerant to a wide range of temperatures (8 - 31°C) and salinities (0 - 60 ppt), their salinity tolerance decreases with the age of the fish. Juvenile spot prefer tributaries with salinities greater than 16 ppt (Phillips et al. 1989).

Primary nursery areas for post-larval and juveniles occur in higher salinity bays, tidal creeks, and SAV beds (Phillips et al. 1989; Love and May 2007). In these habitats, post-larval and juvenile spot represent 80 – 90% of the total number of fish present (Weinstein and Brooks 1983). After the first year, spot move from the higher reaches of the tributaries to the lower reaches of the tributaries. Spot spawn at sea from November through February in moderately deep water (Cowan and Birdsong 1985). In the late spring to early summer, adults begin to return to Chesapeake Bay, where they reside until the fall migration to offshore spawning grounds. Once water temperatures drop in the fall (typically November), most adults return to the sea. Larvae and juveniles migrate inshore earlier than adults, between mid-December to February (Phillips et al. 1989).

## 6.6 Atlantic Croaker (*Micropogon undulates*)

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The widely abundant Atlantic croaker inhabits areas of the Atlantic and Gulf coasts from Cape Cod, Massachusetts to Campeche, Mexico (Lassuy 1983; Barbieri et al. 1994). Croakers are demersal fish, preferring areas with sandy or muddy substrates. Adults are typically found in deeper portions of rivers or bays, while juveniles are found in more shallow, nearshore areas. Juvenile croaker reside in the Chesapeake Bay region year round, occupying tidal streams with soft mud and plant material (Cowan and Birdsong 1985).

Croakers are highly opportunistic feeders that rely on readily available food sources. Although the diet of croakers changes as the fish age, all ages feed from the lower portion of the water column. The diet of adult and juvenile croaker consists of a variety of polychaetes, crustaceans, small fish, and other invertebrates (Hewitt et al. n.d.; Chao and Musick 1977; Lassuy 1983). Larval and post-larval croakers feed on zooplankton, detritus, and benthic macroinvertebrates (Lassuy 1983).

Adult croaker enter the Bay in the early spring and will remain in the foraging grounds throughout the summer (Hewitt et al. n.d.). Juvenile croaker use portions of the estuary and its tributaries as nursery and feeding areas. Croakers reach maturity around two years of age, but some

individuals can live up to four to five years (Lassuy 1983). However, there is some evidence to suggest that a large number of adults die after the fall spawning event in their second year (Pearson 1929; Gunter 1938; Parker 1971).

There is some variation in the literature about the duration of the spawning season and the location of spawning activities. In the Chesapeake Bay area, croakers typically spawn offshore between September and November (Cowan and Birdsong 1985). Other studies suggest that the offshore spawning season extends into January and February (Hildebrand and Schroeder 1928; Joseph et al. 1964). Furthermore, other reports suggest that spawning may be occurring within the estuary as well as offshore (Barbieri et al. 1994). Within the estuary, spawning occurred between July and October (Barbieri et al. 1994).

Larvae and postlarvae were observed in the Chesapeake Bay region from November to January (Cowan and Birdsong 1985). By late summer, the earliest hatched young enter Chesapeake Bay and migrate into the tributaries. By the end of October, most adults leave Chesapeake Bay and move offshore.

## 6.7 Weakfish (*Cynoscion regalis*)

Weakfish are found along the Atlantic seaboard, from Massachusetts to Florida (Mercer 1989), with highest abundance between New York and North Carolina. Weakfish are a valuable recreational species. Chesapeake Bay estuary is used as seasonal foraging and nursery grounds by weakfish (Chao and Musick 1977; Mercer 1989). Habitat use within the estuary varies by age of the fish, time of year, and vertical location within the water column. However, they predominately inhabit shallow waters with sandy to sandy mud substrates.

All populations of weakfish reach maturity at age one; however the length of mature fish varies by geographic region. Mature individuals from southern populations generally grow to a larger size at maturity than northern populations. Adults migrate between inshore and offshore waters seasonally, prompted by the increase in water temperatures during the spring and summer months. As water temperatures increase the adults will move inshore or further north from their overwintering habitats in the south Atlantic (Mercer 1989). The warm spring continental shelf waters stimulate the adults to return to the bays and estuaries in the spring. As water temperature declines in the fall, adults congregate and move offshore and southward towards oceanic waters and the wintering grounds (Chao and Musick 1977; Mercer 1989). The primary wintering grounds are hypothesized to be along the continental shelf from the Chesapeake Bay to Cape Lookout, North Carolina (Mercer 1989).

Spawning occurs near the mouth of Chesapeake Bay and the adjacent nearshore and estuarine waters shortly after their migration inshore. Preferred spawning habitat of weakfish consists of areas with high salinity immediately adjacent to inlets or creeks (Luczkovich et al. 1999; Luczkovich et al. n.d.). Several other species of sciaenids favor spawning habitat with similar features. In these regions where spawning habitat overlaps with other sciaenids, weakfish occupied waters less than ten feet deep. In the Chesapeake Bay region, weakfish have an extended spawning season from approximately March to August (Chao and Musick 1977). The duration of the spawning season varies geographically, with southern populations having an earlier and longer season than northern populations. Multiple spawning events can occur during one spawning season (Mercer 1989).

Larvae are found throughout the lower Bay in the late summer, and young begin to appear in low salinity habitats in August (Chao and Musick 1977). By October, juveniles begin to move down river to higher salinity waters and eventually into the ocean. Two year and older fish appear in lower Chesapeake Bay in April and May with yearlings becoming more abundant in the summer.

## 6.8 White Perch (*Morone americana*)

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White perch are found along the Atlantic coast from New Brunswick, Nova Scotia, and Prince Edward Island, Canada to South Carolina, USA (Stanley and Danie 1983). White perch are very common throughout the Chesapeake Bay and the James River. White perch are commonly found in the upper tributaries of the Chesapeake Bay along the fresh water and salt water interface zone. Juvenile white perch favor shallow areas at and above the tidal freshwater interface (Fay et al. 1983).

Spawning transpires between April and June, with migrations to spawning areas triggered by seasonal temperature changes (Hewitt et al. n.d.). Spawning occurs in fresh or brackish marshes, rivers, lakes, or estuaries with low salinity (under 4.2 ppt) (Hardy 1978). Spawning occurs in freshwater areas from April to May, and in estuarine environments spawning occurs between May and July. Spawning habitat substrate consists of gravel, clay, sand, or crushed shell (Stanley and Danie 1983). Some white perch spawn in their resident body of water, while others migrate up to 90 km. Adults and juveniles move to deeper waters (30 - 40 ft.) as winter approaches. Overwintering habitat is typically in deeper waters averaging 40 - 60 ft. but can reach depths in excess of 130 ft.

As white perch grow, they gradually move downstream. At two years of age, regardless of sex, most white perch are considered adults. Any remaining juveniles will reach maturity no later than age four. Growth and development of white perch is most rapid during the first year but is dependent on availability of food, population density, and water temperature (Stanley and Danie 1983).

White perch are a widespread, abundant, and commercially important species in the Chesapeake Bay region. White perch can survive in a large variety of habitats and environmental conditions. They feed on a diverse array of prey, including zooplankton, insects, crustaceans, amphipods, snails, crayfish, and other fish species. As a result of this great flexibility and adaptability, the white perch has become highly prolific in the James River and Chesapeake Bay.

## 6.9 Killifish/Mummichog/Mud Minnow (*Fundulus spp.*)

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*Fundulus* species frequent both salt and brackish waters. However, in the Chesapeake Bay area, killifish tend to prefer higher salinities, while mummichogs prefer lower salinities (Abraham 1985). *Fundulus* spp. are generally very tolerant of temperature and salinity fluctuations. *Fundulus heteroclitus*, the common killifish, spawns from April to August. It is common in the shallow brackish coves of inlets of the Chesapeake Bay. Mummichogs prefer muddy bottoms in areas with some *Spartina* spp. Coverage as habitat, while some killifish species prefer more sandy sediments. *Fundulus* spp. use a wide variety of food sources, including organisms found within the water column or in the intertidal and subtidal benthos (Abraham 1985). The diet of *Fundulus* spp. includes algae, crustaceans, polychaetes, snails, insects, small fishes, and shrimp. *Fundulus* spp. are a common prey species of a wide variety of birds and predatory fishes. Other *Fundulus* spp. found in the Bay include: *F. majalis*, *F. ocellaris*, *F. diaphanous*, *F. confluentus* and *F. luciae*.

## 7.0 POTENTIAL IMPACTS TO ESSENTIAL FISH HABITAT

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This section will discuss the potential impacts associated with implementation of the Preferred Alternative on EFH and associated managed species in the Action Area. Impacts to water quality and habitat will be described as well as potential impacts caused by underwater noise and

Munitions of Explosive Concern (MEC)/Unexploded Ordinance (UXO). The impact extent depends on hydraulic processes, sediment texture and composition, chemical content of the sediment and pore water matrices, and the behavior or life stages of the managed species.

Following this section, best management practices/mitigation measures that reduce potential impacts to EFH and managed species will be described as well as potential cumulative impacts that could impact EFH and managed species.

## 7.1 Potential Impacts to the Water Column

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The type of dredge and dredging action, including placement activities, have the potential to both directly and indirectly affect the EFH occurring throughout the water column, from benthic to surface waters.

**Turbidity and Total Suspended Solids.** The temporary increase in total suspended solids (TSS) and turbidity in the water column at dredging sites and open ocean placement areas has the potential to directly impact EFH as well as managed species and their prey. Increased amounts of total suspended solids (TSS) in essential habitats can directly impact managed species; these affects are contingent upon species tolerance, exposure rate, duration of the exposure, and life stage. Suspended sediments may impact fish eggs and larvae through deposition, abrasion, or smothering, especially in the dredging and placement areas (Wilbur and Clarke 2001). The extent and duration of turbidity plumes is dependent on factors such dredge type, sediment composition, and hydrologic and environmental conditions in the Action Area.

The dredge footprint of the Norfolk Harbor and Channels Navigation Improvements Project is largely composed of sand, mud, and a combination thereof. Sediments with larger grain sizes tend to settle out of the water column at a faster rate than fine sediments, so it is predicted that turbidity plumes predominately composed of sands will settle faster than those with fine grained, muddy benthic sediments. Channels in the inner harbor area are generally composed of a mix of mud and sand (Norfolk Harbor Channels, Newport New Channel, Anchorage F), whereas channels further from the harbor area are largely composed of sand (Atlantic Ocean Channel and Thimble Shoal Channel). In channels where sediments settle faster, there is a higher abundance of sensitive egg and juvenile life stages for species with EFH, dependent on time of year (Table 3). The faster settling rate of suspended sands in the water column generally results turbidity plumes of lesser extents than plumes composed of fine grained sediments; the water column also returns to pre-dredging conditions quicker, thus minimizing adverse impacts to sensitive egg and larval life stages. Although this is dependent on the hydrological and environmental conditions at the time of dredging and/or placement activities.

The Preferred Alternative could potentially utilize cutterhead suction dredging, hopper dredging, or mechanical dredging methods:

Cutterhead Dredging. Increased TSS concentrations associated with cutterhead dredge sediment plumes typically range from 11.5-282 mg/L. The highest TSS levels are detected adjacent to the cutterhead and decrease with distance from the dredge (Nightingale and Simenstad 2001). A 1983 USACE model indicated that TSS concentrations above background levels could be present in the bottom six feet of the water column in an approximate 1,000 ft radius of the dredging operation.

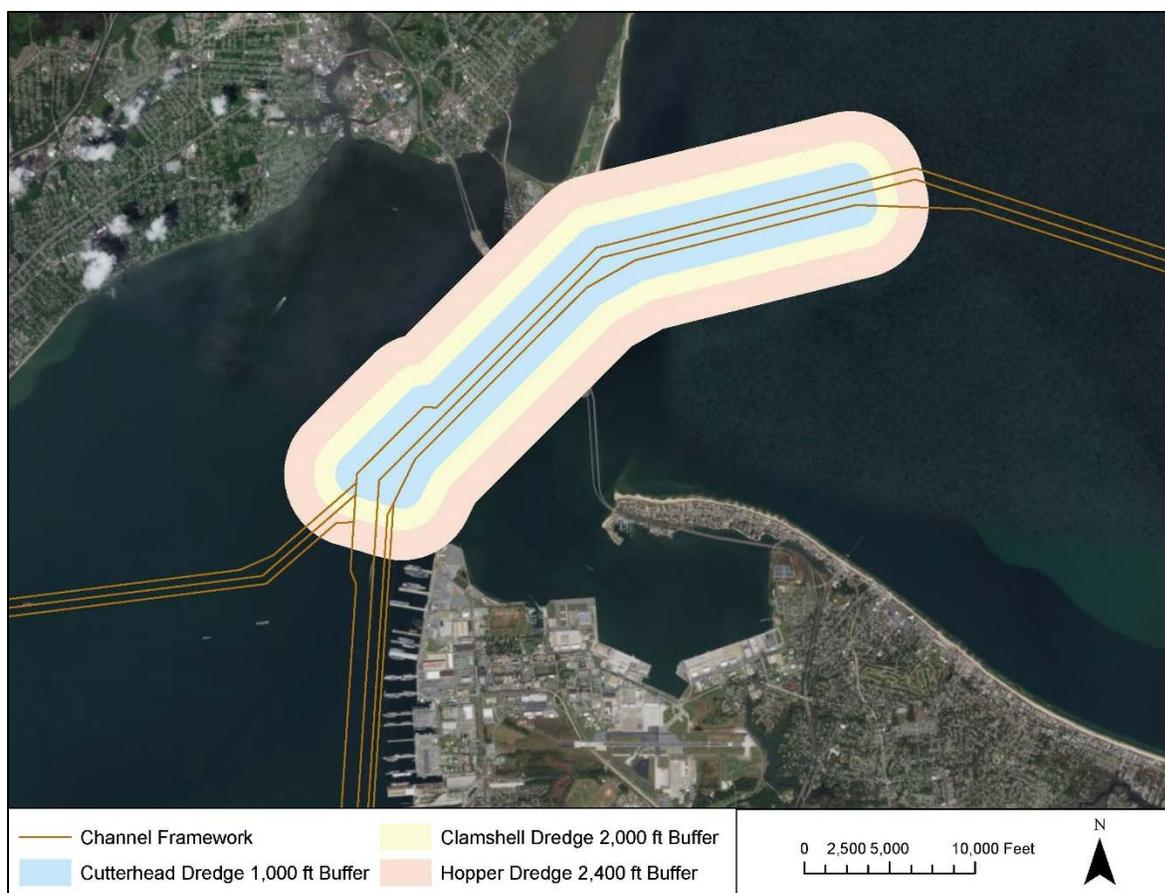
Hopper Dredging. Hopper dredging suspends sediments during dredging and release of dredged material through the vessel's hull. Near the bottom of the water column, dredging plumes may reach 2,300-2,400 feet down-current from the dredge (USACE 1983). Near-field TSS concentrations have been shown to range from 80.0 to 475.0 mg/L, although this is dependent on the sediment being dredged (Anchor Environmental 2003).

Mechanical Dredging. TSS concentrations associated with mechanical clamshell bucket dredging operations have been shown to average approximately 210 mg/L in the water column (USACE 2001). In general, turbidity plumes generated by bucketed dredges have been shown to dissipate to background levels within 600 feet of the source in the upper water column and 2,400 feet in the lower water column. Based on studies conducted by Burton (2003) and the USACE (2014), elevated suspended sediment concentrations at several hundreds of mg/L above background may be present in the immediate vicinity of a bucket, but would settle rapidly within 2,000 foot radius of the dredge location.

Offshore Disposal. Similar to dredging, the discharge of sediment into offshore disposal sites can cause a turbidity plume. During disposal activities, suspended sediment concentrations have been recorded to be as high as 500 mg/L within 250 feet of the disposal vessel, although this is dependent on sediment composition, tidal ebb and flow, as well as other environmental factors (USACE 1983). Additionally, it has been reported that a plume can decrease to background levels within 1,000-6,500 feet (USACE 1983). Additionally, TSS concentrations near the center of a plume have been recorded to return to near background conditions within 35-45 minutes of sediment disposal.

Concentrations of TSS that may adversely impact fishes range from 580 mg/L (for the most sensitive species) to 1,000 mg/L (Burton 1993). Increases in TSS and turbidity can impact the ability of prey species to avoid predators due to visual impairment caused by decreased water clarity (Gregory and Northcote 1993; Wilbur and Clarke 2001). Turbid waters can also visually impair predator species that rely on sight to forage, including coastal pelagic fishes, highly migratory fishes, and sharks.

Additionally, dredging during anadromous fish migrations into and out of the James River for spawning (generally February – June) may increase turbidity in the water column, thus impeding fish passage through the narrowest portions of the Action Area, which includes Norfolk Harbor Channel, Norfolk Harbor Entrance Channel, and Anchorage F. These areas are within migration corridors used by fishes such as alewife, blueback herring, American shad, hickory shad, striped bass, yellow perch, white perch, and the federally listed Atlantic sturgeon. The Virginia Department of Game and Inland Fisheries (VDGIF) has designated Hampton Roads as a confirmed anadromous fish use area. Adverse impacts to migration and spawning of anadromous fishes, many of which are prey species, can lead to indirect adverse impacts to EFH designated for bluefish, summer flounder, windowpane flounder, and other piscivorous fishes that feed on anadromous fishes migrating through the Action Area. The extent of the turbidity plume in the Action Area is dependent upon circulation currents, sediment type, and extent of the area being dredged in a particular time frame. Based on the above dredge turbidity plume information, Figure 10 displays potential extents of turbidity plumes for dredging methods with the potential to be implemented for the Proposed Action; bear in mind, the entire channel extent would not be dredged at once, so the figure below displays a very conservative estimate of potential turbidity plume extents. Based on past dredging actions in the area, the hydraulic cutterhead suction dredging method would be the most likely to be implemented in the narrowest channel reach. This method has the smallest expected turbidity plume, and would allow for the greatest margin for fish passage through the Action Area. Additionally, deepening in the Action Area would be to required depths ranging from 50-59 feet; and due to the bathymetry and force of gravity, suspended sediment particles would likely remain in the deep areas of navigation channels. Generally, trends indicate that at the source of dredging, TSS is much greater, but as distance from the source increases, TSS dissipates rapidly both vertically and horizontally in the water column (USACE 1986). The dissipation of TSS in the water column allows for both horizontal and vertical clearance for anadromous fish passage through the narrowest portion of the Action Area.



**Figure 10. Estimated buffer distance for cutterhead, hopper, and mechanical (clamshell) dredges in the narrowest reach of the Proposed Action. Total suspended solids would be much greater at the point of dredging and would be near background levels at the furthest extent of the dredge;**

The behavioral response of estuarine fish species to TSS and turbidity has been documented in a number of studies. The suspension of fine particles hinders gas exchange with the water by coating the respiratory epithelia of juvenile and adult fish (Clarke and Wilbur 2000). Larger suspended particles can be trapped in the gill filaments and fill the opercular cavity, which may lead to asphyxiation by prohibiting the passage of water through the gills (Johnston, 1981; Clarke and Wilbur, 2000). Even so, increased sediment loading in the water column is predicted to be temporary, with the effects subsiding within a few days or weeks of dredging or dredged material placement operations. During dredging activities, fish and/or prey species may also move away from the disturbance and visual effects. Additionally, if ocean disposal of dredged material were to occur during the overwintering period (December-March) of the important prey species, blue crab, there is the possibility that dredged material may accumulate to such an extent that mortality to those hibernating crabs may occur. We anticipate that benthic epifaunal and infaunal prey species to be those most affected by the settlement of a turbidity plume or dredged material disposal. Essential Habitats for benthic species, such as flounder, or those species with egg or larval life stages, will be most affected by increased TSS levels in the water column. Table 3 displays those species with egg and larval life stages that have a higher probability of being impacted by increased TSS levels in the water column resulting from dredging and dredged material disposal.

**Table 3. Channels dredged with EFH for egg and/or larval life stages for managed species.**

Species	Location of Dredging and Dredged Material Disposal						
	Atlantic Ocean Channel	Thimble Shoals Channel	Norfolk Harbor Entrance Channel	Norfolk harbor Channels	Channel to Newport News	Anchorage F	Placement Sites
<b>Coastal Demersal Fishes</b>							
black sea bass ( <i>Centropristus striata</i> )	X	X	-	-	-	-	X
monkfish ( <i>Lophius americanus</i> )	-	-	-	-	-	-	X
red drum ( <i>Stotomus chrysops</i> )	-	-	-	X	-	-	-
red hake ( <i>Urophycis chuss</i> )	X	X	-	-	-	-	X
summer flounder ( <i>Paralichthys dentatus</i> )	X	-	X	X	X	X	X
windowpane flounder ( <i>Scophthalmus aquosus</i> )	X	X	-	-	-	-	X
witch flounder ( <i>Glyptocephalus cynoglossus</i> )	X	X	-	-	-	-	X
yellowtail flounder ( <i>Limanda ferrunginea</i> )	X	X	-	-	-	-	X
<b>Coastal Pelagic Fishes</b>							
Atlantic butterfish ( <i>Peprilus triacanthus</i> )	X	X	X	X	X	X	X
bluefish ( <i>Pomatomus saltarix</i> )	-	-	-	-	-	-	X
cobia ( <i>Rachycentron canadum</i> )	X	X	-	-	-	-	X
king mackerel ( <i>Scomberomorus cavalla</i> ) and Spanish mackerel ( <i>Scomberomorus maculatus</i> )	X	X	-	-	-	-	X
longfin inshore squid ( <i>Loligo pealeii</i> )	X	X	-	-	-	-	X

X indicates egg and/or larval lifestage presence for managed species in a given channel

The USACE, Norfolk District contracted EA Engineering, Science, and Technology, Inc. (EA) to conduct dredged material evaluation for the Thimble Shoal, Atlantic Ocean, and Norfolk Harbor Channels in 2010. As a part of this contract, STFATE modeling for the placement of dredged material at the NODS for the Norfolk Harbor Channel, and the DNODS for the Thimble Shoal and Atlantic Ocean Channel was conducted (EA 2010). The model was conducted to document compliance with Section 103 of the Marine Protection, Research and Sanctuaries Act (MPRSA) for ocean placement of dredged material. The model analyzed a 4,000 cubic yard placement event at the NODS and DNODS via hopper dredge. The calculated distance traveled by turbidity for each of the channels analyzed ranged from 400 - 1,140 feet after one hour and 1,400 - 4,713 feet after 4 hours (Figure 10) (EA 2010). The modeling also indicated that there were no acute water quality violations or water column toxicity (EC50), which demonstrates that the dispersal of sediment was sufficient to not cause significant adverse impacts to water quality or larval test species, *A. bahia* (opossum shrim), *M. beryllina* (inland silverside), and *M. edulis* (blue mussel) (EA 2010). The STFATE modeling determined that placement of sediment from Action Area into

ocean disposal sites meets the United States Environmental Protection Agency's (EPA) MPRSA guidelines.

**Figure 11. Results of 2010 STFATE modeling for dredged material placement at the Dam Neck Ocean Disposal Site for the Thimble Shoal, Atlantic Ocean, and Norfolk Harbor Channels.**

The STFATE modeled the placement of a much higher amount of sediment (4,000 cubic yards) than would occur in practice, and all EPA MPRSA guidelines were still met. During dredging and placement operations that would commence under the Preferred Alternative, the amount of TSS in the Action Area would be orders of magnitude lower than the model, which indicates TSS concentrations would not significantly impact EFH, managed species, or their prey. While dredging operations will increase TSS and turbidity concentrations, these impacts will be temporary. The high flushing rate (due to the water exchange and tidal fluctuations) within the Norfolk Harbor and Channels will quickly disperse turbidity plumes, resulting in temporary adverse impacts to essential habitats in the water column. Operational controls and best management practices, discussed in Section 8.0, will aide in reducing impacts to EFH, associated managed species, and their prey. Overall, adverse impacts resulting from increased turbidity and TSS concentrations would be minor and temporary in duration.

**Salinity and Dissolved Oxygen.** Increased turbidity can impact primary productivity and respiration of organisms within the Action Area. By limiting light availability in the water column, the rate of primary productivity has the potential to drop and may ultimately and indirectly reduce the availability of dissolved oxygen (DO). If dissolved oxygen levels drop significantly, anoxic conditions may ensue, which can result in stress-induced sublethal and lethal effects to fishes inhabiting a particular habitat. Although dredging operations have occurred in the Norfolk Harbor and Channels for more than 30 years, no dredging operation has resulted in an anoxic fish kill or harmful algal bloom. Therefore, anoxia, hypoxia, or harmful algal blooms following dredging operations are extremely unlikely with implementation of the Preferred Alternative.

Simulation modeling conducted by Liu et al. (2017), Shen et al. (2017) Zhang et al. (2017) and Wang et al. (2017a,b) indicate that salinity in the lower James River would experience a minor increase, approximately less than one PSU, on average, in both surface and bottom waters

(Appendix J). Implementation of the Preferred Alternative is anticipated to cause less than a 0.5 mg/L percent change in average dissolved oxygen levels (Wang et al. 2017a,b), which is not anticipated to result in habitat or ecological impacts in the Action Area. Potential salinity and dissolved oxygen adverse impacts could be permanent; however, based on the modeling conducted to date for the project, we anticipate salinity and dissolved oxygen impacts to range from negligible to minor in intensity.

**Nutrient/Contaminant Release.** Dredging has the potential to release and disperse nutrients and contaminants from the sediment to the water column. Contaminant release and dispersal may negatively impact EFH, managed fish species, and their prey by causing direct sublethal or lethal effects through the uptake of contaminants in tissue. In the Action Area, contaminated sediments would not likely not be encountered based on extensive sediment testing that has been previously conducted as required per the Marine Protection Research and Sanctuaries Act (MPRSA). However, sediment contaminant testing has not been conducted to the planned depth of sediment dredging anticipated with this project. Therefore, additional testing will be required during the Preconstruction, Engineering, and Design Phase of the project and will also be conducted approximately every three years or as otherwise required. In the unlikely event that contaminated sediments are encountered, environmental bucket dredging would be utilized to reduce the risk of impacts to essential habitats, managed fishes, and their prey.

**Underwater Noise.** Underwater soundscapes are of vital importance to numerous species of estuarine and coastal fishes. Soundscapes are characterized by the ambient sound created by both the physical and biological processes at a specific location, such that the soundscape of an oyster reef is considerably different than that of a seagrass bed or an open expanse of sand (Lillis et al. 2014). In shallow water communities, soundscapes are affected by a variety of factors, such as bathymetry, waves, and animal activities (e.g. intra-specific and defense communications and foraging) (Lillis et al. 2014). Sound transmits efficiently through water, making it particularly important to aquatic communities, and studies indicate that sound plays a role in a multitude of ecological processes, including reproductive behavior, navigation, defense, territoriality displays, foraging, and orientation and timing of larval settlement (Cotter 2008; Nichols et al. 2015; Lillis et al. 2014). Over the past century, as human maritime and coastal activity has increased exponentially, oceanic noise has also risen.

Sounds created by human activities fall into two categories: sounds that are an unintentional byproduct and sounds that are used as a measurement tool (Slabbekoorn et al. 2010). The first category includes low-frequency noises from small or large water craft (e.g. container shipping, public transportation, and fishing/recreation) (Slabbekoorn et al. 2010). The second category of anthropogenic noise is generated largely by sonar, which enables humans to map the benthos and locate objects and resources (e.g. sunken ships, oil, natural gas, etc.) in the ocean; this generates both low and high frequency sound (Slabbekoorn et al. 2010). Although there are a variety of noise inputs, it is hypothesized that motorized vessels, particularly in coastal environments, produce the largest proportion of anthropogenic noise (Slabbekoorn et al. 2010; Nichols et al. 2015).

For the Norfolk Harbor Project, hopper, mechanical, and hydraulic cutterhead pipeline dredges may be used. When hopper dredges are used, the principle noise generating equipment includes hydraulic winches, sediment pumps, and the ship's main engines (EDAW, Inc. 2002). Hopper dredges, along with other dredging vessels produce, on average, continuous, broadband sound frequencies varying from 20 – 1,000 Hz, and sound is attenuated based on factors including ambient noise, sediment type, and water circulation patterns (Todd et al. 2015; Richardson et al. 1995). Throughout the dredging process, low frequency noise is produced and the highest level of noise occurs during the loading of dredged material onto the ship (Richardson et al. 1995).

Underwater sounds generated from hydraulic cutterhead suction dredges are typically low in intensity and frequency but, in some instances, higher frequencies are emitted (CEDA Position Paper, 7 November 2011). Hydraulic cutterhead suction dredging generally produces sound below 1,000 Hz in frequency, with estimated source sound pressure levels ranging between 168 to 186 dB (re 1 micro-Pascals) at one meter below the surface. The CEDA (2011) reported that cutterhead suction dredge estimated source sound pressure levels ranging between 172 to 185 dB (re 1 micro-Pascals) at one meter below the surface. The majority of the sound produced by cutterhead suction dredges occur in the 70 to 1,000 Hz range and peaks in the 100 to 110 dB range (Clarke et al. 2002). Clarke et al. (2002) recorded sounds from a 10,000 horsepower, 24 inch cutterhead suction dredge during maintenance dredging operations in Mississippi and found that sounds emitted from hydraulic cutterhead suction dredges were rather muted when compared to other sound sources in the aquatic environment. In this example, the sounds attributed to the cutterhead suction dredge operation were virtually undetectable at 500 meters from the plant (Clarke et al. 2002)

For the construction and maintenance dredging of the Norfolk Harbor, there are several different channels with different dredging needs. Therefore, the exact type of dredge and its size and specifications may vary. Dredges used in the past ranged between approximately 18 to 36 inches. The dredge used in the aforementioned study from Mississippi, while not identical in size of the cutterhead suction dredges operating in Norfolk Harbor, is of comparable size or slightly smaller to those being used. Therefore, it is anticipated that the underwater sound levels associated with mechanical cutterhead dredging on the Norfolk Harbor will be equal to or slightly greater than the levels discussed previously.

Underwater noise generated by dredging may impact EFH soundscapes and managed fish species in the Action Area. Anthropogenic sources of underwater sound, and specifically dredging, have recently become the source of concern for regulatory agencies. Despite these concerns, only a few studies have examined the sound levels of dredging equipment and the potential impacts these sound levels have on aquatic organisms. Therefore, the influence of noise on aquatic organisms, including fishes, is poorly understood. Research has primarily looked at the potential impacts of dredging sound on marine mammals, with only a few documents examining potential impacts to fishes. However, preliminary research has provided valuable insight regarding the effect of disturbed marine soundscapes on associated fish populations.

Of the marine fish species studied, nearly all fall within the spectrum of auditory sensitivity from 20 – 1,000 Hz (outliers can sense up to 4,000 Hz); there is a considerable amount of spectral overlap between the noise produced from dredging activities and fish auditory sensitivity (Kasumyan 2005; Nichols et al. 2015). Results from a study conducted by Nichols et al. (2015) suggest that random, intermittent noise, rather than continuous noise, produced by water craft raised the levels of cortisol, a stress hormone, in a coastal fish species. Elevated cortisol levels in fishes, and especially in juvenile fishes, are correlated with a variety of negative effects, including increased susceptibility to infection, decreased growth rates, and reduced predator avoidance (McCormick et al. 1998; Nichols et al. 2015).

Estimating noise impacts on managed fish species from implementation of the Preferred Alternative is difficult due to the limited available data on impacts of dredging and dredged material placement activities on aquatic habitats and associated species. Species lacking a swim bladder or other gas-filled chambers, including jawless fishes, elasmobranchs, and some flat fish and tuna species, are not as susceptible to Temporary Threshold Shifts (TTS) in sound detection as those species having gas bladders, including Atlantic cod and herring species (Popper et al. 2014). Additionally, research conducted by Popper et al. suggests that larval fishes have similar sensitivity to sound pressure as juvenile and adult fishes (2014). Sensitivity to anthropogenic

noise is largely from high intensity impulsive sound inputs to the water column, especially from pile driving. Research suggests that dredging noise, especially in soft, non-gravelly sediments, is not likely to produce physiologically damaging results to fish, though it may mask natural sounds used by larvae to locate suitable habitats, and some fishes may demonstrate a change in swimming as a result of noise inputs into their habitat (Wenger et al. 2017; Popper et al. 2014).

Similarly, the impacts of dredging equipment and the associated noise on Atlantic sturgeon have not been well documented, but existing studies demonstrate no impact to behavior, spawning, feeding, or movement of any Atlantic sturgeon within the vicinity of active dredging operations (Moser and Ross, 1995). Moser and Ross (1995) concluded that Atlantic sturgeon showed no difference in habitat preference or behavior between the dredged and undisturbed areas during dredging operations. The conclusions are consistent with a USACE study conducted on the James River with active dredging operations that found no change in behavior or movement as a result of an active dredge operating within close proximity to radio-tracked Atlantic sturgeon (unpublished USACE 2009).

Although the studies linking potential noise impacts to managed fish species from navigation, dredging, and dredged material placement are limited, implementation of the Norfolk Harbor Project is not anticipated to substantially increase noise levels as they relate to habitat impacts or impacts to managed fish species. Also, all impacts would be temporary, and, thus, we anticipate noise impacts on managed fish species or their prey to range from negligible to minor.

#### 7.1.1 Effects to Habitat Area of Particular Concern (Sandbar Shark)

Although much of the lower Bay is considered HAPC for the sandbar shark, tagging studies have shown that juveniles of this species occur in high abundance in nursery areas near the outer mouth of the York River and off the southwestern coast of the Eastern Shore due to better water quality conditions (Grubbs et al. 2005). Very little the mouth of the James River is primary nursery area due to increased freshwater discharge and runoff, both industrial and agricultural. Even so, the benthic composition of the Action Area aligns with the preferred sand and mud substrate in sandbar shark nursery habitats; additionally, depths and temperatures occurring in the Action Area align with EFH sandbar sharks. Changes in TSS concentrations, salinity and DO, and potential increases in disturbance caused by noise have the potential to directly affect the summer nursery habitats and prey species utilized by neonate and juvenile sandbar sharks. It is predicted that the *preferred* nursery areas near the mouth of the York River and off the Southwestern coast of the Eastern Shore for juvenile and neonate sandbar sharks will not be affected by implementation of the Action Alternative, however, there would be minor and temporary adverse impacts to HAPC caused by increased dredging in the Action Area, which includes the Norfolk Harbor.

## 7.2 Potential Impacts to Benthic Habitats

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**Removal of Habitat.** Dredging and dredged material placement will alter benthic habitats by direct removal of sediment via dredging and placement of dredged material into designated open ocean disposal sites. Therefore, benthic habitats will remain open water habitats but will be disturbed and may be temporarily unsuitable for some sessile and benthic organisms. Ecological successional processes in these benthic habitats will be temporarily disturbed. There may be indirect effects on managed fish that utilize these benthic habitats for activities such as resting, foraging, or settlement.

Removal of suitable benthic substrate by dredging may impact EFH by removing important food resources (i.e. benthic organisms and macroalgae) or by altering nursery and spawning areas. Re-colonization of newly exposed substrate after dredging is a function of site-specific

characteristics (i.e. bathymetry, tidal energy) and substrate requirements of larval re-colonizing species (Rhoads and Germano, 1982). Any deviation from the existing benthic floor changes the complexion for smaller species that use the area for foraging and refuge. Additionally, some demersal species require specific substrates for foraging and spawning. Therefore, dredging and dredged material placement would likely result in the temporary loss of some benthic habitat and foraging grounds. Even so, the channels proposed for deepening are regularly maintained at their current depths; therefore, these already-disturbed benthic communities will not be significantly disturbed when comparing the No Action Alternative with the Preferred Alternative.

Impacts to benthic habitats would likely include loss and displacement of non-motile benthic organisms in the open ocean disposal sites. McCauley et al. (1977) documented that the total abundance of benthic organisms at a dredging site returned to pre-dredging levels 7 - 28 days after dredging was completed. This study also showed a similar pattern at the overboard dredged material placement area, with total abundance levels rebounding to pre-dredging numbers within seven days. In a similar study conducted in the nearby James River, Diaz (1994) found that almost all species of benthic organisms had re-colonized the disturbed areas within three weeks of completion of dredging. Diaz (1994) also demonstrated that benthic organisms continued to sustain pre-disturbance population densities three months after a dredging event on the James River. Additionally, this study revealed similar benthic community structure and species composition in undisturbed areas and in the areas of dredged material placement.

As described in the Potential Water Quality Impact Section, we would not anticipate that the Norfolk Harbor Project would cause any substantial impacts to salinity or dissolved oxygen, and, therefore, no substantial long-term shifts in benthic species community composition are anticipated.

In summary, once dredging and dredged material placement is complete, impacted benthic areas will likely begin to re-colonize with organisms similar to those from adjacent non-impacted areas. Therefore, the adverse effects to EFH and associated managed species would be expected to be minor and temporary. Benthic organisms and habitats would be expected to recover to near pre-construction conditions following a dredging or dredged material placement event.

**Sediment Deposition.** Benthic communities may be adversely impacted with approximately 390 mg/L of TSS. However, for species such as the white perch, the deposition of particulate matter on eggs does not have any demonstrable adverse effects. White perch eggs can tolerate concentrations of 500 mg/L of particulate matter without any adverse effects (Stanley and Danie 1983). In addition, sessile benthic prey species may be buried and smothered during dredging and dredged material placement (Refer to Section 7.1, Turbidity and Total Suspended Solids).

### 7.3 Potential Unexploded Ordinance Impacts

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Another potential threat to EFH and associated managed species for all life stages is injury or incidental take resulting from MEC/UXO detonation or contact with contaminants leaching from MEC/UXO that occur in the project area. We do not anticipate an MEC/UXO encounter, and this would not be a substantial threat, as the USACE deploys MEC/UXO screening devices on dredges where there is risk of MEC/UXO detonation. The UXO/MEC special screening are installed on dragheads to prevent or minimize the entrainment of UXO/MEC materials that could be present in navigation channels. Unexploded Ordinance/Munitions of Explosive Concern have been recovered during hopper dredging operations in Atlantic Ocean Channel, Thimble Shoals Channel, Cape Henry Channel, and the Thimble Shoals Surround Borrow Area. The presence of UXO/MEC presents a safety hazard to both the vessel and human personnel onboard the vessel. The current specification for UXO/MEC screening on hopper dredge requires UXO/MEC special screening with screen openings no larger than 1.25 inch by 6-inch openings to prevent

the passage of any material greater than 1.25 inch diameter. Additionally, based on screening requirements, the use of UXO/MEC special screening has the potential to prevent the entrainment of some managed species.

## 8.0 CUMULATIVE IMPACTS TO ESSENTIAL FISH HABITAT AND MANAGED SPECIES

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In the future, with or without implementation of the Preferred Alternative, vessel calls would be anticipated to increase as compared to current conditions. However, when comparing the future with or without the project, there would be less vessel calls in the future with project as compared to the future without project because the existing, larger ships in the fleet would carry more goods, thus requiring a smaller number of ships to transport the same amount of goods. Virginia Port growth is anticipated to increase throughout the next 50 years, and a new port facility is planned, which may increase the number of vessels transiting the Norfolk Harbor and Channels. Also, additional development, including construction of the Third Crossing, and expansion of the Chesapeake Bay Bridge Tunnel is planned in the future. Additional development could increase impacts to the managed species occurring in the project area. However, implementation of the Preferred Alternative, along with other past, present, and future actions, is not anticipated to significantly contribute to those increased impacts.

Cumulative threats to managed species, including exposure to contaminants, have the potential to impact fish populations and their habitats, but implementation of the Preferred Alternative is not anticipated to significantly contribute cumulatively to injuries and mortalities resulting from these impacts.

Global climate change has the potential to affect fish populations and their associated habitat in the future. Sea level rise may cause an increase in salinity in upstream areas that could affect breeding sites and survival of early life stages (eggs, larvae, and young-of-the-year). There could be shifts in breeding habitat availability or timing of spawning, and the effects of this change on fish populations is uncertain but could be detrimental. Shifts in salinity, temperature, and sea level all may result in shifts in prey species availability, which could also impact fish populations. While continued development and climate change will likely impact fishes, implementation of the Preferred Alternative is not anticipated to substantially contribute cumulatively to injuries and/or mortalities resulting from these impacts.

## 9.0 BEST MANAGEMENT PRACTICES/MITIGATION MEASURES

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Depending on the method of dredging, measures would be implemented to minimize disturbances to the environment.

- Agitation and operation of a cutterhead dredge would not begin until the cutterhead is in immediate contact with the substrate.
- A similar measure would be taken for hopper dredges where dredging would not begin until the draghead is in direct contact with the substrate.
  - For both cutter head and hopper dredges, this measure reduces the intake of water and sediment and the potential uptake and entrainment of eggs and larvae as well as juvenile and adult fish species.

- By lowering the cutterhead/draghead to the bottom before starting the agitation and suction of water and sediment, potential impacts and losses of fish species in the vicinity of the dredge are minimized.
- If the use of a mechanical dredge with environmental bucket is deemed necessary, slower ascent rates would aid in reducing slough-off and resuspension of dredged material in the water column.
- Disposal of dredged material will occur within the confines of the Norfolk Ocean Disposal Site, Dam Neck Ocean Disposal Site, Craney Island Dredged Material Management Area, or in an upland disposal facility. No unconfined disposal of contaminated sediments would occur with implementation of the Action Alternative.

## 10.0 CONCLUSIONS

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Implementation of the Preferred Alternative may adversely impact essential habitats and managed species due to increased TSS levels, sedimentation, direct removal of habitat, and underwater noise. Effects to HAPC for the sandbar shark are also expected to be minor.

Total suspended solids and turbidity are anticipated to temporarily increase within the affected area following dredging and dredged material placement events. However, TSS and turbidity levels will rapidly decline to background concentrations following dredging and dredged material placement. Impacts to EFH from changes in salinity and dissolved oxygen are not anticipated to be substantial and will likely not permanently alter benthic community composition in the affected area. Benthic impacts from maintenance dredging activities will likely result in some mortality of benthic prey species consumed by managed fishes, but it is likely that these prey species would quickly re-colonize the area following dredging events and essential habitats would return to their current state. While we would anticipate adverse impacts to managed species as a result of increased depths and dredging frequency of the federal navigation channels, impacts are would anticipated to be minor and temporary in nature. Although impacts of underwater noise on habitats utilized by managed species is uncertain, we do not anticipate underwater noise levels to substantially increase from current ambient noise levels, and all noise impacts from dredging and dredge material placement will be temporary. There is some potential risk of contaminant release or release of unexploded ordinance; however, both are highly unlikely, and release of unexploded ordinance is mitigated with the use of MEC/UXO screening on dredging equipment where applicable. Based on these assumptions, it is our opinion that the water column and physical benthic habitat will recover within a short period of time in the Action Area.

The USACE concludes that implementation of the Preferred Alternative is anticipated to result in minor adverse impacts to EFH, managed species, and their prey. Impacts would largely be temporary, though minor changes in salinity and dissolved oxygen may be permanent. However, no substantial adverse impacts to EFH or managed species are anticipated and best management practices will aid in reducing potential impacts to essential habitats utilized by managed species in the Action Area.

## 11.0 RECENT ENVIRONMENTAL STUDIES AND REPORTS

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- **2009** – Final Environmental Impact Statement – for the proposed dredging of the Norfolk Harbor Channel, Portsmouth and Norfolk, Virginia. U.S. Navy Mid-Atlantic region.

- **2002**– Final Limited Reevaluation Report Norfolk Harbor and Channels, Virginia, 50-Foot Channel Project, 50-Foot Inbound Element. U.S. Army Corps of Engineers, Norfolk District. October.
- **1995** – Webb, D. W. Ship Navigation Simulation Study, Southern Branch of the Elizabeth River, Gilmerton and Interstate 64 Bridges, Norfolk, Virginia. U.S Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS.
- **1992** – Final Environmental Impact Statement for the Designation of an Ocean Dredged Material Disposal Site Located Offshore Norfolk Virginia. U.S. Environmental Protection Agency, Region III office. November.
- **1985** – Final Supplement I to the Final Environmental Impact Statement: Norfolk Harbor and Channels, Virginia; Deepening and Disposal.
- **1981** – Addendum to Final Environmental Impact Statement: Norfolk Harbor and Channels, Virginia; Deepening and Disposal.
- **1980** – Final Environmental Impact Statement: Norfolk Harbor and Channels, Virginia; Deepening and Disposal

## 12.0 REFERENCES

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- Abraham, B.J. 1985. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic) – Mummichog and striped killifish. U.S. Fish and Wildlife Service. Biological Report 82 (11.40). U.S. Army Corps of Engineers, TR-EL-82-4. 23 pp.
- Anchor Environmental. 2003. Literature review of effects of re-suspended sediments due to dredging. 140 pp.
- Armstrong, M.P., Musick, J.A., Colvocoresses, J.A. 1992. Age, growth, and reproduction of the goosefish *Lophius Americanus* (Pices: Lophiiformes). U.S. Fish. Bull. 90: 217-230.
- Atlantic Herring. 2015. In Fishwatch U.S. Seafood Facts Online. Retrieved from <http://www.fishwatch.gov/profiles/atlantic-herring>
- Ballard, B. S., and W. Abbott. Osmotic accommodation in *Callinectes sapidus* Rathbun. 1969. Comparative Biochemistry and Physiology 29: 671–687.
- Barbieri, L.R., Chittenden Jr., M.E., S.K. Lowerre-Barbieri. 1994. Maturity, spawning, and ovarian cycle of Atlantic croaker, *Micropogonias undulatus*, in the Chesapeake Bay and adjacent coastal waters. Fishery Bulletin 92:671-685.
- Bass, R. J., and J. W. Avault, Jr. 1975. Food habits, length-weight relationship, condition factor, and growth of juvenile red drum, *Sciaenops ocellata*, in Louisiana. Transactions of the American Fisheries Society 104: 35–45.
- Beutel, D. and L.G. Skrobe. 2004. Characterization of bycatch reduction from codend mesh size increases in the directed scup bottom trawl fishery. University of Rhode Island Fisheries Center Technical Report: 01-04
- Bransetter, S., Musick, J.A., and J.A. Colvocoresses. 1987. A comparison of the age and growth of the Tiger shark, *Galeocerdo cuvieri*, from off Virginia and from the Northwestern Gulf of Mexico. Fishery Bulletin: Vol. 85, No. 2.
- Burton, W.H. 1993. Effects of bucket dredging on water quality in the Delaware River and the potential for effects on fisheries resources. Versar, Inc., 9200 Rumsey Road, Columbia, Maryland 21045
- Cargnelli, L.M., Griesbach, S.J., Packer, D.B., Berrien, P.L., Morse, W.W. and D. L. Johnson. 1999. Essential Fish Habitat Source Document: Witch Flounder, *Glyptocephalus Cynoglossus*, Life History and Habitat Characteristics. National Marine Fisheries Service, Highlands, NJ. NOAA Technical Memorandum NMFS-NE-139.
- Castro, J.I. 2011. Sharks of North America. Oxford University Press. New York, NY. 613 pp.
- Castro, J.I., Woodley, C.M., and R.L. Brudek. 1999. A Preliminary Evaluation of the Status of Shark Species. Food and Agriculture Org. technical paper, Issue No. 380. Rome, 72 pp.
- Castro, J.I. 1983. The sharks of North American waters. Tex. A&M Univ. Press, College Station: 180pp.
- Central Dredging Association (CEDA). 2011. “Underwater sound in relation to dredging”. CEDA Position Paper, Prepared by the CEDA Working Group on Underwater Sound under the remit of the CEDA Environment Commission. Available at: [www.dredgingtoday.org/news\\_details.asp](http://www.dredgingtoday.org/news_details.asp)
- Chang, S., Berrien, P.L., Johnson, D.L., and W.W. Morse. 1999. Essential Fish Habitat Source Document: Windowpane, *Scophthalmus aquosus*, Life History and Habitat Characteristics. National Marine Fisheries Service, Highlands, NJ. NOAA Technical Memorandum NMFS-NE 137.

- Chao, L.N. and Musick, J. A. 1977. Life history, feeding habits, and functional morphology of juvenile Sciaenid fishes in the York River estuary, Virginia. *Fishery Bulletin*: Vol. 75, No. 4.
- Clarke, D.G., Dickerson, C., and K. Reine. 2002. Characterization of underwater sounds produced by dredges. *Dredging 2002*, American Society of Civil Engineers, Orlando, Florida, USA, p 64-81.
- Clarke, D.G., and D. H. Wilber. 2000. Assessment of potential impacts of dredging operations due to sediment resuspension. DOER Technical Notes Collection (ERDC TN-DOER-E9), U.S. Army Engineer Research and Development Center, Vicksburg, MS. [www.wes.army.mil/el/dots/doer](http://www.wes.army.mil/el/dots/doer)
- Collette, B.B. and C.E. Nauen. 1983. FAO species catalogue Vol. 2. Scombrids of the world. AN annotated and illustrated catalogue of tunas, mackerels, bonitos and related species known to date. FAO Fish. Synop., (125) Vol.2: 137p.
- Compagno, L.J.V. 1984. FAO Species Catalog Vol.4, Part 1 and 2: Sharks of the world: An annotated and illustrated catalogue of shark species known to date. FAO Fish. Synop. 125. FAO, Rome, Italy.
- Costlow, J. D., Jr., and C. G. Bookhout. 1959. The larval development of *Callinectes sapidus* Rathbun reared in the laboratory. *Biological Bulletin (Woods Hole)* 116: 373–396.
- Cotter A. 2008. The ‘soundscape’ of the sea, underwater navigation, and why we should be listening more. In: Payne A, Cotter J, Potter T (eds) *Advances in fisheries science: 50 years on from Beverton and Holt*. Blackwell, Oxford, p 451–471.
- Cowan, Jr., J.H. and R.S. Birdsong. 1985. Seasonal occurrence of larval and juvenile fishes in a Virginia Atlantic coast estuary with emphasis on Drums (Family Sciaenidae). *Estuaries*, Vol. 8, No. 1 (March), pp. 48-59.
- Consoli, P. T. Romero, P. Battaglia, L. Castriota, V. Esposito, and F. Andaloro. 2008. Feeding habits of the albacore tuna *Thunnus alaguna* (Perciformes, Scombridae) from central Mediterranean Sea. *Mar. Biol* 155: 113-120.
- Davis, C. C. 1965. A study of the hatching process in aquatic invertebrates: XX. The blue crab, *Callinectes sapidus*, Rathbun, XXI. The nemertean, *Carcinonemertes carcinophila* (Kolliker). *Chesapeake Science* 6: 201–208.
- DeVries, M. C., R. A. Tankersley, R. B. Forward, W. W. Kirby-Smith, and R. A. Luettich Jr. 1994. Abundance of estuarine crab larvae is associated with tidal hydrologic variables. *Marine Biology* 118: 403–413.
- Diaz, R.J. 1994. Response of tidal freshwater macrobenthos to sediment disturbance. *Hydrobiologia* 278: 201-212. Virginia Institute of Marine Science. College of William and Mary. Gloucester Point, Virginia.
- EA Engineering, Science, and Technology, Inc. (EA). 2010. Evaluation of Dredged Material; Norfolk Harbor Approach Channels; Norfolk Inner Harbor Channel, Thimble Shoal Channel, Atlantic Ocean Channel.
- EDAW, Inc. 2002. Draft: Environmental Impact Statement/ Environmental Impact Report for San Diego Harbor Deepening (Central Navigation Channel). Retrieved from: [https://books.google.com/books?id=gzc0AQAAMAAJandpg=RA1-PR99andlpg=RA1-PR99anddq=hopper+dredging+noise+levels+and+operating+statusandsource=blandots=7BwosjhjPeandsig=sHM04DvIP7KMVOSXaq6umcusMJoandhl=enandsa=Xandved=0ahUKEwi37Ny24P\\_NAhVPw2MKHT5TAtUQ6AEINjAE#v=snippetanddq=Army%20Corpsandf=false](https://books.google.com/books?id=gzc0AQAAMAAJandpg=RA1-PR99andlpg=RA1-PR99anddq=hopper+dredging+noise+levels+and+operating+statusandsource=blandots=7BwosjhjPeandsig=sHM04DvIP7KMVOSXaq6umcusMJoandhl=enandsa=Xandved=0ahUKEwi37Ny24P_NAhVPw2MKHT5TAtUQ6AEINjAE#v=snippetanddq=Army%20Corpsandf=false)

- Ellis, J.K. and J.A. Musick. 2007. Ontogenetic changes in the diet of the sandbar shark, (*Carcharhinus plumbeus*), in the lower Chesapeake Bay and Virginia (USA) coastal waters. *Environ. Biol. Fish.* 80:51-67.
- Epifanio, C. E. 1995. Transport of blue crab (*Callinectes sapidus*) larvae in the waters off Mid-Atlantic states. *Bulletin of Marine Science* 57: 713-725.
- Epifanio, C. E. 2007. Biology of larvae. Pages 513–533 in V. S. Kennedy and L. E. Cronin, editors. *The Blue Crab: Callinectes sapidus*.
- Epifanio, C. E., and R. W. Garvine. 2001. Larval transport on the Atlantic continental shelf of North America: a review. *Estuarine Coastal And Shelf Science* 52: 51–77.
- Epifanio, C. E., A. K. Masse, and R. W. Garvine. 1989. Transport of blue crab larvae by surface currents off Delaware Bay, USA. *Marine Ecology Progress Series* 54:35–41.
- Epifanio, C. E., C. C. Valenti, and A. E. Pembroke. 1984. Dispersal and recruitment of blue crab larvae in Delaware Bay, U.S.A. *Estuarine, Coastal and Shelf Science* 18: 1-12.
- Etherington, L. L., and D. B. Eggleston. 2000. Large-scale blue crab recruitment: linking postlarval transport, post-settlement planktonic dispersal, and multiple nursery habitats. *Marine Ecology Progress Series* 204: 179–198.
- Fahay, M.P., Berrien, P.L., Johnson, D.L., and Morse, W.W. 1999. Bluefish, *Pomatomus saltatrix*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-144.
- Fahay, M.P. 1974. Occurrence of Silver Hake, *Merluccius bilinearis*, eggs along the Middle Atlantic continental shelf during the 1966 period. *Fish. Bull. (U.S.)* 72, 813-834.
- Fay, C.W., Neves, R.J., and G.B. Pardue. 1983. Species profiles: life histories and environmental requirements of coastal fisheries and invertebrates (Mid-Atlantic) – Atlantic silverside. U.S. Fish and Wildlife Service, Division of Biological Services. Biological Report 82 (11.10), U.S. Army Corps of Engineers, TR EL-82-4. 15 pp.
- Fisher, S.J., and D.W. Willis. 2000. Seasonal dynamics of aquatic fauna and habitat parameters in a perched upper Missouri River wetland. *Wetlands* 20:470-478.
- Fitz, E. and F. Daiber. 1963. An introduction to the biology of *Raja eglanteria* Bosc 1802 and *Raja erinacea* Mitchell 1825 as they occur in Delaware Bay. *Bull. Bingham Ocean Coll.* 18(3):69-97.
- Forward, R. B., Jr, J. Swanson, and R. Tankersely. 1997. Endogenous swimming rhythms of blue crab, *Callinectes sapidus*, megalopae: effects of offshore and estuarine cues. *Marine Biology* 127: 621–628.
- Forward, R. B., Jr, R. A. Tankersley, and J. M. Welch. 2003. Selective tidal-stream transport of the blue crab *Callinectes sapidus*: an overview. *Bulletin of Marine Science* 72: 347–365.
- Gelsleichter, J., Musick, J.A., and S. Nichols. 1999. Food habits of the smooth dogfish, *Mustelus canis*, dusky shark, *Carcharhinus obscurus*, Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, and the sand tiger shark, *Carcharias taurus*, from the northwest Atlantic Ocean. *Environmental Biology of Fishes* 54:205-217.
- Gregory, R.S., and T.G. Northcote. 1993. Surface, planktonic, and benthic foraging by juvenile Chinook salmon (*Oncorhynchus tshawytscha*) in turbid laboratory conditions. *Canadian Journal of Fisheries and Aquatic Sciences* 50:233-240.
- Grubbs, R.D. 1995. Preliminary recruitment patterns and delineation of nursery grounds for *Carcharhinus plumbeus* in the Chesapeake Bay. SB-III-11. Prepared for the 1996 NMFS Shark Evaluation Workshop, Miami, FL, as cited in Camhi 1998.

- Grubbs, R.D., Musick, J.A., Conrath, C.L., and J.G. Romine. 2005. Long-term movements, migration, and temporal delineation of a summer nursery for juvenile sandbar sharks in the Chesapeake Bay region.
- Guerin, J. L., and W. B. Stickle. 1992. Effects of salinity gradients on the tolerance and bioenergetics of juvenile blue crabs (*Callinectes sapidus*) from waters of different environmental salinities. *Marine Biology* 114: 391–396.
- Guillory, V., and P. Prejean. 2001. Red drum predation on blue crabs. In *Proceedings of the Blue Crab Mortality Symposium*, Gulf States Marine Fisheries Commission, Ocean Springs, Mississippi. Foodweb—References (pp. 93-104).
- Gunter, G. 1938. Seasonal variations in abundance of certain estuarine and marine fishes in Louisiana, with particular reference to life histories. *Ecol. Monogr.* 8(3): 315-346.
- Hardy, J.D., Jr. 1978. Development of fishes of the mid-Atlantic Bight – an atlas of egg, larval, and juvenile stages. Vol. III. Aphredoderidae through Rachycentridae. U.S. Fish and Wildlife Service, Biological Services Program, FWS/OBS – 78/12.
- Heist, E.J., Graves, J.E., and J.A. Musick. 1995. Population genetics of the sandbar shark (*Carcharhinus plumbeus*) in the Gulf of Mexico and Mid-Atlantic Bight. *Copeia*, Vol. 1995, No. 3 (Aug. 18 1995), pp. 555-562. American Society of Ichthyologists and Herpetologists.
- Hendrickson, L. 2006. Status of Fishery Resources off the Northeastern US NEFSC - Resource Evaluation and Assessment Division, NOAA: Windowpane flounder (*Scophthalmus aquosus*).
- Hendrickson, L.C. and Holmes, E.M. 2004. Essential Fish Habitat Source Document: Northern Shortfin Squid, *Illex illecebrosus*, Life History and Habitat Characteristics. 2<sup>nd</sup> Ed. Available: <https://www.nefsc.noaa.gov/publications/tm/tm191/tm191.pdf>
- Hewitt, A., Ellis, J., and M.C. Fabrizio. n.d. Fisheries of the York River System. Virginia Institute of Marine Science. College of William and Mary. Gloucester Point, Virginia.
- Hildebrand, S.F. and W.C. Schroeder. 1928. Fishes of Chesapeake Bay. *Bull. U.S. Bur. Fish.* 43:1-338.
- Holt, S.A. (2008). Distribution of Red Drum Spawning Sites Identified by a Towed Hydrophone Array. *Transactions of the American Fisheries Society* 137:551-561.
- ICCAT. 1997. Report for biennial period 1996097, 1 (2).
- ICCAT. 1994. Report of the working group to evaluate Atlantic yellowfin tuna. *Collect. Vol. Pap. ICCAT 1994 Vol. 42(2)*: 1-25.
- Jaworski, E. 1972. The blue crab fishery, Barataria Estuary, Louisiana. Louisiana State University, Sea Grant Publication. LSU-SG-72-01. 112 p.
- Jensen, A.C. n.d. Life History of the Spiny Dogfish. U.S. Bureau of Commercial Fisheries Biological Laboratory, Woods Hole, MA.
- Johnson, D.L., Morse, W.W., Berrien, P.L., and J.J. Vitaliano. 1999. Essential Fish Habitat Source Document: Yellowtail Flounder, *Limanda ferruginea*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-140.
- Johnston, S.A. 1981. Estuarine dredge and fill activities: A Review of Impacts. *Journal of Environmental Management* Vol. 5, No. 5, pp. 427-440.

- Jones, C. M., J. R. McConaugha, P. J. Greer, and M. H. Prager. 1990. Estimates of spawning size of blue crab, *Callinectes sapidus*, in Chesapeake Bay, 1986-1987. *Bulletin of Marine Science* 46: 159-169.
- Joseph, Norcross and Mosmann. 1964. Spawning of the Cobia (*Rachycentron canadum*), in the Chesapeake Bay area, with observations of juvenile specimens. *Estuarine Research Federation*. Vol. 5 1964.
- Jung, S. and E.D. Houde. 2003. Spatial and temporal variabilities of pelagic fish community structure and distribution in Chesapeake Bay, USA. *Estuarine, Coastal and Shelf Science* 58 (2003) 335-351.
- Kasumyan, A. O. 2005. Structure and Function of the Auditory System in Fishes. *Journal of Ichthyology*, 45(2), S223-S270.
- Kneebone, J., Chisholm, J., and G. Skomal. 2014. Movement patterns of juvenile sand tigers (*Carcharias taurus*) along the east coast of the USA. *Marine Biology International Journal on Life and Oceans and Coastal Waters*.
- Lassuy, D.R. 1983. Species profiles: life histories and environmental requirements (Gulf of Mexico) – Atlantic croaker. U.S. Fish and Wildlife Service, Division of Biological Services. FWS/OBS-82/11.3, U.S. Army Corps of Engineers, TR EL-82-4.
- Legault, C. and S. Cadrin. 2006. Yellowtail flounder - Distribution, Biology and Management. NEFSC - Resource Evaluation and Assessment Division, NOAA.
- Lewis, V.P. and D.S. Peters. 1994. Diet of juvenile and adult Atlantic Menhaden in estuarine and coastal habitats. *Transactions of the American Fisheries Society* 123:803-810.
- Lillis, A., Eggleston, D. B., Bohnenstiehl, D. R. 2014. Estuarine soundscapes: distinct acoustic characteristics of oyster reefs compared to soft-bottom habitats. *Marine Ecology Progress Series*, 505 1-17.
- Liu Z., Wang H., Zhang, J. Ye, F. 2017. Incorporating Sea Level Change Scenarios into Norfolk Harbor Channels Deepening and Elizabeth River Southern Branch Navigation Improvements Study. Final Report on the “hydrodynamic modeling,” Special Report No. 457, Applied Marine Science and Ocean Engineering doi: 10.21220/V5BX49
- Lloyd, D.S. 1987. Turbidity as a water quality standard for salmonid habitats in Alaska. *North American Journal of Fisheries Management* 7:34-45.
- Lock, M.C., Packer, D.B. 2004. Essential Fish Habitat Source Document: Silver Hake, *Merluccius bilinearis*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-186.
- Love, J.W. and E.B. May. 2007. Relationships between fish assemblage structure and selected environmental factors in Maryland’s coastal bays. *Northeastern Naturalist* 14(2):251-268.
- Luczkovich, J.J., Sprague, M.W., Johnson, S.E., and R.C. Pullinger. 1999. Delimiting spawning areas of Weakfish *Cynoscion regalis* (Family Sciaenidae) in Pamlico Sound, North Carolina using passive hydroacoustic surveys. *International Journal of Animal Sound and its Recording*. Vol. 10, pp. 143-160.
- Luczkovich, J.J., H.J. Daniel III, M.W. Sprague. n.d. Characterization of critical spawning habitats of weakfish, spotted seatrout and red drum in Pamlico Sound using hydrophone surveys. Final Report and Annual Performance Report. U.S. Fish and Wildlife Service, Grant F-62-1 and Grant F-62-2. Institute for Coastal and Marine Resources, East Carolina University, Greenville, North Carolina.

- Maguire Group, Inc. Essential Fish Habitat (EFH) Assessment. Gloucester Harbor, Massachusetts. 2001. Prepared for: Massachusetts Coastal Zone Management by: Maguire Group, Inc.
- Mancini, P.L and A.F. Amorim. 2006. Embryos of common thresher shark *Alopias vulpinus* in southern Brazil, South Atlantic Ocean. *Journal of Fish Biology* 69:318-321.
- Mann, R. Harding, J., Southworth, M., and Wesson, J. 2005. Northern Quahog (Hard Clam) *Mercenaria* Abundance and Habitat Use in Chesapeake Bay. *Journal of Shellfish Research* 24(2):509-516.
- Manooch, C. S., III. 1973. Food habits of yearling and adult striped bass, *Morone saxatilis* (Walbaum), from Albemarle Sound, North Carolina. *Chesapeake Science* 14: 73–86.
- Mather, F.J., III, H.L. Clark, and J.M. Mason, Jr. 1995. Historical document: life history and fisheries of Atlantic Bluefin tuna. NOAA Technical Memorandum NMFS-SEFSC- 370:165 p.
- McCaughey, J.E., Parr, R.A., and D.R. Hancock. 1977. Benthic infauna and maintenance dredging: A case study. *Water Research*. Vol. 11, pp. 233-242.
- McConaughy, J. R. 1988. Export and reinvasion of larvae as regulators of estuarine decapod populations. *American Fisheries Society Symposium* 3: 90–103.
- McConaughy, J. R., D. F. Johnson, A. J. Provenzano, and R. C. Maris. 1983. Seasonal distribution of larvae of *Callinectes sapidus* (Crustacea: Decapoda) in the waters adjacent to Chesapeake Bay. *Journal of Crustacean Biology* 3: 582-591.
- McCormick, S.D., Shrimpton, J.M., Carey, J.B., O'Dea, M.F., Sloan, K.E., Moriyama, S., Bjornsson, B. Th. 1998. Repeated acute stress reduces the growth rate of Atlantic salmon parr and alters plasma levels of growth hormone, inulin-like growth factor I and cortisol. *Aquaculture* 186 221-235.
- Mercer, L.P. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates. U.S. Fish and Wildlife Service Biological Report 82 (11.109), U.S. Army Corps of Engineers, TR EL-82-4. 17 pp.
- Metcalf, K S, and R. N. Lipcius. 1992. Relationship of habitat and spatial scale physiological state and settlement of blue crab postlarvae in Chesapeake Bay. *Marine Ecology Progress Series* 82: 143–150.
- Millikin, M. R, and A. B. Williams. 1984. Synopsis of biological data on the blue crab *Callinectes sapidus* Rathbun. NOAA. NOAA Technical Report.
- Miller, J.M., Burke, J.S., and G.R. Fitzhugh. 1991. Early life history patterns of Atlantic North American flatfish: likely (and unlikely) factors controlling recruitment. *Netherlands Journal of Sea Research* 27 (3/4): 261-275.
- Miller, M.H., Carlson, J., Cooper, P., Kobayashi, D., Nammack, M., and J. Wilson. 2013. Status review report: scalloped hammerhead shark (*Sphyrna lewini*). Report to National Marine Fisheries Service, Office of Protected Resources. March 2013. 131 pp.
- Morse, W.W., Johnson, D.L., Berrien, P.L., Wilk, S.J. 1999. Essential Fish Habitat Source Document: Silver hake, *Merluccius bilinearis*, life history and habitat characteristics. NOAA Tech. Mem. NMFS-NE-135.
- Moser, M.L., and S.W. Ross. 1995. Habitat use and movements of short nose and Atlantic sturgeons in the lower Cape Fear River, North Carolina. *Transactions of the American Fisheries Society* 124:225-234.

Murdy, E.O. and J.A. Musick. 2013. Field guide to fishes of the Chesapeake Bay. Johns Hopkins University Press. 345 pp.

National Marine Fisheries Service (NMFS). 1998. Essential Fish Habitat Description, Monkfish (*Lophius americanus*). NEFMC-EFH Amendment.

National Marine Fisheries Service (NMFS) 1998. Essential Fish Habitat Description, Windowpane Flounder (*Scophthalmus aquosus*). NEFMC EFH Amendment.

National Oceanic and Atmospheric Administration/National Marine Fisheries Service (NMFS). 2009. Amendment 1 to the Consolidated HMS FMP, Chapter 5: Essential Fish Habitat. Available: [http://www.nmfs.noaa.gov/sfa/hms/documents/fmp/am1/feis/feis\\_amendment\\_1\\_chapter5.pdf#page=59](http://www.nmfs.noaa.gov/sfa/hms/documents/fmp/am1/feis/feis_amendment_1_chapter5.pdf#page=59)

National Marine Fisheries Service (NMFS). 2010. Life History Accounts and Essential Fish Habitat Descriptions. Amendment 3 FEIS, Chapter 11. Available: [http://www.nmfs.noaa.gov/sfa/hms/documents/fmp/am3/am3\\_feis/chapter\\_11.pdf](http://www.nmfs.noaa.gov/sfa/hms/documents/fmp/am3/am3_feis/chapter_11.pdf)

National Marine Fisheries Service (NMFS). 2012. Endangered Species Act Biological Opinion: Maintenance of Chesapeake Bay Entrance Channels and use of sand borrow areas for beach nourishment. Dated 16 November 2012.

National Oceanographic and Atmospheric Administration/National Marine Fisheries Section (NMFS). 2014. Guide to Essential Fish Habitat Designations in the Northeastern United States. Available: <http://www.nero.noaa.gov/hcd/webintro.html>

National Marine Fisheries Service (NMFS). 2014b. Omnibus Essential Fish Habitat Amendment 2 Volume 2: EFH and HAPC Designation Alternatives and Environmental Impacts. Available: <https://www.greateratlantic.fisheries.noaa.gov/sustainable/species/multispecies/safe/OA2%20EIS%20Volume%20%20EFH%20and%20HAPC.pdf>

National Oceanographic and Atmospheric Administration, Chesapeake Bay Office (NOAA-CBo). 2014. Chesapeake Bay Benthic data [file].

National Oceanographic and Atmospheric Administration (NOAA)/National Marine Fisheries (NMFS). 2017a. Essential Fish Habitat Mapper. Available: <http://www.habitat.noaa.gov/protection/efh/efhmapper/#>

National Oceanographic and Atmospheric Administration (NOAA)/ National Marine Fisheries (NMFS). 2017b. Essential Fish Habitat Descriptions, Clearnose skate (*Raja eglanteria*). Available at: [http://www.habitat.noaa.gov/protection/efh/newInv/EFHI/docs/Clearnose\\_Skate\\_EFH.pdf](http://www.habitat.noaa.gov/protection/efh/newInv/EFHI/docs/Clearnose_Skate_EFH.pdf)

National Oceanographic and Atmospheric Administration (NOAA)/ National Marine Fisheries (NMFS). 2017c. Essential Fish Habitat Descriptions, Little skate (*Leucoraja erinacea*). Available at: [http://www.habitat.noaa.gov/protection/efh/newInv/EFHI/docs/Little\\_Skate\\_EFH.pdf](http://www.habitat.noaa.gov/protection/efh/newInv/EFHI/docs/Little_Skate_EFH.pdf)

National Oceanographic and Atmospheric Administration (NOAA)/ National Marine Fisheries (NMFS). 2017d. Essential Fish Habitat Descriptions, winter skate (*Leucoraja ocellata*). Available at: [http://www.habitat.noaa.gov/protection/efh/newInv/EFHI/docs/Winter\\_Skate\\_EFH.pdf](http://www.habitat.noaa.gov/protection/efh/newInv/EFHI/docs/Winter_Skate_EFH.pdf)

National Marine Fisheries Service (NMFS). 2017e. NOAA Fisheries Announces the Availability of Final Amendment 10 to the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan: Essential Fish Habitat. Available: <http://www.nmfs.noaa.gov/sfa/hms/documents/fmp/am10/index.html>

National Marine Fisheries Service (NMFS). 2017f. Omnibus Essential Fish Habitat Amendment 2; Volume 2: EFH and HAPC Designation Alternative and Environmental Impacts. Available: [https://www.habitat.noaa.gov/protection/efh/efhmapper/oa2\\_efh\\_hapc.pdf](https://www.habitat.noaa.gov/protection/efh/efhmapper/oa2_efh_hapc.pdf)

- National Marine Fisheries Service (NMFS). 2018. GIS Data for Essential Fish Habitat. [Data Files]. Available: <https://www.habitat.noaa.gov/protection/efh/newInv/index.html>
- Nichols, T.A., Anderson, T.W., and Sirovic, A. 2015. Intermittent Noise Induces Physiological Stress in a Coastal Marine Fish. *PLoS One* 10(9) 1-13.
- Nightingale, B., and C. Simenstad. 2001. White Paper: Dredging A viti vi ties. Marine Issues. Submitted to Washington Department of Fish and Wildlife; Washington Department of Ecology; Washington Department of Transportation. 119 pp.
- Northeast Fisheries Science Center (NEFSC). 2011. 51st Northeast Regional Stock Assessment Workshop (51<sup>st</sup> SAW) Assessment Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 11-02; 856 p. Available from: National Marine Fisheries Service 166 Water Street, Woods Hole, MA 02543-1026. Accessed online at: <http://www.nefsc.noaa.gov/publications/crd/crd1102/>
- Orth, R.J. and K.L. Heck, Jr. 1980. Structural components of Eelgrass (*Zostera marina*) meadows in the lower Chesapeake Bay – Fishes. *Estuaries* Vol. 3, No. 4 (December), pp. 278-288.
- Overstreet, R. M., and R. W. Heard. 1978a. Food of the red drum, *Sciaenops ocellata*, from Mississippi Sound. *Gulf Research Report* 6: 131–135.
- Overstreet, R. M., and R. W. Heard. 1978b. Food of the Atlantic croaker, *Micropogonias undulatus*, from Mississippi Sound and the Gulf of Mexico. *Gulf Research Report* 6: 145–152.
- Packer, D.B., Griesbach, S.J., Berrien, P.L., Zetlin, C.A., Johnson, D.L., and Morse, W.W. 1999. Essential fish Habitat Source Document: Summer Flounder, *Paralichthys dentatus*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-151.
- Parker, J.C. 1971. The biology of spot, *Leiostomus xanthurus* Lacepede, and Atlantic croaker, *Micropogon undulatus* (Linnaeus), in two Gulf of Mexico nursery areas. Sea Grant Publication No. TAMU-SG-71-210. Texas A&M University, College Station, Texas.
- Parsons, G.R. 2006. Sharks, skates, and rays of the Gulf of Mexico: A field guide. University of Mississippi Press, Mississippi. 170 pp. CHECK
- Pearson, J.C. 1929. Natural history and conservation of the redfish and other commercial *Sciaenids* on the Texas coast. *Bur. Fish. Bull.* 64; 178-194.
- Phillips, J.M., M.T. Huish, J.H. Kerby, and D.P. Moran. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (mid-Atlantic) — spot. U.S. Fish and Wildlife Service Biological Report 82 (11.98), U.S. Army Corps of Engineers, TR-EL-82-4. 13 pp.
- Pitt, T. K. 1970. Distribution, abundance, and spawning of yellowtail flounder, *Limanda ferruginea* in the Newfoundland area of the northwest Atlantic. *J. Fish. Res. Bd. Canada* 27: 2261-2271.
- Popper, A. N., Bartol, S., & Carlson, T. (2014). Asa s3/sc1. 4 tr-2014 sound exposure guidelines for fishes and sea turtles: a technical report prepared by ansi-accredited standards committee s3/sc1 and registered with ansi. Retrieved from <http://ebookcentral.proquest.com>
- Pyle, R., and E. Cronin. 1950. The general anatomy of the blue crab *Callinectes sapidus* Rathbun. Chesapeake Biological Laboratory Publication 87, 40 p.
- Reid, R.N., Cargnelli, L.M., Griesbach, S.J., Packer, D.B., Johnson, D.L., Zetlin, C.A., Morse, W.W., and P.L. Berrien. 1999. Essential fish habitat source document: Atlantic Herring, *Clupea harengus*, life history and habitat characteristics. NOAA Technical Memorandum NMFS-NE-126; 56 pp.

- Rhoads, D.C. and J.D. Germano. 1982. Characterization of Benthic Processes Using Sediment Profile Imaging: an Efficient Method of Remote Ecological Monitoring on the Seafloor (REMOTS System). *Marine Ecology Process Series* 8:115-128
- Richard, S., D. Merriman and L. Calhoun, 1963. The biology of the little skate *Raja erinacea* Mitchill. *Bull. Bingham Ocean Coll.* 18(3):5-67.
- Richardson, J.W., Greene, C. R. Jr., Malme C. I., and Thomson, D. H. 1995. *Marine Mammals and Noise*. San Diego, CA: Academic Press.
- Robins, C.R. and G.C. Ray, 1986. A field guide to Atlantic coast fishes of North America. Houghton Mifflin Company, Boston, U.S.A. 354 p.
- Ropes, J.W. 1980. Biological and fisheries data on the Atlantic surf clam, *Spisula solidissima* (Dillwyn). Tech. Serv. Rep. 24, Woods Hole Lab., Natl. Mar. Fish. Serv., NOAA, Woods Hole, MA 02543.
- Sandoz, M., and R. Rogers. 1944. The effect of environmental factors on hatching, moulting, and survival of zoea larvae of the blue crab *Callinectes sapidus* Rathbun. *Ecology* 25: 216–228.
- Schaffner, L. C., and R. J. Diaz. 1988. Distribution and abundance of overwintering blue crabs, *Callinectes sapidus*, in the lower Chesapeake Bay. *Estuaries* 11: 68–72.
- Scharf, F. S., and K. K. Schlicht. 2000. Feeding habits of red drum (*Sciaenops ocellatus*) in Galveston Bay, Texas: Seasonal diet variation and predator-prey size relationships. *Estuaries* 23: 128–139.
- Slabbekoorn, H., Bouton, N., Van Opzeeland, I., Coers, A., ten Cate, C., Popper, A. N. 2010. A noisy spring: the impact of globally rising underwater sound levels on fish. *Trends in Ecology and Evolution* 25(7), 419-427.
- Smith, B.E. and J.S. Link. 2010. The Trophic Dynamics of 50 Finfish and 2 Squid Species on the Northeast US Continental Shelf. NOAA Technical Memorandum NMFS-NE-216. 646 pp.
- Smith, C.L., 1997. National Audubon Society field guide to tropical marine fishes of the Caribbean, the Gulf of Mexico, Florida, the Bahamas, and Bermuda. Alfred A. Knopf, Inc., New York. 720 p.
- Stanley, J. G. and D. S. Danie. 1983. Species profiles: life histories and environmental requirements of coastal fisheries and invertebrates (North Atlantic) -- white perch. U.S. Fish and Wildlife Service. Biological Report 82 (11.7), U.S. Army Corps of Engineers, TR-EL-82-4. 12 pp.
- Stehlik, L.L. 2007. Essential Fish Habitat Source Document: Spiny Dogfish, *Squalus acanthias*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-203
- Stehmann, M. and J.D. McEachran, 1978. Rajidae. In W. Fischer (ed.) *FAO Species Identification Sheets for Fishery Purposes. West Atlantic (Fishing Area 31). Volume 5.* [pag. var.]. FAO, Rome.
- Steimle, F.W., Morse, W.W., Berrien, P.L., and D.L. Johnson. 1999a. Essential Fish Habitat Source Document: Red Hake, *Urophycis chuss*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-133.
- Steimle, F. W., Zetlin, C. A., Berrien, P. L., and S. Chang. 1999b. Essential fish habitat source document: black sea bass, *Centropristis striata*, life history and habitat requirements. NOAA Technical Memorandum NMFS-NE 143.
- Steimle, F. W., Zetlin, C. A., Berrien, P. L., Johnson, D.L. and S. Chang. 1999c. Essential fish habitat source document: scup, *Stenotomus chrysops*, life history and habitat characteristics. NOAA Technical Memorandum NMFS-NE 149.

- Steiner, W.W., J.J. Luczkovich, and B.L. Olla. 1982. Activity, shelter usage, growth and recruitment of juvenile Red Hake *Urophycis chuss*. Mar. Ecol. Prog. Ser. Vol. 7: 125-135, Published February 15.
- Strasburg, D.W. 1958. Distribution, abundance, and habitats of pelagic sharks in the central Pacific Ocean. U.S. Fish. Wildl. Serv. Fish. Bull. 138(58): 335-361.
- Studholme, A.L., Packer, D.B., Berrien, P.L., Johnson, D.L., Zetlin, C.A., Morse, W.W. 1999. Essential Fish Habitat Source Document: Atlantic Mackerel, *Scomber scombrus*, Life History and Habitat Characteristics. Available: <https://www.nefsc.noaa.gov/publications/tm/tm141/tm141.pdf>
- Tagatz, M. E. 1971. Osmoregulatory ability of blue crabs in different temperature-salinity combinations. Chesapeake Science 12: 14–17.
- Tan, E., and W. A. Van Engel. 1966. Osmoregulation in the adult blue crab, *Callinectes sapidus* Rathbun. Chesapeake Science 7: 30–35.
- Terceiro, M. 2006. Summer flounder assessment and biological reference point update for 2006. 64 pp. Accessed online at: [http://www.nefsc.noaa.gov/nefsc/saw/2006FlukeReview/BRP2006\\_Review.pdf](http://www.nefsc.noaa.gov/nefsc/saw/2006FlukeReview/BRP2006_Review.pdf).
- Terceiro, M. and G.R. Shepard. 1994. The Summer Flounder, Scup, and Black Sea Bass Fishery of the Middle Atlantic Bight and Southern New England Waters. NOAA Technical Report NMFS 122.
- Todd, V. L. G., Todd, I. B., Gardiner, J. C., Morrin, E. C. N., Macpherson, N. A., DiMarzio, N. A., Thomsen, F. 2015. A review of impacts of marine dredging activities on marine mammals. ICES Journal of Marine Science, 72(2), 328-340.
- Traver, M. and L. Col. 2006. Status of Fishery Resources off the Northeastern US, NEFSC - Resource Evaluation and Assessment Division - Red hake (*Urophycis chuss*). Website Accessed: <http://www.nefsc.noaa.gov/sos/spsyn/pg/redhake/>
- US Army Corps of Engineers (USACE). 1983. Dredging and Dredged Material Disposal. U.S. Dept. Army Engineer Manual 111 0-2-5025.
- US Army Corps of Engineers (USACE). 2001. Monitoring of Boston Harbor confined aquatic disposal cells. Compiled by L.Z. Hales, ACOE Coastal and Hydraulics Laboratory. ERDC/CHL TR-01-27.
- US Army Corps of Engineers (USACE). 2014. Appendix C, Essential Fish Habitat Assessment, Piankatank River Oyster Restoration, Middlesex and Mathews Counties, Virginia.
- US Army Corps of Engineers (USACE). 2014. Technical Memo: Far-Field Surveys of Suspended Sediment Plumes Associated with Cutterhead Dredging in Jones Inlet, Long Island, New York.
- US Geologic Survey (USGS). 2017. What is the difference between consolidated and unconsolidated sediments? Available: [https://www.usgs.gov/fags/what-difference-between-consolidated-and-unconsolidated-sediments?qt-news\\_science\\_products=0#qt-news\\_science\\_products](https://www.usgs.gov/fags/what-difference-between-consolidated-and-unconsolidated-sediments?qt-news_science_products=0#qt-news_science_products)
- Van Engel, W. A. 1958. The blue crab and its fishery in Chesapeake Bay. Part 1-Reproduction, early development, growth, and migration. Commercial Fisheries Review 20: 6–17.
- Vinnichenko, V.I. 1996. New data on the distribution of some species of tuna (Scombridae) in the North Atlantic. J. of Ichth. 36(8): 679-681.
- Walter, J. F., and H. M. Austin. 2003. Diet composition of large striped bass (*Morone saxatilis*) in Chesapeake Bay. Fishery Bulletin 101: 414–423.

- Walter, J. F., A. S. Overton, K.H. Ferry, and M. E. Mather. 2003. Atlantic coast feeding habits of striped bass: a synthesis supporting a coast-wide understanding of trophic biology. *Fisheries Management and Ecology*, 10: 349–360.
- Wang, R., Shen, J., Sisson, M. 2017a. Incorporation of Sea Level Change Scenarios into Norfolk Harbor Channels Deepening Study & Elizabeth River Southern Branch Navigation Improvements Study. Final Report, Special Report No. 456, Applied Marine Science and Ocean Engineering. doi:10.21220/V5GM8Z
- Wang, R., Shen, J., Sisson, M. 2017b. Assessment of Hydrodynamic and Water Quality Impacts for Channel Deepening in the Thimble Shoals, Norfolk Harbor, and Elizabeth River Channels. Final Report, Special Report No. 454, Applied Marine Science and Ocean Engineering, Virginia Institute of Marine Science. doi:10.21220/V5R41Z.
- Weinstein, M.P. and H.A. Brooks. 1983. Comparative ecology of nekton residing in a tidal creek and adjacent seagrass meadow: Community composition and structure. *Marine Ecology Progress Series*. Oldendorf. Vol.12:15-28.
- Wenger, Amelia & Harvey, Euan & Wilson, Shaun & Rawson, Chris & Newman, Stephen & Clarke, Douglas & Saunders, Benjamin & Browne, Nicola & Travers, Michael & McIlwain, Jennifer & Erftemeijer, Paul & Hobbs, Jean-Paul & Mclean, Dianne & Depczynski, Martial & Evans, Richard. (2017). A critical analysis of the direct effects of dredging on fish. *Fish and Fisheries*. 10.1111/faf.12218.
- Wenner, C.A. and G.R. Senberry. 1989. Species composition, distribution, and relative abundance of fishes in the coastal habitat off the Southeastern United States. Marine Resources Research Institute, South Carolina Wildlife and Marine Resources Department, Charleston, South Carolina. National Oceanic and Atmospheric Administration. NOAA Technical Report NMFS 79.
- Wenner, C. A., and J. A. Musick. 1975. Food habits and seasonal abundance of the American eel, *Anguilla rostrata*, from the lower Chesapeake Bay. *Chesapeake Science* 16: 62–66.
- Wigley, S. and L. Col. 2006. Status of Fishery Resources off the Northeastern US NEFSC - Resource Evaluation and Assessment Division - Witch Flounder (*Glyptocephalus cynoglossus*). Website accessed: <http://www.nefsc.noaa.gov/sos/spsyn/fldrs/witch/>
- Wilbur, D.H. and D.G. Clarke. 2001. Biological effects of suspended sediments: A review of suspended sediment impacts on fish and shellfish with relation to dredging activities in estuaries. *North American Journal of Fisheries Management* 21:4, 855-875.
- Yancy, R.M., Welch, W.R. 1968. The Atlantic Coast Surf Clam – with a partial bibliography. United States Department of the Interior, U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries. Washington, D.C.
- Zhang, J., Wang, H., Ye, F., and Wang Z. 2017. Assessment of Hydrodynamic and Water Quality Impacts for Channel Deepening in the Thimble Shoals, Norfolk Harbor, and Elizabeth River Channels, Final report on the “hydrodynamic modeling.” Special Report No. 455, Applied Marine Science and Ocean Engineering, Virginia Institute of Marine Science. doi:10.21220/V5MF0F

# **APPENDIX A**

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Sturgeon Take Records from Dredging Operations  
1990-2012

## Sturgeon Take Records from Dredging Operations 1990 - Mar 2012

Take #	Date	Corps District	Location	Sp	Dredge Type/ Name	Status	Specimen Description	Notes	Photos	Documentation
1	30 Oct 90	SAC	Winyah Bay Georgetown	A	H <i>Ouchita</i>	Dead	~69cm, rear half	Overflow Screening	N	Chris Slay pers com Observer report DACW 60-90-C-0067
2	15 Jan 94	SAS	Savannah Harbor	A	H <i>RN Weeks</i>	NA	NA	Found by Turtle observer	No	Steve Calver pers com 14 Jun 05 Observer load sheet and final rpt #DACW21-93-C-0072
3	07 Dec 94	SAS	Savannah Harbor	A	H <i>Dodge Island</i>	Live released	71cm, whole fish	Starboard Skimmer Screening	Yes We have efile	Chris Slay pers com Observer report
4	07 Dec 94 Different Load	SAS	Savannah Harbor	A	H <i>Dodge Island</i>	Dead	77.5cm, whole fish	Starboard Skimmer Screening	Yes We have efile	Chris Slay pers com Observer report
5	Feb 96	NAP	Delaware River Newbold Island	S	P <i>Ozark</i>	Dead	83cm, female w/eggs	In DMA Money Island		NMFS memo for record From Laurie Silva 19 Apr 96
6	Feb 96	NAP	Delaware River Newbold Island	S	P <i>Ozark</i>	Dead	63cm, mature male	In DMA Money Island		NMFS memo for record From Laurie Silva 19 Apr 96
7	06 Jan 98	NAP	Delaware River Kinkora Range	S	P ??	Dead	Either 657mm or 573mm ???	In DMA Money Island	Y Not e-file	Memo for file 20 Jan 98 From Greg Wacik NAP
8	12 Jan 98	NAP	Delaware River Florence Range	S	P ??	Dead	Either 657mm or 573mm ???	In DMA Money Island	Y Not e-file	Memo for file 20 Jan 98 From Greg Wacik NAP
9	13 Jan 98	NAP	Delaware River Florence Range	S	P ??	Dead	Either 657mm or 573mm ???	In DMA Money Island	Y Not e-file	Memo for file 20 Jan 98 From Greg Wacik NAP
10	7 Sep 98	SAW	Wilmington Har Cape Fear River	A	H <i>McFarland</i>	Dead	Head only (1 ft long)	In turtle Inflow screen		Observer incident report Pers com Bill Adams- SAW 26 Jul 04
11	01 Mar 00	SAC	Charleston Harbor	A	H <i>Stuyvesant</i>	Dead	Missing head and tail	Main Overflow Screening	No	Chris Slay pers com Observer reporting forms
12	12 Apr 00	SAC	Charleston Harbor	A	H <i>Stuyvesant</i>	Dead	71.6cm, whole fish	Starboard Overflow screening	No	Chris Slay pers com Observer reporting forms

13	03 Dec 00	SAW	Wilmington Har MOTSU	A	C <i>New York</i>	Dead	82.5cm, whole fish decomposing	In bucket	Y Not e-file Payonk? ?	Chris Slay pers com Phil Payonk pers com 30 Jul 04 Bill Adams pers com 28 Jul 04 #DACW54-00-C-0013
14	24 Feb 01	SAS	Brunswick Harbor	A	H <i>RN Weeks</i>	Dead	Head only	Just mentions take on all forms, no other info.	No	Daily and Weekly Reports, Load sheet.
15	19 Jun 01	NAE	Kennebec River Bath Iron Works	A	C ??	Live released		Put in scow, released unharmed		Julie Crocker NMFS pers com 19 Jul 04 2003 Chesapeake BA, Section 7.2 Normandeau Associates, Inc 2001
16	30 Apr 03	NAE	Kennebec River Bath Iron Works	S	C Reed and Reed dredge company	Dead	Fish nearly cut in half		Y We have e-file	Julie Crocker NMFS pers com 19 Jul 04 2003 Chesapeake BA, Section 7.2 Normandeau Associates, Inc 2001
17	6 Oct 03	NAE	Kennebec River Doubling Point	S	H <i>Padre Island</i>	Dead	38.1 inches	In hopper	Y We have e-file	Observer incident report Kennebec River BA Jul 04 Memo for Commander, from Bill Kavanaugh, 1 Jul 04 Bill Kavanaugh pers com 15 Jul 04 Julie Crocker pers com 19 Jul 04
18	6 Oct 03	NAE	Kennebec River Doubling Point	S	H <i>Padre Island</i>	Dead	37.0 inches	In hopper Did not dive Probably died	Y We have e-file	Observer incident report Kennebec River BA Jul 04 Memo for Commander, from Bill Kavanaugh, 1 Jul 04 Bill Kavanaugh pers com 15 Jul 04 Julie Crocker pers com 19 Jul 04

19	6 Oct 03	NAE	Kennebec River Doubling Point	S	H <i>Padre Island</i>	Live	Swam away	In hopper	Y We have e-file	Observer incident report Kennebec River BA Jul 04 Memo for Commander, from Bill Kavanaugh, 1 Jul 04 Bill Kavanaugh pers com 15 Jul 04 Julie Crocker pers com 19 Jul 04
20	06 Oct 03	NAE	Kennebec River Doubling Point	S	H <i>Padre Island</i>	Dead	Found alive	In hopper	Y We have e-file	Observer incident report Kennebec River BA Jul 04 Memo for Commander, from Bill Kavanaugh, 1 Jul 04 Bill Kavanaugh pers com 15 Jul 04 Julie Crocker pers com 19 Jul 04
21	08 Oct 03	NAE	Kennebec River Doubling Point	S	H <i>Padre Island</i>	Live	Good condition	In hopper	Y We have e-file	Observer incident report Kennebec River BA Jul 04 Memo for Commander, from Bill Kavanaugh, 1 Jul 04 Bill Kavanaugh pers com 15 Jul 04 Julie Crocker pers com 19 Jul 04
22	07 Jan 04	SAC	Charleston Harbor	A	H <i>Manhattan Island</i>	Live	Whole fish 49 inches total length May have died later when released	Found by Coastwise turtle observers	Yes (We Have e-file)	Robert Chappell pers com 28 Jun 04 Observer daily report 7 Jan 04
23	13 Dec 04	SAM	Gulfport Harbor Channel	G	H <i>Bayport</i>	Dead	Trunk of fish 59.5cm	Found by turtle observers		Observer incident report Susan Rees pers com 7 Jan 05
24a	28 Dec 04	SAM	Mobile Bar Channel	G	H <i>Padre Island</i>	Dead	Trunk of fish 2 ft, 1 inch	Found by Turtle observers	Yes (We Have e-file)	Observer incident report Susan Rees pers com 7 Jan 05 #W91278-04-C-0049
24b	01 Jan 05	SAM	Mobile Bar Channel	G	H <i>Padre Island</i>	Dead	Head only of fish 22.5cm	2 <sup>nd</sup> part of take on 28 Dec 04	Yes taken But we Have not received	Observer incident report Susan Rees pers com 7 Jan 05 #W91278-04-C-0049

25	2 Mar 05	SAS	Brunswick Harbor	A	H <i>RN Weeks</i>	Dead	Posterior section only 60 cm section w/tail	Found by turtle observer	Yes (We Have e-file)	Chris Slay pers com 7 Jun 05 Steve Calver pers com 14 Jun 05
26	26 Dec 06	SAS	Brunswick	A	H <i>Newport</i>	Dead	Head only	Caught in port screen and turtle part caught in starboard screen	Black and white	Incident and load report
27	17 Jan 07	SAS	Savannah Entrance Channel	A	H <i>Glenn Edwards</i>	Dead	Whole fish, FL 104 cm	Fresh Dead, 60 Horseshoe crab in	Coastwise took photo	Incident and Load report
28	2 Mar 09	SAS	Savannah Entrance Channel	A	H <i>Dodge Island</i>	Dead	Total Length 111 cm	Fresh Dead, found in starboard aft inflow box,		Incident, Load and Daily report
29	6 Feb 10	SAS	Brunswick Entrance Channel	A	H <i>Glenn Edwards</i>	Dead	No measurements	Fore screen contents, Load #19 with 12 Horseshoe		No incident report, just listed on load sheet and daily summary
30	7 Feb 10	SAS	Brunswick Entrance Channel	A	H <i>Glenn Edwards</i>	Dead	No measurements	Fore screen contents, Load #25 with 20 Horseshoe crab		No incident report, just listed on load sheet and daily summary
31	2 Feb 10	SAS	Brunswick Entrance Channel	A	H <i>Bayport</i>	Dead	No measurements, head to mid body in load #193 and mid body to tail recovered in load #194.	Stbd screen contents, load #193 and overflow screen in #194,		No incident report, just listed on load sheet and daily summary
32	7 Dec 10	SAW	Wilmington Harbor	A	H <i>Terrapin Island</i>	Dead	Whole fish, FL 61 cm	Fresh Dead, water temp 12 C, air 2 C, load 6	Coastwise took photo	Incident and Load report

33	10 Apr 11	NAO	York Spit Channel	A	H Terrapin Island	Dead	Total Length 24.5" in, Fork Length 13.5", Middle of anus to Anal Fin 3.8"	During Clean up. Torn in half, only posterior from pectoral region to tail, no head. Fins and tail torn but complete		Hopper daily report from, QCR, e-mail, incident report, daily report, load sheets
34	11 Apr 11	NAO	York Spit Channel	A	H Liberty Island	Dead		During cleanup. Another piece taken on 4/13/11 matches perfectly.	Y	E-mail
35	14 Mar 12	SAC	Charleston Harbor Channel	A	H Glenn Edwards	Dead	Fresh dead, body part 26"-30" long X 13" width, no head or tail	Load 129 (0024-0345) found in starboard draghead, during cleanup mode. Given to South Carolina DNR	Yes	E-mail, load sheet, incident report
NT	25 May 05	NAO	York Spit Channel	?	H <i>McFarland</i>	Dead	Approx. 2 ft estimate from photos	Too decomposed to identify	Yes (We Have e-file)	Observer final report, REMSA 2004
NDNEF	26 Jun 96	NAN	East Rock Away Long Island	?	H Dodge Island	Dead	(~3'), couldn't identify and doesn't mention condition (fresh or dead already)? Chris Starbird.	Load sheet states Carp or sturgeon	No	Load sheet, Daily and Weekly Summary mentions. No way to confirm.
NDNEF	About 98	SAW	Wilmington Har Cape Fear River	A	P ??	Dead				NMFS 1998 Shortnose Recovery Plan p. 53
NDNEF	About 98	SAW	Wilmington Har Cape Fear River	A	C	Dead				NMFS 1998 Shortnose Recovery Plan p. 53

NDNEF	About 98	SAJ or SAS	Kings Bay	A	H ??	Dead					NMFS 1998 Shortnose Recovery Plan p. 52 Chris Slay pers com
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Sp=sturgeon species

A=Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*)

S=Shortnose sturgeon (*Acipenser brevirostrum*)

G=Gulf sturgeon (*Acipenser oxyrinchus desotoi*)

NT = Non-take incident by dredge

SAC=Charleston

SAW=Wilmington  
SAS=Savannah  
SAJ=Jacksonville  
SAM=Mobile  
NAE=New England  
NAO=Norfolk  
NAN=New York  
NAP=Philadelphia  
H=Hopper  
P=Hydraulic Cutterhead pipeline  
C=Mechanical clamshell or bucket, bucket and barge  
DMA=Dredged material disposal area  
NDNEF=No documentation, no evidence found to confirm citation

# **NORFOLK HARBOR NAVIGATION IMPROVEMENTS MEETING AREA VALIDATION STUDY/SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT PROJECT DESCRIPTION**

## **1.0 INTRODUCTION, PURPOSE, AND NEED**

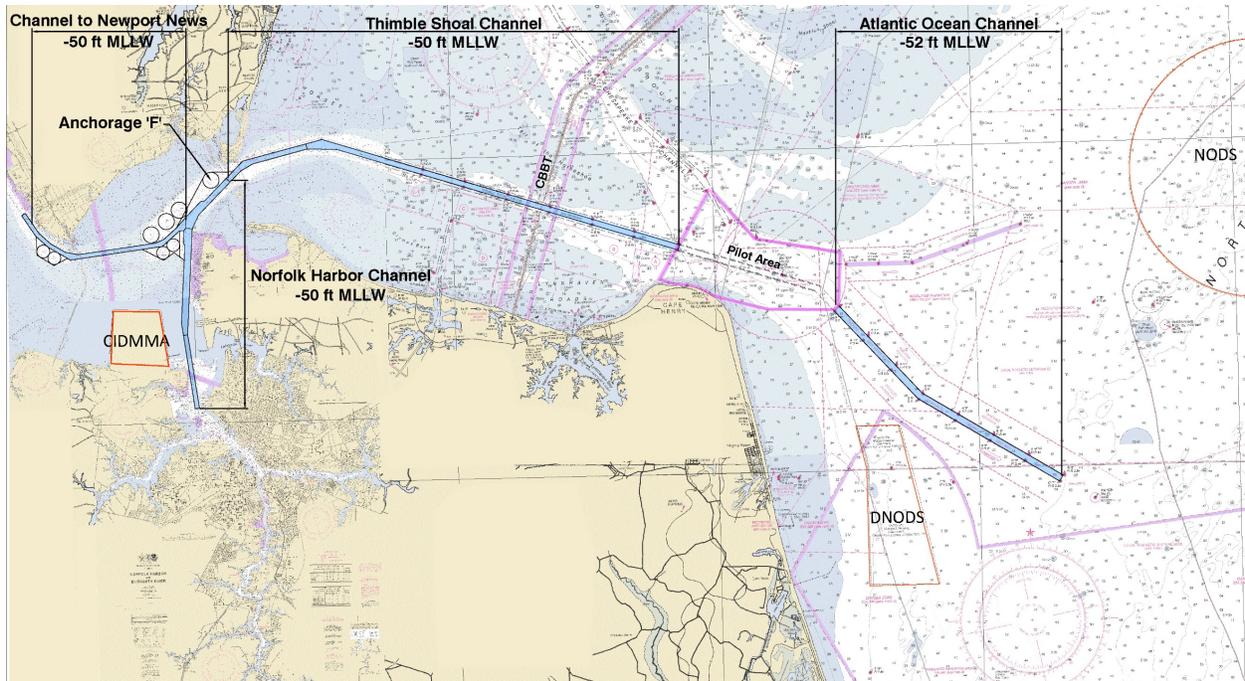
The Norfolk Harbor and Channels consists of a network of multiple channel and anchorage elements that provide deep draft access from the Atlantic Ocean into the Port of Virginia. The harbor in which the Port of Virginia is located covers a 25 square-mile area and serves a variety of private marine terminals, state-owned marine terminals, and federal maritime/military facilities located within the cities of Norfolk, Newport News, Portsmouth, Chesapeake, and Hampton in southeastern Virginia.

The purpose of the Norfolk Harbor Navigation Improvements Meeting Area Validation Study is to improve the operational efficiency of commercial vessels currently using and projected to use the Norfolk Harbor and Channels. The need for this project arises from inefficiencies currently experienced by commercial vessels within the existing Norfolk Harbor and Channels as industry adoption toward larger vessels has necessitated periodic establishment of one-way traffic within channels that normally support two-way traffic.

Updated forecasted fleet inventory and economic data is now available which warrants the reevaluation of expanding the existing, approved meeting area (Meeting Area 2) with an additional meeting area (Meeting Area 1), where two-way traffic of larger vessels can be accommodated. Compared to the forecast used during for the 2018 Norfolk Harbor Navigation Improvements General Reevaluation Report/Environmental Assessment (GRR/EA), ocean carriers have more rapidly transitioned to the ultra large container vessels than the forecast predicted, warranting a reassessment of the of the Meeting Area 1. The proposed Meeting Area 1 would consist of a widened area of the Thimble Shoal Channels that is approximately located in a 5.1 mile (statute mile)-long area west of the Chesapeake Bay Bridge Tunnel. The widening would consist of approximately 200 additional feet located north of the existing Thimble Shoal Channel and an additional 200 feet south of the existing Thimble Shoal Channel.

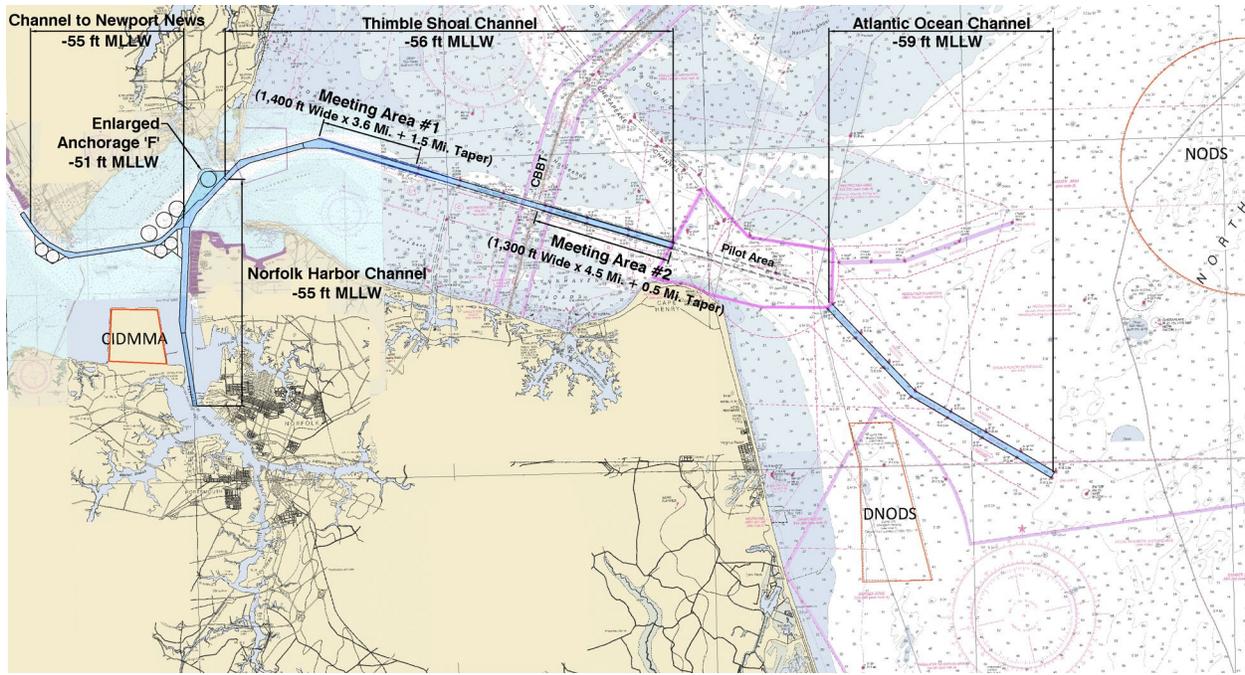
## **2.0 PROJECT SCOPE**

The Norfolk Harbor Project is a single purpose deep draft navigation project that consists of a network of federally improved channels extending from the Atlantic Ocean, through the Chesapeake Bay, and into the Port of Virginia (**Figure 1**).



**Figure 1.** The existing Norfolk Harbor and Channels from the Atlantic Ocean Channel to the Lamberts Bend. Dredged material placement/disposal sites are also depicted. CIDMMA = Craney Island Dredged Material Management Area; DNODS = Dam Neck Ocean Disposal Site; NODS = Norfolk Ocean Disposal Site

Originally authorized in the Water Resources Development Act (WRDA) of 1986 and as further defined by the 2018 Norfolk Harbor Navigation Improvements GRR/EA, the authorized and approved project includes a system of two-way, full-width channels to a depth of 55 feet in the Norfolk Harbor, 56 feet in the Thimble Shoal Channels, 55 feet in the Newport News Channel and 59 feet in the Atlantic Ocean Channel (**Figure 2**)



**Figure 2.** Norfolk Harbor and Channels Project Segments with approved project depths. Miles provided in statute miles.

Since the original authorization by WRDA, the project has been constructed in separable elements based on the needs of the port community and the financial capability of the nonfederal sponsor, the Virginia Port Authority, agent of the Commonwealth of Virginia:

- The 50 Foot Outbound Element was completed in 1989
- The 50 Foot Anchorage was completed in 1999.
- The 50 Foot Inbound Element was completed in 2007.
- The deepening of the Thimble Shoal Channel to 56 feet as described in the Norfolk Harbor Navigation Improvements GRR/EA is currently underway.

The approved project also includes Meeting Area 2, a widening of the Thimble Shoal Channel east of the Chesapeake Bay Bridge Tunnel to 1,300 feet, widening of Anchorage F to 3,620 feet and the associated modification of the Approach Area, and deepening of Anchorage F to 51 feet. The approved project includes disposal of dredged material at the Dam Neck Ocean Disposal Site (DNODS), the Norfolk Ocean Disposal Site (NODS), and the Craney Island Dredged Material Management Area (CIDMMA).

The scope of this validation study is limited to a reevaluation of the construction and maintenance of Meeting Area 1 and disposal of material dredged from the Meeting Area 1. This meeting area was partially evaluated in the approved Norfolk Harbor Navigation Improvements GRR/EA but was not included in the Recommended Plan (Preferred Alternative); only Meeting Area 2 was included in the approved Norfolk Harbor Navigation Improvements GRR/EA. However, Meeting Area 1 is being reevaluated due to ongoing concerns about the inefficiencies experienced by commercial vessels and due to changes in the fleet forecast and associated economic benefits of the project.

## **2.1 CURRENT NORFOLK HARBOR PROJECT DREDGING AND DREDGED MATERIAL PLACEMENT/DISPOSAL PRACTICES**

### **Atlantic Ocean Channel**

The Atlantic Ocean Channel, off the eastern coast of Virginia (**Figure 2**), was authorized by the WRDA of 1986. The WRDA authorized the U.S. Army Corps of Engineers (USACE) to construct the Atlantic Ocean Channel which consists of a channel 11.1 miles long, 1,300 feet wide, and 57 feet deep<sup>1</sup>. As part of the 50-foot inbound construction effort in 2006, the channel was deepened to provide for a required depth and width of 52 feet and 1,300 feet, respectively.

The Atlantic Ocean Channel is part of the Port of Virginia and Baltimore system of channels, and is the segment providing access for all ships calling on port facilities, naval bases, and shipyards in the Hampton Roads, York River and Baltimore areas. All commercial tonnage entering and leaving the Ports of Virginia and Baltimore pass through this channel. The channel is currently maintained to a full width and a required depth of 52 feet to enable loaded colliers, container ships and military vessels to transit the channel with ship drafts as great as 47 feet (45 ft with no tide restrictions).

Material is typically dredged via hopper dredge from this channel. Dredged material is placed at DNODS. Dredged material is largely fine sand that has also been beneficially used for the Virginia Beach Hurricane Protection project and the Craney Island Eastern Expansion (CIEE) Project. Due to periodic use as a sand source, maintenance dredging has not been required.

Per the Norfolk Harbor Navigation Improvements GRR/EA, deepening of the Atlantic Ocean Channel to a required depth of approximately 59 feet was approved.

### **Thimble Shoal Channel**

The Thimble Shoal Channel is located in the southern part of the Chesapeake Bay, just off the shoreline of Norfolk and Virginia Beach, east of the CIDMMA (**Figure 2**). This project was originally authorized by the River and Harbor Act of 1917. The original authorized channel dimensions were 13.4 miles long, 1,000 feet wide, between the 55 foot contours, to a depth of 55 feet. The channel has been maintained to a required depth of 50 feet. Thimble Shoal Channel extends from the deep water to the east of Hampton Roads to the deep water at the mouth of the Chesapeake Bay.

Material dredging is typically via hopper dredging. Dredged material is placed at the DNODS. The sediments of Thimble Shoal Channel to the west of the Chesapeake Bay Bridge Tunnel are predominantly clays and silts, for which beneficial use projects have not been identified. In contrast, sediments in the eastern portion of channel are largely fine to medium-grained sand and the segment is a common source of material for beach nourishment projects.

Per the Norfolk Harbor Navigation Improvements GRR/EA, deepening of the Thimble Shoal Channel to a required depth of approximately 56 feet was approved. This also included approval of Meeting Area 2 which consists of a widening of the Thimble Shoal Channel east of the Chesapeake Bay Bridge Tunnel to approximately 1,300 feet. Construction of the Thimble Shoal Channel to a depth of 56 feet is currently underway but not yet completed.

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<sup>1</sup> Please note that depths described in this document are provided in Mean Lower Low Water (MLLW).

Per the WRDA 2018, additional widening of the Thimble Shoal Channel was authorized as long as the modifications do not exceed the maximum 902 cost limitations of the previously approved project. Therefore, we are reassessing the need for an additional meeting area, Meeting Area 1 in the Norfolk Harbor Navigation Improvements Meeting Area Validation Study/Supplemental EA.

### **Channel to Newport News and Anchorages**

The Channel to Newport News and associated Newport News anchorages segment of the Norfolk Harbor Project (**Figure 2**) is authorized to 55 feet deep by 800 feet wide from Norfolk Harbor Channel in Hampton Roads to Newport News and the Newport News Anchorages. However, the channel has been maintained to a required depth of 50 feet. Material dredging is via hydraulic and/or mechanical dredging methods. Material dredged from this area is typically placed at the CIDMMA.

Per the Norfolk Harbor Navigation Improvements GRR/EA, deepening of the Newport News Channel was approved to a required depth of approximately 55 feet.

### **Norfolk Harbor Channel - Sewells Point to Lamberts Bend and Norfolk Harbor Anchorages**

The Sewells Point to Lamberts Bend reach of the Norfolk Harbor Project is located in Norfolk between Sewells Point and Lamberts Bend (**Figure 2**). This segment of the project is approximately eight miles long and varies in width between 800 feet to 1,200 feet. This reach also consists of: Anchorage F, Sewells Point East Anchorage (includes the Naval Maneuvering Area and Approach Areas), Sewells Point West Anchorage and (Approach Area), Anchorage G, and all approach areas.

The authorized project dimensions for this reach include a channel 55 feet deep and 1,200 feet wide from that depth in Hampton Roads to a point approximately 6.0 miles upstream from the Hampton Roads Bridge-Tunnel; thence 55 feet deep and 800 feet wide to Lambert Point. The Sewells Point to Lamberts Bend Channel is currently maintained to a required depth of 50 feet from the 55-foot contour in Hampton Roads (near the Hampton Roads Bridge Tunnel) to Lamberts Point.

Material is dredged from this area via hydraulic cutterhead pipeline dredge and/or a clamshell dredge. Material dredged from this area is then placed at the CIDMMA. The consistency of the dredged material in the Sewells Point to Lamberts Bend Channel is primarily silt and clay for which beneficial use projects have not been identified.

Per the Norfolk Harbor Navigation Improvements GRR/EA, deepening of the Norfolk Harbor and Channel as well as the Norfolk Harbor and Channels Entrance Area was approved to a required depth of approximately 55 feet. Per the Norfolk Harbor Navigation Improvements GRR/EA, the following was also approved:

- Widening Anchorage F to approximately 3,620 feet and associated modifications of the Approach Area; and
- Deepening Anchorage F to a required depth of approximately 51 feet.

### **Dam Neck Ocean Disposal Site**

The DNODS is located three nautical miles east of Virginia Beach (Figure 1). The DNODS area was first utilized as an ocean placement site in 1967. This ocean placement site was designated by the administrator of the U.S. Environmental Protection Agency (USEPA) in March of 1988. The DNODS runs parallel to Virginia Beach, covering about eight square nautical miles. Water depths at DNODS vary between 31 to 49 feet deep. The remaining DNODS capacity is estimated to be about 63 million cubic yards. The site is the primary dredged material disposal site for the Thimble Shoal Channel, Cape Henry Channel, and Atlantic Ocean Channel. Only material that meets ocean dumping criteria will be disposed at this site.

### **Norfolk Ocean Disposal Site**

The NODS (Figure 1) was officially designated as an ocean placement site in 1993, pursuant to Section 102 (c) of the Marine Protection, Research, and Sanctuaries Act of 1972 (as amended, 33 U.S.C. 1401 *et seq*). This ocean placement site was designated by the administrator of the USEPA in December of 1986. The site is authorized to receive new work and maintenance dredged material from the lower Chesapeake Bay. This site is also authorized to receive appropriate dredged material from the Thimble Shoal, Cape Henry, Atlantic Ocean Channel, Hampton Roads, and York Spit channels. An Environmental Impact Statement, titled: "Final Environmental Impact Statement for the Designation of an Ocean Dredged Material Disposal Site Located Offshore Norfolk Virginia" was finalized in November of 1992.

The center of the NODS is located 17 nautical miles from Virginia Beach. Water depths near the center of the site vary between 65 to 80 feet. Up to approximately 250 million cubic yard of dredged material from dredging projects (public and private) may be disposed at the site over the next 49 years. The quantity of material to be placed at the site depends on the quality of the dredged material. As with DNODS, only material that meets ocean dumping criteria will be disposed at this site.

### **Craney Island Dredged Material Management Area**

The CIDMMA is located in the City of Portsmouth in the eastern portion of the Atlantic Coastal Plain and adjacent to the confluence of the James River, Elizabeth River, and Nansemond River, and is in close proximity to the Chesapeake Bay and the Atlantic Ocean. The CIDMMA is a 2,500 acre confined disposal facility in the Hampton Roads area of Virginia. The CIDMMA was authorized by the River and Harbor Act of 1946 and constructed from 1956-1958. The federally owned facility is operated by USACE and is used by private interests, local municipalities, federal and Commonwealth of Virginia government agencies for the disposal of dredged material from Norfolk Harbor and its adjacent waterways.

Dredged material is received in two different ways at the CIDMMA. It is either pumped directly into one of three upland containment cells or it is deposited in the rehandling basin and then pumped into the facility. The Craney Island Rehandling Basin is a large deeper area off the southeast shoreline of the island that can be filled with material and then dredged once filled. Since it began operation, the CIDMMA has received, on average, 3.5 million cubic yards of dredged material per year. However, there have been several years when it has received more than 10 million cubic yards.

At present, the USACE estimates that the facility has a realistic timeline lasting until 2030. However, this may change as newer technologies and/or new management techniques are employed at the facility.

## **2.2 DREDGING AND DREDGED MATERIAL PLACEMENT PRACTICES FOR THE PREFERRED ALTERNATIVE, MEETING AREA 1**

The Preferred Alternative for the Norfolk Harbor Navigation Improvements Meeting Area Validation Study/Supplemental EA consists of constructing and maintaining the Meeting Area 1 including disposal of the dredged material. The proposed Meeting Area 1 would consist of a widened area of the Thimble Shoal Channels that is approximately located in a 5.1 mile (statute mile)-long area west of the Chesapeake Bay Bridge Tunnel (**Figure 2**). The channel widening would consist of dredging 200 additional feet along the north and south channel edges of the existing 1,000 ft wide Thimble Shoal Channel to create a 1,400 ft wide meeting area with a required depth of 56 feet to accommodate two way traffic for larger vessels. Existing conditions and geotechnical analyses of the area indicate side slopes of approximately 3H:1V are typical. As final design of the Preferred Alternative is ongoing, features may vary slightly prior to construction.

Dredged material placement/disposal could occur at the CIDMMA, DNODS, the NODS, and/or upland disposal sites for this project (if needed). It is anticipated that the DNODS placement would likely be the preferred dredged material placement option. While dredged material will be evaluated for beneficial use opportunities, the characteristics of the dredged material in vicinity of the Meeting Area 1 segment historically have not been suitable for typical projects in the region (which are generally seeking more sandier material). Portions of the dredged areas may be suitable for beneficial use projects and beneficial use projects would be coordinated separately from this project. General operation and maintenance of the CIDMMA will continue with or without implementation of the Preferred Alternative.

One important consideration in the impact analysis is that the actual dredged depths can be deeper than the required channel depths. Required depths do not necessarily indicate the maximum, potential dredging depths which may also include Advanced Maintenance Dredging (1 foot), Paid Allowable Overdepth Dredging (2 feet), and Non-Pay Allowable Overdepth dredging (2 feet) for the Norfolk Harbor Project. We refer to required depths throughout the text but in terms of the environmental impact analysis (affect determination), the estimated maximum, potential impact depths and dredging volumes will be used. For Meeting Area 1, a maximum depth of 61 feet was used to reflect these factors.

Dredges used for construction and maintenance of the Preferred Alternative would include hopper dredges, hydraulic cutterhead dredges, as well as mechanical dredges. Channel bed leveling equipment may also be used to flatten the channel bottom following dredging.

In the future, with or without implementation of the Preferred Alternative, vessel calls are anticipated to increase as compared to current conditions. However, when comparing the future with or without the project, there would be less vessel calls in the future with project as compared to the future without project because the existing, larger ships in the fleet would carry more goods, thus requiring fewer vessel calls to transport the same amount of goods.



**Figure 3.** Meeting Areas at the Thimble Shoal. The previous Norfolk Harbor Navigation Improvements GRR/EA Recommended Plan (Preferred Alternative) only included the Meeting Area 2. With the Norfolk Harbor Validation Study/Supplemental Environmental Assessment, Meeting Area 1 is being proposed as an additional meeting area.

Table 1 summarizes the approximate maximum dredging volumes, and durations with implementation of the Preferred Alternative, Meeting Area 1 based on a maximum depth of 61 feet.

Table 1 – Summary of Meeting Area 1 dredging volumes and durations

Segment	Required Depth (feet, MLLW)	Estimated Construction					Estimated Maintenance (50 Years)		Estimated Construction and Maintenance (50 Years)	
		Estimated Maximum Depth (feet, MLLW)	Estimated Maximum Dredging Volume- all allowable and nonpay (cubic yards)	Estimated Maximum Dredging Duration (months)	Estimated Total Land Disturbance - Maximum (square feet)	Change/Delta (increase) in Land Disturbance - Maximum (square feet)	Estimated 50 Year Total of Maintenance Volume (cubic yards)	Estimated 50 Year Total - Maintenance Dredging Duration (months)	Estimated Maximum Volume-Total Allowable and Non-pay + Maintenance Volume (cubic yards)	Estimated Maximum Construction + 50-year Maintenance Dredging Duration (months)
Thimble Shoal Channel Meeting Area 1 (5.1 miles that are 200 feet north and south of the existing Thimble Shoal Channel)	-56	-61	6,170,000	18 <sup>A</sup>	11,863,428	11,863,428	2,607,750	36	8,777,750	54

<sup>A</sup>18 months is active dredging duration based on one large hopper dredge being assigned to the project. Duration of work will extend across at least one 2.5 month-long voluntary seasonal dredging restriction that could extend the total duration to approximately 21 months.

### 2.3 PROJECT SCHEDULE AND DREDGING FREQUENCIES

Construction is anticipated to begin in approximately 2023 but is contingent on funding availability. Construction of the Meeting Area 1 will take approximately two years to complete. Maintenance dredging is anticipated to occur approximately every three to four years; after the deepening, this may accelerate to every two to three years.

Maintenance dredging may occur on an accelerated schedule based on shoaling conditions in the channel resulting from storm events or a delayed schedule depending on funding availability. Maintenance dredging will take approximately three months to complete and will be contingent on the type and size of the dredge used. Maintenance dredging may occur at any time of the year, however, to the maximum practical extent possible, dredging using a hopper dredge will not occur during September 1 - November 15 to reduce potential impacts to sea turtles. Dredging operations may be active 24 hours per day, 7 days per week, though two to three times per day, a hopper dredge will suspend dredging to transit to the disposal area, which represents a round trip transit time of 4 to 5 hours per trip.

## **2.4 FUTURE CONDITIONS**

The number of future vessel calls to Norfolk Harbor is projected to increase over time due to the projected increase in future cargo tonnage under both without and with-project conditions. The projected amount of future cargo would not be affected by implementation of the project, but the number of projected future vessel calls would be fewer under the with-project condition. Under the with-project condition, the deeper channel would allow some vessels to load more cargo (increasing vessel draft deeper than the existing 47-foot restriction) and would allow for the use of larger vessels.

Currently and under without-project conditions, the largest vessels using Norfolk Harbor require a one-way traffic restriction when transiting. This restriction causes some vessels to be delayed (either waiting at the dock or waiting out at sea) while the large vessel is transiting the channel. After the large vessel has finished its transit, the other vessels can enter the channel. Under with project conditions with a wider channel provided by Meeting Area 1, the one-way restriction would be reduced, resulting in fewer vessel delays.

Life Stage and Species	Meeting Area	Placement Sites
E = Eggs; L = Larvae; J = Juvenile; A = Adult; N = Neonate; n/a = not found; HAPC = Habitat Area of Particular Concern	CSD, M	Ocean Disposal (NODS & DNODS)
<b>Atlantic Highly Migratory Species</b>		
albacore tuna ( <i>Thunnus alaguna</i> )	n/a	J
bluefin tuna ( <i>Thunnus thynnus</i> )	n/a	J, A
skipjack tuna ( <i>Katsuwonus pelamis</i> )	n/a	J, A
yellowfin tuna ( <i>Thunnus albacores</i> )	n/a	J
<b>Coastal Demersal Fishes</b>		
black sea bass ( <i>Centropristus striata</i> )	J, A	L, J, A
red hake ( <i>Urophycis chuss</i> )	E, L, J, A	E, L, J
scup ( <i>Stenotomous chrysops</i> )	J, A	J, A
summer flounder ( <i>Paralichthys dentatus</i> )	L, J, A	E, L, J, A
surf clam ( <i>Spisula solidissima</i> )	n/a	J, A
windowpane flounder ( <i>Scophthalmus aquosus</i> )	J, A	E, L, J, A
witch flounder ( <i>Glyptocephalus cynoglossus</i> )	n/a	E, L
yellowtail flounder ( <i>Limanda ferrunginea</i> )	n/a	L
<b>Coastal Pelagic Fishes</b>		
Atlantic butterfish ( <i>Peprilus triacanthus</i> )	E, L, J, A	E, L, J, A
Atlantic mackerel ( <i>Scomber scombrus</i> )	n/a	J, A
Atlantic sea herring ( <i>Clupea harengus</i> )	n/a	J, A
<b>Coastal Pelagic Fishes Continued</b>		
bluefish ( <i>Pomatomus saltarix</i> )	J, A	E, L, J, A
longfin inshore squid ( <i>Loligo pealeii</i> )	n/a	E, J, A
northern shortfin squid ( <i>Illex illecebrosus</i> )		
<b>Sharks</b>		
angel shark ( <i>Squatina dumeril</i> )	n/a	N, J, A
Atlantic sharpnose shark ( <i>Rhizopriondon terranovae</i> )	J, A	J, A
blacktip shark (Atlantic stock) ( <i>Carcharhinus limbatus</i> )	n/a	J, A
common thresher shark ( <i>Alopias vulpinus</i> )	n/a	N, J, A
dusky shark ( <i>Carcharhinus obscurus</i> )	n/a	N, J, A

sand tiger shark ( <i>Carcharia taurus</i> )	N, J, A	N, J, A
sandbar shark ( <i>Carcharhinus plumbeus</i> )	N, J	N, J, A
sandbar shark ( <i>Carcharhinus plumbeus</i> )*	HAPC	HAPC
smooth dogfish ( <i>Mustelus canis</i> )	n/a	N, J, A
spiny dogfish ( <i>Squalus acanthias</i> )	n/a	J**, A
tiger shark ( <i>Galeocerdo cuvieri</i> )	n/a	J, A
<b>Skates</b>		
winter skate ( <i>Leucoraja ocellata</i> )	A	J
little skate ( <i>Leucoraja erinacea</i> )	A	J
<b>Skates Continued</b>		
clearnose skate ( <i>Raja eglanteria</i> )	J, A	J, A



# Essential Fish Habitat Dredge Area Buffers

-  Channels
-  Meeting Area 1

-  Cutterhead Dredge 1,000FT Buffer
-  Clamshell Dredge 2,000FT Buffer
-  Hopper Dredge 2,400FT Buffer



Map: NorfolkHarbor\_55\_Project.aprx  
 Developed By: Kevin White  
 Date of Map: 10/13/2021





UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL MARINE FISHERIES SERVICE  
GREATER ATLANTIC REGIONAL FISHERIES OFFICE  
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OCT 05 2018

Susan Conner  
Chief, Planning and Policy Branch  
and  
Keith Lockwood  
Chief, Operations Branch  
Department of the Army  
Norfolk District Corps of Engineers  
Fort Norfolk  
803 Front Street  
Norfolk, Virginia 23510-1011

**Re: Re-Initiation of ESA Consultation – Norfolk Harbor Navigation Improvements and Craney Island Eastward Expansion Projects**

Dear Ms. Conner and Mr. Lockwood:

Enclosed is the biological opinion (Opinion), issued under Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, for the U.S. Army Corps of Engineers' (USACE) Craney Island Eastward Expansion Project and Norfolk Harbor Navigation Improvements Project, as well as 50 years of maintenance dredging of the Federal navigation channels from Chesapeake Bay to the Sea (to previously authorized depths) and associated beach nourishment projects.

In this Opinion, we conclude that the proposed action is likely to adversely affect, but not likely to jeopardize the continued existence of the threatened Gulf of Maine Distinct Population Segment (DPS) of Atlantic sturgeon, the endangered New York Bight, Chesapeake Bay, South Atlantic and Carolina DPSs of Atlantic sturgeon, the threatened Northwest Atlantic DPS of loggerhead sea turtles, endangered green sea turtles, or endangered Kemp's ridley sea turtles. We also conclude that the proposed action may affect, but is not likely to adversely affect, shortnose sturgeon, endangered hawksbill sea turtles, endangered leatherback sea turtles, endangered North Atlantic right whales, endangered sperm whales, endangered sei whales, endangered blue whales, or endangered fin whales. Lastly, we conclude that the proposed action may affect, but is not likely to adversely affect critical habitat designated for the Chesapeake Bay DPS of Atlantic sturgeon.

This document replaces the previous opinion covering these activities:

- 2012 Opinion: Chesapeake Bay Entrance Channels and Beach Nourishment Projects



In addition to considering effects of the dredging operations, the Opinion considers effects of taking fin clips from Atlantic sturgeon for genetic testing and relocation trawling to minimize the number of sea turtles exposed to effects of dredging.

Our Opinion includes an Incidental Take Statement (ITS), which is an exemption from the prohibition of take of listed species. Incidental take is defined as “take of listed fish or wildlife species that results from, but is not the purpose of carrying out an otherwise lawful activity conducted by a Federal agency or applicant” [50 CFR §402.02]. “Otherwise lawful activities” are those actions that meet all state and federal legal requirements, including any state endangered species laws or regulations, except for the prohibition against taking in ESA Section 9. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not prohibited under the ESA, provided that such taking is in compliance with the terms and conditions of this ITS.

#### Application of Reasonable and Prudent Measures

The ITS specifies reasonable and prudent measures (RPMs) necessary to minimize and monitor take of Atlantic sturgeon and sea turtles. The measures described in the ITS are non-discretionary, and must be undertaken by you so that they become binding conditions for the exemption in section 7(o)(2) to apply. You have a continuing duty to regulate the activity covered by the ITS. If you (1) fail to assume and implement the terms and conditions or (2) fail to require any contractors to adhere to the terms and conditions of the ITS through enforceable terms that are added to permits and/or contracts as appropriate, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, you must report the progress of the action and its impact on listed species to us as specified in the ITS [50 CFR §402.14(i)(3)] (See U.S. Fish and Wildlife Service and National Marine Fisheries Service’s Joint Endangered Species Act Section 7 Consultation Handbook (1998) at 4-49).

#### Revised Reasonable and Prudent Measures (RPMs) and Terms and Conditions (TC)

Per our discussions with you during the consultation, we have worked together to update and revise the RPMs and TCs based on the best available science and new information to minimize and monitor take. We are pleased that our extensive technical discussions allowed us to collaboratively finalize the applicable RPMs and TCs for the re-initiated projects as outlined below. These updated RPMs will apply to the construction and maintenance dredging activities implemented under the Norfolk Harbor Channels Navigation Improvements and Craney Island Eastward Expansion projects. These RPM and their implementing TCs were updated based on the best information available with respect to monitoring the impact of incidental take. These RPMs also reflect updates to our policy regarding the action agency’s financial responsibilities related to monitoring and minimizing the impacts of incidental take. Although the updated RPMs in this biological opinion only apply to those dredging activities that we re-initiated, we updated them with the expectation that all the action agencies included under this Opinion would voluntarily implement these revised mitigation and monitoring measures before any future re-initiation of consultation and commencement of ongoing or new projects. The revised RPMs and TCs are included in the biological opinion. A summary document is attached that outlines the three main issues that we discussed, your comments and our proposed resolution.

### Conclusion

This concludes formal consultation on the proposed actions. As provided in 50 CFR §402.16, re-initiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of taking specified in the incidental take statement is exceeded; (2) new information reveals effects of the action that may not have been previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species; or (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, section 7 consultation must be reinitiated immediately.

Finally, any future batch biological opinion shall include updated information for projects which are not being re-initiated, including but not limited to updated volumes of material dredged to date. Thus, prior to initiation of consultation, the incoming request for consultation (the biological assessment (BA)) from the action agency or agencies will need to include project updates for all project activities, including those activities conducted by other action agencies and considered in the new batch biological opinion. The lead Federal action agency requesting re-initiation of consultation will coordinate with the remaining Federal action agencies, (i.e. U.S. Navy, BOEM, U.S. Environmental Protection Agency, USACE Baltimore District, or USACE Norfolk District) regarding the need for re-initiation for projects under their jurisdiction. Regardless of whether one or more Federal action agencies are requesting re-initiation, one lead Federal action agency will be identified. Either on their own or in cooperation with other action agencies, the lead Federal agency will submit one BA, which we will review for adequacy and completeness. When we have determined that the BA contains all information necessary to initiate consultation on those projects for which re-initiation was requested as well as updated information on remaining projects, we will send a letter to the lead Federal agency to provide notice that formal consultation has been initiated.

Thank you for working cooperatively with my staff throughout the consultation process. We look forward to continuing to work cooperatively with your office to minimize the effects of dredging projects in the Norfolk District on listed species. Should you have any questions about this correspondence please contact Brian D. Hopper at (410) 573-4592 or by e-mail (brian.d.hopper@noaa.gov).

Sincerely,



Jennifer Anderson  
Acting Assistant Regional Administrator  
for Protected Resources

Attachment – Summary of ACOE / NMFS Discussion of several RPMs and TC

Ecc: O'Brien, NOAA/HCD; Pruhs, ACOE/Norfolk District; Logalbo, ACOE/Norfolk District; Ostrofski, ACOE/Baltimore District; Bassi, Navy; Kubico, EPA; Reidenaucr, BOEM

PCTS: NER-2018-14816

File Code: H:\Section 7 Team\Section 7\Non-Fisheries\ACOE\Formal\2018\Norfolk\Norfolk Harbor and CIEE

**Attachment:**

**Summary of ACOE / NMFS Discussion of several RPMs and TC**

**Issue 1: Sea Turtle Necropsy**

NMFS RPM	NMFS <i>Current</i> TC	ACOE Comment	NMFS <i>Revised</i> TC
All sea turtle captures, injuries, or mortalities and any sea turtle sightings in the action area must be reported to us within 12 hours.	If the cause of death is unknown (e.g., dead sea turtles that may have been incidentally collected during dredging or found along the coastline (e.g., beaches) within two weeks of when dredge operations occurred, with injuries consistent with dredges, in an area where the carcass reasonably could have drifted from dredge operations), you are responsible for the cost of any necropsies	USACE cannot comply with this RPM. Through technical meetings, NMFS indicated that they have not been able to conclusively link cause of death of any stranded sea turtle to dredge operations (to date). The proposed protocol has not been successfully implemented to date, has limited sample size (i.e. 8 cases cited), little or no peer reviewed research has been conducted to support the approach (i.e. only C. Trapani memo cited), implementation may lead to double counting of incidental take, implementation could incentivize determining conclusive linkage if monetary re-imbursement is included. NMFS indicated that they expect this to be rarely implemented, since they have not been able to conclusively link through necropsy, therefore this RPM will not significantly contribute to monitoring of incidental take but conversely causes USACE significant fiscal, contractual, and project issues with little successful history to support implementation	If the cause of death is unknown, dead sea turtles found along the coastline (e.g., beaches) within two weeks of when dredge operations occurred in the Norfolk Harbor Navigation Channels and in an area where the carcass reasonably could have drifted from dredge operations, will have the mortality assigned to the incidental take statement if a necropsy determines that the death was due to injuries sustained from an interaction with dredge gear (using the process outlined in the November 27, 2017, stranding/dredge take memo).

**Resolution**

Although your comments indicated that you would prefer to remove this RPM, we maintain our position regarding this approach and include this RPM because, in some cases, when the cause of death is uncertain, a necropsy may be necessary to aid in the determination of whether or not a mortality should count toward the ITS. This is essential for monitoring the level of incidental take associated with the proposed action. We also believe that the outcome of the necropsy would benefit you by ensuring that takes are not erroneously attributed to the ITS. We have modified this RPM and TC to remove the obligation for the ACOE to pay for the necropsy at this time and will instead gather more information and experience with necropsies of sea turtles until such time that we have sufficient data to revisit this approach.

## Issue 2: Sea Turtle Rehabilitation

NMFS RPM	NMFS TC	ACOE <i>Proposed</i> TC	NMFS <b>Revised</b> TC
You shall ensure that all measures are taken to protect any turtles or sturgeon that survive entrainment in a hopper dredge.	You must make arrangements with a NMFS-approved facility that agrees to receive any sea turtles injured during dredging. This arrangement must include procedures for transferring these turtles to the care of the facility and arrangements for the funding of any necessary care and/or rehabilitation. This plan must be developed in cooperation with our Sea Turtle Stranding Coordinator and is subject to approval by us. <b>This plan must be in place and approved before December 31, 2018.</b>	<b>Within USACE legal and fiscal authority,</b> you must make arrangements with a NMFS-approved facility that agrees to receive any sea turtles injured during dredging. This arrangement must include procedures for transferring these turtles to the care of the facility and arrangements for the funding of any necessary care and/or rehabilitation. This plan must be developed in cooperation with our Sea Turtle Stranding Coordinator and is subject to approval by us.	You must make arrangements with a NMFS-approved facility that agrees to receive any sea turtles injured during dredging. This arrangement must include procedures for transferring these turtles to the care of the facility. <b>To the extent authorized by law,</b> arrangements must address funding of any necessary care and/or rehabilitation. This plan must be developed in cooperation with our Sea Turtle Stranding Coordinator and is subject to approval by us. <b>This plan must be in place and approved before December 31, 2019.</b>

### Resolution

The Norfolk District informed us that they are not opposed to this requirement; however, you are trying to determine a way to support it through a funding mechanism. The revised version we received from you had deleted the deadline for getting a plan approved by the end of December 2018 and instead, we have extended the deadline to December 31, 2019.

Before the end of this year, we will develop and provide Standard Operating Procedures and Guidance Documents for complying with the RPM and TC, and development of a Rehabilitation Plan.

### Issue 3: Atlantic Sturgeon Genetic Analysis

NMFS RPM	ACOE <i>proposed</i> RPM	NMFS <b>Revised</b> RPM
All Atlantic sturgeon captured must have a fin clip taken for genetic analysis. This sample must be transferred to the archive at USGS.	All Atlantic sturgeon captured must have a fin clip taken for genetic analysis. This sample must be transferred to a laboratory capable of performing the genetic analysis.	All Atlantic sturgeon captured must have a fin clip taken for genetic analysis. This sample must be transferred to a NMFS-approved laboratory capable of performing the genetic analysis.
NMFS TC	ACOE <i>Proposed</i> TC	NMFS <b>Revised</b> TC
You must ensure that fin clips are taken (according to the procedure outlined in Appendix D) of any Atlantic sturgeon captured during the project (including relocation trawling) and that the fin clips are sent to USGS for genetic analysis. Fin clips must be taken prior to preservation of other fish parts or whole bodies. You are responsible for the cost of the genetic analysis.	You must ensure that fin clips are taken (according to the procedure outlined in Appendix D) of any Atlantic sturgeon captured during the project (including relocation trawling) and that the fin clips are sent to suitable laboratory capable of performing genetic analysis. Fin clips must be taken prior to preservation of other fish parts or whole bodies. You are responsible for the cost of the genetic analysis if determined to be within USACE legal and fiscal authority.	You must ensure that fin clips are taken (according to the procedure outlined in Appendix D) of any Atlantic sturgeon captured during the project (including relocation trawling) and that the fin clips are <b>sent to a NMFS approved laboratory</b> capable of performing genetic analysis. Fin clips must be taken prior to preservation of other fish parts or whole bodies. <b>To the extent authorized by law</b> , you are responsible for the cost of the genetic analysis.

### Resolution

We agree that the genetic analysis could be conducted at alternate locations as long as the laboratory possesses the materials and facilities to perform the testing. By the end of the year, we will provide you with Standard Operating Procedures and guidance documents for complying with the RPM and TC, which includes criteria for accepting alternate laboratory facilities and a step-by-step process for submitting samples to USGS for archiving.

Marine mammal species in stranding records from Virginia, 1988-2013. Threatened and endangered species and documented occurrences of marine mammals in the Region of Influence per survey and/or marine stranding data are also indicated (Aschettino et al. 2017-2015; Swingle et al. 2017-2010; Barco and Swingle 2014).

<b>Taxonomic Category/Common Name</b>	<b>Scientific Names</b>	<b>Strandings</b>
<b>Baleen Whales</b>		
Bryde's whale	<i>Balaenoptera brydei</i>	historic
Fin whale <sup>^*</sup>	<i>Balaenoptera physalus</i>	11
Humpback whale <sup>^</sup>	<i>Megaptera novaeangliae</i>	33
Minke whale <sup>^</sup>	<i>Balaenoptera acutorostrata</i>	9
Northern right whale <sup>^*</sup>	<i>Eubalena glacialis</i>	4
Sei whale <sup>^*</sup>	<i>Balaenoptera borealis</i>	2
<b>Delphinids</b>		
Atlantic spotted dolphin	<i>Stenella frontalis</i>	4
Atlantic white-sided dolphin	<i>Lagenorhynchus acutus</i>	14
Bottlenose dolphin <sup>^</sup>	<i>Tursiops truncatus</i>	1,593
Clymene dolphin	<i>Stenella clymene</i>	C. Potter, pers. Comm
Common dolphin <sup>^</sup>	<i>Delphinus delphis</i>	98
Long-finned pilot whale <sup>^</sup>	<i>Globicephala melas</i>	14
Melon headed whale	<i>Peponocephala electra</i>	2
Pantropical spotted dolphin	<i>Stenella attenuata</i>	historic
Pygmy killer whale <sup>^</sup>	<i>Feresa attenuata</i>	3
Risso's dolphin <sup>^</sup>	<i>Grampus griseus</i>	22
Rough toothed dolphin	<i>Steno bredanensis</i>	14
Short-finned pilot whale <sup>^</sup>	<i>Globicephala macrorhynchus</i>	7
Striped dolphin <sup>^</sup>	<i>Stenella coeruleoalba</i>	16
<b>Other toothed whales</b>		
Cuvier's beaked whale	<i>Ziphius cavirostris</i>	historic
Dwarf sperm whale	<i>Kogia sima</i>	10
Gervais' beaked whale	<i>Mesoplodon europaeus</i>	6
Harbor porpoise <sup>^</sup>	<i>Phocoena phocoena</i>	318
Pygmy sperm whale	<i>Kogia breviceps</i>	24
Sowerby's beaked whale	<i>Mesoplodon bidens</i>	2

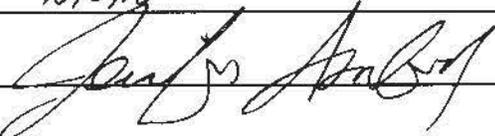
<b>Taxonomic Category/Common Name</b>	<b>Scientific Names</b>	<b>Strandings</b>
Sperm whale*^	<i>Physeter macrocephalus</i>	1
True's beaked whale	<i>Mesoplodon mirus</i>	1
<b>Pinnipeds</b>		
Grey seal^	<i>Halichoerus grypus</i>	15
Harbor seal^	<i>Phoca vitulina</i>	82
Harp seal^	<i>Pagophilus groenlandica</i>	38
Hooded seal	<i>Cystophora cristata</i>	12
<b>Sirenians</b>		
West Indian manatee*	<i>Trichechus manatus</i>	annual sightings
<p>*Species is Federally listed in Virginia under the protection of the Endangered Species Act.  ^Documented to occur in the Region of Influence based on survey and/or stranding data.  'Historic' refers to published accounts for the species. For these species, no animals were documented in the Virginia stranding record from 1988-2013</p>		

**NATIONAL MARINE FISHERIES SERVICE  
ENDANGERED SPECIES ACT  
BIOLOGICAL OPINION**

**Action Agencies:** Army Corps of Engineers (USACE), Norfolk District (lead)  
USACE Baltimore District  
Bureau of Ocean Energy Management  
U.S. Environmental Protection Agency  
U.S. Navy

**Activity Considered:** Construction and Maintenance of Chesapeake Bay Entrance  
Channels and use of sand borrow areas for beach nourishment  
**F/NER/2018/14816**

**Conducted by:** National Marine Fisheries Service  
Greater Atlantic Regional Fisheries Office

**Date Issued:** 10/5/18  
**Approved by:** 

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## **1.0 INTRODUCTION**

This constitutes the biological opinion (Opinion) of NOAA's National Marine Fisheries Service (NMFS) issued pursuant to Section 7 of the Endangered Species Act (ESA) of 1973, as amended, on the effects of the following projects:

- Cape Henry Channel;
- York Spit Channel;
- Rappahannock Shoal;
- York River Entrance Channel;
- Sandbridge Beach Nourishment and Hurricane Protection Project;
- Virginia Beach Hurricane Protection Project;
- Thimble Shoals Channel;
- Atlantic Ocean Channel;
- Norfolk Harbor Channels;
- Craney Island Eastward Expansion; and,
- Dredged Material Disposal Areas: Dam Neck Ocean Disposal Site, Wolf Trap Alternate Placement Site, Rappahannock Shoal Deep Alternate Open Water Site, Craney Island Dredged Material Management Area, and, Norfolk Ocean Dredged Material Disposal Site.

The basis for this Opinion come from information provided in the Biological Assessments (BAs) dated March 2018, past consultations with the USACE Norfolk and Baltimore Districts and scientific papers and other sources of information as cited in this Opinion. We will keep a complete administrative record of this consultation at our Greater Atlantic Regional Fisheries Office. This Opinion replaces the following Opinion, which is hereby withdrawn: Maintenance of Chesapeake Bay Entrance Channels and Use of Sand Borrow Areas for Beach Nourishment (October 16, 2012). This consultation was initiated on March 14, 2018. A draft of the Reasonable and Prudent Measures and Terms and Conditions was sent to you on June 20, 2018. A complete draft of the Opinion was provided to you on June 26, 2018 and September 24, 2018.

## **2.0 CONSULTATION HISTORY**

Consultation between USACE and NMFS on effects of dredging in the Chesapeake Bay navigation channels and borrow areas has been ongoing since the 1980s. We have completed numerous consultations, culminating in four separate biological opinions, most of which have been reinitiated multiple times (see below for detailed history). In all of these Opinions we concluded that the proposed dredging was likely to adversely affect, but not likely to jeopardize any species of listed sea turtle and was not likely to adversely affect any species of listed whales. In February 2012, we published two final rules listing five Distinct Population Segments (DPS) of Atlantic sturgeon. The New York Bight, Chesapeake Bay, South Atlantic and Carolina DPSs

are listed as endangered and the Gulf of Maine DPS is listed as threatened. Reinitiation of consultation is required if: (a) the amount or extent of taking specified in the ITS is exceeded; (b) new information reveals effects of these actions that may affect listed species or critical habitat in a manner or to an extent not previously considered; (c) any of the identified actions are subsequently modified in a manner that causes an effect to the listed species that was not considered in the Opinion; or (d) a new species is listed or critical habitat designated that may be affected by the identified actions (50 CFR § 402.16).

Following the listing of Atlantic sturgeon, you prepared BAs to supplement the BAs prepared previously for the channels and dredged material disposal areas listed in Section 1.0. These BAs were submitted to us along with requests to reinitiate consultation and produce new Biological Opinions. Because the actions considered in those Opinions were similar, they took place in the same geographic area, and affected the same species in the same manner, we determined it would be most efficient to combine the analysis of effects of continued dredging of these channels and borrow areas into one consultation. As such, while there were seven independent actions considered (i.e., dredging Baltimore Harbor Entrance Channels, York River Entrance Channel, Sandbridge Shoal, Virginia Beach Nourishment, Port of Norfolk Entrance Channels, Norfolk Harbor Channels and Craney Island Eastward Expansion), we produced one Biological Opinion. This type of “multi-action” consultation is contemplated in the NMFS-USFWS Section 7 Consultation Handbook (see page 5-5), and is referred to as a Batch Opinion. Further below, we detail the consultation history for each of these activities.

Additionally, on August 17, 2017, we published a final rule designating critical habitat for all five DPSs of Atlantic sturgeon (82 FR 39160; effective date September 18, 2017). A portion of the action area for this consultation overlaps with the James River unit of critical habitat designated for the Chesapeake Bay DPS, the effects to which are analyzed in this Opinion.

On September 28, 2017, and December 20, 2017, we received your Biological Assessments and letters requesting reinitiation of formal consultation to assess the potential impacts of dredging and placement activities associated with the Craney Island Eastward Expansion Project and Norfolk Harbor Navigation Improvements Project, respectively. In your requests, you stated that reinitiation had been triggered due to changes in the project that introduce effects not previously considered as well as the need to consider Atlantic sturgeon critical habitat that was designated in August, 2017 (not included in the Batch Opinion in 2012). In emails dated January 4, 2018, and February 5, 2018, we requested additional information from you before we could initiate consultation. We received a revised BA for the Norfolk Harbor Navigation Improvement Project on March 5, 2018. We received the revised BA for the Craney Island Eastward Expansion Project on March 14, 2018. On April 12, 2018, we sent you a letter with our determination that we had received all of the information necessary to reinitiate consultation on the Norfolk Harbor Navigation Improvement Project and the Craney Island Eastward Expansion Project with updates to the remaining project included in the 2012 Batch Opinion. We determined that we initiated consultation on March 14, 2018.

## **2.1 Norfolk Harbor -- Thimble Shoals and Atlantic Ocean Channel**

Previous consultations for Thimble Shoals Channel regarding maintenance dredging operations were conducted on April 16, 1984, March 14, 1985, March 20, 1985, and March 10, 1986 and

were concluded informally due to scheduling of dredging outside of the time of year when sea turtles would be present. Formal consultation for dredging activities in Thimble Shoals Channel (TSC) and Atlantic Ocean Channel (AOC) was initiated on April 14, 1999; a biological opinion was issued on February 7, 2001. Consultation was re-initiated on March 30, 2001 to account for sand borrow for beach nourishment in Atlantic Ocean Channel and associated impacts to listed sea turtles and other listed species. An amendment to the February 7, 2001 biological opinion was issued on May 30, 2001. You requested re-initiation of consultation on August 15, 2001 due to a change in the scope of the project; a revised biological opinion was issued on September 6, 2001. On December 4, 2001, you re-initiated consultation on the 50-foot deepening of the Norfolk Harbor and Channels project, which would require the removal of a total of up to 7.5 million cubic yards in the inner Norfolk Harbor and 5 million cubic yards of dredged material from TSC and AOC. In response to the request for re-initiation, we issued a biological opinion on April 25, 2002. In this biological opinion, we concluded that the proposed dredging may adversely affect but is not likely to jeopardize the continued existence of any listed species. An ITS was included with this biological opinion, exempting the lethal take of up to 18 loggerhead and 4 Kemp's ridley sea turtles during each dredge event and the non-lethal capture of an "unquantifiable" number of loggerheads and Kemp's ridleys during each relocation trawling event. Most recently, we issued a biological opinion in response to a request for re-initiation on October 16, 2012. In this biological opinion, we concluded that the proposed dredging may adversely affect but is not likely to jeopardize the continued existence of any listed species. An ITS was included with the 2012 biological opinion, exempting the lethal take of up to 151 loggerhead, 13 Kemp's ridley and 3 green sea turtles, and 25 Atlantic sturgeon, incidental to hopper dredging activities at Thimble Shoals and the Atlantic Ocean Channel over the course of 50 years.

## **2.2 Baltimore Harbor Entrance Channels and York River Entrance Channel**

Formal consultation for dredging activities in Cape Henry Channel (CHC), York Spit Channel (YSC), Rappahannock Shoal Channel (RSC), and York River Entrance Channel (YEC) was initiated on May 18, 1993. We issued a biological opinion on October 6, 1993. Consultation was re-initiated on October 12, 2001, to account for greater dredging quantities, project durations, and associated impacts to listed sea turtles; we issued a new biological opinion on January 24, 2002. In letters dated January 15 and February 6, 2003, you requested re-initiation of consultation as the exempted level of take was exceeded in 2002. We issued a new biological opinion on July 24, 2003. We concluded that the proposed dredging was not likely to jeopardize the continued existence of any listed species. An ITS was included, exempting the annual lethal take of up to 18 loggerhead, up to 4 Kemp's ridley and 1 green sea turtle, depending on the volume of material removed from the channels. The ITS also exempted the capture of up to 120 sea turtles (loggerhead, Kemp's ridley and green) and one lethal take of a loggerhead, Kemp's ridley or green sea turtle during each relocation trawling event. Most recently, we issued a biological opinion in response to a request for re-initiation on October 16, 2012. In this biological opinion, we concluded that the proposed dredging may adversely affect but is not likely to jeopardize the continued existence of any listed species. An ITS was included with this biological opinion, exempting the lethal take of up to 194 loggerheads, 17 Kemp's ridleys, 4 greens, and 32 Atlantic sturgeon incidental to hopper dredging activities at the Baltimore Harbor Entrance Channels over the course of 50 years. In addition, the ITS exempted

the lethal take of 20 loggerheads, 2 Kemp's ridleys, and 3 Atlantic sturgeon incidental to hopper dredging activities in the York River Entrance Channel.

### **2.3 Sandbridge Shoal**

Formal consultation for the use of the Sandbridge Shoal borrow area was initiated in May 1992. We issued a biological opinion on April 2, 1993. This biological opinion was amended by letter issued August 20, 2001, to account for greater dredging quantities, project durations, and associated impacts to listed sea turtles. In 2007, you requested that we waive the requirement for 100% endangered species observer coverage for dredging planned for 2007. This request was due to the presence of unexploded ordinance in the area to be dredged and the placement of screening on the dragheads. We granted that request by letter and determined that the use of UXO screening did not require reinitiation of the consultation. The 1993 biological opinion, as amended in 2001, concluded that dredging in Sandbridge Shoal was not likely to jeopardize the continued existence of any species of whale or sea turtle. An ITS was included with the biological opinion, exempting the lethal take of five loggerhead sea turtles and one Kemp's ridley or green sea turtle for each biennial dredge event. This consultation was re-initiated in 2012. In September 2012, we issued a new biological opinion on effects of proposed dredging at Sandbridge Shoal in 2012-2013 with placement of 1.5-2 million cubic yards of sand along Sandbridge Beach. We concluded that the proposed action was not likely to jeopardize any DPS of Atlantic sturgeon or any species of listed sea turtle, and not likely to adversely affect any species of listed whale. The ITS exempted the lethal take of six loggerheads and one Kemp's ridley or green and one Atlantic sturgeon from any of the five DPSs. On October 16, 2012, we replaced the September 2012 biological opinion in response to a request for re-initiation. An ITS was included with this biological opinion, exempting the lethal take of up to 38 loggerheads, 3 Kemp's ridleys, 1 green sea turtle, and 6 Atlantic sturgeon incidental to hopper dredging activities at Sandbridge Shoal over the course of 50 years. Use of the Sandbridge Shoal borrow areas requires coordination with the Bureau of Ocean Energy Management (BOEM); the USACE's Norfolk District was designated the lead agency for purposes of complying with ESA requirements per 50 C.F.R 5402.07 and served as the lead agency for biological consultation.

### **2.4 Virginia Beach Nourishment and Hurricane Protection Project**

Formal consultation for dredging activities at the Thimble Shoals Surround borrow area (TSS) and the Atlantic Ocean Offshore borrow area (AOO) was initiated with your submittal of a BA in January 2005. We issued a biological opinion on December 2, 2005. In this biological opinion, we concluded that the proposed dredging may adversely affect but is not likely to jeopardize the continued existence of loggerhead and Kemp's ridley sea turtles and is not likely to adversely affect leatherback or green sea turtles or right, humpback or fin whales. An ITS was included with this biological opinion, exempting the lethal take of 4 loggerheads and 1 Kemp's ridley during each dredge event and the non-lethal capture of 45 sea turtles (loggerhead, Kemp's ridley and green) during each relocation trawling event. The ITS also exempted one lethal take of a loggerhead, Kemp's ridley or loggerhead sea turtle during each relocation trawling event. We issued a biological opinion in response to a request for re-initiation on October 16, 2012. An ITS was included with this biological opinion, exempting the lethal take of up to 13 loggerheads, 2 Kemp's ridleys or greens, and 22 Atlantic sturgeon incidental to hopper dredging activities for the Virginia Beach Hurricane Project over the course of 50 years.

## **2.5 Norfolk Harbor Channels**

We previously considered effects of maintenance dredging and deepening of the Norfolk Harbor inner channels. These actions were considered in the biological opinion dated April 25, 2002 described in Section 2.1 above. In the biological opinion, we determined that dredging in the inner channels was not likely to adversely affect any species of sea turtles because a hydraulic cutterhead or mechanical dredge would be used and these dredge types are not known to capture, injure or kill sea turtles. We issued a biological opinion in response to a request for re-initiation on October 16, 2012. In this biological opinion, we concluded that the proposed dredging was not likely to adversely affect any species of sea turtles. An ITS was included with this biological opinion, exempting the lethal take of up to 1 Atlantic sturgeon incidental to mechanical dredging activities at the Norfolk Harbor Channels over the course of 50 years.

## **2.6 Craney Island Eastward Expansion**

We completed informal consultation with you on the Craney Island Eastward Expansion project in 2006. In a letter dated June 15, 2006, we concluded that the proposed action was not likely to adversely affect any species of sea turtle. This conclusion was based on the use of mechanical or hydraulic dredges for dredged material removal and the lack of benthic prey at the site. We issued a biological opinion in response to a request for re-initiation on October 16, 2012. In this biological opinion, we concluded that the proposed dredging was not likely to adversely affect any species of sea turtles. An ITS was included with this biological opinion, exempting the lethal take of up to 1 Atlantic sturgeon incidental to mechanical dredging activities at the Craney Island Eastward Expansion project over the course of 50 years.

## **3.0 DESCRIPTION OF THE PROPOSED ACTION**

This Opinion considers the effects of proposed new dredging, continued maintenance dredging, and sand borrow operations in several Federal navigation channels located in the Chesapeake Bay and Atlantic Ocean. The Opinion also evaluates the placement and disposal of dredged material at the Craney Island Dredged Material Management Area (CIDMMA) and open ocean disposal sites, the Dam Neck Ocean Disposal Site (DNODS) and the Norfolk Ocean Disposal Site (NODS). The Opinion considers that dredged material could also be potentially placed at beneficial use sites or upland disposal sites. Construction is scheduled to begin in 2023, but is contingent on funding availability. Construction of the Norfolk Harbor and Channels Deepening Project will take approximately 3.5 to 4 years to complete. Table 2 provides the approximate schedule for maintenance dredging, which is also subject to change based on funding availability.

These activities are carried out by you and your contractors as independent actions, as detailed below. The Norfolk District in coordination with the Baltimore District maintains the Port of Baltimore Approach Channels. Additionally, authorization with BOEM, in the form of a lease, is required for use of the Sandbridge Shoal borrow area. The U.S. EPA has regulatory authority over the designation of the ocean disposal sites considered in this Opinion. While you requested consultation on the Craney Island Eastward Expansion Project and Norfolk Harbor Navigation Improvements Project, we are including updates on all projects batched under the 2012

biological opinion, which are reflected in the sections below.

### **3.1 Port of Hampton Roads Approach Channels – Thimble Shoals and Atlantic Ocean Channel**

The Atlantic Ocean Channel (AOC) and Thimble Shoals Channel (TSC) make up the approach channels to the Port of Hampton Roads, Virginia. These channels provide access for all ships calling on port facilities, naval bases, and shipyards in the Hampton Roads area. All commercial tonnage entering and leaving the Port of Hampton Roads passes through these channels. The USACE Norfolk District is responsible for maintaining these Federal navigation channels to ensure safe passage for all vessel traffic. To provide depths needed for safe navigation of large vessels, maintenance dredging of these Federal navigation channels must occur before shoaling causes draft restrictions and/or other safety concerns. The location of TSC and AOC is depicted in Appendix A.

The proposed action involves continued ongoing sand borrow operations, maintenance and new dredging of the AOC and TSC and the use of the associated dredged material placement sites. The project includes the entire footprint of these channels and the shoals contained within each channel, plus the entire footprint of the associated dredged material placement sites. Dredged material would be placed at the DNODS and/or the NODS. Other potential placement sites could include CIDMMA or upland disposal sites (if needed). Material could potentially be used for beneficial use projects as well. The AOC and TSC are preferred sand borrow sources for beach nourishment and port development projects in the Hampton Roads region. You are proposing to borrow from the TSC and AOC for the following projects: the Craney Island Eastward Expansion, Virginia Beach Hurricane Protection Project, Willoughby Spit and Vicinity Hurricane Protection Project, and JEB Fort Story Beach Replenishment Project (U.S. Navy).

The AOC and TSC normally require maintenance dredging every two to five years but dredging is typically located in distinct shoaled areas within the channels. These shoaled areas vary from year to year, but are often located along the toe of the channel. New dredging may also occur when Congress authorizes and appropriates funding for channel improvements. The duration of dredging, the amount of material removed from each shoal, and the frequency in which each shoal is dredged is dependent on several factors. These factors include, but are not limited to: environmental conditions, funding, whether it is new work or maintenance dredging, location, length of time after the last dredging cycle, time of year conservation measures, availability of suitable dredge plant, emergencies, and others. It is important to note that the areas within the channel that are dredged during each maintenance cycle are typically relatively small in comparison to the total channel dimensions. The primary objective is to provide vessels with safe, navigable passage to the Port of Hampton Roads in support of commerce and national defense.

#### *Atlantic Ocean Channel Federal Navigation Project*

The Water Resources Development Act (WRDA) of 1986 authorized the AOC. The WRDA authorized the USACE to construct the AOC, which consists of a channel 11.1 miles long, 1,300 feet wide, and -57 feet deep located 3-4 miles east of the Thimble Shoal Channel, in the Atlantic Ocean at the mouth of the Chesapeake Bay off the coast of Virginia Beach, Virginia. As part of the -50-foot inbound construction effort in 2006, the channel was deepened to provide for a

depth and width of -52 feet and 1,300 feet, respectively. The AOC is part of the Port of Virginia and Baltimore system of channels, and is the segment providing access for all ships calling on port facilities, naval bases, and shipyards in the Hampton Roads, York River, and Baltimore areas. All commercial tonnage entering and leaving the Ports of Virginia and Baltimore pass through this channel. The channel is currently maintained to full width and a depth of -52 feet to enable loaded colliers, container ship, and military vessels to transit the channel with ship drafts as great as -50 feet. The proposed action would deepen the AOC to a required depth of approximately -59 feet. The AOC is managed by the USACE Norfolk District.

Material is typically dredged via hopper dredge from this channel. Dredged material is placed at Dam Neck Ocean Disposal Site (DNODS). Dredged material also has been used for beneficial uses for the Virginia Beach Hurricane Protection project and the Craney Island Eastern Expansion (CIEE) Project. The sediment composition in this channel segment is largely fine sand (85%) with some silt (15%). The channel has been utilized as a sand borrow source for hurricane protection projects and port development projects, therefore maintenance of the channel has not been required.

#### *Thimble Shoal Federal Navigation Project*

The TSC is located in the southern part of the Chesapeake Bay, just off the shoreline of the City of Norfolk and City of Virginia Beach, east of the Craney Island Dredged Material Management Area. The TSC was originally authorized by the River and Harbor Act of August 8, 1917. The authorized channel dimensions are 13.4 miles long, 1,000 feet wide, between the 55-foot contours, to a depth of -55. Although the channel is authorized to be dredged to 55 feet, the channel is currently maintained to a required depth of -50 feet. Thimble Shoal Channel extends from the deep water to the east of Hampton Roads to the deep water at the mouth of the Chesapeake Bay.

The proposed action would authorize a new depth of -61 feet, deepen the TSC from -50 feet to a required depth of approximately -56 feet, and widen the channel east of the Chesapeake Bay Bridge Tunnel to approximately 1,300 feet. The Thimble Shoal Channel is managed by the Norfolk District.

As part of the proposed action, the existing 10 feet of sand cover over the Chesapeake Bay Bridge Tunnel in the Thimble Shoal Channel would be reduced to approximately five feet. The materials covering the tunnel would be sand or potentially sand and rock.

Material dredging is via hopper dredging. Dredged material is placed at the DNODS. The sediments of Thimble Shoal Channel to the west of the Chesapeake Bay Bridge Tunnel are predominantly clays and silts (50-75%). In contrast, sediments in the eastern portion of channel are largely fine to medium-grained sand (75-90%).

### **3.2 Port of Baltimore Approach Channels**

Cape Henry Channel (CHC), York Spit Channel (YSC) and Rappahannock Shoals Channel (RSC) make up the Chesapeake Bay approach channels to the Port of Baltimore. All commercial tonnage entering and leaving the Port of Baltimore pass through these channels. The Norfolk District maintains these Federal navigation channels in coordination with Baltimore District.

In order to provide depths needed for safe navigation of large vessels, maintenance dredging of these Federal navigation channels must occur before shoaling causes draft restrictions and/or other safety concerns. All of these channels and placement sites are depicted in Appendix A.

The proposed project involves continued ongoing maintenance dredging of the CHC, YSC and RSC and the use of the associated dredged material placement sites. New work dredging may also occur when Congress authorizes and appropriates funding for channel improvements. The project includes the entire footprint of these channels and the shoals contained within each channel, plus the entire footprint of the associated dredged material placement sites. The CHC, YSC and RSC normally require dredging every two to five years; dredging is typically located in distinct shoaled areas within the channels and not through the entirety of the channel. These shoaled areas vary from year to year, but are often located along the toe of the channel. The duration of dredging, the amount of material removed from each shoal, and the frequency at which each shoal is dredged is dependent on several factors. These factors include, but are not limited to: environmental conditions, funding, location of the shoal, degree of shoaling, time of year conservation measures, availability of suitable dredge plant, navigation emergencies, and others.

#### *Cape Henry Federal Navigation Project*

The CHC was authorized under the River and Harbor Act of 1945 and Section 101 of the River and Harbor Act of 1970 as part of the Baltimore District - USACE 50-Foot Project. The River & Harbor Act of 1945 authorized increasing the channel depth to -39 feet deep and 1,000 feet wide in the CHC and YSC in Virginia. The River and Harbor Act of 1970 authorized a uniform main channel 50 feet deep, and generally 800 (in Maryland) or 1,000 (in Virginia) feet wide through the Chesapeake Bay from the Virginia Capes to Fort McHenry in the Port of Baltimore, a distance of 175 miles. The CHC Federal Navigation Channel is a 1,000 foot wide channel approximately 4.7 nautical miles long located between the -50 foot contours at the entrance to the Chesapeake Bay just south of the Chesapeake Bay Bridge Tunnel. The Norfolk District in coordination with the Baltimore District maintains the CHC.

#### *Rappahannock Shoal Federal Navigation Project*

The RSC was authorized under Section 101 of the River and Harbor Act of 1970 as part of the Baltimore District - USACE 50-Foot Project. The River and Harbor Act of 1970 authorized a uniform main channel -50 feet deep, and generally 800 (in Maryland) or 1,000 (in Virginia) feet wide through the Chesapeake Bay from the Virginia Capes to Fort McHenry in the Port of Baltimore, a distance of 175 miles, which includes the RSC. Dredging of the initial phase reduced the channel widths in the RSC from 1,000 to 800 feet wide. The RSC is -50 feet deep, 800 feet wide and approximately 10.3 nautical miles long and traverses the Rappahannock Shoal from southeast to northwest. The Norfolk District in coordination with the Baltimore District maintains the RSC.

#### *York Spit Federal Navigation Project*

The YSC was authorized to a depth of -37 feet under the River and Harbor Act of 1930. After World War II, the River & Harbor Act of 1945 authorized increasing the channel depth to -39

feet deep and 1,000 feet wide in the CHC and YSC in Virginia. Finally, the YSC was authorized to -50 feet via Section 101 of the River and Harbor Act of 1970, as part of the Baltimore District USACE 50-Foot Project, which authorized a uniform main channel -50 feet deep, and generally 800 (in Maryland) or 1,000 (in Virginia) feet wide through the Chesapeake Bay from the Virginia Capes to Fort McHenry in the Port of Baltimore, a distance of 175 miles. Dredging of the initial phase reduced the channel widths in the YSC from 1,000 to 800 feet wide. The YSC is 800 feet wide, -52 feet deep and is approximately 18.4 nautical miles long. The YSC is located between the -50 foot contours, just north of the Chesapeake Bay Bridge Tunnel and is maintained by the Norfolk District in coordination with the Baltimore District.

### **3.3 York River Entrance Channel Federal Navigation Project**

The Norfolk District is responsible for maintenance dredging the York River Entrance Channel (YREC) Federal Navigation Project. In order to provide depths needed for safe navigation of larger vessels, maintenance dredging of this Federal navigation channel must occur on or before shoaling causes draft restrictions and/or other safety concerns. The location of YREC is depicted in Appendix A.

The proposed project does not include continued ongoing maintenance dredging of YREC and the use of the associated dredged material placement sites. During the consultation, you informed us that there is no planned federal action for YREC. The federal project is not funded and no maintenance dredging is planned at this time. Should project plans change, further coordination with us should be pursued.

The YREC was first dredged in 1951 and 1952, when the natural entrance channel into the York River was deepened by the USACE for the Department of the Navy. The original channel dimensions provided for a 39-foot deep channel at mean low water, 750 feet wide at the bottom, and approximately 11 miles long. There was no dredging of the YREC between 1952 and 1998. In 1995, the Chief of Engineers authorized dredging under Section 107 of the River and Harbor Act of 1960. The YREC project consisted of a channel 37 feet deep at mean lower low water (mllw), 750 feet wide at the bottom, and approximately 23 miles long. New work was authorized in 1995, and the channel was dredged to its current dimensions in 1999. The channel begins at the 38-foot contour in the Chesapeake Bay and ends at a point adjacent to the piers at the Yorktown U.S. Naval Weapons Station, approximately 8 miles above the river mouth.

### **3.4 Virginia Beach Nourishment and Hurricane Protection Project**

The Virginia Beach Hurricane Protection Project is conducted under authority of the WRDA of 1986, as modified by the WRDA of 1992 and 1996. The project was authorized in Section 102 of the WRDA of 1992 (Public Law [P.L.] 102-580) as amended in 1996, and is funded by the Federal Government and the city of Virginia Beach, Virginia, acting as the project's non-Federal sponsor.

The hurricane protection site is located at Cape Henry, Virginia Beach, Virginia, as generally described in the "Beach Erosion Control and Hurricane Protection Study Virginia Beach, Virginia General Reevaluation Report Main Report and Appendices," dated September 1993 and revised January 1994, and approved by the Assistant Secretary of the Army for Civil Works on February 1, 1994, and as further defined by Draft plans and Specifications which are incorporated

herein by reference. The authorized duration of the initial project of hurricane protection is 50 years, including initial construction and periodic nourishment. Sand to be placed at the hurricane protection site may be obtained from Federal navigation channels or the Thimble Shoals Channel Borrow Area (TSS) and the Atlantic Ocean Channel Borrow Area (AOO). The location of these borrow areas are illustrated in Appendix A.

The TSS area is a rectangle surrounding a short reach of the Thimble Shoals Channel located in the lower Chesapeake Bay between deep water in Hampton Roads and the Atlantic Ocean. It is approximately 2 miles off the Chesapeake Bay shoreline, with its western terminus approximately 5,400 feet east of the Chesapeake Bay Bridge Tunnel. The TSS is about 5,700 feet in length and approximately 1,200 feet wide, totaling about 1,960 acres. Depths in the area range from about 35 to 50 feet and do not include the Thimble Shoals Channel.

The AOO area is roughly triangular in shape and is located in the Atlantic Ocean off Cape Henry, Virginia. It encompasses about 9,253 acres and extends southeasterly from a point due east of the Cape Henry lighthouse and in the direction of the continental slope. It is bounded to the east by the Atlantic Ocean Channel deepwater route east of the Virginia Beach oceanfront. This borrow site does not include any section of the Atlantic Ocean Channel deepwater route. This borrow site is located about 5 miles from the TSS borrow area.

Maintenance of the hurricane protection project will require that approximately 1,000,000 cubic yards (cy) of sand be dredged and placed on the beach during the initial maintenance, with an additional 2,000,000 cy to be dredged and placed every 3 to 4 years.

The maintenance borrow activities may be rotated among these sites over the 50-year period. Approximately 12.5 million cy of sand may be dredged and used for beach nourishment over the 50-year period, with approximately 8.125 MCY (66%) of the volume to be removed from Atlantic Ocean Channel and Thimble Shoals Channel. The remaining 4.375 MCY is likely to be removed from the AOO and TSS. Dredging will be accomplished via hopper dredge, although there is a possibility that a hydraulic cutterhead dredge may be used in the AOO. Dredged beach-quality sand may be placed on the site by means of hydraulically pumping from the dredging site directly to the beach via a hydraulic dredge and pipeline, if the sand source is less than 2 miles from the beach; or, if the sand source is more than 2 miles from the beach, a hopper dredge may be used.

### **3.5 Sandbridge Beach Nourishment and Hurricane Protection**

The Advanced Engineering and Design Study for Beach Erosion and Hurricane Protection at Virginia Beach, Virginia, including Sandbridge Beach, was authorized by Section 1(a) of the Water Resources Development Act of 1974 (Public Law 93-251, 93'd Congress, H.R. 10203.7 March 1974). The applicable portion of the authorizing act is as follows:

"Sec. I (a) The Secretary of the Army, acting through the Chief of Engineers, is hereby authorized to undertake the Phase I Design Memorandum stage of advanced engineering and design of the following multi-purpose water resources development projects, substantially in accordance with, and subject to the conditions recommended by the Chief of Engineers in the reports here in after designated."

## Middle Atlantic Coastal Area

"The project for hurricane-flood protection at Virginia Beach, Virginia: House Document Numbered 92-365, at an estimated cost of \$8,954,000 (1974 dollars)."

BOEM will authorize the use of sand from an OCS sand borrow area for the project under the OCS Lands Act, 43 U.S.C. §1337(k). In 1994, OCSLA was amended to allow BOEM to convey, on a noncompetitive basis, the rights to OCS sand, gravel, or shell resources for use in a program for shore protection, beach restoration, or coastal wetlands restoration undertaken by a Federal, State, or local government agency (43 U.S.C. § 1337(k)(2)(A)(i)). An agreement will be negotiated between BOEM, the USACE Norfolk District, and the City of Virginia Beach for the dredging and relocation of the sand.

The beach nourishment will occur along a five mile stretch of the Sandbridge Beach between the Back Bay National Wildlife Refuge (NWR) at the southern most extent (36.698017 N, - 75.924196 W-WSG84 datum) and the U.S. Naval Fleet Anti-Air Warfare Training Center at the northern most extent (36.760823 N, - 75.948829 W) along the beach. The borrow areas (A and B) are located about three miles offshore at Sandbridge Shoal perpendicular to the beach nourishment reach (Appendix A). A no dredging zone separates the two borrow areas to protect underground cable lines. The coordinates for these borrow areas start at the three miles state waters boundary from east to west and are approximate as follows:

Area A: 36.7396 N, - 75.8762 W; 36.7235 N, - 75.8315 W

Area B: 36.7638 N, - 75.8860 W; 36.7537 N, - 75.8387 W

The proposed action would involve beach nourishment at the Sandbridge oceanfront, an area approximately 5 miles long and 725 feet wide (as illustrated in Appendix A). The specific beach area covered extends from the U.S. Naval Fleet Anti-Air Warfare Training Center at Dam Neck to the north to Back Bay NWR to the south. The project dimensions include a 50-foot wide berm at an elevation of 6 feet North American Vertical Datum (NAVD) with a foreshore slope of approximately 1:20 (one vertical value to 20 horizontal) for a distance of approximately 5 miles. The designated borrow area is Sandbridge Shoal (Appendix A), located approximately 3 nautical miles from the shoreline, outside of Virginia's territorial sea. There are two selected borrow areas within Sandbridge Shoal, Area B to the north and Area A to the south; depths range from 30 to 65 feet. The area between the two borrow areas is restricted due to the presence of a buried Navy submarine communications cable. Beach quality sand would most likely be removed by trailing suction hopper dredge with the possibility of using a hydraulic pipeline dredge (i.e. cutterhead).

As previously mentioned, the proposed action will utilize either a hopper style dredge or a hydraulic pipeline dredge to borrow beach quality sand from authorized sites along Sandbridge Shoals to renourish the beach at Sandbridge Beach via the placement of dredged material onto the beach.

### **3.6 Norfolk Harbor Channels**

The Norfolk Harbor Channels are part of the larger Port of Hampton Roads complex and initially included the deep draft channels in the Elizabeth River and Hampton Roads. Portions of the Norfolk Harbor project have been authorized and modified by the Rivers and Harbors Act of July 5, 1884, 2 March 1907, 25 June 1910, 4 March 1913, 8 August 1917, 3 March 1925, 30 August 1935, 2 March 1945, 24 July 1946, 30 June 1948, 3 September 1954, 27 October 1965, the Flood Control Act of 1965, and the WRDA of 1986. On April 16, 2018, you requested informal consultation on the Elizabeth River Southern Branch Navigation Improvements project, which had previously been included as part of the Norfolk Harbor Channels complex. On June 25, 2018, we responded with a letter that concurred with your determination that the proposed action was not likely to adversely affect ESA-listed species under our jurisdiction. The June 2018 consultation included the following channel sections that now comprise the Elizabeth River Southern Branch Navigation Improvements Project:

- A channel 45-feet deep over its 375 feet to 750-foot width from Lamberts Point to the N&W Railroad Bridge (Norfolk Harbor Channel - Lamberts Bend to Paradise Creek);
- A channel 40-feet deep over its 250 to 500-foot width to the U.S. Routes 460 and 13 Highway Bridge (Norfolk Harbor - Southern Branch Channel); hence a channel 35-feet deep over its 250 feet to 300 feet width to a point 0.8-mile above Interstate 64 high level bridge;
- A channel 25-feet deep over its 200 feet to 500 feet width from the junction with the southern Branch of the Elizabeth River to the N&W Railroad Bridge on the eastern Branch of the Elizabeth River (Norfolk Harbor – Eastern Branch Channel);
- A channel 18 feet deep over its 150 feet to 300 feet width and 1.72 mile length on the western Branch of the Elizabeth River (Norfolk Harbor – Western Branch Channel);
- A channel 12 feet deep, 100 feet wide, and 0.73 mile in length in Scotts Creek (Norfolk Harbor – Scotts Creek Channel);

The project considered in this consultation includes the following:

- A channel 55 feet deep over its 800 to 1,500-foot width from the 55-foot contour in Hampton Roads to Lamberts Point (Norfolk Harbor Channel - Sewells Point to Lamberts Bend);
- Sewells Point Anchorages and 50-foot Anchorages;
- A channel 55 feet deep and 800 feet wide from Norfolk Harbor Channel in Hampton Roads to Newport News (Channel to Newport News);
- Newport News Anchorages;
- Craney Island Dredged Material Management Area (CIDMMA) consist of a 2,500 acre upland confined disposal facility for the placement of navigation related dredged material from Norfolk Harbor and adjacent waters.

The Norfolk District is responsible for maintaining these Federal navigation channels and anchorages to ensure safe passage for all vessel traffic. A specific description of the channel reaches, anchorages, and dredged material placement sites serving the greater port of Hampton Roads follows and is depicted in Appendix A.

The Norfolk Harbor Channels provide access for all ships calling on port facilities, naval bases, and shipyards in the Hampton Roads area. All commercial tonnage entering and leaving the Port of Hampton Roads passes through one or more of these channels. The Norfolk District is responsible for maintaining these Federal navigation channels to ensure safe passage for all vessel traffic utilizing the port. In order to provide depths needed for safe navigation of larger vessels, maintenance dredging of these Federal navigation channels must occur before shoaling causes draft restrictions and/or other safety concerns. The proposed project activity will involve ongoing maintenance and future new dredging of the Norfolk Harbor channels and the use of the associated dredged material placement sites. The project includes the entire footprint of these channels and the shoals contained within each channel, plus the entire footprint of the associated dredged material placement sites. Portions of these channels require maintenance dredging annually, but dredging is typically located in distinct shoaled areas within the channels. The duration of dredging, the amount of material removed from each channel reach and the frequency in which each shoal is dredged is dependent on several factors. These factors include, but are not limited to: new dredging (deepening) to authorized depths, environmental conditions and time of year windows, funding, location of the shoal, length of time after the last dredging cycle, availability of suitable dredge plant, emergencies, and others. It is important to note that the areas within the channel that are maintenance dredged during each cycle are relatively small in comparison to the total channel dimensions. However, new dredging projects – such as the proposed deepening and widening - that are initiated to deepen navigation channels to Congressionally-authorized depths involve dredging a large part of the channel to establish required channel depths. The amount of dredged material removed during a period of new deepening may exceed average maintenance dredging volumes, and may also be dependent on how Congress funds the project for the fiscal year. The primary objective of maintenance and new dredging is to provide vessels with safe, navigable passage to the Port of Hampton Roads in support of commerce and national defense.

#### *Channel to Newport News and Anchorages*

The Channel to Newport News is located from Norfolk Harbor Channel in Hampton Roads to Newport News. The Channel to Newport News Federal Navigation Project was authorized by the River and Harbor Act of 25 June 1910 and modified by the River and Harbor Acts of 8 August 1917, 21 January 1927, 27 October 1965, and the WRDA of 1986. The project is authorized to a depth of 55 feet and 800 feet wide from Norfolk Harbor Channel in Hampton Roads to Newport News and the Newport News Anchorages, a distance of about 5.4 miles, and two deep-draft anchorage berths opposite Newport News 45 feet deep over a 1,200-foot swinging radius. Material dredged from this area is then placed at the CIDMMA. The proposed action would deepen the Newport News Channel to a required depth of approximately 55 feet. The proposed action would deepen the Anchorage F to a required depth of 51 feet and widen the Anchorage F to 3,620 feet and its associated approach area. Material dredged from this area is then placed at the CIDMMA and could also potentially be placed at the NODS. Dredged material could also be disposed of at upland disposal sites (if needed). Material could potentially be used for beneficial use projects as well.

#### *Norfolk Harbor Channel – Sewells Point to Lamberts Bend and Norfolk Harbor Anchorages*

The Sewells Point to Lamberts Bend reach of the Norfolk Harbor Project is located in Norfolk between Sewells Point and Lamberts Bend. This segment of the project is approximately 8 miles long and varies in width between 800 feet to 1,200 feet. The reach also consists of: Anchorage F, Sewells Point East Anchorage (includes the Naval Maneuvering Area and Approach Areas), Sewells Point West Anchorage and (Approach Area), Anchorage G, and all approach areas. The proposed action would deepen Anchorage F to a required depth of 51 feet and widen it to approximately 3,620 feet (and associated modifications to the Approach Area).

The authorized project dimensions for this reach include a channel 55 feet deep and 1,200 feet wide from that depth in Hampton Roads to a point approximately 6 miles upstream from the Hampton Roads Bridge-Tunnel; then 55 feet deep and 800 feet wide to Lamberts Point. The Sewells Point to Lamberts Bend Channel is currently maintained to a required depth of 50 feet MLLW from the 55-foot contour in Hampton Roads (near the Hampton Roads Bridge Tunnel) to Lamberts Point. The proposed action would deepen the Norfolk Harbor Channel and the Norfolk Harbor Entrance Channel to a required depth of 55 feet.

Material is dredged from this area via hydraulic cutterhead pipeline dredge and/or mechanical dredge. Material dredged from this area is then placed at the CIDMMA. The consistency of the dredged material in the Sewells Point to Lamberts Bend Channel is primarily silt and clay (85%), with some sand (15%). The consistency of the Elizabeth River sediment is predominantly clay in the Town Point area of Norfolk. However, as you travel south along the Elizabeth River (towards Chesapeake), the sediments become increasingly more coarse and sandy.

### **3.7 Craney Island Eastward Expansion**

The Craney Island Eastward Expansion (CIEE) project is located on the east side of the existing CIDMMA. The project activities are bounded by the CIDMMA on the west and the Norfolk Harbor Channel – Sewells Point to Lamberts Bend to the east. The CIEE is a water resources development project in the Port of Hampton Roads complex. The project consists of construction of a new 522-acre dredged material containment cell and marine terminal. CIEE was congressionally authorized in the WRDA of 2007 (Public Law 110-114), Section 1001 (45), which became law on November 8, 2007. The CIEE project consists of multiple construction elements within Hampton Roads and the Elizabeth River. The location of the project is illustrated in Appendix A.

In 2012, we formally consulted with you on multiple navigation channels and hurricane protection project sites within Chesapeake Bay and the Atlantic Ocean, including the CIEE project. However, the schedule and timing of the proposed action at the CIEE site was not considered under the previous formal consultation. To address the potential effects, you prepared a new Biological Assessment for hopper dredging activities for the purpose of sand borrow throughout the year, including the period from April 1 to November 30.

The Craney Island Eastward Expansion Project is a dual purpose project that provides a new dredged material containment cell for additional dredged material placement capacity for dredging projects in the Port of Hampton Roads and, at the completion of filling of the containment cell, a new marine terminal. The site may also serve as a logistical and tactical area supporting deployment of national defense forces. Dredging operations are proposed in the

Atlantic Ocean Channel, Thimble Shoals Channel, Cape Henry Channel, and the Thimble Shoals Surround Borrow Area to borrow suitable sand as back-fill material for the main dike footprint and sand fill in the south and north perimeter dike and division dike.

The proposed project will involve multiple construction phases of dredging for sand borrow and associated sand placement of approximately 19,500,000 million cubic yards (MCY). The sand borrow placement is expected to occur over a period of approximately 20 years, contingent upon funding availability. The project area includes the entire footprint of the Atlantic Ocean Channel, Cape Henry Channel, Thimble Shoals Channel east of the Chesapeake Bay Bridge Tunnel (CBBT), and the Thimble Shoals Surround Borrow Area. The sand fill project area includes the CIEE main dike footprint, the south and north containment dike, and the division dike located in the Port of Hampton Roads and Elizabeth River. The estimated volumes of new dredging and fill activities for each construction element are presented in Table 1.

Construction of the CIEE new containment cell will occur in two phases creating a 197-acre south sub-containment cell (south cell) and 325-acre north sub-containment cell (north cell). The south cell will be constructed first. Once the dikes of the south cell are completed it will become the primary placement site for dredged material inflows from Port of Hampton Roads. After the south cell is filled, it will be turned over to the Virginia Port Authority for marine terminal construction. Construction of the north cell will follow completion of the south cell. The work will be accomplished by the Norfolk District and the Virginia Port Authority. A description of the construction elements follows and is depicted in Appendix A.

**Table 1.** Borrow/Fill Activity at CIEE

<b>Fill Activity</b>	<b>Total Volume</b>
CIEE – Main Dike fill (5,500 linear feet), North Cell Construction	15,000,000
CIEE – South Perimeter Dike fill	1,500,000
CIEE – North Perimeter Dike fill	1,500,000
CIEE – Division Dike fill	1,500,000
<b><i>TOTAL FILL VOLUME 19,500,000</i></b>	

*Sand Borrow and Backfill of Main Dike Footprint*

The proposed action involves the dredging, by hopper dredge, of approximately 19.5 MCY of sediments for the purpose of sand borrow. Sand will be borrowed from a combination of the Atlantic Ocean Channel, Cape Henry Channel, Thimble Shoals Channel (east of the CBBT), and the Thimble Shoals Surround Borrow Area. The total volume of sand dredged from each channel or borrow source will be contingent on the availability of suitable sand volume at the time of dredging. These channels and borrow areas have historically and are currently a shared

source of suitable sand for other local hurricane protection and beach nourishment projects. Continued maintenance of these projects will affect the available volume of sand at each channel or borrow area over time. Additionally, the amount of sand borrowed from the channels and borrow area during each dredging event will be contingent on federal and state funding.

The borrowed sand will be placed on the CIEE main dike footprint that extends approximately 8,500 feet running north-south, forming the east perimeter of the CIEE project. Sand placement in this area will occur after the dredging of the main dike footprint to remove unsuitable marine clays that comprise the Norfolk geologic formation. Dredging of the main dike will range from a depth of -90 feet to -130 feet and construct a 120 feet wide trench bottom. The main dike will be located approximately 2,500 feet east of the existing CIDMMA. The main dike footprint will require approximately 15 MCY of sand backfill. The length of the main dike that will be constructed with the south cell is approximately 3,000 linear feet. The remaining 5,500 linear feet of main dike will be constructed in a late phase during construction of the north cell.

#### *Construction of Perimeter and Division Dikes*

The construction of the south and north perimeter dikes and the division dike for the new containment cell will require placement of 4.5 MCY of suitable sand fill (i.e., 1.5 MCY each). The south, north and division dikes will be approximately 2,500 linear feet in length and approximately 240 feet top width.

### **3.8 Dredged Material Borrow and Disposal Areas**

#### *Thimble Shoals Surround Borrow Area*

The Thimble Shoals Surround Borrow Area (TSS) is a rectangle surrounding a short reach of the Thimble Shoals Channel located in the lower Chesapeake Bay between deep water in Hampton Roads and the Atlantic Ocean. It is approximately 2 miles off the Chesapeake Bay shoreline, with its western terminus approximately 5,400 feet east of the Chesapeake Bay Bridge Tunnel. The TSS is about 5,700 feet in length and approximately 1,200 feet wide, totaling about 19,600 acres. Depths in the area range from about 35 to 50 feet and do not include the Thimble Shoals Channel. The area has previously served as a sand borrow source for the Virginia Beach Hurricane Protection Project, Fort Story Hurricane Protection Project (U.S. Navy), and the Willoughby Spit Hurricane Protection Project.

Any material that is not used for dike construction at Craney Island or hurricane protection projects at Virginia Beach, Sandbridge Beach or Ft. Story could be placed at one of the ocean disposal sites noted below.

#### *Dam Neck Ocean Disposal Site*

The Dam Neck Ocean Disposal Site (DNODS) site was officially designated as an ocean placement site in 1993, pursuant to Section 102 (c) of the Marine Protection, Research, and Sanctuaries Act of 1972 (as amended, 33 U.S.C. 1401 *et seq*). The administrator of the Environmental Protection Agency (EPA) designated this ocean placement site in March of 1988 (53 FR 10382). This site is authorized to receive dredged material from the Atlantic Ocean Channel, the Cape Henry Channel, and the Thimble Shoal Channel. An Environmental Impact Statement and related Supplements, titled "Final Supplement 1 to the Final Environmental Impact Statement and Appendix: Dam Neck Ocean Disposal Site and Site Evaluation Study,

Norfolk Harbor and Channels, Virginia, Deepening and Disposal” was finalized in May of 1985. The initial deepening of Thimble Shoal Channel by the USACE triggered a need for a placement site relatively close to the dredge site. The DNODS disposal site was developed in 1967 to accommodate the deepening work in Thimble Shoal Channel (-45 feet). The DNODS has an area of about 8-square nautical miles. Water depths at DNODS vary between -31 and -49 feet deep with an average water depth in the placement site of about -40 feet. An estimated 1.5 million cubic yards of dredged material are placed at this site every two years from the aforementioned navigation projects. The remaining capacity at DNODS is estimated to be about 63 million cubic yards. Placement activities at DNODS placement area are performed primarily by hopper dredge. The DNODS is located approximately 3 nautical miles east of Virginia Beach, Virginia.

The DNODS boundary coordinates are as follows:

36.856694 N, - 75.9115 W;  
36.856694 N, -75.884139 W;  
36.774278 N, - 75.860889 W;  
36.774306 N, - 75.905278 W;  
36.834861 N, - 75.905278 W.

#### *Wolf Trap Alternate Placement Site*

The Wolf Trap Alternative Placement Site (WTA) is a 2,300-acre (4,500 acres with the designated buffer zone) area located in the Chesapeake Bay, east of New Point Comfort and south of Wolf Trap light, east of Mathews County. Water depths over the site range from -32.0 to -37.0 feet mean low low water. As a result of monitoring efforts from both the Virginia Institute of Marine Science and the Waterways Experiment Station from 1987 to 1991, the area was classified into six equally divided cells. It is intended that all six cells be utilized for placement of dredged material, and that the material be placed in a manner consistent within the criteria established in the project’s environmental assessment published in July 1992. This placement site is currently used for the periodic maintenance dredging of the York River Entrance and York Spit Channels. The WTA is a 2,300-acre (4,400 acres with the designated buffer zone) area located in the Chesapeake Bay near Mathews County, east of New Point Comfort and south of Wolf Trap light.

The WTA boundary coordinates are as follows:

37.363063 N, -76.178684 W;  
37.363063 N, -76.157913 W;  
37.274736 N, -76.194135 W;  
37.274736 N, -76.173363 W.

#### *Rappahannock Shoal Deep Alternate Open Water Site*

The Rappahannock Shoal Alternative Placement Site (RSA) is an area approximately 4.5 nautical miles by 0.8 nautical miles in dimension, has an area of approximately 3,100 acres in size, and is the primary placement site for dredged material from RSC. The site is located approximately 1-mile west of the RSC. The average water depth is -39 feet. The site has capacity to manage dredged material over a 20-year planning period, the site has not been utilized for dredged material placement since 1989. The RSA boundary coordinates are as follows:

37.666797 N, -76.174662 W;

37.666796 N,-76.191337 W;  
37.591797 N,-76.191321 W;  
37.591799 N,76.174662 W.

#### *Norfolk Ocean Dredged Material Disposal Site*

The NODS was officially designated by the Environmental Protection Agency (EPA) pursuant to Section 102(c) of the Marine Protection, Research, and Sanctuaries Act of 1972, as amended, as suitable for ocean disposal of dredged material on July 2, 1993 (FR. Vol. 5a No. 126). NODS is located in the Atlantic Ocean approximately 17 miles east of Cape Henry and is approximately 50 square nautical miles in size. The site is circular with a radius of 4 nautical miles and the water depth ranges from 43 to 85 feet. The center point coordinate of the site is north latitude 36° 59' and west longitude 75° 39'. The site is authorized to receive dredged materials from the lower Chesapeake Bay. The site is also authorized to receive dredged material from the Thimble Shoal, Cape Henry, Atlantic Ocean Channel, Hampton Roads, and York Spit channels. Up to approximately 250 million cubic yards of dredged material (public and private dredging projects) may be disposed at the site over the next 49 years; however, only material that meets ocean dumping criteria may be disposed at the site.

#### *Craney Island Dredged Material Management Area and Facilities*

The Craney Island Dredged Material Management Area (CIDMMA) was authorized by the Rivers and Harbors act of 1946. It was constructed on 2,500 acres of river bottom in Hampton Roads in the City of Portsmouth, Virginia. CIDMMA is the primary dredged material placement area for construction and maintenance of navigation channels in the Hampton Roads port complex. It provides essential dredged material placement capacity for the Federal navigation channels, U.S. Navy facilities, Virginia Port Authority facilities and other commercial port facilities in Hampton Roads. The CIDMMA is an upland confined placement area that is enclosed by a perimeter containment dike and divided into three sub-containment cells by two division dikes.

The CIDMMA receives dredged materials in two different ways. It is either pumped directly into one of three upland containment cells or it is deposited in the rehandling basin and then pumped into the facility. The Craney Island Rehandling Basin (CIRB) is located to the east of the upland containment area and consists of a subaqueous rectangular area 1,400 feet in length by 1,100 feet in width and 40 feet in depth. The CIRB is connected by two access channels being 1,500 feet in length, 20 feet in depth and 200 feet wide. The basin is meant for the deposit of dredged material from dump scows from mechanical dredging operations. The project also provides for a debris channel, a segment of channel that connects the rehandling basin to the CIDMMA bulkhead. The debris channel is 80 feet wide and 13 feet deep. To date, the CIDMMA has received, on average, 3.5 million cubic yards of dredged material per year; however, there have been several years when it has received more than 10 million cubic yards. You estimate that the facility has a realistic lifespan up to 2030, but this may be subject to change as newer technologies and/or new management techniques are employed at the site.

### **3.9 Information on Dredges That May Be Used**

Nearly all dredging in the Chesapeake Bay considered in this Opinion will occur with a hydraulic hopper dredge. However, other dredging methods could include mechanical dredging and also hydraulic cutterhead dredging.

### **3.9.1           *Self-Propelled Hopper Dredges***

Hopper dredges are typically self-propelled seagoing vessels. They are equipped with propulsion machinery, sediment containers (i.e., hoppers), dredge pumps, and other specialized equipment required to excavate sediments from the channel bottom. Hopper dredges have propulsion power adequate for required free-running speed and dredging against strong currents.

A hopper dredge removes material from the bottom of the channel in thin layers, usually 2-12 inches, depending on the density and cohesiveness of the dredged material (Taylor, 1990). Pumps within the hull, but sometimes mounted on the dragarm, create a region of low pressure around the dragheads; this forces water and sediment up the dragarm and into the hopper. The more closely the draghead is maintained in contact with the sediment, the more efficient the dredging (i.e., the greater the concentration of sediment pumped into the hopper). In the hopper, the slurry mixture of sediment and water is managed to settle out the dredged material solids and overflow the supernatant water. When a full load is achieved, the vessel suspends dredging, the dragarms are heaved aboard, and the dredge travels to the placement site where dredged material is disposed of.

### **3.9.2           *Hydraulic Cutterhead Pipeline Dredges***

The cutterhead dredge is essentially a barge hull with a moveable rotating cutter apparatus surrounding the intake of a suction pipe (Taylor, 1990). By combining the mechanical cutting action with the hydraulic suction, the hydraulic cutterhead has the capability of efficiently dredging a wide range of material, including clay, silt, sand, and gravel.

The largest hydraulic cutterhead dredges have 30 to 42 inch diameter pumps with 15,000 to 20,000 horsepower. The dredge used for this project is expected to have a pump and pipeline with approximately 30" diameter<sup>1</sup>. These dredges are capable of pumping certain types of material through as much as 5-6 miles of pipeline, though up to 3 miles is more typical. The cutterhead pipeline plant employs spuds and anchors in a manner similar to floating mechanical dredges.

### **3.9.3           *Mechanical Dredges***

Mechanical dredging will be used in association with CIEE and in some of the Norfolk Harbor Channels. Mechanical dredges are relatively stationary. While operating, the dredge swings slowly in an arc across the channel cut as material is excavated. This is accomplished by pivoting the dredge on vertical pilings called spuds that are alternately raised and lowered from the stern corners of the dredge. Cables to anchors, set roughly perpendicular to the forward section of the dredge, are used to shift the lateral position of the digging area. Periodically, as

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<sup>1</sup> While 30" dredge is possible for this project, historically a 20-24 inch cutterhead dredge has been used to perform work in the area due to the inflow constraints at Craney Island.

the cut advances, the anchors are reset. Bucket dredging entails lowering the open bucket through the water column, closing the bucket after impact on the bottom, lifting the bucket up through the water column, and emptying the bucket into a barge. An environmental clamshell dredge differs from traditional dredging buckets by having an outer covering that seals when the bucket is closed. Water passes through its top moveable vents as it submerges, thereby reducing turbidity. Once it lifts off the bottom and closes, the covering seals over the bucket and minimizes overspill as the dredge bucket moves back up through the water column.

### **3.10 Bed Leveling Devices**

You have indicated that in certain circumstances, a dredge contractor may employ a bed-leveler device to smooth the channel bottom or to reduce the isolated shoals or ridges in the channel that cannot be economically or effectively dredged with a hopper dredge. Since 2012, bed-leveling has been used on multiple contracts including Thimble Shoals Channel, York Spit Channel, and Cape Henry Channel located in the action area. Bed-leveling may be a preferred alternative during certain phases of the dredging operations (i.e. clean-up phase) and it is possible that a bed leveler will be used in upcoming dredging cycles.

Bed leveling techniques have been documented as far back as 1565 (USACE, 2006). However, the use of bed-levelers in U.S. waters is not well documented. The devices are typically used during final clean-up operations when localized mounds or ridges exist shallower than required dredging depths. Passage of a draghead can create ridges up to two feet high and can require multiple passes to reduce the height during clean-up operations. Often these areas cannot be efficiently or economically dredged to specified depths and make it difficult to maintain hard contact between the draghead and channel bottom. Bed-leveler devices may consist of a large customized plow or a box beam suspended from a work-barge that can be pushed or towed by a tug. The bed-leveler may be towed by a short or long towing line depending on the sea-state. Bed-leveler size and geometry can vary but are typically thirty and fifty feet in width and may weigh from twenty-five to fifty tons. Bed-levelers are generally towed at speeds ranging from 1-2 knots. Bed-leveler operation can be affected by sea state conditions and generally require longer towing line in rougher waters.

The USACE-ERDC has performed an engineering evaluation on various configurations of bed-leveler prototypes to determine their performance aspects for production rates (i.e. ability to remove target material), ability to deflect model turtles, and bed-leveler construction and operation in the field. Model studies were performed at Texas A&M. The study tested conceptual designs using a conventional straight square tube box-beam, a 90-degree raked plow (i.e. inclined), a 90-degree square tube box beam plow, a 130-degree box square tube box beam plow. Model study results indicated that the straight square tube box beam design provided the highest production rate moving sediment in the direction of the bed leveler device but provided the least turtle shedding capability. The 90-degree raked (inclined) plow produced an increased vertical downward force on the towing cables resulting in some operational difficulty. In general, the increase in the sweep angle increased the side-spilling or side-casting of sediment which also accounted for the designs ability to shed model turtles from in front of the bed-leveler device. The 130-degree box beam plow likely provides the optimal mix of production, turtle shedding capability, and operational deployment. The conceptual bed-leveling designs tested in the model study are presented in Appendix B of this Opinion.

### **3.11 Interrelated or Interdependent Actions**

Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR § 402.02; see also 1998 FWS-NMFS Joint Consultation Handbook, pp. 4-26 to 4-28). We have identified the potential effects of larger vessels coming into port as a result of the channel deepening as an interrelated or interdependent action.

### **3.12 Summary of Proposed Action**

The proposed construction to deepen and widen the existing channels is scheduled to commence in approximately 2023 and will take approximately 3.5 to 4 years to complete. Following construction, maintenance dredging will continue for approximately the next 50 years. In the remaining channels, maintenance dredging has been ongoing since 2012 and has a 50-year project life. Due to the multiple overlapping timelines for ongoing dredging, construction, and future maintenance dredging, and in recognition of the fact that projects may encounter unanticipated delays, throughout the Opinion we will generally refer to the “project life” or “life span of the project,” which are intended to encompass all temporal components of the action. The action considered here includes dredging, as summarized in the table below, as well as fill activities associated with the CIEE and continued use of several dredged material disposal sites and placement of sand on Virginia Beach and Sandbridge Beach as well as at the U.S. Navy’s Fort Story Facility.

The following tables summarize the anticipated dredging during this period:

**Table 2.** Anticipated dredging considered in this consultation

<b>Channel</b>	<b>Type of Dredge</b>	<b>Typical Volume Removed</b>	<b>Frequency of Dredge Events</b>	<b>Number of events over the project life</b>	<b>Volume Removed over the project life</b>
<b>Baltimore Harbor Entrance Channels</b>					
<i>Cape Henry</i>	<i>H</i>	<i>1.1 mcy</i>	<i>1-2 years</i>	<i>25-50</i>	<i>Up to 50 mcy</i>
<i>York Spit Channel</i>	<i>H</i>	<i>0.5 mcy</i>	<i>2 years</i>	<i>25</i>	<i>12.5 mcy</i>
<i>Rappahannock Shoals Channel</i>	<i>H</i>	<i>no maintenance dredging to date</i>	<i>Every 20 years</i>	<i>2</i>	<i>Up to 2 mcy</i>
<b>Total: 64.5 MCY</b>					
<b>VA Beach Hurricane Protection</b>	<b>H</b>	<b>0.27 mcy</b>	<b>Every 3 years</b>	<b>16</b>	<b>4.4 mcy</b>
<b>Sandbridge</b>	<b>H or C</b>	<b>0.5 mcy</b>	<b>Every 2 years</b>	<b>25</b>	<b>12.5 mcy</b>
<b>Craney Island Eastward Expansion</b>					
CIEE – Main Dike dredging (8,500 linear feet)	<i>C or M</i>	<i>Subject to Federal Funding</i>	<i>Subject to Federal Funding</i>	<i>Subject to Federal Funding</i>	22,400,000
CIEE – Access Channel dredging	<i>C or M</i>	<i>Subject to Federal Funding</i>	<i>Subject to Federal Funding</i>	<i>Subject to Federal Funding</i>	1,600,000
CIEE – Wharf Access dredging	<i>C or M</i>	<i>Subject to Federal Funding</i>	<i>Subject to Federal Funding</i>	<i>Subject to Federal Funding</i>	7,300,000
<b>Total: 31.3 mcy (6.8 mcy cutterhead; 24.5 mcy mechanical)</b>					

Channel	Required Depth (ft)	Construction				Maintenance over the life of the project		Construction + Maintenance	
		Est. Max Depth (ft)	Est. Max Volume (cy)	Est. Max Duration (months)	Est. Max Bottom Disturbance (sq ft)	Est. Total Volume (cy)	Est. Total Duration (months)	Est. Max Volume (cy)	Est. Max Duration (months)
Atlantic Ocean	59	64	16,074,736	42	78,738,613	15,191,112	62	31,265,848	104
Thimble Shoals	56	61	18,069,823	57	119,644,916	24,331,540	210	42,401,363	276
Thimble Shoals Meeting Areas #1 & #2	56	61	7,191,000	23	13,388,000	3,640,924	31	10,831,924	54
Sewell's Point to Lamberts Bend	55	60	12,147,318	11	57,012,805	42,346,689	78	54,494,008	89
Anchorage F	55	60	1,914,788	14	25,222,454	7,590,328	15	9,505,116	30
Newport News	55	60	4,906,284	4	29,272,754	6,676,305	16	11,582,589	19
<b>Total</b>			<b>60,303,949</b>	<b>151</b>	<b>323,279,542</b>	<b>99,776,899</b>	<b>412</b>	<b>160,080,647</b>	<b>564</b>

### **3.13 Action Area**

The action area is defined in 50 CFR § 402.02 as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.” The action area for this consultation is the area affected by dredging and disposal activities as well as the area transited by dredges, dredged material disposal vessels, and vessels using the navigation channels. The action area, therefore, is the entirety of the navigation channels, borrow areas and disposal areas noted above. The action area will also encompass the underwater area where dredging will result in increased suspended sediment. The size of the sediment plume will vary depending on the type of dredge used and is detailed below.

#### **3.13.1 *Physical Characteristics of the Action Area***

The Chesapeake Bay is approximately 320 km (200 m) long and extends from Cape Henry and Cape Charles to Havre de Grace, Maryland. It is 4.5 km (2.8 m) wide at its narrowest (between Kent County's Plum Point near Newtown and the Harford County shore near Romney Creek) and 48 km (30 miles) at its widest (just south of the mouth of the Potomac River). Water depth in the bay averages 6.4 m (21 feet), reaching a maximum depth of 53 m (174 feet).

The lower Chesapeake Bay attained its current configuration after the end of the last Ice Age and it has been relatively stable for the last several thousand years (Bratton et al. 2002), although waters have continued to slowly rise over this time, due to glacial rebound and now the addition of human-induced climate change (Schulte et al. 2015) (Figure 2-15). The Norfolk Harbor has been in use since shipping into and out of Chesapeake Bay began, and has been deepened to accommodate larger ships over the decades. This channel was formed naturally as river valleys (in this case the James/Susquehanna). This dredging has not significantly altered the tidal prism of the lower Chesapeake Bay, due to the small size of the channel relative to the size of the Chesapeake Bay. It has been deepened by prior dredging efforts, with initial dredging to ensure at least -40 feet of depth occurring during 1917-1927 (VIMS 1993). Additional deepening to -45 feet occurred in 1967. In 1986, the channel was authorized to be deepened to -50 feet. The current authorized depth at this time is -55 feet, though most of the channel is at -50 feet at this time. The main shipping channel follows the natural bathymetry of lower Chesapeake Bay. This natural channel, however, has been deepened where needed to accommodate larger vessels.

The typical tidal range in the action area, including the Elizabeth River and nearby open waters of lower Chesapeake Bay, is approximately 2.85 feet, though this varies significantly with time of the month (spring and neap tides) as well as due to storm activity, which can create significant storm surges well beyond the normal tidal range. Tides are diurnal in the Chesapeake Bay, with two high and low tides per day. The mean discharge rate of Chesapeake Bay is approximately 2,500 m<sup>3</sup> /sec, over 80% of which is supplied by three rivers (the Susquehanna, Potomac, and James Rivers) (Goodrich 1988). Salinity typically ranges from 20-30 ppt (parts per thousand) in the action area, which covers a broad area from the mouth of Chesapeake Bay into the lower James River. These areas are sufficiently mixed so that anoxic waters are not typical within the action area. Such deep channels can go anoxic in the summer, particularly in the mid to upper Chesapeake Bay, causing a significant “dead zone” of hypoxic waters. The bathymetry of the action area ranges from intertidal shallows to the deep channels, which generally lie within the immediate action area where dredging is proposed and typically range in depth from

approximately -20 feet in side and/or natural and unmaintained channels to -50 feet within the channel itself.

The landforms surrounding the project area are comprised primarily of geologically recent (Pleistocene and Holocene) sediments, primarily fine sands, silts, with small amounts of small gravel (College of William and Mary 2006). The subaqueous terrain of the project area is of similar material, with sand, fine sand, shell, mud, with some pebbles or gravel that were deposited during interglacial periods under conditions similar to those that exist in the modern Chesapeake Bay and its tidal tributaries (College of William and Mary 2006).

Frequent dredged material placement and subsequent consolidation results in varying topography throughout the CIDMMA. Although not anticipated, any dredged material unsuitable for open water placement or placement at CIDMMA would likely be dewatered in accordance with Federal and state water quality requirements, and transported to a permitted, upland disposal facility. Dredged material placement and dynamic hydraulic processes at the DNODS and the NODS result in varying topography throughout the sites.

#### 4.0 STATUS OF LISTED SPECIES AND CRITICAL HABITAT

Several ESA-listed species under our jurisdiction occur in the action area for this consultation. We have determined that the proposed action being considered in this Opinion may affect the following ESA-listed species in a manner that will likely result in adverse effects:

Common name	Scientific name	ESA Status
Loggerhead sea turtle - NWA DPS <sup>2</sup>	<i>Caretta caretta</i>	Threatened
Kemp's ridley sea turtle	<i>Lepidochelys kempii</i>	Endangered
Green sea turtle - North Atlantic DPS <sup>3</sup>	<i>Chelonia mydas</i>	Threatened
Atlantic sturgeon	<i>Acipenser oxyrinchus oxyrinchus</i>	
Gulf of Maine (GOM) DPS		Threatened
New York Bight (NYB) DPS		Endangered
Chesapeake Bay (CB) DPS		Endangered
Carolina DPS		Endangered
South Atlantic (SA) DPS		Endangered

We have determined that the proposed action being considered in this Opinion is not likely to adversely affect North Atlantic right whales (*Eubalaena glacialis*), fin whales (*Balaenoptera physalus*), sei whales (*Balaenoptera borealis*), sperm whales (*Physeter macrocephalus*), blue whales (*Balaenoptera musculus*), hawksbill sea turtles (*Eretmochelys imbricata*), leatherback sea turtles (*Dermochelys coriacea*), or shortnose sturgeon (*Acipenser brevirostrum*), all of which are listed as endangered under the ESA. We have also determined that the proposed action being considered in this Opinion is not likely to adversely affect the James and York River Units of the designated critical habitat for the Chesapeake Bay DPS of Atlantic sturgeon. The following discussions are our rationale for these determinations.

<sup>1</sup> NWA DPS = Northwest Atlantic DPS, the only loggerhead sea turtle DPS expected to occur in the action area.

<sup>2</sup> The North Atlantic DPS is the only green sea turtle DPS expected to occur in the action area.

#### **4.1 Species and Critical Habitat Not Likely to be Adversely Affected by the Proposed Action**

Federally endangered North Atlantic right whales and fin whales are expected to occur in Virginia nearshore and coastal waters of the action area, including Chesapeake Bay, while federally endangered sei, sperm, and blue whales are not, due to their primarily offshore distribution in the Atlantic Ocean. Transient individual right and fin whales may occasionally be present in the lower Bay and nearshore waters of Virginia for brief periods during annual migrations or during the summer months, but no whales are known to be resident in this area and even transient whales are considered rare within the action area .

Whales in the action area will be exposed to effects of the proposed actions including vessel traffic, increased turbidity/suspended sediment (which may affect prey), and potential removal of prey during dredging. All sand will be placed on beaches or in nearshore shallow areas adjacent to beaches. Whales do not occur in these areas; therefore, no whales will be exposed to effects of sand placement.

There have not been any reports of dredge vessels colliding with listed species but contact injuries resulting from dredge movements could occur at or near the water surface and could therefore involve any of the listed species present in the area. Because the dredge is unlikely to be moving at speeds greater than three knots during dredging operations, blunt trauma injuries resulting from contact with the hull are unlikely during dredging. It is more likely that contact injuries during actual dredging would involve the propeller of the vessel. Contact injuries with the dredge are more likely to occur when the dredge is moving from the dredging area to port, or between dredge locations. While the distance between these areas is relatively short (up to approximately 30 miles), the dredge in transit would be moving at faster speeds (9.8 – 10.8 mph) than during dredging operations (2 – 3 mph), particularly when empty while returning to the borrow area.

Large whales, particularly right whales, are vulnerable to injury and mortality from ship strikes. Ship strike injuries to whales take two forms: (1) propeller wounds characterized by external gashes or severed tail stocks; and (2) blunt trauma injuries indicated by fractured skulls, jaws, and vertebrae, and massive bruises that sometimes lack external expression (Laist *et al.* 2001). Collisions with smaller vessels may result in propeller wounds or no apparent injury, depending on the severity of the incident. Laist *et al.* (2001) reports that of 41 ship strike accounts that reported vessel speed, no lethal or severe injuries occurred at speeds below ten knots, and no collisions have been reported for vessels traveling less than six knots. A majority of whale ship strikes seem to occur over or near the continental shelf, probably reflecting the concentration of vessel traffic and whales in these areas (Laist *et al.* 2001).

Most ship strikes have occurred at vessel speeds of 13-15 knots or greater (Jensen and Silber 2003; Laist *et al.* 2001). An analysis by Vanderlaan and Taggart (2006) showed that at speeds greater than 15 knots, the probability of a ship strike resulting in death increases asymptotically to 100%. At speeds below 11.8 knots, the probability decreases to less than 50%, and at ten knots or less, the probability is further reduced to approximately 30%. As noted above, the

speed of the dredge is not expected to exceed 2.6 knots while dredging and 10 knots while transiting to and from the disposal sites. In addition, all vessels will have lookouts on board and operators will receive training on prudent vessel operating procedures to avoid vessel strikes with all protected species. All project related vessels will slow down or alter course if whales are sighted and no vessel will approach within 500 meters of a whale. With these measures in place, interactions between the dredge vessels and any listed whales are extremely unlikely. Therefore, the effects of vessel strike are discountable.

Dredging operations cause sediment to be suspended in the water column. This results in a sediment plume in the water, typically present from the dredge site and decreasing in concentration as sediment falls out of the water column as distance increases from the dredge site. The nature, degree, and extent of sediment suspension around a dredging operation are controlled by many factors including: the particle size distribution, solids concentration, and composition of the dredged material; the dredge type and size, discharge/cutter configuration, discharge rate, and solids concentration of the slurry; operational procedures used; and the characteristics of the hydraulic regime in the vicinity of the operation, including water composition, temperature and hydrodynamic forces (i.e., waves, currents, etc.) causing vertical and horizontal mixing (USACE 1983).

Resuspension of fine-grained dredged material during hopper dredging operations is caused by the dragheads as they are pulled through the sediment, turbulence generated by the vessel and its prop wash, and overflow of turbid water during hopper filling operations. During the filling operation, dredged material slurry is often pumped into the hoppers after they have been filled with slurry in order to maximize the amount of solid material in the hopper. The lower density turbid water at the surface of the filled hoppers overflows and is usually discharged through ports located near the waterline of the dredge. In the vicinity of hopper dredge operations, a near-bottom turbidity plume of resuspended bottom material may extend 2,300 to 2,400 ft down current from the dredge (USACE 1983). In the immediate vicinity of the dredge, a well-defined upper plume is generated by the overflow process. Approximately 1,000 ft behind the dredge, the two plumes merge into a single plume (USACE 1983). Suspended solid concentrations may be as high as several tens of parts per thousand (ppt; grams per liter) near the discharge port and as high as a few parts per thousand near the draghead. In a study done by Anchor Environmental (2003), nearfield concentrations ranged from 80.0-475.0 mg/l. Turbidity levels in the near-surface plume appear to decrease exponentially with increasing distance from the dredge due to settling and dispersion, quickly reaching concentrations less than 1 ppt. By a distance of 4,000 feet from the dredge, plume concentrations are expected to return to background levels (USACE 1983). Studies also indicate that in almost all cases, the vast majority of resuspended sediments resettle close to the dredge within one hour, and only a small fraction takes longer to resettle (Anchor Environmental 2003).

Total suspended sediment (TSS) is most likely to affect whales if a plume causes a barrier to normal behaviors or if elevated levels of suspended sediment affects prey. As whales are highly mobile, individuals are likely to be able to avoid any sediment plume that is present and any effect on their movements or behavior is likely to be insignificant. In addition, the total suspended sediment levels expected (80 – 475 mg/L) are below those shown to have an adverse effect on fish (580.0 mg/L for the most sensitive species, with 1,000.0 mg/L more typical

(Breitbart 1988 in Burton 1993; Summerfelt and Moiser 1976 and Combs 1979 in Burton 1993)). The whales that may be present in the action area feed on krill and small schooling fish. No impacts to these forage fish are likely to result from exposure to increased suspended sediment during dredging operations. Given this information, effects to whales from increased turbidity is extremely unlikely; effects to listed whales will be discountable.

We have also determined that the proposed action will not have any adverse effects on the availability of prey for right, fin, sei, sperm, and blue whales. Right and sei whales feed on copepods. The proposed action will not affect the availability of copepods for foraging right and sei whales because copepods are very small organisms that live in the water column and not in the bottom sediment affected by dredging. Fin and blue whales feed on pelagic krill as well as small schooling fish (e.g., sand lance, herring, mackerel) (Aguilar 2002; Sears 2002), while sperm whales feed on larger organisms that inhabit the deeper ocean regions such as mesopelagic squid (Whitehead 2002). Because these organisms either live pelagically and are highly mobile, or are not located in the action area (i.e., mesopelagic squid), effects of dredging and vessels related to the project will not present a pathway of effects to these prey. As a result, the proposed action will not affect the availability of the often pelagic and deepwater prey of foraging sei, sperm, and blue whales.

In addition, the proposed action does not occur in low latitude waters where the overwhelming majority of calving and nursing occurs for these five large whale species (Aguilar 2002; Horwood 2002; Kenney 2002; Sears 2002; Whitehead 2002). Therefore, the proposed action will not affect the oceanographic conditions that are conducive for calving and nursing.

Based on the analysis above, we have determined that the proposed action is not likely to adversely affect these endangered species of whales, and we will not assess them further in this Opinion.

The hawksbill sea turtle is listed as endangered. This species is uncommon in the waters of the continental U.S. Hawksbills prefer coral reef habitats, such as those found in the Caribbean and Central America. Mona Island (Puerto Rico) and Buck Island (St. Croix, U.S. Virgin Islands) contain especially important foraging and nesting habitat for hawksbills. Within the continental U.S., nesting is restricted to the southeast coast of Florida and the Florida Keys, but nesting is rare in these areas. Hawksbills have been recorded from all Gulf of Mexico states and along the U.S. east coast as far north as Massachusetts, but sightings north of Florida are rare. Many of the strandings in states north of Florida have been observed after hurricanes or offshore storms. Aside from Florida, Texas is the only other U.S. state where hawksbills are sighted with any regularity. Since hawksbill sea turtles are extremely unlikely to be present in the action area, impacts to this species as a result of the proposed action are discountable. The lack of any captures of hawksbill sea turtles during dredging operations to date supports this determination.

The leatherback sea turtle is listed as endangered. Adult leatherback sea turtles engage in routine migrations between northern temperate and tropical waters (NMFS and USFWS 1992). Leatherbacks are frequently thought of as a pelagic species that feed on jellyfish (e.g., *Stomolophus*, *Chrysaora*, and *Aurelia* species) and tunicates (e.g., salps, pyrosomas) (Rebel 1974; Davenport and Balazs 1991); however, leatherbacks are also known to use coastal waters of the

U.S. continental shelf (James *et al.* 2005a; Eckert *et al.* 2006; Murphy *et al.* 2006). Leatherbacks are present in the action area between April and November as they migrate to and from southern tropical waters. If suitable forage is present, foraging is expected to occur. Nesting occurs outside of the action area and the presence of leatherbacks in the action area is limited to large juveniles and adults.

Leatherback sea turtles in the action area will be exposed to effects of the proposed actions including vessel traffic and increased turbidity/suspended sediment (which may affect prey). Leatherbacks in the action area are too large to be vulnerable to impingement or entrainment in a dredge. As reported by you, no leatherback sea turtles have been entrained in hopper dredge operations operating along the U.S. Atlantic coast (USACE Sea Turtle Warehouse, 2017). No leatherback sea turtles are likely to be captured during relocation trawling.

Although little is known about a sea turtle's reaction to vessel traffic, it is generally assumed that turtles are more likely to avoid injury from slower-moving vessels since the turtle has more time to maneuver and avoid the vessel. The speed of the dredge is not expected to exceed 3 knots while dredging or while transiting to the pump out site with a full load and it is expected to operate at a maximum speed of 10 knots while empty. In addition, the risk of ship strike will be influenced by the amount of time the animal remains near the surface of the water. For the proposed action, the greatest risk of vessel collision will occur during transit between shore and the areas to be dredged. The presence of an experienced endangered species observer who can advise the vessel operator to slow the vessel or maneuver safely when sea turtles are spotted will further reduce the potential risk for interaction with vessels. To date, there have not been any reports of dredge vessels colliding with leatherback sea turtles. The addition of one to two slow moving vessels in the action area have an insignificant effect on the risk of interactions between leatherback sea turtles and vessels in the action area.

Suspended sediments are most likely to affect leatherback sea turtles if a plume causes a barrier to normal behaviors. As leatherback sea turtles are highly mobile, individuals are likely to be able to avoid any sediment plume that is present and any effect on their movements or behavior is likely to be insignificant due to the small, temporary disruption of normal movements that may result from avoiding the sediment plume are expected to be so small as to not be susceptible to meaningful measurement or detection. Since dredging involves removing the bottom material down to a specified depth, only the benthic environment will be impacted by dredging operations. No effects to the prey base of leatherback sea turtles are anticipated because their preferred prey – jellyfish – are located in the water column.

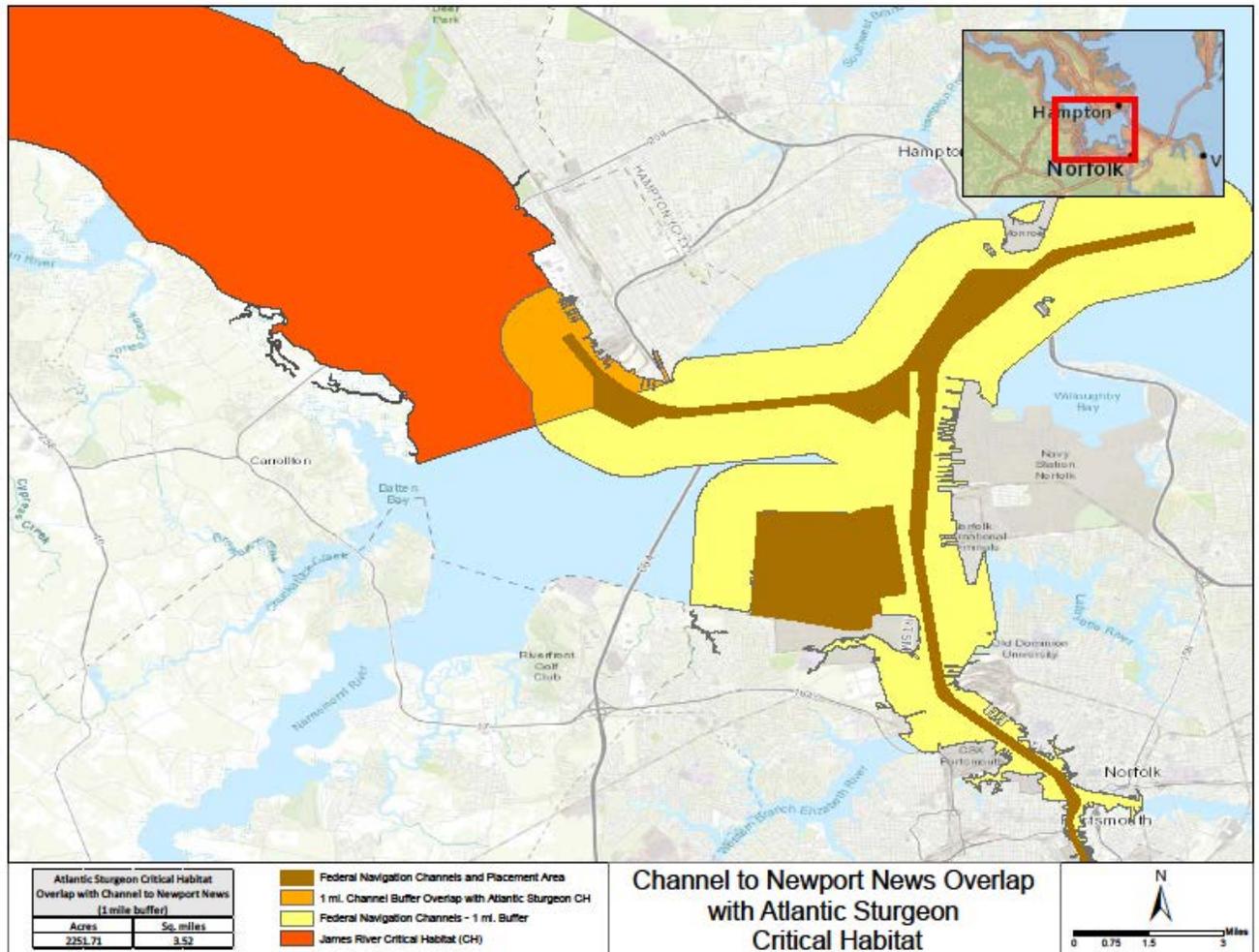
As all effects to leatherback sea turtles from the proposed actions are likely to be too small to be meaningfully measured or detected or extremely unlikely and, therefore, insignificant or discountable, these actions are not likely to adversely affect this species. We do not anticipate any incidental take of any leatherback sea turtles from any of the activities considered in this Opinion.

Shortnose sturgeon are benthic fish that occur in large coastal rivers of eastern North America. They range from as far south as the St. Johns River, Florida (possibly extirpated from this system) to as far north as the Saint John River in New Brunswick, Canada. The species is

anadromous in the southern portion of its range (*i.e.*, south of Chesapeake Bay), while some northern populations are amphidromous (NMFS 1998a), and mostly remain in their native rivers. In Chesapeake Bay, shortnose sturgeon are most often found in Maryland waters of the mainstem bay and tidal tributaries such as the Susquehanna, Potomac, and Rappahannock Rivers (Spells 1998; Litwiler 2001; Kynard et al. 2007, 2009; SSSRT 2010). Documented modern use of Virginia waters of Chesapeake Bay is limited to two individual shortnose sturgeon: one captured in 2016 and a second sturgeon (a confirmed gravid female) caught in 2018. Given the range of the species (remaining mostly in the river systems, with some coastal migrations between rivers), its general restriction to the upper part of Chesapeake Bay (Maryland portion), and the proposed action mostly occurring within the entrance channels of large rivers within the southern portion of Chesapeake Bay, shortnose sturgeon are expected to be extremely rare in areas where the action may occur. As shortnose sturgeon are extremely unlikely to be present in the action area, except for rare transient occurrences, impacts to this species as a result of the proposed action are discountable.

On August 17, 2017, we issued a final rule to designate critical habitat for the threatened Gulf of Maine DPS of Atlantic sturgeon, the endangered New York Bight DPS of Atlantic sturgeon, the endangered Chesapeake Bay DPS of Atlantic sturgeon, the endangered Carolina DPS of Atlantic sturgeon, and the endangered South Atlantic DPS of Atlantic sturgeon (82 FR 39160). The rule was effective on September 18, 2017. The action area for this consultation overlaps slightly with the river mouth of the James River, which is designated as critical habitat for the Chesapeake Bay DPS of Atlantic sturgeon. A portion of the York River Entrance Channel overlaps the York River critical habitat unit; however, during the consultation, you informed us that there is no planned federal action for the channel because the project is not funded and, therefore, no maintenance dredging is planned at this time. Should project plans change or new information become available, further coordination should be pursued.

**Figure 1. Channel to Newport News Overlap with Atlantic Sturgeon Critical Habitat**



The conservation objective identified in the final rule is to increase the abundance of each DPS by facilitating increased successful reproduction and recruitment to the marine environment. We designated five critical habitat units to achieve this objective for the Chesapeake Bay DPS: (1) Potomac River from the Little Falls Dam downstream to where the main stem river discharges at its mouth into the Chesapeake Bay; (2) Rappahannock River from the U.S. Highway 1 Bridge, downstream to where the river discharges at its mouth into Chesapeake Bay; (3) York River from its confluence with the Mattaponi and Pamunkey rivers downstream to where the main stem river discharges at its mouth into Chesapeake Bay as well as the waters of the Mattaponi River from its confluence with the York River and upstream to the Virginia State Route 360 Brige of the Mattaponi River, and waters of the Pamunkey River from its confluence with the York River and upstream to the Nelson’s Bridge Road Route 615 crossing of the Pamunkey River; (4) James River from Boshers Dam downstream to where the main stem river discharges at its mouth into Chesapeake Bay at Hampton Roads; and (5) Nanticoke River from the Maryland State Route 313 Bridge crossing near Sharptown, MD to where the main stem discharges at its mouth into Chesapeake Bay as well as Marshyhope Creek from its confluence with the Nanticoke River and upriver to the Maryland State Route 318 Bridge crossing near

Federalsburg, MD. In total, these designations encompass approximately 773 kilometers (480 miles) of aquatic habitat.

As identified in the final rule, the physical and biological features (PBFs) that are essential to the conservation of the species and that may require special management considerations or protection are:

- 1) Hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0 to 0.5 parts per thousand (ppt) range) for settlement of fertilized eggs, refuge, growth, and development of early life stages;
- 2) Aquatic habitat with a gradual downstream salinity gradient of 0.5 up to as high as 30 ppt and soft substrate (e.g., sand, mud) between the river mouth and spawning sites for juvenile foraging and physiological development;
- 3) Water of appropriate depth and absent physical barriers to passage (e.g., locks, dams, thermal plumes, turbidity, sound, reservoirs, gear, etc.) between the river mouth and spawning sites necessary to support:
  - (i) Unimpeded movement of adults to and from spawning sites;
  - (ii) Seasonal and physiologically dependent movement of juvenile Atlantic sturgeon to appropriate salinity zones within the river estuary; and
  - (iii) Staging, resting, or holding of subadults or spawning condition adults.Water depths in main river channels must also be deep enough (e.g., at least 1.2 m) to ensure continuous flow in the main channel at all times when any sturgeon life stage would be in the river.
- 4) Water, between the river mouth and spawning sites, especially in the bottom meter of the water column, with the temperature, salinity, and oxygen values that, combined, support:
  - (i) Spawning;
  - (ii) Annual and interannual adult, subadult, larval, and juvenile survival; and
  - (iii) Larval, juvenile, and subadult growth, development, and recruitment (e.g., 13 °C to 26 °C for spawning habitat and no more than 30 °C for juvenile rearing habitat, and 6 milligrams per liter (mg/L) dissolved oxygen (DO) or greater for juvenile rearing habitat).

The action area for the proposed work considered in this Opinion overlaps the lower portions of the James River critical habitat unit. Specifically, the northern end of the Newport News Channel and adjacent Newport News anchorage. The total area of the channel and anchorage that overlaps critical habitat in the James River is approximately 0.38 square miles (0.99 square kilometers). To account for potential dredging impacts (e.g., a temporary increase in suspended sediments) in the James River, you included a one mile radius buffer zone around the channel and anchorage, which totals approximately 3.52 square miles (9.12 square kilometers). The critical habitat designation is bank-to-bank within the James River. We have estimated that the total area of the James River critical habitat unit is approximately 166 square miles or 106,240 acres. While the majority of the proposed work in designated critical habitat takes place within

the Federal navigation channel, indirect effects from turbidity extend as far as 1,000 feet (305 meters) (cutterhead dredge turbidity plume). If you were to assume a worst-case scenario where a dredge event occurred in the center of the river and the plume extended in a 305 m radius around the dredge (note: we would generally expect the plume to extend only downcurrent of the dredge), the action area would encapsulate a 610 m width of the river. In the overlapping stretch of the James designated as critical habitat, the river is approximately 4.4 miles (7.14 km) wide. The section of the navigation channel and anchorage area that extends into the James River critical habitat unit is approximately 1.5 miles long. Therefore, the action area overlaps with just the southeastern corner of the bank-to-bank critical habitat designation. Each critical habitat unit contains all four of the physical features (referred to as physical or biological features (PBF)); however, the action area only contains three PBFs: PBF 2, 3, and 4, as PBF 1 is not present because the salinity level present at the river mouth exceeds that identified in PBF 1.

We have analyzed the potential impacts of the proposed action on this designated critical habitat, inclusive of the three physical and biological features (PBFs) present that have been deemed essential to the conservation of the species and which may require special management considerations or protections. For each PBF, we identify those activities that may affect the PBF. For each feature that may be affected by the action, we then determine whether any effects to the feature are adverse, insignificant, discountable, or entirely beneficial. In making this determination, we consider the action's potential to affect how each PBF supports Atlantic sturgeon's conservation needs in the action area. Part of this analysis is consideration of whether the action will have effects on the ability of Atlantic sturgeon to access the feature, temporarily or permanently, and consideration of the effect of the action on the action area's ability to develop the feature over time. We have determined that the effects to these PBFs from the proposed action will be insignificant or discountable for the following reasons.

*PBF 2: Transitional salinity zone with soft substrate for juvenile foraging and physiological development*

In considering effects to PBF 2, we consider whether the proposed action will have any effect on areas of soft substrate within transitional salinity zones between the river mouth and spawning sites for juvenile foraging and physiological development; therefore, we consider effects of the action on soft substrate, salinity and any change in the ability of the feature to support juvenile foraging and physiological development. We also consider the effects to PBF 2 in light of the value it provides to the conservation of the species in the action area. Finally, we consider whether the action will have effects on access to this feature, temporarily or permanently, and on the action area's ability to develop the feature over time.

In order to successfully complete their physiological development, Atlantic sturgeon must have access to a gradual gradient of salinity from freshwater to saltwater. Atlantic sturgeon move along this gradient as their tolerance to increased salinity increases with age. PBF 2 occurs from approximately the mouth of the James River upstream to the downstream median range of the salt front. Salinity levels in the river are dynamic, and the salt front<sup>4</sup> is defined by a lower

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<sup>4</sup> The salt front in an estuary is the line between brackish water and freshwater. The location of the salt front changes with the tide cycle and the season. Daily, as the tide in the ocean rises, it brings saltier ocean water into the

concentration (0.25 ppt) than the salinity level of PBF 2 (0.5 ppt), but in the summer and fall RKM 95 is a reasonable approximation given the lack of real time data and the very small difference we would expect between the area where salinity is 0.5 ppt and 0.25 ppt. The action area that overlaps with critical habitat in the James River is between RKM 15 and RKM 18. In the James River critical habitat unit, the only activity that overlaps with PBF 2 is dredging of the portion of the Newport News channel and anchorage. Using the one mile radius zone around the channel and anchorage, we estimate that there are 2,252 acres of unconsolidated soft substrates within the salinity gradient for juvenile foraging and physiological development potentially meeting the criteria for PBF 2 within critical habitat in the action area.

Here we consider whether those activities may affect PBF 2 and if so, whether the dredging described herein are adverse, insignificant, discountable or entirely beneficial.

In the James River, the proposed action involves the deepening of the Newport News channel and subsequent maintenance dredging of non-contiguous shoaled areas every five years. We do not anticipate that the dredging will result in a change in the type of substrate. The portion of the navigation channel and anchorage within critical habitat in the James River is approximately 244 acres. We expect that dredging of the area will result in reduction in benthic habitat through the removal of soft substrate and increased turbidity in the area surrounding the dredge footprint to a 305 meter radius. The area of soft substrate designated as part of PBF 2, and affected by the dredging activities may be slightly larger than 244 acres in the James River, as areas outside of the dredge footprint impacted by sedimentation from the nearfield turbidity plume of dredges may experience a loss of benthic life from burial/suffocation. As stated above, if you were to assume a worst-case scenario where a dredge event occurred in the center of the river and the plume extended in a 305m radius around the dredge (note: we would generally expect the plume to extend only downcurrent of the dredge), the area impacted would be approximately 610 meters wide. We do not expect dredging to impact salinity levels, the other applicable attribute in PBF 2, to an extent that would influence the movement or seasonal location of the salt front. Accordingly, the salinity gradient feature that is a component of PBF 2 would continue to perform its function to facilitate the physiological development of juveniles. This is explained further, below under PBF 4.

Dredging is likely to entrain and kill at least some potential sturgeon forage items. Turbidity and suspended sediments from dredging activities may also affect benthic resources in those areas where increased turbidity and suspended sediments settle out and result in burial or suffocation of immobile organisms. The TSS levels expected for all of the proposed activities (ranging from 5 mg/L to 475 mg/L) are mostly below those shown to have adverse effects on benthic communities (390 mg/L (EPA 1986). Benthic sampling done by O'Herron and Hastings (1985) in association with past USACE maintenance dredging in the Delaware River found that *Corbicula* recolonized the dredge areas during the subsequent growing season. Until the areas recover and are repopulated by neighboring colonies of benthic invertebrates, juvenile sturgeon will be able to access these areas during their development, but will not be able to use these areas

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estuary and pushing the salt front further up the river estuary. As the tide recedes, the salt front occurs further downriver. Seasonally, higher freshwater flow (e.g., in the spring) pushes the salt front further downriver in the estuary. During times of less freshwater input (e.g., during the summer), the salt front is further upriver in the estuary.

for foraging. Sturgeon may be exposed to a temporary reduction in forage in these noncontiguous shoaled areas where dredging occurs for one to two seasons immediately following dredging (O'Herron and Hastings 1985). As the Newport News channel may require maintenance dredging of non-contiguous areas every 5 years, areas dredged in one cycle are expected to fully recover their value for juvenile foraging for two to three years before being dredged again. During this time, sturgeon will be able to access and transit through the area and use it for other aspects of their development.

Soft substrate within the navigation channels and anchorage may also be disturbed on a daily basis by large, deep draft, commercial vessels. Channels requiring maintenance dredging are particularly vulnerable to disturbance from vessels, as once sediments build up (which occurs over time after dredging), they can be close enough to the keels and propellers of large vessels to be a navigation hazard. Given the dynamic nature of the substrates that form these channels, the impacts of natural factors that lead to the accumulation of sediments in these channels, and the disturbance of at least the top layer of sediment when large ships pass overhead, these areas may not support the same abundance of benthic resources as areas outside of the channels do, where the disturbance regime is not as frequent. However, given that Atlantic sturgeon forage on a variety of benthic invertebrates, including worms that bury into the substrate, it is not entirely clear what impact the disturbance regime has on the ability of these shoaled areas to support the foraging and development of juvenile Atlantic sturgeon. While we do not have fine scale information on sturgeon forage items or sturgeon distribution that we could use to make a conclusive determination about foraging in the channel versus outside the channel, it is reasonable to assume that areas outside the channel that are not subject to disturbance as frequently are more likely to support forage species. Accordingly, the value of PBF 2 outside the channel is greater to the conservation of the species.

In conclusion, although the dredging in the James River of up to 244 acres will affect benthic invertebrates throughout the life of the project, by removing them with the dredged sediment and limiting the feature's ability to permanently improve in value in the future (the intermittent removal of substrates to maintain the channel depth will affect the availability of forage species while areas are recolonized by benthic invertebrates that juvenile Atlantic sturgeon would otherwise feed on), the area will continue to consist of soft bottom substrate. In addition, the dredging footprint represents a small (up to approximately 0.23% of the James River critical habitat unit potentially supporting PBF 2) and non-contiguous amount of the available soft bottom substrate within the subset of the action area that overlaps critical habitat. Furthermore, the non-contiguous areas of PBF 2 will not be impacted at the same times during dredging events. Considering these factors, as well as the naturally dynamic nature of these areas which may limit their ability to support foraging juvenile Atlantic sturgeon (except for opportunistically), i.e., the function of PBF 2 in the action area even if dredging did not occur, the effects of dredging this small amount of habitat on juvenile foraging or physiological development will be so small that they cannot be meaningfully measured, evaluated, or detected. Therefore, any effects on the value of PBF 2 in the action area to the conservation of the species are insignificant.

*PBF 3: Water absent physical barriers to passage between the river mouth and spawning sites*

In considering effects to PBF 3, we consider whether the proposed action will have any effect on water of appropriate depth and absent physical barriers to passage (e.g., locks, dams, thermal plumes, turbidity, sound, reservoirs, gear, etc.) between the river mouth and spawning sites necessary to support: unimpeded movements of adults to and from spawning sites; seasonal and physiologically dependent movement of juvenile Atlantic sturgeon to appropriate salinity zones within the river estuary, and; staging, resting, or holding of subadults or spawning condition adults. We also consider whether the proposed action will affect water depth or water flow, because if water is too shallow it can be a barrier to sturgeon movements, and an alteration in water flow could similarly impact the movements of sturgeon in the river. Therefore, we consider effects of the action on water depth and water flow and whether the action results in barriers to passage that impede the movements of Atlantic sturgeon. We also consider whether the action will have effects on access to this feature, temporarily or permanently and consider the effect of the action on the action area's ability to develop the feature over time.

Unlike some southern rivers, given the extent of tidal flow, geomorphology and naturally deep depths of the James River, it is not vulnerable to natural reductions in water flow or water depth that can result in barriers to sturgeon movements; also, we are not aware of any impacts from this action that reduce water depth or water flow in a way that impact sturgeon movements. We are not aware of any complete barriers to passage for Atlantic sturgeon in the James River; that is, we do not know of any structures or conditions that prevent sturgeon from moving up or downstream within the river. There are areas in the James River critical habitat unit where sturgeon movements are affected by water quality (e.g., thermal plumes discharged from power plant outfalls) and noise (e.g., during pile driving at ongoing in-water construction projects); however, impacts on movements are normally temporary and/or intermittent and best available data suggests there is always a zone of passage through the affected river reach. Here we consider whether the dredging activities in the Newport News channels and anchorage may affect PBF 3 and whether those effects are adverse, insignificant, discountable or entirely beneficial.

A study conducted in the James River by Reine et al. (2014) found no evidence that would suggest that the presence of an active dredge represented a physical barrier to sturgeon movement. Similarly, the above referenced dredging project within the Newport News channels and anchorage portion of the James River will not create physical barriers within the river that will impede Atlantic sturgeon movements or use of the river. In areas where the channel is being deepened, the new depth still falls within a range suitable for Atlantic sturgeon use. As stated in other sections, even during times of active dredging, Atlantic sturgeon can still access and use the surrounding area. While some studies indicate that Atlantic sturgeon tend to avoid areas of active dredging (Hatin et al. 2007), other studies (Reine et al. 2014) state that Atlantic sturgeon showed neither attraction to nor avoidance of active dredging activities. Moser and Ross (1993) found that both shortnose and Atlantic sturgeon occupied both undisturbed and regularly dredged areas during concurrent dredging operations with no negative impact. A study by Cameron (2012) showed that sturgeon exhibited no signs of impeded movement up or downriver due to the physical presence of a dredge. Fish were actively tracked freely moving past the dredge during full production mode and showed no signs of avoidance response (e.g., due to noise

generated by the dredge) as indicated by the amount of time spent in close proximity to the dredge after release (3.5 – 21.5 hours). In addition, tagged fish showed no evidence of attraction to the dredge. Brundage (personal communication with USACE, 2017) has noted reduced catches in the Marcus Hook Anchorage in the Delaware River when hydraulic dredging was occurring in the adjacent navigation channel. It is not known, however, if the noise produced by pumping the dredged material through the pipeline was causing an avoidance response or if the physical presence of the pipeline and general disturbance of the area may have also contributed to the sturgeon moving away.

In sum, the proposed action may have temporary effects on PBF 3 by creating temporary in-water stressors from construction activities (i.e., presence of dredge and turbidity plumes); however, none of the proposed activities will be barriers to the movement of adult, subadult or juvenile Atlantic sturgeon (because of the salinity levels in the action area, early life stages of Atlantic sturgeon will not be present). Based on our assessment, these impediments to movement are extremely unlikely to affect the value of PBF 3 to the conservation of the species in the action area; that is, it is extremely unlikely that the habitat alterations will create barriers that will affect the movement of Atlantic sturgeon in the action area generally. Specifically, it is extremely unlikely that the habitat alterations will impede the movement of adults to and from spawning sites or the seasonal and physiologically dependent movement of juvenile Atlantic sturgeon to appropriate salinity zones within the river estuary or impede the staging, resting, or holding of subadults or spawning condition adults; therefore, the effects are discountable.

*PBF 4: Water with the temperature, salinity, and oxygen values that, combined, provide for dissolved oxygen values that support successful reproduction and recruitment and are within the temperature range that supports the habitat function*

In considering effects to PBF 4, we consider whether the proposed action will have any effect on water quality, between the river mouth and spawning sites, especially in the bottom meter of the water column with the temperature, salinity, and oxygen values that, combined, support: spawning; annual and interannual adult, subadult, larval, and juvenile survival; and larval, juvenile, and subadult growth, development, and recruitment. Therefore, we consider effects of the action on temperature, salinity and dissolved oxygen needs for Atlantic sturgeon spawning and recruitment. These water quality conditions are interrelated and both temperature and salinity influence the dissolved oxygen saturation for a particular area. We also consider whether the action will have effects to access to this feature, temporarily or permanently and consider the effect of the action on the action area's ability to develop the feature over time.

As defined, water quality factors of temperature, salinity and dissolved oxygen are interrelated environmental variables, and in a river system such as the James, are constantly changing from influences of the tide, weather, season, etc. The area with PBF 4 (water between the river mouth and spawning sites, especially in the bottom meter of the water column, with the temperature, salinity, and oxygen values that combined support spawning, survival, and larval, juvenile, and subadult development and recruitment), may be present throughout the extent of critical habitat designated in the James River (depending on the life stage); therefore, PBF 4 overlaps with the action area.

Many factors influence salinity in the James River, including stream flow, ocean salinity, sea level, wind stress, and human activities (e.g., dredging activities). Deepening and maintenance dredging in the navigation channel have the potential to affect the spatial and temporal salinity distribution in the action area. However, Ross et al. (2015) stated that dredging in the Delaware River (i.e., increased depth to 45 ft) has not influenced long-term salinity trends (statistical models did not detect a significant salinity trend in the area following completed deepening). While we do expect salt water intrusion further into the James River over time due to climate change, the relative effects of dredging on salinity levels and location (spatial and temporal), in addition to baseline conditions, will be too small to be meaningfully measured or detected.

The only pathway for the proposed dredging to impact DO is through increased suspended sediments and turbidity. Sediments suspended during dredging may have minor, temporary, localized effects on DO levels, but we expect sediment to settle out of the water column within an hour before effects would impact the value of the feature for any lifestage of Atlantic sturgeon<sup>5</sup>. While proposed deepening activities in the Newport News channel may have minor effects to the temperature in that section of navigation channel, the area requiring deepening is a small non-contiguous portion of the action area that overlaps with critical habitat (up to 10%), and we do not expect any minor changes in temperature to alter how various life stages of Atlantic sturgeon use those respective sections of the river for spawning, rearing, and development.

To summarize, we expect the effects of dredging in the action area on the value of PBF 4 to the conservation of the species (i.e., the current and future development of this feature to provide the temperature, salinity, and oxygen values that, combined, support: spawning; annual and interannual adult, subadult, larval, and juvenile survival; and larval, juvenile, and subadult growth, development, and recruitment) to be too small to be meaningfully measured or detected, and are therefore, insignificant.

## **4.2 Species Likely to be Adversely Affected by the Proposed Action**

This section will focus on the status of the various ESA-listed species likely to be adversely affected within the action area, summarizing information necessary to establish the environmental baseline and to assess the effects of the proposed action.

### **4.2.1 Status of Sea Turtles**

With the exception of loggerheads and greens, sea turtles are listed under the ESA at the species level rather than as subspecies or DPSs. Therefore, information on the range-wide status of Kemp's ridley sea turtles is included to provide the status of each species overall. Information on the status of loggerhead and green sea turtles will only be presented for the DPS affected by this action. Additional background information on the range-wide status of these species can be found in a number of published documents, including sea turtle status reviews and biological reports (NMFS and USFWS 1995, 2007a, 2007b, 2013; 2015; Hirth 1997; Marine Turtle Expert Working Group [TEWG] 1998, 2000, 2007, 2009; Conant *et al.* 2009; Seminoff *et al.* 2015), and

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<sup>5</sup> We only expect adult, sub-adult, and juvenile lifestages of Atlantic sturgeon in the action area; early life stages will not be present due to the salinity levels.

recovery plans for the loggerhead sea turtle (NMFS and USFWS 2008), Kemp's ridley sea turtle (NMFS *et al.* 2011), and green sea turtle (NMFS and USFWS 1991)).

### *2010 BP Deepwater Horizon Oil Spill*

The April 20, 2010, explosion of the Deepwater Horizon (DWH) oil rig affected sea turtles in the Gulf of Mexico. This extensive oiling event contaminated important sea turtle foraging, migratory, and breeding habitats at the surface, in the water column, on the ocean bottom, and on beaches throughout the northern Gulf of Mexico in areas used by different life stages. Sea turtles were exposed to oil when in contaminated water or habitats; breathing oil droplets, oil vapors, and smoke; ingesting oil-contaminated water and prey; and potentially by maternal transfer of oil compounds to embryos (DWH NRDA Trustees 2016). Response activities and shoreline oiling also directly injured sea turtles and disrupted or deterred sea turtle nesting in the Gulf.

During direct at-sea capture events, more than 900 turtles were sighted, 574 of which were captured and examined for oiling (Stacy 2012). Of the turtles captured during these operations, greater than 80% were visibly oiled (DWH NRDA Trustees 2016). Most of the rescued turtles were taken to rehabilitation facilities; more than 90% of the turtles admitted to rehabilitation centers eventually recovered and were released (Stacy 2012; Stacy and Innis 2012). Recovery efforts also included relocating nearly 300 sea turtle nests from the northern Gulf to the east coast of Florida in 2010, with the goal of preventing hatchlings from entering the oiled waters of the northern Gulf. Approximately 14,000 hatchlings were released off the Atlantic coast of Florida, 95% of which were loggerheads (<http://www.nmfs.noaa.gov/pr/health/oilspill/gulf2010.htm>).

Direct observations of the effects of oil on turtles obtained by at-sea captures, sightings, and strandings only represent a fraction of the scope of the injury. As such, the DWH NRDA (Natural Resource and Damage Assessment) Trustees used expert opinion, surface oiling maps, and statistical approaches to apply the directly observed adverse effects of oil exposure to turtles in areas and at times that could not be surveyed. The Trustees estimated that between 4,900 and up to 7,600 large juvenile and adult sea turtles (Kemp's ridleys, loggerheads, and hard-shelled sea turtles not identified to species), and between 55,000 and 160,000 small juvenile sea turtles (Kemp's ridleys, green turtles, loggerheads, hawksbills, and hard-shelled sea turtles not identified to species) were killed by the DWH oil spill (DWH NRDA Trustees 2016). Nearly 35,000 hatchling sea turtles (loggerheads, Kemp's ridleys, and green turtles) were also injured by response activities. Despite uncertainties and some unquantified injuries to sea turtles (e.g., unrealized reproduction), the Trustees conclude that this assessment adequately quantifies the nature and magnitude of injuries to sea turtles caused by the DWH oil spill and related activities.

Based on this quantification of sea turtle injuries caused by the DWH oil spill, sea turtles from all life stages and all geographic areas were lost from the northern Gulf of Mexico ecosystem. The DWA NRDA Trustees (2016) conclude that the recovery of sea turtles in the northern Gulf of Mexico from injuries caused by the DWH oil spill will require decades of sustained efforts to reduce the most critical threats and enhance survival of turtles at multiple life stages. The ultimate population level effects of the spill and impacts of the associated response activities are likely to remain unknown for some period into the future.

#### 4.2.1.1 Status of Loggerhead Sea Turtles – Northwest Atlantic DPS

The loggerhead is the most abundant species of sea turtle in U.S. waters. Loggerhead sea turtles are found in temperate and subtropical waters and occupy a range of habitats including offshore waters, continental shelves, bays, estuaries, and lagoons. They are also exposed to a variety of natural and anthropogenic threats in the terrestrial and marine environment.

##### *Listing History*

Loggerhead sea turtles were listed as threatened throughout their global range on July 28, 1978. Since that time, several status reviews have been conducted to review the status of the species and make recommendations regarding its ESA listing status. Based on a 2007 five-year status review of the species, which discussed a variety of threats to loggerheads including climate change, NMFS and USFWS (2007a) determined that loggerhead sea turtles should not be delisted or reclassified as endangered. However, it was also determined that an analysis and review of the species should be conducted in the future to determine whether DPSs should be identified for the loggerhead (NMFS and USFWS 2007a). Genetic differences exist between loggerhead sea turtles that nest and forage in the different ocean basins (Bowen 2003; Bowen and Karl 2007). Differences in the maternally inherited mitochondrial DNA also exist between loggerhead nesting groups that occur within the same ocean basin (TEWG 2000; Pearce 2001; Bowen 2003; Bowen *et al.* 2005; Shamblin 2007; TEWG 2009; NMFS and USFWS 2008). Site fidelity of females to one or more nesting beaches in an area is believed to account for these genetic differences (TEWG 2000; Bowen 2003).

In part to evaluate those genetic differences, in 2008, NMFS and USFWS established a Loggerhead Biological Review Team (BRT) to assess the global loggerhead population structure to determine whether DPSs exist and, if so, the status of each DPS. The BRT evaluated genetic data, tagging and telemetry data, demographic information, oceanographic features, and geographic barriers to determine whether population segments exist. The BRT report was completed in August 2009 (Conant *et al.* 2009). In this report, the BRT identified the following nine DPSs as being discrete from other conspecific population segments and significant to the species: (1) North Pacific Ocean, (2) South Pacific Ocean, (3) North Indian Ocean, (4) Southeast Indo-Pacific Ocean, (5) Southwest Indian Ocean, (6) Northwest Atlantic Ocean, (7) Northeast Atlantic Ocean, (8) Mediterranean Sea, and (9) South Atlantic Ocean.

The BRT concluded that although some DPSs are indicating increasing trends at nesting beaches (Southwest Indian Ocean and South Atlantic Ocean), available information about anthropogenic threats to juveniles and adults in neritic and oceanic environments indicate possible unsustainable additional mortalities. According to an analysis using expert opinion in a matrix model framework, the BRT report stated that all loggerhead DPSs have the potential to decline in the foreseeable future. Based on the threat matrix analysis, the potential for future decline was reported as greatest for the North Indian Ocean, Northwest Atlantic Ocean, Northeast Atlantic Ocean, Mediterranean Sea, and South Atlantic Ocean DPSs (Conant *et al.* 2009). The BRT concluded that the North Pacific Ocean, South Pacific Ocean, North Indian Ocean, Southeast Indo-Pacific Ocean, Northwest Atlantic Ocean, Northeast Atlantic Ocean, and Mediterranean Sea DPSs were at risk of extinction. The BRT concluded that although the Southwest Indian Ocean and South Atlantic Ocean DPSs were likely not currently at immediate risk of extinction, the extinction risk was likely to increase in the foreseeable future.

On March 16, 2010, NMFS and USFWS published a proposed rule (75 FR 12598) to divide the worldwide population of loggerhead sea turtles into nine DPSs, as described in the 2009 Status Review. Two of the DPSs were proposed to be listed as threatened and seven of the DPSs, including the Northwest Atlantic Ocean DPS, were proposed to be listed as endangered. NMFS and USFWS accepted comments on the proposed rule through September 13, 2010 (75 FR 30769, June 2, 2010). On March 22, 2011 (76 FR 15932), NMFS and USFWS extended the date by which a final determination on the listing action would be made to no later than September 16, 2011. This action was taken to address the interpretation of the existing data on status and trends and its relevance to the assessment of risk of extinction for the Northwest Atlantic Ocean DPS, as well as the magnitude and immediacy of the fisheries bycatch threat and measures to reduce this threat. New information or analyses to help clarify these issues were requested by April 11, 2011.

On September 22, 2011, NMFS and USFWS issued a final rule (76 FR 58868), determining that the loggerhead sea turtle is composed of nine DPSs (as defined in Conant *et al.* 2009) that constitute species that may be listed as threatened or endangered under the ESA. Five DPSs were listed as endangered (North Pacific Ocean, South Pacific Ocean, North Indian Ocean, Northeast Atlantic Ocean, and Mediterranean Sea), and four DPSs were listed as threatened (Northwest Atlantic Ocean, South Atlantic Ocean, Southeast Indo-Pacific Ocean, and Southwest Indian Ocean). Note that the Northwest Atlantic Ocean (NWA) DPS and the Southeast Indo-Pacific Ocean DPS were originally proposed as endangered. The NWA DPS was determined to be threatened based on review of nesting data available after the proposed rule was published, information provided in public comments on the proposed rule, and further discussions within the agencies. The two primary factors considered were population abundance and population trend. NMFS and USFWS found that an endangered status for the NWA DPS was not warranted given the large size of the nesting population, the overall nesting population remains widespread, the trend for the nesting population appears to be stabilizing, and substantial conservation efforts are underway to address threats. This final listing rule became effective on October 24, 2011.

The September 2011 final rule also noted that critical habitat for the two DPSs occurring within the U.S. (NWA DPS and North Pacific DPS) would be designated in a future rulemaking. Information from the public related to the identification of critical habitat, essential physical or biological features for this species, and other relevant impacts of a critical habitat designation was solicited. On July 10, 2014, the USFWS and NMFS published two separate final rules in the Federal Register designating critical habitat for the NWA DPS of loggerhead sea turtles under the ESA (79 FR 39755 for nesting beaches under FWS jurisdiction; 79 FR 39856 for marine areas under NMFS jurisdiction). Effective August 11, 2014, NMFS's final rule for marine areas designated 38 occupied areas within the at-sea range of the DPS. These designated marine areas of critical habitat contain one or a combination of: nearshore reproductive habitat, overwintering habitat, breeding habitat, migratory habitat, and *Sargassum* habitat.

#### *Presence of Loggerhead Sea Turtles in the Action Area*

The effects of the proposed action are only experienced within Virginia's nearshore and coastal waters and its portion of Chesapeake Bay and associated river mouths. We have considered the available information on the distribution of the nine DPSs to determine the origin of any

loggerhead sea turtles that may occur in the action area. As noted in Conant *et al.* (2009), the range of the four DPSs occurring in the Atlantic Ocean are as follows: NWA DPS – north of the equator, south of 60° N latitude, and west of 40° W longitude; Northeast Atlantic Ocean (NEA) DPS – north of the equator, south of 60° N latitude, east of 40° W longitude, and west of 5° 36' W longitude; South Atlantic DPS – south of the equator, north of 60° S latitude, west of 20° E longitude, and east of 60° W longitude; Mediterranean DPS – the Mediterranean Sea east of 5° 36' W longitude. These boundaries were determined based on oceanographic features, loggerhead sightings, thermal tolerance, fishery bycatch data, and information on loggerhead distribution from satellite telemetry and flipper tagging studies. While adults are highly structured with no overlap, there may be some degree of overlap by juveniles of the NWA, NEA, and Mediterranean DPSs on oceanic foraging grounds (Laurent *et al.* 1993, 1998; Bolten *et al.* 1998; LaCasella *et al.* 2005; Carreras *et al.* 2006, Monzón-Argüello *et al.* 2006; Revelles *et al.* 2007). Previous literature (Bowen *et al.* 2004) has suggested that there is the potential, albeit small, for some juveniles from the Mediterranean DPS to be present in U.S. Atlantic coastal foraging grounds. These conclusions must be interpreted with caution however, as they may be representing a shared common haplotype and lack of representative sampling at Eastern Atlantic rookeries rather than an actual presence of Mediterranean DPS turtles in U.S. Atlantic coastal waters. A re-analysis of the data by the Atlantic Loggerhead Turtle Expert Working Group has found that that it is unlikely that U.S. fishing fleets are interacting with either the NEA or Mediterranean DPS (Peter Dutton, NMFS, Marine Turtle Genetics Program, Program Leader, personal communication, September 10, 2011). Given that the action area is a very small subset of the area fished by U.S. fleets, it is reasonable to assume that based on this analysis, no individuals from the NEA or Mediterranean DPS would be present in the action area. Sea turtles of the South Atlantic DPS do not inhabit the action area of this consultation (Conant *et al.* 2009). As such, the remainder of this consultation will focus on the NWA DPS, listed as threatened.

#### *Distribution and Life History*

Ehrhart *et al.* (2003) provided a summary of the literature identifying known nesting habitats and foraging areas for loggerheads within the Atlantic Ocean. Detailed information is also provided in the five-year status review for loggerheads (NMFS and USFWS 2007a), the TEWG (2009) report, and the final revised recovery plan for loggerheads in the Northwest Atlantic Ocean (NMFS and USFWS 2008), which is a second revision to the original recovery plan that was approved in 1984 and subsequently revised in 1991.

In the western Atlantic, waters as far north as the Gulf of Maine and the Canadian Maritimes are used for foraging by juveniles as well as adults (Shoop 1987; Shoop and Kenney 1992; Ehrhart *et al.* 2003; Mitchell *et al.* 2003; NEFSC 2011a). In U.S. Atlantic waters, loggerheads commonly occur throughout the inner continental shelf from Florida to Cape Cod, Massachusetts and in the Gulf of Mexico from Florida to Texas, although their presence varies with the seasons due to changes in water temperature (Shoop and Kenney 1992; Epperly *et al.* 1995a, 1995b; Braun and Epperly 1996; Mitchell *et al.* 2003; Braun-McNeill *et al.* 2008). Loggerheads have been observed in waters with surface temperatures of 7°C to 30°C, but water temperatures  $\geq 11^\circ\text{C}$  are most favorable (Shoop and Kenney 1992; Epperly *et al.* 1995b). The presence of loggerhead sea turtles in U.S. Atlantic waters is also influenced by water depth. Aerial surveys of continental shelf waters north of Cape Hatteras, North Carolina indicated that loggerhead sea turtles were most commonly sighted in waters with bottom depths ranging from 22 to 49 meters

deep (Shoop and Kenney 1992). However, more recent survey and satellite tracking data support that they occur in waters from the beach to beyond the continental shelf (Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; Mansfield 2006; Blumenthal *et al.* 2006; Hawkes *et al.* 2006; McClellan and Read 2007; Mansfield *et al.* 2009).

Loggerhead sea turtles occur year round in ocean waters off North Carolina, South Carolina, Georgia, and Florida. In these areas of the South Atlantic Bight, water temperature is influenced by the proximity of the Gulf Stream. As coastal water temperatures warm in the spring, loggerheads begin to migrate to inshore waters of the Southeast U.S. (e.g., Pamlico and Core Sounds) and also move up the U.S. Atlantic coast (Epperly *et al.* 1995a, 1995b, 1995c; Braun-McNeill and Epperly 2004), occurring in Virginia foraging areas as early as April/May and on the most northern foraging grounds in the Gulf of Maine in June (Shoop and Kenney 1992). The trend is reversed in the fall as water temperatures cool. The large majority leave the Gulf of Maine by mid-September but some turtles may remain in Mid-Atlantic and Northeast areas until late fall. By December, loggerheads have migrated from inshore and more northern coastal waters to waters offshore of North Carolina, particularly off of Cape Hatteras, and waters further south where the influence of the Gulf Stream provides temperatures favorable to sea turtles (Shoop and Kenney 1992; Epperly *et al.* 1995b).

Recent studies have established that the loggerhead's life history is more complex than previously believed. Rather than making discrete developmental shifts from oceanic to neritic environments, research is showing that both adults and (presumed) neritic stage juveniles continue to use the oceanic environment and will move back and forth between the two habitats (Witzell 2002; Blumenthal *et al.* 2006; Hawkes *et al.* 2006; McClellan and Read 2007; Mansfield *et al.* 2009). One of the studies tracked the movements of adult post-nesting females and found that differences in habitat use were related to body size with larger adults staying in coastal waters and smaller adults traveling to oceanic waters (Hawkes *et al.* 2006). A tracking study of large juveniles found that the habitat preferences of this life stage were also diverse with some remaining in neritic waters and others moving off into oceanic waters (McClellan and Read 2007). However, unlike the Hawkes *et al.* (2006) study, there was no significant difference in the body size of turtles that remained in neritic waters versus oceanic waters (McClellan and Read 2007).

Pelagic and benthic juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation at or near the surface (Dodd 1988; NMFS and USFWS 2008). Sub-adult and adult loggerheads are primarily coastal dwelling and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats (NMFS and USFWS 2008). As presented below, Table 3 from the 2008 loggerhead recovery plan (Table 3 in this Opinion) highlights the key life history parameters for loggerheads nesting in the U.S.

**Table 3. Typical values of life history parameters for loggerheads nesting in the U.S.**

Life History Parameter	Data
Clutch size	100-126 eggs <sup>1</sup>
Egg incubation duration (varies depending on time of year and latitude)	42-75 days <sup>2,3</sup>
Pivotal temperature (incubation temperature that produces an equal number of males and females)	29.0°C <sup>5</sup>
Nest productivity (emerged hatchlings/total eggs) x 100 (varies depending on site specific factors)	45-70% <sup>2,6</sup>
Clutch frequency (number of nests/female/season)	3-5.5 nests <sup>7</sup>
Interesting interval (number of days between successive nests within a season)	12-15 days <sup>8</sup>
Juvenile (<87 cm CCL) sex ratio	65-70% female <sup>4</sup>
Remigration interval (number of years between successive nesting migrations)	2.5-3.7 years <sup>9</sup>
Nesting season	late April-early September
Hatching season	late June-early November
Age at sexual maturity	32-35 years <sup>10</sup>
Life span	>57 years <sup>11</sup>

<sup>1</sup> Dodd 1988.

<sup>2</sup> Dodd and Mackinnon (1999, 2000, 2001, 2002, 2003, 2004).

<sup>3</sup> Blair Witherington, FFWCC, personal communication, 2006 (information based on nests monitored throughout Florida beaches in 2005, n=865).

<sup>4</sup> National Marine Fisheries Service (2001); Allen Foley, FFWCC, personal communication, 2005.

<sup>5</sup> Mrosovsky (1988).

<sup>6</sup> Blair Witherington, FFWCC, personal communication, 2006 (information based on nests monitored throughout Florida beaches in 2005, n=1,680).

<sup>7</sup> Murphy and Hopkins (1984); Frazer and Richardson (1985); Ehrhart, unpublished data; Hawkes *et al.* 2005; Scott 2006; Tony Tucker, Mote Marine Laboratory, personal communication, 2008.

<sup>8</sup> Caldwell (1962), Dodd (1988).

<sup>9</sup> Richardson *et al.* (1978); Bjørndal *et al.* (1983); Ehrhart, unpublished data.

<sup>10</sup> Melissa Snover, NMFS, personal communication, 2005; see Table A1-6.

<sup>11</sup> Dahlen *et al.* (2000).

### *Population Dynamics and Status*

By far, the majority of Atlantic nesting occurs on beaches of the southeastern U.S. (NMFS and USFWS 2007a). For the past decade or so, the scientific literature has recognized five distinct nesting groups, or subpopulations, of loggerhead sea turtles in the Northwest Atlantic, divided geographically as follows: (1) a northern group of nesting females that nest from North Carolina to northeast Florida at about 29° N latitude; (2) a south Florida group of nesting females that nest from 29° N latitude on the east coast to Sarasota on the west coast; (3) a Florida Panhandle group of nesting females that nest around Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán group of nesting females that nest on beaches of the eastern Yucatán Peninsula, Mexico; and (5) a Dry Tortugas group that nests on beaches of the islands of the Dry Tortugas, near Key West, Florida and on Cal Sal Bank (TEWG 2009). Genetic analyses of mitochondrial DNA, which a sea turtle inherits from its mother, indicate that there are genetic differences between loggerheads that nest at and originate from the beaches used by each of the

five identified nesting groups of females (TEWG 2009). However, analyses of microsatellite loci from nuclear DNA, which represents the genetic contribution from both parents, indicates little to no genetic differences between loggerheads originating from nesting beaches of the five Northwest Atlantic nesting groups (Pearce and Bowen 2001; Bowen 2003; Bowen *et al.* 2005; Shamblin 2007). These results suggest that female loggerheads have site fidelity to nesting beaches within a particular area, while males provide an avenue of gene flow between nesting groups by mating with females that originate from different nesting groups (Bowen 2003; Bowen *et al.* 2005). The extent of such gene flow, however, is unclear (Shamblin 2007).

The lack of genetic structure makes it difficult to designate specific boundaries for the nesting subpopulations based on genetic differences alone. Therefore, the Loggerhead Recovery Team recently used a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences, to reassess the designation of these subpopulations to identify recovery units in the 2008 recovery plan.

In the 2008 recovery plan, the Loggerhead Recovery Team designated five recovery units for the Northwest Atlantic population of loggerhead sea turtles based on the aforementioned nesting groups and inclusive of a few other nesting areas not mentioned above. The first four of these recovery units represent nesting assemblages located in the Southeast U.S. The fifth recovery unit is composed of all other nesting assemblages of loggerheads within the Greater Caribbean, outside the U.S., but which occur within U.S. waters during some portion of their lives. The five recovery units representing nesting assemblages are: (1) the Northern Recovery Unit (NRU: Florida/Georgia border through southern Virginia), (2) the Peninsular Florida Recovery Unit (PFRU: Florida/Georgia border through Pinellas County, Florida), (3) the Dry Tortugas Recovery Unit (DTRU: islands located west of Key West, Florida), (4) the Northern Gulf of Mexico Recovery Unit (NGMRU: Franklin County, Florida through Texas), and (5) the Greater Caribbean Recovery Unit (GCRU: Mexico through French Guiana, Bahamas, Lesser Antilles, and Greater Antilles).

More recently, Shamblin *et al.* (2011, 2012) evaluated expanded mitochondrial sequences and identified additional genetic diversity in the North Atlantic. Specifically, based on genetics, the PFRU can be subdivided into further discrete units (Shamblin *et al.* 2011). This expanded genetic assessment found that the Northwest Atlantic loggerhead turtle rookeries can be subdivided into 10 management units, corresponding to the beaches from (1) Virginia through northeastern Florida, (2) central eastern Florida, (3) southeastern Florida, (4) Dry Tortugas, Florida, (5) Cay Sal, Bahamas, (6) southwestern Cuba, (7) Quintana Roo, Mexico, (8) southwestern Florida, (9) central western Florida, and (10) northwestern Florida (Shamblin *et al.* 2012).

The Loggerhead Recovery Team evaluated the status and trends of the Northwest Atlantic loggerhead population for each of the five recovery units, using nesting data available as of October 2008 (NMFS and USFWS 2008). The level and consistency of nesting coverage varies among recovery units, with coverage in Florida generally being the most consistent and thorough over time. Since 1989, nest count surveys in Florida have occurred in the form of statewide surveys (a near complete census of entire Florida nesting) and index beach surveys (Witherington *et al.* 2009). Index beaches were established to standardize data collection

methods and maintain a constant level of effort on key nesting beaches over time.

NMFS and USFWS (2008), Witherington *et al.* (2009), and TEWG (2009) analyzed the status of the nesting assemblages within the NWA DPS using standardized data collected over periods ranging from 10-23 years. These analyses used different analytical approaches, but found the same finding that there had been a significant, overall nesting decline within the NWA DPS. However, with the addition of nesting data from 2008 to 2017, the trend line changes, showing a strong positive trend since 2007 (<http://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/>). The nesting data presented in the Recovery Plan (through 2008) is described below, with updated trend information through 2014 for two recovery units.

From the beginning of standardized index surveys in 1989 until 1998, the PFRU, the largest nesting assemblage in the Northwest Atlantic by an order of magnitude, had a significant increase in the number of nests. However, from 1998 through 2008, there was a 41% decrease in annual nest counts from index beaches, which represent an average of 70% of the statewide nesting activity (NMFS and USFWS 2008). From 1989-2008, the PFRU had an overall declining nesting trend of 26% (95% CI: -42% to -5%; NMFS and USFWS 2008). With the addition of nesting data through 2010, the nesting trend for the PFRU does not show a nesting decline statistically different from zero (76 FR 58868, September 22, 2011). Further, annual nest counts on Florida index beaches have shown an increase over the last six years (FFWC 2015). Florida Fish and Wildlife Commission researchers examined the period between the high count nesting season in 1998 and the most recent nesting season (2014) and found a slight but non-significant increase. The overall change in nest counts from 1989 to 2014 is positive (FFWC 2015, <http://www.myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trends/>).

The NRU, the second largest nesting assemblage of loggerheads in the U.S., has been declining at a rate of 1.3% annually since 1983 (NMFS and USFWS 2008). The NRU dataset included 11 beaches with an uninterrupted time series of coverage of at least 20 years; these beaches represent approximately 27% of NRU nesting (in 2008). Since that 2008 analysis, nesting has increased substantially on North Carolina, South Carolina, and Georgia beaches, with record highs in 2013 (M. Dodd, 2015, pers. comm.). A recent analysis, including nesting data through 2014, indicates no significant trend in NRU nesting for the 32 year time period (M. Dodd, 2015, pers. comm.).

Evaluation of long-term nesting trends for the NGMRU is difficult because of changed and expanded beach coverage. However, the NGMRU has shown a significant declining trend of 4.7% annually since index nesting beach surveys were initiated in 1997 (NMFS and USFWS 2008). The trend was analyzed using nesting data available as of October 2008.

No statistical trends in nesting abundance can be determined for the DTRU because of the lack of long-term data. Similarly, statistically valid analyses of long-term nesting trends for the entire GCRU are not available because there are few long-term standardized nesting surveys representative of the region. Additionally, changing survey effort at monitored beaches and scattered and low-level nesting by loggerheads at many locations currently precludes comprehensive analyses (NMFS and USFWS 2008).

Sea turtle census nesting surveys are important in that they provide information on the relative abundance of nesting each year, and the contribution of each nesting group to total nesting of the species. Nest counts can also be used to estimate the number of reproductively mature females nesting annually. The 2008 recovery plan compiled information on mean number of loggerhead nests and the approximated counts of nesting females per year for four of the five identified recovery units (i.e., nesting groups). This information is dated, but still represents the most comprehensive number of nests per year that is publicly available. They are: (1) for the NRU, a mean of 5,215 loggerhead nests per year (1989-2008) with approximately 1,272 females nesting per year; (2) for the PFRU, a mean of 64,513 nests per year (1989-2007) with approximately 15,735 females nesting per year; (3) for the DTRU, a mean of 246 nests per year (1995-2004, excluding 2002) with approximately 60 females nesting per year; and (4) for the NGMRU, a mean of 906 nests per year (1995-2007) with approximately 221 females nesting per year. For the GCRU, the only estimate available for the number of loggerhead nests per year is from Quintana Roo, Yucatán, Mexico, where a range of 903-2,331 nests per year was estimated (1987-2001) (NMFS and USFWS 2007a). There are no annual nest estimates available for the Yucatán since 2001 or for any other regions in the GCRU, nor are there estimates of the number of nesting females per year for any nesting assemblage in this recovery unit. The above values for average nesting females per year were based upon 4.1 nests per female per Murphy and Hopkins (1984).

Genetic studies of juvenile and a few adult loggerhead sea turtles collected from Northwest Atlantic foraging areas (beach strandings, a power plant in Florida, and North Carolina fisheries) show that the loggerheads that occupy U.S. East Coast waters originate from these Northwest Atlantic nesting groups; primarily from the nearby nesting beaches of southern Florida, as well as the northern Florida to North Carolina beaches, and finally from the beaches of the Yucatán Peninsula, Mexico (Rankin-Baransky *et al.* 2001; Witzell *et al.* 2002; Bass *et al.* 2004; Bowen *et al.* 2004). The contribution of these three nesting assemblages varies somewhat among the foraging habitats and age classes surveyed along the east coast. The distribution is not random and bears a significant relationship to the proximity and size of adjacent nesting colonies (Bowen *et al.* 2004). Bass *et al.* (2004) attribute the variety in the proportions of sea turtles from loggerhead nesting assemblages documented in different east coast foraging habitats to a complex interplay of currents and the relative size and proximity of nesting beaches. More recently, ongoing work at SWFSC (Dutton and LaCasella, unpublished data) provides preliminary results for loggerhead bycatch samples (n=141) from Northeast fisheries from 2003-2012. The preliminary Mixed-Stock Analysis indicates that the majority of the Northeast bycatch is composed of turtles from Florida rookeries in the Northwest Atlantic. The combined central eastern Florida and southeastern Florida Management Units (MU) comprise the majority (79%) of the mean estimated stock composition. The remainder was made up primarily of western Florida MUs (southwestern Florida, central western Florida, northwestern Florida, Dry Tortugas), the northern US MU and to a lesser extent, Mexico. There is great uncertainty around point estimates, due to widespread shared haplotypes; however, there is no significant evidence of contribution from the Mediterranean or South Atlantic MUs (Dutton and LaCasella, unpublished data).

Unlike nesting surveys, in-water studies of sea turtles typically sample both sexes and multiple age classes. In-water studies have been conducted in some areas of the Northwest Atlantic and

provide data by which to assess the relative abundance of loggerhead sea turtles and changes in abundance over time (Maier *et al.* 2004; Morreale *et al.* 2005; Mansfield 2006; Ehrhart *et al.* 2007; Epperly *et al.* 2007). The TEWG (2009) used raw data from six in-water study sites to conduct trend analyses. They identified an increasing trend in the abundance of loggerheads from three of the four sites located in the Southeast U.S., one site showed no discernible trend, and the two sites located in the northeast U.S. showed a decreasing trend in abundance of loggerheads. The 2008 loggerhead recovery plan also includes a full discussion of in-water population studies for which trend data have been reported, and a brief summary will be provided here.

Maier *et al.* (2004) used fishery-independent trawl data to establish a regional index of loggerhead abundance for the southeast coast of the U.S. (Winyah Bay, South Carolina to St. Augustine, Florida) during the period 2000-2003. A comparison of loggerhead catch data from this study with historical values suggested that in-water populations of loggerhead sea turtles along the southeast U.S. coast appear to be larger, possibly an order of magnitude higher than they were 25 years ago, but the authors caution a direct comparison between the two studies given differences in sampling methodology (Maier *et al.* 2004). A comparison of catch rates for sea turtles in pound net gear fished in the Pamlico-Albemarle Estuarine Complex of North Carolina between the years 1995-1997 and 2001-2003 found a significant increase in catch rates for loggerhead sea turtles for the latter period (Epperly *et al.* 2007). A long-term, on-going study of loggerhead abundance in the Indian River Lagoon System of Florida found a significant increase in the relative abundance of loggerheads over the last four years of the study (Ehrhart *et al.* 2007). However, there was no discernible trend in loggerhead abundance during the 24-year time period of the study (1982-2006) (Ehrhart *et al.* 2007). At St. Lucie Power Plant, data collected from 1977-2004 show an increasing trend of loggerheads at the power plant intake structures (FPL and Quantum Resources 2005).

In contrast to these studies, Morreale *et al.* (2005) observed a decline in the percentage and relative numbers of loggerhead sea turtles incidentally captured in pound net gear fished around Long Island, New York during the period 2002-2004 in comparison to the period 1987-1992, with only two loggerheads (of a total 54 turtles) observed captured in pound net gear during the period 2002-2004. This is in contrast to the previous decade's study where numbers of individual loggerheads ranged from 11 to 28 per year (Morreale *et al.* 2005). No additional loggerheads were reported captured in pound net gear in New York through 2007, although two were found cold-stunned on Long Island bay beaches in the fall of 2007 (Memo to the File, L. Lankshear, December 2007). Potential explanations for this decline include major shifts in loggerhead foraging areas and/or increased mortality in pelagic or early benthic stage/age classes (Morreale *et al.* 2005). Using aerial surveys, Mansfield (2006) also found a decline in the densities of loggerhead sea turtles in Chesapeake Bay over the period 2001-2004 compared to aerial survey data collected in the 1980s. Significantly fewer loggerheads ( $p < 0.05$ ) were observed in both the spring (May-June) and the summer (July-August) of 2001-2004 compared to those observed during aerial surveys in the 1980s (Mansfield 2006). A comparison of median densities from the 1980s to the 2000s suggested that there had been a 63.2% reduction in densities during the spring residency period and a 74.9% reduction in densities during the summer residency period (Mansfield 2006). The decline in observed loggerhead populations in Chesapeake Bay may be related to a significant decline in prey, namely horseshoe crabs and blue

crabs, with loggerheads redistributing outside of Bay waters (NMFS and USFWS 2008). A more recent aerial survey effort by the Virginia Aquarium & Marine Science Center found preliminary abundance estimates in 2011-2013 significantly higher than annual estimates for the lower Chesapeake Bay generated from 2001-2004 (Mansfield 2006, VAQ 2014). The 2011-2013 estimates, while preliminary, also suggest that ocean waters may be more important for this species than the waters of Chesapeake Bay.

As with other turtle species, population estimates for loggerhead sea turtles are difficult to determine, largely given their life history characteristics. However, a recent loggerhead assessment using a demographic matrix model estimated that the loggerhead adult female population in the western North Atlantic ranges from 16,847 to 89,649, with a median size of 30,050 (SEFSC 2009). The model results for population trajectory suggest that the population is most likely declining, but this result was very sensitive to the choice of the position of the parameters within their range and hypothesized distributions. The pelagic stage survival parameter had the largest effect on the model results. As a result of the large uncertainty in our knowledge of loggerhead life history, at this point predicting the future populations or population trajectories of loggerhead sea turtles with precision is very uncertain. It should also be noted that additional analyses are underway which will incorporate any newly available information.

As part of the Atlantic Marine Assessment Program for Protected Species (AMAPPS), line transect aerial abundance surveys and turtle telemetry studies were conducted along the Atlantic Coast and annual reports for 2010, 2011, 2012, and 2013 have been produced. AMAPPS is a multi-agency initiative to assess marine mammal, sea turtle, and seabird abundance and distribution in the Atlantic. As presented in NMFS NEFSC (2011a), the 2010 survey found a preliminary total surface abundance estimate within the entire study area of about 60,000 loggerheads (CV=0.13) or 85,000, if a portion of unidentified hard-shelled sea turtles were included (CV=0.10). Surfacing times were generated from the satellite tag data collected during the aerial survey period, resulting in a 7% (5%-11% inter-quartile range) median surface time in the South Atlantic area and a 67% (57%-77% inter-quartile range) median surface time to the north. The calculated preliminary regional abundance estimate is about 588,000 loggerheads along the U.S. Atlantic coast, with an inter-quartile range of 382,000-817,000 (NMFS NEFSC 2011a). The estimate increases to approximately 801,000 (inter-quartile range of 521,000-1,111,000) when based on known loggerheads and a portion of unidentified turtle sightings. The density of loggerheads was generally lower in the north than the south; based on number of turtle groups detected, 64% were seen south of Cape Hatteras, NC, 30% in the southern Mid-Atlantic Bight, and 6% in the northern Mid-Atlantic Bight. These estimates of loggerhead abundance over the U.S. Atlantic continental shelf are considered very preliminary. A more thorough analysis will be completed pending the results of further studies related to improving estimates of regional and seasonal variation in loggerhead surface time (by increasing the sample size and geographical area of tagging) and other information needed to improve the biases inherent in aerial surveys of sea turtles (e.g., research on depth of detection and species misidentification rate). This survey effort represents the most comprehensive assessment of sea turtle abundance and distribution in many years. Additional aerial and vessel surveys as well as tagging research to improve abundance estimates of loggerheads have continued through 2017.

### *Threats*

The diversity of a loggerhead sea turtle's life history leaves them susceptible to many natural and human impacts, including impacts while they are on land, in the neritic environment, and in the oceanic environment. The five-year status review and 2008 recovery plan provide a summary of natural as well as anthropogenic threats to loggerhead sea turtles (NMFS and USFWS 2007a, 2008). Amongst those of natural origin, hurricanes are known to be destructive to sea turtle nests. Sand accretion, rainfall, and wave action that result from these storms can appreciably reduce hatchling success. Other sources of natural mortality include cold-stunning, biotoxin exposure, and native species predation.

Anthropogenic factors that impact hatchlings and adult females on land, or the success of nesting and hatching include: beach erosion, beach armoring, and nourishment; artificial lighting; beach cleaning; beach pollution; increased human presence; recreational beach equipment; vehicular and pedestrian traffic; coastal development/construction; exotic dune and beach vegetation; removal of native vegetation; and poaching. An increased human presence at some nesting beaches or close to nesting beaches has led to secondary threats such as the introduction of exotic fire ants, feral hogs, dogs, and an increased presence of native species (e.g., raccoons, armadillos, and opossums), which raid nests and feed on turtle eggs (NMFS and USFWS 2007a, 2008). Although sea turtle nesting beaches are protected along large expanses of the Northwest Atlantic coast (in areas like Merritt Island, Archie Carr, and Hobe Sound National Wildlife Refuges), other areas along these coasts have limited or no protection. Sea turtle nesting and hatching success on unprotected high density East Florida nesting beaches from Indian River to Broward County are affected by all of the above threats.

Loggerheads are affected by a completely different set of anthropogenic threats in the marine environment. These include oil and gas exploration, coastal development, and transportation; marine pollution; pile driving and underwater explosions; hopper dredging; offshore artificial lighting; power plant entrainment and/or impingement; entanglement in and ingestion of marine debris; marina and dock construction and operation; boat collisions; poaching; and fishery interactions (including both commercial and recreational fisheries).

A 1990 National Research Council (NRC) report concluded that for juveniles, subadults, and breeding adults in coastal waters, the most important source of human caused mortality in U.S. Atlantic waters was fishery interactions. The sizes and reproductive values of sea turtles taken by fisheries vary significantly, depending on the location and season of the fishery, and size-selectivity resulting from gear characteristics. Therefore, it is possible for fisheries that interact with fewer, more reproductively valuable turtles to have a greater detrimental effect on the population than one that takes greater numbers of less reproductively valuable turtles (Wallace *et al.* 2008). The 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). Attaining a more thorough understanding of the characteristics, as well as the quantity of sea turtle bycatch across all fisheries is of great importance.

Finkbeiner *et al.* (2011) compiled cumulative sea turtle bycatch information in U.S. fisheries from 1990 through 2007, before and after implementation of bycatch mitigation measures. Information was obtained from peer reviewed publications and NMFS documents (e.g., Opinions

and bycatch reports). In the Atlantic, a mean estimate of 137,700 bycatch interactions, of which 4,500 were mortalities, occurred annually (since implementation of bycatch mitigation measures). Kemp's ridleys interacted with fisheries most frequently, with the highest level of mean annual mortality (2,700), followed by loggerheads (1,400), greens (300), and leatherbacks (40). The Southeast/Gulf of Mexico shrimp trawl fishery was responsible for the vast majority of U.S. interactions (up to 98%) and mortalities (more than 80%). While this provides an initial cumulative bycatch assessment, there are a number of caveats that should be considered when interpreting this information, such as sampling inconsistencies and limitations.

Of the many fisheries known to adversely affect loggerheads, the U.S. South Atlantic and Gulf of Mexico shrimp fisheries were considered to pose the greatest threat of mortality to neritic juvenile and adult age classes of loggerheads (NRC 1990, Finkbeiner *et al.* 2011). Significant changes to the U.S. South Atlantic and Gulf of Mexico shrimp fisheries have occurred since 1990, and the effects of these shrimp fisheries on ESA-listed species, including loggerhead sea turtles, have been assessed several times through section 7 consultation. There is also a lengthy regulatory history with regard to the use of Turtle Excluder Devices (TEDs) in the U.S. South Atlantic and Gulf of Mexico shrimp fisheries (Epperly and Teas 2002; NMFS 2002; Lewison *et al.* 2003). A section 7 consultation on the U.S. South Atlantic and Gulf of Mexico shrimp fisheries completed in 2002 estimated the total annual level of loggerhead interactions to be 163,160 (the total number of turtles that enter a shrimp trawl, which may then escape through the TED or fail to escape and be captured) with 3,948 of those being lethal (NMFS 2002).

In addition to improvements in TED designs and TED enforcement, interactions between loggerheads and the shrimp fishery have also been declining because of reductions in fishing effort unrelated to fisheries management actions. The 2002 Opinion take estimates were based in part on fishery effort levels. In recent years, low shrimp prices, rising fuel costs, competition with imported products, and the impacts of recent hurricanes in the Gulf of Mexico have all impacted the shrimp fleets; in some cases reducing fishing effort by as much as 50% for offshore waters of the Gulf of Mexico (GMFMC 2007). As a result, loggerhead interactions and mortalities in the Gulf of Mexico have been substantially less than were projected in the 2002 Opinion. In 2008, the NMFS Southeast Fisheries Science Center (SEFSC) estimated annual number of interactions between loggerheads and shrimp trawls in the Gulf of Mexico shrimp fishery to be 23,336, with 647 (2.8%) of those interactions resulting in mortality (Memo from Dr. B. Ponwith, Southeast Fisheries Science Center to Dr. R. Crabtree, Southeast Region, PRD, December 2008). However, the section 7 consultation on the shrimp fishery, completed in May 2012, was unable to estimate the total annual level of loggerhead interactions at present. Instead, it qualitatively estimated that the shrimp fishery, as currently operating, would result in at least thousands and possibly tens of thousands of interactions annually, of which at least hundreds and possibly thousands are expected to be lethal (NMFS 2012a).

Loggerhead sea turtles are also known to interact with non-shrimp trawl, gillnet, longline, dredge, pound net, pot/trap, and hook and line fisheries. The NRC (1990) report stated that other U.S. Atlantic fisheries collectively accounted for 500 to 5,000 loggerhead deaths each year, but recognized that there was considerable uncertainty in the estimate. The reduction of sea turtle captures in fishing operations is identified in recovery plans and five-year status reviews as a priority for the recovery of all sea turtle species. In the threats analysis of the loggerhead

recovery plan, trawl bycatch is identified as the greatest source of mortality. Loggerhead bycatch in U.S. Mid-Atlantic bottom otter trawl gear has been previously estimated for the periods of 1996-2004 (Murray 2008) and 2005-2008 (Warden 2011), with the most recent bycatch analysis estimating the number of loggerhead sea turtle interactions with U.S. Mid-Atlantic bottom trawl gear from 2009-2013 (Murray 2015a). From 2009-2013, 1,156 loggerheads (95% CI: 908-1,488) were estimated to have interacted with bottom trawl gear in the U.S. Mid-Atlantic, of which 479 resulted in mortality. The total number of estimated interactions was equivalent to 166 adults, of which 68 resulted in mortality (Murray 2015a). That equates to an annual average of 231 loggerhead interactions (95% CI: 182-298) for the period of 2009-2013. The trawl fishery targeting Atlantic croaker in the southern Mid-Atlantic had the highest turtle interactions among fisheries investigated, which may be due to larger mesh sizes in the mouth of the trawl and high headline height of the gear. Murray (2015a) found that retained catch, depth, latitude, and sea surface temperature (SST) were associated with the interaction rate, with the rates being highest south of 37°N latitude in warm, shallow (<50 meters deep) waters. This estimate is a decrease from the average annual loggerhead bycatch in U.S. Mid-Atlantic bottom otter trawls during the 1996-2004 and 2005-2008 time periods, which were estimated to be 616 (95% CI: 367-890) and 352 turtles (95% CI: 276-439), respectively (Murray 2008; Warden 2011; Murray 2015a).

There have been several published estimates of the number of loggerheads interacting annually with the dredge fishery for Atlantic sea scallops, ranging from a low of zero in 2005 (Murray 2007) to a high of 749 in 2003 (Murray 2004). Murray (2011) re-evaluated loggerhead sea turtle interactions in scallop dredge gear from 2001-2008. In that paper, the average number of annual observable interactions of hard-shelled sea turtles in the Mid-Atlantic scallop dredge fishery prior to the implementation of chain mats (January 1, 2001 through September 25, 2006) was estimated to be 288 turtles (95% CI: 209-363) [equivalent to 49 adults], 218 of which were loggerheads [equivalent to 37 adults]. After the implementation of chain mats, the average annual number of observable interactions was estimated to be 20 hard-shelled sea turtles (95% CI: 3-42), 19 of which were loggerheads. If the rate of observable interactions from dredges without chain mats had been applied to trips with chain mats, the estimated number of observable and inferred interactions of hard-shelled sea turtles after chain mats were implemented would have been 125 turtles per year (95% CI: 88-163) [equivalent to 22 adults], 95 of which were loggerheads [equivalent to 16 adults]. Interaction rates of hard-shelled turtles were correlated with SST, depth, and use of a chain mat. Results from that analysis suggested that chain mats and fishing effort reductions contributed to the decline in estimated loggerhead sea turtle interactions with scallop dredge gear after 2006 (Murray 2011). A more recent analysis has indicated that the average annual observable sea turtle interactions in the Mid-Atlantic scallop dredge fishery plus unobserved, quantifiable interactions was 22 loggerheads per year (95% CI: 4-67), 9-19 of which were lethal (Murray 2015b). The 22 interactions equate to two adult equivalents per year and 1-2 adult equivalent mortalities. Thus, estimated interactions in the scallop dredge fishery have decreased relative to 2001-2008, although the utility of observers as a monitoring tool for turtle interactions in the fishery seems to be decreasing (Murray 2015b).

An estimate of the number of loggerheads interacting annually with U.S. Mid-Atlantic gillnet fisheries has also recently been published (Murray 2013). From 2007-2011, an annual average

of 95 hard-shelled sea turtles (95% CI: 60-138) and 89 loggerheads (equivalent to nine adults) were estimated to have interacted with U.S. Mid-Atlantic gillnet gear. An estimated 52 annual loggerhead interactions (equivalent to five adults) were considered to result in mortality. Gillnet trips landing monkfish had the highest estimated number of loggerhead and hard-shelled sea turtle interactions during 2007-2011. Estimated rates and interactions have decreased relative to those from 1996-2006. Bycatch rates were correlated with latitude, SST, and mesh size. High interaction rates are estimated in the southern Mid-Atlantic, in warm surface temperature water, and in large-mesh gillnets; findings which are consistent with prior loggerhead bycatch analyses (Murray 2013).

The U.S. tuna and swordfish longline fisheries that are managed under the Highly Migratory Species (HMS) Fishery Management Plan (FMP) are estimated to capture 1,905 loggerheads (no more than 339 mortalities) for each three-year period starting in 2007 (NMFS 2004b). NMFS has mandated gear changes for the HMS fishery to reduce sea turtle bycatch and the likelihood of death from those incidental takes that would still occur (Garrison and Stokes 2017). In 2015, there were 30 observed interactions between loggerhead sea turtles and longline gear used in the HMS fishery (Garrison and Stokes 2017). All of the loggerheads were released alive, with 14 out of 30 (47%) released with all gear removed. A total of 242.6 (95% CI: 161.9-363.6) loggerhead sea turtles were estimated to have interacted with the longline fisheries managed under the HMS FMP in 2015 based on the observed bycatch events (Garrison and Stokes 2017).

Including the 2015 estimate, loggerhead interactions since 2000 have been below the historical highs that occurred in the mid-1990s (Garrison and Stokes 2017). Following the implementation of regulations, the bycatch dropped in 2005, but rebounded to be similar to the pre-regulation period. There appears to be a cyclical pattern in loggerhead bycatch rate occurring at four-year intervals since 1996 with a generally increasing trend over a four-year period, followed by a sharp decline. This cycle continued during the 2010-2015 period. The 2014 and 2015 estimates remain relatively low and seem to be consistent with an overall downward trend since the late 1990s. Notably, the estimate for 2015 was consistent with that from 2014 despite a sharp decline in fishing effort (Garrison and Stokes 2017). This fishery represents just one of several longline fisheries operating in the Atlantic Ocean. Lewison *et al.* (2004) estimated that 150,000-200,000 loggerheads were taken in all Atlantic longline fisheries in 2000 (including the U.S. Atlantic tuna and swordfish longline fisheries as well as others).

Documented interactions also occur in other fishery gear types and by non-fishery mortality sources (e.g., hopper dredges, power plants, vessel collisions), although quantitative/qualitative estimates are only available for activities on which NMFS has consulted.

The most recent Recovery Plan for loggerhead sea turtles as well as the 2009 Status Review Report identifies global climate change as a threat to loggerhead sea turtles. However, trying to assess the likely effects of climate change on loggerhead sea turtles is extremely difficult given the uncertainty in all climate change models and the difficulty in determining the likely rate of temperature increases and the scope and scale of any accompanying habitat effects. Additionally, no significant climate change-related impacts to loggerhead sea turtle populations have been observed to date. Over the long-term, climate change related impacts are expected to influence biological trajectories on a century scale (Parmesan and Yohe 2003). As noted in the

2009 Status Review (Conant *et al.* 2009), impacts from global climate change induced by human activities are likely to become more apparent in future years (IPCC 2007). Climate change related increasing temperatures, sea level rise, changes in ocean productivity, and increased frequency of storm events may affect loggerhead sea turtles.

Increasing temperatures are expected to result in rising sea levels (Titus and Narayanan 1995 in Conant *et al.* 2009), which could result in increased erosion rates along nesting beaches. Sea level rise could result in the inundation of nesting sites and decrease available nesting habitat (Daniels *et al.* 1993; Fish *et al.* 2005; Baker *et al.* 2006). The BRT noted that 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; both in Conant *et al.* 2009). Along developed coastlines, and especially in areas where erosion control structures have been constructed to limit shoreline movement, rising sea levels may cause severe effects on nesting females and their eggs as nesting females may deposit eggs seaward of the erosion control structures potentially subjecting them to repeated tidal inundation. However, if global temperatures increase and there is a range shift northwards, beaches not currently used for nesting may become available for loggerhead sea turtles, which may offset some loss of accessibility to beaches in southern portions of the range.

Climate change also has the potential to result in changes at nesting beaches that may affect loggerhead sex ratios. Loggerhead sea turtles exhibit temperature-dependent sex determination. Rapidly increasing global temperatures may result in warmer incubation temperatures and highly female-biased sex ratios (e.g., Glen and Mrosovsky 2004; Hawkes *et al.* 2009); however, to the extent that nesting can occur at beaches further north where sand temperatures are not as warm, these effects may be partially offset. The BRT specifically identified climate change as a threat to loggerhead sea turtles in the neritic/oceanic zone where climate change may result in future trophic changes, thus impacting loggerhead prey abundance and/or distribution. In the threats matrix analysis, climate change was considered for oceanic juveniles and adults as well as for eggs/hatchlings. The report states that for oceanic juveniles and adults, “although the effect of trophic level change from...climate change...is unknown it is believed to be very low.” For eggs/hatchlings, the report states that total mortality from anthropogenic causes, including sea level rise resulting from climate change, is believed to be low relative to the entire life stage. However, only limited data are available on past trends related to climate effects on loggerhead sea turtles; current scientific methods are not able to reliably predict the future magnitude of climate change, associated impacts, whether and to what extent some impacts will offset others, or the adaptive capacity of this species.

While there is a reasonable degree of certainty that certain climate change related effects will be experienced globally (e.g., rising temperatures and changes in precipitation patterns), due to a lack of scientific data, the specific effects to sea turtles resulting from climate change, and the severity of and rate at which these impacts will occur, are not predictable or quantifiable at this time (Hawkes *et al.* 2009). Nonetheless, it is likely that once climate change impacts get to a certain level, there will be feedback loops that may cause indications of climate change (e.g., increases in greenhouse gas concentrations, rising global temperatures, and sea level rise) to get much worse much more quickly (Torn and Harte 2006).

In terms of “climate forcing” (which is different from what we are defining as “climate change,” in that it also factors in the effects of cyclical climate patterns such as the North Atlantic and Pacific Decadal Oscillations in addition to ongoing effects from anthropogenically-induced changes in climate under Intergovernmental Panel on Climate Change [IPCC] projections), Van Houtan and Halley (2011) recently developed climate-based models to investigate loggerhead nesting in the Northwest Atlantic and North Pacific. These models, which considered juvenile recruitment and breeding remigration, found that climate conditions/oceanographic influences explain loggerhead nesting variability, with climate models alone explaining an average of 60% (range 18%-88%) of the observed nesting changes over the past several decades. Hindcasts indicate that climatic conditions may have been a factor in past nesting declines in both the Atlantic and Pacific. However, in terms of future nesting projections, modeled climate data show a future positive trend for Atlantic nesting in Florida, with substantial increases through 2040 as a result of the Atlantic Multidecadal Oscillation signal (Van Houtan and Halley 2011). Thus, independent of any dramatic losses of sea turtle nesting habitat in the Northwest Atlantic due to climate change, NWA DPS loggerheads are expected to increase their nesting output over the next few decades. Van Houtan and Halley (2011) did not project nesting trends in the Northwest Atlantic beyond 2040 as forecasting beyond that point was not deemed possible given their methods. Much like our analyses of climate change, climate forcing analyses can only predict so far into the future.

#### *Summary of Status for the Northwest Atlantic DPS of Loggerhead Sea Turtles*

Loggerheads continue to be affected by many factors occurring on nesting beaches and in the water. These include poaching, habitat loss, and nesting predation that affects eggs, hatchlings, and nesting females on land, as well as fishery interactions, vessel interactions, marine pollution, and non-fishery (e.g., dredging) operations affecting all sexes and age classes in the water (NRC 1990; NMFS and USFWS 2007a, 2008). As a result, loggerheads still face many of the original threats that were the cause of their listing under the ESA.

As mentioned previously, a final revised recovery plan for loggerhead sea turtles in the Northwest Atlantic was published by NMFS and USFWS in December 2008. The revised recovery plan is significant in that it identifies five unique recovery units, which comprise the population of loggerheads in the Northwest Atlantic, and describes specific recovery criteria for each recovery unit. The recovery plan noted a decline in annual nest counts for three of the five recovery units for loggerheads in the Northwest Atlantic, including the PFRU, which is the largest (in terms of number of nests laid) in the Atlantic Ocean. The nesting trends for the other two recovery units could not be determined due to an absence of long term data.

NMFS convened a new Loggerhead Turtle Expert Working Group (TEWG) to review all available information on Atlantic loggerheads in order to evaluate the status of this species in the Atlantic. A final report from the Loggerhead TEWG was published in July 2009. In this report, the TEWG indicated that it could not determine whether the decreasing annual numbers of nests among the Northwest Atlantic loggerhead subpopulations were due to stochastic processes resulting in fewer nests, a decreasing average reproductive output of adult females, decreasing numbers of adult females, or a combination of these factors. Many factors are responsible for past or present loggerhead mortality that could impact current nest numbers; however, no single

mortality factor stands out as a likely primary factor. It is likely that several factors compound to create the current decline, including incidental capture (in fisheries, power plant intakes, and dredging operations), lower adult female survival rates, increases in the proportion of first-time nesters, continued directed harvest, and increases in mortality due to disease. Regardless, the TEWG stated that “it is clear that the current levels of hatchling output will result in depressed recruitment to subsequent life stages over the coming decades” (TEWG 2009). However, the report does not provide information on the rate or amount of expected decrease in recruitment but goes on to state that the ability to assess the current status of loggerhead stocks is limited due to a lack of fundamental life history information and specific census and mortality data.

While several documents reported the decline in nesting numbers in the NWA DPS (NMFS and USFWS 2008, TEWG 2009), when nest counts through 2010 are analyzed, the nesting trends from 1989-2010 are not significantly different than zero for all recovery units within the NWA DPS for which there are enough data to analyze (76 FR 58868, September 22, 2011). The SEFSC (2009) estimated the number of adult females in the NWA DPS at 30,000, and if a 1:1 adult sex ratio is assumed, the result is 60,000 adults in this DPS. Based on the reviews of nesting data, as well as information on population abundance and trends, NMFS and USFWS determined in the September 2011 listing rule that the NWA DPS should be listed as threatened. They found that an endangered status for the NWA DPS was not warranted given the large size of the nesting population, the overall nesting population remains widespread, the trend for the nesting population appears to be stabilizing, and substantial conservation efforts are underway to address threats. On July 10, 2014, we published a final rule designating critical habitat for NWA DPS (79 FR 39856). Specific areas designated include 38 occupied marine areas within the range of the Northwest Atlantic Ocean DPS. These areas contain one or a combination of habitat types: nearshore reproductive habitat, winter area, breeding areas, constricted migratory corridors, and/or *Sargassum* habitat.

#### *4.2.1.2 Status of Kemp’s Ridley Sea Turtles*

##### *Listing History*

The Kemp’s ridley sea turtle was listed as endangered on December 2, 1970 (35 FR 18319). The most recent status review was completed in 2015; no change in listing status was recommended. NMFS and USFWS were petitioned to designate critical habitat for Kemp’s ridleys on February 17, 2010; no listing determination has been made.

##### *Distribution and Life History*

The Kemp’s ridley is one of the least abundant of the world’s sea turtle species. In contrast to loggerhead, green, and leatherback sea turtles, which are found in multiple oceans of the world, Kemp’s ridleys typically occur only in the Gulf of Mexico and the northwestern Atlantic Ocean (NMFS *et al.* 2011); a very small number of individuals have been documented in the Mediterranean Sea (Tomas and Raga 2008).

Kemp’s ridleys likely mature at 10-18 years of age (Caillouet *et al.* 1995; Schmid and Witzell 1997; Shaver and Wibbels 2007; Snover *et al.* 2007; NMFS and USFWS 2015). Nesting occurs from April through July each year with hatchlings emerging after 45-58 days (NMFS *et al.* 2011). Females lay an average of 2.5 clutches within a season (TEWG 1998, 2000) and the

mean remigration interval for adult females is two years (Márquez *et al.* 1982; TEWG 1998, 2000).

Once they leave the nesting beach, hatchlings presumably enter the Gulf of Mexico where they feed on available *Sargassum* and associated infauna or other epipelagic species (NMFS *et al.* 2011). The presence of juvenile turtles along both the U.S. Atlantic and Gulf of Mexico coasts, where they are recruited to the coastal benthic environment, indicates that post-hatchlings are distributed in both the Gulf of Mexico and Atlantic Ocean (TEWG 2000).

The location and size classes of dead turtles recovered by the Sea Turtle Stranding and Salvage Network (STSSN) suggests that benthic immature developmental areas occur along the U.S. coast and that these areas may change given resource quality and quantity (TEWG 2000). Developmental habitats are defined by several characteristics, including coastal areas sheltered from high winds and waves such as embayments and estuaries, and nearshore temperate waters shallower than 50 meters (NMFS and USFWS 2015). The suitability of these habitats depends on resource availability, with optimal environments providing rich sources of crabs and other invertebrates. Kemp's ridleys consume a variety of crab species, including *Callinectes*, *Ovalipes*, *Libinia*, and *Cancer* species. Mollusks, shrimp, and fish are consumed less frequently (Bjorndal 1997). A wide variety of substrates have been documented to provide good foraging habitat, including seagrass beds, oyster reefs, sandy and mud bottoms, and rock outcroppings (NMFS and USFWS 2015).

Foraging areas documented along the U.S. Atlantic coast include Charleston Harbor, Pamlico Sound (Epperly *et al.* 1995c), Chesapeake Bay (Musick and Limpus 1997), Delaware Bay (Stetzar 2002), and Long Island Sound (Morreale and Standora 1993; Morreale *et al.* 2005). For instance, in the Chesapeake Bay, Kemp's ridleys frequently forage in submerged aquatic grass beds for crabs (Musick and Limpus 1997). Upon leaving Chesapeake Bay in the fall, juvenile Kemp's ridleys migrate down the coast, passing Cape Hatteras in December and January (Musick and Limpus 1997). These larger juveniles are joined by juveniles of the same size from North Carolina and smaller juveniles from New York and New England to form one of the densest concentrations of Kemp's ridleys outside of the Gulf of Mexico (Epperly *et al.* 1995a, 1995b; Musick and Limpus 1997).

Adult Kemp's ridleys are found in the coastal regions of the Gulf of Mexico and southeastern U.S., but are typically rare in the northeastern U.S. waters of the Atlantic (TEWG 2000). Adults are primarily found in nearshore waters of 68 meters or less (mean  $33.2 \pm 25.3$  kilometers from shore) that are rich in crabs and have a sandy or muddy bottom (NMFS and USFWS 2015).

#### *Population Dynamics and Status*

The majority of Kemp's ridleys nest along a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963; NMFS *et al.* 2011; NMFS and USFWS 2015). There is a limited amount of scattered nesting to the north and south of the primary nesting beach (NMFS and USFWS 2015). Nesting often occurs in synchronized emergences termed *arribadas*. The number of recorded nests reached an estimated low of 702 nests in 1985, estimated to be fewer than 250 adult females nesting in that season (TEWG 2000; NMFS *et al.* 2011; NMFS and USFWS 2015). Conservation efforts by Mexican and U.S. agencies have aided this species by

eliminating egg harvest, protecting eggs and hatchlings, and reducing at-sea mortality through fishing regulations (TEWG 2000). From the mid-1980s to the early 2000s, the number of nests observed at Rancho Nuevo and nearby beaches increased 14-16% per year (Heppell *et al.* 2005), allowing cautious optimism that the population was on its way to recovery. The total number of nests for all of Mexico was 22,458 in 2012 (the highest nesting total recorded since 1947), but fell back to 16,944 in 2013 and 12,060 in 2014. Based on an average of 2.5 nests per female per nesting season (NMFS *et al.* 2011), the total number of nests on Mexico beaches represented about 8,984 nesting females in 2012, 6,778 in 2013, and 4,824 in 2014 (NMFS and USFWS 2015). Similar to Mexico, Texas also experienced an overall increase in the number of nests since 2000. At Padre Island National Seashore, the number of observed nests hit an all-time high of 209 in 2012, but then fell back to 153 in 2013 and 119 in 2014 (NMFS and USFWS 2015). The most recent five-year review (NMFS and USFWS 2015) suggests that the population growth rate (measured by numbers of nests) stopped abruptly after 2009, possibly due to the Deepwater Horizon oil spill and other anthropogenic factors such as fisheries bycatch and climate change. Given the lower nesting numbers from 2009-2014, the population was not projected to grow at former rates in 2015. Recent data, however, indicates an increase in nesting. In 2015, there were 14,006 recorded nests in Mexico, and in 2016 overall numbers increased to 18,354 recorded nests (Gladys Porter Zoo 2016). Preliminary information indicates a record high nesting season in 2017, with 24,570 nests recorded on Mexican beaches (J. Pena, pers. comm., 2017). At this time, it is unclear if future Kemp's ridley nesting will steadily and continuously increase, similar to what occurred from 1990-2009, or if nesting will continue to exhibit sporadic declines and increases as recorded in the past eight years.

A small nesting population is also emerging in the U.S., primarily at Padre Island National Seashore in Texas, rising from six nests in 1996, to 42 in 2004, to a record high of 353 nests in 2017 (<https://www.nps.gov/pais/learn/nature/2017-nesting-season.htm>). It is worth noting that nesting in Texas has paralleled the trends observed in Mexico, with an overall increase in nests from 2000-2009, a significant decline in 2010, an all-time high in 2012, followed by a second decline in 2013-2014, and a rebound from 2015-2017 (NMFS and USFWS 2015).

### *Threats*

Kemp's ridley sea turtles face many of the same natural threats as loggerheads, including destruction of nesting habitat from storm events, predators, and oceanographic-related events such as cold-stunning. Although cold-stunning can occur throughout the range of the species, it may be a greater risk for Kemp's ridleys that use the more northern habitats of Cape Cod Bay and Long Island Sound. From 2009-2013, the number of cold-stunned Kemp's ridleys on Massachusetts beaches averaged 185 turtles (NMFS unpublished data). The numbers ranged from a low of 132 in 2011 to a high of 235 in 2012. However, in 2014, the number of cold-stunned Kemp's ridleys documented in Massachusetts skyrocketed to 1,179, of which 466 died (NMFS unpublished data). As evidenced by this drastic increase, annual cold stun events can vary greatly in magnitude. The extent of episodic major cold stun events may be associated with numbers of sea turtles utilizing Northeast U.S. waters in a given year, oceanographic conditions, and/or the occurrence of storm events in the late fall. Although many cold-stunned turtles can survive if they are found early enough, these events represent a significant source of natural mortality for Kemp's ridley sea turtles.

Like other sea turtle species, the severe decline in the Kemp's ridley population appears to have been heavily influenced by a combination of exploitation of eggs and impacts from fishery interactions. From the 1940s through the early 1960s, nests from Ranch Nuevo were heavily exploited, but beach protection in 1967 helped to curtail this activity (NMFS *et al.* 2011). Following World War II, there was a substantial increase in the number of trawl vessels, particularly shrimp trawlers, in the Gulf of Mexico where adult Kemp's ridley sea turtles occur. Information from fisheries observers helped to demonstrate the high number of turtles captured in these shrimp trawls (USFWS and NMFS 1992). Subsequently, NMFS has worked with the industry to reduce sea turtle captures in shrimp trawls and other trawl fisheries, including the development and use of TEDs. As described above, there is lengthy regulatory history on the use of TEDs in the U.S. South Atlantic and Gulf of Mexico shrimp fisheries (NMFS 2002; Epperly 2003; Lewison *et al.* 2003). The 2002 Opinion on shrimp trawling in the southeastern U.S. concluded that 155,503 Kemp's ridley sea turtles would be captured annually in the fishery with 4,208 of the captures resulting in mortality (NMFS 2002).

Although modifications to shrimp trawls have helped to reduce mortality of Kemp's ridleys, a recent assessment found that the Southeast/Gulf of Mexico shrimp trawl fishery remained responsible for the vast majority of U.S. fishery interactions (up to 98%) and mortalities (more than 80%). Finkbeiner *et al.* (2011) compiled cumulative sea turtle bycatch information in U.S. fisheries from 1990 through 2007, before and after implementation of bycatch mitigation measures. Information was obtained from peer reviewed publications and NMFS documents (e.g., Opinions and bycatch reports). In the Atlantic, a mean estimate of 137,700 bycatch interactions, of which 4,500 were mortalities, occurred annually (since implementation of bycatch mitigation measures). Kemp's ridleys interacted with fisheries most frequently, with the highest level of mean annual mortality (2,700), followed by loggerheads (1,400), greens (300), and leatherbacks (40). While this provides an initial cumulative bycatch assessment, there are a number of caveats that should be considered when interpreting this information, such as sampling inconsistencies and limitations. The most recent section 7 consultation on the shrimp fishery, completed in May 2012, was unable to estimate the total annual level of Kemp's ridley interactions occurring in the fishery. Instead, it qualitatively estimated that the shrimp fishery, as currently operating, would result in at least tens of thousands and possibly hundreds of thousands of interactions annually, of which at least thousands and possibly tens of thousands are expected to be lethal (NMFS 2012a).

This species is also affected by other sources of anthropogenic impact (fishery and non-fishery related), similar to those discussed above. One Kemp's ridley capture in Mid-Atlantic trawl fisheries was documented by NMFS observers between 2009 and 2013 (Murray 2015b), and five Kemp's ridleys were documented by NMFS observers in Mid-Atlantic sink gillnet fisheries between 2007 and 2011 (Murray 2013). Additionally, in the spring of 2000, five Kemp's ridley carcasses were recovered from the same North Carolina beaches where 275 loggerhead carcasses were found. The cause of death for most of the turtles recovered was unknown, but the mass mortality event was suspected by NMFS to have been from a large-mesh gillnet fishery for monkfish and dogfish operating offshore in the preceding weeks (67 FR 71895, December 3, 2002). The five Kemp's ridley carcasses that were found are likely to have been only a minimum count of the number of Kemp's ridleys that were killed or seriously injured as a result of the fishery interaction, since it is unlikely that all of the carcasses washed ashore. The NEFSC

also documented 14 Kemp's ridleys entangled in or impinged on Virginia pound net leaders from 2002-2005. Note that bycatch estimates for Kemp's ridleys in various fishing gear types (e.g., trawl, gillnet, dredge) are not available at this time, largely due to the low number of observed interactions precluding a robust estimate. Kemp's ridley interactions in non-fisheries have also been observed; for example, the Oyster Creek Nuclear Generating Station in Barnegat Bay, New Jersey, recorded a total of 56 Kemp's ridleys (36 of which were found alive) impinged or captured on their intake screens from 1992-2011 (NMFS 2011).

The recovery plan for Kemp's ridley sea turtles (NMFS *et al.* 2011) identifies climate change as a threat; however, as with the other species discussed above, no significant climate change-related impacts to Kemp's ridley sea turtles have been observed to date. Atmospheric warming could cause habitat alteration which may change food resources such as crabs and other invertebrates. It may increase hurricane activity, leading to an increase in debris in nearshore and offshore waters, which may result in an increase in entanglement, ingestion, or drowning. In addition, increased hurricane activity may cause damage to nesting beaches or inundate nests with sea water. Atmospheric warming may change convergence zones, currents, and other oceanographic features that are relevant to Kemp's ridleys, as well as change rain regimes and levels of nearshore runoff.

Considering that the Kemp's ridley has temperature-dependent sex determination (Wibbels 2003) and the vast majority of the nesting range is restricted to the State of Tamaulipas, Mexico, global warming could potentially shift population sex ratios towards females and thus change the reproductive ecology of this species. A female bias is presumed to increase egg production (assuming that the availability of males does not become a limiting factor) (Coyne and Landry 2007) and increase the rate of recovery; however, it is unknown at what point the percentage of males may become insufficient to facilitate maximum fertilization rates in a population. If males become a limiting factor in the reproductive ecology of the Kemp's ridley, then reproductive output in the population could decrease (Coyne 2000). Low numbers of males could also result in the loss of genetic diversity within a population; however, there is currently no evidence that this is a problem in the Kemp's ridley population (NMFS *et al.* 2011). Models (Davenport 1997, Hulin and Guillon 2007, Hawkes *et al.* 2007, all referenced in NMFS *et al.* 2011) predict very long-term reductions in fertility in sea turtles due to climate change, but due to the relatively long life cycle of sea turtles, reductions may not be seen until 30 to 50 years in the future.

Another potential impact from global climate change is sea level rise, which may result in increased beach erosion at nesting sites. Beach erosion may 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. In the case of the Kemp's ridley where most of the critical nesting beaches are undeveloped, beaches may shift landward and still be available for nesting. The Padre Island National Seashore shoreline is accreting, unlike much of the Texas coast, and with nesting increasing and sand temperatures slightly cooler than at Rancho Nuevo, Padre Island could become an increasingly important source of males for the population.

As with the other sea turtle species discussed in this section, while there is a reasonable degree of certainty that certain climate change related effects will be experienced globally (e.g., rising temperatures and changes in precipitation patterns), due to a lack of scientific data, the specific

effects of climate change on this species are not predictable or quantifiable at this time (Hawkes *et al.* 2009). Based on the most recent five-year status review (NMFS and USFWS 2015), and following from the climate change discussion on loggerheads, significant impacts from climate change in the future are to be expected, but the severity of and rate at which these impacts will occur is currently unknown.

#### *Summary of Status for Kemp's Ridley Sea Turtles*

The majority of Kemp's ridleys nest along a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963; NMFS *et al.* 2011; NMFS and USFWS 2015). The number of nesting females in the Kemp's ridley population declined dramatically from the late 1940s through the mid-1980s, with an estimated 40,000 nesting females in a single *arribada* in 1947 and fewer than 300 nesting females in the entire 1985 nesting season (TEWG 2000; NMFS *et al.* 2011). However, the total annual number of nests at Rancho Nuevo gradually began to increase in the 1990s and 2000s (NMFS and USFWS 2015). Based on an average of 2.5 nests per female per nesting season (NMFS *et al.* 2011), the total number of nests on Mexico beaches represented about 4,824 nesting females in 2014 (NMFS and USFWS 2015). The number of adult males in the population is unknown, but sex ratios of hatchlings and immature Kemp's ridleys suggest that the population is female-biased, suggesting that the number of adult males is less than the number of adult females (NMFS and USFWS 2015). While there is still potential for recovery, factors such as the Deepwater Horizon oil spill, an overall decrease in the number of nests since 2009, climate change, and stranding events associated increased skimmer trawl use and poor TED compliance in the northern Gulf of Mexico may have dampened recent population growth.

As with the other sea turtle species, fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches, while other activities like dredging, pollution, and habitat destruction also contribute to annual human caused mortality, but the levels are unknown. A revised bi-national recovery plan was published in September 2011 by the NMFS, USFWS, and the Secretary of Environment and Natural Resources, Mexico (SEMARNAT) to address these ongoing threats. Based on their recent five-year status review of the species, NMFS and USFWS (2015) determined that Kemp's ridley sea turtles should remain classified as endangered under the ESA and that the Recovery Priority Number for the species be changed from a '5' to a '1.' A recovery priority 1 is defined as a species whose extinction is almost certain in the immediate future because of a rapid population decline or habitat destruction, whose limiting factors and threats are well understood and the needed management actions are known and have a high probability of success, and is a species that is in conflict with construction or other developmental projects or other forms of economic activity.

#### *4.2.1.3 Status of Green Sea Turtles – North Atlantic DPS*

Green sea turtles are distributed circumglobally, occurring throughout tropical, subtropical waters, and, to a lesser extent, temperate waters. They can be found in the Pacific, Indian, and Atlantic Oceans as well as the Mediterranean Sea (NMFS and USFWS 1991, 2007b; Seminoff 2004; Seminoff *et al.* 2015). Their movements within the marine environment are not fully understood, but it is believed that green sea turtles inhabit coastal waters of over 140 countries (Groombridge and Luxmoore 1989).

### *Listing History*

The green sea turtle was originally listed under the ESA on July 28, 1978 (43 FR 32800). Breeding populations of the green sea turtle in Florida and along the Pacific coast of Mexico were listed as endangered; while all other populations were listed as threatened. The major factors contributing to its status at the time included human encroachment and associated activities on nesting beaches; commercial harvest of eggs, subadults, and adults; predation; lack of comprehensive and consistent protective regulations; and incidental take in fisheries. Marine critical habitat for the green sea turtle was designated on September 2, 1998, for the waters surrounding Culebra Island, Puerto Rico, and its outlying keys (63 FR 46693).

On April 6, 2016, the NMFS and USFWS issued a final determination that the green sea turtle is comprised of eleven DPSs, constituting the “species,” to be listed as threatened or endangered under the ESA (81 FR 20058). Effective May 6, 2016, three DPSs were listed as endangered, eight as threatened. The April 2016 final rule replaced the 1978 global listing of green sea turtles.

In the final ESA listing decision, the NMFS and USFWS listed eleven green sea turtle DPSs distributed globally: (1) North Atlantic (threatened), (2) Mediterranean (endangered), (3) South Atlantic (threatened), (4) Southwest Indian (threatened), (5) North Indian (threatened), (6) East Indian-West Pacific (threatened), (7) Central West Pacific (endangered), (8) Southwest Pacific (threatened), (9) Central South Pacific (endangered), (10) Central North Pacific (threatened), and (11) East Pacific (threatened) (81 FR 20058; April 6, 2016). Based on the best available scientific and commercial data, only one listed DPS is likely to occur in the action area, the threatened North Atlantic DPS. The range of the North Atlantic DPS extends from the boundary of South and Central America, north along the coast to include Panama, Costa Rica, Nicaragua, Honduras, Belize, Mexico, and the U.S. It extends due east across the Atlantic Ocean at 48°N and follows the coast south to include the northern portion of the Islamic Republic of Mauritania (Mauritania) on the African continent to 19°N. It extends west at 19°N to the Caribbean basin to 65.1°W, then due south to 14°N, 65.1°W, then due west to 14°N, 77°W, and due south to 7.5°N, 77°W, the boundary of South and Central America. It includes Puerto Rico, the Bahamas, Cuba, Turks and Caicos Islands, Republic of Haiti, Dominican Republic, Cayman Islands, and Jamaica. The North Atlantic DPS includes the Florida breeding population, which was originally listed as endangered under the ESA (43 FR 32800; July 28, 1978).

In regards to discreteness, North Atlantic DPS populations of green sea turtles exhibit minimal mixing with the adjacent South Atlantic DPS and no mixing with the adjacent Mediterranean DPS. Occasionally, juvenile turtles from the North Atlantic may settle into foraging grounds in the South Atlantic or Mediterranean, while adult turtles nesting at sites in the equatorial region of the North Atlantic may travel to, and reside at, foraging grounds in the South Atlantic (Troëng *et al.* 2005). However, the reverse (i.e., turtles from the South Atlantic or Mediterranean DPS settling in North Atlantic waters) has yet to be documented. Furthermore, green sea turtles from the Mediterranean DPS appear to be spatially separated from populations in the Atlantic Ocean (Seminoff *et al.* 2015).

### *Distribution and Life History*

Green sea turtles were once the target of directed fisheries in the U.S. and throughout the Caribbean. In 1890, over one million pounds of green sea turtles were captured in a directed fishery in the Gulf of Mexico (Doughty 1984). However, declines in the turtle fishery throughout the Gulf of Mexico were evident by 1902 (Doughty 1984).

In the North Atlantic, large juvenile and adult green sea turtles are largely herbivorous, occurring in habitats containing benthic algae and seagrasses from Massachusetts to Central America, including the Gulf of Mexico and Caribbean (Wynne and Schwartz 1999). Green sea turtles occur seasonally in U.S. Mid-Atlantic and Northeast waters such as Chesapeake Bay and Long Island Sound (Musick and Limpus 1997; Morreale and Standora 1998; Morreale *et al.* 2005), which serve as foraging and developmental habitats.

Some of the principal feeding areas in the North Atlantic Ocean include the upper west coast of Florida, the Florida Keys, and the northwestern coast of the Yucatán Peninsula. Additional important foraging areas in the western Atlantic include the Mosquito and Indian River Lagoon systems and nearshore wormrock reefs between Sebastian and Fort Pierce Inlets in Florida, Florida Bay, the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Mosquito Coast of Nicaragua, and the Caribbean coast of Panama (Hirth 1971).

Age at maturity for green sea turtles is estimated to be 20-50 years (Balazs 1982; Frazer and Ehrhart 1985; Seminoff 2004). Adult females may nest multiple times in a season (average three nests/season with approximately 100 eggs/nest) and typically do not nest in successive years (NMFS and USFWS 1991; Hirth 1997).

### *Population Dynamics and Status*

Nest count information for green sea turtles provides information on the relative abundance of nesting, and the contribution of each nesting group to total nesting of the species. Nest counts can also be used to estimate the number of reproductively mature females nesting annually. The North Atlantic DPS contains an estimated 167,424 females nesting at 73 sites (81 FR 20058).

In 2015, the Green Turtle Status Review Team (SRT) identified those 73 nesting sites within the North Atlantic DPS, although some represent numerous individual beaches. There are four regions that support high density nesting concentrations for which data were available: Costa Rica (Tortuguero), Mexico (Campeche, Yucatan, and Quintana Roo), U.S. (Florida), and Cuba. Nester abundance was assessed by the SRT for 48 nesting sites within the North Atlantic DPS. Abundance was estimated using the best scientific information available. Remigration intervals and clutch frequencies were used to estimate total nester abundance when counts of nesters were not available. In terms of nester distribution, the largest nesting site (Tortuguero, Costa Rica) hosts 79% of total nester abundance (167,528 nesters). There were also 26 nesting sites for which there were qualitative reports of nesting activity but no nesting data: three in the Bahamas, three in Belize, one in Costa Rica, four in Cuba, one in the Dominican Republic, one in Haiti, six in Honduras, two in Jamaica, one in Mauritania, one in Panama, and three in the Turks and Caicos Islands (Seminoff *et al.* 2015). Green turtle nesting populations in the North Atlantic are some of the most studied in the world, with time series exceeding 40 years in Costa Rica and 35

years in Florida. There are seven sites for which ten years or more of recent data are available for annual nester abundance.

By far, the most important nesting concentration for green sea turtles in the North Atlantic DPS is in Tortuguero, Costa Rica (Seminoff *et al.* 2015). This population has been studied since the 1950s and nesting has increased markedly since the early 1970s. From 1971 to 1975, there were approximately 41,250 nesting emergences per year and from 1992 to 1996 there were approximately 72,200 nesting emergences per year (Bjorndal *et al.* 1999). From 1999 to 2003, about 104,411 nests/year were deposited, which corresponds to approximately 17,402–37,290 nesting females each year (Troëng and Rankin 2005). An estimated 180,310 nests were laid during 2010, the highest level of green sea turtle nesting estimated since the start of nesting track surveys in 1971. This equates to 30,052–64,396 nesters in 2010. This increase has occurred despite substantial human impacts to the population at the nesting beach and at foraging areas (Troëng 1998; Campbell and Lagueux 2005; Troëng and Rankin 2005). The number of females nesting per year on beaches in Mexico, Florida, and Cuba number in the hundreds to low thousands, depending on the site (Seminoff *et al.* 2015).

The 2015 status review also evaluated the status of the Florida breeding population (Seminoff *et al.* 2015). In Florida, nesting occurs in coastal areas of all regions except the Big Bend area of west central Florida. The bulk of nesting occurs along the Atlantic coast of eastern central Florida, where a mean of 5,055 nests were deposited each year from 2001 to 2005 (Meylan *et al.* 2006) and 10,377 each year from 2008 to 2012 (B. Witherington, Florida Fish and Wildlife Conservation Commission, pers. comm., 2013). Nesting has increased substantially over the last 20 years and peaked in 2011 with 15,352 nests statewide (Chaloupka *et al.* 2008; B. Witherington, Florida Fish and Wildlife Conservation Commission, pers. comm., 2013). The estimated total nester abundance for Florida is 8,426 turtles.

The pattern of green sea turtle nesting shows biennial peaks in abundance, with a generally positive trend since establishment of the Florida index beach surveys in 1989. This trend is perhaps due to increased protective legislation throughout the Caribbean (Meylan *et al.* 1995), as well as protections in Florida and throughout the U.S. (Seminoff *et al.* 2015). The statewide Florida index beach surveys (1989–2017) have shown that green sea turtle nest counts have increased over one hundredfold since 1989, from a low of 267 to a high of almost 39,000 in 2017 (<http://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/>). The last four odd-numbered years (2011, 2013, 2015, and 2017) have all broken previous records for the highest numbers of green sea turtle nests on Florida's index beaches.

Most nesting occurs along the east coast of Florida, but occasional nesting has been documented along the Gulf coast of Florida, at Southwest Florida beaches, as well as the beaches in the Florida Panhandle (Meylan *et al.* 1995). More recently, green sea turtle nesting occurred on Bald Head Island, North Carolina (just east of the mouth of the Cape Fear River), Onslow Island, and Cape Hatteras National Seashore. One green sea turtle nested on a beach in Delaware in 2011, although its occurrence was considered very rare.

Similar to the nesting trend found in Florida, in-water studies in Florida have also recorded increases in green sea turtle captures at the Indian River Lagoon site, with a 661% increase over

24 years (Ehrhart *et al.* 2007), and the St Lucie Power Plant site, with a significant increase in the annual rate of capture of immature green sea turtles (SCL<90 centimeters) from 1977 to 2002 or 26 years (3,557 green sea turtles total; Witherington *et al.* 2006).

### *Threats*

Green sea turtles face many of the same natural threats as loggerhead and Kemp's ridley sea turtles. In addition, green sea turtles appear to be particularly susceptible to fibropapillomatosis, an epizootic disease producing lobe-shaped tumors on the soft portion of a turtle's body. Juveniles appear to have the highest incidence of disease and the most extensive lesions, whereas lesions in nesting adults are rare. Also, green sea turtles frequenting nearshore waters, areas adjacent to large human populations, and areas with low water turnover, such as lagoons, have a higher incidence of the disease than individuals in deeper, more remote waters. The occurrence of fibropapilloma tumors may result in impaired foraging, breathing, or swimming ability, leading potentially to death (George 1997).

Incidental fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches. Witherington *et al.* (2009) observed that because green sea turtles spend a shorter time in oceanic waters, and as older juveniles occur on shallow seagrass pastures (where benthic trawling is unlikely), they avoid high mortalities in pelagic longline and benthic trawl fisheries. Although the relatively low number of observed green sea turtle captures makes it difficult to estimate bycatch rates and annual levels of interactions, green sea turtles have been observed captured in the pelagic driftnet, pelagic longline, southeast shrimp trawl, and Mid-Atlantic trawl and gillnet fisheries. Two green sea turtle captures in Mid-Atlantic trawl fisheries was documented by NMFS observers between 2009 and 2013, and there were 12 observed captures of green sea turtles in Mid-Atlantic sink gillnet gear between 2007 and 2011 (Murray 2009, 2015b).

Finkbeiner *et al.* (2011) compiled cumulative sea turtle bycatch information in U.S. fisheries from 1990 through 2007, before and after implementation of bycatch mitigation measures. Information was obtained from peer reviewed publications and NMFS documents (e.g., Opinions and bycatch reports). In the Atlantic, a mean estimate of 137,700 bycatch interactions, of which 4,500 were mortalities, occurred annually (since implementation of bycatch mitigation measures). Kemp's ridleys interacted with fisheries most frequently, with the highest level of mean annual mortality (2,700), followed by loggerheads (1,400), greens (300), and leatherbacks (40). The Southeast/Gulf of Mexico shrimp trawl fishery was responsible for the vast majority of U.S. interactions (up to 98%) and mortalities (more than 80%). While this provides an initial cumulative bycatch assessment, there are a number of caveats that should be considered when interpreting this information, such as sampling inconsistencies and limitations. The most recent section 7 consultation on the shrimp fishery, completed in May 2012, was unable to estimate the total annual level of green sea turtle interactions occurring in the fishery. Instead, it qualitatively estimated that the shrimp fishery, as currently operating, would result in at least hundreds and possibly low thousands of interactions annually, of which hundreds are expected to be lethal (NMFS 2012a).

Other activities like channel dredging, marine debris, pollution, vessel strikes, power plant impingement, and habitat destruction account for an unquantifiable level of other mortality.

Stranding reports indicate that between 200-400 green sea turtles strand annually along the eastern U.S. coast from a variety of causes most of which are unknown (STSSN database).

The most recent five-year status review for green sea turtles (Seminoff *et al.* 2015) notes that global climate change is affecting the species and will likely continue to be a threat. There is an increasing female bias in the sex ratio of green sea turtle hatchlings. While this is partly attributable to imperfect egg hatchery practices, global climate change is also implicated as a likely cause, as warmer sand temperatures at nesting beaches are likely to result in the production of more female embryos. Climate change may also impact nesting beaches through sea level rise which may reduce the availability of nesting habitat and increase the risk of nest inundation. Loss of appropriate nesting habitat may also be accelerated by 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. Oceanic changes related to rising water temperatures could result in changes in the abundance and distribution of the primary food sources of green sea turtles, which in turn could result in changes in behavior and distribution of this species. Seagrass habitats may suffer from decreased productivity and/or increased stress due to sea level rise, as well as salinity and temperature changes (Short and Neckles 1999; Duarte 2002).

As noted above, the increasing female bias in green sea turtle hatchlings is thought to be at least partially linked to increases in temperatures at nesting beaches. However, due to a lack of scientific data, the specific future effects of climate change on green sea turtles species are not predictable or quantifiable to any degree at this time (Hawkes *et al.* 2009). For example, information is not available to predict the extent and rate to which sand temperatures at the nesting beaches used by green sea turtles may increase in the short-term future and the extent to which green sea turtles may be able to cope with this change by selecting cooler areas of the beach or shifting their nesting distribution to other beaches at which increases in sand temperature may not be experienced. Based on the most recent five-year status review (Seminoff *et al.* 2015), and following from the climate change discussions on the other hard-shelled sea turtle species, significant impacts from climate change in the future are to be expected, but the severity of and rate at which these impacts will occur is currently unknown.

#### *Summary of Status for the North Atlantic DPS of Green Sea Turtles*

In the North Atlantic, nesting groups are considered to be doing relatively well (i.e., the number of sites with increasing nesting are greater than the number of sites with decreasing nesting) (Seminoff *et al.* 2015). However, given the late age to maturity for green sea turtles, caution is urged regarding the status of nesting groups in the North Atlantic DPS since no area has a dataset spanning a full green sea turtle generation (Seminoff *et al.* 2015).

Seminoff *et al.* (2015) concluded that green sea turtle abundance is increasing for four nesting sites in the North Atlantic. They also concluded that nesting at Tortuguero, Costa Rica represents the most important nesting area for green sea turtles in the North Atlantic and that nesting at Tortuguero has increased markedly since the 1970s (Seminoff *et al.* 2015). However, the five-year status review also noted that the Tortuguero nesting stock continues to be affected by ongoing directed captures at their primary foraging area in Nicaragua. The breeding

population in Florida appears to be increasing rapidly in recent years based upon index nesting data from 1989-2015.

As with the other sea turtle species, fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches, while other activities like hopper dredging, pollution, and habitat destruction also contribute to human caused mortality, though the level is unknown.

#### **4.2.2 Status of Atlantic Sturgeon**

The section below describes the Atlantic sturgeon listing, provides life history information that is relevant to all DPSs of Atlantic sturgeon, and then provides information specific to the status of each DPS of Atlantic sturgeon. Below, we also provide a description of the Atlantic sturgeon DPSs likely to occur in the action area and their use of the action area.

The Atlantic sturgeon is a subspecies of sturgeon distributed along the east coast of North America from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida (Scott and Scott 1988; ASSRT 2007). We have delineated U.S. populations of Atlantic sturgeon into five DPSs: Gulf of Maine (GOM), New York Bight (NYB), Chesapeake Bay (CB), Carolina, and South Atlantic (SA) (77 FR 5880 and 77 FR 5914; Figure 4)<sup>6</sup>. The results of genetic studies suggest that natal origin influences the distribution of Atlantic sturgeon in the marine environment (Wirgin and King 2011). However, satellite tracking and tagging data along with other genetic data demonstrate that Atlantic sturgeon from all five DPSs and Canada occur throughout the full range of the subspecies. Therefore, Atlantic sturgeon originating from any of the five DPSs can be affected by threats in the marine, estuarine, and riverine environment that occur far from natal spawning rivers.

At present, the NYB, CB, Carolina, and SA DPSs are listed as endangered, while the GOM DPS is listed as threatened (77 FR 5880 and 77 FR 5914; February 6, 2012). The effective date of the listings was April 6, 2012. The DPSs do not include Atlantic sturgeon that are spawned in Canadian rivers. Therefore, Canadian spawned fish are not included in the listings. As described below, individuals originating from all five listed DPSs are likely to occur in the action area. Information general to all Atlantic sturgeon as well as information specific to each DPS is provided below.

##### *Life history*

Atlantic sturgeon are long lived (approximately 60 years), late maturing, estuarine dependent, anadromous<sup>7</sup> fish (Bigelow and Schroeder 1953; Vladykov and Greeley 1963; Mangin 1964; Pikitch *et al.* 2005; Dadswell 2006; ASSRT 2007). They are relatively large fish, even amongst sturgeon species (Pikitch *et al.* 2005) and can grow to over 14 feet and weigh up to 800 pounds. Atlantic sturgeon are bottom feeders that suck food into a ventral protruding mouth (Bigelow and Schroeder 1953). Four barbels in front of the mouth assist the sturgeon in locating prey

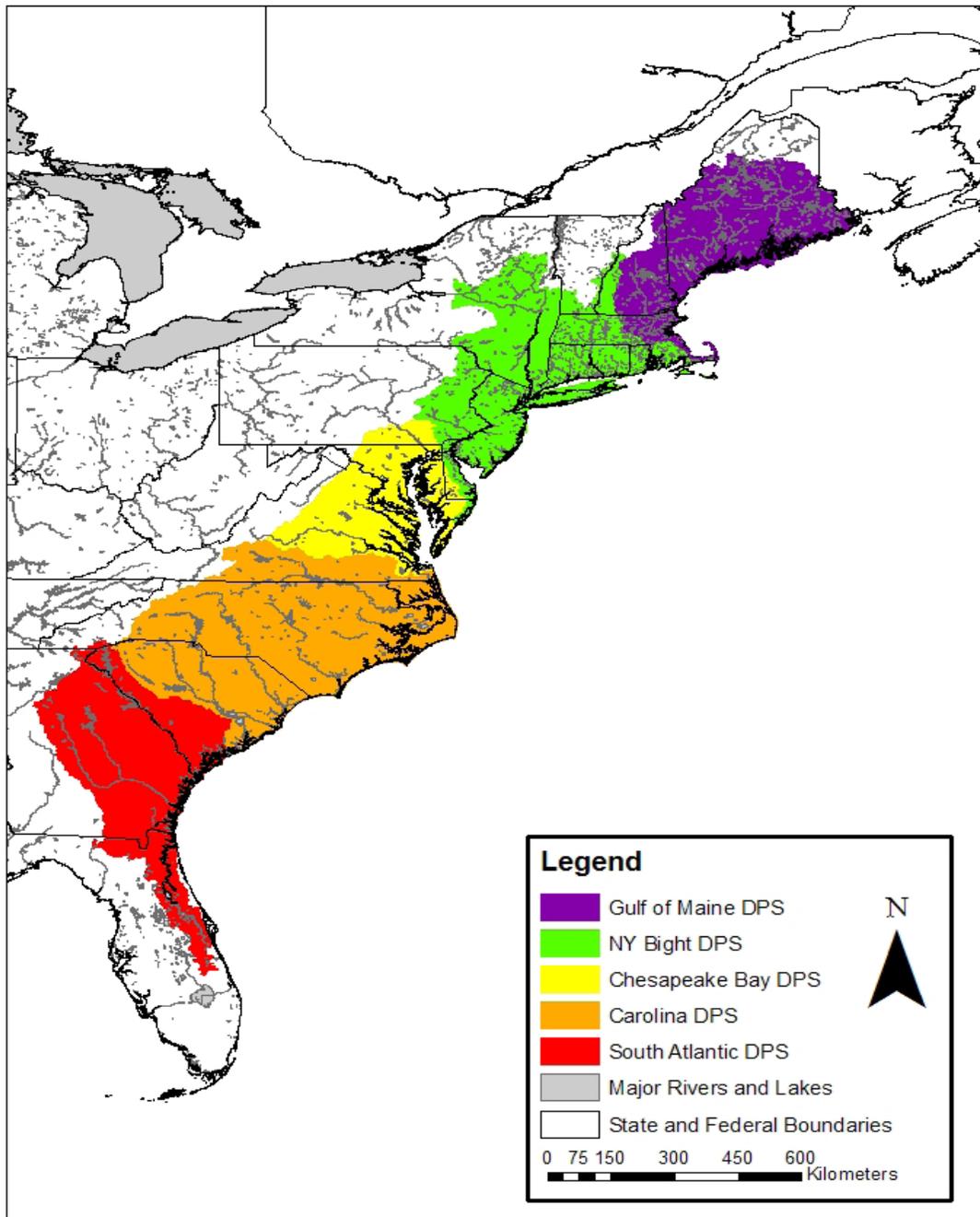
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<sup>6</sup> To be considered for listing under the ESA, a group of organisms must constitute a “species.” A “species” is defined in section 3 of the ESA to include “any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature.”

<sup>7</sup> Anadromous refers to a fish that is born in freshwater, spends most of its life in the sea, and returns to freshwater to spawn (NEFSC FAQ’s, available at <http://www.nefsc.noaa.gov/faq/fishfaq1a.html>, modified June 16, 2011)

(Bigelow and Schroeder 1953). Diets of adult and migrant subadult Atlantic sturgeon include mollusks, gastropods, amphipods, annelids, decapods, isopods, and fish such as sand lance (Bigelow and Schroeder 1953; ASSRT 2007; Guilbard *et al.* 2007; Savoy 2007). Juvenile Atlantic sturgeon feed on aquatic insects, larvae, and other invertebrates (Bigelow and Schroeder 1953; ASSRT 2007; Guilbard *et al.* 2007). The life history of Atlantic sturgeon can be divided into five general categories as described in Table 4 below (adapted from ASSRT 2007).

Figure 2. Map Depicting the 5 Atlantic Sturgeon DPSs



**Table 4. Descriptions of Atlantic sturgeon life history stages.**

Age Class	Size	Description
<b>Egg</b>		Fertilized or unfertilized
<b>Larvae</b>		Negative photo-tactic, nourished by yolk sac
<b>Young-of-the-Year (YOY)</b>	<b>0.3 grams; &lt;41 cm TL</b>	Fish that are > 3 months and < one year; capable of capturing and consuming live food
<b>Sub-adults</b>	<b>&gt;41 cm and &lt;150 cm TL</b>	Fish that are at least age 1 and are not sexually mature
<b>Adults</b>	<b>&gt;150 cm TL</b>	Sexually mature fish

Rate of maturation is affected by water temperature and gender. In general: (1) Atlantic sturgeon that originate from southern systems grow faster and mature sooner than Atlantic sturgeon that originate from more northern systems; (2) males grow faster than females; (3) fully mature females attain a larger size (i.e., length) than fully mature males. The largest recorded Atlantic sturgeon was a female captured in 1924 that measured approximately 4.26 meters (Vladykov and Greeley 1963). Dadswell (2006) reported seeing seven fish of comparable size in the St. John River estuary from 1973 to 1995. Observations of large-sized sturgeon are particularly important given that egg production is correlated with age and body size (Smith *et al.* 1982; Van Eenennaam *et al.* 1996; Van Eenennaam and Doroshov 1998; Dadswell 2006). The lengths of Atlantic sturgeon caught since the mid-late 20<sup>th</sup> century have typically been less than three meters (Smith *et al.* 1982, Smith and Dingley 1984; Smith 1985; Scott and Scott 1988; Young *et al.* 1998; Collins *et al.* 2000; Caron *et al.* 2002; Dadswell 2006; ASSRT 2007; Kahnle *et al.* 2007; DFO 2011). While females are prolific, with egg production ranging from 400,000 to four million eggs per spawning year, females spawn at intervals of two to five years (Vladykov and Greeley 1963; Smith *et al.* 1982; Van Eenennaam *et al.* 1996; Van Eenennaam and Doroshov 1998; Stevenson and Secor 1999; Dadswell 2006). Given spawning periodicity and a female's relatively late age to maturity, the age at which 50% of the maximum lifetime egg production is achieved is estimated to be 29 years (Boreman 1997). Males exhibit spawning periodicity of one to five years (Smith 1985; Collins *et al.* 2000; Caron *et al.* 2002). While long-lived, Atlantic sturgeon are exposed to a multitude of threats prior to achieving maturation and have a limited number of spawning opportunities once mature.

Water temperature plays a primary role in triggering the timing of spawning migrations (Greene *et al.* 2009). Spawning migrations generally occur during February-March in southern systems, April-May in Mid-Atlantic systems, and May-July in Canadian systems (Murawski and Pacheco 1977; Smith 1985; Bain 1997; Smith and Clugston 1997; Caron *et al.* 2002). Male sturgeon begin upstream spawning migrations when waters reach approximately 6°C (43°F) (Smith *et al.* 1982; Dovel and Berggren 1983; Smith 1985; Greene *et al.* 2009), and remain on the spawning grounds throughout the spawning season (Bain 1997). Females begin spawning migrations when temperatures are closer to 12° to 13°C (54° to 55°F) (Dovel and Berggren 1983; Smith 1985; Collins *et al.* 2000), make rapid spawning migrations upstream, and quickly depart following spawning (Bain 1997).

The spawning areas in most U.S. rivers have not been well defined. However, the habitat characteristics of spawning areas have been identified based on historical accounts of where fisheries occurred, tracking and tagging studies of spawning sturgeon, and physiological needs of early life stages. Spawning is believed to occur in flowing water between the salt front of estuaries and the fall line of large rivers, when and where optimal flows are 46-76 centimeters/second and depths are 3-27 meters (Borodin 1925; Dees 1961; Leland 1968; Scott and Crossman 1973; Crance 1987; Shirey *et al.* 1999; Bain *et al.* 2000; Collins *et al.* 2000; Caron *et al.* 2002; Hatin *et al.* 2002; Greene *et al.* 2009). Sturgeon eggs are deposited on hard bottom substrate such as cobble, coarse sand, and bedrock (Dees 1961; Scott and Crossman 1973; Gilbert 1989; Smith and Clugston 1997; Bain *et al.* 2000; Collins *et al.* 2000; Caron *et al.* 2002; Hatin *et al.* 2002; Mohler 2003; Greene *et al.* 2009), and become adhesive shortly after fertilization (Murawski and Pacheco 1977; Van den Avyle 1984; Mohler 2003). Incubation time for the eggs increases as water temperature decreases (Mohler 2003). At temperatures of 20° and 18°C, hatching occurs approximately 94 and 140 hours, respectively, after deposition (ASSRT 2007).

Larval Atlantic sturgeon (i.e., less than four weeks old, with TL less than 30 millimeters; Van Eenennaam *et al.* 1996) are assumed to mostly live on or near the bottom and inhabit the same riverine or estuarine areas where they were spawned (Smith *et al.* 1980; Bain *et al.* 2000; Kynard and Horgan 2002; Greene *et al.* 2009). Studies suggest that age-0 (i.e., YOY), age-1, and age-2 juvenile Atlantic sturgeon occur in low salinity waters of the natal estuary (Haley 1999; Hatin *et al.* 2007; McCord *et al.* 2007; Munro *et al.* 2007) while older fish are more salt tolerant and occur in higher salinity waters as well as low salinity waters (Collins *et al.* 2000). Atlantic sturgeon remain in the natal estuary for months to years before emigrating to open ocean as subadults (Holland and Yelverton 1973; Dovel and Berggen 1983; Waldman *et al.* 1996; Dadswell 2006; ASSRT 2007).

After emigration from the natal estuary, subadults and adults travel within the marine environment, typically in waters less than 50 meters in depth, using coastal bays, sounds, and ocean waters (Vladykov and Greeley 1963; Murawski and Pacheco 1977; Dovel and Berggren 1983; Smith 1985; Collins and Smith 1997; Welsh *et al.* 2002; Savoy and Pacileo 2003; Stein *et al.* 2004a; Laney *et al.* 2007; Dunton *et al.* 2010; Erickson *et al.* 2011; Wirgin and King 2011). Tracking and tagging studies reveal seasonal movements of Atlantic sturgeon along the coast. Satellite-tagged adult sturgeon from the Hudson River concentrated in the southern part of the Mid-Atlantic Bight at depths greater than 20 meters during winter and spring, and in the northern portion of the Mid-Atlantic Bight at depths less than 20 meters in summer and fall (Erickson *et al.* 2011). A similar movement pattern for juvenile Atlantic sturgeon has been found based on recaptures of fish originally tagged in the Delaware River (C. Shirey, Delaware Department of Fish and Wildlife, unpublished data reviewed in Greene *et al.* 2009). After leaving the Delaware River estuary during the fall, juvenile Atlantic sturgeon were recaptured by commercial fishermen in nearshore waters along the Atlantic coast as far south as Cape Hatteras from November through early March. In the spring, a portion of the tagged fish re-entered the Delaware River estuary. However, many fish continued a northerly coastal migration through the Mid-Atlantic as well as into southern New England waters where they were recovered throughout the summer months. Movements as far north as Maine were documented. A southerly coastal migration was apparent from tag returns reported in the fall. The majority of

these tag returns were reported from relatively shallow nearshore fisheries with few fish reported from waters in excess of 25 meters (C. Shirey, Delaware Department of Fish and Wildlife, unpublished data reviewed in Greene *et al.* 2009). Areas where migratory Atlantic sturgeon commonly aggregate include the Bay of Fundy (e.g., Minas and Cumberland Basins), Massachusetts Bay, Connecticut River estuary, Long Island Sound, New York Bight, Delaware Bay, Chesapeake Bay, and waters off of North Carolina from the Virginia/North Carolina border to Cape Hatteras at depths up to 24 meters (Dovel and Berggren 1983; Dadswell *et al.* 1984; Johnson *et al.* 1997; Rochard *et al.* 1997; Kynard *et al.* 2000; Eyler *et al.* 2004; Stein *et al.* 2004a; Wehrell 2005; Dadswell 2006; ASSRT 2007; Laney *et al.* 2007). These sites may be used as foraging sites and/or thermal refugia.

#### *Determination of DPS Composition in the Action Area*

As explained above, the range of all five DPSs overlaps and extends from Canada through Cape Canaveral, Florida. The Chesapeake Bay is known to be used by Atlantic sturgeon originating from all five DPSs. We have considered the best available information from a recent mixed stock analysis to determine from which DPSs individuals in the action area are likely to have originated. We have determined that Atlantic sturgeon in the action area likely originate from the five DPSs at the following frequencies: NYB 51.7%; SA 21.9%; CB 11.8%; GOM 10.1%; and Carolina 2.4%. Approximately 2.2% of the Atlantic sturgeon in the action area originate from Canadian rivers or management units. These percentages are based on genetic sampling of all individuals (n=173) captured during observed fishing trips along the Atlantic coast from Maine through North Carolina, and the results of the genetic analyses for these 173 fish were compared against a reference population of 411 fish and results for an additional 790 fish from other sampling efforts. Therefore, they represent the best available information on the likely genetic makeup of individuals occurring in the action area. The genetic assignments have corresponding 95% confidence intervals. However, for purposes of section 7 consultation, we have selected the reported values without their associated confidence intervals. The reported values, which approximate the mid-point of the range, are a reasonable indication of the likely genetic makeup of Atlantic sturgeon in the action area. These assignments and the data from which they are derived are described in detail in Wirgin *et al.* (2015).

#### *Distribution and Abundance*

Atlantic sturgeon underwent significant range-wide declines from historical abundance levels due to overfishing in the mid to late 19<sup>th</sup> century when a caviar market was established (Scott and Crossman 1973; Taub 1990; MNRPD 1993; Smith and Clugston 1997; Dadswell 2006; ASSRT 2007). Abundance of spawning-aged females prior to this period of exploitation was predicted to be greater than 100,000 for the Delaware River, and at least 10,000 females for other spawning stocks (Secor and Waldman 1999; Secor 2002). Historical records suggest that Atlantic sturgeon spawned in at least 35 rivers prior to this period. Currently, only 17 U.S. rivers are known to support spawning (i.e., presence of YOY or gravid Atlantic sturgeon documented within the past 15 years) (ASSRT 2007). While there may be other rivers supporting spawning for which definitive evidence has not been obtained (e.g., in the Penobscot and York Rivers), the number of rivers supporting spawning of Atlantic sturgeon are approximately half of what they were historically. In addition, only five rivers (Kennebec, Androscoggin, Hudson, Delaware, and James) are known to currently support spawning from Maine through Virginia, where historical records show that there used to be 15 spawning rivers (ASSRT 2007). Thus, there are

substantial gaps between Atlantic sturgeon spawning rivers amongst northern and Mid-Atlantic States, which could make recolonization of extirpated populations more difficult.

There are no current, published population abundance estimates for any of the currently known spawning stocks or for any of the five DPSs of Atlantic sturgeon. An estimate of 863 mature adults per year (596 males and 267 females) was calculated for the Hudson River based on fishery-dependent data collected from 1985-1995 (Kahnle *et al.* 2007). An estimate of 343 spawning adults per year is available for the Altamaha River, Georgia, based on fishery-independent data collected in 2004 and 2005 (Schueller and Peterson 2006). Using the data collected from the Hudson and Altamaha Rivers to estimate the total number of Atlantic sturgeon in either subpopulation is not possible, since mature Atlantic sturgeon may not spawn every year (Vladykov and Greeley 1963; Smith 1985; Van Eenennaam *et al.* 1996; Stevenson and Secor 1999; Collins *et al.* 2000; Caron *et al.* 2002), the age structure of these populations is not well understood, and stage to stage survival is unknown. In other words, the information that would allow us to take an estimate of annual spawning adults and expand that estimate to an estimate of the total number of individuals (e.g., yearlings, subadults, and adults) in a population is lacking. The ASSRT presumed that the Hudson and Altamaha Rivers had the most robust of the remaining U.S. Atlantic sturgeon spawning populations and concluded that the other U.S. spawning populations were likely less than 300 spawning adults per year (ASSRT 2007).

Lacking complete estimates of population abundance across the distribution of Atlantic sturgeon, the NEFSC developed a virtual population analysis model with the goal of estimating bounds of Atlantic sturgeon ocean abundance. The NEFSC suggested that cumulative annual estimates of surviving fishery discards could provide a minimum estimate of abundance. The objectives of producing the Atlantic Sturgeon Production Index (ASPI) were to characterize uncertainty in abundance estimates arising from multiple sources of observation and process error and to complement future efforts to conduct a more comprehensive stock assessment (Table 4). The ASPI provides a general abundance metric to assess risk for actions that may affect Atlantic sturgeon in the ocean; however, it is not a comprehensive stock assessment. In general, the model uses empirical estimates of post-capture survivors and natural survival, as well as probability estimates of recapture using tagging data from the USFWS sturgeon tagging database, and federal fishery discard estimates from 2006 to 2010 to produce a virtual population. The USFWS sturgeon tagging database is a repository for sturgeon tagging information on the Atlantic coast. The database contains tag release and recapture information from state and federal researchers. The database records recaptures by the fishing fleet, researchers, and researchers on fishery vessels.

In addition to the ASPI, a population estimate was derived from the NEAMAP trawl surveys (Table 5). The NEAMAP trawl surveys are conducted from Cape Cod, Massachusetts to Cape Hatteras, North Carolina in nearshore waters at depths up to 18.3 meters (60 feet) during the fall since 2007 and spring since 2008. Each survey employs a spatially stratified random design with a total of 35 strata and 150 stations. The Atlantic States Marine Fisheries Commission (ASMFC) has initiated a new stock assessment with the goal of completing it in the near future. NMFS will be partnering with them to conduct the stock assessment, and the ocean population abundance estimates produced by the NEFSC will be shared with the stock assessment committee for consideration in the stock assessment.

**Table 5. Description of the ASPI model and NEAMAP survey based area estimate method.**

Model Name	Model Description
A. ASPI	Uses tag-based estimates of recapture probabilities from 1999 to 2009. Natural mortality based on Kahnle <i>et al.</i> (2007) rather than estimates derived from tagging model. Tag recaptures from commercial fisheries are adjusted for non-reporting based on recaptures from observers and researchers. Tag loss assumed to be zero.
B. NEAMAP Swept Area	Uses NEAMAP survey-based swept area estimates of abundance and assumed estimates of gear efficiency. Estimates based on average of ten surveys from fall 2007 to spring 2012.

Atlantic sturgeon are frequently encountered during the NEAMAP surveys. The information from these surveys can be used to calculate minimum swept area population estimates within the strata swept by the surveys. The estimate from fall surveys ranges from 6,980 to 42,160 with coefficients of variation between 0.02 and 0.57, and the estimates from spring surveys ranges from 25,540 to 52,990 with coefficients of variation between 0.27 and 0.65 (Table 6). These are considered minimum estimates because the calculation makes the assumption that the gear will capture (i.e., net efficiency) 100% of the sturgeon in the water column along the tow path and that all sturgeon are within the sampling domain of the survey. We define catchability as: 1) the product of the probability of capture given encounter (i.e., net efficiency), and 2) the fraction of the population within the sampling domain. Catchabilities less than 100% will result in estimates greater than the minimum. The true catchability depends on many factors including the availability of the species to the survey and the behavior of the species with respect to the gear. True catchabilities much less than 100% are common for most species. The average ASPI estimate of 417,934 fish implies a catchability of between 6% and 13% for the spring NEAMAP surveys, and a catchability of between 2% and 10% for the fall NEAMAP surveys. If the availability of Atlantic sturgeon in the areas sampled by the spring NEAMAP surveys were say 50%, then the implied range of net efficiencies for this survey would double to 12% and 26%. The ratio of total sturgeon habitat to area sampled by the NEAMAP surveys is unknown, but is certainly greater than one.

The NEAMAP-based estimates do not include YOY fish and juveniles in the rivers; however, those segments of the Atlantic sturgeon populations are at minimal risk from the proposed action since they are rare to absent within the action area. The NEAMAP surveys are conducted in waters that include the preferred depth ranges of subadult and adult Atlantic sturgeon and take place during seasons that coincide with known Atlantic sturgeon coastal migration patterns in the ocean. Therefore, the NEAMAP estimates are minimum estimates of the ocean population of Atlantic sturgeon but are based on sampling throughout the action area, in known sturgeon coastal migration areas during times that sturgeon are expected to be migrating north and south.

**Table 6. Annual minimum swept area estimates for Atlantic sturgeon during the spring and fall NEAMAP surveys. Estimates provided by Dr. Chris Bonzek (VIMS) and assume 100% net efficiencies.**

Year	Fall Number	CV	Spring Number	CV
2007	6,981	0.015		
2008	33,949	0.322	25,541	0.391
2009	32,227	0.316	41,196	0.353
2010	42,164	0.566	52,992	0.265
2011	22,932	0.399	52,840	0.480
2012			28,060	0.652

Available data do not support estimation of true catchability (i.e., net efficiency x availability) of the NEAMAP trawl survey for Atlantic sturgeon. Thus, the NEAMAP swept area biomass estimates were produced and presented for catchabilities from 5% to 100%. Assuming the NEAMAP surveys have been 100% efficient would require the unlikely assumption that the survey gear captures all Atlantic sturgeon within the path of the trawl and all sturgeon are within the sampling area of the NEAMAP survey. The 50% efficiency assumption seems to reasonably account for the robust, yet not complete sampling of the Atlantic sturgeon oceanic temporal and spatial ranges and the documented high rates of encounter with NEAMAP survey gear and Atlantic sturgeon. For this Opinion, we have determined that the best available data at this time are the population estimates derived from NEAMAP swept area biomass resulting from the 50% catchability rate (Table 7). The estimates are derived directly from empirical data with fewer assumptions than have been required to model Atlantic sturgeon populations to date.

**Table 7. Modeled results from the ASPI and NEAMAP Atlantic sturgeon estimation methods.**

<b>Model Run</b>	<b>Model Years</b>	<b>95% low</b>	<b>Mean</b>	<b>95% high</b>
A. ASPI	1999-2009	165,381	417,934	744,597
B.1 NEAMAP Survey, swept area assuming 100% efficiency	2007-2012	8,921	33,888	58,856
B.2 NEAMAP Survey, swept area assuming 50% efficiency	2007-2012	13,962	67,776	105,984
B.3 NEAMAP Survey, swept area assuming 10% efficiency	2007-2012	89,206	338,882	588,558

The ocean population abundance of 67,776 fish estimated from the NEAMAP surveys assuming 50% efficiency (based on net efficiency and the fraction of the total population exposed to the survey) was subsequently partitioned by DPS based on genetic frequencies of occurrence in the sampled area (Table 8). Given the proportion of adults to subadults in the observer database (approximate ratio of 1:3), we have also estimated a number of subadults originating from each DPS. However, this cannot be considered an estimate of the total number of subadults because it only considers those subadults that are of a size vulnerable to capture in commercial sink gillnet and otter trawl gear in the marine environment and are present in the marine environment, which is only a fraction of the total number of subadults.

**Table 8. Summary of calculated population estimates based upon the NEAMAP survey swept area model assuming 50% efficiency.**

DPS	Estimated Ocean Population Abundance	Estimated Ocean Population of Adults	Estimated Ocean Population of Subadults (of size vulnerable to capture in fisheries)
GOM	7,455	1,864	5,591
NYB	34,566	8,642	25,925
CB	8,811	2,203	6,608
Carolina	1,356	339	1,017
SA	14,911	3,728	11,183
Canada	678	170	509

The ASMFC released a new benchmark stock assessment for Atlantic sturgeon in October 2017 (ASMFC 2017). The assessment used both fishery-dependent and fishery-independent data, as well as biological and life history information. Fishery-dependent data came from commercial fisheries that formerly targeted Atlantic sturgeon (before the moratorium), as well as fisheries that catch sturgeon incidentally. Fishery-independent data were collected from scientific research and survey programs.

**Table 9: Stock status determination for the coastwide stock and DPSs (from the ASMFC’s Atlantic Sturgeon Stock Assessment Overview, October 2017)**

Population	Mortality Status	Biomass/Abundance Status	
	Probability that $Z > Z_{50\%EPR}$ 80%	Relative to Historical Levels	Average probability of terminal year of indices > 1998* value
Coastwide	7%	Depleted	95%
Gulf of Maine	74%	Depleted	51%
New York Bight	31%	Depleted	75%
Chesapeake Bay	30%	Depleted	36%
Carolina	75%	Depleted	67%
South Atlantic	40%	Depleted	Unknown (no suitable indices)

\* For indices that started after 1998, the first year of the index was used as the reference value.

At the coastwide and DPS levels, the stock assessment concluded that Atlantic sturgeon are depleted relative to historical levels. The low abundance of Atlantic sturgeon is not due solely to effects of historic commercial fishing, so the ‘depleted’ status was used instead of ‘overfished.’ This status reflects the array of variables preventing Atlantic sturgeon recovery (e.g., bycatch, habitat loss, and ship strikes).

As described in the Assessment Overview, Table 9 shows “the stock status determination for the coastwide stock and DPSs based on mortality estimates and biomass/abundance status relative to historic levels, and the terminal year (i.e., the last year of available data) of indices relative to the start of the moratorium as determined by the ARIMA<sup>8</sup> analysis.”

Despite the depleted status, the assessment did include signs that the coastwide index is above the 1998 value (95% chance). The GOM, NYB, and Carolina DPS indices also all had a greater than 50% chance of being above their 1998 value; however, the index from the CB DPS (highlighted red) only had a 36% chance of being above the 1998 value. There were no representative indices for the SA DPS. Total mortality from the tagging model was very low at the coastwide level. Small sample sizes made mortality estimates at the DPS level more difficult. The NYB, CB, and SA DPSs all had a less than 50% chance of having a mortality rate higher than the threshold. The GOM and Carolina DPSs (highlighted red) had 74%-75% probability of being above the mortality threshold (ASMFC 2017).

### *Threats*

Atlantic sturgeon are susceptible to over exploitation given their life history characteristics (e.g., late maturity, dependence on a wide-variety of habitats). Similar to other sturgeon species (Vladykov and Greeley 1963; Pikitch *et al.* 2005), Atlantic sturgeon experienced range-wide declines from historical abundance levels due to overfishing (for caviar and meat) and impacts to habitat in the 19<sup>th</sup> and 20<sup>th</sup> centuries (Taub 1990; Smith and Clugston 1997; Secor and Waldman 1999).

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 could 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) loss of unique haplotypes; (5) loss of adaptive traits; and (6) reduction in total number. The loss of a population will negatively impact the persistence and viability of the DPS as a whole, as fewer than two individuals per generation spawn outside their natal rivers (Secor and Waldman 1999). The persistence of individual populations, and in turn the DPS, depends on successful spawning and rearing within the freshwater habitat, emigration to marine habitats to grow, and return of adults to natal rivers to spawn.

Based on the best available information, we have concluded that unintended catch in fisheries, vessel strikes, poor water quality, freshwater availability, dams, lack of regulatory mechanisms for protecting the fish, and dredging are the most significant threats to Atlantic sturgeon (77 FR 5880 and 77 FR 5914; February 6, 2012). While all the threats are not necessarily present in the same area at the same time, given that Atlantic sturgeon subadults and adults use ocean waters from Labrador, Canada to Cape Canaveral, Florida, as well as estuaries of large rivers along the U.S. East Coast, activities affecting these water bodies are likely to impact more than one Atlantic sturgeon DPS. In addition, because Atlantic sturgeon depend on a variety of habitats, every life stage is likely affected by one or more of the identified threats.

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<sup>8</sup> “The ARIMA (Auto-Regressive Integrated Moving Average) model uses fishery-independent indices of abundance to estimate how likely an index value is above or below a reference value” (ASMFC 2017).

Atlantic sturgeon are particularly sensitive to bycatch mortality because they are a long-lived species, have an older age at maturity, have lower maximum fecundity values, 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. 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. 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 dissolved oxygen). This may result in reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality.

As a wide-ranging, anadromous species, Atlantic sturgeon are subject to numerous Federal (U.S. and Canadian), state and provincial, and inter-jurisdictional laws, regulations, and agency activities. While these mechanisms, including the prohibition on possession, have addressed impacts to Atlantic sturgeon through directed fisheries, there are currently insufficient mechanisms in place to address the significant risk posed to Atlantic sturgeon from commercial bycatch.

An ASMFC interstate fishery management plan for sturgeon (Sturgeon FMP) was developed and implemented in 1990 (Taub 1990). In 1998, the remaining Atlantic sturgeon fisheries in U.S. state waters were closed per Amendment 1 to the FMP. NMFS implemented complementary regulations in 1999 that prohibited fishing for, harvesting, possessing, or retaining Atlantic sturgeon or their parts in or from the U.S. Exclusive Economic Zone (EEZ) in the course of a commercial fishing activity.

Commercial fisheries for Atlantic sturgeon still exist in Canadian waters (DFO 2011). Sturgeon belonging to one or more of the DPSs may be harvested in the Canadian fisheries. In particular, the Bay of Fundy fishery in the Saint John estuary may capture sturgeon of U.S. origin given that sturgeon from the GOM and the NYB DPSs have been incidentally captured in other Bay of Fundy fisheries (DFO 2011; Wirgin and King 2011). Because Atlantic sturgeon are listed under Appendix II of the Convention on International Trade in Endangered Species (CITES), the U.S. and Canada are currently working on a conservation strategy to address the potential for captures of U.S. fish in Canadian directed Atlantic sturgeon fisheries and of Canadian fish incidentally captured in U.S. commercial fisheries. At this time, there are no estimates of the number of individuals from any of the DPSs that are captured or killed in Canadian fisheries each year. Based on geographic distribution, most U.S. Atlantic sturgeon that are intercepted in Canadian fisheries are likely to originate from the GOM DPS, with a smaller percentage from the NYB DPS.

Fisheries bycatch in U.S. waters is the primary threat faced by all five DPSs. At this time, we have an estimate of the number of Atlantic sturgeon captured and killed in sink gillnet and otter trawl fisheries authorized by Federal FMPs (NEFSC 2011b) in the Greater Atlantic Region but do not have a similar estimate for Southeast fisheries. We also do not have an estimate of the number of Atlantic sturgeon captured or killed in state fisheries. At this time, we are not able to quantify the effects of other significant threats (e.g., vessel strikes, poor water quality, water availability, dams, and dredging) in terms of habitat impacts or loss of individuals. While we have some information on the number of mortalities that have occurred in the past in association with certain activities (e.g., mortalities in the Delaware and James Rivers that are thought to be due to vessel strikes), we are not able to use those numbers to extrapolate effects throughout one or more DPS. This is because of (1) the small number of data points and, (2) lack of information on the percent of incidences that the observed mortalities represent.

As noted above, the NEFSC prepared an estimate of the number of encounters of Atlantic sturgeon in fisheries authorized by Northeast FMPs (NEFSC 2011b). The analysis estimates that from 2006-2010 there were averages of 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%. Mortality rates in otter trawl gear were generally lower at approximately 5%.

Based on the results of a NEFSC climate vulnerability analysis, diadromous fish are amongst the functional groups with the highest overall climate vulnerability (data quality is moderate; Hare et al. 2016). Specifically, the overall vulnerability of Atlantic sturgeon to climate change is very high (Hare et al. 2016). The contributing factors to climate exposure included ocean surface temperature, air temperature and ocean acidification, and contributing biological sensitivity attributes included stock status, population growth rate, habitat specialization, and dispersal and early life history (Hare et al. 2016). Hare et al. (2016) noted some of the following studies related to climate change effects on abundance and distribution: 1) juvenile metabolism and survival were impacted by increasing hypoxia in combination with increasing temperature (Secor and Gunderson; 1998); and 2) a 1°C temperature increase reduced productivity by 65% when a multivariable bioenergetics and survival model was used to generate spatially explicit maps of potential production in the Chesapeake Bay (Niklitschek and Secor, 2005).

#### *4.2.2.1 Gulf of Maine DPS of Atlantic sturgeon*

The GOM DPS includes the following: all anadromous Atlantic sturgeon that spawn or 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. The marine range of Atlantic sturgeon from the GOM DPS extends from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine range of the GOM DPS and the adjacent portion of the marine range are shown in Figure 2. 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 it is possible that it still occurs in the Penobscot River as well. Spawning in the Androscoggin River was just recently confirmed by the Maine Department of Marine Resources when they captured a larval Atlantic sturgeon during the 2011 spawning season below the Brunswick Dam. There is no evidence of recent spawning in the remaining rivers. In the 1800s, construction of the Essex Dam on the

Merrimack River at river kilometer (rkm) 49 blocked access to 58% of Atlantic sturgeon habitat in the river (Oakley 2003; ASSRT 2007). However, the accessible portions of the Merrimack seem to be suitable habitat for Atlantic sturgeon spawning and rearing (i.e., nursery habitat) (Kieffer and Kynard 1993). Therefore, the availability of spawning habitat does not appear to be the reason for the lack of observed spawning in the Merrimack River. Studies are on-going to determine whether Atlantic sturgeon are spawning in the Penobscot and Saco Rivers. Atlantic sturgeon that are spawned elsewhere continue to use habitats within all of these rivers as part of their overall marine range (ASSRT 2007).

At its mouth, the Kennebec River drains an area of 24,667 square kilometers, and is part of a large estuarine system that includes the Androscoggin and Sheepscot Rivers (ASMFC 1998a; ASSRT 1998; Squiers 1998). The Kennebec and Androscoggin Rivers flow into Merrymeeting Bay, a tidal freshwater bay, and exit as a combined river system through a narrow channel, flowing approximately 32 kilometers (20 miles) to the Atlantic Ocean as the tidal segment of the Kennebec River (Squiers 1998). This lower tidal segment of the Kennebec River forms a complex with the Sheepscot River estuary (ASMFC 1998a; Squiers 1998).

Substrate type in the Kennebec estuary is largely sand and bedrock (Fenster and FitzGerald 1996; Moore and Reblin 2010). Main channel depths at low tide typically range from 17 meters (58 feet) near the mouth to less than 10 meters (33 feet) in the Kennebec River above Merrymeeting Bay (Moore and Reblin 2010). Salinities range from 31 parts per thousand at Parker Head (five kilometers from the mouth) to 18 parts per thousand at Doubling Point during summer low flows (ASMFC 1998a). The 14-kilometer river segment above Doubling Point to Chops Point (the outlet of Merrymeeting Bay) is an area of transition (mid estuary) (ASMFC 1998a). The salinities in this section vary both seasonally and over a tidal cycle. During spring freshets this section is entirely fresh water but during summer low flows, salinities can range from two to three parts per thousand at Chops Point to 18 ppt at Doubling Point (ASMFC 1998a). The river is essentially tidal freshwater from the outlet of Merrymeeting Bay upriver to the site of the former Edwards Dam (ASMFC 1998a). Mean tidal amplitude ranges from 2.56 meters at the mouth of the Kennebec River estuary to 1.25 meters in Augusta near the head of tide on the Kennebec River (in the vicinity of the former Edwards Dam) and 1.16 meters at Brunswick on the Androscoggin River (ASMFC 1998a).

Bigelow and Schroeder (1953) surmised that Atlantic sturgeon likely spawned in Gulf of Maine Rivers in May-July. More recent captures of Atlantic sturgeon in spawning condition within the Kennebec River suggest that spawning more likely occurs in June-July (Squiers *et al.* 1981; ASMFC 1998a; ASSRT 1998). Evidence for the timing and location of Atlantic sturgeon spawning in the Kennebec River includes: (1) the capture of five adult male Atlantic sturgeon in spawning condition (i.e., expressing milt) in July 1994 below the (former) Edwards Dam; (2) the capture of 31 adult Atlantic sturgeon from June 15 through July 26, 1980, in a small commercial fishery directed at Atlantic sturgeon from the South Gardiner area (above Merrymeeting Bay) that included at least four ripe males and one ripe female captured on July 26, 1980; and, (3) the capture of nine adults during a gillnet survey conducted from 1977-1981, the majority of which were captured in July in the area from Merrymeeting Bay and upriver as far as Gardiner, Maine (ASSRT 1998; ASMFC TC 2007). The low salinity values for waters above Merrymeeting Bay

are consistent with values found in other rivers where successful Atlantic sturgeon spawning is known to occur.

Age to maturity for GOM DPS Atlantic sturgeon is unknown. However, Atlantic sturgeon riverine populations exhibit clinal variation with faster growth and earlier age to maturity for those that originate from southern waters, and slower growth and later age to maturity for those that originate from northern waters (75 FR 61872; October 6, 2010). Age at maturity is 11 to 21 years for Atlantic sturgeon originating from the Hudson River (Young *et al.* 1998), and 22 to 34 years for Atlantic sturgeon that originate from the Saint Lawrence River (Scott and Crossman 1973). Therefore, age at maturity for Atlantic sturgeon of the GOM DPS likely falls within these values. Of the 18 sturgeon examined from the commercial fishery that occurred in the Kennebec River in 1980, all of which were considered mature, age estimates for the 15 males ranged from 17-40 years, and from 25-40 years old for the three females (Squiers *et al.* 1981).

Several threats play a role in shaping the current status of GOM DPS Atlantic sturgeon. Historical records provide evidence of commercial fisheries for Atlantic sturgeon in the Kennebec and Androscoggin Rivers dating back to the 17<sup>th</sup> century (Squiers *et al.* 1979). In 1849, 160 tons of sturgeon was caught in the Kennebec River by local fishermen (Squiers *et al.* 1979). After the collapse of sturgeon stock in the 1880s, the sturgeon fishery was almost non-existent. All directed Atlantic sturgeon fishing as well as retention of Atlantic sturgeon bycatch has been prohibited since 1998. Nevertheless, mortalities associated with bycatch in fisheries in state and Federal waters still occurs. In the marine range, GOM DPS Atlantic sturgeon are incidentally captured in Federal and state-managed fisheries, reducing survivorship of subadult and adult Atlantic sturgeon (Stein *et al.* 2004b; ASMFC TC 2007). As explained above, we have estimates of the number of subadults and adults that are killed as a result of bycatch in fisheries authorized under Northeast FMPs. At this time, we are not able to quantify the impacts from other threats or estimate the number of individuals killed as a result of other anthropogenic threats. Habitat disturbance and direct mortality from anthropogenic sources are the primary concerns.

Riverine habitat may be impacted by dredging and other in-water activities, disturbing spawning habitat and also altering the benthic forage base. Many rivers in the GOM DPS have navigation channels that are maintained by dredging. Dredging outside of Federal channels and in-water construction occurs throughout the GOM DPS. While some dredging projects operate with observers present to document fish mortalities, many do not. To date we have not received any reports of Atlantic sturgeon killed during dredging projects in the Gulf of Maine region. At this time, we do not have any information to quantify the number of Atlantic sturgeon killed or disturbed during dredging or in-water construction projects are also not able to quantify any effects to habitat.

Connectivity is disrupted by the presence of dams on several rivers in the Gulf of Maine region, including the Penobscot and Merrimack Rivers. While there are also dams on the Kennebec, Androscoggin, and Saco Rivers, these dams are near the site of historical natural falls and likely represent the maximum upstream extent of sturgeon occurrence even if the dams were not present. Because no Atlantic sturgeon occur upstream of any hydroelectric projects in the Gulf of Maine region, passage over hydroelectric dams or through hydroelectric turbines is not a

source of injury or mortality in this area. The extent that Atlantic sturgeon are affected by operations of dams in the Gulf of Maine region is currently unknown; however, the documentation of an Atlantic sturgeon larvae downstream of the Brunswick Dam in the Androscoggin River suggests that Atlantic sturgeon spawning may be occurring in the vicinity of at least that project and therefore, may be affected by project operations. The range of Atlantic sturgeon in the Penobscot River is limited by the presence of the Milford Dam, at the base of which is the presumed historical spawning habitat. Atlantic sturgeon are known to occur in the Penobscot River, but it is unknown if spawning is currently occurring in this river. The Essex Dam on the Merrimack River blocks access to approximately 58% of historically accessible habitat in this river. Atlantic sturgeon occur in the Merrimack River but spawning has not been documented. As with the Penobscot, it is unknown how the Essex Dam affects the likelihood of spawning in this river.

GOM DPS Atlantic sturgeon may also be affected by degraded water quality. In general, water quality has improved in the Gulf of Maine over the past decades (Lichter *et al.* 2006; EPA 2008). Many rivers in Maine, including the Androscoggin River, were heavily polluted in the past from pulp and paper mill industrial discharges. While water quality has improved and most discharges are limited through regulations, many pollutants persist in the benthic environment. This can be particularly problematic if pollutants are present on spawning and nursery grounds, as developing eggs and larvae are particularly susceptible to exposure to contaminants.

There are no direct in-river abundance estimates for the GOM DPS. The Atlantic Sturgeon Status Review Team (ASSRT 2007) presumed that the GOM DPS was comprised of less than 300 spawning adults per year, based on extrapolated abundance estimates from the Hudson and Altamaha riverine populations of Atlantic sturgeon. Surveys of the Kennebec River over two time periods, 1977-1981 and 1998-2000, resulted in the capture of nine adult Atlantic sturgeon (Squiers 2004). However, since the surveys were primarily directed at capture of shortnose sturgeon, the capture gear used may not have been selective for the larger-sized, adult Atlantic sturgeon; several hundred subadult Atlantic sturgeon were caught in the Kennebec River during these studies. As described earlier in Section 4.2.2, we have estimated that there are a minimum of 7,455 GOM DPS adult and subadult Atlantic sturgeon of size vulnerable to capture in U.S. Atlantic waters. We note further that this estimate is predicated on the assumption that fish in the GOM DPS would be available for capture in the NEAMAP surveys which extend from Block Island Sound, Rhode Island southward. Recoveries of tagged sturgeon do not support this migration pattern.

#### *Summary of the Gulf of Maine DPS*

Spawning for the GOM DPS is known to occur in two rivers (Kennebec and Androscoggin). Spawning may be occurring in other rivers, such as the Sheepscot, Merrimack, and Penobscot, but has not been confirmed. There are indications of potential increasing abundance of Atlantic sturgeon belonging to the GOM DPS. Atlantic sturgeon continue to be present in the Kennebec River; in addition, they are captured in directed research projects in the Penobscot River, and are observed in rivers where they were unknown to occur or had not been observed to occur for many years (e.g., Saco, Presumpscot, and Charles Rivers). These observations suggest that abundance of the GOM DPS of Atlantic sturgeon is sufficient such that recolonization to rivers historically suitable for spawning may be occurring. However, despite some positive signs, there

is not enough information to establish a trend for this DPS.

Some of the impacts from the threats that contributed to the decline of the GOM DPS have been removed (e.g., directed fishing), or reduced as a result of improvements in water quality and removal of dams (e.g., the Edwards Dam on the Kennebec River in 1999 and the Veazie Dam on the Penobscot River in 2013). In Maine state waters, there are strict regulations on the use of fishing gear that incidentally catches sturgeon. In addition, in the last several years there have been reductions in fishing effort in state and Federal waters, which most likely would result in a reduction in bycatch mortality of Atlantic sturgeon. A significant amount of fishing in the Gulf of Maine is conducted using trawl gear, which is known to have a much lower mortality rate for Atlantic sturgeon caught in the gear compared to sink gillnet gear (ASMFC TC 2007). Atlantic sturgeon from the GOM DPS are not commonly taken as bycatch in areas south of Chatham, Massachusetts, with only 8% (e.g., 7 of 84 fish) of interactions observed south of Chatham being assigned to the GOM DPS (Wirgin and King 2011). Tagging results also indicate that GOM DPS fish tend to remain within the waters of the Gulf of Maine and only occasionally venture to points south.

Data on Atlantic sturgeon incidentally caught in trawls and intertidal fish weirs fished in the Minas Basin area of the Bay of Fundy (Canada) indicate that approximately 35% originated from the GOM DPS (Wirgin *et al.* 2012). Thus, a significant number of the GOM DPS fish appear to migrate north into Canadian waters where they may be subjected to a variety of threats including bycatch.

As noted previously, studies have shown that in order to rebuild, Atlantic sturgeon can only sustain low levels of bycatch and other anthropogenic mortality (Boreman 1997; ASMFC TC 2007; Kahnle *et al.* 2007; Brown and Murphy 2010). We have determined that the GOM DPS is at risk of becoming endangered in the foreseeable future throughout all of its range (i.e., is a threatened species) based on the following: (1) significant declines in population sizes and the protracted period during which sturgeon populations have been depressed; (2) the limited amount of current spawning; and, (3) the impacts and threats that have and will continue to affect recovery.

#### *4.2.2.2 New York Bight DPS of Atlantic sturgeon*

The NYB DPS includes the following: all anadromous Atlantic sturgeon that spawn or are spawned 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 (Murawski and Pacheco, 1977; Secor, 2002; ASSRT, 2007). Spawning still occurs in the Delaware and Hudson Rivers, but there is no recent evidence of spawning in the Taunton Rivers (ASSRT, 2007); several age-0 Atlantic sturgeon were captured in the Connecticut in June 2014, suggesting that occasional successful spawning may occur in the Connecticut River (Savoy *et al.* 2017). Atlantic sturgeon that are spawned elsewhere continue to use habitats within the Connecticut and Taunton Rivers as part of their overall marine range (ASSRT 2007; Savoy 2007; Wirgin and King 2011).

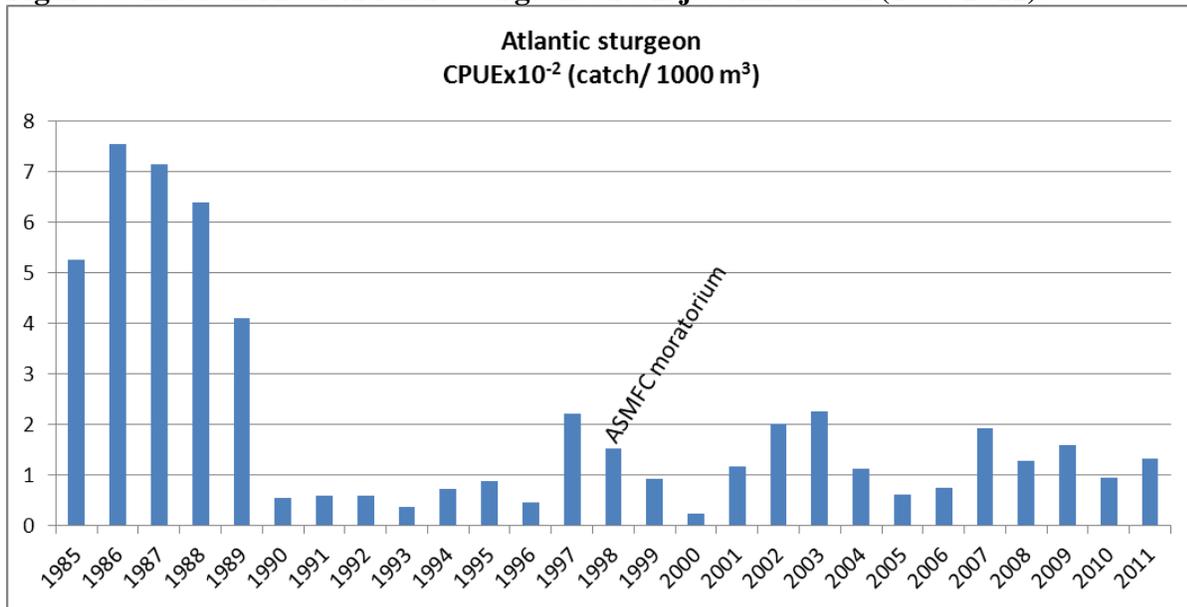
The abundance of the Hudson River Atlantic sturgeon riverine population before the over-exploitation of the 1800s is unknown, but has been conservatively estimated at 6,000 adult

females (Secor 2002). Current abundance is likely at least one order of magnitude smaller than historical levels (Secor 2002; ASSRT 2007; Kahnle *et al.* 2007). As described above, an estimate of the mean annual number of mature adults (863 total; 596 males and 267 females) was calculated for the Hudson riverine population based on fishery-dependent data collected from 1985-1995 (Kahnle *et al.* 2007). Kahnle *et al.* (1998, 2007) 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 (Kahnle *et al.* 1998; Sweka *et al.* 2007; ASMFC 2010). Catch-per-unit-effort (CPUE) data suggests that recruitment has remained depressed relative to catches of juvenile Atlantic sturgeon in the estuary during the mid-late 1980s (Sweka *et al.* 2007; ASMFC 2010). The CPUE data from 1985-2011 show significant fluctuations. There appears to be a decline in the number of juveniles between the late 1980s and early 1990s and then a slight increase in the 2000s, but, given the significant annual fluctuation, it is difficult to discern any trend. Despite the CPUEs from 2000-2011 being slightly higher than those from 1990-1999, they are low compared to the late 1980s (Figure 3). There is currently not enough information regarding any life stage to establish a trend for the Hudson River population.

There is no overall, empirical 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 and Waldman 1999; Secor 2002). Sampling in 2009 to target YOY Atlantic sturgeon in the Delaware River (i.e., natal sturgeon) resulted in the capture of 34 YOY, ranging in size from 178 to 349 millimeters TL (Fisher 2009), and the collection of 32 YOY Atlantic sturgeon in a separate study (Brundage and O'Herron 2009 in Calvo *et al.* 2010). Genetics information collected from 33 of these YOY indicates that at least three females successfully contributed to the 2009 year class (Fisher 2011). Therefore, while the capture of YOY in 2009 provides evidence that successful spawning still occurs in the Delaware River, the relatively low numbers suggest the existing riverine population is small.

Several threats play a role in shaping the current status and trends observed in the Delaware River and Estuary. In-river threats include habitat disturbance from dredging, and impacts from historical pollution and impaired water quality. A dredged navigation channel extends from Trenton seaward through the tidal river (Brundage and O'Herron 2009), and the river receives significant shipping traffic. Vessel strikes have been identified as a threat in the Delaware River and may be detrimental to the long-term viability of the NYB DPS, as well as other DPSs (Brown and Murphy 2010).

**Figure 3. Hudson River Atlantic sturgeon CPUE juvenile index (1985-2011).**



*Summary of the New York Bight DPS*

Atlantic sturgeon originating from the NYB DPS have been documented to spawn in the Hudson and Delaware Rivers and may spawn in the Connecticut and Housatonic Rivers, although that has not been confirmed. While genetic testing can differentiate between individuals originating from the Hudson or Delaware River, the available information suggests that the straying rate is relatively high between these rivers. Some of the impact from the threats that contributed to the decline of the NYB DPS have been removed (e.g., directed fishing) or reduced as a result of improvements in water quality since passage of the Clean Water Act (CWA). In addition, there have been reductions in fishing effort in state and Federal waters, which may result in a reduction in bycatch mortality of Atlantic sturgeon. Nevertheless, areas with persistent, degraded water quality, habitat impacts from dredging, continued bycatch in state and federally-managed fisheries, and vessel strikes remain significant threats to the NYB DPS.

In its marine range, NYB DPS Atlantic sturgeon are incidentally captured in Federal and state-managed fisheries, reducing survivorship of subadult and adult Atlantic sturgeon (Stein *et al.* 2004a; ASMFC TC 2007). Based on mixed stock analysis results presented by Wirgin and King (2011), more than 40% of the Atlantic sturgeon bycatch interactions in the Mid-Atlantic Bight region were sturgeon from the NYB DPS. Individual-based assignment and mixed stock analysis of samples collected from sturgeon captured in Canadian fisheries in the Bay of Fundy indicated that approximately 1%-2% were from the NYB DPS (Wirgin *et al.* 2012). At this time, we are not able to quantify the impacts from threats other than fisheries or estimate the number of individuals killed as a result of other anthropogenic threats.

Riverine habitat may be impacted by dredging and other in-water activities, disturbing spawning habitat and also altering the benthic forage base. 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. Dredging outside of Federal channels and in-water construction occurs throughout the New York Bight region. While some dredging projects

operate with observers present to document fish mortalities, many do not. We have reports of one Atlantic sturgeon entrained during hopper dredging operations in Ambrose Channel, New Jersey, and four entrained during hopper dredging operations aboard the McFarland in the Delaware River. We have recently consulted on two Army Corps of Engineers (ACOE) dredging projects: (1) the Deepening and Maintenance of the Delaware River Federal Navigation Channel and (2) the New York and New Jersey Harbor Deepening Project. In both cases, we determined that while the proposed actions may adversely affect Atlantic sturgeon, they were not likely to jeopardize the continued existence of any DPS of Atlantic sturgeon.

In the Hudson and Delaware Rivers, dams do not block access to historical habitat. The Holyoke Dam on the Connecticut River blocks passage past the dam at Holyoke; however, the extent that Atlantic sturgeon would historically have used habitat upstream of Holyoke is unknown. The first dam on the Taunton River may block access to historical spawning habitat. Connectivity also may be disrupted by the presence of dams on several smaller rivers in the New York Bight region. Because no Atlantic sturgeon occur upstream of any hydroelectric projects in the New York Bight region, passage over hydroelectric dams or through hydroelectric turbines is not a source of injury or mortality in this area. The extent to which Atlantic sturgeon are affected by operations of dams in the New York Bight region is currently unknown. Atlantic sturgeon may also be impinged or entrained at power plants in the Hudson and Delaware Rivers, and may be adversely affected by the operation of the power plants, but the power plants have not been found to jeopardize their continued existence.

NYB DPS Atlantic sturgeon may also be affected by degraded water quality. Rivers in the New York Bight region, including the Hudson and Delaware, have been heavily polluted by industrial and sewer discharges. In general, water quality has improved in the Hudson and Delaware over the past several decades (Lichter *et al.* 2006; EPA 2008). While water quality has improved and most discharges are limited through regulations, it is likely that pollutants persist in the benthic environment. This can be particularly problematic if pollutants are present on spawning and nursery grounds, where developing eggs and larvae are particularly susceptible to exposure to contaminants.

Vessel strikes are known to occur in the Delaware River and may also be occurring in the Hudson and other New York Bight rivers. Twenty-nine mortalities believed to be the result of vessel strikes were documented in the Delaware River from 2004-2008, and at least 13 of these fish were large adults. Additionally, 138 sturgeon carcasses were observed on the Hudson River and reported to the NYSDEC between 2007 and 2015. Of these, 69 are suspected of having been killed by vessel strike. Genetic analysis has not been completed on any of these individuals to date, given that the majority of Atlantic sturgeon in the Hudson River belong to the New York Bight DPS, we assume that the majority of the dead sturgeon reported to NYSDEC belonged to the New York Bight DPS. Given the time of year in which the fish were observed (predominantly May through July, with two in August), it is likely that many of the adults were migrating through the river to the spawning grounds. Because we do not know the percent of total vessel strikes that the observed mortalities represent, we are not able to quantify the number of individuals likely killed as a result of vessel strikes in the NYB DPS.

Studies have shown that to rebuild, Atlantic sturgeon can only sustain low levels of anthropogenic mortality (Boreman 1997; ASMFC TC 2007; Kahnle *et al.* 2007; Brown and Murphy 2010). There are no empirical abundance estimates of the number of Atlantic sturgeon in the NYB DPS. As described in Section 4.2.2, we have estimated that there are a minimum of 34,566 NYB DPS adult and subadult Atlantic sturgeon of size vulnerable to capture in U.S. Atlantic waters. We have determined that the NYB DPS is currently at risk of extinction due to: (1) precipitous declines in population sizes and the protracted period in which sturgeon populations have been depressed; (2) the limited amount of current spawning; and (3) the impacts and threats that have and will continue to affect population recovery.

#### 4.2.2.3 Chesapeake Bay DPS of Atlantic sturgeon

The CB DPS includes the following: all anadromous Atlantic sturgeon that spawn or 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. The marine range of Atlantic sturgeon from the CB DPS extends from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine range of the CB DPS and the adjacent portion of the marine range are shown in Figure 2. Within this range, Atlantic sturgeon historically spawned in the Susquehanna, Potomac, James, York, Rappahannock, and Nottoway Rivers (ASSRT 2007). Based on the review by Oakley (2003), 100% of Atlantic sturgeon habitat is currently accessible in these rivers since most of the barriers to passage (i.e., dams) are located upriver of where spawning is expected to have historically occurred (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, specifically within the Pamunkey River (a tributary of the York River) (Musick *et al.* 1994; ASSRT 2007; Greene *et al.* 2009). The recent capture of an adult sturgeon in spawning condition suggests that spawning may occur in Marshyhope Creek, a tributary to the Nanticoke River (Bruce *et al.* 2016). However, conclusive evidence of current spawning is only available for the James River, where a study found evidence of Atlantic sturgeon spawning in the fall (Balazik *et al.* 2012). Atlantic sturgeon that are spawned elsewhere are known to use the Chesapeake Bay (Vladykov and Greeley 1963; Wirgin *et al.* 2000; ASSRT 2007; Grunwald *et al.* 2008).

Age to maturity for CB DPS Atlantic sturgeon is unknown. However, Atlantic sturgeon riverine populations exhibit clinal variation with faster growth and earlier age to maturity for those that originate from southern waters, and slower growth and later age to maturity for those that originate from northern waters (75 FR 61872; October 6, 2010). Age at maturity is five to 19 years for Atlantic sturgeon originating from South Carolina rivers (Smith *et al.* 1982) and 11 to 21 years for Atlantic sturgeon originating from the Hudson River (Young *et al.* 1998). Therefore, age at maturity for Atlantic sturgeon of the CB DPS likely falls within these values.

Several threats play a role in shaping the current status of CB DPS Atlantic sturgeon. Historical records provide evidence of the large-scale commercial exploitation of Atlantic sturgeon from the James River and Chesapeake Bay in the 19<sup>th</sup> century (Hildebrand and Schroeder 1928; Vladykov and Greeley 1963; ASMFC 1998b; Secor 2002; Bushnoe *et al.* 2005; ASSRT 2007) as well as subsistence fishing and attempts at commercial fisheries as early as the 17<sup>th</sup> century (Secor 2002; Bushnoe *et al.* 2005; ASSRT 2007; Balazik *et al.* 2010). Habitat disturbance caused by in-river work, such as dredging for navigational purposes, is thought to have reduced

available spawning habitat in the James River (Holton and Walsh 1995; Bushnoe *et al.* 2005; ASSRT 2007). At this time, we do not have information to quantify this loss of spawning habitat.

Decreased water quality also threatens Atlantic sturgeon of the CB 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 (Pyzik *et al.* 2004; ASMFC 1998a; ASSRT 2007; EPA 2008). These conditions contribute to reductions in dissolved oxygen levels throughout the Bay. The availability of nursery habitat, in particular, may be limited given the recurrent hypoxia (low dissolved oxygen) conditions within the Bay (Niklitschek and Secor 2005, 2010). Heavy industrial development during the 20<sup>th</sup> century in rivers inhabited by sturgeon impaired water quality and impeded these species' recovery.

Although there have been improvements in the some areas of the Bay's health, the ecosystem remains in poor condition. The EPA gave the overall health of the Bay a grade of 45% based on goals for water quality, habitats, lower food web productivity, and fish and shellfish abundance (EPA CBP 2010). This was a 6% increase from 2008. According to the EPA, the modest gain in the health score was due to a large increase in the adult blue crab population, expansion of underwater grass beds growing in the Bay's shallows, and improvements in water clarity and bottom habitat health as highlighted below:

- 12% of the Bay and its tidal tributaries met CWA standards for dissolved oxygen between 2007 and 2009, a decrease of 5% from 2006 to 2008,
- 26% of the tidal waters met or exceeded guidelines for water clarity, a 12% increase from 2008,
- Underwater bay grasses covered 9,039 more acres of the Bay's shallow waters for a total of 85,899 acres, 46% of the Bay-wide goal,
- The health of the Bay's bottom dwelling species reached a record high of 56% of the goal, improving by approximately 15% Bay-wide, and
- The adult blue crab population increased to 223 million, its highest level since 1993.

At this time, we do not have sufficient information to quantify the extent that degraded water quality effects habitat or individuals in the James River or throughout the Chesapeake Bay.

Vessel strikes have been observed in the James River (ASSRT 2007). Eleven Atlantic sturgeon were reported to have been struck by vessels from 2005-2007. Several of these were mature individuals. Because we do not know the percent of total vessel strikes that the observed mortalities represent, we are not able to quantify the number of individuals likely killed as a result of vessel strikes in the CB DPS.

In the marine and coastal range of the CB DPS from Canada to Florida, fisheries bycatch in federally and state-managed fisheries poses a threat to the DPS, reducing survivorship of subadults and adults and potentially causing an overall reduction in the spawning population (Stein *et al.* 2004b; ASMFC TC 2007; ASSRT 2007).

### *Summary of the Chesapeake Bay DPS*

Known spawning for the CB DPS occurs only in the James and Pamunkey Rivers (a tributary of the York River). Spawning may be occurring in other rivers, such as the mainstem York, Rappahannock, Potomac, Nanticoke, and Susquehanna, but has not been confirmed for any of those. There are anecdotal reports of increased sightings and captures of Atlantic sturgeon in the James River. However, this information has not been comprehensive enough to develop a population estimate for the James River or to provide sufficient evidence to confirm increased abundance. Some of the impact from the threats that facilitated the decline of the CB DPS have been removed (e.g., directed fishing) or reduced as a result of improvements in water quality since passage of the CWA. As described in Section 4.2.2, we have estimated that there are a minimum of 8,811 CB DPS adult and subadult Atlantic sturgeon of size vulnerable to capture in U.S. Atlantic waters.

Areas with persistent, degraded water quality, habitat impacts from dredging, continued bycatch in U.S. state and federally-managed fisheries, Canadian fisheries, and vessel strikes remain significant threats to the CB DPS of Atlantic sturgeon. Of the 35% of Atlantic sturgeon incidentally caught in the Bay of Fundy, about 1% were CB DPS fish (Wirgin *et al.* 2012). Studies have shown that Atlantic sturgeon can only sustain low levels of bycatch mortality (Boreman 1997; ASMFC TC 2007; Kahnle *et al.* 2007). The CB DPS is currently at risk of extinction given (1) precipitous declines in population sizes and the protracted period in which sturgeon populations have been depressed; (2) the limited amount of current spawning; and, (3) the impacts and threats that have and will continue to affect the potential for population recovery.

#### *4.2.2.4 Carolina DPS of Atlantic sturgeon*

The Carolina DPS includes all Atlantic sturgeon that spawn or are spawned in the watersheds (including all rivers and tributaries) from Albemarle Sound southward along the southern Virginia, North Carolina, and South Carolina coastal areas to Charleston Harbor. The marine range of Atlantic sturgeon from the Carolina DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine range of the Carolina DPS and the adjacent portion of the marine range are shown in Figure 2. Sturgeon are commonly captured 40 miles offshore (Dewayne Fox, Delaware State University, pers. comm.). Records providing fishery bycatch data by depth show the vast majority of Atlantic sturgeon bycatch via gillnets is observed in waters less than 50 meters deep (Stein *et al.* 2004b, ASMFC TC 2007), but Atlantic sturgeon are recorded as bycatch out to 500 fathoms.

Rivers known to have current spawning populations within the range of the Carolina DPS include the Roanoke, Tar-Pamlico, Cape Fear, Waccamaw, and Pee Dee Rivers. We determined spawning was occurring if YOY were observed or mature adults were present in freshwater portions of a system (Table 10). 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. There may also be spawning populations in the Neuse, Santee, and Cooper Rivers, though it is uncertain. Historically, both the Sampit and Ashley Rivers were documented to have spawning populations at one time. However, 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. 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. Prior reductions from the commercial fishery and ongoing threats have drastically reduced the numbers of Atlantic sturgeon within the Carolina DPS. Currently, the Atlantic sturgeon spawning population in at least one river system within the Carolina DPS has been extirpated, with potential extirpation in an additional system. 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). As described in Section 4.2.2, we have estimated that there are a minimum of 1,356 Carolina DPS adult and subadult Atlantic sturgeon of size vulnerable to capture in U.S. Atlantic waters.

**Table 10. Major rivers, tributaries, and sounds within the range of the Carolina DPS and currently available data on the presence of an Atlantic sturgeon spawning population in each system.**

River/Estuary	Spawning Population	Data
Roanoke River, VA/NC; Albemarle Sound, NC	Yes	collection of 15 YOY (1997-1998); single YOY (2005)
Tar-Pamlico River, NC; Pamlico Sound	Yes	one YOY (2005)
Neuse River, NC; Pamlico Sound	Unknown	
Cape Fear River, NC	Yes	upstream migration of adults in the fall, carcass of a ripe female upstream in mid-September (2006)
Waccamaw River, SC; Winyah Bay	Yes	age-1, potentially YOY (1980s)
Pee Dee River, SC; Winyah Bay	Yes	running ripe male in Great Pee Dee River (2003)
Sampit, SC; Winyah Bay	Extirpated	
Santee River, SC	Unknown	
Cooper River, SC	Unknown	
Ashley River, SC	Unknown	

*Threats*

The Carolina DPS was listed as endangered under the ESA as a result of a combination of habitat curtailment and modification, overutilization (i.e., being taken as bycatch) in commercial fisheries, and the inadequacy of regulatory mechanisms in ameliorating these impacts and threats.

The modification and curtailment of Atlantic sturgeon habitat resulting from dams, dredging, and degraded water quality is contributing to the status of the Carolina DPS. Dams have curtailed Atlantic sturgeon spawning and juvenile developmental habitat by blocking more than 60% of the historical sturgeon habitat upstream of the dams in the Cape Fear and Santee-Cooper River systems. Water quality (velocity, temperature, and dissolved oxygen) downstream of these dams, as well as on the Roanoke River, has been reduced, which modifies and curtails the extent of spawning and nursery habitat for the Carolina DPS. Dredging in spawning and nursery grounds modifies the quality of the habitat and is further curtailing the extent of available habitat in the Cape Fear and Cooper Rivers, where Atlantic sturgeon habitat has already been modified and curtailed by the presence of dams. Reductions in water quality from terrestrial activities have modified habitat used by the Carolina DPS. In the Pamlico and Neuse systems, nutrient-loading and seasonal anoxia are occurring, associated in part with concentrated animal feeding operations (CAFOs). Heavy industrial development and CAFOs have also degraded water quality in the Cape Fear River. Water quality in the Waccamaw and Pee Dee Rivers has been affected by industrialization and riverine sediment samples contain high levels of various toxins, including dioxins. Additional stressors arising from water allocation and climate change threaten to exacerbate water quality problems that are already present throughout the range of the Carolina DPS. Twenty 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 Environmental and Natural Resources and other resource agencies. Since the 1993 legislation requiring certificates for transfers took effect, 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 the system will alter flows, temperature, and dissolved oxygen. Existing water allocation issues will likely be compounded by population growth and potentially climate change. Climate change is also predicted to elevate water temperatures and exacerbate nutrient-loading, pollution inputs, and lower dissolved oxygen, all of which are current stressors to the Carolina DPS.

Overutilization of Atlantic sturgeon from directed fishing caused initial severe declines in Atlantic sturgeon populations in the Southeast in the mid- to late 19<sup>th</sup> century, from which they have never rebounded. Continued bycatch of Atlantic sturgeon in commercial fisheries is an ongoing impact to the Carolina DPS. More robust fishery independent data on bycatch are available for the Northeast and Mid-Atlantic than in the Southeast where high levels of bycatch underreporting are suspected.

Although there are statutory and regulatory regulations that authorize reducing the impact of dams on riverine and anadromous species, these mechanisms have proven inadequate for preventing dams from blocking access to habitat upstream and degrading habitat downstream. Water quality continues to be a problem in the Carolina DPS, even with existing controls on some pollution sources. Current regulatory regimes are not effective in controlling water allocation issues (e.g., no restrictions on interbasin water transfers in South Carolina, the lack of ability to regulate non-point source pollution, etc.).

The recovery of Atlantic sturgeon along the Atlantic Coast, especially in areas where habitat is limited and water quality is severely degraded, will require improvements in the following areas: (1) elimination of barriers to spawning habitat either through dam removal, breaching, or

installation of successful fish passage facilities; (2) operation of water control structures to provide appropriate flows, especially during spawning season; (3) imposition of dredging restrictions including seasonal moratoriums and avoidance of spawning/nursery habitat; and (4) mitigation of water quality parameters that are restricting sturgeon use of a river (i.e., dissolved oxygen). Additional data regarding sturgeon use of riverine and estuarine environments are needed.

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 Carolina DPS put them in danger of extinction throughout their range; none of the populations are large or stable enough to provide with any level of certainty for the continued existence of Atlantic sturgeon in this part of its range. Although the largest impact that caused the precipitous decline of the species has been curtailed (directed fishing), the population sizes within the Carolina DPS have remained relatively constant at greatly reduced levels (approximately 3% of historical population sizes) for 100 years. Small numbers of individuals resulting from drastic reductions in populations, such as that which occurred due to the commercial fishery, can remove the buffer against natural demographic and environmental variability provided by large populations (Berry 1971; Soulé 1980; Shaffer 1981). Recovery of depleted populations is an inherently slow process for 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 also allows multiple opportunities to contribute to future generations, it also increases the timeframe over which exposure to the multitude of threats facing the Carolina DPS can occur. The viability of the Carolina DPS 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.

#### *Summary of the Status of the Carolina DPS of Atlantic Sturgeon*

Recovery of depleted populations is an inherently slow process for a late-maturing species such as Atlantic sturgeon. Their late age at maturity provides more opportunities for individuals to be removed from the population before reproducing. While a long life-span also allows multiple opportunities to contribute to future generations, this is hampered within the Carolina DPS by habitat alteration and bycatch. This DPS was severely depleted by past directed commercial fishing, and faces ongoing impacts and threats from habitat alteration or inaccessibility, bycatch, and the inadequacy of existing regulatory mechanisms to address and reduce habitat alterations and bycatch that have prevented river populations from rebounding and will prevent their recovery.

The presence of dams has resulted in the loss of more than 60% of the historical sturgeon habitat on the Cape Fear River and in the Santee-Cooper system. Dams are contributing to the status of the Carolina DPS by curtailing the extent of available spawning habitat and further modifying the remaining habitat downstream by affecting water quality parameters (such as depth, temperature, velocity, and dissolved oxygen) that are important to sturgeon. Dredging is also contributing to the status of the Carolina DPS by modifying Atlantic sturgeon spawning and nursery habitat. Habitat modifications through reductions in water quality are contributing to the status of the Carolina DPS due to nutrient-loading, seasonal anoxia, and contaminated sediments.

Interbasin water transfers and climate change threaten to exacerbate existing water quality issues. Bycatch is also a current threat to the Carolina DPS that is contributing to its status. 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 use multiple river systems for nursery and foraging habitat in addition to their natal spawning river, they are subject to being caught in multiple fisheries throughout their range. In addition to direct mortality, 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). This may result in either reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality. While many of the threats to the Carolina DPS have been ameliorated or reduced due to existing regulatory mechanisms, such as the moratorium on directed fisheries for Atlantic sturgeon, bycatch and habitat alterations are currently not being addressed through existing mechanisms. Further, despite NMFS's authority under the Federal Power Act to prescribe fish passage and existing controls on some pollution sources, access to habitat and improved water quality continues to be a problem. The inadequacy of regulatory mechanisms to control bycatch and habitat alterations is contributing to the status of the Carolina DPS.

#### *4.2.2.5 South Atlantic DPS of Atlantic sturgeon*

The SA DPS includes all Atlantic sturgeon that spawn or are spawned in the watersheds (including all rivers and tributaries) of the Ashepoo, Combahee, and Edisto Rivers (ACE) Basin southward along the South Carolina, Georgia, and Florida coastal areas to the St. Johns River, Florida. The marine range of Atlantic sturgeon from the SA DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine range of the SA DPS and the adjacent portion of the marine range are shown in Figure 2. Sturgeon are commonly captured 40 miles offshore (Dwayne Fox, Delaware State University, pers. comm.). Records providing fishery bycatch data by depth show the vast majority of Atlantic sturgeon bycatch via gillnets is observed in waters less than 50 meters deep (Stein *et al.* 2004b, ASMFC TC 2007), but Atlantic sturgeon are recorded as bycatch out to 500 fathoms (900 meters).

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 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, the Broad-Coosawatchie was documented to have spawning populations; there is also evidence that spawning may have occurred in the St. Johns River or one of its tributaries. However, the historical spawning population present in the St. Johns is believed to be extirpated, and the status of the spawning population in the Broad-Coosawatchie is unknown. The St. Johns River is 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; however, fish from the SA DPS likely use other river systems than those listed here for their specific life functions.

Secor (2002) estimates that 8,000 adult females were present in South Carolina before the 1890. 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 the state prior to 1890. Reductions from the commercial fishery and ongoing threats have drastically reduced the numbers of Atlantic sturgeon within the South Atlantic DPS. Currently, the Atlantic sturgeon spawning population in at least two river systems within the South Atlantic DPS has been extirpated. The Altamaha River population of Atlantic sturgeon, with an estimated 343 adults spawning annually, is believed to be the largest population in the Southeast, yet is estimated to be only 6 percent of its historical population size. The ASSRT estimated the abundances of the remaining river populations within the DPS, each estimated to have fewer than 300 spawning adults, to be less than 1 percent of what they were historically (ASSRT 2007).

### *Threats*

The SA DPS was listed as endangered under the ESA as a result of a combination of habitat curtailment and modification, overuse (i.e., being taken as bycatch) in commercial fisheries, and the inadequacy of regulatory mechanisms in ameliorating these impacts and threats.

The modification and curtailment of Atlantic sturgeon habitat resulting from dredging and degraded water quality is contributing to the status of the SA DPS. Dredging is a present threat to the SA DPS and is contributing to its status by modifying the quality and availability of Atlantic sturgeon habitat. Maintenance dredging is currently modifying Atlantic sturgeon nursery habitat in the Savannah River and modeling indicates that the proposed deepening of the navigation channel will result in reduced dissolved oxygen and upriver movement of the salt wedge, curtailing spawning habitat. Dredging is also modifying nursery and foraging habitat in the St. Johns Rivers. Reductions in water quality from terrestrial activities have modified habitat used by the SA DPS. Low dissolved oxygen is modifying sturgeon habitat in the Savannah due to dredging, and non-point source inputs are causing low dissolved oxygen in the Ogeechee River and in the St. Marys River, which completely eliminates juvenile nursery habitat in summer. Low dissolved oxygen has also been observed in the St. Johns River in the summer. Sturgeon are more sensitive to low dissolved oxygen and the negative (metabolic, growth, and feeding) effects caused by it increase when water temperatures are concurrently high, as they are within the range of the SA DPS. Additional stressors arising from water allocation and climate change threaten to exacerbate water quality problems that are already present throughout the range of the SA DPS. Large withdrawals of over 240 million gallons per day mgd of water occur in the Savannah River for power generation and municipal uses. However, permits for users withdrawing less than 100,000 gallons per day (gpd) are not required to get permits, so actual water withdrawals from the Savannah and other rivers within the range of the SA DPS are unknown, but likely much higher. The removal of large amounts of water from the system will alter flows, temperature, and dissolved oxygen. Water shortages and “water wars” are already occurring in the rivers occupied by the SA DPS and will likely be compounded in the future by population growth and, potentially, by climate change. Climate change is also predicted to

elevate water temperatures and exacerbate nutrient-loading, pollution inputs, and lower dissolved oxygen, all of which are current stressors to the SA DPS.

Overutilization of Atlantic sturgeon from directed fishing caused initial severe declines in Atlantic sturgeon populations in the Southeast, from which they have never rebounded. Further, continued overutilization of Atlantic sturgeon as bycatch in commercial fisheries is an ongoing impact to the South Atlantic DPS. The loss of large subadults and adults as a result of bycatch impacts Atlantic sturgeon populations because they are a long-lived species, have an older age at maturity, have lower maximum fecundity values, and a large percentage of egg production occurs later in life. Little data exists on bycatch in the Southeast and high levels of bycatch underreporting are suspected. Further, a total population abundance for the DPS is not available, and it is therefore not possible to calculate the percentage of the DPS subject to bycatch mortality based on the available bycatch mortality rates for individual fisheries. 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.

As a wide-ranging anadromous species, Atlantic sturgeon are subject to numerous Federal (U.S. and Canadian), state and provincial, and inter-jurisdictional laws, regulations, and agency activities. While these mechanisms have addressed impacts to Atlantic sturgeon through directed fisheries, there are currently no mechanisms in place to address the significant risk posed to Atlantic sturgeon from commercial bycatch. Though statutory and regulatory mechanisms exist that authorize reducing the impact of dams on riverine and anadromous species, such as Atlantic sturgeon, and their habitat, these mechanisms have proven inadequate for preventing dams from blocking access to habitat upstream and degrading habitat downstream. Further, water quality continues to be a problem in the South Atlantic DPS, even with existing controls on some pollution sources. Current regulatory regimes are not necessarily effective in controlling water allocation issues (e.g., no permit requirements for water withdrawals under 100,000 gpd in Georgia, no restrictions on interbasin water transfers in South Carolina, the lack of ability to regulate non-point source pollution.)

The recovery of Atlantic sturgeon along the Atlantic coast, especially in areas where habitat is limited and water quality is severely degraded, will require improvements in the following areas: (1) elimination of barriers to spawning habitat either through dam removal, breaching, or installation of successful fish passage facilities; (2) operation of water control structures to provide appropriate flows, especially during spawning season; (3) imposition of dredging restrictions including seasonal moratoriums and avoidance of spawning/nursery habitat; and (4) mitigation of water quality parameters that are restricting sturgeon use of a river (i.e., dissolved oxygen). Additional data regarding sturgeon use of riverine and estuarine environments is needed.

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 South Atlantic DPS put them in danger of extinction throughout their range. None of the populations are large or stable enough to provide with any level of certainty for continued existence of Atlantic sturgeon in this part of its range. Although the largest impact that caused the precipitous decline of the species has been curtailed (directed fishing), the population sizes within the South Atlantic DPS have remained relatively constant at greatly reduced levels for 100 years. 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. While a long life-span also allows multiple opportunities to contribute to future generations, it also increases the timeframe over which exposure to the multitude of threats facing the South Atlantic DPS can occur.

#### *Summary of the Status of the South Atlantic DPS of Atlantic Sturgeon*

The South Atlantic DPS is estimated to number a fraction of its historical abundance. There are an estimated 343 spawning adults per year in the Altamaha and less than 300 spawning adults per year (total of both sexes) in each of the other major river systems occupied by the DPS in which spawning still occurs, whose freshwater range occurs in the watersheds (including all rivers and tributaries) of the ACE Basin southward along the South Carolina, Georgia, and Florida coastal areas to the St. Johns River, Florida. Recovery of depleted populations is an inherently slow process for a late-maturing species such as Atlantic sturgeon. While a long life-span also allows multiple opportunities to contribute to future generations, this is hampered within the SA DPS by habitat alteration, bycatch, and from the inadequacy of existing regulatory mechanisms to address and reduce habitat alterations and bycatch.

Dredging is contributing to the status of the SA DPS by modifying spawning, nursery, and foraging habitat. Habitat modifications through reductions in water quality and dissolved oxygen are also contributing to the status of the SA DPS, particularly during times of high water temperatures, which increase the detrimental effects on Atlantic sturgeon habitat. Interbasin water transfers and climate change threaten to exacerbate existing water quality issues. Bycatch also contributes to the SA DPS's status. 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 use multiple river systems for nursery and foraging habitat in addition to their natal spawning river, they are subject to being caught in multiple fisheries throughout their range. In addition to direct mortality, 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). This may result in reduced ability to perform major life functions, such as foraging and spawning, or even post-capture mortality. While many of the threats to the SA DPS have been ameliorated or reduced due to the existing regulatory mechanisms, such as the moratorium on directed fisheries for Atlantic sturgeon, bycatch and habitat alteration are currently not being addressed through existing mechanisms. Further, access to habitat and good water quality continues to be a problem even with NMFS's authority under the Federal Power Act to prescribe fish passage and

existing controls on some pollution sources. There is a lack of regulation for some large water withdrawals, which threatens sturgeon habitat. Current regulatory regimes do not require a permit for water withdrawals under 100,000 gpd in Georgia and there are no restrictions on interbasin water transfers in South Carolina. Existing water allocation issues will likely be compounded by population growth, drought, and, potentially, climate change. The inadequacy of regulatory mechanisms to control bycatch and habitat alterations is contributing to the status of the SA DPS.

## **5.0 ENVIRONMENTAL BASELINE**

Environmental baselines for biological opinions include the past and present impacts of all state, federal or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR § 402.02). The environmental baseline for this Opinion includes the effects of several activities that may affect the survival and recovery of the listed species in the action area. The activities that shape the environmental baseline in the action area of this consultation generally include: commercial and recreational fisheries, hopper dredging operations, sand mining and beach nourishment activities, commercial shipping and other vessel activities, military operations, scientific research, projects affecting water quality and pollution, global climate change, and recovery activities associated with reducing impacts to listed species.

### **5.1 Federal Actions that have Undergone Section 7 Consultation**

We have undertaken a number of section 7 consultations to address the effects of Federal actions on threatened and endangered species in the action area. Each of those consultations sought to develop ways to reduce the probability of adverse impacts of the action on listed species.

#### ***5.1.1 Authorization of Fisheries through Fishery Management Plans***

We authorize the operation of several nearshore fisheries in the action area under the authority of the Magnuson-Stevens Fishery Conservation Act and through FMPs and their implementing regulations. Commercial and recreational fisheries in the action area employ gear that is known to harass, injure, and/or kill sea turtles and Atlantic sturgeon.

In the Greater Atlantic Region (Maine through Virginia), a formal ESA section 7 consultation has been conducted on the batched Northeast multispecies, monkfish, spiny dogfish, Northeast skate complex, Atlantic bluefish, Atlantic mackerel/squid/butterfish, and summer flounder/scup/black sea bass fisheries, the last three of which may overlap in part with the action area for the proposed action. This consultation considered adverse effects to loggerhead, green, Kemp's ridley, and leatherback sea turtles. In the batched fisheries biological opinion, we concluded that the seven fisheries were likely to adversely affect but were not likely to jeopardize the continued existence of any sea turtle species. The biological opinion included an ITS exempting a certain amount of lethal or non-lethal take resulting from interactions with the fisheries. The ITS is summarized in the table below (Table 11).

**Table 11. Sea turtle incidental take information from the most recent NMFS GARFO Biological Opinion for seven federally managed fisheries, three of which (in bold) overlap with the action area.**

Opinion	Date	Loggerhead	Kemp's ridley	Green	Leatherback
Northeast Multispecies, Monkfish, Spiny Dogfish, <b>Atlantic Bluefish</b> , Northeast Skate Complex, <b>Atlantic Mackerel/Squid/Butterfish</b> , and <b>Summer Flounder/Scup/Black Sea Bass</b> (Batched Fisheries)	December 16, 2013 (ITS amended March 10, 2016)	1,345 (835 lethal) every 5 years in gillnets; 1,020 (335 lethal) every 5 years in bottom trawls; 1 (lethal or non-lethal) annually in pot/trap gear	4 (3 lethal) annually in gillnets; 3 (2 lethal) annually in bottom trawls	4 (3 lethal) annually in gillnets; 3 (2 lethal) annually in bottom trawls	4 (3 lethal) annually in gillnets; 4 (2 lethal) annually in bottom trawls; 4 (lethal or non-lethal) annually in pot/trap gear

Although there are documented incidental takes of sea turtles in these Federal fisheries, the action area for them includes the entire EEZ along the U.S. Atlantic coast from Maine through Florida. The nearshore and coastal waters of Virginia and those inside Chesapeake Bay represent a tiny fraction of the action area assessed and for which interactions of sea turtles are anticipated in the batched fisheries biological opinion. Thus, the amount of incidental take of sea turtles that occurs in Virginia state waters as a result of Federal fisheries is also a tiny fraction of the amount exempted in that biological opinion. Furthermore, very little commercial and recreational fishing effort for those species occurs in Virginia state waters, and even less occurs within Chesapeake Bay. Scup and summer flounder have a larger state waters recreational component, but that effort is often prosecuted offshore and outside of the bay. In the batched fisheries biological opinion, we also concluded that the potential for interactions (i.e., vessel strikes) between sea turtles and fishing vessels was extremely low and similarly that any effects to their prey and/or habitat would be insignificant and discountable.

Atlantic sturgeon originating from each the five listed DPSs are known to be captured and killed in otter trawl, sink gillnet, and hook and line fisheries operating in the action area. At the time of this writing, the batched fisheries biological opinion covers Atlantic sturgeon interactions in the Greater Atlantic Region. As noted in the *Status of the Species* section above, the NEFSC prepared a bycatch estimate for Atlantic sturgeon captured in sink gillnet and otter trawl fisheries operated from Maine through Virginia. This estimate indicates that, based on data from 2006-2010, annually, an average of 3,118 Atlantic sturgeon are captured in these fisheries with 1,569 in sink gillnet and 1,548 in otter trawls. The mortality rate in sink gillnets is estimated at approximately 20% and the mortality rate in otter trawls is estimated at 5%. Based on this estimate, a total of 391 Atlantic sturgeon are estimated to be killed annually in these fisheries that are prosecuted in the Greater Atlantic Region. We are currently in the process of determining the effects of this annual loss to each of the DPSs. Again, nearshore and coastal waters of Virginia and those inside Chesapeake Bay represent a tiny fraction of the action area assessed and for which interactions of Atlantic sturgeon are anticipated in the batched fisheries Opinion. Nonetheless, any Federal fisheries that use sink gillnets, otter trawls, or hook and line gear are likely to interact with Atlantic sturgeon and be an additional, albeit minor, source of

incidental take and mortality in the action area. An updated Atlantic sturgeon bycatch estimate in Northeast sink gillnet and otter trawl fisheries for 2011-2015 was prepared in mid-2016 but is not yet publically available.

### **5.1.2 *Hopper Dredging, Sand Mining, and Beach Nourishment***

The construction and maintenance of Federal navigation channels, sand mining (“borrow”) activities, beach nourishment, and shoreline restoration/stabilization projects have been identified as sources of sea turtle and Atlantic sturgeon incidental take and mortality in the action area. The majority of these projects in the action area are authorized and carried out by the U.S. Army Corps of Engineers (USACE), with a few facility-specific ones overseen by the National Aeronautics and Space Administration (NASA) and U.S. Navy. In the action area, USACE projects are under the jurisdiction of the Norfolk District of the North Atlantic Division. From 1993-2017, hopper dredging projects in the Norfolk District have resulted in the recorded incidental take of 66 loggerheads, six Kemp’s ridleys, one green, and four unidentified hard shell turtles. To date, nearly all of these interactions have occurred in nearshore coastal waters with very few interactions in the open ocean. Few interactions between hopper dredges and Atlantic sturgeon have been reported, with just two records documenting interactions between hopper dredges and Atlantic sturgeon in the action area (in Virginia near the Chesapeake Bay entrance).

We have completed several ESA section 7 consultations with you to consider effects of these dredging, sand mining, and nourishment projects on listed sea turtles and Atlantic sturgeon. Many of these consultations – including this one - are in the process of being reinitiated to consider effects to Atlantic sturgeon critical habitat. In our 2012 biological opinion, over the 50-year period of your maintenance dredging of the Chesapeake Bay entrance channels and use of sand borrow areas for beach nourishment from 2012-2062, we anticipated that up to 937 loggerhead (452 lethal), 275 Kemp’s ridley (48 lethal), and 38 green (11 lethal) sea turtles would be incidentally taken. We also anticipated up to 800 Atlantic sturgeon would be incidentally taken during the same action over the same period.

Recently, the U.S. Navy’s Dam Annex Shoreline Protection System Repairs operations and NASA’s Wallops Island Shoreline Restoration/Infrastructure Protection Program were determined to cause the entrainment of up to one Atlantic sturgeon from any of the five DPSs for approximately every 9.4 million cubic yards of material removed from the borrow areas. This equated to one and two captures, respectively, from any of the five DPSs over the course of the two projects. Three additional biological opinions (two Navy projects and one ACOE project) were also completed in 2012 to assess Atlantic sturgeon interactions in dredging operations in the action area. Table 12 below provides information on biological opinions covering dredging, beach nourishment, and shoreline restoration/stabilization projects in the action area and the associated ITSs for sea turtles (unless otherwise noted, take estimates are per dredge cycle). Takes of sea turtles and Atlantic sturgeon during relocation trawling activities are also included in these consultations. Relocation trawling has been successful at temporarily displacing loggerhead, Kemp’s ridley, leatherback, and green sea turtles from channels and nearshore mining areas in both the Atlantic and Gulf of Mexico during periods when hopper dredging was imminent or ongoing.

**Table 12. Information on NMFS GARFO consultations for dredging, nourishment, and shoreline restoration/stabilization projects that occur in the action area, and their ITSs for sea turtles.**

Project	Date of Opinion	Loggerhead	Kemp's ridley	Green	Leatherback	Notes
U.S. Navy Shoreline Restoration and Protection Project, JEB Little Creek/ Fort Story, VA Beach	7/13/2012	1 loggerhead or Kemp's ridley		0	0	
U.S. Navy Shoreline Protection Sys Repairs, Naval Air Station Oceana, Dam Neck Annex, VA Beach	7/20/2012	1 loggerhead or Kemp's ridley		0	0	
NASA Wallops Isl Shoreline Restoration/ Infrastructure Protection Program	8/3/2012	up to 9	no more than 1	0	0	total takes over 50-year project life
ACOE Dredging of Chesapeake Bay Entrance Channels and Beach Nourishment	10/16/2012	937 non-lethal captures, 452 mortalities	275 non-lethal captures, 48 mortalities	38 non-lethal captures, 11 mortalities	0	total takes over 50-year project life
		Relocation Trawling: up to 938 captures (37 mortalities) of loggerheads, 275 captures (11 mortalities) of Kemp's ridleys, and 37 captures (2 mortalities) of green sea turtles				

### 5.1.3 Vessel Activity and Military Operations

Potential sources of adverse effects to sea turtles and Atlantic sturgeon from Federal vessel operations in the action area include operations of the U.S. Navy (USN) and the U.S. Coast Guard (USCG), which maintain the largest Federal fleets, as well as the Bureau of Ocean Energy Management (BOEM), Maritime Administration (MARAD), Environmental Protection Agency (EPA), NOAA, and ACOE. We have conducted formal consultations with the USN, USCG, EPA, and NOAA on their vessel-based operations. We have also conducted section 7 consultations with BOEM and MARAD on vessel traffic related to energy projects in the Greater Atlantic Region and implemented conservation measures. Through the section 7 process, where applicable, we have and will continue to establish conservation measures for all these agency vessel operations to avoid or minimize adverse effects to listed species. To date, ocean-going vessels and military activities have not been identified as significant threats to Atlantic sturgeon.

However, the possibility exists for interactions between vessels and these species in marine, estuarine, and riverine environments. However, because of a lack of information on the effects of these activities on sturgeon, the discussion below focuses on sea turtles.

Although consultations on individual Navy and USCG activities have been completed, only a few formal consultations on overall military activities along the U.S. Atlantic coast have been completed at this time. In June 2009, we prepared a biological opinion on Navy activities in each of their four training range complexes along the U.S. Atlantic coast—Northeast, Virginia Capes, Cherry Point, and Jacksonville (NMFS 2009). The Virginia Capes Operating Area overlaps with the action area for this consultation. In August 2017, NMFS prepared an Opinion on the operation of the Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active (LFA) sonar onboard four Navy vessels (NMFS 2017). In addition, the following biological opinions for the Navy (NMFS 1996, 1997, 2008b) and USCG (NMFS 1995, 1998b) contain details on the scope of vessel operations for these agencies and the conservation measures that are being implemented as standard operating procedures. In the U.S. Atlantic, the operation of USCG boats and cutters is estimated to take no more than one individual sea turtle, of any species, per year (NMFS 1995).

Military activities such as ordnance detonation also affect listed species of sea turtles. A section 7 consultation was conducted in 1997 for Navy aerial bombing training in the ocean off the southeast U.S. coast, involving drops of live ordnance (500 and 1,000-lb bombs). The resulting biological opinion for this consultation determined that the activity was likely to adversely affect sea turtles but would not jeopardize their continued existence. In the ITS included within the biological opinion, these training activities were estimated to have the potential to injure or kill, annually, 84 loggerheads, 12 leatherbacks, and 12 greens or Kemp's ridleys, in combination (NMFS 1997).

We have also conducted recent section 7 consultations on Navy explosive ordnance disposal, mine warfare, sonar testing (e.g., AFTT, SURTASS LFA), and other major training exercises (e.g., bombing, Naval gunfire, combat search and rescue, anti-submarine warfare, and torpedo and missile exercises) in the Atlantic Ocean. These consultations have determined that the proposed Navy activities may adversely affect but would not jeopardize the continued existence of ESA-listed sea turtles (NMFS 2008b, 2009, 2017). We estimated that five loggerhead and six Kemp's ridley sea turtles were likely to be harmed as a result of training activities in the Virginia Capes Range Complex from June 2009 to June 2010, and that nearly 1,500 sea turtles, including ten leatherbacks, were likely to experience harassment (NMFS 2009). For SURTASS LFA sonar testing, we were unable to estimate the number of sea turtles of each species occurring in USN mission areas that could be incidentally taken, although all takes were expected to result in behavioral harassment rather than serious injury or mortality (NMFS 2017).

Similarly, operations of vessels by other Federal agencies within the action area (BOEM, MARAD, EPA, and ACOE) may adversely affect sea turtles and Atlantic sturgeon. However, vessel activities of those agencies are often limited in scope, as they operate a limited number of vessels or are engaged in research/operational activities that are unlikely to contribute a significant amount of risk.

#### **5.1.4 Research and Other Permitted Activities**

Research activities either conducted or funded by Federal agencies within the action area may adversely affect ESA-listed sea turtles and fish, and may require a section 7 consultation. Several section 7 consultations on research activities have recently been completed, as described below.

##### *Fish Surveys funded by the USFWS*

USFWS Region 5 provides funds to 13 states and the District of Columbia under the Dingell-Johnson Sport Fish Restoration Grant program and the State Wildlife Grant Program. Vermont and West Virginia are the only two Northeast states that do not use these funds to conduct ongoing surveys in marine, estuarine or riverine waters where NMFS listed species are present. The eleven other states (Maine, New Hampshire, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia) and the District of Columbia carry out a total of approximately 80-90 studies, mostly on an annual basis. There are several broad categories of fisheries surveys including: hook and line; beach seine; bottom trawl; fishway trap; boat electrofishing; long line; fyke net; gill net; haul seine; push net; and, backpack electrofishing. These surveys occur in state waters (rivers, estuaries, and in nearshore ocean waters), generally from Maine through Virginia, with several studies occurring in Virginia state waters including juvenile fish trawl surveys, juvenile striped bass beach seine surveys, and the Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAAP) surveys. These surveys have resulted in the non-lethal capture of both sea turtles (eight loggerheads and one Kemp's ridley) and Atlantic sturgeon (seven total) since 2013.

We completed a biological opinion in 2013 which bundled the eleven independent actions carried out by USFWS (i.e., awarding of each grant fund to each state is an independent action). The biological opinion provides an ITS by activity and provided a summary by state. Overall, we anticipate that the surveys described in the biological opinion, to be funded by USFWS and carried out by the states will result in the capture of up to two sea turtles of any species and 140 Atlantic sturgeon (no more than three lethal) over a five-year period. The only mortalities that we anticipate for Virginia state waters are three Atlantic sturgeon (originating from any of the five DPSs) during striped bass and shad gillnet surveys in the action area.

##### *Section 10(a)(1)(A) Permits*

We have issued additional research permits under section 10(a)(1)(A) of the ESA, which authorizes activities for scientific purposes or to enhance the propagation or survival of the affected species. The permitted activities do not operate to the disadvantage of the species and are consistent with the purposes of the ESA, as outlined in section 2 of the Act. A total of 13 section 10(a)(1)(A) permits are currently in effect for sea turtles and Atlantic sturgeon within the action area for this consultation.

##### *Section 10(a)(1)(B) Permits*

Section 10(a)(1)(B) of the ESA authorizes us, under some circumstances, to permit non-Federal parties to take otherwise prohibited fish and wildlife if such taking is "incidental to, and not the purpose of carrying out otherwise lawful activities" (50 CFR 217-222). As a condition for issuance of a permit, the permit applicant must develop a conservation plan that minimizes negative impacts to the species. There are currently no active Section 10(a)(1)(B) permits in the

action area for this consultation, although on August 14, 2017, we published a notice in the Federal Register announcing the receipt of an application from Dominion Virginia Power for a section 10(a)(1)(B) permit, which is discussed in more detail below. In addition, most coastal Atlantic states are either in the process of applying for permits or considering applications for state fisheries. Active permits and permit applications are posted online for all ESA-listed species as they become available at [http://www.nmfs.noaa.gov/pr/permits/esa\\_review.htm](http://www.nmfs.noaa.gov/pr/permits/esa_review.htm).

### ***5.1.5 Coal Burning Power Stations***

#### *Chesterfield Power Station – James River*

The Chesterfield Power Station (CPS) is a coal-fired power plant operated by Dominion Virginia Power (Dominion). The CPS began operations in 1945 and has been operating at its current level since 1992. The station is located at river mile 82 (RKM 132 of the James River in Chesterfield, VA. The six power-generating units at CPS utilize a once-through cooling water system that withdraws water directly from the James River through five cooling water intake structures. The operation of the CPS has resulted in the take of Atlantic sturgeon. An Atlantic sturgeon presumed to be an adult based on its size (no measurements available), was impinged on “trash racks” of the CPS on October 3, 2015. The sturgeon was injured, but returned alive to the James River. Also in October 2015, two yolk-sac Atlantic sturgeon larvae were captured during entrainment sampling conducted pursuant to section 316(b) of the Clean Water Act. After the incidental take of the two larvae, Dominion suspended entrainment sampling on March 2, 2016, prior to the spring spawning of Atlantic sturgeon in the James River. On April 10, 2017, we received a complete application from Dominion requesting an Incidental Take Permit (ITP) to take Atlantic sturgeon over a 10-year period. Dominion estimates the take of up to 846 Atlantic sturgeon per year from the Chesapeake Bay DPS due to entrainment in the CPS cooling water intakes. Dominion also estimates the take of up to two juvenile, sub-adult, or adult Atlantic sturgeon from the Chesapeake Bay DPS over a 10-year period as a result of impingement at the CPS intakes.

## **5.2 Non-Federally Regulated Fisheries**

Sea turtles and Atlantic sturgeon may be vulnerable to capture, injury, and mortality in fisheries occurring in Virginia state waters. Information on the number of sea turtles and Atlantic sturgeon captured or killed in Virginia state fisheries is extremely limited and as such, efforts are currently underway to obtain more information on the numbers of these species captured and killed in state water fisheries. We are currently working with the Northeast Fisheries Observer Program (NEFOP), Atlantic States Marine Fisheries Commission (ASMFC), the Virginia Marine Resources Commission (VMRC), and the Virginia Aquarium and Marine Science Center to assess the impacts of state authorized fisheries on sea turtles and Atlantic sturgeon. We are also currently working with Virginia on applications for ESA section 10(a)(1)(B) Incidental Take Permits to cover their fisheries; however, to date, no permit applications have been submitted. Below, we discuss the different fisheries authorized by the state of Virginia and any available information on interactions between these fisheries and sea turtles/Atlantic sturgeon.

#### *American eel fishery*

American eel is exploited in fresh, brackish, and coastal waters from the southern tip of Greenland to northeastern South America. Eel fisheries are conducted primarily in tidal and

inland waters. Eels are typically caught with hook and line or with eel traps and may also be caught with fyke nets. Sturgeon and sea turtles are not known to interact with the eel fishery.

#### *Atlantic croaker fishery*

An Atlantic croaker fishery using trawl and gillnet gear also occurs within the action area and sea turtle interactions have been observed in the fishery. The average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the Atlantic croaker fishery was estimated to be 92 loggerhead sea turtles (with a 95% CI of 63-121) from 2009-2013 (Murray 2015a). Additional information on sea turtle interactions with gillnet gear used in the Atlantic croaker fishery has also been recently published by Murray (2013). The average annual bycatch of loggerhead sea turtles in gillnet gear used in the Atlantic croaker fishery, based on VTR data from 2007-2011, was estimated to be 6 per year with a 95% CI of 2-10 (Murray 2013). These estimates encompass the bycatch of loggerheads in the Atlantic croaker fishery in both state and Federal waters.

Atlantic sturgeon interactions have also been observed in the Atlantic croaker fishery, but a quantitative assessment of the number of Atlantic sturgeon captured in the croaker fishery is not available. A mortality rate of Atlantic sturgeon in commercial trawls has been estimated at 5%. A review of the NEFOP database indicates that from 2006-2010, 60 Atlantic sturgeon (out of a total of 726 observed interactions) were captured during observed trips where the trip target was identified as croaker. This represents a minimum number of Atlantic sturgeon captured in the croaker fishery during this time period as it only considers trips that included a NEFOP observer onboard.

#### *Weakfish fishery*

The weakfish fishery occurs in both state and Federal waters, but the majority of commercially and recreationally caught weakfish are caught in state waters (ASMFC 2002). The dominant commercial gears include gillnets, pound nets, haul seines, flynets, and trawls, with the majority of landings occurring in the fall and winter months (ASMFC 2002). Weakfish landings were dominated by the trawl fishery through the mid-1980s, after which gillnet landings began to account for most weakfish landed (ASMFC 2002). Virginia has ranked second among U.S. Atlantic states in annual landings since 1972 (ASMFC 2002). Sea turtle bycatch in the weakfish fishery has occurred (Murray 2013, 2015a) and NMFS originally assessed the impacts of the fishery on sea turtles in an Opinion in 1997 (NMFS 1997b). Currently, the average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the weakfish fishery is estimated to be 0 loggerheads (with a 95% CI of 0-1) from 2009-2013 (Murray 2015a). Additional information on loggerhead sea turtle interactions with gillnet gear has also been recently published by Murray (2009a, 2009b). The average annual bycatch of loggerhead sea turtles in gillnet gear used in the weakfish fishery, based on VTR data from 2002-2006, was estimated to be one per year with a 95% CI of 0-1 (Murray 2009b), although the more recent Murray (2013) gillnet bycatch estimate for 2007-2011 does not include a loggerhead bycatch estimate for the weakfish gillnet fishery. These estimates encompass the bycatch of loggerheads in the weakfish fishery in both state and Federal waters.

A quantitative assessment of the number of Atlantic sturgeon captured in the weakfish fishery is not available. A mortality rate of Atlantic sturgeon in commercial trawls has been estimated at

5%. A review of the NEFOP observer database indicates that from 2006-2010, 36 Atlantic sturgeon (out of a total of 726 observed interactions) were captured during observed trips where the trip target was identified as weakfish. This represents a minimum number of Atlantic sturgeon captured in the weakfish fishery during this time period as it only considers observed trips, and most inshore fisheries are not observed. An earlier review of bycatch rates and landings for the weakfish fishery reported that the weakfish-stripped bass fishery had an Atlantic sturgeon bycatch rate of 16% from 1989-2000; the weakfish-Atlantic croaker fishery had an Atlantic sturgeon bycatch rate of 0.02%, and the weakfish fishery had an Atlantic sturgeon bycatch rate of 1.0% (ASSRT 2007).

#### *Whelk fishery*

A whelk fishery using pot/trap gear is known to occur in Virginia waters of Chesapeake Bay. Whelk pots, which unlike lobster traps are not fully enclosed, have been suggested as a potential source of entrapment for loggerhead sea turtles that may be enticed to enter the trap to get the bait or whelks caught in the trap (Mansfield *et al.* 2001). Loggerhead, leatherback, and green sea turtles are known to become entangled in lines associated with pot/trap gear used in several fisheries including lobster, whelk, and crab species (SEFSC 2001; Dwyer *et al.* 2002: NMFS 2007b). Whelk fisheries in Virginia have been verified as the fisheries involved in a handful of loggerhead, leatherback, and green sea turtle entanglements since 2001, averaging around one per year (Northeast Region Sea Turtle Disentanglement Network [STDN] database). Whelk pots are not known to interact with Atlantic sturgeon.

#### *Crab fisheries*

Various crab fisheries, such as horseshoe crab and blue crab, also occur in Virginia state waters. Loggerhead, leatherback, and green sea turtles are known to become entangled in lines associated with pot/trap gear used in several fisheries including lobster, whelk, and crab species (SEFSC 2001; Dwyer *et al.* 2002: NMFS 2007b). The Virginia blue crab fishery has been verified as the fishery involved in a handful of loggerhead and leatherback sea turtle entanglements since 2001 (Northeast Region STDN database). In 2017, crab fisheries in Virginia accounted for two live and possibly one dead leatherbacks entangled in vertical lines of the gear.

The crab fisheries may have detrimental impacts on sea turtles beyond entanglement in the fishing gear itself. Loggerheads are known to prey on crab species, including horseshoe and blue crabs. In a study of the diet of loggerhead sea turtles in Virginia waters from 1983 to 2002, Seney and Musick (2007) found a shift in the diet of loggerheads in the area from horseshoe and blue crabs to fish, particularly menhaden and Atlantic croaker. The authors suggested that a decline in the crab species have resulted in the shift and loggerheads are likely foraging on fish captured in fishing nets or on discarded fishery bycatch (Seney and Musick 2007). The physiological impacts of this shift are uncertain although it was suggested as a possible explanation for the declines in loggerhead abundance noted by Mansfield (2006). Other studies have detected seasonal declines in loggerhead abundance coincident with seasonal declines of horseshoe and blue crabs in the same area (Maier *et al.* 2005). While there is no evidence of a decline in horseshoe crab abundance in the Southeast during the period 1995-2003, declines were evident in some parts of the Mid-Atlantic (ASMFC 2004; Eyster *et al.* 2007). Given the variety of loggerheads prey items (Dodd 1988; Burke *et al.* 1993; Bjorndal 1997; Morreale and Standora

1998) and the differences in regional abundance of horseshoe crabs and other prey items (ASMFC 2004; Eyster *et al.* 2007), a direct correlation between loggerhead sea turtle abundance and horseshoe crab and blue crab availability cannot be made at this time. Nevertheless, the decline in loggerhead abundance in Virginia waters (Mansfield 2006), coincident with noted declines in the abundance of horseshoe crab and other crab species, raises concerns that crab fisheries may be impacting the forage base for loggerheads in some areas of their range.

Atlantic sturgeon are known to be caught in state water horseshoe crab fisheries, which currently operate in all Northeast U.S. states except New Jersey. Along the U.S. East Coast, hand, trawl, and dredge fisheries account for more than 85% of the commercial horseshoe crab landings in the bait fishery. Other methods used are gillnets, pound nets, and traps (ASMFC 2011a). State waters from Delaware to Virginia are closed to horseshoe crab harvest and landing from January 1 to June 7 (ASMFC 2011a). The majority of horseshoe crab landings in 2010 came from Massachusetts, Virginia, and Delaware. Stein *et al.* (2004) examined bycatch of Atlantic sturgeon using the NMFS sea-sampling/observer database (1989-2000) and found that the bycatch rate for horseshoe crabs was low, at 0.05%. An Atlantic sturgeon “reward program,” where commercial fishermen were provided monetary rewards for reporting captures of Atlantic sturgeon in the Maryland waters of Chesapeake Bay, operated from 1996 to 2012 (Mangold *et al.* 2007).<sup>9</sup> The data from this program during the 11-year period of 1996-2006 show that one of 1,395 wild Atlantic sturgeon was found caught in a crab pot (Mangold *et al.* 2007).

#### *Fish trap, seine, and channel net fisheries*

Incidental captures of loggerheads in fish traps have been reported from several states along the U.S. Atlantic coast (Shoop and Ruckdeschel 1989; W. Teas, NMFS, pers. comm.), while leatherbacks have been documented as entangled in the buoy line systems of conch and sea bass traps off Massachusetts (Northeast Region STDN database). Long haul seines, purse seines, and channel nets are also known to incidentally capture sea turtles in sounds and other inshore waters along the U.S. Atlantic coast, although no lethal interactions have been reported (SEFSC 2001). No information on interactions between Atlantic sturgeon and fish traps, long haul seines, purse seines, or channel nets is currently available; however, depending on where this gear is set and the mesh size, the potential exists for Atlantic sturgeon to be entangled or captured in this gear.

#### *Striped bass fishery*

The striped bass fishery occurs only in state waters, as Federal waters have been closed to the harvest and possession of striped bass since 1990, except that possession is allowed in a defined area around Block Island, Rhode Island (ASMFC 2011b). The ASMFC has managed striped bass since 1981, and provides guidance to states from Maine to North Carolina through an ISFMP. All states are required to have recreational and commercial size limits, recreational creel limits, and commercial quotas. The commercial striped bass fishery is closed in Maine, New Hampshire, and Connecticut, but open in Massachusetts (hook and line only), Rhode Island, New Jersey (hook and line only), Delaware, Maryland, Virginia, and North Carolina. Recreational striped bass fishing occurs all along the U.S. East Coast.

Several states have reported incidental catch of Atlantic sturgeon (NMFS Sturgeon Workshop 2011). Data from the Atlantic Coast Sturgeon Tagging Database (2000-2004) shows that the

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<sup>9</sup> The program was terminated in February 2012, with the listing of Atlantic sturgeon under the ESA.

striped bass fishery accounted for 43% of Atlantic sturgeon recaptures (ASSRT 2007). The striped bass-weakfish fishery also had one of the highest bycatch rates of 30 directed fisheries according to NMFS Observer Program data from 1989-2000 (ASSRT 2007). However, greater rates of bycatch do not necessarily translate into high mortality rates. Other factors, such as gear, season, and soak times, may be important variables in understanding Atlantic sturgeon mortality.

#### *State gillnet fisheries*

Two 10- to 14-inch (25.6- to 35.9-centimeter) mesh gillnet fisheries, the black drum and sandbar shark gillnet fisheries, occur in Virginia state waters along the tip of the eastern shore. Given the gear type, these fisheries may capture or entangle sea turtles. Entanglements of sea turtles in gillnet sets targeting and/or landing both species have been recorded in the NEFOP database. Similarly, sea turtles are thought to be vulnerable to capture in small mesh gillnet fisheries occurring in Virginia state waters. During May-June 2001, NMFS observed 2% of the Atlantic croaker fishery and 12% of the dogfish fishery (which represent approximately 82% of Virginia's total small mesh gillnet landings from offshore and inshore waters during this time), yet no sea turtle captures were observed (NMFS 2004c). Based on gear type (i.e., gillnets), it is likely that Atlantic sturgeon would be vulnerable to capture in these fisheries. An Atlantic sturgeon "reward program" where fishermen were provided monetary rewards for reporting captures of Atlantic sturgeon, operated in the late 1990s in Virginia. The majority of reports of Atlantic sturgeon captures were in drift gillnets and pound nets. No quantitative information on the number of Atlantic sturgeon captured or killed in Virginia fisheries is currently available.

#### *Poundnet Fishery*

This fishery is managed by the states, except for regulations NMFS issued under the authority of the ESA to protect sea turtles. Pound nets with large mesh and stringer leaders set in the Chesapeake Bay have been observed to lethally take turtles as a result of entanglement in the leader. Virginia sea turtle strandings during the spring are consistently high, and given the best available information, including observer reports, the nature and location of the turtle strandings, the type of fishing gear in the vicinity of the greatest number of strandings, and the known interactions between sea turtles and large mesh and stringer pound net leaders, pound nets were considered to be a likely contributor to high sea turtle strandings in 2001 (and likely every spring). NMFS conducted pound net monitoring during the spring of 2002 and 2003. This monitoring documented 23 sea turtles either entangled in or impinged on pound net leaders, 18 of which were in leaders with less than 12 inches (30.5 cm) stretched mesh. Nine animals were found entangled in leaders, of which 7 were dead, and 14 animals were found impinged on leaders, of which one was dead. In this situation, impingement refers to a sea turtle being held against the leader by the current, apparently unable to release itself under its own ability.

In 2004 and 2005, NMFS implemented a coordinated research program with pound net industry participants and other interested parties to develop and test a modified pound net leader design with the goal of eliminating or reducing sea turtle interactions while retaining an acceptable level of fish catch. During the 2-year study, the modified leader was found effective in reducing sea turtle interactions as compared to the unmodified leader. The final results of the 2004 study found that out of eight turtles impinged on or entangled in pound net leaders, seven were in an unmodified leader. One leatherback turtle was found entangled in the vertical lines of a modified leader. In response to the leatherback entanglement, the gear was further modified by increasing

the stiffness of the vertical lines for the 2005 experiment. In 2005, 15 turtles entangled in or impinged on the leaders of unmodified leaders, and no turtles were found entangled in or impinged on modified leaders. In addition, there have been documented interactions between pound nets and Atlantic sturgeon; however, neither an interaction rate or mortality rate is currently available.

On February 9, 2015, we published a final rule amending the Bottlenose Dolphin Take Reduction Plan (BDTRP) and its implementing regulations under the Marine Mammal Protection Act (MMPA) to require year-round use of modified leaders for offshore Virginia pound nets in specified waters of the lower mainstem Chesapeake Bay and coastal state waters (80 FR 6925). Seasonality of modified leader use as previously required under the ESA regulations remains in place. Under both the MMPA and ESA, the final rule also included a one-time compliance training for fishermen using modified leaders, new and revised Virginia pound net-related definitions, and requirements to fish all sections of the gear at the same time.

The modified pound net leader regulations issued in the early 2000s reduced the number of interactions compared to the time period before the regulations were in place. To date, only leatherback sea turtles have been documented as entangled in modified pound net leaders in Virginia waters, and all of them but one have occurred in the Cape Henry area of Chesapeake Bay. Sixteen leader entanglements have been documented from 2013-2017, with two of those being lethal. The VMRC also disentangled an unidentified sea turtle in an inshore leader in September 2017. Atlantic sturgeon are known to become entrapped in pound nets and were routinely observed in Maryland waters, primarily through the USFWS reward program (U.S. FWS 2007). We have only anecdotal reports of Atlantic sturgeon entrapped in pound nets in Virginia.

We completed a biological opinion in 2018 on the gear regulations implemented by NMFS for the pound net fishery operating in nearshore coastal and estuarine waters of Virginia, including waters inside Chesapeake Bay. The biological opinion provides an ITS, which exempts the annual incidental take by entrapment, impingement, or entanglement of sea turtles and Atlantic sturgeon. Overall, we anticipate that the activities described in the biological opinion, will result in the take of up to 806 loggerhead sea turtles (up to 2 lethal), 162 Kemp's ridley sea turtles (up to 2 lethal), 17 green sea turtles (up to 2 lethal), 8 leatherback sea turtles (up to 4 lethal), and 13 Atlantic sturgeon (up to 1 lethal).

#### *State recreational fisheries*

Observations of state recreational fisheries in Virginia have shown that loggerhead, leatherback, Kemp's ridley, and green sea turtles are known to bite baited hooks, and loggerheads frequently ingest the hooks. Hooked sea turtles have been reported by the public fishing from boats, piers, beaches, banks, and jetties, and from commercial fishermen fishing with both single rigs and bottom longlines (SEFSC 2001). A summary of known impacts of hook-and-line captures on loggerhead sea turtles can be found in the TEWG (1998, 2000, 2009) reports. Stranding data also provide some evidence of interactions between recreational hook-and-line gear and sea turtles, but assigning the gear to a specific fishery is rarely, if ever, possible. In 2017, the Northeast STDN documented one dead Kemp's ridley sea turtle in Virginia waters with a circle hook in its mouth and wrapped around the neck in monofilament line, strong indications that a recreational fisherman may have been at fault.

Atlantic sturgeon have also been observed captured in hook-and-line gear, yet the number of interactions that occur annually is unknown. While most Atlantic sturgeon are likely to be released alive, we currently have no information on post-release survival. Although we do not currently have adequate information to quantify the level of take that occurs in state fisheries due to the lack of a the federal nexus, we expect that take does occur and will continue to occur into the future. NMFS is currently working on a project to assess the extent of sea turtle interactions that occur in recreational fisheries of the Southeast (North Carolina to Florida) and believes that the survey platform and questionnaire may also be applicable for determining the amount of Atlantic sturgeon interactions as well.

### **5.3 Other Activities**

#### **5.3.1 *Maritime Industry***

Private and commercial vessels, including fishing vessels, operating in the action area of this consultation also have the potential to interact with sea turtles and Atlantic sturgeon. The effects of fishing vessels, recreational vessels, or other types of commercial vessels on ESA-listed species may involve disturbance or injury/mortality due to collisions or entanglement in anchor lines. During 2007-2010, researchers documented 31 carcasses of adult Atlantic sturgeon in the tidal freshwater portion of the James River, Virginia. Twenty-six of the carcasses had gashes from vessel propellers, and the remaining five carcasses were too decomposed to allow determination of the cause of death. The types of vessels responsible for these mortalities were not explicitly demonstrated. Most (84%) of the carcasses were found in a relatively narrow reach that was modified to increase shipping efficiency (Balazik *et al.* 2012). Listed species may also be affected by fuel oil spills resulting from vessel accidents. Fuel oil spills could affect animals through the food chain. However, these spills typically involve small amounts of material that are unlikely to adversely affect listed species. Larger oil spills may result from severe accidents, although these events would be rare and involve small areas. No direct adverse effects on listed sea turtles and Atlantic sturgeon resulting from fishing vessel fuel spills have been documented.

#### **5.3.2 *Pollution***

Anthropogenic sources of marine pollution, while difficult to attribute to a specific Federal, state, local, or private action, may affect sea turtles and Atlantic sturgeon in the action area. Sources of pollutants in the action area include atmospheric loading of pollutants such as PCBs; storm water runoff from coastal towns, cities, and villages; runoff into rivers emptying into bays; groundwater discharges; wastewater and sewage treatment plant effluents; and oil spills. The pathological effects of oil spills on sea turtles have been documented in several laboratory studies (Vargo *et al.* 1986). Nutrient loading from land-based sources, such as coastal communities and agricultural operations, is known to stimulate plankton blooms in closed or semi-closed estuarine systems. The effect to larger embayments is unknown. Contaminants could degrade habitat if pollution and other factors reduce the food available to sea turtles and Atlantic sturgeon. The effects from pollution are long term and ongoing.

### **5.3.3 Coastal Development**

Beachfront development, lighting, and beach erosion control all are ongoing activities along the Mid- and South Atlantic coastlines of the U.S. These activities potentially reduce or degrade sea turtle nesting habitats or interfere with hatchling movement to sea. Nocturnal human activities along nesting beaches may also discourage sea turtles from nesting sites. The extent to which these activities reduce sea turtle nesting and hatchling production is unknown. However, more and more coastal counties are adopting stringent protective measures to protect hatchling sea turtles from the disorienting effects of beach lighting. Coastal development may also impact sea turtles and Atlantic sturgeon if it disturbs or degrades foraging habitats or otherwise affects the ability of these species to use coastal habitats. At present, only limited nesting of sea turtles occurs on Virginia beaches, primarily in the southernmost part of the state. Virginia represents the northernmost extreme of loggerhead sea turtle nesting along the U.S. Atlantic coast. From 1970-2015, 166 loggerhead nests have been documented on Virginia's ocean-facing beaches. The state's first and only green sea turtle nest was reported in 2005 and its first and second Kemp's ridley nests were documented in 2012 and 2014, respectively (Virginia DGIF 2016).

### **5.3.4 Global Climate Change and Ocean Acidification**

In addition to the information on climate change presented in the *Status of the Species* section for sea turtles and Atlantic sturgeon, the discussion below presents further background information on global climate change as well as past and projected effects of global climate change throughout the range of the ESA-listed species considered in this Opinion. Below is the available information on projected effects of climate change in the action area and how listed sea turtles and Atlantic sturgeon may be affected by those projected environmental changes. The effects are summarized on the time span of the proposed action, for which we can realistically analyze impacts, yet are discussed and considered for longer time periods when feasible.

In its Fifth Assessment Report (AR5) from 2013, the Intergovernmental Panel on Climate Change (IPCC) stated that the globally averaged combined land and ocean surface temperature data has shown a warming of 0.85°C (likely range: 0.65° to 1.06°C) over the period of 1880-2012. Similarly, the total increase between the average of the 1850-1900 period and the 2003-2012 period is 0.78°C (likely range: 0.72° to 0.85°C). On a global scale, ocean warming has been largest near the surface, with the upper 75 meters of the world's oceans having warmed by 0.11°C (likely range: 0.09° to 0.13°C) per decade over the period of 1971-2010 (IPCC 2013). The mean rate of global averaged sea level rise was 1.7 millimeters/year (likely range: 1.5 to 1.9 millimeters/year) between 1901 and 2010, 2.0 millimeters/year (likely range: 1.7 to 2.3 millimeters/year) between 1971 and 2010, and 3.2 millimeters/year (likely range: 2.8 to 3.6 millimeters/year) between 1993 and 2010.

Climate model projections exhibit a wide range of plausible scenarios for both temperature and precipitation over the next several decades. The global mean surface temperature change for the period 2016-2035 relative to 1986-2005 will likely be in the range of 0.3° to 0.7°C (medium confidence). This assessment is based on multiple lines of evidence and assumes there will be no major volcanic eruptions or secular changes in total solar irradiance. Relative to natural internal variability, near-term increases in seasonal mean and annual mean temperatures are expected to be larger in the tropics and subtropics than in mid- and high latitudes (high confidence). This temperature increase will very likely be associated with more extreme

precipitation and faster evaporation of water, leading to greater frequency of both very wet and very dry conditions. Climate warming has also resulted in increased river discharge and glacial and sea-ice melting (Greene *et al.* 2008). The strongest ocean warming is projected for the surface in tropical and Northern Hemisphere subtropical regions. At greater depths, the warming will be most pronounced in the Southern Ocean (high confidence). Best estimates of ocean warming in the top 100 meters are about 0.6° to 2.0°C, and about 0.3° to 0.6°C at a depth of about 1,000 meters by the end of the 21<sup>st</sup> century (IPCC 2013).

Under Representative Concentration Pathway (RCP) 8.5, the climate change scenario where emission levels continue to rise throughout the 21<sup>st</sup> century, the projected change in global mean surface air temperature and global mean sea level rise for the mid- and late 21<sup>st</sup> century relative to the reference period of 1986-2005 is as follows. Global average surface temperatures are likely to be 2.0°C higher (likely range: 1.4° to 2.6°C) from 2046-2065 and 3.7°C higher (likely range: 2.6° to 4.8°C) from 2081-2100. Global mean sea levels are likely to be 0.30 meters higher (likely range: 0.22 to 0.38 meters) from 2046-2065 and 0.63 meters higher (likely range: 0.45 to 0.82 meters) from 2081-2100, with a rate of sea level rise during 2081-2100 of 8 to 16 millimeters/year (medium confidence). There is uncertainty about the magnitude of global sea level rise, projected to rise .30 to 1.22 meters by 2100, as it is primarily dependent on the dynamics of ice sheet melting (Melillo *et al.*, 2014).

The past three decades have witnessed major changes in ocean circulation patterns in the Arctic, and these were accompanied by climate associated changes as well (Greene *et al.* 2008). Shifts in atmospheric conditions have altered Arctic Ocean circulation patterns and the export of freshwater to the North Atlantic (IPCC 2007; Greene *et al.* 2008). With respect specifically to the North Atlantic Oscillation (NAO), changes in salinity and temperature are thought to be the result of changes in the Earth's atmosphere caused by anthropogenic forces (IPCC 2007). The NAO impacts climate variability throughout the Northern Hemisphere (IPCC 2007). Data from the 1960s through the 2000s showed that the NAO index increased from minimum values in the 1960s to strongly positive index values in the 1990s and somewhat declined since (IPCC 2007). This warming extends over 1,000 meters deep and is deeper than anywhere in the world's oceans and is particularly evident under the Gulf Stream/North Atlantic Current system (IPCC 2007). On a global scale, large discharges of freshwater into the North Atlantic subarctic seas can lead to intense stratification of the upper water column and a disruption of North Atlantic Deepwater (NADW) formation (IPCC 2007; Greene *et al.* 2008). There is evidence that the NADW has already freshened significantly (IPCC 2007). This in turn can lead to a slowing down of the global ocean thermohaline (large-scale circulation in the ocean that transforms low-density upper ocean waters to higher density intermediate and deep waters and returns those waters back to the upper ocean), which can have climatic ramifications for the entire world (Greene *et al.* 2008).

There is a high confidence, based on substantial new evidence, that observed changes in marine systems are associated with rising water temperatures, as well as related changes in ice cover, salinity, oxygen levels, and circulation. Ocean acidification resulting from massive amounts of carbon dioxide and pollutants released into the air can have major adverse impacts on the calcium balance in the oceans. Changes to the marine ecosystem due to climate change include shifts in ranges and changes in algal, plankton, and fish abundance (IPCC 2007). These trends have been most apparent over the past few decades, although this may also be due to increased

research. Below, we discuss information on future impacts of climate change in the action area.

While predictions are available regarding potential effects of climate change globally, it is more difficult to assess the potential effects of climate change over the next few decades on coastal and marine resources on smaller geographic scales, such as the action area, especially as climate variability is a dominant factor in shaping coastal and marine systems. The effects of future change will vary greatly in diverse coastal regions of the U.S. Warming is very likely to continue in the U.S. over the life span of the project regardless of reduction in greenhouse gases, due to emissions that have already occurred (NAST 2000). It is very likely that the magnitude and frequency of ecosystem changes will continue to increase during the life of the project, and it is possible that they will accelerate. Climate change can cause or exacerbate direct stress on ecosystems through high temperatures, a reduction in water availability, and altered frequency of extreme events and severe storms. Water temperatures in streams and rivers are likely to increase as the climate warms and are very likely to have both direct and indirect effects on aquatic ecosystems. Changes in temperature will be most evident during low flow periods when they are of greatest concern (NAST 2000). In some marine and freshwater systems, shifts in geographic ranges and changes in algal, plankton, and fish abundance are associated with high confidence with rising water temperatures, as well as related changes in ice cover, salinity, oxygen levels and circulation (IPCC 2007).

Expected consequences of climate change for river systems could be a decrease in the amount of dissolved oxygen in surface waters and an increase in the concentration of nutrients and toxic chemicals due to reduced flushing rate (Murdoch *et al.* 2000). Because many rivers are already under a great deal of stress due to excessive water withdrawal or land development, and this stress may be exacerbated by changes in climate, anticipating and planning adaptive strategies may be critical (Hulme 2005). A warmer-wetter climate could ameliorate poor water quality conditions in places where human-caused concentrations of nutrients and pollutants currently degrade water quality (Murdoch *et al.* 2000). Increases in water temperature and changes in seasonal patterns of runoff will very likely disturb fish habitat and affect recreational uses of lakes, streams, and wetlands. Surface water resources along the U.S. Atlantic coast are intensively managed with dams and channels and almost all are affected by human activities; in some systems water quality is either below recommended levels or nearly so. A global analysis of the potential effects of climate change on river basins indicates that due to changes in discharge and water stress, the area of large river basins in need of reactive or proactive management interventions in response to climate change will be much higher for basins impacted by dams than for basins with free-flowing rivers (Palmer *et al.* 2008). Human-induced disturbances also influence coastal and marine systems, often reducing the ability of the systems to adapt so that systems that might ordinarily be capable of responding to variability and change are less able to do so. Because stresses on water quality are associated with many activities, the impacts of the existing stresses are likely to be exacerbated by climate change.

While debated, researchers anticipate: 1) the frequency and intensity of droughts and floods will change across the nation; 2) a warming of about 0.2°C per decade; and 3) a rise in sea level (NAST 2000). Sea level is expected to continue rising; during the 20th century global sea level has increased 15 to 20 centimeters. It is also important to note that ocean temperature in the U.S. Northeast Shelf and surrounding Northwest Atlantic waters have warmed faster than the global

average over the last decade (Pershing *et al.* 2015). New projections for the U.S. Northeast Shelf and Northwest Atlantic Ocean suggest that this region will warm two to three times faster than the global average and thus existing projections from the IPCC may be too conservative (Saba *et al.* 2015). Hare *et al.* (2016b) provides a literature summary of other aspects of the climate system that is changing on the U.S. Northeast Shelf including a high rate of sea-level rise, as well as increases in annual precipitation and river flow, magnitude of extreme precipitation events, magnitude and frequency of floods, and dissolved CO<sub>2</sub>.

### *Effects on sea turtles and Atlantic sturgeon globally*

#### Sea turtles

Sea turtle species have persisted for millions of years and throughout this time have experienced wide variations in global climate conditions and have successfully adapted to these changes. As such, climate change at normal rates (thousands of years) is not thought to have historically been a problem for sea turtle species. As explained in the *Status of the Species* sections above, sea turtles are most likely to be affected by climate change due to (1) changing air temperature and rainfall at nesting beaches, which in turn could impact nest success (hatching success and hatchling emergence rate) and sex ratios among hatchlings; (2) sea level rise, which could result in a reduction or shift in available nesting beach habitat and increased risk of nest inundation; (3) changes in the abundance and distribution of forage species, which could result in changes in the foraging behavior and distribution of sea turtle species; and (4) changes in water temperature, which could possibly lead to a northward shift in their range and changes in phenology (timing of nesting seasons, timing of migrations). Over the time period of this action considered in this Opinion, sea surface temperatures are expected to rise less than 1°C. It is unknown if that is enough of a change to contribute to shifts in the range, distribution, and recruitment of sea turtles. Theoretically, we expect that as waters in the action area warm, more sea turtles could be present or sea turtles could be present for longer periods of time.

The nesting range of some sea turtle species may shift northward. Nesting in the Mid-Atlantic generally is extremely rare and no nesting has been documented at any beach in the Northeast. In 2010, one green sea turtle came up on the beach in Sea Isle City, New Jersey; however, it did not lay any eggs. In August 2011, a loggerhead came up on the beach in Stone Harbor, New Jersey, but did not lay any eggs. On August 18, 2011, a green sea turtle laid one nest at Cape Henlopen Beach in Lewes, Delaware, near the entrance to Delaware Bay. The nest contained 190 eggs and was transported indoors to an incubation facility on October 7. A total of 12 eggs hatched, with eight hatchlings surviving. In December, seven of the hatchlings were released in Cape Hatteras, North Carolina. In September 2017, about 100 baby loggerheads successfully emerged from nests on the Maryland side of Assateague Island. It is important to consider that in order for nesting to be successful in the Mid-Atlantic, fall and winter temperatures need to be warm enough to support the successful rearing of eggs and sea temperatures must be warm enough for hatchlings to survive when they enter the water. The projected increase in ocean temperature over the next fifty years is unlikely to allow for more successful rearing of sea turtle eggs in the action area. However, if increased nesting activity is detected, that would constitute new information that may require reinitiation of this Opinion.

As noted above, sea level rise has the potential to remove possible beach nesting habitat. A recent study by the U.S. Geological Survey found that sea levels in a 620-mile “hot spot” along the East Coast are rising three to four times faster than the global average (Sallenger *et al.* 2012). The disproportionate sea level rise is due to the slowing of Atlantic currents caused by fresh water from the melting of the Greenland Ice Sheet. Sharp rises in sea levels from North Carolina to Massachusetts could threaten wetland and beach habitats, and negatively affect sea turtle nesting along the North Carolina coast. If warming temperatures moved favorable nesting sites northward, it is possible that rises in sea level could constrain the availability of nesting sites on existing beaches. In the next 100 years, the study predicted that sea levels will rise an additional 20-27 centimeters along the Atlantic coast “hot spot” (Sallenger *et al.* 2012).

Warming sea temperatures are likely to result in a shift in the seasonal distribution of sea turtles in the action area, such that sea turtles may begin northward migrations from their southern overwintering grounds earlier in the spring and thus would be present in the action area earlier in the year. Likewise, if water temperatures were warmer in the fall, sea turtles could remain in the action area later in the year.

Changes in water temperature may also alter the forage base and thus, foraging behavior of sea turtles. Changes in the foraging behavior of sea turtles in the action area could lead to either an increase or decrease in the number of sea turtles in the action area, depending on whether there was an increase or decrease in the forage base and/or a seasonal shift in water temperature. For example, if there was a decrease in sea grasses in the action area resulting from increased water temperatures or other climate-change related factors, it is reasonable to expect that there may be a decrease in the number of foraging green sea turtles in the action area. Likewise, if the prey base for loggerhead, Kemp’s ridley, or leatherback sea turtles is affected, there may be changes in the abundance and distribution of these species in the action area. However, as noted above, because we do not know the adaptive capacity of these individuals or how much of a change in temperature would be necessary to cause a shift in distribution, it is not possible to predict future changes to the foraging behavior of sea turtles. If sea turtle distribution shifted along with prey distribution, it is likely that there would be minimal, if any, impact on the availability of food. Similarly, if sea turtles shifted to areas where different forage was available and sea turtles were able to obtain sufficient nutrition from that new source of forage, any effect would be minimal. The greatest potential for effect to forage resources would be if sea turtles shifted to an area or time where insufficient forage is available; however, the likelihood of this happening seems low because sea turtles feed on a wide variety of species and in a wide variety of habitats. Finally, it is important to note that ocean temperature in the U.S. Northeast continental shelf and surrounding Northwest Atlantic waters have warmed faster than the global average over the last decade (Pershing *et al.* 2015).

#### Atlantic sturgeon

As there is significant uncertainty in the rate and timing of change as well as the effect of any changes that may be experienced in the action area due to climate change, it is difficult to predict the impact of these changes on Atlantic sturgeon. We have analyzed the available information,

however, to consider likely impacts to sturgeon and their habitat in the action area. We consider here, likely effects of climate change during the life span of the project.

Atlantic sturgeon have persisted for millions of years and have experienced wide variations in global climate conditions, to which they have successfully adapted. Climate change at historical rates (thousands of years) is not thought to have been a problem for sturgeon species. However, at the current rate of global climate change, future effects to sturgeon are possible. Rising sea level may result in the salt wedge moving upstream in affected rivers. Atlantic sturgeon spawning occurs in fresh water reaches of rivers because early life stages have little to no tolerance for salinity. Similarly, juvenile sturgeon have limited tolerance to salinity and remain in waters with a salinity gradient that they adapt to over time. If the salt wedge moves further upstream, sturgeon spawning and rearing habitat could be restricted. In river systems with dams or natural falls that are impassable by sturgeon, the extent that spawning or rearing may be shifted upstream to compensate for the shift in the movement of the salt wedge would be limited. While there is an indication that an increase in sea level rise would result in a shift in the location of the salt wedge, at this time there are no predictions on the timing or extent of any shifts that may occur; thus, it is not possible to predict any future loss in spawning or rearing habitat. However, in all river systems, spawning occurs miles upstream of the salt wedge. It is unlikely that shifts in the location of the salt wedge would eliminate freshwater spawning or rearing habitat. If habitat was severely restricted, productivity or survivability may decrease.

The increased rainfall predicted by some models in some areas may increase runoff and scour spawning areas and flooding events could cause temporary water quality issues. Rising temperatures predicted for all of the U.S. could exacerbate existing water quality problems with dissolved oxygen (DO) and temperature. While this occurs primarily in rivers in the southeast U.S. and the Chesapeake Bay, it may start to occur more commonly in the northern rivers. Atlantic sturgeon are tolerant to water temperatures up to approximately 28°C (82.4°F); these temperatures are experienced naturally in some areas of rivers during the summer months. If river temperatures rise and temperatures above 28°C are experienced in larger areas, sturgeon may be excluded from some habitats.

Increased droughts (and water withdrawal for human use) predicted by some models in some areas may cause loss of habitat including loss of access to spawning habitat. Drought conditions in the spring may also expose eggs and larvae in rearing habitats. If a river becomes too shallow or flows become intermittent, all sturgeon life stages, including adults, may become susceptible to strandings or habitat restriction. Low flow and drought conditions are also expected to cause additional water quality issues. Any of the conditions associated with climate change are likely to disrupt river ecology causing shifts in community structure and the type and abundance of prey. Additionally, cues for spawning migration and spawning could occur earlier in the season causing a mismatch in prey that are currently available to developing sturgeon in rearing habitat.

Atlantic sturgeon in the action area are most likely to experience the effects of global climate change in warming water temperatures, which could change their range and migratory patterns. Warming temperatures predicted to occur over the next 100 years would likely result in a northward shift/extension of their range (i.e., into the St. Lawrence River, Canada) while truncating the southern distribution, thus affecting the recruitment and distribution of sturgeon

rangewide. The increase in sea surface temperature over the life of the proposed action is expected to be minimal, and thus, it is unlikely that this expanded range will be observed in the near future. If any shift does occur, it is likely to be minimal and thus, it seems unlikely that this small increase in temperature will cause a significant effect to shortnose and Atlantic sturgeon or a significant modification to the number of sturgeon likely to be present in the action area over the life of the proposed action. However, even a small increase in temperature can affect DO concentrations. A one degree change in temperature in Chesapeake Bay could make parts of Chesapeake Bay inaccessible to sturgeon due to decreased levels of DO (Batiuk *et al.* 2009) and projections, from global climate models representing a wide range of potential futures, suggest water temperature increases in the bay of 2-5.5°C (3.5-9°F) by the end of the 21<sup>st</sup> century (Muhling *et al.* 2018).

Although the action area does not include spawning grounds for Atlantic sturgeon, sturgeon are migrating through the action area to reach their natal rivers to spawn. Elevated temperatures could modify cues for spawning migration, resulting in an earlier spawning season, and thus, altering the time of year sturgeon may or may not be present within the action area. This may cause an increase or decrease in the number of sturgeon present in the action area. However, because spawning is not triggered solely by water temperature, but also by day length (which would not be affected by climate change) and river flow (which could be affected by climate change), it is not possible to predict how any change in water temperature will affect the seasonal movements of sturgeon through the action area.

In addition, changes in water temperature may also alter the forage base and thus, foraging behavior of sturgeon. Any forage species that are temperature-dependent may also shift in distribution as water temperatures warm and cause a shift in the distribution of sturgeon. However, because we do not know the adaptive capacity of these species or how much of a change in temperature would be necessary to cause a shift in distribution, it is not possible to predict how these changes may affect foraging sturgeon. If sturgeon distribution shifted along with prey distribution, it is likely that there would be minimal, if any, impact on the availability of food. Similarly, if sturgeon shifted to areas where different forage was available and sturgeon were able to obtain sufficient nutrition from that new source of forage, any effect would be minimal. The greatest potential for effect to forage resources would be if sturgeon shifted to an area or time where insufficient forage was available; however, the likelihood of this happening seems low because sturgeon feed on a wide variety of species and in a wide variety of habitats.

## **5.4 Reducing Threats to ESA-listed Species**

### **5.4.1 *Education and Outreach Activities***

Education and outreach activities are considered some of the primary tools that will effectively reduce the threats to all protected species. For example, NMFS has been active in public outreach to educate fishermen about handling and resuscitation techniques for sea turtles and sturgeon, and educates recreational fishermen and boaters on how to avoid interactions with these species. NMFS also has a program called “SCUTES” (Student Collaborating to Undertake Tracking Efforts for Sturgeon), which offers educational programs and activities about the movements, behaviors, and threats to sturgeon. NMFS intends to continue these outreach efforts

in the action area in an attempt to reduce interactions with protected species, and to reduce the likelihood of injury to protected species when interactions do occur.

#### **5.4.2 *Stranding and Salvage Programs***

The Sea Turtle Stranding and Salvage Network (STSSN) we manage does not directly reduce the threats to sea turtles. However, the extensive network of STSSN participants along the Atlantic and Gulf of Mexico coasts not only collects data on dead sea turtles, but also rescues and rehabilitates live stranded turtles, reducing mortality of injured or sick animals. Data collected by the STSSN are used to monitor stranding levels, to identify areas where unusual or elevated mortality is occurring, and to identify sources of mortality. These data are also used to monitor incidence of disease, study toxicology and contaminants, and conduct genetic studies to determine population structure. All of the states that participate in the STSSN tag live turtles when encountered (either via the stranding network through incidental takes or in-water studies). Tagging studies help improve our understanding of sea turtle movements, longevity, and reproductive patterns, all of which contribute to our ability to reach recovery goals for the species.

A salvage program is also in place for sturgeon. Sturgeon carcasses can provide pertinent life history data and information on new or evolving threats. Their use in scientific research studies can reduce the need to collect live sturgeon. Our Sturgeon Salvage Program is a network of individuals qualified to retrieve and/or use sturgeon carcasses and parts for scientific research and education. All carcasses and parts are retrieved opportunistically and participation in the network is voluntary.

#### **5.4.3 *Sea Turtle Disentanglement Network***

We established the Northeast Sea Turtle Disentanglement Network (STDN) in 2002 in response to the high number of leatherback sea turtles found entangled in pot gear along the U.S. Northeast Atlantic coast. The STDN is a component of the larger STSSN program, and it operates in all states in the region. The STDN responds to entangled sea turtles and disentangles and releases live animals, thereby reducing serious injury and mortality. In addition, the STDN collects data on live and dead sea turtle entanglement events, providing valuable information for management purposes. We oversee the STDN program and manage the STDN database. As knowledge of the network and number of participants involved in the network has increased, so have reports of sea turtle entanglements in Virginia waters increased over the past several years. In 2017, the STDN documented eleven sea turtle entanglements in the state of Virginia in gears such as pound nets, the vertical lines of crab traps, and monofilament or unknown line.

#### **5.4.4 *Regulatory Measures for Sea Turtles***

Numerous efforts are ongoing to reduce threats to listed sea turtles. Below, we detail efforts that are ongoing within the action area. The majority of these activities are related to regulations that have been implemented to reduce the potential for incidental mortality of sea turtles from commercial fisheries. These include sea turtle release gear requirements for TEDs in the southern part of the summer flounder trawl fishery and mesh size restrictions in Virginia's gillnet fisheries. The summaries below discuss all of these measures in more detail.

### *Large Mesh Gillnet Requirements in the Mid-Atlantic*

In March 2002, NMFS published new restrictions for the use of gillnets with larger than 8-inch (20.3 cm) stretched mesh, in Federal waters (3-200 nautical miles) off of North Carolina and Virginia. These restrictions were published in an interim final rule under the authority of the ESA (67 FR 13098) and were implemented to reduce the impact of the monkfish and other large-mesh gillnet fisheries on ESA-listed sea turtles in areas where sea turtles are known to concentrate. Following review of public comments submitted on the interim final rule, NMFS published a final rule on December 3, 2002, that established the restrictions on an annual basis. As a result, gillnets with larger than 8-inch (20.3 cm) stretched mesh are not allowed in Federal waters (3-200 nautical miles) in the areas described as follows: (1) North of the North Carolina/South Carolina border at the coast to Oregon Inlet at all times; (2) north of Oregon Inlet to Currituck Beach Light, NC from March 16 through January 14; (3) north of Currituck Beach Light, NC, to Wachapreague Inlet, VA, from April 1 through January 14; and (4) north of Wachapreague Inlet, VA, to Chincoteague, VA, from April 16 through January 14. On April 26, 2006, NMFS published a final rule (71 FR 24776) that included modifications to the large-mesh gillnet restrictions. The new final rule revised the gillnet restrictions to apply to stretched mesh that is  $\geq 7$  inches (17.9 cm). Federal waters north of Chincoteague, VA, remain unaffected by the large-mesh gillnet restrictions. These measures are in addition to the HPTRP measures that prohibit the use of large-mesh gillnets in southern Mid-Atlantic waters (territorial and Federal waters from Delaware through North Carolina out to 72°30'W longitude) from February 15 through March 15, annually. The measures are also in addition to comparable North Carolina and Virginia regulations for large-mesh gillnet fisheries in their respective state waters that were enacted in 2005.

### *Modified Scallop Dredge Gear in the Mid-Atlantic Sea Scallop Fishery*

To reduce post-interaction mortality to sea turtles resulting from capture in the sea scallop dredge bag, NMFS has required the use of a chain-mat modified dredge in the Atlantic sea scallop fishery since 2006 (71 FR 50361, August 25, 2006; 71 FR 66466, November 15, 2006; 73 FR 18984, April 8, 2008; 74 FR 20667, May 5, 2009). Federally permitted scallop vessels south of 41°09'N from the shoreline to the outer boundary of the EEZ are required to modify their dredge gear by adding an arrangement of horizontal and vertical chains (a "chain mat") over the opening of the dredge bag from of May 1 through November 30 each year. This modification is not expected to reduce the overall number of sea turtle interactions with gear. However, it is expected to reduce the severity of the interactions.

Since May 1, 2013, all limited access scallop vessels, as well as Limited Access General Category vessels with a dredge width of 10.5 feet or greater, have been required to use a Turtle Deflector Dredge (TDD) in the Mid-Atlantic (west of 71°W) from May 1 through October 31 each year (77 FR 20728, April 6, 2012). The purpose of the TDD requirement is to deflect sea turtles over the dredge frame and bag rather than under the cutting bar, so as to reduce sea turtle injuries due to contact with the dredge frame on the ocean bottom (including being crushed under the dredge frame). The TDD has specific components that are defined in the regulations. When combined with the effects of chain mats, which decrease captures in the dredge bag, the TDD should provide greater sea turtle benefits by reducing post-interaction mortality due to interactions with the dredge frame, compared to a standard New Bedford dredge.

To eliminate confusion, the seasons and areas for these two gear measures designed to protect sea turtles were later aligned through the final rule for Framework 26 to the Atlantic Sea Scallop FMP (80 FR 22119; April 21, 2015). Following the enactment of the final rule, sea turtle chain mats and TDDs are now required west of 71°W longitude from May through November.

#### *TED Requirements for the Summer Flounder Fishery*

As mentioned above, significant measures have been developed to reduce the incidental take of sea turtles in summer flounder trawls and trawls that meet the definition of a summer flounder trawl (which would include fisheries for other species like scup and black sea bass) by requiring TEDs in trawl nets used in the area of greatest turtle bycatch off the North Carolina and part of the Virginia coast from North Carolina/South Carolina border to Cape Charles, Virginia. The TED requirements for the summer flounder trawl fishery do not, however, require the use of larger TEDs that are required in the U.S. Southeast shrimp trawl fisheries.

#### *Sea Turtle Entanglements and Rehabilitation*

A final rule (70 FR 42508) published on July 25, 2005, allows any agent or employee of NMFS, USFWS, USCG, 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)).

### **5.4.5            *Regulatory Measures for Atlantic Sturgeon***

#### *Sturgeon Recovery Planning*

Several conservation actions aimed at reducing threats to Atlantic sturgeon are currently ongoing. In the near future, we will be convening a recovery team and drafting a recovery plan which will outline recovery goals and criteria and steps necessary to recover all Atlantic sturgeon DPSs. Numerous research activities are underway for sturgeon, involving us and other Federal, state, and academic partners, to obtain more information on the distribution and abundance of sturgeon throughout their range, including in the action area. Efforts are also underway to better understand threats faced by sturgeon and ways to minimize these threats, including bycatch and water quality. Fishing gear research is underway to design fishing gear that minimizes interactions with Atlantic sturgeon while maximizing retention of targeted fish species. Several states are in the process of preparing ESA section 10 Habitat Conservation Plans aimed at minimizing the effects of state fisheries on Atlantic sturgeon.

#### *Research Activity Guidelines*

Research activities aid in the conservation of listed species by furthering our understanding of the species' life history and biological requirements. We recognize, however, that many scientific research activities involve capture and may pose some level of risk to individuals or to the species. Therefore, it is necessary for research activities to be carried out in a manner that minimizes the adverse impacts of the activities on individuals and the species while obtaining crucial information that will benefit the species. Guidelines developed by sturgeon researchers in cooperation with NMFS staff (Moser *et al.* 2000; Damon-Randall *et al.* 2010; Kahn and

Mohead 2010) provide standardized research protocols that minimize the risk to sturgeon from capture, handling, and sampling. These guidelines must be followed by any entity receiving a federal permit to do research on Atlantic sturgeon.

#### *Protections for the GOM DPS of Atlantic Sturgeon*

The prohibitions listed under section 9(a)(1) of the ESA automatically apply when a species is listed as endangered but not when listed as threatened. When a species is listed as threatened, section 4(d) of the ESA requires the Secretary of Commerce (Secretary) to issue regulations, as deemed necessary and advisable, to provide for the conservation of the species. The Secretary may, with respect to any threatened species, issue regulations that prohibit any act covered under section 9(a)(1). Whether section 9(a)(1) prohibitions are necessary and advisable for a threatened species is largely dependent on the biological status of the species and the potential impacts of various activities on the species. On June 10, 2011, we proposed protective measures for the GOM DPS of Atlantic sturgeon (76 FR 34023). On November 19, 2013 we published a final rule that applied all prohibitions of section 9(a)(1) to the GOM DPS beginning on December 19, 2013 (78 FR 69310).

### **5.5 Summary of Available Information on Listed Species Likely to be Adversely Affected by the Proposed Action in the Action Area**

#### **5.5.1 Sea Turtles**

As described in sections 4.2.1.1 - 4.2.1.3, the occurrence of loggerhead, Kemp's ridley, and green sea turtles along the U.S. Atlantic coast is primarily temperature dependent (Thompson 1984; Keinath *et al.* 1987; Shoop and Kenney 1992; Musick and Limpus 1997; Morreale and Standora 1998, 2005; Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; James *et al.* 2005a). In general, sea turtles move up the U.S. Atlantic coast from southern wintering areas as water temperatures warm in the spring (Keinath *et al.* 1987; Shoop and Kenney 1992; Musick and Limpus 1997; Morreale and Standora 1998, 2005; Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; James *et al.* 2005a). The trend reverses in the fall as water temperatures cool. By December, sea turtles have passed Cape Hatteras, returning to more southern waters for the winter (Keinath *et al.* 1987; Shoop and Kenney 1992; Musick and Limpus 1997; Morreale and Standora 1998, 2005; Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; James *et al.* 2005a). Recreational anglers have reported sightings of sea turtles in waters defined as inshore waters (bays, inlets, rivers, or sounds; Braun-McNeill and Epperly 2004) as far north as New York as early as March-April, but in relatively low numbers (Braun-McNeill and Epperly 2004). Greater numbers of loggerheads, Kemp's ridleys, and greens are found in inshore, nearshore, and offshore waters of North Carolina and Virginia from May through November and in inshore, nearshore, and offshore waters of New York from June through October (Keinath *et al.* 1987; Morreale and Standora 1993; Braun-McNeill and Epperly 2004). The hard-shelled sea turtles (loggerheads, Kemp's ridleys, and greens) appear to be temperature limited to water no further north than Cape Cod.

Extensive survey effort of the continental shelf from Cape Hatteras to Nova Scotia, Canada in the 1980s (CeTAP 1982) revealed that loggerheads were observed at the surface in waters from the beach to waters with bottom depths of up to 4,481 meters. However, they were generally found in waters where bottom depths ranged from 22-49 meters deep (the median value was 36.6

meters; Shoop and Kenney 1992). However, 84.5% of loggerhead sightings occurred in waters where the bottom depth was less than 80 meters (Shoop and Kenney 1992). The CeTAP study did not include Kemp's ridley and green sea turtle sightings, given the difficulty of sighting these smaller sea turtle species (CeTAP 1982).

Sea turtles are generally present in Virginia waters from May to November each year, with the highest number of individuals present from June to October. Sea turtles occur throughout the Virginia portion of Chesapeake Bay, from shallow waters along the shoreline and near river mouths to deeper waters in the bay's interior and near its confluence with the Atlantic Ocean. One of the main factors influencing sea turtle presence in Mid-Atlantic waters is seasonal temperature patterns (Ruben and Morreale 1999). Temperature is correlated with the time of year, with warmer waters in the late spring, summer, and early fall being the most suitable for cold-blooded sea turtles. Sea turtles are most likely to occur in the action area when water temperatures are above 11°C, although depending on seasonal weather patterns and prey availability, they could be also present in months when water temperatures are cooler (as evidenced by fall and winter cold stunning records as well as year round stranding records). Sea turtles have also been documented in the action area through aerial and vessel surveys, satellite tracking programs, and by fisheries observers. The majority of sea turtle observations in the Chesapeake Bay and vicinity are of loggerhead sea turtles, yet all four species of sea turtles have been recorded in the action area.

To some extent, water depth also dictates the number of sea turtles occurring in a particular area. Satellite tracking studies of sea turtles in the Northeast U.S. found that foraging turtles mainly occurred in areas where the water depth was between approximately 16 and 49 feet (Ruben and Morreale 1999). This depth was interpreted not to be as much an upper physiological depth limit for turtles, as a natural limiting depth where light and food are most suitable for foraging turtles (Morreale and Standora 1990). The action area and the depths preferred by sea turtles do overlap, suggesting that if suitable forage is present, adult and juvenile loggerhead and green sea turtles as well as juvenile Kemp's ridley sea turtles may be foraging in the areas where the proposed action will occur.

### **5.5.2 Atlantic Sturgeon**

The marine and estuarine range of all five Atlantic sturgeon DPSs overlaps and extends from Canada through Cape Canaveral, Florida. Based on the best available information, Atlantic sturgeon originating from any of five DPSs could occur in the Virginia waters of Chesapeake Bay. The dredging activities associated with the proposed action will not typically occur upstream of the mouths of major Chesapeake Bay rivers, so eggs and early life stages will not be present in the action area. Juvenile, subadult, and adult Atlantic sturgeon are likely to occur in the Virginia portion of Chesapeake Bay as they are known to be present throughout the bay in spring, summer, and fall. Atlantic sturgeon are known to use the Chesapeake Bay for life functions such as spawning migrations, foraging, and as juvenile nursery habitat prior to entering marine waters as subadults.

Diets of adult and subadult Atlantic sturgeon include mollusks, gastropods, amphipods, annelids, decapods, isopods, and fish such as sand lance (Bigelow and Schroeder 1953; ASSRT 2007; Guilbard *et al.* 2007; Savoy 2007). Juvenile Atlantic sturgeon feed on aquatic insects, insect

larvae, and other invertebrates (Bigelow and Schroeder 1953; ASSRT 2007; Guilbard *et al.* 2007). Because of the benthic nature of their prey, it is likely that foraging Atlantic sturgeon could swim into and ultimately be entrapped during dredging operations in the action area.

Atlantic sturgeon from all five DPSs can be found in Virginia nearshore and coastal waters and within Chesapeake Bay, typically from spring through fall. Migratory behaviors occur from April to November for adults and subadults and year round for juveniles (Dovel and Berggren 1983; Secor *et al.* 2000; Welsh *et al.* 2002; Horne and Stence 2016). Each of these life stages are expected to wander among coastal and estuarine habitats of the bay. Foraging behaviors typically occur in areas where suitable forage and appropriate habitat conditions are present. These areas include tidally influenced flats and mud, sand, and mixed cobble substrates (Stein *et al.* 2004). The areas to be dredged and the depths preferred by Atlantic sturgeon do overlap, suggesting that if suitable forage and/or habitat features are present, adult and subadults from any of the five listed DPSs and Chesapeake Bay DPS juveniles may be foraging or undertaking migrations in the areas where the proposed action will occur.

## **6.0 EFFECTS OF THE ACTION**

This section of the Opinion assesses the direct and indirect effects of the proposed action on threatened and endangered species or critical habitat, together with the effects of other activities that are interrelated or interdependent (50 CFR § 402.02). Indirect effects are those that are caused later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR § 402.02). We have identified the use of the deeper channels by larger vessels as an interdependent or interrelated action. The action area for this consultation overlaps slightly with the river mouths of the James and York Rivers, which are designated as critical habitat for the Chesapeake Bay DPS of Atlantic sturgeon. In section 4.1, we determined the effects of the proposed action are not likely to adversely affect critical habitat.

This Opinion examines the likely effects (direct and indirect) of the proposed action on five DPSs of Atlantic sturgeon and four species of sea turtles and their habitat in the action area within the context of the species current status, the environmental baseline and cumulative effects. As explained in the Description of the Action, the action under consideration in this Opinion is the continued use of sand borrow areas for beach nourishment and hurricane protection as well as maintenance of federal navigation channels over the life of these projects. Additionally, we consider the effects of the use of dredged material disposal sites (onshore and offshore) as well as the CIEE.

The effects of dredging on listed species will be different depending on the type of dredge used. As such, the following discussion of effects of dredging will be organized by dredge type. Below, the discussion will consider the effects of dredging, including the risk of entrainment or capture of Atlantic sturgeon and sea turtles. We also consider effects of dredging and disposal on water quality, including turbidity/suspended sediment. Last, there is a discussion of other effects that are not specific to the type of equipment used. This includes effects on prey and foraging, changes in the characteristics of the dredged area and effects of dredge vessel traffic.

## 6.1 Hopper Dredge

### 6.1.1 *Interactions with Hopper Dredges – Sea Turtles*

As outlined above, sea turtles are likely to occur in Chesapeake Bay from April through mid-November each year with the largest numbers present from June through October of any year. The majority of sea turtles in the Chesapeake Bay are juvenile loggerheads; however, adult loggerheads, juvenile Kemp's ridley, and adult green sea turtles have also been documented in the area. The Chesapeake Bay is an important foraging area for sea turtles and an important developmental habitat for juvenile sea turtles, particularly loggerheads.

Entrainment is the direct uptake of aquatic organisms by the suction field generated at the draghead. Hydraulic dredges operate for prolonged periods underwater, with minimal disturbance, but generate continuous flow fields of suction forces while dredging. Loggerhead, Kemp's ridley and green sea turtles are vulnerable to entrainment in the draghead of the hopper dredge. Given their large size, leatherback sea turtles are not vulnerable to entrainment. As reported by you, no leatherback sea turtles have been entrained in hopper dredge operations operating along the U.S. Atlantic coast (USACE Sea Turtle Warehouse, 2017). Sea turtles are likely to be feeding on or near the bottom of the water column during the warmer months, with loggerhead and Kemp's ridley sea turtles being the most common species in these waters. Although not expected to be as numerous as loggerheads and Kemp's ridleys, green sea turtles are also likely to occur seasonally in the Bay.

Most sea turtles are able to escape from the oncoming draghead due to the slow speed that the draghead advances (up to 3 mph or 4.4 feet/second); however, dead sea turtles have been reported impaled on the draghead. For example, on July 23, 2018, you reported to us the lethal take of an adult loggerhead sea turtle, which was observed impaled on the teeth of the starboard draghead during hopper dredging in the Cape Henry channel. Interactions with a hopper dredge result primarily from crushing when the draghead is placed on the bottom or when an animal is unable to escape from the suction of the dredge and becomes stuck on the draghead (impingement). Entrainment occurs when organisms are sucked through the draghead into the hopper. Mortality most often occurs when animals are sucked into the dredge draghead, pumped through the intake pipe and then killed as they cycle through the centrifugal pump and into the hopper.

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

Sea turtles may become entrained in hopper dredges as the draghead moves along the bottom. Because entrainment is believed to occur primarily while the draghead is operating on the bottom, it is likely that only those species feeding or resting on or near the bottom would be vulnerable to entrainment. Turtles can also be entrained if suction is created in the draghead by current flow while the device is being placed or removed, or if the dredge is operating on an uneven or rocky substrate and rises off the bottom. Recent information from you suggests that the risk of entrainment is highest when the bottom terrain is uneven or when the dredge is conducting "clean up" operations at the end of a dredge cycle when the bottom is trenched and

the dredge is working to level out the bottom. In these instances, it is difficult for the dredge operator to keep the draghead buried in the sand and sea turtles near the bottom may be more vulnerable to entrainment.

There is some evidence to indicate that turtles can become entrained in trunions or other water intakes (see Nelson and Shafer 1996). For example, a large piece of a loggerhead sea turtle was found in a UXO screening basket on Virginia Beach in 2013. The hopper dredge was operated with UXO screens on the draghead designed to prevent entrainment of any material with a diameter greater than 1.25 inches. The pieces of turtle found were significantly larger. Because an inspection of the UXO screens revealed no damage, it is suspected that the sea turtle was entrained in another water intake port. There are also several examples of relatively large sturgeon (2-3' length) detected in inflow screening alive and relatively uninjured. Given the damage anticipated from passing through the pumps, it is possible that these sturgeon were entrained somewhere other than the draghead. You are currently investigating potential sources of entrainment and exploring the use of screening to minimize possible entrainment in areas other than the draghead.

Sea turtles have been found resting in deeper waters, which could increase the likelihood of interactions from dredging activities. In 1981, observers documented the take of 71 loggerheads by a hopper dredge at the Port Canaveral Ship Channel, Florida (Slay and Richardson 1988). This channel is a deep, low productivity environment in the Southeast Atlantic where sea turtles are known to rest on the bottom, making them extremely vulnerable to entrainment. The large number of turtle mortalities at the Port Canaveral Ship Channel in the early 1980s resulted in part from turtles being buried in the soft bottom mud, a behavior known as brumation. Since 1981, 77 loggerhead sea turtles have been taken by hopper dredge operations in the Port Canaveral Ship Channel, Florida. Chelonid turtles have been found to make use of deeper, less productive channels as resting areas that afford protection from predators because of the low energy, deep water conditions. Sea turtle brumation has not been documented in the Chesapeake Bay.

#### *6.1.1.1 Background Information on Sea Turtles Interactions with Hopper Dredges*

Sea turtles have been killed in hopper dredge operations along the East and Gulf coasts of the US. Documented turtle mortalities during dredging operations in the USACE South Atlantic Division (SAD; i.e., south of the Virginia/North Carolina border) are more common than in the USACE North Atlantic Division (NAD; Virginia-Maine) presumably due to the greater abundance of turtles in these waters and the greater frequency of hopper dredge operations. For example, in the USACE SAD, over 400 sea turtles have been entrained in hopper dredges since 1980 and in the Gulf Region over 160 sea turtles have been killed since 1995. Records of sea turtle entrainment in the USACE NAD began in 1994. Through October 2015, 85 sea turtles deaths (see Table 13) related to hopper dredge activities have been recorded in waters north of the North Carolina/Virginia border (USACE Sea Turtle Database<sup>10</sup>); the majority of these turtles have been entrained in dredges operating in Chesapeake Bay, but sea turtles can also be killed by direct contact with the draghead.

Before 1994, endangered species observers were not required on board hopper dredges and

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<sup>10</sup> The USACE Sea Turtle Data Warehouse is maintained by the USACE's Environmental Laboratory and contains information on USACE dredging projects conducted since 1980 with a focus on information on interactions with sea turtles.

dredge baskets were not inspected for sea turtles or sea turtle parts. The majority of sea turtle takes in the NAD have occurred in the Norfolk District. This is largely a function of the large number of loggerhead and Kemp's ridley sea turtles that occur in the Chesapeake Bay each summer and the intense dredging operations that are conducted to maintain the Chesapeake Bay entrance channels and for beach nourishment projects at Virginia Beach. Since 1992, the take of 10 sea turtles (all loggerheads) has been recorded during hopper dredge operations in the Philadelphia, Baltimore and New York Districts. Hopper dredging is relatively rare in New England waters where sea turtles are known to occur, with most hopper dredge operations being completed by the specialized Government owned dredge Currituck which operates at low suction and has been demonstrated to have a very low likelihood of entraining or impinging sea turtles. To date, no hopper dredge operations (other than the Currituck) have occurred in the New England District in areas or at times when sea turtles are likely to be present.

**Table 13. Sea Turtle Takes in USACE NAD Dredging Operations**

<b>Project Location</b>	<b>Year of Operation</b>	<b>Cubic Yardage Removed</b>	<b>Observed Takes</b>
Cape Henry Channel	2018	n/a	1 loggerhead
Thimble Shoals Channel	2016	1,098,514	1 loggerhead
York Spit Channel	2015	815,979	6 loggerheads
Cape Henry Channel	2014	2,165,425	3 loggerheads 1 Kemp's ridley
Sandbridge Shoal	2013	815,842	1 loggerhead <sup>11</sup>
Cape Henry Channel	2012	1,190,004	1 loggerhead
York Spit	2012	145,332	1 Loggerhead
Thimble Shoal Channel	2009	473,900	3 Loggerheads
York Spit	2007	608,000	1 Kemp's Ridley
Cape Henry	2006	447,238	3 Loggerheads
Thimble Shoal Channel	2006	300,000	1 loggerhead
Delaware Bay	2005	50,000	2 Loggerheads
Thimble Shoal Channel	2003	1,828,312	7 Loggerheads 1 Kemp's ridley 1 unknown
Cape Henry	2002	1,407,814	6 Loggerheads 1 Kemp's ridley 1 green
VA Beach Hurricane Protection Project (Cape Henry)	2002	1,407,814	1 Loggerhead

<sup>11</sup> Sea turtle observed in cage on beach (material pumped directly to beach from dredge).

York Spit Channel	2002	911,406	8 Loggerheads 1 Kemp's ridley
Cape Henry	2001	1,641,140	2 loggerheads 1 Kemp's ridley
VA Beach Hurricane Protection Project (Thimble Shoals)	2001	4,000,000	5 loggerheads 1 unknown
Thimble Shoal Channel	2000	831,761	2 loggerheads 1 unknown
York River Entrance Channel	1998	672,536	6 loggerheads
Atlantic Coast of NJ	1997	1,000,000	1 Loggerhead
Thimble Shoal Channel	1996	529,301	1 loggerhead
Delaware Bay	1995	218,151	1 Loggerhead
Cape Henry	1994	552,671	4 loggerheads 1 unknown
York Spit Channel	1994	61,299	4 loggerheads
Delaware Bay	1994	NA	1 Loggerhead
Cape May NJ	1993	NA	1 Loggerhead
Off Ocean City MD	1992	1,592,262	3 Loggerheads
			<b><i>TOTAL = 88 Turtles</i></b>

It should be noted that the observed takes may not be representative of all the turtles killed during dredge operations. Typically, endangered species observers are required to observe a total of 50% of the dredge activity (i.e., 6 hours on watch, 6 hours off watch). As such, if the observer was off watch or the cage was emptied and not inspected or the dredge company either did not report or was unable to identify the turtle incident, there is the possibility that a turtle could be taken by the dredge and go unnoticed. Additionally, in older biological opinions (i.e., prior to 1995), we frequently only required 25% observer coverage and monitoring of the overflows which has since been determined to not be as effective as monitoring of the intakes. These conditions may have led to sea turtle takes going undetected.

We raised this issue with you during the 2002 season, after several turtles were taken in the Cape Henry and York Spit Channels, and expressed the need for 100% observer coverage. On September 30, 2002, you informed the dredge contractor that when the observer was not present, the cage should not be opened unless it is clogged. This modification was to ensure that any sea turtles that were taken and on the intake screen (or in the cage area) would remain there until the observer evaluated the load. Your letter further stated, "crew members will only go into the cage and remove wood, rocks, and man-made debris; any aquatic biological material is left in the cage for the observer to document and clear out when they return on duty. In addition, the observer is the only one allowed to clean off the overflow screen. This practice provides us with 100% observation coverage and shall continue." Theoretically, all sea turtle parts were observed under this scheme, but the frequency of clogging in the cage is unknown at this time. The most effective way to attain 100% observer coverage is to have a NMFS-approved endangered species observer monitoring all loads at all times. This level of observer coverage would document all

turtle interactions and better quantify the impact of dredging on turtle populations.

It is likely that not all sea turtles killed by dredges are observed onboard the hopper dredge. Several sea turtles stranded on Virginia shores with crushing type injuries from May 25 to October 15, 2002. The Virginia Aquarium and Marine Science Center (formerly the Virginia Marine Science Museum (VMSM)) found 10 loggerheads, 2 Kemp's ridleys, and 1 leatherback exhibiting injuries and structural damage consistent with what they have seen in animals that were known dredge takes. While in some cases it may not be conclusively determined that these strandings were the result of dredge interactions, the link is possible given the location of the strandings (e.g., in the southern Chesapeake Bay near ongoing dredging activity), the time of the documented strandings in relation to dredge operations, the lack of other ongoing activities which may have caused such damage, and the nature of the injuries (e.g., crushed or shattered carapaces and/or flipper bones, black mud in mouth). Additionally, in 1992, three dead sea turtles were found on an Ocean City, Maryland beach while dredging operations were ongoing at a borrow area located 3 miles offshore. Necropsy results indicate that the deaths of all three turtles were dredge related. It is unknown if turtles observed on the beach with these types of injuries were crushed by the dredge and subsequently stranded on shore or whether they were entrained in the dredge, entered the hopper and then were discharged onto the beach with the dredge spoils.

A dredge could crush an animal as it was setting the draghead on the bottom, or if the draghead was lifting on and off the bottom due to uneven terrain, but the actual cause of these crushing injuries cannot be determined at this time. Further analyses need to be conducted to better understand the link between crushed strandings and dredging activities, and if those strandings need to be factored into an incidental take level. As mentioned above, necropsy results can determine whether the cause of death was due to an interaction with dredge gear. When necessary, we believe that necropsies on stranded sea turtles will help determine not only whether the death was due to dredging activities, but also relevant information about the nature of the interaction (i.e., the specific dredging activity that led to the interaction). Regardless, it is possible that dredges are taking animals that are not observed on the dredge, which may result in strandings on nearby beaches.

Due to the nature of interactions between listed species and dredge operations, it is difficult to predict the number of interactions that are likely to occur from a particular dredging operation. Projects that occur in an identical location with the same equipment year after year may result in interactions in some years and none in other years as noted above in the examples of sea turtle takes. Dredging operations may go on for months, with sea turtle takes occurring intermittently throughout the duration of the action. For example, dredging occurred at Cape Henry over 160 days in 2002 with 8 sea turtle takes occurring over 3 separate weeks while dredging at York Spit in 1994 resulted in 4 sea turtle takes in one week. In Delaware Bay, dredge cycles have been conducted during the May-November period with no observed entrainment; in contrast, as many as two sea turtles have been entrained in as little as three weeks. Even in locations where thousands of sea turtles are known to be present (i.e., Chesapeake Bay) and where dredges are operating in areas with preferred sea turtle depths and forage items (as evidenced by entrainment of these species in the dredge), the numbers of sea turtles entrained is an extremely small percentage of the likely number of sea turtles in the action area. This is likely due to the

distribution of individuals throughout the action area, the relatively small area which is affected at any given moment and the ability of some sea turtles to avoid the dredge even if they are in the immediate area.

The number of interactions between dredge equipment and sea turtles seems to be best associated with the volume of material removed, which is closely correlated to the length of time dredging takes, with a greater number of interactions associated with a greater volume of material removed and a longer duration of dredging. The number of interactions is also heavily influenced by the time of year dredging occurs (with more interactions correlated to times of year when more sea turtles are present in the action area) and the type of dredge plant used (sea turtles are apparently capable of avoiding pipeline and mechanical dredges as no takes of sea turtles have been reported with these types of dredges). The number of interactions may also be influenced by the terrain in the area being dredged, with interactions more likely when the draghead is moving up and off the bottom frequently. Interactions are also more likely at times and in areas when sea turtle forage items are concentrated in the area being dredged, as sea turtles are more likely to be spending time on the bottom while foraging.

We have compiled a dataset representing all of the hopper dredge projects in the Norfolk District that have reported the cubic yardage removed as well as the number of takes observed. The table below includes records for all projects in the Norfolk District since 1994 and indicates the volume of material removed during “sea turtle season” (i.e., April - November).

**Table 14. Projects in Norfolk District since 1994.**

Project Location	Dredging Dates	CY of Material Removed	% during sea turtle season	Volume Removed during turtle season	total sea turtles	Log	KR	green	unknown
Cape Henry Channel	7/23/18	n/a	1.000	1,000	1	1	0	0	0
Thimble Shoals Channel	4/26/17-8/31/17	1,098,514	1.000	1,098,514	1	1	0	0	0
York Spit Channel	5/23/15 – 8/4/15	815,979	1.000	815,979	6	6	0	0	0
Cape Henry Channel	4/2/15 – 6/1/15	478,566	1.000	478,566	0	0	0	0	0
Cape Henry Channel	4/23/14 – 9/5/14	1,686,859	1.000	1,686,859	4	3	1	0	0
Thimble Shoals Channel	4/23/14 – 7/31/14	863,933	1.000	863,933	0	0	0	0	0
VA Beach Hurricane Protection (Thimble Shoal Channel)	6/26/13 – 8/1/13	724,290	1.000	724,290	0	0	0	0	0
Sandbridge Beach	3/14/13 – 6/25/13	851,842	0.35	851,842	1	1	0	0	0
VA Beach Hurricane Protection (Atlantic Ocean Channel)	1/6/13-3/3/13	716,000	0.00	-	0	0	0	0	0
Craney Island	12/30/12-3/31/13, 4/1/13 –	1,534,123	0.05	188,123	0	0	0	0	0

	4/12/13								
Cape Henry Channel	1/29/12 - 4/12/12	1,190,004	0.162	192,780.65	1	1	0	0	0
York Spit	3/1/12 - 3/8/12, 4/3/12 - 4/5/2012	145,332	0.200	29,066.40	1	1	0	0	0
Cape Henry Channel	2/9/11-5/10/11	957,996	0.444	425,350.22	0	0	0	0	0
York Spit	1/9/11-4/24/11	1,503,517	0.153	230,038.10	0	0	0	0	0
Thimble Shoals	12/19/10-2/27/11; 4/19/11-4/21/11	368,104	0.000	-	0	0	0	0	0
Thimble Shoals	4/4/09-5/20/09	370,412	1.000	370,412.00	3	3	0	0	0
York Spit	6/18/07-7/03/07; 7/13/07-08/05/07	415,626	1.000	415,626.00	1	0	1	0	0
Atlantic Ocean Channel (Deepening)	12/24/05-04/8/06; 4/16/06-4/19/06	1,185,436	0.109	129,212.52	0	0	0	0	0
Cape Henry Channel	6/15/06-7/21/06	447,238	1.000	447,238.00	3	3	0	0	0
Thimble Shoal Channel	6/13/06-6/30/06; 7/10/06-7/27/06	419,624	1.000	419,624.00	1	1	0	0	0
York Spit Channel	04/01/04-04/06/04; 5/23/04-	93,665	1.000	93,665.00	0	0	0	0	0

	5/28/04								
Thimble Shoal Channel	4/5/04-4/20/04; 4/30/04-5/01/04; 5/29/04-6/16/04	426,588	1.000	426,588.00	0	0	0	0	0
York River Entrance Channel	9/9/03-9/11/03; 10/17/03-11/30/03	268,641	1.000	268,641.00	0	0	0	0	0
Sandbridge Beach	05/1/03-5/25/03	1,500,000	1.000	1,500,000.00	0	0	0	0	0
Thimble Shoal Channel (VA Beach)	8/24/03-12/28/03	1,300,223	0.778	1,011,573.49	9	7	1	0	1
Cape Henry Channel	4/12/02-8/19/02; 10/21/02-11/02/02	2,449,285	1.000	2,449,285.00	8	6	1	1	0
York Spit Channel	8/20/02-10/21/02; 11/03/02-11/05/02	978,846	1.000	978,846.00	9	8	1	0	0
Cape Henry Channel	09/17/01-01/14/02	1,641,140	0.622	1,020,789.08	3	2	1	0	0
VA Beach Hurricane Protection (Thimble Shoal Channel)	6/26/01-11/30/01	4,000,000	1.000	4,000,000.00	6	5	0	0	1
Cape Henry Channel	04/08/00-06/02/00	541,037	1.000	541,037.00	0	0	0	0	0
Thimble Shoal	6/22/00-	1,370,316	0.667	914,000.77	3	2	0	0	1

Channel	7/31/00; 8/13/00- 9/19/00; 12/16/99- 1/23/00								
Cape Henry Channel	1/5/98- 3/25/98	1,169,639	0.000	-	0	0	0	0	0
York River Entrance Channel	8/22/98- 11/03/98	853,743	1.000	853,743.00	6	6	0	0	0
York Spit Channel	3/26/98- 5/31/98	371,200	0.924	342,988.80	0	0	0	0	0
Cape Henry Channel	1/05/98- 3/25/98	1,169,639	0.000	-	0	0	0	0	0
Thimble Shoal Channel	05/07/96- 06/03/96	282,431	1.000	282,431.00	1	1	0	0	0
Cape Henry Channel	02/19/95- 5/16/95	534,362	0.409	218,554.06					
Cape Henry Channel	4/11/94- 5/12/94; 5/27/94- 6/20/94	739,642	1.000	739,642.00	5	4	0	0	1
York Spit Channel	6/21/94- 6/28/94	141,434	1.000	141,434.00	4	4	0	0	0
<b>TOTAL:</b>				<b>25,150,672</b>	<b>77</b>	<b>66</b>	<b>6</b>	<b>1</b>	<b>4</b>

#### *6.1.1.2 Predicted Entrainment in Proposed Hopper Dredging*

Based on the data in Table 14, we calculate that an average of one sea turtle is entrained for approximately every 320,000 cubic yards (cy) removed (25,150,672 CY removed April – November divided by 77 sea turtles). This calculation has been based on a number of assumptions including the following: that sea turtles are evenly distributed throughout all channel reaches for which takes have occurred, that all dredges will take an identical number of sea turtles, and that sea turtles are equally likely to be encountered throughout the April to November time frame. Based on these calculations, we expect that for any hopper dredging project in any of the channels or borrow areas considered in this Opinion during the time of year when sea turtles are likely to be present, one sea turtle is likely to be entrained for every 320,000 cy of material removed by a hopper dredge. While this estimate is based on several assumptions, it is reasonable because it uses the best available information on entrainment of sea turtles from past dredging operations in the action area, includes multiple projects over several years, and all of the projects have had observer coverage.

Of the 77 entrained sea turtles, 73 have been identifiable to species; 66 were loggerheads, 6 Kemp's ridley and 1 green. Overall, of those identified to species, 90% were loggerheads, 8% Kemp's ridley and 2% green. The high percentage of loggerheads is likely due to several factors including their tendency to forage on the bottom where the dredge is operating and the fact that this species is the most numerous of the sea turtle species in Northeast and Mid-Atlantic waters. It is likely that the documentation of only one green sea turtle entrainment in Virginia dredging operations is a reflection of the low numbers of green sea turtles that occur in waters north of North Carolina.

Based on the above information, it is reasonable to expect that one sea turtle is likely to be injured or killed for approximately every 320,000 cy of material removed from the channels and borrow areas considered in this Opinion when dredging is carried out between April and November, and that 90% will be loggerheads, 8% will be Kemp's ridley and 2% will be green. Because sea turtles do not occur in the action area from December – March, we do not expect any entrainment during these months. Based on the information outlined above and the volume of material estimated to be removed from each reach during the time of year when sea turtles are likely to be present (in parentheses below), we anticipate the following levels of entrainment during hopper dredge activities:

**Table 15. Estimated Sea Turtle Takes During Construction**

<b>Project</b>	<b>Total Volume</b>	<b>Number of Interactions</b>			
		<b>Total Sea Turtles</b>	<b>Loggerhead</b>	<b>Kemp's ridley</b>	<b>Green</b>
Atlantic Ocean Channel	16,074,736	50	45	4	1
Thimble Shoals Channel	18,069,823	56	50	4	2
Thimble Shoals Channel Meeting Area #1 & #2	7,191,000	22	20	2	0
Sewells Point to Lamberts Bend	12,147,318	38	34	3	1
Anchorage F	1,914,788	6	5	1*	1*
Newport News Channel	4,906,284	15	14	1	0
CIEE	19,500,000	61	55	5	1
<b>TOTAL:</b>			<b>223</b>	<b>20</b>	<b>6</b>

\*1 Kemp's ridley or green

**Table 16. Estimated Sea Turtle Takes During Maintenance Dredging**

Project	Total Volume (cubic yards)	Number of Interactions			
		Total Sea Turtles	Loggerhead	Kemp's ridley	Green
Atlantic Ocean Channel	15,191,112	47	42	4	1
Thimble Shoals Channel	24,331,540	76	68	6	2
Thimble Shoals Channel Meeting Area #1 & #2	3,640,924	11	10	1	0
Sewells Point to Lamberts Bend	42,346,689	132	119	10	3
Anchorage F	7,590,328	24	22	2	0
Newport News Channel	6,676,305	21	19	2	0
<b>TOTAL:</b>			<b>280</b>	<b>25</b>	<b>6</b>

Project	Total Volume (cubic yards)	Number of Interactions			
		Total Sea Turtles	Loggerhead	Kemp's ridley	green
Baltimore Harbor Entrance Channels	64,500,000	215	194	17	4
Virginia Beach Hurricane Project (TSS and AO borrow areas)	4,400,000	15	13	1*	1*
Sandbridge Shoal	12,500,000	42	38	3	1
<b>TOTAL:</b>			<b>245</b>	<b>21</b>	<b>6</b>

\*1 Kemp's ridley or green

### 6.1.2 *Hopper Dredge Entrainment – Atlantic Sturgeon*

Atlantic sturgeon are vulnerable to entrainment in hopper dredges. Entrainment is believed to occur primarily when the draghead is not in firm contact with the channel bottom, so the potential exists that sturgeon feeding or resting on or near the bottom may be vulnerable to entrainment. Additionally, the size and flow rates produced by the suction power of the dredge, the condition of the channel being dredged, and the method of operation of the dredge and draghead all relate to the potential of the dredge to entrain sturgeon (Reine and Clarke 1998). These parameters also govern the ability of the dredge to entrain other species of fish, sea turtles, and shellfish.

The risk of interactions is related to both the amount of time sturgeon spend on the bottom and the behavior the fish are engaged in (i.e., whether the fish are overwintering, foraging, resting or migrating) as well as the intake velocity and swimming abilities of sturgeon in the area (Clarke 2011). Intake velocities at a typical large self-propelled hopper dredge are 11 feet per second. As noted above, exposure to the suction of the draghead intake is minimized by not turning on the suction until the draghead is properly seated on the bottom sediments and by maintaining contact between the draghead and the bottom.

A significant factor influencing potential entrainment is based upon the swimming stamina and size of the individual fish at risk (Boysen and Hoover 2009). Swimming stamina is positively correlated with total fish length. Entrainment of larger sturgeon is less likely due to the increased swimming performance and the relatively small size of the draghead opening. Juvenile entrainment is possible depending on the location of the dredging operations and the time of year in which the dredging occurs. Typically, major concerns of juvenile entrainment relate to fish below 200 mm (Hoover *et al.*, 2005; Boysen and Hoover, 2009). Juvenile sturgeon are not as powerful swimmers as older, larger fish and they are prone to bottom-holding behaviors, which make them more vulnerable to entrainment when in close proximity to dragheads (Hoover *et al.*, 2011).

In general, entrainment of large mobile animals, such as sturgeon, is relatively rare. Several factors are thought to contribute to the likelihood of entrainment. In areas where animals are present in high density, the risk of an interaction is greater because more animals are exposed to the potential for entrainment. The risk of entrainment is likely to be higher in areas where the movements of animals are restricted (e.g., in narrow rivers or confined bays) where there is limited opportunity for animals to move away from the dredge than in unconfined areas such as wide rivers or open bays. The hopper dredge draghead operates on the bottom and is typically at least partially buried in the sediment. Sturgeon are benthic feeders and are often found at or near the bottom while foraging or while moving within rivers. Sturgeon at or near the bottom could be vulnerable to entrainment if they were unable to swim away from the draghead.

Entrainment of Atlantic sturgeon during hopper dredging operations in Federal navigation channels appears to be relatively rare. From 1990-2012, USACE documented 28 incidents of sturgeon entrainment on monitored hopper dredges (see Appendix C). Of these, 20 were Atlantic sturgeon, five were shortnose and two were Gulf sturgeon (one unknown). Since that report was generated, one Atlantic sturgeon was entrained in the Ambrose Channel, New York

(October 2012; alive); one Atlantic sturgeon was entrained in the Delaware River in May 2013 (released alive); five sturgeon were entrained in the Delaware River by hopper dredges in 2014; and two sturgeon were entrained in 2017. USACE-Norfolk District and Baltimore District hopper dredging projects have been monitored in the Chesapeake Bay from 1994 to present. During this period, observers have been present during the removal of more than 18 million cubic yards of dredged material from the channels considered in this consultation (see Table 14 above) with only two documented entrainments of Atlantic sturgeon.

As explained above, since 1994, endangered species observers have been present for at least a portion of all hopper dredging done during the April – November time frame in the action area. Only two entrained Atlantic sturgeon have been documented during any hopper dredge activity in the action area, both in YSC in April 2011. Additionally, during sea turtle relocation trawling conducted in the fall of 2003 in conjunction with the 50-foot deepening of the inbound element of the Thimble Shoal Channel, 14 Atlantic sturgeon were captured by the trawler and released live in and around the channel; no incidental takes of Atlantic sturgeon by hopper dredge were observed during this period.

On a hopper dredge, it is possible to monitor entrainment because the dredged material is retained on the vessels as opposed to the direct placement of dredged material both overboard or in confined disposal facilities by a hydraulic pipeline dredge. A hopper dredge contains screened inflow cages from which an observer can inspect recently dredged contents. Typically, the observer inspection is performed at the completion of each load while the vessel is transiting to the authorized placement area and does not impact production of the dredging operations.

In the fall of 2003, the Norfolk District captured fourteen Atlantic sturgeon during sea turtle relocation trawling activities supporting hopper dredging operations in Thimble Shoals Channel in the Chesapeake Bay. The Atlantic sturgeon were captured in the immediate vicinity of the dredging operation with no entrainment observed by NMFS approved observers onboard the hopper dredge before, during or after the relocation trawling where Atlantic sturgeon were captured.

Given the large size of adults (greater than 150cm) and the size of the openings on the dragheads, adult Atlantic sturgeon are unlikely to be vulnerable to entrainment. USACE reports that from 1990-2012, 37 confirmed interactions with sturgeon occurred during dredge operations (see Appendix C). Of these, 22 were reported as Atlantic sturgeon (20 individuals; two individuals were observed in 2 separate pieces), with 19 of these entrained in hopper dredges. Of the entrained Atlantic sturgeon for which size is available, all were subadults (larger than 50cm but less than 150cm). Information on these interactions is presented in Table 17. Most of these interactions occurred within rivers and harbors.

**Table 17. USACE Atlantic Sturgeon Entrainment Records from Hopper Dredge Operations 1990-2012**

<b>Project Location</b>	<b>Corps Division/District *</b>	<b>Month/Year Interaction Observed</b>	<b>Cubic Yards Removed</b>	<b>Observed** Entrainment</b>
Winyah Bay, Georgetown (SC)	SAD/SAC	Oct-90	517,032	1
Savannah Harbor (GA)	SAD/SAS	Jan-94	2,202,800	1
Savannah Harbor	SAD/SAS	Dec-94	2,239,800	2
Wilmington Harbor, Cape Fear River (NC)	SAD/SAW	Sep-98	196,400	1
Charleston Harbor (SC)	SAD/SAC	Mar-00	5,627,386	2
Brunswick Harbor (GA)	SAD/SAS	Feb-01	1,459,630	1
Charleston Harbor	SAD/SAC	Jan-04	1,449,234	1
Brunswick Harbor	SAD/SAS	Mar-05	966,000	1
Brunswick Harbor	SAD/SAS	Dec-06	1,198,571	1
Savannah Entrance Channel	SAD/SAS	Jan-07	973,463	1
Savannah Entrance Channel	SAD/SAS	Mar-09	261,780	1
Brunswick Entrance Channel	SAD/SAS	Feb-10	1,728,339	3
Wilmington Harbor	SAD/SAW	Dec-10	857,726	1
York Spit (VA)	NAD/NAN	Apr-11	1,630,713	2
Charleston Harbor	SAD/SAC	Mar-12	1,100,000	1
		<b>Total</b>	<b>22,408,874</b>	<b>20</b>

\* SAD= South Atlantic Division; NAD= North Atlantic Division; SAC=Charleston District; SAS=Savannah District; SAW=Wilmington District; NANY=New York District; NAN=Norfolk District.

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

The only instances of observed Atlantic sturgeon entrainment in hopper dredges in our Greaer Atlantic Region are two sturgeon entrained at York Spit, VA in 2011 (both were killed), one live Atlantic sturgeon entrained in Sandy Hook, NJ in 2008, one dead Atlantic sturgeon entrained in Ambrose Channel, NY in 2012, and seven in the Delaware River between 2013 and 2017. As

described in the discussion of sea turtles above, many other hopper dredge projects have occurred in our Greater Atlantic Region; nearly all of which overlap with times and areas where Atlantic sturgeon are known to be present. Because observers have been present on these dredges and we expect that any interactions with Atlantic sturgeon would have been reported to us, the interaction rate between hopper dredges and Atlantic sturgeon seems to be very low (1 Atlantic sturgeon for every 9 mcy removed for the action area, just considering the volume of material removed when observers were present). Even just considering the projects listed in Table 17, where entrainment was recorded, we calculate an entrainment rate of one Atlantic sturgeon for approximately every 1.2 million cy of material removed. If we consider all projects in the action area where observers were present (see table 14) as well as projects outside the action area where interactions with Atlantic sturgeon were recorded (see table 17), we calculate an entrainment rate of 1 Atlantic sturgeon for every 2 mcy removed.

The entrainment estimate generated above using all projects in the Chesapeake Bay where observers have been present plus all projects in rivers and bays where entrained Atlantic sturgeon have been observed is an overestimate because it does not consider other projects outside the action area where no entrainment occurred. However, at this time, it is the best available estimate of entrainment rates for Atlantic sturgeon and hopper dredges. Just using the projects within the Chesapeake Bay (table 14) is likely to be an underestimate because there has only been observer coverage between April and November and Atlantic sturgeon may be present year round.

Based on the above information, we expect one Atlantic sturgeon to be entrained for approximately every two mcy of material removed with a hopper dredge. Given the size of adult Atlantic sturgeon (greater than 150cm) and the size of observed entrained sturgeon (less than 150cm), we do not anticipate the entrainment of any adult Atlantic sturgeon. Given the location of the channels and borrow areas to be dredged, juveniles, subadults, and adults will be present; therefore, we anticipate that all entrained Atlantic sturgeon will be juveniles and subadults less than 150cm in size.

There is evidence that some Atlantic sturgeon, particularly juveniles and small subadults, could be entrained in the dredge and survive. However, as the extent of internal injuries and the likelihood of survival is unknown, and the size of the fish likely to be entrained is impossible to predict, it is reasonable to conclude that any Atlantic sturgeon entrained in the hopper dredge are likely to be killed. Based on the NEFOP mixed-stock analysis, we have determined that Atlantic sturgeon in the action area likely originate from the five DPSs at the following frequencies: NYB 49%; South Atlantic 20%; Chesapeake Bay 14%; Gulf of Maine 11%; and Carolina 4%; we anticipate that entrained Atlantic sturgeon will occur at similar frequencies.

**Table 18. Expected Entrainment of Atlantic sturgeon in hopper dredges during construction**

Project	Total Volume	Number of Interactions					
		Total Atlantic sturgeon	NYB DPS	SA DPS	CB DPS	GOM DPS	Carolina DPS
Atlantic Ocean Channel	16,074,736	8	4	2	1	1	0
Thimble Shoals Channel	18,069,823	9	5	2	1	1	0
Thimble Shoals Meeting Areas #1 & #2	7,191,000	4	2	1	1	0	0
Sewell's Point to Lamberts Bend	12,147,318	6	3	1	1	1	0
Anchorage F	1,914,788	1	1*	1*	1*	1*	1*
Newport News Channel	4,906,284	3	1	1	1*	1*	1*
CIEE	19,500,000	10	5	2	1	1	1
<b>Total:</b>			<b>21</b>	<b>10</b>	<b>7</b>	<b>6</b>	<b>3</b>

**Table 19. Expected Entrainment of Atlantic sturgeon in hopper dredges during maintenance over the life of the project.**

Project	Total Volume	Number of Interactions					
		Total Atlantic sturgeon	NYB DPS	SA DPS	CB DPS	GOM DPS	Carolina DPS
Atlantic Ocean Channel	15,191,112	8	4	2	1	1	0
Thimble Shoals Channel	24,331,540	12	6	2	2	1	1
Thimble Shoals Meeting Areas #1 & #2	3,640,924	2	1	1*	1*	1*	1*
Sewell's Point to Lamberts Bend	42,346,689	21	11	4	3	2	1
Anchorage F	7,590,328	4	2	1	1	0	0
Newport News Channel	6,676,305	3	3	1	1*	1*	1*
<b>Total:</b>			<b>27</b>	<b>11</b>	<b>9</b>	<b>6</b>	<b>4</b>

Project	Total Volume	Number of Interactions					
		Total Atlantic sturgeon	NYB DPS	SA DPS	CB DPS	GOM DPS	Carolina DPS
Baltimore Harbor Entrance Channels	64,500,000	32	16	6	5	4	1
Virginia Beach Hurricane Project	4,400,000	2	1	1*	1*	1*	1*
Sandbridge Shoal	12,500,000	6	3	1	1	1*	1*
<b>Total:</b>			<b>20</b>	<b>8</b>	<b>7</b>	<b>6</b>	<b>3</b>

\*Using the 1 fish per 2 mil cy of dredge material method for estimating takes from entrainment in hopper dredges described above, we estimated take of <1 sturgeon, so using our mixed-stock analysis the individual could originate from any one of the these DPSs.

### 6.1.3 *Interactions with the Sediment Plume - Hopper Dredge*

Physical and biological impairments to the water column can occur from increases in turbidity which can alter light penetration. The proposed dredging will cause temporary increases in turbidity and suspension of sediments during dredging operations. As a result, the increase in turbidity can impact primary productivity and respiration of organisms within the project area. The re-suspension of sediments from dredging and dredged material placement can prevent or reduce gas-water exchanges in the gills of fish (Germano and Cary, 2005; Clarke and Wilber, 2000). The amount of impact that this can have on a species is dependent on the sensitivity of that species. This increase in turbidity can also impact prey species' predator avoidance response ability due to the decreased clarity in the water column.

Increased suspended sediment resulting from dredging can also reduce dissolved oxygen. Low dissolved oxygen conditions can be generated by the dredging operations from the resuspension of sediments and the biochemical oxygen demand of the surrounding water (Johnston, 1981). This can be particularly important during the summer months when water temperatures are warmer and less capable of holding dissolved oxygen. Dredging during the warmer months can exacerbate low dissolved oxygen conditions (Hatin *et al.*, 2007a).

Dredging operations cause sediment to be suspended in the water column. This results in a

sediment plume in the water, typically present from the dredge site and decreasing in concentration as sediment falls out of the water column as distance increases from the dredge site. The nature, degree, and extent of sediment suspension around a dredging operation are controlled by many factors including: the particle size distribution, solids concentration, and composition of the dredged material; the dredge type and size, discharge/cutter configuration, discharge rate, and solids concentration of the slurry; operational procedures used; and the characteristics of the hydraulic regime in the vicinity of the operation, including water composition, temperature and hydrodynamic forces (i.e., waves, currents, etc.) causing vertical and horizontal mixing (USACE 1983).

Resuspension of fine-grained dredged material during hopper dredging operations is caused by the dragheads as they are pulled through the sediment, turbulence generated by the vessel and its prop wash, and overflow of turbid water during hopper filling operations. During the filling operation, dredged material slurry is often pumped into the hoppers after they have been filled with slurry in order to maximize the amount of solid material in the hopper. The lower density, turbid water at the surface of the filled hoppers overflows and is usually discharged through ports located near the waterline of the dredge. Use of this “overflow” technique results in a larger sediment plume than if no overflow is used. In 1998, a study was done of overflow and nonoverflow hopper dredging using the McFarland hopper dredge (USACE 2013). Monitoring of the sediment plumes was accomplished using a boat-mounted 1,200-kHz Broad-Band Acoustic Doppler Current Profiler (ADCP). The instrument collects velocity vectors in the water column together with backscatter levels to determine the position and relative intensity of the sediment plume. Along with the ADCP, a MicroLite recording instrument with an Optical Backscatterance (OBS) Sensor was towed by the vessel at a depth of 15 ft. The MicroLite recorded data at 0.5-sec intervals. Navigation data for monitoring were obtained by a Starlink differential Global Positioning System (GPS). The GPS monitors the boat position from the starting and ending points along each transect.

Transects were monitored in the test area to obtain the background levels of suspended materials prior to dredging activities. A period of 8 minutes following the dredge passing during non-overflow dredging showed the level of suspended material to be returning to background levels. No lateral dispersion of the plume out of the channel was observed during the non-overflow dredging operation. During overflow dredging, a wider transect was performed to determine the lateral extent of the plume. No significant change above background levels could be detected. At 1-hr elapsed time following the end of the overflow dredging operation, the levels of suspended material returned to background conditions. Again, no lateral dispersion of the plume out of the channel area was observed.

Overall, water quality impacts are anticipated to be minor and temporary in nature. Once dredging operations are complete the project area will soon return to ambient conditions due to the dilution or re-deposition of suspended sediments along with the strong littoral currents of the Chesapeake Bay, its river mouths, and the Atlantic Ocean.

No information is available on the effects of total suspended solids (TSS) on juvenile and adult sea turtles. TSS is most likely to affect sea turtles if a plume causes a barrier to normal behaviors or if sediment settles on the bottom affecting sea turtle prey. As sea turtles are highly mobile they are likely to be able to avoid any sediment plume, which is expected to be limited to the

navigation channel and for no more than 8 minutes. Any effect on sea turtle movements between foraging areas or while migrating through the action area is likely to be so small that it cannot be meaningfully measured or detected and is therefore insignificant.

Studies of the effects of turbid water on fish suggest that concentrations of suspended solids can reach thousands of milligrams per liter before an acute toxic reaction is expected (Burton 1993). The TSS levels expected for all of the proposed activities (ranging from 5 mg/L to 475 mg/L) are below those shown to have adverse effect on fish (580 mg/L for the most sensitive species, with 1,000 mg/L more typical; see summary of scientific literature in Burton 1993) and benthic communities (390 mg/L (EPA 1986)). With the exception of near field hopper dredge impacts, TSS levels will not reach levels that are toxic to benthic communities. We expect elevated levels of TSS to settle out of the water column in about an hour. Mobile prey items will likely be able to uncover themselves from any deposited sediment, while a small percentage of non-mobile prey in the near field range of a hopper may be buried/suffocated. Therefore, effects to sturgeon and sea turtle foraging opportunities from TSS impacts to benthic communities in the navigation channel are largely temporary and limited to a small area (i.e., the near-field range of where remaining hopper dredge deepening and maintenance dredging of shoals will occur). Using the data you have provided, the total area subject to deepening and maintenance dredging is approximately 7,492 acres. The additional area potentially impacted by near field hopper dredging plumes beyond the area to be dredged would be slightly larger, as turbidity plumes extend away from the dredge footprint. This area is approximately .26% of the area in Chesapeake Bay. Effects on sturgeon and sea turtle fitness from reduced prey in these small areas relative to available foraging areas in the rest of the action area are too small to be meaningfully measured or detected, and are insignificant.

The life stages of sturgeon most vulnerable to increased sediment are eggs and non-mobile larvae, which are subject to burial and suffocation. As noted above, because of the distance of the projects from the spawning grounds, no Atlantic sturgeon eggs and/or larvae will be present in the action area. Any Atlantic sturgeon in the action area during dredging would be capable of avoiding any sediment plume by swimming around it. Laboratory studies (Niklitschek 2001 and Secor and Niklitschek 2001) have demonstrated shortnose and Atlantic sturgeon are able to actively avoid areas with unfavorable water quality conditions and that they will seek out more favorable conditions when available. While the increase in suspended sediments may cause sturgeon to alter their normal movements, any change in behavior will only involve movement further up in the water column, or movement to an area just outside of the navigation channel. Based on the best available information, we will not be able to meaningfully detect, evaluate, or measure the effects of re-suspended sediment on sturgeon resulting from proposed activities when added to baseline conditions. Therefore, effects on mobile sturgeon are insignificant.

## **6.2 Hydraulic Cutterhead Dredge**

Hydraulic pipeline dredges tend to be more efficient than the hopper style dredges because the pipeline conveys sand directly to the placement site. However, hydraulic pipeline dredges are not well-adapted to work in environments with high wave energy. Most pipeline dredges have a cutterhead on the suction end. A cutterhead is a mechanical device that has rotating blades or teeth to break up or loosen the bottom material so that it can be sucked through the dredge. Some cutterheads are rugged enough to break up rock for removal. Pipeline dredges are

mounted (fastened) to barges and are not usually self-powered, but are towed to the dredging site and secured in place by special anchor piling, called spuds. To move the dredge, the operator's raises and lowers opposite spuds to crab crawl the dredge along at a much slower pace than hopper style dredges and are subsequently less maneuverable. A hydraulic pipeline dredge removes material by controlling the dragline on which the suction cutterhead is attached. This style of dredge works more efficiently when it can move slowly and remove deeper materials as it moves along using the spuds. Material is directly mixed with water as it is sucked into the pipeline and hydraulically pumped and sent directly to the spoil disposal site. This makes this style dredge more efficient than a hopper style dredge that is required to move to a pump-out site to dispose of material. The suction is created by hydraulic pumps either located on board or in route along the pipeline acting as a booster and creates the same low pressure around the drag heads as a hopper dredge to force the material along the pipeline. As with the hopper style dredge, the more closely the cutterhead is maintained in contact with the sediment, the more efficient the dredging.

Sea turtles are not known to be vulnerable to entrainment in cutterhead dredges. This is thought to be due to the size of sea turtles and their swimming ability that allows them to escape the intake velocity near a cutterhead. There are no records of any sea turtles being entrained in cutterhead dredges in the Chesapeake Bay or anywhere else. Based on the available information, we do not anticipate any entrainment of sea turtles any time a cutterhead dredge is used.

#### ***6.2.1 Available Information on the Risk of Entrainment of Sturgeon in Cutterhead Dredge***

As noted above, a cutterhead dredge operates with the dredge head buried in the sediment; however, a flow field is produced by the suction of the operating dredge head. The amount of suction produced is dependent on linear flow rates inside the pipe and the pipe diameter (Clausner and Jones 2004). High flow rates and larger pipes create greater suction velocities and wider flow fields. The suction produced decreases exponentially with distance from the dredge head (Boysen and Hoover 2009). With a cutterhead dredge, material is pumped directly from the dredged area to a disposal site. As such, there is no opportunity to monitor for biological material on board the dredge; rather, observers work at the disposal site to inspect material.

It is generally assumed that sturgeon are mobile enough to avoid the suction of an oncoming cutterhead dredge and that any sturgeon (with the exception of eggs and immobile larvae) in the vicinity of such an operation would be able to avoid the intake and escape. However, in mid-March 1996, two shortnose sturgeon were found in a dredge discharge pool on Money Island, near Newbold Island in the upper Delaware River. The dead sturgeon were found on the side of the spoil area into which the hydraulic pipeline dredge was pumping. An assessment of the condition of the fish indicated that the fish were likely alive and in good condition prior to entrainment and that they were both adult females. The area where dredging was occurring was a known overwintering area for shortnose sturgeon and large numbers of shortnose sturgeon were known to be concentrated in the general area. A total of 509,946 cy were dredged between Florence and the upper end of Newbold Island during this dredge cycle. Since that time, dredging occurring in the winter months in the Newbold – Kinkora range of the Delaware River required that inspectors conduct daily inspections of the dredge spoil area in an attempt to detect the presence of any sturgeon. In January 1998, three shortnose sturgeon carcasses were

discovered in the Money Island Disposal Area. The sturgeon were found on three separate dates: January 6, January 12, and January 13. Dredging was being conducted in the Kinkora and Florence ranges at this time which also overlaps with the shortnose sturgeon overwintering area. A total of 512,923 cy of material was dredged between Florence and upper Newbold Island during that dredge cycle. While it is possible that not all shortnose sturgeon killed during dredging operations were observed at the dredge disposal pool, USACE has indicated that due to flow patterns in the pool, it is expected that all large material (i.e., sturgeon, logs etc.) will move towards the edges of the pool and be readily observable. Monitoring of dredge disposal areas used for deepening of the Delaware River with a cutterhead dredge has occurred. Dredging in Reach C occurred from March – August 2010 with 3,594,963 cy of material removed with a cutterhead dredge. Dredging in Reach B occurred in November and December 2011, with 1,100,000 cy of material removed with a cutterhead dredge. In both cases, the dredge disposal area was inspected daily for the presence of sturgeon. No sturgeon were detected.

In an attempt to understand the behavior of sturgeon while dredging is ongoing, the USACE worked with sturgeon researchers to track the movements of tagged Atlantic and shortnose sturgeon while cutterhead dredge operations were ongoing in Reach B (ERC 2011). The movements of acoustically tagged sturgeon were monitored using both passive and active methods. Passive monitoring was performed using 14 VEMCO VR2 and VR2W single-channel receivers, deployed through the study area. These receivers are part of a network that was established and cooperatively maintained by Environmental Research and Consulting, Inc. (ERC), Delaware State University (DSU), and the Delaware Department of Natural Resources and Environmental Control (DNREC). Nineteen tagged Atlantic sturgeon and three tagged shortnose sturgeon (all juveniles) were in the study area during the time dredging was ongoing. Eleven of the 19 juvenile Atlantic sturgeon detected during this study remained upriver of the dredging area and showed high fidelity to the Marcus Hook anchorage. Three of the juvenile sturgeon detected during this study (Atlantic sturgeons 13417, 1769; shortnose sturgeon 58626) appeared to have moved through Reach B when the dredge was working. The patterns and rates of movement of these fish indicated nothing to suggest that their behavior was affected by dredge operation. The other sturgeon that were detected in the lower portion of the study area either moved through the area before or after the dredging period (Atlantic sturgeons 2053, 2054), moved through Reach B when the dredge was shut down (Atlantic sturgeons 1774, 58628, 58629), or moved through the channel on the east side of Cherry Island Flats (shortnose sturgeon 2090, Atlantic sturgeon 2091) opposite the main navigation channel. It is unknown whether some of these fish chose behaviors (routes or timing of movement) that kept them from the immediate vicinity of the operating dredge. In the report, Brundage speculates that this could be to avoid the noisy area near the dredge but also states that on the other hand, the movements of the sturgeon reported here relative to dredge operation could simply have been coincidence.

A similar study was carried out in the James River (Virginia) (Cameron 2012). Dredging occurred with a cutterhead dredge between January 30 and February 19, 2009 with 166,545 cy of material removed over 417.6 hours of active dredge time. Six subadult Atlantic sturgeon (77.5 – 100 cm length) were caught, tagged with passive and active acoustic tags, and released at the dredge site. The study concluded that: tagged fish showed no signs of impeded up- or downriver movement due to the physical presence of the dredge; fish were actively tracked freely moving past the dredge during full production mode; fish showed no signs of avoidance response (e.g.,

due to noise generated by the dredge) as indicated by the amount of time spent in close proximity to the dredge after release (3.5 – 21.5 hours); and, tagged fish showed no evidence of attraction to the dredge.

Several scientific studies have been undertaken to understand the ability of sturgeon to avoid cutterhead dredges. Hoover *et al.* (2011) demonstrated the swimming performance of juvenile lake sturgeon and pallid sturgeon (12 – 17.3 cm FL) in laboratory evaluations. The authors compared swimming behaviors and abilities in water velocities ranging from 10 to 90 cm/second (0.33-3.0 feet per second). Based on the known intake velocities of several sizes of cutterhead dredges. At distances more than 1.5 meters from the dredges, water velocities were negligible (10 cm/s). The authors conclude that in order for a sturgeon to be entrained in a dredge, the fish would need to be almost on top of the drag head and be unaffected by associated disturbance (e.g., turbidity and noise). The authors also conclude that juvenile sturgeon are only at risk of entrainment in a cutterhead dredge if they are in close proximity, less than 1 meter, to the cutterhead.

Boysen and Hoover (2009) assessed the probability of entrainment of juvenile white sturgeon by evaluating swimming performance of young of the year fish (8-10 cm TL). The authors determined that within 1.0 meter of an operating dredge head, all fish would escape when the pipe was 61 cm (2 feet) or smaller. Fish larger than 9.3 cm (about 4 inches) would be able to avoid the intake when the pipe was as large as 66 cm (2.2 feet). The authors concluded that regardless of fish size or pipe size, fish are only at risk of entrainment within a radius of 1.5 – 2 meters of the dredge head; beyond that distance, velocities decrease to less than 1 foot per second.

Clarke (2011) reports that a cutterhead dredge with a suction pipe diameter of 36" (larger than the one to be used for this project) has an intake velocity of approximately 95 cm/s at a distance of 1 meter from the dredge head and that the velocity reduces to approximately 40cm/s at a distance of 1.5 meters, 25cm/s at a distance of 2.0 meters and less than 10cm/s at a distance of 3.0 meters. Clarke also reports on swim tunnel performance tests conducted on juvenile and subadult Atlantic, white and lake sturgeon. He concludes that there is a risk of sturgeon entrainment only within 1 meter of a cutterhead dredge head with a 36" pipe diameter and suction of 4.6m/second.

### **6.2.2 *Predicted Entrainment of Atlantic sturgeon in a cutterhead dredge***

The risk of an individual sturgeon being entrained in a cutterhead dredge is difficult to calculate. While a large area overall will be dredged, the dredge operates in an extremely small area at any given time (i.e., the river or ocean bottom in the immediate vicinity of the intake). None of the dredging is proposed in habitat where sturgeon are known to aggregate (i.e., deep holes). An individual would need to be in the immediate area where the dredge is operating to be entrained (i.e., within 1 meter of the dredge head). The overall risk of entrainment is low. It is likely that the nearly all Atlantic sturgeon in the action area will never encounter the dredge as they would not occur within 1 meter of the dredge. Information from the tracking studies in the James and Delaware River supports these assessments of risk, as none of the tagged sturgeon were attracted to or entrained in the operating dredges.

The entrainment of five sturgeon in the upper Delaware River indicates that entrainment of sturgeon in cutterhead dredges is possible. However, there are several factors that may increase the risk of entrainment in that area of the river as compared to the areas where cutterhead dredging will occur for this action. All five entrainments occurred during the winter months in an area where shortnose sturgeon are known to concentrate in dense aggregations; sturgeon in these aggregations rest on the bottom and exhibit little movement and may be slow to respond to stimuli such as an oncoming dredge. Additionally, the area where dredging was occurring is fairly narrow and constricted which may limit the ability of sturgeon to avoid the oncoming dredge. These conditions are not present in any of the areas where a cutterhead dredge will be used.

Because the only entrainment of Atlantic or shortnose sturgeon in cutterhead dredges in the United States has been the five shortnose sturgeon found at the disposal site in the upper Delaware River it is difficult to predict the number of Atlantic sturgeon that are likely to be entrained during cutterhead dredging in the action area. Based on the available information presented here, entrainment in a cutterhead dredge is likely to be rare, and would only occur if a sturgeon was within 1 meter of the dredge head. However, because we know that entrainment is possible, we expect that over the project life considered here, some entrainment with a cutterhead dredge will occur. Based on the predicted rarity of the entrainment event, we expect that no more than one Atlantic sturgeon will be entrained each year that a cutterhead dredge is used for dredging in one of the channels discussed herein; this expected amount of entrainment is inclusive of the use of a cutterhead dredge in Norfolk Harbor and the CIEE expansion. Due to the suction, travel through up to several miles of pipe and any residency period in the disposal area, all entrained Atlantic sturgeon are expected to be killed.

Based on the mixed stock analysis, it is likely that most of the entrained Atlantic sturgeon will originate from the New York Bight DPS but could also originate from the Gulf of Maine, Chesapeake Bay or South Atlantic DPS. Given the mixed stock percentages presented above and an estimate of no more than one mortality per year, we expect the following mortality of Atlantic sturgeon in cutterhead dredges:

**Table 20. Expected Takes of Atlantic Sturgeon by Cutterhead Dredges**

<b>Number of Atlantic Sturgeon over the life span of the Project</b>	<b>DPS</b>
25	New York Bight
10	South Atlantic
8	Chesapeake Bay
5	Gulf of Maine
2	Carolina

### **6.2.3 Interactions with the Sediment Plume from Cutterhead Dredges**

The increased turbidity and suspended sediments related to the cutterhead dredging and placement activities are anticipated to have short term, temporary impacts to water quality. Placement of sand at the designated beach nourishment site will be via hydraulic pipeline. Sand will be deposited directly on the beach and graded to profile. Fine particles that may be present in the sand will be transported and dispersed in the swash zone.

Dredging operations cause sediment to be suspended in the water column. This results in a sediment plume in the waterway, typically present from the dredge site and decreasing in concentration as sediment falls out of the water column as distance increases from the dredge site. Dredging with a pipeline dredge minimizes the amount of material re-suspended in the water column as the material is essentially vacuumed up and transported to the disposal site in a pipe.

As reported by you, a near-field water quality modeling of dredging operations in the Delaware River was conducted in 2001. The purpose of the modeling was to evaluate the potential for sediment contaminants released during the dredging process to exceed applicable water quality criteria. The model predicted suspended sediment concentrations in the water column at downstream distances from a working cutterhead dredge in fine-grained dredged material. Suspended sediment concentrations were highest at the bottom of the water column, and returned to background concentrations within 100 meters downstream of the dredge.

In 2005, FERC presented us with an analysis of results from the DREDGE model used to estimate the extent of any sediment plume associated with the proposed dredging at the Crown Landing LNG berth (FERC 2005). The model results indicated that the concentration of suspended sediments resulting from hydraulic dredging would be highest close to the bottom and would decrease rapidly downstream and higher in the water column. Based on a conservative (i.e., low) TSS background concentration of 5mg/L, the modeling results indicated that elevated TSS concentrations (i.e., above background levels) would be present at the bottom 2 meters of the water column for a distance of approximately 1,150 feet. Based on these analyses, elevated suspended sediment levels are expected to be present only within 1,150 feet of the location of the cutterhead. Turbidity levels associated with cutterhead dredge sediment plumes typically range from 11.5 to 282 mg/L with the highest levels detected adjacent to the cutterhead and concentrations decreasing with greater distance from the dredge (see U. Washington 2001).

No information is available on the effects of total suspended solids (TSS) on juvenile and adult sea turtles. Of the effects causing increased levels of TSS discussed above, sea turtles may be exposed to sediment plumes from cutterhead dredging. TSS is most likely to affect sea turtles if a plume causes a barrier to normal behaviors or if sediment settles on the bottom affecting sea turtle prey. In all cases where sea turtles would be exposed to increased TSS resulting from proposed activities in this Opinion (mainly the lower Chesapeake Bay), the area is sufficiently wide for the highly mobile sea turtles to avoid any sediment plume with minor movements. Any effect on sea turtle movements is likely to be too small to be meaningfully measured or detected, and is therefore, insignificant.

Studies of the effects of turbid waters on fish suggest that concentrations of suspended solids can reach thousands of milligrams per liter before an acute toxic reaction is expected (Burton 1993). The studies reviewed by Burton demonstrated lethal effects to fish at concentrations of 580mg/L to 700,000mg/L depending on species. Sublethal effects have been observed at substantially lower turbidity levels. For example, prey consumption was significantly lower for striped bass larvae tested at concentrations of 200 and 500 mg/L compared to larvae exposed to 0 and 75 mg/L (Breitburg 1988 in Burton 1993). Studies with striped bass adults showed that pre-spawners did not avoid concentrations of 954 to 1,920 mg/L to reach spawning sites (Summerfelt and Moiser 1976 and Combs 1979 in Burton 1993).

The life stages of sturgeon most vulnerable to increased sediment are eggs and non-mobile larvae, which are subject to burial and suffocation. As noted above, no sturgeon eggs and/or larvae will be present in the action area. Juvenile, subadult, and adult Atlantic sturgeon are frequently found in turbid water and would be capable of avoiding any sediment plume by swimming higher in the water column. All sturgeon in the action area would be sufficiently mobile to avoid any sediment plume. Therefore, any Atlantic sturgeon in the action area during dredging would be capable of avoiding any sediment plume by swimming around it.

### **6.3 Mechanical Dredge**

Mechanical dredging will be used in association with CIEE and in some of the Norfolk Harbor Channels. Aquatic species can be captured in dredge buckets and may be injured or killed from entrapment in the bucket or burial in sediment during dredging and/or when sediment is deposited into the dredge scow. Fish captured and emptied out of the bucket could suffer stress or injury, which could also lead to mortality.

#### **6.3.1 *Impacts to Sea Turtles***

No sea turtles have been captured in mechanical dredges in the action area. You have no records of any sea turtles being captured in mechanical dredges anywhere. Most mobile organisms, including adult and juvenile sea turtles, are able to avoid mechanical dredge buckets. The slow movement of the dredge bucket through the water column and the relatively small area of bottom impacted by each pass of the bucket makes the likelihood of interaction between a dredge bucket and an individual fish relatively low. Based on all available evidence, the risk of sea turtles being captured in a mechanical dredge is extremely unlikely and, therefore, discountable. As such, we do not anticipate any capture of sea turtles during any mechanical dredging considered here.

#### **6.3.2 *Capture of Atlantic sturgeon in the dredge bucket***

In rare occurrences sturgeon have been captured in dredge buckets and placed in the scow. Very few mechanical dredge operations have employed observers to document interactions between sturgeon and the dredge; because of that we do not know if the lack of observations is a result of fish not being captured at other projects or that captures occur but are not observed. Captures of two shortnose and one Atlantic sturgeon have been documented at the Bath Iron Works (BIW) facility in the Kennebec River, Maine. It is unknown if these observations are the result of a unique situation in this river or whether interactions have occurred elsewhere but have just been undocumented. Observer coverage at dredging operations at BIW has been 100% for approximately 15 years and three observations of captured sturgeon have been documented. Dredging occurs every one to two years at this location. An Atlantic sturgeon was killed in the Cape Fear River in a bucket and barge operation (NMFS 1998).

Due to the nature of interactions between listed species and dredge operations, it is difficult to predict the number of interactions that are likely to occur from a particular dredging operation. Projects that occur in an identical location with the same equipment year after year may result in interactions in some years and none in other years. For example, dredging in the BIW sinking basin prior to 2003 resulted in no interactions with shortnose sturgeon but one shortnose sturgeon

was killed by the clamshell dredge in the last hour of the last day of dredging of a dredge event running from April 7 to April 30, 2003. An additional shortnose sturgeon was captured in this area in 2009, but none were captured between 2003 and 2009 or 2009-2011. Based on all available evidence, the risk of capture in a mechanical dredge is low due to the slow speed at which the bucket moves and the relatively small area of the bottom it interacts with at any one time. Atlantic sturgeon are highly mobile and it is anticipated that they will be able to avoid the dredge bucket in nearly all instances.

Based on the occurrence of Atlantic sturgeon in the area where mechanical dredging will take place and the documented vulnerability of this species to capture with mechanical dredges, it is likely that a small number of sturgeon will be captured by mechanical dredges working at CIEE or the Norfolk Harbor channels. Due to the relatively low level of risk that an individual Atlantic sturgeon would be captured in the slow moving dredge bucket, no more than one Atlantic sturgeon is likely to be captured during dredging at CIEE and no more than one during dredging in the Norfolk Harbor channels.

Atlantic sturgeon captured in the dredge bucket could be injured or killed. Sources of mortality include injuries suffered during contact with the dredge bucket or burial in the dredge scow. Of the three captures of sturgeon with mechanical dredges in the Kennebec River (two shortnose (in 2003 and 2009), one Atlantic (in 2001)), one of the shortnose sturgeon was killed. This fish was killed during the last hour of a 24-hour a day dredging operation that had been ongoing for approximately four weeks. This fish suffered from a large laceration, likely experienced due to contact with the dredge bucket. Of the other two fish, both were observed alive in the dredge scow and were released, with no visible external injuries. Assuming that the risk of mortality once captured is similar across dredging projects, we expect a similar mortality in the action area as has been observed at BIW. Therefore, we expect no more than one of the two captured Atlantic sturgeon to be injured or killed during dredging operations. Due to the potential co-occurrence of juvenile, sub-adult, and adult sturgeon, captured sturgeon could be from any one of these three life stages. Injury or mortality could result from contact with the dredge bucket or through suffocation due to burial in the scow. The dead Atlantic sturgeon could originate from any of the five DPSs; however, any juvenile Atlantic sturgeon would be from the Chesapeake Bay DPS.

### **6.3.3            *Interactions with the Sediment Plume from Mechanical Dredges***

Mechanical dredges include many different bucket designs (e.g., clamshell, closed versus open bucket, level-cut bucket) and backhoe dredges, representing a wide range of bucket sizes. TSS concentrations associated with mechanical clamshell bucket dredging operations have been shown to range from 105 mg/L in the middle of the water column to 445 mg/L near the bottom (210 mg/L, depth-averaged) (USACE 2001). Furthermore, a study by Burton (1993) measured TSS concentrations at distances of 500, 1,000, 2,000 and 3,300 feet (152, 305, 610 and 1006 meters) from dredge sites in the Delaware River and were able to detect concentrations between 15 mg/L and 191 mg/L up to 2,000 feet (610 meters) from the dredge site. In support of the New York/New Jersey Harbor Deepening Project, the U.S. Army Corps of Engineers conducted extensive monitoring of mechanical dredge plumes (USACE 2015). The dredge sites included Arthur Kill, Kill Van Kull, Newark Bay, and Upper New York Bay. Although briefly addressed in the report, the effect of currents and tides on the dispersal of suspended sediment were not

thoroughly examined or documented. Independent of bucket type or size, plumes dissipated to background levels within 600 feet (183 meters) of the source in the upper water column and 2,400 feet (732 meters) in the lower water column. Based on these studies, elevated suspended sediment concentrations at several hundreds of mg/L above background may be present in the immediate vicinity of the bucket, but would settle rapidly within a 2,400-foot (732 meter) radius of the dredge location.

## **6.4 Habitat Impacts from Dredging**

### **6.4.1 *Effects on Sea Turtle Foraging***

Since dredging involves removing the bottom material down to a specified depth, the benthic environment will be impacted by dredging operations. No sea grass beds occur in the areas to be dredged with a hopper dredge, therefore green sea turtles will not use the areas as foraging areas. Thus, we anticipate that the dredging activities are not likely to disrupt normal feeding behaviors for green sea turtles. Records from previous dredge events occurring in the action area indicate that some benthic resources, including whelks, horseshoe crabs, blue crabs and rock crabs are entrained during dredging. Other sources of information indicate that potential sea turtle forage items are present in the channel, including jellyfish, clams, mussels, sea urchins, whelks, horseshoe crabs, blue crabs and rock crabs.

Of the listed species found in the action area, loggerhead and Kemp's ridley sea turtles are the most likely to utilize the channel areas for feeding, foraging mainly on benthic species, namely crabs and mollusks (Morreale and Standora 1992, Bjorndal 1997). As noted above, suitable sea turtle forage items occur in some of the areas to be dredged. However, at least some areas of soft substrate in the channel experience daily disturbance (sedimentation from propellers/prop wash); we expect that this has some impact on the ability of these areas to support an abundant and diverse community of benthic invertebrates. This may mean that areas outside the channel are more likely to be used by foraging sea turtles; however, we do not have fine scale information on sea turtle forage items or sea turtle distribution that we could use to make a conclusive determination about foraging in the channel versus outside the channel. This disturbance is more likely to disturb or displace non-mobile organisms that occur at the surface of the sediment and is less likely to impact mobile prey (such as crabs) or benthic invertebrates that bury deep into the substrate (such as worms).

Dredging can effect sea turtles by reducing prey species through the alteration of the existing biotic assemblages; this occurs through the entrainment of prey items as well as displacement or crushing under the cutterhead pipeline that lies on the bottom and transports dredged material to the disposal site. Some of the prey species targeted by turtles, including crabs, are mobile; therefore, some individuals are likely to avoid the dredge. However, there is likely to be some entrainment of mobile sea turtle prey items as well as benthic invertebrates that do not have sufficient (or any) mobility to avoid the dredge.

Previous studies in the upper Chesapeake Bay have demonstrated rapid recovery and resettlement by benthic biota and similar biomass and species diversity to pre-dredging conditions (Johnston, 1981; Diaz, 1994). Similar studies in the lower portions of the Chesapeake Bay produced rapid resettlement of dredging and placement areas by infauna (Sherk, 1972).

McCauley et al. (1977) observed that while infauna populations declined significantly after dredging, infauna at dredging and placement areas recovered to pre-dredging conditions within 28 and 14 days, respectively. Therefore, the effects to benthic communities are anticipated to be short term. Rapid recovery and resettlement of benthic species is expected.

While there is likely to be some reduction in the amount of prey, these losses are limited in space and time. That is, these reductions will only be experienced in the areas being dredged and will only last as long as it takes benthic resources to return to the area. Given the small portion of the total habitat available for foraging sea turtles, and the temporary nature of these impacts, any effects on foraging from remaining deepening, periodic maintenance dredging of shoaled areas, and temporarily removing habitat under cutterhead pipelines are too small to be meaningfully measured or detected, and are therefore insignificant. We do not expect that these reductions in forage will have impacts on the fitness of any sea turtles.

Based on this analysis, while there will be a small reduction in sea turtle prey due to dredging, these effects will be too small to be meaningfully measured, detected, or evaluated and are, therefore, insignificant to foraging loggerhead and Kemp's ridley sea turtles. No effects to the prey base of green sea turtles is anticipated.

#### **6.4.2        *Effects on Atlantic Sturgeon Foraging***

Atlantic sturgeon feed on a variety of benthic invertebrates; primarily soft bodied invertebrates such as worms (Guilbard *et al.* in Munro *et al.* 2007; Savoy in Munro *et al.* 2007). The proposed dredging will occur in the navigation channel and adjacent anchorage areas. As explained in the discussion above about effects on sea turtle foraging, we expect the daily disturbance in the navigation channel (e.g., sedimentation from propellers/prop wash) to have some impact on the ability of these areas to support an abundant and diverse community of benthic invertebrates; however, we expect that this disturbance is more likely to disturb or displace non-mobile organisms that occur at the surface of the sediment and is less likely to impact mobile invertebrates (such as crabs) or benthic invertebrates that bury deep into the substrate (such as worms). Dredging is likely to entrain and kill at least some of these potential forage items. Turbidity and suspended sediments from dredging activities, as well as the placement of sand at the beneficial use sites may affect benthic resources in those areas. As noted in Section 6.5.1, the TSS levels expected for all of the proposed activities (ranging from 5 mg/L to 500 mg/L) are expected to have some adverse effects on some benthic communities (390 mg/L (EPA 1986).

Sturgeon may forage in the full extent of the action area, primarily over soft substrates. Using the data you have provided, the combined areas that are subject to frequent maintenance dredging and the areas remaining to be deepened/widened are approximately 7,492 acres. This area is approximately .26% of the area in Chesapeake Bay.

Impacts from the placement of the cutterhead dredge pipe during beach nourishment will be minor and temporary. In sum, there is likely to be some permanent reduction in the amount of sturgeon prey in frequently dredged shoaling areas, as well as a temporary removal of habitat under the cutterhead pipeline. Given the limited area where benthic resources will be removed or displaced, effects on sturgeon from reductions in benthic resources in a limited area and for

limited periods of time, will be too small to be meaningfully measured or detected, and are therefore insignificant.

#### **6.4.3        *Effects of Deepening and Maintenance Dredging on Substrate/Habitat Type***

During the consultation process, we requested information on the potential of the proposed deepening to alter the substrate type in areas to be dredged. If substrate type was altered, the benthic community that recolonizes the dredged area could be fundamentally different than the original community and this could affect the availability of forage items for listed species. However, you have indicated that the remaining sub-surface strata below the dredging pay-prism is consistent with the maintenance material removed during a typical dredging operation (USACE 2012; USACE 2017c). The maintenance material removed from this project historically consists of a mixture of sand and mud. Typical material densities vary in range from silt/mud between 1137 (g/l) to 1337 (g/l) and sands 1526 (g/l) to 1874 (g/l). You have indicated that the same ratio is anticipated as a result of the deepening project and that no alterations in the type of sediment occurring in the dredged areas will result from the proposed action.

Based on the information provided by you and confirmation sampling that has occurred to date, no changes in substrate type are anticipated to result from dredging. Effects to forage items are considered in sections 7.4, 7.8.2, and 7.8.3.

#### **6.4.4        *Effects of Deepening on Salinity***

Salinity is the concentration of inorganic salts (total dissolved solids, or "TDS") by weight in water, and is commonly expressed in units of "psu" (practical salinity units) or "ppt" (parts per thousand). For example, ocean water with a salinity of 30 ppt contains ~30 grams of salt per 1,000 grams of water. The action area experiences a wide variety of salinity influenced by multiple factors. Also, the salinity gradient effects the distribution of listed species in the action area with sea turtles less likely to occur as salinity decreases and Atlantic sturgeon juveniles more prevalent in the low salinity reaches. Here, we consider whether the proposed deepening could alter the salinity regime in the estuary.

##### ***6.4.4.1 Existing Salinity Conditions in the Chesapeake Bay***

The distribution of salinity in the Chesapeake estuary exhibits significant variability on both spatial and temporal scales, and at any given time reflects the opposing influences of freshwater inflow from tributaries (and groundwater) versus saltwater inflow from the Atlantic Ocean. Saltwater inflow from the ocean is in turn dependent on the tidal discharge and the ocean salinity. Salinity at the bay mouth typically ranges from about 25 to 30 ppt. Tributary inflows by definition have "zero" salinity in the sense of ocean-derived salt; however, these inflows contain small but finite concentrations of dissolved salts, typically in the range of 100 to 250 parts per million (ppm) or from 0.1 to 0.25 ppt TDS.

A longitudinal salinity gradient is a permanent feature of salt distribution in the Chesapeake Bay estuary. That is, salinity is always higher at the mouth and downstream end of the system and decreases in the upstream direction. Salinity concentrations can also vary by season. The winter average varies from over 23 ppt at the mouth of the Bay to less than 2 ppt near the head of the estuary at the Susquehanna flats. In spring, salinity levels generally decrease throughout the Bay

and tributaries. In summer, surface salinity distribution is similar to winter levels. Surface salinity levels are highest in the Fall – approximately 29 ppt at the mouth of the Bay.

There is also a lateral salinity gradient present in the bay portion of the estuary, with higher salinities on the eastern shore and fresher water on the western shore. This lateral salinity gradient also occurs in the tidal rivers that flow into the Bay due to the Coriolis effect. For example, in the James River where there is one primary source of fresh water, there is lower salinity on the western shore than on the eastern shore because of the effects of the Earth's rotation. Under most conditions in the estuary, there is only a small vertical salinity gradient, due to the dominance of tidal circulation and mixing relative to the normal freshwater inflow. However, under prolonged high-flow conditions, such as during the spring freshet, vertical salinity gradients of as much as 5 ppt can occur in the lower bay, with corresponding smaller vertical gradients at locations further upstream to the limit of the salt line. At any given point in the estuary between the bay mouth and the location of the salt line, the salinity of the water column will vary directly with the phase of the tidal currents. Maximum salinity at a point occurs around the time of slack water after high tide, and minimum salinity occurs at the time of slack after low. This condition reflects the significant role played by tidal currents in advecting higher salinity water in the upstream direction during flood flow, with lower salinity water being advected in the downstream direction during ebb. For periods longer than a single tidal cycle, the salinity at a given location varies in response to other important forcing functions, including the short-term and seasonal changes in freshwater inflow, wind forcing over the estuary and adjacent portions of the continental shelf, and salinity and water level changes at the bay mouth. Over longer periods (years to decades and longer), sea level changes and modifications to the geometry of the estuary also affect the long-term patterns of salinity distribution.

The four longitudinal salinity zones within the Chesapeake Estuary, starting at the downstream end, are referred to as: polyhaline (18 - 30 ppt) at the mouth of the bay; mesohaline (5 - 18 ppt) in the mid-bay; oligohaline (0.5 - 5 ppt) and fresh (0.0 - 0.5 ppt) in the upper bay. Although these zones are useful to describe the long-term average distribution of salinity in the estuary, the longitudinal salinity gradient is dynamic and subject to short and long-term changes caused by variations in freshwater inflows, tides, storm surge, weather (wind) conditions, etc. These variations can cause a specific salinity value (isohaline) to move upstream or downstream by as much as 16 km in a day due to semi-diurnal tides, and by more than 32 km over periods ranging from a day to weeks or months due to storm and seasonal effects on freshwater inflows.

#### *6.4.4.2 Effects of Salinity Changes on sturgeon*

Changes in salinity could affect the distribution of shortnose and Atlantic sturgeon in the bay. In the Chesapeake Bay, Atlantic sturgeon are known to congregate and overwinter within brackish river waters (Bushnoe and Musick, 2006). Previous studies have noted that subadult Atlantic sturgeon typically occupy both the oligohaline and moderately mesohaline (<10ppt) environments (Dovel and Berggren, 1983; Kiefer and Kynard, 1993; Moser and Ross, 1995; Simpson, 2008). For both of these species, early life stages (i.e., eggs and larvae) have little to no tolerance to salinity and therefore, spawning occurs in fresh water. Tolerance to salinity increases with age and size (Jenkins *et al.* 1993, McEnroe and Cech 1985). During at least the first year, shortnose and Atlantic sturgeon are limited in distribution to fresh water; as a result

their distribution is typically upstream of the “salt wedge.” If the salt wedge moved further upstream, there could be a reduction in available spawning or rearing habitat.

Given the availability and location of spawning habitat in the river, it is unlikely that the salt front would shift far enough upstream to result in a significant restriction of spawning or nursery habitat. Atlantic sturgeon fall spawning habitat in the James River (between RKM 105 and the fall line near Richmond, VA) is approximately 10 km upstream of the current median range of the salt front (RKM 95). Atlantic sturgeon spring spawning habitat in the James River (RKM 90-95) is approximately 40 km upstream of the current median range of the salt front (RKM 47.5). However, without an upstream barrier to passage, and spawning habitat extending to Richmond, VA, it is unlikely that salt front movement upstream would significantly limit spawning and nursery habitat. The available habitat for juvenile sturgeon of both sturgeon species could decrease over time; however, even if the salt front shifted several miles upstream, it seems unlikely that the decrease in available habitat would have a significant effect on juvenile sturgeon.

Overall, the effects of remaining deepening on salinity and resulting changes to sturgeon habitat use, above baseline conditions, are too small to be meaningfully measured or detected, and are therefore, insignificant.

#### *6.4.4.3 Effects of Salinity Change on Sea Turtles*

Sea turtles occur in saline water. Sea turtles do not occur in the reaches of the river where we expect salinity changes resulting from the deepening project. No impacts to sea turtles from increase in salinity will occur.

#### **6.4.5            *Effects of Deepening on Dissolved Oxygen***

Atlantic sturgeon are known to be more sensitive to low dissolved oxygen levels than many other fish species and juvenile sturgeon are particularly sensitive to low dissolved oxygen levels. In comparison to other fishes, sturgeon have a limited behavioral and physiological capacity to respond to hypoxia (multiple references reviewed and cited in Secor and Niklitschek 2001, 2003). Sturgeon basal metabolism, growth, consumption and survival are all very sensitive to changes in oxygen levels, which may indicate their relatively poor ability to oxyregulate. Sturgeon may be negatively affected, primarily through changes in behavior and distribution, when dissolved oxygen levels are below 5mg/l, particularly at times when water temperatures are higher than 28°C (see Flourney *et al.* 1992; Campbell and Goodman 2004).

In certain areas and during certain times of year, dissolved oxygen levels in the Chesapeake Bay may be stressful to sturgeon. As sea turtles are air breathers, they are not directly affected by dissolved oxygen levels; however, if dissolved oxygen levels affect sea turtle prey, sea turtles could be affected as well. We have considered whether the deepening project and subsequent maintenance are likely to affect dissolved oxygen levels in the action area. Dissolved oxygen levels could be affected due to increases in suspended sediment and if submerged aquatic vegetation was affected.

There will be small, short-term increases in suspended sediment and turbidity near where dredging and beach nourishment. However, given the short duration and limited geographic

extent of these increases in suspended sediment and turbidity any effects to dissolved oxygen are similarly likely to be limited to small areas and for short periods of time. As such, any effects to sea turtles or Atlantic sturgeon will be insignificant and discountable.

## **6.5 On Shore Dredged Material Disposal**

We have considered whether the disposal of sand at Sandbridge Beach, Virginia Beach and Ft. Story would impact sea turtles. Limited loggerhead sea turtle nesting (less than 10 nests per year) occurs on Virginia Beach; no nesting is known to occur on Sandbridge Beach or at Ft. Story. However, as noted above, there is the potential for a northward shift in nesting by sea turtles. The disposal of material at these beaches is meant to stabilize and restoring eroding habitats and maintain existing beach. None of the activity is likely to reduce the suitability of these beaches for potential future nesting.

As indicated above, all material removed by cutterhead dredge will be disposed of at a beach location. When a cutterhead dredge is used, the material is piped directly from the intake to an onshore disposal area. The pipe will extend up to 3 miles, depending on the distance between the dredge site and the disposal site. The pipe will be approximately 30" in diameter and be laid on the ocean bottom. While the presence of the pipe will cause a small amount of benthic habitat to be unavailable to sturgeon and sea turtles, the effects from the loss of this area of potential forage will be too small to be meaningfully measured, detected or evaluated. In addition, while the discharge of sediment could cause a small increase in suspended sediment in the immediate vicinity of sand placement, any effects are likely to be minor and temporary. Impacts associated with this action include a short term localized increase in turbidity during disposal operations. During the discharge of sediment at a disposal site, suspended sediment levels have been reported as high as 500mg/L within 250 feet of the disposal vessel and decreasing to background levels (i.e., 15-100mg/L depending on location) within 1000-6500 feet (USACE 1983). For this project, you report that because the dredged material is clean sand, the material will settle out within minutes and any sediment plume will be localized and temporary. Any sea turtles or sturgeon (juvenile, sub-adult, and adults) in the vicinity of the beach disposal sites during disposal may alter their movements to temporarily avoid the disposal area; however, as any effects to movements will be temporary and too small to be meaningfully measured, detected, or evaluated; therefore, these effects will be insignificant.. Effects of disposal on prey resources are considered below in section 6.6.3.

## **6.6 Use of Offshore/Ocean Dredged Material Disposal Sites**

The use of offshore dredged material disposal sites can affect sea turtles and sturgeon by: exposing them to increased levels of turbidity and suspended sediments; increasing the potential for exposure to contaminants; affecting benthic resources; and, increasing vessel traffic in the area. Vessel traffic is discussed in Section 6.8. Other impacts are discussed here.

### **6.6.1 *Turbidity and Suspended Sediments***

Dredged material placement operations at the ocean disposal sites are anticipated to have localized and temporary impacts to water quality. Dredged material designated for placement at these sites will be transported to the ocean placement site via bottom dump scow or split hull barges. Upon release from the barge, dredged material will enter the water column as a dense

fluid plume, which will descend vertically. The dense fluid plume will descend to the bottom at a high velocity, leaving behind a low-density turbidity cloud, which will contain a small amount of total solids and settle within a few hours (USACE, 2010a). This temporary increase in turbidity in the water column when dredged material is released will cause short-term impacts that may include lower levels of dissolved oxygen for a few hours following material placement at the immediate site.

During the discharge of sediment at offshore disposal sites, suspended sediment levels have been reported as high as 500.0 mg/l within 250 feet of the disposal vessel and decreasing to background levels (i.e., 15.0-100.0 mg/l depending on location and sea conditions) within 1,000-6,500 feet (USACE 1983). Total suspended solids near the center of the dredged material placement plume body have been observed to reach near background levels in 35 to 45 minutes (Battele 1994 in USACE and USEPA 2009).

TSS is most likely to affect sea turtles and Atlantic sturgeon if a plume causes a barrier to normal behaviors or if sediment settles on the bottom and affects benthic prey. As sea turtles and adult/sub-adult Atlantic sturgeon are highly mobile, individuals are likely to be able to avoid any sediment plume that is present and any effect on their movements or behavior is likely to be insignificant due to the small, temporary disruption of normal movements that may result from avoiding the sediment plume are expected to be so small as to not be susceptible to meaningful measurement or detection.

### **6.6.2            *Contaminants***

In order to be eligible for ocean disposal, material must meet stringent criteria as required by the Clean Water Act and Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972 (as described in the EPA/USACE joint testing guidelines, available at <http://water.epa.gov/type/oceb/oceandumping/dredgedmaterial/upload/gbook.pdf>; last accessed July 7, 2018). By law and regulation, the disposal of dredged material must have no unacceptable adverse effects. All dredged material disposal sites, including the ones considered here, are required to have and are managed under a dredged material monitoring and management plan that assesses the health and well-being of the site and surrounding environment. Monitoring of the disposal site is a part of this plan, which is designed to ensure that any degradation of resources or alteration in seafloor characteristics are identified and corrective actions implemented by permitting agencies (USEPA 2004).

The testing of dredged material is overseen by EPA and the USACE. Sediments are tested for possible contamination prior to any planned dredging to ensure that proposed dredging and the dredge material disposal are conducted in a way that minimizes the potential pathways for contaminant exposure. EPA and the USACE have jointly developed comprehensive testing procedures, which may include physical, chemical and biological tests, to evaluate dredged material placed into ocean waters.

Laboratory and evaluation methods that apply to dredged material proposed for ocean disposal in accordance with the Marine Protection, Research and Sanctuaries Act (MPRSA) are published in the 1991 USEPA/USACE guidance document entitled "Ecological Evaluation for Dredged Material Proposed for Ocean Disposal in the Marine Environment." An overview of the

Dredged Material Testing Framework is contained in EPA's Ocean Dumping Program Update (1996). As described by EPA, "the acute toxicity of a sediment is determined by quantifying the mortality of appropriately sensitive organisms that are put into contact with the sediment, under either field or laboratory conditions, for a specified period." Also, bioaccumulation is described as, "the accumulation of contaminants in the tissues of organisms through any route, including respiration, ingestion, or direct contact with contaminated sediment or water" (EPA 1996). The regulations require that bioaccumulation be considered as part of the environmental evaluation of dredged material proposed for ocean dumping. This consideration involves predicting whether there will be a cause-and-effect relationship between an animal's presence in the area influenced by the dredged material and an environmentally important elevation of its tissue content or body burden of contaminants above that in similar animals not influenced by the disposal of the dredged material."

In order for the dredged material to be disposed of at an in-water disposal site, it must be tested in accordance with the USACE and EPA procedures for suitability. Material that can be disposed of at the disposal site cannot be acutely toxic to any aquatic species. Further, the material must not present a risk of bioaccumulation; that is, even if it is not acutely toxic, it must not increase the potential for bioaccumulation of toxins in higher trophic level species that may prey upon benthic organisms present at the disposal site. In the BAs, you report that water column bioassay testing of dredged material from the areas considered in this Opinion, using sensitive benchmark water column species were conducted in accordance with Section 103 of the Marine Protection, Research, and Sanctuary Act (MPRSA). Test results have shown that the discharge of dredged material at designated placement sites complies with the limiting permissible concentration (LPC) defined in Section 103 of the MPRSA and is not acutely toxic to sensitive benchmark organisms and no unacceptable adverse effects were observed from the liquid phase or liquid and particulate phase of the dredged material. The high flushing rate (due to the water exchange and tidal fluctuations) of the Chesapeake Bay and Atlantic Ocean is anticipated to minimize potential dredging plumes and cause them to be more quickly dispersed, minimizing long term impacts to water quality.

For purposes of this consultation, we consider that sediment that is suitable for ocean disposal would not be toxic to marine life and would not be likely to cause adverse effects to sea turtles, Atlantic sturgeon or their prey. Because the material to be disposed was tested to ensure it is not acutely toxic and will not increase the risk of bioaccumulation of toxins or contaminants in any marine species, effects to sea turtles and Atlantic sturgeon will be too small to be meaningfully, measured, detected, or evaluated and are, therefore, insignificant.

### **6.6.3            *Effects to the Benthic Environment***

Disposal operations can also affect foraging animals by burying benthic prey. Direct impacts to fish or other mobile species during placement of the dredged material would be expected to be minimal due to the small contact footprint of the fluidized sediments as they leave the barge (typically 50 foot by 100 foot). Given the small area impacted by each disposal event, mobile species are expected to be able to avoid the falling sediment and would not be subject to burial. The only species that are likely to be buried are immobile benthic organisms. Sea grasses and macroalgae that green sea turtles forage on are not present at the disposal sites. Some species of mollusks and gastropods that loggerheads and Atlantic sturgeon feed on have limited mobility

and could be buried during disposal operations.

The loss of potential benthic prey species would be minimized spatially and temporally through use of a grid system for the placement of dredged material. Some buried animals will be able to unbury themselves. Areas where dredged material will be placed are expected to be recolonized by individuals from nearby similar habitats. Because the characteristics of the sediment from the project would be similar to those in and around the disposal sites, benthic invertebrates would be expected to quickly recolonize the cells used for the placement of this material. Thus, any reduction in benthic prey at the disposal site will be temporary and limited to the small area where dredged material will be placed. Green sea turtles will not have any reduction in prey. The potential loss of prey for loggerhead and Kemp's ridley sea turtles will be extremely small, as only a fraction of the benthic species that loggerheads and Kemp's ridleys prey on will be affected, and those losses will occur in a very small area. Effects to foraging loggerhead and Kemp's ridley sea turtles will be too small to meaningfully measure, detect, or evaluate and are, therefore, insignificant.

The temporary localized increase in sediment loading within the water column at the dredging and placement area (NODS) has the potential to directly impact demersal species, such as the Atlantic sturgeon. Deposition of suspended sediments may induce impacts to demersal eggs and larvae through deposition and or smothering, especially in the dredging and placement areas (Johnston, 1981). There are no anticipated impacts to Atlantic sturgeon eggs and/or larvae because the project site and placement site are not located within known spawning grounds of the sturgeon and consist of soft marine clay substrate in marine waters and sturgeon spawn in freshwater over hard bottom substrate. Although other demersal species may be impacted initially, impacts over the duration of the project are not anticipated after disposal operations cease. The high flushing rate, small area of impact during actual disposal will minimize water quality impacts to non-motile demersal organisms. Effects to demersal species will be too small to meaningfully measure, detect, or evaluate and are, therefore, insignificant.

## **6.7 Craney Island Eastward Expansion**

Dredged material removal and fill activities at the CIEE project site will permanently convert approximately 522-acres of subaqueous benthic habitat in the footprint of the containment cell to uplands and provide the foundation for a future marine terminal. As reported in the BA, an assessment of the benthic habitat conducted for the project using the Benthic Index of Biotic Integrity (B-IBI) indicates much of the existing benthic habitat within the project site is degraded (USACE, 2006a). The proposed activities will temporarily disrupt the benthic community processes in the access channel and wharf dredging areas and permanently effect benthic processes in the footprint of the containment cell and marine terminal. New work dredging and fill activities will result in the permanent loss of the benthic community in the footprint of the new containment cell and result in a conversion of shallow water benthic habitat to a deep-water benthic habitat with similar sediment characteristics (access channels and wharf access area) potentially altering the benthic species composition at the site based on bathymetry preferences. Future maintenance dredging events in the access channels and wharf access area will temporarily and locally disrupt the benthic community through removal of shoaled material and result in periodic re-colonization of the channel and wharf area. Here, we consider the

permanent loss of the benthic substrate. Other effects of the CIEE (dredging, turbidity, etc.) are considered in other sections of this Opinion.

As noted in Section 2.6, we previously determined that the dredged material removal and fill activities at the CIEE were not likely to adversely affect listed sea turtles. Green sea turtles feed primarily on seagrasses (Bjorndal 1997) while loggerhead and Kemp's ridleys feed primarily on crustaceans and mollusks. You have indicated that there is a total absence of submerged aquatic vegetation (SAV) at the site of the proposed expansion. The lack of SAV eliminates the potential for this site to be used by foraging green sea turtles. Kemp's ridley's also typically forage near SAV beds (Musick and Limpus 1997). You have also indicated that sampling at the proposed expansion site has demonstrated that the presence of crustaceans and mollusks is rare. As such, this area is not likely to be used by foraging loggerhead and Kemp's ridleys. Given the degraded nature of this habitat, the effects to listed sea turtles from the loss of benthic habitat, i.e., the loss of potentially opportunistic foraging grounds that will result from the conversion to uplands, will be so small they cannot be meaningfully measured, detected or evaluated and are, therefore, insignificant.

Atlantic sturgeon are likely to forage nearly anywhere where suitable benthic resources are present. However, given the nature of the habitats in the CIEE area (i.e., no SAV, degraded benthic communities), it is unlikely that this area is used by foraging Atlantic sturgeon. As such, effects from the loss of future benthic foraging opportunities that will result from the conversion of this habitat to uplands, are extremely unlikely and, therefore, discountable.

## **6.8 Vessel Traffic**

### *Dredge and Disposal Vessels*

Deepening and maintenance dredging activities require the use of dredge and support vessels. Hopper and cutterhead dredges are autonomous vessels, while some mechanical dredging takes place from a barge with a mounted excavator. Barges typically require one or two tug boats to position them. Mechanical dredging also involves a scow vessel where contractors deposit the dredged material. A maximum of four project vessels (combination of barge, tug boats, and scows) would likely be needed for any of the deepening or maintenance dredging activities.

There have not been any reports of dredge vessels colliding with listed species but although they do not possess characteristics commonly associated with vessel strikes (e.g., deep drafts and high speed) contact injuries resulting from dredge movements could occur at or near the water surface and; therefore, involve any of the listed species present in the area. Because the dredge is unlikely to be moving at speeds greater than three knots during dredging operations, blunt trauma injuries resulting from contact with the hull are unlikely during dredging. It is more likely that contact injuries during actual dredging would involve the propeller of the vessel. Contact injuries with the dredge are more likely to occur when the dredge is moving from the dredging area to port, or between dredge locations. While the distance between these areas is relatively short, the dredge in transit would be moving at faster speeds than during dredging operations, particularly when empty while returning to the borrow area.

The dredge vessel may collide with sea turtles when they are at the surface. Sea turtles have been documented with injuries consistent with vessel interactions. It is reasonable to believe that

the dredge vessels considered in this Opinion could inflict such injuries on sea turtles, should they collide. As mentioned, sea turtles are found distributed throughout the action area in the warmer months, generally from May through mid-November.

Interactions between vessels and sea turtles occur and can take many forms, from the most severe (death or bisection of an animal or penetration to the viscera), to severed limbs or cracks to the carapace which can also lead to mortality directly or indirectly. Sea turtle stranding data for the U.S. Gulf of Mexico and Atlantic coasts, Puerto Rico, and the U.S. Virgin Islands show that between 1986 and 1993, about 9% of living and dead stranded sea turtles had propeller or other boat strike injuries (Lutcavage et al. 1997). According to 2001 STSSN stranding data, at least 33 sea turtles (loggerhead, green, Kemp's ridley and leatherbacks) that stranded on beaches within the northeast (Maine through North Carolina) were struck by a boat. This number underestimates the actual number of boat strikes that occur since not every boat struck turtle will strand, every stranded turtle will not be found, and many stranded turtles are too decomposed to determine whether the turtle was struck by a boat. It should be noted, however, that it is not known whether all boat strikes were the cause of death or whether they occurred post-mortem (NMFS SEFSC 2001). More recently, boat strike wounds were confirmed to be ante-mortem in over 75% of sea turtles that were found dead or stranded along the U.S. Atlantic coast (B. Stacy, NMFS, pers. comm., 2017) and a majority of sea turtles struck in Virginia waters were healthy prior to those collisions (Barco *et al.* 2016).

Information is lacking on the type or speed of vessels involved in turtle vessel strikes. However, there does appear to be a correlation between the number of vessel struck turtles and the level of recreational boat traffic (NRC 1990). Although little is known about a sea turtle's reaction to vessel traffic, it is generally assumed that turtles are more likely to avoid injury from slower-moving vessels since the turtle has more time to maneuver and avoid the vessel. The speed of the dredge is not expected to exceed 3 knots while dredging or while transiting to the pump out site with a full load and it is expected to operate at a maximum speed of 10 knots while empty. In addition, the risk of ship strike will be influenced by the amount of time the animal remains near the surface of the water. For the proposed action, the greatest risk of vessel collision will occur during transit between shore and the areas to be dredged. The presence of an experienced endangered species observer who can advise the vessel operator to slow the vessel or maneuver safely when sea turtles are spotted will further reduce the potential risk for interaction with vessels. The addition of one to two slow moving vessels in the action area have an insignificant effect on the risk of interactions between sea turtles and vessels in the action area.

Information regarding the risk of vessel strikes to Atlantic sturgeon is discussed in the Status of the Species and Environmental Baseline sections above. As explained there, we have limited information on vessel strikes and many variables likely affect the potential for vessel strikes in a given area. Assuming that the risk of vessel strike increases with an increase in vessel traffic, we have considered whether an increase in vessel traffic in the action area during dredging and disposal (one to two slow moving vessels per day) would increase the risk of vessel strike for Atlantic sturgeon in this area. Given the large volume of traffic in the action area and the wide variability in traffic in any given day, the increase in risk from the addition of one to two vessels per day in addition to the baseline is too small to be meaningfully measured, detected, or evaluated and the increased risk to Atlantic sturgeon is insignificant.

### *Deepening and Widening of Federal Navigation Channels*

Throughout the consultation process on the Norfolk Harbor Channels and Craney Island Eastward Expansion projects, you have maintained that the project was formulated, evaluated, and authorized by Congress based on the parameter that no tonnage will be induced or attracted to the port's facilities as a direct result of the proposed deepening and widening of the channels. Increasing the depth of the channel will allow segments of the current container and dry bulk vessel fleets to carry more cargo as well as allowing the fleets to shift to more efficient sized vessels. Therefore, the new channel depth will improve the economic efficiency of ships moving through the Chesapeake Bay ports, resulting in a reduction in total vessel trips. The number of vessel calls of the largest twenty-foot equivalent unit (TEU) ships is not anticipated to increase in the future; however, the number of smaller sized ships in the deep draft fleet (e.g., Panamax-size ships) may decrease due to the increased efficiency of cargo loading in the future (USACE 2018). These vessels will continue to carry the same tonnage from the origin ports but will be able to operate more efficiently in the Chesapeake Bay with a deepened channel from reduced lightering. These factors will more efficiently apportion operating costs for the same amount of total tonnage and further reduce total vessel trips through the port (USACE 2011).

Similarly, beyond the use of project vessels discussed above, we do not expect maintenance dredging of the channels to increase baseline levels of vessel traffic in the Chesapeake Bay. The effects of baseline (i.e., non-project related vessels) vessel traffic is included in the discussion of threats facing the species as addressed in the *Status of the Species* and *Environmental Baseline* sections of this Opinion. Accordingly, the increase in risk of a vessel strike from the addition of project vessels, including maintenance vessels, to baseline conditions is so small it cannot be meaningfully measured, detected or evaluated and is, therefore, insignificant.

### **6.9 Unexploded Ordnance and Munitions of Concern**

The United States Army Environmental Command (USAEC) defines unexploded ordnance (UXO) or munitions of explosive concern (MEC) as military munitions that have been (1) primed, fused, armed or otherwise prepared for action; (2) fired, dropped, launched, projected, or placed in such a manner to constitute a hazard to operations, installations, personnel, or material, and (3) remain unexploded either by malfunction, design, or any other case. UXO/MEC comes in many shapes and sizes, may be completely visible or partially or completely buried, and may be easy or virtually impossible to recognize as a military munition. UXO/MEC can be found in the ocean. UXO/MEC may look like a bullet or bomb, or be in many pieces, but even small pieces of UXO/MEC can be dangerous. If disturbed, (touched, picked up, played with, kicked, thrown, etc.) UXO/MEC may explode without warning, resulting in serious injury or even death. Sandbridge Shoal borrow area occurs in an area associated with past and current military activities and has produced UXO/MEC during dredging operations.

The presence of UXO in dredged material presents two unique challenges. First, it poses a potential explosive safety hazard to dredging or observer personnel and potential damage to equipment and vessel. Second, any subsequent beneficial use of dredged material must also address the possibility of the presence of UXO and/or its removal.

The presence of UXO was documented during the previous Sandbridge Hurricane Protection Projects constructed in 2002 and 2007. Over 100 UXO were recovered during dredging operations and were transported to and properly disposed of at an undisclosed naval installation. Recent dredging of the Cape Henry Channel, documented UXO/MEC in the observer cages on April 15, 2011 and May 8, 2011. On April 1, 2006, the Dredge Padre Island operated by the Great Lakes Dredge & Dock Company was conducting maintenance dredging activities in the Atlantic Ocean Channel (AOC) when it suffered a ruptured dredge clean out section and severed drag head as a result of an explosion presumed to be from an ordnance device that was pumped into the draghead and associated lines. Unexploded ordnance had been previously retrieved from the draghead on three different occasions in February 2006. During the last dredging cycle of the AOC in February 2011, it was documented that UXO/MEC was encountered four times, mostly 5-inch shells, two of which were determined to be live ordnance. A UXO/MEC device also is presumed to be the cause of an explosion on a hydraulic cutter-head dredge conducting maintenance dredging in Norfolk Harbor in April 2005 rupturing the primary pump casing on the dredge. The Coast Guard rendered assistance to the dredge plant to provide additional pump-out capacity for the incoming water and stabilize the plant. Fortunately, in most incidents ordnance has not detonated and has been safely removed or jettisoned from the vessel.

As a safety precaution, in any area where UXO may be encountered (including some if not all portions of Sandbridge Shoal), you will install special intake screening to be permanently placed over the drag head or cutterhead to effectively prevent any UXO from entering the dredge and/or being subsequently placed within the associated placement site. Additionally, you will install screening at the point where the material is discharged onto the beach. Special intake screening for UXO/MEC will be specified and installed to prevent entrainment of any material greater than 1-1/4 inches in diameter. Typical allowable openings specified by USACE-Norfolk District are 1-1/4 inches x 6 inches. While use of this screening poses challenges for monitoring interactions with listed species (see section 10 below), its use is not expected to change the entrainment rates calculated above. That is because, while it may prevent turtles or sturgeon from entering the intake pipes, it does not change the way the dredge operates or the suction power at the intake. So, while sea turtles or sturgeon may be less likely to be sucked through the dredge plant (as this could be prevented by the small size of the intakes as caused by the screening), the risk of an interaction does not change, and our analysis remains the same.

#### **6.10 Bed Leveling Devices**

Bed-leveling is often associated with hopper dredging (and other types of dredging) operations. Bed-levelers redistribute sediments, rather than removing them. Plows, I-beams, or other seabed-leveling mechanical dredging devices are used to lower high spots left in channel bottoms and dredged material deposition areas by hopper dredges or other type dredges. Leveling devices typically weigh about 30 to 50 tons, are fixed with cables to a derrick mounted on a barge pushed or pulled by a tugboat at about one to two knots.

We have considered the potential for sea turtles to 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 at Brunswick Harbor, Georgia, may have been crushed and killed in 2003 by bed-leveling which commenced after the hopper dredge finished its work in a particular area. Brunswick Harbor is a site where sea turtles captured by

relocation trawlers sometimes show evidence of brumating (over-wintering) in the muddy channel bottom, which could explain why, if they were in fact crushed, they failed to react quickly enough to avoid the bed-leveler.

You have engaged in efforts to design bed leveler devices that are more likely to push sea turtles out of the way (much like a deflector on a hopper dredge); it is thought that this would reduce any potential for crushing. The available information on bed leveling and sea turtles indicates that crushing is extremely unlikely outside of areas where sea turtles are brumating. Brumation is not known to occur in the action area. Additionally, the proposed modifications (i.e., integrated deflector configurations) to traditional bed-levelers are expected to further reduce the potential for impacts to sea turtles; therefore, any effects to sea turtles are discountable.

Atlantic sturgeon are likely to be able to avoid being crushed by a bed-leveler. These fish are highly mobile. The bed leveler will be pushing a sand wave in front of it that should cause sturgeon to relocate out of the path of the bed leveler. In addition, the bed leveler will be moving very slowly at approximately one to two knots. The low rate of entrainment of this species in any type of dredge suggests an ability to avoid interactions with dredge gear, including bed levelers. No reports of injured or dead sturgeon have been reported in association with any bed leveling activities. Therefore, we believe that any effects of the bed leveler on Atlantic sturgeon are extremely unlikely and will be discountable. As such, we do not anticipate any Atlantic sturgeon to be injured or killed if a bed leveler is used.

#### **6.11 Effects of relocation trawling as required by the Incidental Take Statement**

In the Incidental Take Statement accompanying this Biological Opinion (see Section 10), consistent with past Opinions considering dredging in these channels and borrow areas, we have determined that relocation trawling is necessary and appropriate when certain conditions are met to minimize the number of sea turtles captured and killed during dredging operations. The effects of relocation trawling on listed species in the action area are outlined below.

Relocation trawling is undertaken with the goal of moving sea turtles out of the area being dredged and placing them in area outside of the dredge area. There is evidence to suggest that relocation trawling can be effective at minimizing dredge interactions when the density of sea turtles in the dredge area is high. Relocation trawling has occurred occasionally in the Chesapeake Bay. Research is currently ongoing by the USACE to determine if “captureless” trawling can be as effective or more effective at displacing sea turtles from the path of the dredge. This technique uses an open bag that is thought to displace turtles from the path of the dredge without the stress of capturing the turtles and relocating them. Preliminary information available from use of captureless trawling in association with dredging activities in the Southeastern U.S. shows promise. However, the unintentional mortality of sea turtles during this type of trawling suggests that great care needs to be taken to ensure that the trawl is fishing properly. Relocation trawling can also capture species other than sea turtles. Atlantic sturgeon have been captured in relocation trawling activities in the action area.

Relocation trawling will be required if two sea turtles are entrained in one 24-hour period, or four sea turtles are entrained in a two month period, or in other circumstances where entrainment

indicates that the density of sea turtles in the action area is high and would result in entrainment at a higher rate than predicted.

### **6.11.1 Past Relocation Trawling in the Action Area**

Relocation trawling occurred in the action area in 2001, 2002 and 2003. No relocation trawling has occurred since the Fall of 2003. Relocation trawling occurred in Thimble Shoal Channel from September 6 to October 17, 2001. Twelve turtles (9 loggerheads and 3 Kemp's ridleys) were caught and released during this time period. Trawling in the Cape Henry Channel was conducted from October 13 to November 12, 2001, for 12 hours per day and with 15-30 minute tow times. Four turtles (three loggerheads and one green) were caught in water temperatures ranging from approximately 15.5 to 19°C. The turtles were relocated approximately four miles off the Virginia coast.

In 2002, several incidents of relocation trawling were initiated in Cape Henry and York Spit Channels as a result of triggering a term and condition from the January 2002 BO. From May 26 to June 6, trawling was conducted in Cape Henry, and two loggerheads were captured (in 174 30-minute tows). From September 20-25, trawling was performed in York Spit and no turtles were captured (in 103 30-minute tows). No turtles were taken by the dredge during this time. From October 10 to November 3, trawling was conducted in York Spit and Cape Henry Channels (in whichever channel the dredge was operating) with 15-30 minute tow times for 12 hours a day. Fifteen turtles were relocated (11 loggerheads, 3 Kemp's ridleys, and 1 green), and an additional Kemp's ridley turtle was found dead in the trawl. During the October to November trawling period, 5 turtles were captured by the dredge, but 2 of these incidents involved decomposed turtle parts (i.e., cause of death determined not to be related to the current dredging operations).

Relocation trawling also occurred in Thimble Shoals in 2003. Trawling occurred September 15 and 16 (20 30-minute tows, no turtles), September 20 – 22 (31 30-minute tows, 1 loggerhead) and from September 30 – October 22 (234 30-minute tows, 16 loggerheads and 5 Kemp's ridleys) and November 10 – November 28 (2 loggerheads, 1 Kemp's ridley). A total of 25 turtles were relocated during this time period. During this period of relocation trawling, fourteen Atlantic sturgeon were captured and released alive within and nearby the channel.

Most recently, the Baltimore District conducted relocation trawling during maintenance dredging of Cape Henry Channel in 2014. The relocation trawling was conducted over a 5-day period, 24 -27 July 2014 and 30 July 2014. A total of zero turtles were relocated during this time period.

The maximum number of turtles relocated in one year was 25 live uninjured turtles in 2003 (September 15-16, 20-22, September 30-October 22 and November 10-28). Only one mortality has been observed. The only incidence of Atlantic sturgeon capture in relocation trawling was in the fall of 2003 with 14 individuals captured.

### **6.11.2 Effects of Relocation Trawling on Sea Turtles**

Relocation trawling conducted in association with dredging activities is specifically targeting sea turtles and as such, we expect sea turtles to be captured in the trawls. It is difficult to determine

the magnitude, or the frequency, of these interactions, but potential capture levels can be estimated by previous capture rates from Virginia relocation trawling.

The maximum number of turtles caught in one year was 25, with the maximum in one month being 15. As it cannot be foreseen as to whether relocation trawling will occur in any given year or month, this anticipated capture level for relocation trawling associated with this project has been estimated with the assumption that trawling could occur every month whenever sea turtles are present and dredging occurs. Relocation trawling could therefore occur any time from April 1 to November 30 when the dredge is operating. Considering that a maximum of 15 turtles have been captured in one month of relocation trawling, if trawling occurred for all eight months that sea turtles were present, a maximum of 120 sea turtles could be captured annually during relocation trawling. We recognize that because relocation trawling is not likely to be required for every project, and even when required is unlikely to occur continuously for an 8-month period, this annual estimate is likely significantly higher than the number of relocation captures that would reasonably occur in a typical year. Therefore, we believe our best assessment of the maximum number of turtles that would be captured during relocation trawling in any given year is 25. Most of the captured sea turtles are likely to be loggerheads; however, we expect that some will be Kemp's ridley and greens. Of the 59 sea turtles captured during past relocation trawling, 44 were loggerheads, 13 Kemp's ridleys and 2 greens. We expect future relocation trawling to capture these species in a similar ratio (75% loggerhead, 22% Kemp's ridley and 3% green). No leatherback sea turtles are anticipated to be captured during relocation trawling due to the rarity of this species in the area and the lack of documented captures during other relocation trawling operations in the action area.

With an estimate of 25 captures per year (the maximum number of turtles caught in one year) for the duration of construction and maintenance dredging and the ratio of species noted above, we expect the following total number of captures over the life span of the project:

**Table 21. Maximum sea turtle takes by relocation trawling**

<b>Species</b>	<b>Number of Captures</b>
Loggerhead	937
Kemp's Ridley	275
Green	38

The relocation trawling capture estimation uses the best available information, but makes several assumptions. First, this estimation assumes that turtle distribution in the action area is not variable by month. The number used for the calculations were determined by a fall trawling event, and it is possible that turtle and/or sturgeon abundance in the action area will be higher or lower in the spring and summer. Second, this estimation assumes that turtle and sturgeon distribution will be relatively constant over the years. Relocation trawling has been conducted in Virginia only three years, and this limited amount of data was used to generate this estimated take level (e.g., one year of data noting the maximum number of turtles taken). This take estimation was based upon the best available data, but it is possible that turtle distribution may increase or decrease in future years, changing the number of turtles taken in the trawl from what was anticipated. Third, the estimated capture rate was generated under the assumption that relocation trawling would be conducted for 12 hours/day as it has in the past. If the frequency of

trawling is increased beyond 12 hours/day, more turtles could be taken (e.g., if trawling is completed 24 hours/day, the capture rates could double. Fourth, this assumes that trawling will need to be completed each week that dredging occurs and that all dredging will be conducted during the April to November time frame. It is highly unlikely that this will occur, as the term and condition requiring trawling may not be triggered for every project or dredging may not need to be completed during the entire “turtle season.” Finally, this estimation assumes that different trawl companies and trawlers do not have any variation in turtle catch rates. This take level was generated with one company’s trawl data, and if a different vessel is more or less successful at catching turtles, the anticipated take amount may be different. However, a standardized trawling protocol is required of all relocation trawling activities, so it is unlikely that the various trawl companies would have significantly different capture rates.

Relocation trawling moves animals out of their preferred environment, which may result in additional stress on the animal. While the effects of this relocation are not fully known or quantifiable, if the sea turtle is not injured or its swimming ability impaired, it is likely that the turtle could find other suitable foraging habitat or move to its desired location. Typically sea turtles are relocated at least 3 miles from the capture location. Some turtles captured during relocation trawling operations return to the dredge site and are subsequently recaptured. The likelihood of recapture may be related to where the animal was relocated, relocation distance, duration of dredging projects, and an individual turtle’s preferences or site fidelity. In Canaveral Channel in the early 1980s toward the end of a 90-day dredging project, about 25-33% of the turtles caught in a given day were recaptures of turtles previously relocated in the project. Relocation sites were 5 miles north, 5 miles south, and 5 miles east of the channel. One of those turtles was caught and relocated on 7 different occasions. One was caught and removed one night and taken again on the following night. Some turtles appear to return to the area regardless of where they are moved, while others are never seen again (E-mails, C. Oravetz to E. Hawk, T. Henwood to E. Hawk, September 27, 2002). In any event, relocating animals out of the channels may subject them to stress and require the turtles to undergo extra effort to migrate back to their intended habitat.

Sea turtles forcibly submerged in any type of restrictive gear can eventually suffer fatal consequences from prolonged anoxia and/or seawater infiltration of the lung (Lutcavage *et al.* 1997). A study examining the relationship between tow time and sea turtle mortality in the shrimp trawl fishery showed that mortality was strongly dependent on trawling duration, with the proportion of dead or comatose sea turtles rising from 0% for the first 50 minutes of capture to 70% after 90 minutes of capture (Henwood and Stuntz 1987). However, metabolic changes that can impair a sea turtle’s ability to function can occur within minutes of a forced submergence. While most voluntary dives appear to be aerobic, showing little if any increases in blood lactate and only minor changes in acid-base status, the story is quite different in forcibly submerged sea turtles, where oxygen stores are rapidly consumed, anaerobic glycolysis is activated, and acid-base balance is disturbed, sometimes to lethal levels (Lutcavage and Lutz 1997). Forced submergence of Kemp’s ridley sea turtles in shrimp trawls resulted in an acid-base imbalance after just a few minutes (times that were within the normal dive times for the species) (Stabenau *et al.* 1991). Conversely, recovery times for acid-base levels to return to normal may be prolonged. Henwood and Stuntz (1987) found that it took as long as 20 hours for the acid-base levels of loggerhead sea turtles to return to normal after capture in shrimp trawls for less than 30

minutes. This effect is expected to be worse for sea turtles that are recaptured before metabolic levels have returned to normal.

Following the recommendations of the NRC to reexamine the association between tow times and sea turtle deaths, the data set used by Henwood and Stuntz (1987) was updated and re-analyzed (Epperly *et al.* 2002; Sasso and Epperly 2006). Seasonal differences in the likelihood of mortality for sea turtles caught in trawl gear were apparent. For example, the observed mortality exceeded 1% after 10 minutes of towing in the winter (defined in Sasso and Epperly (2006) as the months of December-February), while the observed mortality did not exceed 1% until after 50 minutes in the summer (defined as March-November; Sasso and Epperly 2006). In general, tows of short duration (<10 minutes) in either season have little effect on the likelihood of mortality for sea turtles caught in the trawl gear and would likely achieve a negligible mortality rate (defined by the NRC as <1%). Intermediate tow times (10-200 minutes in summer and 10-150 minutes in winter) result in a rapid escalation of mortality, and eventually reach a plateau of high mortality, but will not equal 100%, as a sea turtle caught within the last hour of a long tow will likely survive (Epperly *et al.* 2002; Sasso and Epperly 2006). However, in both seasons, a rapid escalation in the mortality rate did not occur until after 50 minutes (Sasso and Epperly 2006) as had been found by Henwood and Stuntz (1987). Although the data used in the reanalysis were specific to bottom otter trawl gear in the U.S. south Atlantic and Gulf of Mexico shrimp fisheries, the authors considered the findings to be applicable to the impacts of forced submergence in general (Sasso and Epperly 2006).

Sea turtle behaviors may influence the likelihood of them being captured in bottom trawl gear. Video footage recorded by the NMFS, Southeast Fisheries Science Center (SEFSC), Pascagoula Laboratory indicated that sea turtles will keep swimming in front of an advancing shrimp trawl, rather than deviating to the side, until they become fatigued and are caught by the trawl or the trawl is hauled up (NMFS 2002a). Sea turtles have also been observed to dive to the bottom and hunker down when alarmed by loud noise or gear (Memo to the File, L. Lankshear, December 4, 2007), which could place them in the path of bottom gear such as a bottom otter trawl. With respect to oceanographic features, a review of the data associated with the 11 sea turtles captured by the scallop dredge fishery in 2001 concluded that the sea turtles appeared to have been near the shelf/slope front (D. Mountain, pers. comm.).

Tows for relocation trawling will be less than 30 minutes in duration. Based on the analysis by Sasso and Epperly (2006) and Epperly *et al.* (2002) as well as information on captured sea turtles from past NJ trawl surveys, the NEAMAP and NEFSC trawl surveys, and the NEFSC FSB observer program, a 30-minute tow time for the trawl gear to be used will likely eliminate the risk of death from forced submergence for sea turtles caught in the trawl gear.

During spring and fall bottom otter trawl surveys conducted by the NEFSC from 1963-2009, 71 loggerhead sea turtles were observed captured. Only one of the 71 loggerheads suffered injuries (cracks to the carapace) causing death (Wendy Teas, SEFSC, pers. comm. to Linda Despres, NEFSC, 2007). All others were alive and returned to the water unharmed. The one leatherback sea turtle captured in the NEFSC trawl survey was released alive and uninjured. NEFSC trawl survey tows are approximately 30 minutes in duration. All sea turtles captured in the NEAMAP surveys as well as the NJ trawl surveys have also been released alive and uninjured.

Only one mortality of a sea turtle during relocation trawling has been recorded in the action area. On November 3, 2002, during relocation trawling conducted in York Spit Channel (with 15-30 minute tows), a dead Kemp's ridley sea turtle was recovered (REMSA 2002). The fresh dead turtle was bleeding with wounds to the head. VMSM conducted a necropsy and concluded that the animal appeared to be a healthy, fresh dead juvenile Kemp's ridley with the only noted abnormalities to the head. This suggests that the cause of death could have been trawl related. Mortality of sea turtles during relocation trawling is expected to be very rare. As such, we anticipate that during each year that relocation trawling occurs, no more than 1 sea turtle will be seriously injured or killed. We expect mortalities to occur in proportion to the ratio of species captured. Therefore, we expect 75% of the mortalities to be loggerheads, 22% to be Kemp's ridleys and 3% to be greens. As such, we expect the following mortalities during relocation trawling over the 50-year period considered here: 37 loggerheads, 11 Kemp's ridleys, and 2 greens.

### **6.11.3        *Effects of Relocation Trawling on Atlantic sturgeon***

The capture of Atlantic sturgeon in otter trawls used for commercial fisheries is well documented (see for example, Stein *et al.* 2004 and ASMFC 2007). Atlantic sturgeon are also captured incidentally in trawls used for scientific studies. Atlantic sturgeon can occur in the action area year round. While it is possible that relocation trawling may be beneficial in removing these fish from the channels being dredged, we have no information to determine if it is reasonable to expect this to occur. Relocation trawling occurred in 2001, 2002 and 2003; however, Atlantic sturgeon were captured during only one of these relocation trawl events. Fourteen Atlantic sturgeon were captured during relocation trawling in November 2003.

Because Atlantic sturgeon are known to be vulnerable to capture in trawls and Atlantic sturgeon have been captured during past relocation trawling in the action area, it is reasonable to expect that Atlantic sturgeon will be captured during future relocation trawling events. Based on past events, we expect that no more than 14 Atlantic sturgeon are likely to be captured in any year that relocation trawling is required. We expect the Atlantic sturgeon that will be captured to consist of individuals from the five DPSs at the following frequencies: NYB 49%; South Atlantic 20%; Chesapeake Bay 14%; Gulf of Maine 11%; and Carolina 4%.

The short duration of the tow and careful handling of any sturgeon once on deck is likely to result in a low potential for mortality. None of the 14 Atlantic sturgeon captured in past relocation trawling had any evidence of injury or mortality. We reviewed results of short-tow trawl surveys (i.e., 20-30 minute tow time surveys carried out by NEFSC, VIMS (NEAMAP), and the States of New Jersey and Connecticut). None of the more than six hundred Atlantic sturgeon captured during these trawl surveys have been injured or killed. Based on this information, we expect that all Atlantic sturgeon captured during relocation trawling will be alive and will be released uninjured.

**6.11.4 Summary of Effects of Relocation Trawling**

Relocation trawling is only required when the risk of entrainment of sea turtles is higher than normal and is undertaken to minimize the potential for injury and mortality of sea turtles in the dredge. The short tow times and relocation of turtles away from the active dredge site have the goal of benefiting sea turtles. As noted above, there is the potential for some stress and a very low potential for injury or mortality. We have estimated the following maximum annual levels of capture and mortality due to relocation trawling:

**Table 22. Maximum annual and total takes over the project life from relocation trawling**

<b>Species</b>	<b>Number Captured Per Year</b>	<b>Number of Mortalities per Year</b>	<b>Number Captured</b>	<b>Number of Mortalities</b>
<i>Sea Turtles</i>	<i>25 total</i>	<i>1</i>	<i>1,250</i>	<i>50</i>
Loggerhead	19	1*	937	37
Kemp’s Ridley	5	1*	275	11
Green	1	1*	38	2
<i>Atlantic sturgeon</i>	<i>14 total</i>	<i>0</i>	<i>700 total</i>	<i>0</i>
NYB DPS	≤ 7	0	≤350	0
SA DPS	≤ 3	0	≤150	0
CB DPS	≤ 2	0	≤100	0
GOM DPS	≤ 2	0	≤100	0
Carolina DPS	≤ 1	0	≤50	0

\*1 loggerhead, Kemp’s ridley or green annually

We expect that one turtle (either a loggerhead, Kemp’s ridley, or green turtle) may be killed during relocation trawling activities each dredge cycle. In addition, a number of sea turtles (loggerheads, Kemp’s ridley and green) are likely to be captured during relocation trawling and released uninjured. While this action may temporarily disrupt normal foraging and migratory behaviors, these displaced turtles are likely to rapidly resume normal behaviors. As such, the capture and displacement of live, uninjured sea turtles is not likely to have any significant effect on sea turtles in the Chesapeake Bay or the species as a whole. We have also required that any live sea turtles captured during the relocation trawling be weighed and measured. While this requirement will cause additional handling of these individuals and may cause stress, this is likely to be temporary and there are no known lasting effects of taking these measurements. As such, the weighing and measuring of live, uninjured sea turtles is not likely to have any significant effect on sea turtles in the Chesapeake Bay or the species as a whole.

At this time, we have only preliminary information regarding the potential for captureless trawling to successfully minimize entrainment of sea turtles during dredging. Potential benefits to this trawling method are that the trawler can operate closer to the dredge, and therefore potentially intercept animals in the immediate pathway to the dredge; there may be less “down time” for the trawler as it does not need to stop operating every 30 minutes to haul in the trawl, handle and relocate animals, which means that the trawl is operating for a greater percentage of

time, and there may be less stress and potential for injury to animals “caught” in the trawl. Potential disadvantages are that by merely disturbing animals off the bottom and not moving them outside the area being dredged, the “relocation” may be less effective and because the animals are not being brought on board the trawl vessel there is no means to monitor the number of turtles encountered so it would be difficult to gauge the success of the trawling operation (other than in any reduction in entrainment). As such, at this time, we expect that future relocation trawling will use a traditional capture methodology. If in the future you proposes to use captureless relocation trawling in the action area, we will review the proposal to determine if it will: (1) achieve the same expected reduction in sea turtle entrainment as traditional relocation trawling, and (2), if it is likely to cause any effects to sea turtles or sturgeon not considered in this Opinion. If we determine that captureless trawling is at least as effective as traditional relocation trawling, that it will not cause any effects to sea turtles or sturgeon not considered in this Opinion, and takes can be monitored to ensure that the number of exempted takes are not exceeded, then no further consultation is likely to be necessary and the proposed “captureless” trawling will be considered to be within the scope of this consultation.

### **6.12 Tissue Sampling**

Genetic samples will be taken from all captured fish. This will be done by taking a small (1 cm<sup>2</sup>) tissue sample, clipped with surgical scissors from a section of soft fin rays. This procedure does not appear to impair the sturgeon’s ability to swim and is not thought to have any long-term adverse impact (Kahn and Mohead 2010). Many researchers have removed tissue samples according to this same protocol reporting no adverse effects (Wydoski and Emery 1983); therefore, we do not anticipate any long-term adverse effects to the sturgeon from this activity.

## **7.0 CUMULATIVE EFFECTS**

Cumulative effects as defined in 50 CFR 402.02 include the effects of future State, tribal, local, or private actions that are reasonably certain to occur within the action area considered in this Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Effects of ongoing Federal activities, are considered in the *Environmental Baseline* and *Status of the Species* sections above and are also factored into the *Integration and Synthesis of Effects* section below.

Sources of human-induced mortality, injury, and/or harassment of sea turtles and Atlantic sturgeon in the action area that are reasonably certain to occur in the future include interactions in state-regulated and recreational fishing activities, vessel collisions, ingestion of plastic debris, pollution, underwater noise, and global climate change. While the combination of these activities may affect sea turtles and Atlantic sturgeon, preventing or slowing a species’ recovery, the magnitude of these effects is currently unknown.

### *State Water Fisheries*

Future recreational and commercial fishing activities in state waters may capture, injure, or kill sea turtles and sturgeon. However, it is not clear to what extent these future activities would affect listed species differently than the current state fishery activities described in the *Environmental Baseline* section. Atlantic sturgeon are captured and killed in fishing gear

operating in the action area; however, at this time we are not able to quantify the number of interactions that occur. However, this Opinion assumes effects in the future would be similar to those in the past and are, therefore, reflected in the anticipated trends described in the *Status of the Species* and *Environmental Baseline* sections.

Fishing activities are considered one of the most significant causes of death and serious injury for sea turtles. Finkbeiner *et al.* (2011) compiled cumulative sea turtle bycatch information in U.S. fisheries from 1990 through 2007, before and after implementation of bycatch mitigation measures. In the Atlantic, a mean estimate of 137,700 bycatch interactions, of which 4,500 were mortalities, occurred annually (since implementation of bycatch mitigation measures). Kemp's ridleys interacted with fisheries most frequently, with the highest level of mean annual mortality (2,700), followed by loggerheads (1,400), greens (300), and leatherbacks (40). The Southeast/Gulf of Mexico shrimp trawl fishery was responsible for the vast majority of U.S. interactions (up to 98%) and mortalities (more than 80%). Fishing gear in state waters, including bottom trawls, gillnets, trap/pot gear, and pound nets, interacts with sea turtles each year. NMFS is working with state agencies to address the bycatch of sea turtles in state water fisheries within the action area of this consultation where information exists to show that these fisheries capture sea turtles. Action has been taken by some states to reduce or remove the likelihood of sea turtle bycatch and/or the likelihood of serious injury or mortality in one or more gear types. However, given that state managed commercial and recreational fisheries along the U.S. Atlantic coast are reasonably certain to occur within the action area in the foreseeable future, additional interactions of sea turtles with these fisheries are anticipated. There is insufficient information to quantify the number of sea turtle interactions with state water fisheries as well as the number of sea turtles injured or killed as a result of these interactions. While actions have been taken to reduce sea turtle bycatch in some state water fisheries, the overall effect of these actions is unknown, and the future effects of state water fisheries on sea turtles cannot be quantified. However, this Opinion assumes effects in the future would be similar to those in the past and are, therefore, reflected in the anticipated trends described in the *Status of the Species* and *Environmental Baseline* sections.

#### *Vessel Interactions*

Our STSSN data indicate that vessel interactions are responsible for a number of sea turtle strandings within the action area each year. In the U.S. Atlantic from 1997-2005, 14.9% of all stranded loggerheads were documented as having sustained some type of propeller or collision injuries (NMFS and USFWS 2007a). The incidence of propeller wounds rose from approximately 10% in the late 1980s to a record high of 20.5% in 2004 (STSSN database). Such collisions are reasonably certain to continue into the future. Collisions with boats can stun, injure, or kill sea turtles, and many live-captured and stranded sea turtles have obvious propeller or collision marks (Dwyer *et al.* 2003). However, it is not always clear whether the collision occurred pre- or post-mortem. We believe that vessel interactions with sea turtles will continue in the future. An estimate of the number of sea turtles that will likely be killed by vessels is not available at this time. Similarly, we are unable at this time to assess the risk that vessel operations in the action area pose to Atlantic sturgeon. While vessel strikes have been documented in several rivers, the extent that interactions occur in the marine environment is currently unknown. However, this Opinion assumes effects in the future would be similar to those in the past and are, therefore, reflected in the anticipated trends described in the *Status of*

*the Species and Environmental Baseline* sections.

#### *Debris, Pollution, and Contaminants*

Human activities in the action area causing marine debris and pollution are reasonably certain to continue in the future, as are impacts from them on sea turtles and Atlantic sturgeon. However, the level of impacts cannot be projected. Sources of contamination in the action area include atmospheric loading of pollutants, stormwater runoff from coastal development, groundwater discharges, and industrial development. Chemical contamination may have effects on listed species' reproduction and survival. Excessive turbidity due to coastal development and/or construction sites could influence sea turtle or sturgeon foraging ability. Marine debris (e.g., discarded fishing line or lines from boats, plastics) also has the potential to entangle ESA-listed species in the water or to be consumed by them. Sea turtles commonly ingest plastic or mistake debris for food and sometimes this may lead to asphyxiation. This Opinion assumes effects in the future would be similar to those in the past and are therefore reflected in the anticipated trends described in the *Status of the Species and Environmental Baseline* sections.

In the future, global climate change is expected to continue and may impact ESA-listed species and their habitat in the action area. As noted in the *Status of the Species and Environmental Baseline* sections, the likely rate of change associated with climate impacts is on a century scale, which makes the ability to discern changes in the abundance, distribution, or behavior of these species in the action area as a result of climate change impacts challenging in the short term.

## **8.0 INTEGRATION AND SYNTHESIS OF EFFECTS**

In the effects analysis outlined above, we considered potential effects from construction and maintenance dredging in several channels and borrow areas in the Chesapeake Bay and near its entrance as well as the CIEE. These effects include: (1) dredging with mechanical, cutterhead and hopper dredges; (2) bed leveling; and, (3) physical alteration of the action area including disruption of benthic communities. In addition to these categories of effects, we considered the potential for collisions between listed species and project vessels as well as the effect of taking fin clip samples from Atlantic sturgeon for genetic testing. We anticipate the mortality of loggerhead, Kemp's ridley and green sea turtles and Atlantic sturgeon from the five DPSs. Mortality of sea turtles will result from entrainment in hopper dredges operating in the Bay and as a result of relocation trawling. We also anticipate non lethal take of sea turtles and Atlantic sturgeon from relocation trawling. Mortality of Atlantic sturgeon will occur from entrainment in hopper and/or cutterhead dredges and capture in mechanical dredges. As explained in the *Effects of the Action* section, effects of the dredging and disposal on habitat and benthic resources will be insignificant and discountable. We do not anticipate any take of sea turtles or Atlantic sturgeon due to any of the other effects including vessel traffic and dredge disposal.

We have determined that the proposed action is likely to result in the following levels of capture and mortality over the life of these projects:

**Table 23. Total non-lethal and lethal takes**

<b>Species</b>	<b>Non-lethal Capture</b>	<b>Mortality</b>
NWA DPS of Loggerhead sea turtle	937	785 (748 in hopper dredge; 37 in trawl)
Kemp's ridley sea turtle	275	77 (66 in hopper dredge; 11 in trawl)
North Atlantic DPS of Green sea turtle	38	20 (18 in hopper dredge; 2 in trawl)
NYB DPS of Atlantic sturgeon	350	94 (68 hopper, 25 cutterhead, 1 mechanical)
SA DPS of Atlantic sturgeon	150	40 (29 hopper, 10 cutterhead, 1 mechanical)
CB DPS of Atlantic sturgeon	100	34 (23 hopper, 8 cutterhead, 1 mechanical)
GOM DPS of Atlantic sturgeon	100	24 (18 hopper, 5 cutterhead, 1 mechanical)
Carolina DPS of Atlantic sturgeon	50	13 (10 hopper, 2 cutterhead, 1 mechanical)

In the discussion below, we consider whether the effects of the proposed actions reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of the listed species in the wild by reducing the reproduction, numbers, or distribution of the listed species that will be adversely affected by the action. The purpose of this analysis is to determine whether the proposed actions, in the context established by the status of the species, environmental baseline, and cumulative effects, would jeopardize the continued existence of any listed species. In the NMFS/USFWS Section 7 Handbook, for the purposes of determining jeopardy, survival is defined as:

“the species’ persistence as listed or as a recovery unit, beyond the conditions leading to its endangerment, with sufficient resilience to allow for the potential recovery from endangerment. Said in another way, survival is the condition in which a species continues to exist into the future while retaining the potential for recovery. This condition is characterized by a species with a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species’ entire life cycle, including reproduction, sustenance, and shelter.”

Recovery is defined as, “improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in Section 4(a)(1) of the Act.” We summarize below the status of the species and consider whether the proposed action will result in reductions in reproduction, numbers or distribution of these species and then consider whether any reductions in reproduction, numbers or distribution resulting from the proposed action would reduce appreciably the likelihood of both the survival and recovery of these species, as those terms are defined for purposes of the Endangered Species Act.

## **8.1 Atlantic sturgeon**

As explained above, the proposed actions are likely to result in the mortality of a total of 205 Atlantic sturgeon from the Gulf of Maine, New York Bight, Chesapeake Bay, South Atlantic and Carolina DPSs over the project life. Based on the proposed dredge schedule and known maintenance and nourishment needs, in a typical year we expect that no more than two Atlantic sturgeon would be entrained. We do not anticipate the mortality of any early life stages because the high salinities in the action area preclude these life stages from being present. We do not anticipate any mortality of adults because these fish are large enough to avoid entrainment in the dredge. The proposed action is also likely to result in the capture of up to 700 Atlantic sturgeon during sea turtle relocation trawling; these captures could be subadults or adults. No mortality due to capture in relocation trawling is anticipated. All other effects to Atlantic sturgeon, including effects to habitat and prey due to dredging and dredge material disposal, will be insignificant and discountable.

### **8.1.1 *Determination of DPS Composition***

We have considered the best available information to determine from which DPSs individuals that will be affected by the proposed actions are likely to have originated. Using mixed stock analysis explained above, we have determined that Atlantic sturgeon in the action area likely originate from the five DPSs at the following frequencies: NYB 49%; South Atlantic 20%; Chesapeake Bay 14%; Gulf of Maine 11%; and Carolina 4%. Given these percentages, we expect that in the worst case that all 205 sturgeon likely to be killed during dredging were Atlantic sturgeon, 94 will originate from the New York Bight DPS, 40 from the South Atlantic DPS, 34 from the Chesapeake Bay DPS, 24 from the Gulf of Maine DPS, and 13 from the Carolina DPS.

### **8.1.2 *Gulf of Maine DPS***

The GOM DPS is listed as threatened. While Atlantic sturgeon occur in several rivers in the GOM DPS, recent spawning has only been documented in the Kennebec; spawning is suspected to also occur in the Androscoggin River. No total population estimates are available for any river population or the DPS as a whole. As discussed in section 4.2.2.1, we have estimated a total of 7,455 GOM DPS adults and subadults in the ocean (1,864 adults and 5,591 subadults). This estimate is the best available at this time and represents only a percentage of the total GOM DPS population as it does not include young of the year or juveniles and does not include all adults and subadults. GOM origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. While there are some indications that the status of the GOM DPS may be improving, there is currently not enough information to establish a trend for any life stage or for the DPS as a whole.

Based on mixed-stock analysis, we expect that 11% of the sub-adult and adult Atlantic sturgeon in the action area will originate from the GOM DPS. While some adults from the GOM DPS are expected to be present in the action area, we do not anticipate any mortality of adult Atlantic sturgeon from the GOM DPS. Over the life of the project, we anticipate the mortality of up to 24

subadult GOM DPS Atlantic sturgeon and the non-lethal capture of up to 100 subadult and adult GOM DPS Atlantic sturgeon.

Capture during relocation trawling will temporarily prevent captured sturgeon from carrying out normal behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the fish are returned to the water. The capture of live Atlantic sturgeon is not likely to reduce the numbers of GOM DPS Atlantic sturgeon. Similarly, as the capture of live GOM DPS Atlantic sturgeon will not affect the fitness of any individual, no effects to reproduction are anticipated. The capture of live GOM DPS Atlantic sturgeon is also not likely to affect the distribution of GOM DPS Atlantic sturgeon throughout their range. As any effects to individual GOM DPS Atlantic sturgeon captured during relocation trawling and temporarily removed from the water will be minor and temporary there are not anticipated to be any population level impacts.

The number of subadult GOM DPS Atlantic sturgeon we expect to be killed due to the proposed action (24 between now and the conclusion of the proposed action) represents an extremely small percentage of the GOM DPS. While the death of 24 GOM DPS Atlantic sturgeon over this period will reduce the number of GOM DPS Atlantic sturgeon compared to the number that would have been present absent the proposed action, it is not likely that this reduction in numbers will change the status of this species as this loss represents a very small percentage of the GOM DPS population of subadults and an even smaller percentage of the overall DPS as a whole. Even if there were only 5,591 subadults in the GOM DPS, the loss would represent only 0.43% of the subadults in the DPS. The percentage would be much less if we also considered the number of young of the year, juveniles, adults, and other subadults not included in the NEAMAP-based oceanic population estimate.

Because there will be no loss of adults, the reproductive potential of the GOM DPS will not be affected in any way other than through a reduction in numbers of individual future spawners as opposed to current spawners. The loss of 24 female subadults would have the effect of reducing the amount of potential reproduction, as any dead GOM DPS Atlantic sturgeon would have no potential for future reproduction. This small reduction in potential future spawners is expected to result in an extremely small reduction in the number of eggs laid or larvae produced in future years and similarly, an extremely small effect on the strength of subsequent year classes. Even considering the potential future spawners that would be produced by the individual that would be killed as a result of the proposed action, any effect to future year classes is anticipated to be extremely small and would not change the status of this species. The loss of 24 male subadults may have less of an impact on future reproduction as other males are expected to be available to fertilize eggs in a particular year. The proposed action will also not affect the spawning grounds within the rivers where GOM DPS fish spawn.

The proposed action is not likely to reduce distribution because while sturgeon may temporarily avoid areas where dredging or disposal activities are underway, all of these changes in distribution will be temporary and limited to movements to relatively nearby areas. We do not anticipate that any impacts to habitat will impact how GOM DPS sturgeon use the action area. Additionally, given the small percentage of the species that will be killed as a result of the proposed actions, there is not likely to be any loss of unique genetic haplotypes and no loss of

genetic diversity

Based on the information provided above, the death of up to 24 sub-adult GOM DPS Atlantic sturgeon over the life of the proposed action, will not appreciably reduce the likelihood of survival of the GOM DPS (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect GOM DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in effects to the environment which would prevent Atlantic sturgeon from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the death of 24 subadult GOM DPS Atlantic sturgeon represents an extremely small percentage of the population of the DPS; (2) the death of 24 GOM DPS Atlantic sturgeon will not change the status or trends of the DPS as a whole; (3) the loss of 24 GOM DPS Atlantic sturgeon is not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the loss of 24 subadult GOM DPS Atlantic sturgeon is likely to have such a small effect on reproductive output that the loss of these individuals will not change the status or trends of the DPS; (5) the action will have only a minor and temporary effect on the distribution of GOM DPS Atlantic sturgeon in the action area and no effect on the distribution of the DPS throughout its range; and, (6) the action will have no effect on the ability of GOM DPS Atlantic sturgeon to shelter and only an insignificant effect on foraging GOM DPS Atlantic sturgeon.

In certain instances, an action that does not appreciably reduce the likelihood of a species' survival might affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, we have determined that the proposed actions will not appreciably reduce the likelihood that the GOM DPS will survive in the wild. Here, we consider the potential for the actions to reduce the likelihood of recovery from the perspective of ESA Section 4. As noted above, recovery is defined as the improvement in status such that listing under Section 4(a) as "in danger of extinction throughout all or a significant portion of its range" (endangered) or "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range..." (threatened) is no longer warranted. Thus, we have considered whether the proposed action will appreciably reduce the likelihood that the GOM DPS of Atlantic sturgeon can rebuild to a point where it is no longer in danger of becoming endangered within the foreseeable future throughout all or a significant portion of its range.

A Recovery Plan for the GOM DPS has not yet been developed. The Recovery Plan will outline the steps necessary for recovery and the demographic criteria, which once attained, would allow the species to be delisted. We know that in general, to recover, a listed species must have a sustained positive trend of increasing population over time. In order for that to happen for GOM Atlantic sturgeon, individuals must have access to enough habitat in suitable condition for foraging, migrating, resting, and spawning. Conditions must be suitable for the successful development of early life stages. Mortality rates must be low enough to allow for recruitment to all age classes so that successful spawning can continue over time and over generations. For Atlantic sturgeon, habitat conditions must be suitable both in the natal river and in other rivers and estuaries where foraging by subadults and adults will occur and in the ocean where subadults and adults migrate, overwinter and forage. Habitat connectivity must also be maintained so that

individuals can migrate between important habitats without delays that impact their fitness. Here, we consider whether this proposed action will affect the GOM DPS likelihood of recovery. The proposed actions are not expected to modify, curtail or destroy the range of the species since it will result in an extremely small reduction in the number of GOM DPS Atlantic sturgeon and since it will not affect the overall distribution of GOM DPS Atlantic sturgeon. Any effects to habitat will be insignificant and discountable and will not affect the ability of Atlantic sturgeon to carry out any necessary behaviors or functions. Any impacts to available forage will also be insignificant. The proposed actions will result in an extremely small amount of mortality annually (one individual) and a subsequent small reduction in future reproductive output. For these reasons, it is not expected to affect the persistence of the GOM DPS of Atlantic sturgeon. These actions will not change the status or trend of the GOM DPS of Atlantic sturgeon. The very small reduction in numbers and future reproduction resulting from the proposed actions will not reduce the likelihood of improvement in the status of the GOM DPS of Atlantic sturgeon. The effects of the proposed actions will not delay the recovery timeline or otherwise decrease the likelihood of recovery. The effects of the proposed actions will also not reduce the likelihood that the status of the species can improve to the point where it is recovered and could be delisted. Therefore, the proposed actions will not appreciably reduce the likelihood that the GOM DPS of Atlantic sturgeon can be brought to the point at which they are no longer listed as threatened. Based on the analysis presented herein, the proposed actions are not likely to appreciably reduce the survival and recovery of this species.

Despite the threats faced by individual GOM DPS Atlantic sturgeon inside and outside of the action area, the proposed actions will not increase the vulnerability of individual sturgeon to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed actions. We have considered the effects of the proposed action in light of cumulative effects explained above, including climate change, and have concluded that even in light of the ongoing impacts of these activities and conditions; the conclusions reached above do not change. Based on the analysis presented herein, the proposed actions, resulting in the mortality of 24 subadult GOM DPS Atlantic sturgeon and the non-lethal capture of up to 100 subadult and adult GOM DPS Atlantic sturgeon over the life span of the project, are not likely to appreciably reduce the survival and recovery of this species.

### **8.1.3            *New York Bight DPS***

The NYB DPS is listed as endangered. While Atlantic sturgeon occur in several rivers in the NYB DPS, recent spawning has only been documented in the Delaware and Hudson rivers. The capture of age-0 Atlantic sturgeon in the Connecticut River indicates that spawning, at least in some years, is likely occurring in that river as well. Based on Mixed Stock Analysis, we expect that 49% of the subadult and adult Atlantic sturgeon in the action area will originate from the NYB DPS.

NYB origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance (e.g., impingement at water intakes, dredging, bycatch in commercial and recreational fisheries, in-water construction activities, vessel traffic) throughout the riverine and marine portions of their range. As discussed in section 4.2.2.2, we have estimated a total of 34,566 NYB DPS adults and subadults in the ocean (8,642 adults and 25,925 subadults). This estimate is the best available at this time and represents only a percentage of the total NYB DPS

population as it does not include young of the year or juveniles and does not include all adults and subadults. The largest single source of mortality appears to be capture as bycatch in commercial fisheries operating in the marine environment. A bycatch estimate provided by NEFSC indicates that approximately 376 Atlantic sturgeon die as a result of bycatch each year. While there are some indications that the status of the NYB DPS may be improving, there is currently not enough information to establish a trend for any life stage or for the DPS as a whole.

Based on mixed-stock analysis, we expect that 49% of the sub-adult and adult Atlantic sturgeon in the action area will originate from the NYB DPS. While some adults from the NYB DPS are expected to be present in the action area, we do not anticipate any mortality of adult Atlantic sturgeon from the NYB DPS. Because juveniles do not leave their natal rivers, they are not impacted by the proposed action.

Over the life of the proposed action, we anticipate the mortality of up to 94 subadult NYB DPS Atlantic sturgeon. These sturgeon could be killed due to entrainment in a hopper or cutterhead dredge, or capture in a mechanical dredge. These fish could be subadults originating from the Delaware or Hudson River. While it is possible that entrained fish could survive, we assume here that these fish will be killed.

Capture during relocation trawling will temporarily prevent captured sturgeon from carrying out normal behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the fish are returned to the water. The capture of live Atlantic sturgeon is not likely to reduce the numbers of NYB DPS Atlantic sturgeon. Similarly, as the capture of live NYB DPS Atlantic sturgeon will not affect the fitness of any individual, no effects to reproduction are anticipated. The capture of live NYB DPS Atlantic sturgeon is also not likely to affect the distribution of NYB DPS Atlantic sturgeon throughout their range. As any effects to individual NYB DPS Atlantic sturgeon captured during relocation trawling and temporarily removed from the water will be minor and temporary there are not anticipated to be any population level impacts.

While overall we anticipate the death of 94 subadult Atlantic sturgeon from the NYB DPS over the life span of the project, we do not anticipate that there would be a loss of more than 1 NYB DPS subadult in most years and never more than 2 NYB DPS Atlantic sturgeon killed per year. Here, we consider the effect of the loss of these subadults on the reproduction, numbers and distribution of the NYB DPS.

Any New York Bight DPS subadults could originate from the Delaware or Hudson River. We have limited information from which to determine the percentage of NYB DPS fish in the Chesapeake Bay that are likely to originate from the Delaware vs. the Hudson River. Given the sizes of the two populations, the worst case scenario is that all 94 NYB fish that are killed are Delaware River fish (rather than some Delaware River, some Hudson River); however, that appears to be unlikely. Individual assignments of NYB DPS Atlantic sturgeon that have undergone genetic testing indicates that in the oceanic environment, approximately 91% of NYB individuals originate from the Hudson River. This is likely due to the greater number of Hudson River origin Atlantic sturgeon than Delaware River Atlantic sturgeon. Thus, of the 94 NYB Atlantic sturgeon likely to be killed, eight are likely to originate from the Delaware River and 86 from the Hudson River.

Some Delaware River fish have a unique genetic haplotype (the A5 haplotype); however, whether there is any evolutionary significance or fitness benefit provided by this genetic makeup is unknown. Genetic evidence indicates that while spawning continued to occur in the Delaware River and in some cases Delaware River origin fish can be distinguished genetically from Hudson River origin fish, there is free interchange between the two rivers. This relationship is recognized by the listing of the New York Bight DPS as a whole and not separate listings of a theoretical Hudson River DPS and Delaware River DPS. Thus, while we can consider the loss of Delaware River fish on the Delaware River population and the loss of Hudson River fish on the Hudson River population, it is more appropriate, because of the interchange of individuals between these two populations, to consider the effects of these mortalities on the New York Bight DPS as a whole.

While overall we anticipate the death of 94 subadult Atlantic sturgeon from the NYB DPS over the life span of the project, we do not anticipate that there would be a loss of more than 2 NYB DPS subadult per year. The mortality of 2 subadult Atlantic sturgeon from the NYB DPS each year represents a very small percentage of subadult population (*i.e.*, approximately 0.08% of the population, just considering the minimum estimated number of subadults; the percentage would be much less if the number of YOY, juveniles and adults was considered). While the death of these subadult Atlantic sturgeon will reduce the number of NYB DPS Atlantic sturgeon compared to the number that would have been present absent the proposed actions, it is not likely that this reduction in numbers will change the status of this species as this loss represents a very small percentage of the subadult population and an even smaller percentage of the overall population of the DPS (juveniles, subadults and adults combined). Even when converting these fish to adult equivalents<sup>12</sup> (using a conversion rate of 0.48 considering the adult equivalent), and assuming no growth in the adult population, the annual mortality of 1 subadult represents an extremely small percentage of the adult population (approximately 0.11%).

Because there will be no loss of adults, the reproductive potential of the NYB DPS will not be affected in any way other than through a reduction in numbers of individual future spawners. The loss of 94 subadults over a 50-year period would have the effect of reducing the amount of potential reproduction as any dead NYB DPS Atlantic sturgeon would have no potential for future reproduction. This small reduction in potential future spawners is expected to result in an extremely small reduction in the number of eggs laid or larvae produced in future years and similarly, an extremely small effect on the strength of subsequent year classes. Even considering the potential future spawners that would be produced by the individual that would be killed as a result of the proposed actions, any effect to future year classes is anticipated to be extremely small and would not change the status of this species. The proposed actions will also not affect the spawning grounds within the Hudson River or Delaware River where NYB DPS fish spawn. There will be no effects to spawning adults and therefore no reduction in individual fitness or any future reduction in spawning by these individuals.

The proposed action is not likely to reduce distribution. Although the action will temporarily affect the distribution of individual sturgeon by displacing sturgeon captured with the trawl from

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<sup>12</sup> The “adult equivalent” rate converts a number of subadults to adult equivalents (the number of subadults that would, through natural mortality, live to be adults; for Atlantic sturgeon, this is calculated as 0.48).

one area and relocating them to an alternate area and sturgeon may temporarily avoid areas where dredging or disposal activities are underway, all of these changes in distribution will be temporary and limited to movements to relatively nearby areas. We do not anticipate that any impacts to habitat will permanently impact how sturgeon use the action area. Further, the action is not expected to reduce the river by river distribution of Atlantic sturgeon. Additionally, given the small percentage of the species that will be killed as a result of the proposed actions, there is not likely to be any loss of unique genetic haplotypes and no loss of genetic diversity

Based on the information provided above, the death of up to 94 NYB DPS Atlantic sturgeon over the project life considered here, will not appreciably reduce the likelihood of survival of the New York Bight DPS (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The actions will not affect NYB DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in effects to the environment which would prevent Atlantic sturgeon from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the death of 94 subadult NYB DPS Atlantic sturgeon represents an extremely small percentage of the population of the DPS; (2) the death of 94 subadult NYB DPS Atlantic sturgeon will not change the status or trends of the species as a whole; (3) the loss of 94 subadult NYB DPS Atlantic sturgeon is not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the loss of 94 subadult NYB DPS Atlantic sturgeon is likely to have such a small effect on reproductive output that the loss of these individuals will not change the status or trends of the species; (5) the actions will have only a minor and temporary effect on the distribution of NYB DPS Atlantic sturgeon in the action area and no effect on the distribution of the species throughout its range; and, (6) the actions will have no effect on the ability of NYB DPS Atlantic sturgeon to shelter and only an insignificant effect on individual foraging NYB DPS Atlantic sturgeon.

In certain instances, an action that does not appreciably reduce the likelihood of a species' survival might affect its likelihood of recovery. As explained above, we have determined that the proposed actions will not appreciably reduce the likelihood that the NYB DPS will survive in the wild. Here, we consider whether the action will appreciably reduce the likelihood of recovery from the perspective of ESA Section 4. As noted above, recovery is defined as the improvement in status such that listing under Section 4(a) as "in danger of extinction throughout all or a significant portion of its range" (endangered) or "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range..." (threatened) is no longer appropriate. Thus, we have considered whether the proposed action will appreciably reduce the likelihood that the NYB DPS of Atlantic sturgeon shortnose sturgeon can rebuild to a point where it is no longer in danger of extinction through all or a significant part of its range.

A Recovery Plan for the NYB DPS has not yet been developed. The Recovery Plan will outline the steps necessary for recovery and the demographic criteria which once attained would allow the species to be delisted. We know that in general, to recover, a listed species must have a sustained positive trend of increasing population over time. To allow that to happen for sturgeon, individuals must have access to enough habitat in suitable condition for foraging,

resting, migrating, and spawning. Conditions must be suitable for the successful development of early life stages. Mortality rates must be low enough to allow for recruitment to all age classes so that successful spawning can continue over time and over generations. For Atlantic sturgeon, habitat conditions must be suitable both in the natal river and in other rivers and estuaries where foraging by subadults and adults will occur and in the ocean where subadults and adults migrate, overwinter and forage. Habitat connectivity must also be maintained so that individuals can migrate between important habitats without delays that impact their fitness. Here, we consider whether this proposed action will affect the NYB DPS likelihood of recovery.

The proposed actions are not expected to modify, curtail or destroy the range of the species since it will result in an extremely small reduction in the number of NYB DPS Atlantic sturgeon and since it will not affect the overall distribution of NYB DPS Atlantic sturgeon. Any effects to habitat will be insignificant and discountable and will not affect the ability of Atlantic sturgeon to carry out any necessary behaviors or functions. Any impacts to available forage will also be insignificant. The proposed actions will result in a small amount of mortality (no more than two individuals per year) and a subsequent small reduction in future reproductive output. For these reasons, it is not expected to affect the persistence of the NYB DPS of Atlantic sturgeon. These actions will not change the status or trend of the NYB DPS of Atlantic sturgeon. The very small reduction in numbers and future reproduction resulting from the proposed actions will not reduce the likelihood of improvement in the status of the NYB DPS of Atlantic sturgeon. The effects of the proposed actions will not delay the recovery timeline or otherwise decrease the likelihood of recovery. The effects of the proposed actions will also not reduce the likelihood that the status of the species can improve to the point where it is recovered and could be delisted. Therefore, the proposed actions will not appreciably reduce the likelihood that the NYB DPS of Atlantic sturgeon can be brought to the point at which they are no longer listed as endangered. Based on the analysis presented herein, the proposed actions are not likely to appreciably reduce the survival and recovery of this species.

Despite the threats faced by individual NYB DPS Atlantic sturgeon inside and outside of the action area, the proposed actions will not increase the vulnerability of individual sturgeon to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed actions. Based on the analysis presented herein, the proposed actions, resulting in the mortality of up to 94 subadult NYB DPS Atlantic sturgeon and the non-lethal capture of up to 350 subadult and adult NYB DPS Atlantic sturgeon over the life span of the project, is not likely to appreciably reduce the survival and recovery of this species.

#### **8.1.4 Chesapeake Bay DPS**

The CB DPS is listed as endangered. Individuals originating from the CB DPS are likely to occur in the action area. While Atlantic sturgeon occur in several rivers in the CB DPS, recent spawning has only been documented in the James River and York River systems. Chesapeake Bay DPS origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance (e.g., impingement at water intakes, dredging, bycatch in commercial and recreational fisheries, in-water construction activities, vessel traffic) throughout the riverine and marine portions of their range. No total population estimates are available for any river population or the DPS as a whole. As discussed in section 4.2.2.3, we have estimated a total of 8,811 CB DPS adults and subadults in the ocean (2,203 adults and 6,608 subadults). This

estimate is the best available at this time and represents only a percentage of the total CB DPS population as it does not include young of the year or juveniles and does not include all adults and subadults. There is currently not enough information to establish a trend for any life stage or for the DPS as a whole.

Based on our mixed-stock analysis, we expect that 14% of the Atlantic sturgeon in the action area will originate from the CB DPS. Over the 50-year period considered here, we anticipate the mortality of up to 34 subadult and juvenile CB DPS Atlantic sturgeon. These sturgeon could be killed due to entrainment in a hopper or cutterhead dredge, or capture in a mechanical dredge. While it is possible that entrained/entrapped fish could survive, we assume here that these fish will be killed. We also anticipate the non-lethal capture of up to 100 subadult, adult, and juvenile CB DPS Atlantic sturgeon.

Capture during relocation trawling will temporarily prevent captured sturgeon from carrying out normal behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the fish are returned to the water. The capture of live Atlantic sturgeon is not likely to reduce the numbers of CB DPS Atlantic sturgeon. Similarly, as the capture of live CB DPS Atlantic sturgeon will not affect the fitness of any individual, no effects to reproduction are anticipated. The capture of live CB DPS Atlantic sturgeon is also not likely to affect the distribution of CB DPS Atlantic sturgeon throughout their range. As any effects to individual CB DPS Atlantic sturgeon captured during relocation trawling and temporarily removed from the water will be minor and temporary there are not anticipated to be any population level impacts.

While overall we anticipate the death of 34 juvenile and subadult Atlantic sturgeon from the CB DPS over the life span of the project, we do not anticipate that there would be a loss of more than 1 CB DPS subadult or juvenile in any year. Here, we consider the effect of the loss of a total of these subadults on the reproduction, numbers and distribution of the CB DPS.

The reproductive potential of the CB DPS will not be affected in any way other than through a reduction in numbers of individuals. The loss of a total of 34 juvenile and subadults, with no more than one per year, would have the effect of reducing the amount of potential reproduction as any dead CB DPS Atlantic sturgeon would have no potential for future reproduction. However, this small reduction in potential future spawners is expected to result in an extremely small reduction in the number of eggs laid or larvae produced in future years and similarly, an extremely small effect on the strength of subsequent year classes. Even considering the potential future spawners that would be produced by the individual that would be killed as a result of the proposed actions, any effect to future year classes is anticipated to be extremely small and would not change the status of this species. Reproductive potential of other captured or injured individuals is not expected to be affected in any way. Additionally, we have determined that any impacts to behavior will be minor and temporary and that there will not be any delay or disruption of any normal behavior including spawning; there will also be no reduction in individual fitness or any future reduction in numbers of individuals. The proposed actions will also not affect the spawning grounds within the rivers where CB DPS fish spawn. The actions will also not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds used by CB DPS fish.

Because we do not have a population estimate for the CB DPS, it is difficult to evaluate the effect of the mortality caused by these actions on the species. However, because the proposed action will result in the loss of only one individual per year, with a total of no more than 34, it is unlikely that these deaths will have a detectable effect on the numbers and population trend of the CB DPS.

The proposed action is not likely to reduce distribution. Although the action will temporarily affect the distribution of individual sturgeon by displacing sturgeon captured with the trawl from one area and relocating them to alternate area and sturgeon may temporarily avoid areas where dredging or disposal activities are underway, all of these changes in distribution will be temporary and limited to movements to relatively nearby areas. We do not anticipate that any impacts to habitat will permanently impact how sturgeon use the action area. Further, the action is not expected to reduce the river by river distribution of Atlantic sturgeon. Additionally, given the small percentage of the species that will be killed as a result of the proposed actions, there is not likely to be any loss of unique genetic haplotypes and no loss of genetic diversity

Based on the information provided above, the death of up to 34 CB DPS Atlantic sturgeon over the life span of the project, will not appreciably reduce the likelihood of survival of the CB DPS (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The actions will not affect CB DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in effects to the environment which would prevent Atlantic sturgeon from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the death of one juvenile or subadult CB DPS Atlantic sturgeon in any year and the total loss of 34 juvenile and subadults will not change the status or trends of the species as a whole; (2) the death of 34 juvenile and subadult CB DPS Atlantic sturgeon represents an extremely small percentage of the species; (3) the loss of 34 juvenile and subadult CB DPS Atlantic sturgeon is not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the loss of 34 juvenile and subadult CB DPS Atlantic sturgeon over the life span of the project will not result in the loss of any age class; (5) the actions will have only a minor and temporary effect on the distribution of CB DPS Atlantic sturgeon in the action area and no effect on the distribution of the species throughout its range; and, (6) the actions will have no effect on the ability of CB DPS Atlantic sturgeon to shelter and only an insignificant effect on any foraging CB DPS Atlantic sturgeon.

In certain instances, an action that does not appreciably reduce the likelihood of a species' survival might affect its likelihood of recovery. As explained above, we have determined that the proposed action will not appreciably reduce the likelihood that the CB DPS of Atlantic sturgeon will survive in the wild. Here, we consider whether the action will appreciably reduce the likelihood of recovery from the perspective of ESA Section 4. As noted above, recovery is defined as the improvement in status such that listing under Section 4(a) as "in danger of extinction throughout all or a significant portion of its range" (endangered) or "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range..." (threatened) is no longer appropriate. Thus, we have considered whether the proposed action will appreciably reduce the likelihood that the CB DPS of Atlantic sturgeon shortnose

sturgeon can rebuild to a point where it is no longer in danger of extinction through all or a significant part of its range.

A Recovery Plan for the CB DPS has not yet been developed. The Recovery Plan will outline the steps necessary for recovery and the demographic criteria, which once attained would allow the species to be delisted. We know that in general, to recover, a listed species must have a sustained positive trend of increasing population over time. To allow that to happen for sturgeon, individuals must have access to enough habitat in suitable condition for foraging, migrating, resting, and spawning. Conditions must be suitable for the successful development of early life stages. Mortality rates must be low enough to allow for recruitment to all age classes so that successful spawning can continue over time and over generations. For Atlantic sturgeon, habitat conditions must be suitable both in the natal river and in other rivers and estuaries where foraging by subadults and adults will occur and in the ocean where subadults and adults migrate, overwinter and forage. Habitat connectivity must also be maintained so that individuals can migrate between important habitats without delays that impact their fitness. Here, we consider whether this proposed action will affect the CB DPS likelihood of recovery.

The proposed actions are not expected to modify, curtail or destroy the range of the species since it will result in an extremely small reduction in the number of CB DPS Atlantic sturgeon and since it will not affect the overall distribution of CB DPS Atlantic sturgeon. Any effects to habitat will be insignificant and discountable and will not affect the ability of Atlantic sturgeon to carry out any necessary behaviors or functions. Any impacts to available forage will also be insignificant. The proposed actions will result in an extremely small amount of mortality (on average, less than one individual per year) and a subsequent small reduction in future reproductive output. For these reasons, it is not expected to affect the persistence of the CB DPS of Atlantic sturgeon. These actions will not change the status or trend of the CB DPS of Atlantic sturgeon. The very small reduction in numbers and future reproduction resulting from the proposed actions will not reduce the likelihood of improvement in the status of the CB DPS of Atlantic sturgeon. The effects of the proposed actions will not delay the recovery timeline or otherwise decrease the likelihood of recovery. The effects of the proposed actions will also not reduce the likelihood that the status of the species can improve to the point where it is recovered and could be delisted. Therefore, the proposed actions will not appreciably reduce the likelihood that the CB DPS of Atlantic sturgeon can be brought to the point at which they are no longer listed as endangered. Based on the analysis presented herein, the proposed actions, are not likely to appreciably reduce the survival and recovery of this species.

Despite the threats faced by individual CB DPS Atlantic sturgeon inside and outside of the action area, the proposed actions will not increase the vulnerability of individual sturgeon to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed actions. We have considered the effects of the proposed actions in light of cumulative effects explained above, including climate change, and have concluded that even in light of the ongoing impacts of these activities and conditions; the conclusions reached above do not change. Based on the analysis presented herein, the proposed actions, resulting in the mortality of 34 juvenile and subadult CB DPS Atlantic sturgeon and the non-lethal capture of up to 100 subadult and adult CB DPS Atlantic sturgeon over the life span of the project, is not likely to appreciably reduce the survival and recovery of this species.

### 8.1.5 *Carolina DPS*

We expect that 4% of the Atlantic sturgeon in the action area will originate from the CA DPS. Individuals originating from the CA DPS are likely to occur in the action area. The CA DPS is listed as endangered. The CA DPS consists of Atlantic sturgeon originating from at least five rivers where spawning is still thought to occur. Carolina DPS origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. There is currently not enough information to establish a trend for any life stage, for any of the spawning populations or for the DPS as a whole. Over the 50-year period considered here, we anticipate the mortality of up to 13 subadult CA DPS Atlantic sturgeon and the non-lethal capture of up to 50 subadult and adult CA DPS Atlantic sturgeon.

Capture during relocation trawling will temporarily prevent captured sturgeon from carrying out normal behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the fish are returned to the water. The capture of live Atlantic sturgeon is not likely to reduce the numbers of CA DPS Atlantic sturgeon. Similarly, as the capture of live CA DPS Atlantic sturgeon will not affect the fitness of any individual, no effects to reproduction are anticipated. The capture of live CA DPS Atlantic sturgeon is also not likely to affect the distribution of CA DPS Atlantic sturgeon throughout their range. As any effects to individual CA DPS Atlantic sturgeon captured during relocation trawling and temporarily removed from the water will be minor and temporary there are not anticipated to be any population level impacts.

While overall we anticipate the death of 13 subadult Atlantic sturgeon from the CA DPS over a 50-year period, we do not anticipate that there would be a loss of more than 1 CA DPS subadult in any year. Here, we consider the effect of the loss of a total of these subadults on the reproduction, numbers and distribution of the CA DPS.

The reproductive potential of the CA DPS will not be affected in any way other than through a reduction in numbers of individuals. The loss of a total of 13 subadults, with no more than one per year, would have the effect of reducing the amount of potential reproduction as any dead CA DPS Atlantic sturgeon would have no potential for future reproduction. However, this small reduction in potential future spawners is expected to result in an extremely small reduction in the number of eggs laid or larvae produced in future years and similarly, an extremely small effect on the strength of subsequent year classes. Even considering the potential future spawners that would be produced by the individual that would be killed as a result of the proposed actions, any effect to future year classes is anticipated to be extremely small and would not change the status of this species. Reproductive potential of other captured or injured individuals is not expected to be affected in any way. Additionally, we have determined that any impacts to behavior will be minor and temporary and that there will not be any delay or disruption of any normal behavior including spawning; there will also be no reduction in individual fitness or any future reduction in numbers of individuals. The proposed actions will also not affect the spawning grounds within the rivers where CA DPS fish spawn. The actions will also not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds used by CA DPS fish.

Because we do not have a population estimate for the CA DPS, it is difficult to evaluate the effect of the mortality caused by these actions on the species. However, because the proposed actions will result in the loss of only one individual per year, with a total of no more than 13, it is unlikely that these deaths will have a detectable effect on the numbers and population trend of the CA DPS.

The proposed action is not likely to reduce distribution because while the action will temporarily affect the distribution of individual sturgeon by displacing sturgeon captured with the trawl from one area and relocating them to alternate area and sturgeon may temporarily avoid areas where dredging or disposal activities are underway, all of these changes in distribution will be temporary and limited to movements to relatively nearby areas. We do not anticipate that any impacts to habitat will permanently impact how sturgeon use the action area. Further, the action is not expected to reduce the river by river distribution of Atlantic sturgeon. Additionally, given the small percentage of the species that will be killed as a result of the proposed actions, there is not likely to be any loss of unique genetic haplotypes and no loss of genetic diversity.

Based on the information provided above, the death of up to 13 CA DPS Atlantic sturgeon over the life of the project, will not appreciably reduce the likelihood of survival of the CA DPS (*i.e.*, it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The actions will not affect CA DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in effects to the environment which would prevent Atlantic sturgeon from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the death of 13 subadult CA DPS Atlantic sturgeon represents an extremely small percentage of the species; (2) the death of one subadult CA DPS Atlantic sturgeon in any year and the total loss of 13 subadults is likely to have a small effect on reproductive output and will not change the status or trends of the species as a whole; (3) the loss of 13 subadult CA DPS Atlantic sturgeon is not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the actions will have only a minor and temporary effect on the distribution of CA DPS Atlantic sturgeon in the action area and no effect on the distribution of the species throughout its range; and, (5) the actions will have no effect on the ability of CA DPS Atlantic sturgeon to shelter and only an insignificant effect on any foraging CA DPS Atlantic sturgeon.

In certain instances, an action that does not appreciably reduce the likelihood of a species' survival might affect its likelihood of recovery. As explained above, we have determined that the proposed action will not appreciably reduce the likelihood that the CA DPS of Atlantic sturgeon will survive in the wild. Here, we consider whether the action will appreciably reduce the likelihood of recovery from the perspective of ESA Section 4. As noted above, recovery is defined as the improvement in status such that listing under Section 4(a) as "in danger of extinction throughout all or a significant portion of its range" (endangered) or "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range..." (threatened) is no longer appropriate. Thus, we have considered whether the proposed

action will appreciably reduce the likelihood that CA DPS of Atlantic sturgeon can rebuild to a point where it is no longer in danger of extinction through all or a significant part of its range.

A Recovery Plan for the CA DPS has not yet been developed. The Recovery Plan will outline the steps necessary for recovery and the demographic criteria, which once attained would allow the species to be delisted. We know that in general, to recover, a listed species must have a sustained positive trend of increasing population over time. To allow that to happen for sturgeon, individuals must have access to enough habitat in suitable condition for foraging, resting and spawning. Conditions must be suitable for the successful development of early life stages. Mortality rates must be low enough to allow for recruitment to all age classes so that successful spawning can continue over time and over generations. There must be enough suitable habitat for spawning, foraging, resting and migrations of all individuals. For Atlantic sturgeon, habitat conditions must be suitable both in the natal river and in other rivers and estuaries where foraging by subadults and adults will occur and in the ocean where subadults and adults migrate, overwinter and forage. Habitat connectivity must also be maintained so that individuals can migrate between important habitats without delays that impact their fitness. Here, we consider whether this proposed action will affect the CA DPS likelihood of recovery.

The proposed actions is not expected to modify, curtail or destroy the range of the species since it will result in an extremely small reduction in the number of CA DPS Atlantic sturgeon and since it will not affect the overall distribution of CA DPS Atlantic sturgeon. Any effects to habitat will be insignificant and discountable and will not affect the ability of Atlantic sturgeon to carry out any necessary behaviors or functions. Any impacts to available forage will also be insignificant. The proposed actions will result in an extremely small amount of mortality (13 individuals over the life of the project) and a subsequent small reduction in future reproductive output. For these reasons, it is not expected to affect the persistence of the CA DPS of Atlantic sturgeon. These actions will not change the status or trend of the CA DPS of Atlantic sturgeon. The very small reduction in numbers and future reproduction resulting from the proposed actions will not reduce the likelihood of improvement in the status of the CA DPS of Atlantic sturgeon. The effects of the proposed actions will not delay the recovery timeline or otherwise decrease the likelihood of recovery. The effects of the proposed actions will also not reduce the likelihood that the status of the species can improve to the point where it is recovered and could be delisted. Therefore, the proposed actions will not appreciably reduce the likelihood that the CA DPS of Atlantic sturgeon can be brought to the point at which they are no longer listed as endangered. Based on the analysis presented herein, the proposed actions, is not likely to appreciably reduce the survival and recovery of this species.

Despite the threats faced by individual CA DPS Atlantic sturgeon inside and outside of the action area, the proposed actions will not increase the vulnerability of individual sturgeon to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed actions. We have considered the effects of the proposed actions in light of cumulative effects explained above, including climate change, and have concluded that even in light of the ongoing impacts of these activities and conditions; the conclusions reached above do not change. Based on the analysis presented herein, the proposed actions, resulting in the mortality of 13 subadult CA DPS Atlantic sturgeon and the non-lethal capture of up to 50

subadult and adult CA DPS Atlantic sturgeon over the life of the project, is not likely to appreciably reduce the survival and recovery of this species.

#### **8.1.6 South Atlantic DPS**

Individuals originating from the SA DPS are likely to occur in the action area. The SA DPS is listed as endangered. We expect that 20% of the subadult and adult Atlantic sturgeon in the action area will originate from the SA DPS. Most of these fish are expected to be subadults, with few adults from the SA DPS expected to be present. SA DPS origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance (e.g., impingement at water intakes, dredging, bycatch in commercial and recreational fisheries, in-water construction activities, vessel traffic) throughout the riverine and marine portions of their range.

Over the life span of the project, we anticipate the mortality of up to 40 subadult SA DPS Atlantic sturgeon. These sturgeon could be killed due to entrainment in a hopper or cutterhead dredge, or capture in a mechanical dredge. While it is possible that entrained/entrapped fish could survive, we assume here that these fish will be killed. In addition, we expect the non-lethal capture of up to 150 subadult and adult SA DPS Atlantic sturgeon.

Capture during relocation trawling will temporarily prevent captured sturgeon from carrying out normal behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the fish are returned to the water. The capture of live Atlantic sturgeon is not likely to reduce the numbers of SA DPS Atlantic sturgeon. Similarly, as the capture of live SA DPS Atlantic sturgeon will not affect the fitness of any individual, no effects to reproduction are anticipated. The capture of live SA DPS Atlantic sturgeon is also not likely to affect the distribution of SA DPS Atlantic sturgeon throughout their range. As any effects to individual SA DPS Atlantic sturgeon captured during relocation trawling and temporarily removed from the water will be minor and temporary there are not anticipated to be any population level impacts.

The number of SA DPS Atlantic sturgeon we expect to be killed (40 subadults) due to the deepening and maintenance of the navigation channels represents an extremely small percentage of the SA DPS. While we anticipate the death of 40 subadult Atlantic sturgeon from the SA DPS over the life span of the project, we do not anticipate that there would be a loss of more than 1 SA DPS subadult in any year. Here, we consider the effect of the loss of a total of these subadults on the reproduction, numbers and distribution of the SA DPS.

No total population estimates are available for any river population or the SA DPS as a whole. As discussed in section 4.2.2.5, we have estimated a total of 14,911 SA DPS adults and subadults in the ocean (3,728 adults and 11,183 subadults). This estimate is the best available at this time and represents only a percentage of the total SA DPS population as it does not include young of the year or juveniles and does not include all adults and subadults. SA origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. There is currently not enough information to establish a trend for any life stage or for the DPS as a whole.

While the death of 40 SA DPS Atlantic sturgeon over the life of the project will reduce the

number of SA DPS Atlantic sturgeon compared to the number that would have been present absent the proposed action, it is not likely that this reduction in numbers will change the status of this species as this loss represents a very small percentage of the SA DPS population of subadults and an even smaller percentage of the DPS as a whole. Even if there were only 11,183 subadults in the SA DPS, the loss of up to 40 would represent less than 0.36% of the subadults in the DPS. The percentage would be much less if we also considered the number of young of the year, juveniles, adults, and other subadults not included in the NEAMAP-based oceanic population estimate.

The reproductive potential of the SA DPS will not be affected in any way other than through a reduction in numbers of individuals. The loss of a total of 40 subadults, with no more than one per year, would have the effect of reducing the amount of potential reproduction as any dead SA DPS Atlantic sturgeon would have no potential for future reproduction. However, this small reduction in potential future spawners is expected to result in an extremely small reduction in the number of eggs laid or larvae produced in future years and similarly, an extremely small effect on the strength of subsequent year classes. Even considering the potential future spawners that would be produced by the individual that would be killed as a result of the proposed actions, any effect to future year classes is anticipated to be extremely small and would not change the status of this species. Reproductive potential of other captured or injured individuals is not expected to be affected in any way. Additionally, we have determined that any impacts to behavior will be minor and temporary and that there will not be any delay or disruption of any normal behavior including spawning; there will also be no reduction in individual fitness or any future reduction in numbers of individuals. The proposed actions will also not affect the spawning grounds within the rivers where SA DPS fish spawn. The actions will also not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds used by SA DPS fish.

The proposed action is not likely to reduce distribution because while the action will temporarily affect the distribution of individual sturgeon by displacing sturgeon captured with the trawl from one area and relocating them to alternate area and sturgeon may temporarily avoid areas where dredging or disposal activities are underway, all of these changes in distribution will be temporary and limited to movements to relatively nearby areas. We do not anticipate that any impacts to habitat will permanently impact how sturgeon use the action area. Further, the action is not expected to reduce the river by river distribution of Atlantic sturgeon. Additionally, given the small percentage of the species that will be killed as a result of the proposed actions, there is not likely to be any loss of unique genetic haplotypes and no loss of genetic diversity.

Based on the information provided above, the death of up to 40 SA DPS Atlantic sturgeon over the life of the project, will not appreciably reduce the likelihood of survival of the SA DPS (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The actions will not affect SA DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, and it will not result in effects to the environment which would prevent Atlantic sturgeon from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the death of 40

subadult SA DPS of Atlantic sturgeon represents an extremely small percentage of the species; (2) the death of one subadult SA DPS Atlantic sturgeon in any year and the total loss of 40 subadults is likely to have a small effect on reproductive output and will not change the status or trends of the species as a whole; (3) the loss of 40 subadult SA DPS Atlantic sturgeon is not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the actions will have only a minor and temporary effect on the distribution of SA DPS Atlantic sturgeon in the action area and no effect on the distribution of the species throughout its range; and, (5) the actions will have no effect on the ability of SA DPS Atlantic sturgeon to shelter and only an insignificant effect on individual foraging SA DPS Atlantic sturgeon.

In certain instances, an action that does not appreciably reduce the likelihood of a species' survival might affect its likelihood of recovery. As explained above, we have determined that the proposed action will not appreciably reduce the likelihood that the SA DPS of Atlantic sturgeon will survive in the wild. Here, we consider whether the action will appreciably reduce the likelihood of recovery from the perspective of ESA Section 4. As noted above, recovery is defined as the improvement in status such that listing under Section 4(a) as "in danger of extinction throughout all or a significant portion of its range" (endangered) or "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range..." (threatened) is no longer appropriate. Thus, we have considered whether the proposed action will appreciably reduce the likelihood that SA DPS of Atlantic sturgeon can rebuild to a point where it is no longer in danger of extinction through all or a significant part of its range.

A Recovery Plan for the SA DPS has not yet been developed. The Recovery Plan will outline the steps necessary for recovery and the demographic criteria, which once attained would allow the species to be delisted. We know that in general, to recover, a listed species must have a sustained positive trend of increasing population over time. To allow that to happen for sturgeon, individuals must have access to enough habitat in suitable condition for foraging, resting and spawning. Conditions must be suitable for the successful development of early life stages. Mortality rates must be low enough to allow for recruitment to all age classes so that successful spawning can continue over time and over generations. There must be enough suitable habitat for spawning, foraging, resting and migrations of all individuals. For Atlantic sturgeon, habitat conditions must be suitable both in the natal river and in other rivers and estuaries where foraging by subadults and adults will occur and in the ocean where subadults and adults migrate, overwinter and forage. Habitat connectivity must also be maintained so that individuals can migrate between important habitats without delays that impact their fitness. Here, we consider whether this proposed action will affect the SA DPS likelihood of recovery.

The proposed actions are not expected to modify, curtail or destroy the range of the species since it will result in an extremely small reduction in the number of SA DPS Atlantic sturgeon and since it will not affect the overall distribution of SA DPS Atlantic sturgeon. Any effects to habitat will be insignificant and discountable and will not affect the ability of Atlantic sturgeon to carry out any necessary behaviors or functions. Any impacts to available forage will also be insignificant. The proposed actions will result in an extremely small amount of mortality (on average, less than one individual per year) and a subsequent small reduction in future reproductive output. For these reasons, it is not expected to affect the persistence of the SA DPS of Atlantic sturgeon. These actions will not change the status or trend of the SA DPS of Atlantic

sturgeon. The very small reduction in numbers and future reproduction resulting from the proposed actions will not reduce the likelihood of improvement in the status of the SA DPS of Atlantic sturgeon. The effects of the proposed actions will not delay the recovery timeline or otherwise decrease the likelihood of recovery. The effects of the proposed actions will also not reduce the likelihood that the status of the species can improve to the point where it is recovered and could be delisted. Therefore, the proposed actions will not appreciably reduce the likelihood that the SA DPS of Atlantic sturgeon can be brought to the point at which they are no longer listed as endangered. Based on the analysis presented herein, the proposed actions, are not likely to appreciably reduce the survival and recovery of this species.

Despite the threats faced by individual SA DPS Atlantic sturgeon inside and outside of the action area, the proposed actions will not increase the vulnerability of individual sturgeon to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed actions. We have considered the effects of the proposed actions in light of cumulative effects explained above, including climate change, and have concluded that even in light of the ongoing impacts of these activities and conditions; the conclusions reached above do not change. Based on the analysis presented herein, the proposed actions, resulting in the mortality of 40 subadult SA DPS Atlantic sturgeon and the non-lethal capture of up to 150 subadult and adult SA DPS Atlantic sturgeon over the life of the project, is not likely to appreciably reduce the survival and recovery of this species.

## **8.2 North Atlantic DPS of Green sea turtles**

The North Atlantic DPS of green sea turtles is listed as threatened under the ESA. North Atlantic DPS green sea turtles face numerous threats on land and in the water that affect the survival of all age classes, as is the case with other sea turtle species.

The greatest abundance of green sea turtle nesting in the North Atlantic occurs on beaches in Tortuguero, Costa Rica. Nesting in the area has increased considerably since the 1970s and nest count data from 1999-2003 suggested that 17,402-37,290 females nested there per year (Seminoff *et al.* 2015). In 2010, an estimated 180,310 nests were laid at Tortuguero, the highest level of green sea turtle nesting estimated since the start of nesting track surveys in 1971. This equated to somewhere between 30,052 and 64,396 nesters in 2010 (Seminoff *et al.* 2015).

The results of genetic analyses show that green sea turtles in the Atlantic do not contribute to green sea turtle nesting elsewhere in the species' range (Bowen and Karl 2007). Therefore, increased nesting by green sea turtles in the Atlantic is not expected to affect green sea turtle abundance in other ocean basins in which the species occurs. We recognize that the nest count data available for green sea turtles in the Atlantic clearly indicates increased nesting at many sites. However, we also recognize that the nest count data, including data for green sea turtles in the Atlantic, only provides information on the number of females currently nesting, and is not necessarily a reflection of the number of mature females available to nest or the number of immature females that will reach maturity and nest in the future. Given the late age to maturity for green sea turtles (20 to 50 years) (Balazs 1982; Frazer and Ehrhart 1985; Seminoff 2004), caution is urged regarding the trend for any of the nesting groups since no area has a dataset spanning a full green sea turtle generation (NMFS and USWS 2007b).

In this Opinion, we have considered the potential impacts of the proposed action on green sea turtles. We expect the mortality of 20 green sea turtles and the non-lethal capture of 38 green sea turtles over the life of the project. As there will be very few mortalities to green sea turtles as a result of the proposed action and no effects to the prey base that would cause sea turtles to leave the action area to forage elsewhere, the proposed action is not likely to reduce the numbers of green sea turtles in the action area or the DPS as a whole. Similarly, no effects to reproduction are anticipated. Despite the threats faced by individual green sea turtles inside and outside of the action area, the proposed action will not increase the vulnerability of individual sea turtles to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed action. Over the time period of this action considered in this Opinion, sea surface temperatures are expected to rise less than 1°C. It is unknown if that is enough of a change to contribute to shifts in the range, distribution, and recruitment of sea turtles. Theoretically, we expect that as waters in the action area warm, more sea turtles could be present or sea turtles could be present for longer periods of time. We have considered the effects of the proposed action in light of cumulative effects explained above, including climate change, and have concluded that even with the ongoing impacts of these activities and conditions, the conclusions reached above do not change.

As described in the *Status of the Species, Environmental Baseline, and Cumulative Effects* sections above, green sea turtles in the action area continue to be affected by multiple anthropogenic impacts including bycatch in commercial and recreational fisheries, habitat alteration and other factors that result in mortality of individuals at all life stages.

In this Opinion, we determined that green sea turtles could be entrained in a hopper dredge operating in any of the channels or borrow areas considered in this consultation and could also be captured and killed during relocation trawling. We have estimated that the proposed actions are likely to result in the mortality of 20 green sea turtles and the non-lethal capture of 38 green sea turtles over the project life. We determined that all other effects of these actions on this species will be insignificant and discountable. This estimate is based on the best available information, and the following assumptions: (1) that all dredging will occur in the April – November time period when sea turtles are present in the action area; and, (2) that any dredging that could occur with a hopper or cutterhead dredge, occurs with a hopper dredge. The number of mortalities would be less than 20 if some of the dredging occurred between December and March and if more of it was carried out with a cutterhead dredge. No mortalities of green sea turtles are expected whenever a cutterhead dredge is used. No green turtles are present in the action area from December – March, therefore, hopper dredging that occurs during this time of year will not result in the mortality of any green sea turtles.

Based on the proposed dredge schedule and known maintenance and nourishment needs, in a typical year during the initial construction period, approximately 1 million cubic yards of material will be removed from the channels and borrow areas considered here; in the worst case, if all channels and borrow areas were dredged in one year, up to 5 million cubic yards of material could be removed. However, it is extremely unlikely that this would happen given the cost of such an operation and the limited number of dredges that are available for this kind of work. Therefore, in a typical year, we expect that no more than 1 green sea turtle would be entrained. All other effects to greens, including effects to habitat and prey due to dredging and dredge disposal, will be insignificant and discountable.

The lethal removal of 20 green sea turtles from the action area over the life span of the project would reduce the number of green sea turtles as compared to the number of green sea turtles that would have been present in the absence of the proposed actions (assuming all other variables remained the same). However, this does not necessarily mean that the species will experience reductions in reproduction, numbers or distribution in response to these effects to the extent that survival and recovery would be appreciably reduced.

The lethal removal of one green sea turtle in a particular year and a total of 20 over the life of the project, whether males or females, immature or mature animals, would reduce the number of green sea turtles as compared to the number of green that would have been present in the absence of the proposed actions assuming all other variables remained the same; the loss of one green sea turtles represents a very small percentage of the species as a whole. Even compared to the number of nesting females (17,000-37,000), which represent only a portion of the number of greens worldwide, the mortality of 20 greens represents approximately 0.12% of the nesting population. The loss of these sea turtles would be expected to reduce the reproduction of green sea turtles as compared to the reproductive output of green sea turtles in the absence of the proposed action. As described in the *Status of the Species* section above, we consider the trend for green sea turtles to be stable. However, as explained below, the death of these green sea turtles will not appreciably reduce the likelihood of survival for the species for the following reasons.

While generally speaking, the loss of a small number of individuals from a subpopulation or species may result in an appreciable reduction on the numbers, reproduction and distribution of the species; this is likely to occur only when there are very few individuals in a population, the individuals occur in a very limited geographic range or the species has extremely low levels of genetic diversity. This situation is not likely in the case of greens because: the species is widely geographically distributed, it is not known to have low levels of genetic diversity, there are several thousand individuals in the population and the number of greens is likely to be increasing and at worst is stable. These actions are not likely to reduce distribution of greens because the actions will not impede greens from accessing foraging grounds or cause more than a temporary disruption to other migratory behaviors.

Based on the information provided above, the death of 20 green sea turtles over the life span of the project will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The actions will not affect green sea turtles in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring and it will not result in effects to the environment which would prevent green sea turtles from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the species' nesting trend is stable; (2) the death of 20 green sea turtles represents an extremely small percentage of the species as a whole; (3) the loss of 20 green sea turtles will not change the status or trends of the species as a whole; (4) the loss of 20 green sea turtles is not likely to have an effect on the levels of genetic heterogeneity in the population; (5) the loss of 20 green sea turtles is likely to have an

undetectable effect on reproductive output of the species as a whole; (6) the actions will have no effect on the distribution of greens in the action area or throughout its range; and (7) the actions will have no effect on the ability of green sea turtles to shelter and only an insignificant effect on individual foraging green sea turtles.

In certain instances, an action may not appreciably reduce the likelihood of a species survival (persistence) but may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, we have determined that the proposed actions will not appreciably reduce the likelihood that green sea turtles will survive in the wild. Here, we consider the potential for the actions to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Thus, we have considered whether the proposed actions will affect the likelihood that the species can rebuild to a point where listing is no longer appropriate. A Recovery Plan for Green sea turtles was published by NMFS and USFWS in 1991. The plan outlines the steps necessary for recovery and the criteria, which, once met, would ensure recovery. In order to qualify for delisting, green sea turtles must experience sustained population growth, as measured in the number of nests laid per year, over time. Additionally, "priority one" recovery tasks must be achieved and nesting habitat must be protected (through public ownership of nesting beaches) and stage class mortality must be reduced. Here, we consider whether these proposed actions will affect the population size and/or trend in a way that would affect the likelihood of recovery.

The proposed actions will not appreciably reduce the likelihood of survival of green sea turtles. Also, it is not expected to modify, curtail or destroy the range of the species since it will result in an extremely small reduction in the number of green sea turtles in any geographic area and since it will not affect the overall distribution of green sea turtles other than to cause minor temporary adjustments in movements in the action area. As explained above, the proposed actions are likely to result in the mortality of up to 20 green sea turtles, with the loss of no more than one per year; however, the loss of these individuals over this time period is not expected to affect the persistence of green sea turtles or the species trend. The actions will not affect nesting habitat and will have only an extremely small effect on mortality. The effects of the proposed actions will not hasten the extinction timeline or otherwise increase the danger of extinction; further, the actions will not prevent the species from growing in a way that leads to recovery and the actions will not change the rate at which recovery can occur. This is the case because while the actions may result in a small reduction in the number of greens and a small reduction in the amount of potential reproduction due to the loss of 20 individuals, these effects will be undetectable over the long-term and the action is not expected to have long term impacts on the future growth of the population or its potential for recovery. Therefore, based on the analysis presented above, the proposed actions will not appreciably reduce the likelihood that green sea turtles can be brought to the point at which they are no longer listed as endangered or threatened.

In addition to the threats faced by individual green sea turtles inside and outside of the action area, the proposed actions may increase the vulnerability of individual sea turtles to these threats and exposure to ongoing threats may increase susceptibility to effects related to the proposed actions. We have considered the effects of the proposed actions in light of cumulative effects explained above, including climate change, and has concluded that even in light of the ongoing impacts of these activities and conditions; the conclusions reached above do not change. Based

on the analysis presented herein, the proposed actions, resulting in the mortality of 20 green sea turtles and nonlethal capture of 38 sea turtles over the life span of the project, is not likely to appreciably reduce the survival and recovery of this species.

### **8.3 Kemp's ridley sea turtles**

Kemp's ridley sea turtles are listed as a single species classified as "endangered" under the ESA. Kemp's ridleys occur in the Atlantic Ocean and Gulf of Mexico. The only major nesting site for Kemp's ridleys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963; U.S. FWS and NMFS 1992; NMFS and U.S. FWS 2015).

Nest count data provides the best available information on the number of adult females nesting each year. As is the case with the other sea turtles species discussed above, nest count data must be interpreted with caution given that these estimates provide a minimum count of the number of nesting Kemp's ridley sea turtles. In addition, the estimates do not account for adult males or juveniles of either sex. Without information on the proportion of adult males to females, and the age structure of the Kemp's ridley population, nest counts cannot be used to estimate the total population size (Meylan 1982; Ross 1996; Zurita *et al.* 2003; Hawkes *et al.* 2005; letter to J. Lecky, NMFS Office of Protected Resources, from N. Thompson, NMFS Northeast Fisheries Science Center, December 4, 2007). Nevertheless, the nesting data does provide valuable information on the extent of Kemp's ridley nesting and the trend in the number of nests laid. Estimates of the adult female nesting population reached a low of approximately 250-300 in 1985 (U.S. FWS and NMFS 1992; TEWG 2000). From 1985 to 1999, the number of nests observed at Rancho Nuevo and nearby beaches increased at a mean rate of 11.3% per year (TEWG 2000). Recent population abundance for Kemp's ridleys, based on nests and hatchling recruitment, was estimated by Gallaway *et al.* (2013). They estimated the female population size for age-2 and older in 2012 to be 188,713 (SD = ±32,529). Assuming females comprise 76% (sex ratio = 0.76; TEWG 1998, 2000) of the population, they estimated the total population (males and females) of age 2 years and over at 248,307. Based on the number of hatchlings released in 2011 and 2012 (1+ million) and recognizing mortality over the first two years is high, Gallaway *et al.* (2013) thought the total population, including hatchlings younger than 2 years, may exceed 1 million turtles (NMFS and USFWS 2015).

The most recent five-year review of the Kemp's ridley suggests that the population growth rate (as measured by numbers of nests) stopped abruptly after 2009. Given the recent lower nest numbers, the population is not projected to grow at former rates. As a result, the status review team determined that the population is not recovering and cannot meet recovery goals unless survival rates improve (NMFS and U.S. FWS 2015). However, some positive outlooks for the species include recent conservation actions (including the protection of females, nests, and hatchlings on nesting beaches since the 1960s) and the enhancement of survival in marine habitats through the implementation of TEDs in the early 1990s and a decrease in the amount of shrimping off the coast of Tamaulipas and in the Gulf of Mexico (NMFS and U.S. FWS 2015). There is also the recent record nesting year in Mexico and Texas for Kemp's ridleys in 2017.

In this Opinion, we determined that Kemp's ridley sea turtles could be entrained in a hopper dredge operating in any of the channels or borrow areas considered in this consultation and could also be captured and killed during relocation trawling. We have estimated that the proposed

actions are likely to result in the mortality of 77 Kemp's ridley sea turtles and the non-lethal capture of 275 Kemp's ridley sea turtles over the project life. We determined that all other effects of the actions on this species will be insignificant and discountable. While this estimate is based on the best available information, and the following assumptions: (1) that all dredging will occur in the April – November time period when sea turtles are present in the action area; and, (2) that any dredging that could occur with a hopper or cutterhead dredge, occurs with a hopper dredge. The number of mortalities would be less than 77 if some of the dredging occurred between December and March and if any of it was carried out with a cutterhead dredge.

The mortality of 77 Kemp's ridleys over the project time period represents a very small percentage of the Kemp's ridleys worldwide. Even taking into account just nesting females, the death of 77 Kemp's ridley represents less than 1% of the population; considering that there is not likely to be more than 1 mortality of a Kemp's ridley per year, the annual impact is less than 0.014% of the population. While the death of 77 Kemp's ridley will reduce the number of Kemp's ridleys compared to the number that would have been present absent the proposed actions, it is not likely that this reduction in numbers will change the status of this species as this loss represents a very small percentage of the population. Reproductive potential of Kemp's ridleys is not expected to be affected in any other way other than through a reduction in numbers of individuals.

A reduction in the number of Kemp's ridleys would have the effect of reducing the amount of potential reproduction as any dead Kemp's ridleys would have no potential for future reproduction. While the species is thought to be female biased, there are likely to be several thousand adult males as well. Given the number of nesting adults, it is unlikely that the loss of 1 Kemp's ridley per year or 77 over the life span of the project would affect the success of nesting in any year. Additionally, this small reduction in potential nesters is expected to result in a small reduction in the number of eggs laid or hatchlings produced in future years and similarly, a very small effect on the strength of subsequent year classes. Even considering the potential future nesters that would be produced by the individuals that would be killed as a result of the proposed actions, any effect to future year classes is anticipated to be very small and would not change the current trend of this species. Additionally, the proposed actions will not affect nesting beaches in any way or disrupt migratory movements in a way that hinders access to nesting beaches or otherwise delays nesting.

The proposed actions are not likely to reduce distribution because the actions will not impede Kemp's ridleys from accessing foraging grounds or cause more than a temporary disruption (due to relocation trawling) to other migratory behaviors. Additionally, given the small percentage of the species that will be killed as a result of the proposed actions, there is not likely to be any loss of unique genetic haplotypes and no loss of genetic diversity. The capture of live Kemp's ridley sea turtles is also not likely to affect the distribution of Kemp's ridley sea turtles in the action area or affect the distribution of sea turtles throughout their range. As any effects to individual live Kemp's ridley sea turtles temporarily removed from the water will be minor and temporary there are not anticipated to be any population level impacts.

While generally speaking, the loss of a small number of individuals from a subpopulation or species may have an appreciable reduction on the numbers, reproduction and distribution of the

species this is likely to occur only when there are very few individuals in a population, the individuals occur in a very limited geographic range or the species has extremely low levels of genetic diversity. This situation is not likely in the case of Kemp's ridleys because: the species is widely geographically distributed, it is not known to have low levels of genetic diversity, there are several thousand individuals in the population and the number of Kemp's ridleys is likely to be stable and at worst is growing a slower rates than the pre 2009 growth rate.

Based on the information provided above, the death of 77 Kemp's ridley sea turtles over the life span of the project will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The actions will not affect Kemp's ridleys in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring and it will not result in effects to the environment which would prevent Kemp's ridleys from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the death of 77 Kemp's ridleys represents an extremely small percentage of the species as a whole; (2) the death of 77 Kemp's ridleys will not change the status or trends of the species as a whole; (3) the loss of these Kemp's ridleys is not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the loss of these Kemp's ridleys is likely to have such a small effect on reproductive output of the species; (5) the actions will have only a minor and temporary effect on the distribution of Kemp's ridleys in the action area and no effect on the distribution of the species throughout its range; and, (6) the actions will have no effect on the ability of Kemp's ridleys to shelter and only an insignificant effect on individual foraging Kemp's ridleys.

In certain instances, an action may not appreciably reduce the likelihood of a species survival (persistence) but may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, we have determined that the proposed actions will not appreciably reduce the likelihood that Kemp's ridley sea turtles will survive in the wild. Here, we consider the potential for the actions to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Thus, we have considered whether the proposed actions will affect the likelihood that Kemp's ridleys can rebuild to a point where listing is no longer appropriate. In 2011, NMFS and the USFWS issued a recovery plan for Kemp's ridleys (NMFS and USFWS 2011). The plan includes a list of criteria necessary for recovery. These include:

1. An increase in the population size, specifically in relation to nesting females<sup>13</sup>;
2. An increase in the recruitment of hatchlings<sup>14</sup>;
3. An increase in the number of nests at the nesting beaches;
4. Preservation and maintenance of nesting beaches (i.e. Rancho Nuevo, Tepehuajes, and Playa Dos); and,

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<sup>13</sup>A population of at least 10,000 nesting females in a season (as measured by clutch frequency per female per season) distributed at the primary nesting beaches in Mexico (Rancho Nuevo, Tepehuajes, and Playa Dos) is attained in order for downlisting to occur; an average of 40,000 nesting females per season over a 6-year period by 2024 for delisting to occur

<sup>14</sup> Recruitment of at least 300,000 hatchlings to the marine environment per season at the three primary nesting beaches in Mexico (Rancho Nuevo, Tepehuajes, and Playa Dos).

#### 5. Maintenance of sufficient foraging, migratory, and inter-nesting habitat.

Although Kemp's ridleys have not continued to grow at the pre 2009 rates a trend over the last several years, as explained above, the loss of one Kemp's ridley per year during the proposed actions will not affect the population trend. The number of Kemp's ridleys likely to die because of the proposed actions is an extremely small percentage of the species. This loss will not affect the likelihood that the population will reach the size necessary for recovery or the rate at which recovery will occur. As such, the proposed actions will not affect the likelihood that criteria one, two or three will be achieved or the timeline on which they will be achieved. The action area does not include nesting beaches; therefore, the proposed actions will have no effect on the likelihood that recovery criteria four will be met. All effects to habitat will be insignificant and discountable; therefore, the proposed actions will have no effect on the likelihood that criteria five will be met.

The effects of the proposed actions will not hasten the extinction timeline or otherwise increase the danger of extinction. Further, the actions will not prevent the species from growing in a way that leads to recovery and the actions will not change the rate at which recovery can occur. This is the case because while the actions may result in a small reduction in the number of Kemp's ridleys and a small reduction in the amount of potential reproduction due to the average loss of one individual per year, these effects will be undetectable over the long-term and the actions are not expected to have long term impacts on the future growth of the population or its potential for recovery. Therefore, based on the analysis presented above, the proposed actions will not appreciably reduce the likelihood that Kemp's ridley sea turtles can be brought to the point at which they are no longer listed as endangered or threatened.

In addition to the threats faced by individual Kemp's ridley sea turtles inside and outside of the action area, the proposed actions may increase the vulnerability of individual sea turtles to these threats and exposure to ongoing threats may increase susceptibility to effects related to the proposed actions. We have considered the effects of the proposed actions in light of cumulative effects explained above, including climate change, and have concluded that even in light of the ongoing impacts of these activities and conditions; the conclusions reached above do not change. Based on the analysis presented herein, the proposed actions, resulting in the mortality of one Kemp's ridley sea turtle per year, is not likely to appreciably reduce the survival and recovery of this species.

#### **8.4 Northwest Atlantic DPS of Loggerhead sea turtles**

The Northwest Atlantic DPS of loggerhead sea turtles is listed as "threatened" under the ESA. It takes decades for loggerhead sea turtles to reach maturity. Once they have reached maturity, females typically lay multiple clutches of eggs within a season, but do not typically lay eggs every season (NMFS and USFWS 2008). There are many natural and anthropogenic factors affecting the survival of loggerheads prior to their reaching maturity as well as for those adults who have reached maturity. As described in the *Status of the Species*, *Environmental Baseline* and *Cumulative Effects* sections above, loggerhead sea turtles in the action area continue to be affected by multiple anthropogenic impacts including bycatch in commercial and recreational fisheries, habitat alteration, dredging, power plant intakes and other factors that result in mortality of individuals at all life stages. Negative impacts causing death of various age classes

occur both on land and in the water. Many actions have been taken to address known negative impacts to loggerhead sea turtles. However, many remain unaddressed, have not been sufficiently addressed, or have been addressed in some manner but the success of which cannot be quantified.

The SEFSC (2009) estimated the number of adult females in the NWA DPS at 30,000, and if a 1:1 adult sex ratio is assumed, the result is 60,000 adults in this DPS. Based on the reviews of nesting data, as well as information on population abundance and trends, NMFS and USFWS determined in the September 2011 listing rule that the NWA DPS should be listed as threatened. They found that an endangered status for the NWA DPS was not warranted given the large size of the nesting population, the overall nesting population remains widespread, the trend for the nesting population appears to be stabilizing, and substantial conservation efforts are underway to address threats. This stable trend is expected to continue over the time period considered in this Opinion.

In this Opinion, we determined that loggerheads could be entrained in a hopper dredge operating in any of the channels or borrow areas considered in this consultation. We have estimated that, over the life span of the project considered here, the proposed actions are likely to result in the mortality of 785 NWA DPS loggerhead sea turtles and the non-lethal capture of 937 loggerheads. We determined that all other effects of the action on this species will be insignificant and discountable. This estimate is based on the best available information, and the following assumptions: (1) that all dredging will occur in the April – November time period when sea turtles are present in the action area; and, (2) that any dredging that could occur with a hopper or cutterhead dredge, occurs with a hopper dredge. The number of mortalities would be less than 748 if some of the dredging occurred between December and March and if any of it was carried out with a cutterhead dredge. No mortalities of sea turtles are expected whenever a cutter head dredge is used.

As stated above, we expect the lethal entrainment of 785 loggerheads over the time period considered here; with an average mortality rate of approximately 9 loggerheads per year. The lethal removal of up to 785 loggerhead sea turtles from the action area over this time period would be expected to reduce the number of loggerhead sea turtles from the recovery unit of which they originated as compared to the number of loggerheads that would have been present in the absence of the proposed actions (assuming all other variables remained the same). However, this does not mean that these recovery units will experience reductions in reproduction, numbers or distribution in response to these effects to the extent that survival and recovery would be appreciably reduced. The 2008 recovery plan compiled the most recent information on the mean number of loggerhead nests and the approximated counts of nesting females per year for four of the five identified recovery units (i.e., nesting groups). They are: (1) for the NRU, a mean of 5,215 nests per year with approximately 1,272 females nesting per year; (2) for the PFRU, a mean of 64,513 nests per year with approximately 15,735 females nesting per year; (3) for the DTRU, a mean of 246 nests per year with approximately 60 females nesting per year; and (4) for the NGMRU, a mean of 906 nests per year with approximately 221 females nesting per year. For the GCRU, the only estimate available for the number of loggerhead nests per year is from Quintana Roo, Yucatán, Mexico, where a range of 903-2,331 nests per year was estimated from 1987-2001 (NMFS and USFWS 2007a). There are no annual nest estimates available for the

Yucatán since 2001 or for any other regions in the GCRU, nor are there any estimates of the number of nesting females per year for any nesting assemblage in this recovery unit. However, the 2008 recovery plan indicates that the Yucatán nesting aggregation has at least 1,000 nesting females annually. It should be noted here, that the above numbers only include nesting females (i.e., do not include non-nesting adult females, adult males, or juvenile males or females in the population).

It is likely that the loggerhead sea turtles in Chesapeake Bay originate from several of the recovery units. Limited information is available on the genetic makeup of loggerheads in an area as extensive as the action area.

Genetic analysis of samples collected from immature loggerheads captured in pound nets in the Pamlico-Albemarle Estuarine Complex in North Carolina between 1995-1997 indicated that 80% of the juveniles and sub-adults utilizing the foraging habitat originated from the south Florida nesting stock, 12% from the northern nesting stock, 6% from the Yucatán nesting stock, and 2% from other rookeries (including the Florida Panhandle, Dry Tortugas, Brazil, Greece, and Turkey nesting stocks) (Bass *et al.* 2004). In a separate study, genetic analysis of samples collected from loggerheads from Massachusetts to Florida also found that all five western Atlantic loggerhead stocks were represented (Bowen *et al.* 2004). However, earlier studies by Rankin-Baransky *et al.* (2001) and Witzell *et al.* (2002) indicated that only a few nesting stocks were represented along the U.S. Atlantic coast: south Florida (59% and 69% of the loggerheads sampled, respectively), northern (25% and 10%, respectively), and Mexico (16% and 20%, respectively). Most recently, Haas *et al.* (2008) found that 89% of the loggerheads captured in the U.S. Atlantic scallop fishery from 1996-2005 originated from the south Florida nesting stock, 4% were from the Mexican stock, 3% were from the northern (northeast Florida to North Carolina) stock, 1% were from the northwest Florida stock, and 0% were from the Dry Tortugas stock. The remaining 3% of loggerheads sampled were attributed to nesting stocks in Greece. However, a re-analysis of loggerhead genetics data by the Atlantic Loggerhead TEWG has found that it is unlikely that U.S. fishing fleets are interacting with the Mediterranean DPS (Peter Dutton, NMFS, pers. comm.) and that loggerheads from Greek nesting stocks are unlikely to occur in the action area.

The previously defined loggerhead nesting stocks do not share the exact delineations of the recovery units identified in the 2008 recovery plan. However, the PFRU encompasses the south Florida stock, the NRU is roughly equivalent to the northern nesting stock, the northwest Florida stock is included in the NGMRU, the Mexico stock is included in the GCRU, and the DTRU encompasses the Dry Tortugas stock. Based on the genetic analysis presented in Haas *et al.* (2008), which is the most recent and one of the most comprehensive (in terms of the area from which samples were acquired) of the loggerhead genetics studies referenced above, the vast majority of the loggerheads in the action area are likely to originate from the PFRU (90%), with the remainder originating from the NRU (3%), GCRU (5%), NGMRU (1.5%), and DTRU (0.5%). Therefore, we expect that 707 of the loggerheads will be from the PFRU, 24 from the NRU, 39 from the GCRU, 12 from the NGMRU, and 4 from the DTRU. The best available information indicates that the proportion of the interactions from each recovery unit are consistent with the relative sizes of the recovery units, and we conclude, based on the available evidence, that none of the recovery units will be disproportionately impacted by the proposed

actions. Thus, genetic heterogeneity should be maintained in the species even in the face of this level of mortality resulting from the proposed actions.

The loss of 707 loggerheads over the life span of the project (approximately 8 per year) represents an extremely small percentage of the number of sea turtles in the PFRU. Even if the total population was limited to 15,735 loggerheads (the number of nesting females), the annual average loss of up to 8 individuals would represent approximately 0.05% of the population. Similarly, the loss of no more than 1 loggerhead from the NRU over 24 years represents an extremely small percentage of the recovery unit. Even if the total population was limited to 1,272 sea turtles (the number of nesting females), the loss of 1 individual in a given year would represent approximately 0.08% of the population. The loss of no more than 1 loggerhead over years from the GCRU, which is expected to support at least 1,000 nesting females, represents less than 0.1% of the population, even just considering the number of adult nesting females, which is only a fraction of the total population. The loss of no more than 1 loggerhead over 12 years from the NGMRU, represents 0.5% of the population, even just considering the approximately 221 adult nesting females, which is only a fraction of the total population. The loss of no more than 1 loggerhead over 4 from the DTRU, which is expected to support at least 60 nesting females, represents 1.6% of the population, even just considering the number of adult nesting females, which is only a fraction of the total population and an even smaller percentage of the DPS as a whole.

The loss of such a small percentage of the individuals from any of these recovery units represents an even smaller percentage of the species as a whole. The impact of these losses is even less when considering that these losses will occur over a span of many years. Considering the extremely small percentage of the populations that will be killed, it is unlikely that these deaths will have a detectable effect on the numbers and population trends of loggerheads in these recovery units or the number of loggerheads in the population as a whole.

All of the loggerheads that are expected to be killed will be juveniles. Thus, any effects on reproduction are limited to the loss of these individuals on their year class and the loss of future reproductive potential. Given the number of nesting adults in each of these populations, it is unlikely that the expected loss of loggerheads would affect the success of nesting in any year. Additionally, this small reduction in potential nesters is expected to result in a small reduction in the number of eggs laid or hatchlings produced in future years and similarly, a very small effect on the strength of subsequent year classes. Even considering the potential future nesters that would be produced by the individuals that would be killed as a result of the proposed actions, any effect to future year classes is anticipated to be very small and would not change the stable trend of this species. Additionally, the proposed actions will not affect nesting beaches in any way or disrupt migratory movements in a way that hinders access to nesting beaches or otherwise delays nesting.

The proposed action is not likely to reduce distribution because while the action will temporarily affect the distribution of individual loggerheads by displacing sea turtles captured with the trawl from one area and relocating them to alternate area, changes in distribution will be temporary and limited to movements to relatively nearby areas. We do not anticipate that any impacts to habitat will permanently impact how loggerheads use the action area. Further, the action is not

expected to reduce the distribution of loggerhead sea turtles. Additionally, given the small percentage of the species that will be killed as a result of the proposed actions, there is not likely to be any loss of unique genetic haplotypes and no loss of genetic diversity

While generally speaking, the loss of a small number of individuals from a subpopulation or species may have an appreciable reduction on the numbers, reproduction and distribution of the species this is likely to occur only when there are very few individuals in a population, the individuals occur in a very limited geographic range or the species has extremely low levels of genetic diversity. This situation is not likely in the case of loggerheads because: the species is widely geographically distributed, it is not known to have low levels of genetic diversity, there are several thousand individuals in the population and the number of loggerheads is likely to be stable or increasing over the time period considered here.

Based on the information provided above, the death of up to 785 loggerheads over the life span of the project will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The actions will not affect loggerheads in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring and it will not result in effects to the environment which would prevent loggerheads from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the death of these loggerheads represents an extremely small percentage of the species as a whole; (2) the death of these loggerheads will not change the status or trends of the species as a whole; (3) the loss of these loggerheads is not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the loss of these loggerheads is likely to have a small effect on reproductive output; (5) the actions will have only a minor and temporary effect on the distribution of loggerheads in the action area and no effect on the distribution of the species throughout its range; and, (6) the actions will have no effect on the ability of loggerheads to shelter and only an insignificant effect on individual foraging loggerheads.

In certain instances, an action may not appreciably reduce the likelihood of a species survival (persistence) but may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, we have determined that the proposed actions will not appreciably reduce the likelihood that loggerhead sea turtles will survive in the wild. Here, we consider the potential for the actions to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Thus, we have considered whether the proposed actions will affect the likelihood that the NWA DPS of loggerheads can rebuild to a point where listing is no longer appropriate. In 2008, NMFS and the USFWS issued a recovery plan for the Northwest Atlantic population of loggerheads (NMFS and USFWS 2008). The plan includes demographic recovery criteria as well as a list of tasks that must be accomplished. Demographic recovery criteria are included for each of the five recovery units. These criteria focus on sustained increases in the number of nests laid and the number of nesting females in each recovery unit, an increase in abundance on foraging grounds, and ensuring that trends in neritic strandings are not increasing at a rate greater than trends in in-water abundance. The recovery tasks focus on protecting habitats, minimizing and managing predation and disease, and minimizing anthropogenic mortalities.

Loggerheads have a stable trend; as explained above, the loss of 785 loggerheads over the life span of the proposed actions will not affect the population trend. The number of loggerheads likely to die as a result of the proposed actions is an extremely small percentage of any recovery unit or the DPS as a whole. This loss will not affect the likelihood that the population will reach the size necessary for recovery or the rate at which recovery will occur. As such, the proposed actions will not affect the likelihood that the demographic criteria will be achieved or the timeline on which they will be achieved. The action area does not include nesting beaches; all effects to habitat will be insignificant and discountable; therefore, the proposed actions will have no effect on the likelihood that habitat based recovery criteria will be achieved. The proposed actions will also not affect the ability of any of the recovery tasks to be accomplished.

The effects of the proposed actions will not hasten the extinction timeline or otherwise increase the danger of extinction; further, the actions will not prevent the species from growing in a way that leads to recovery and the actions will not change the rate at which recovery can occur.

In summary, the effects of the proposed actions will not hasten the extinction timeline or otherwise increase the danger of extinction; further, the actions will not prevent the species from growing in a way that leads to recovery and the actions will not change the rate at which recovery can occur. This is the case because while the actions may result in a small reduction in the number of loggerheads and a small reduction in the amount of potential reproduction due to the loss of these individuals, these effects will be undetectable over the long-term and the actions are not expected to have long term impacts on the future growth of the population or its potential for recovery. Therefore, based on the analysis presented above, the proposed actions will not appreciably reduce the likelihood that loggerhead sea turtles can be brought to the point at which they are no longer listed as threatened.

In addition to the threats faced by individual loggerhead sea turtles inside and outside of the action area, the proposed actions may increase the vulnerability of individual sea turtles to these threats and exposure to ongoing threats may increase susceptibility to effects related to the proposed actions. We have considered the effects of the proposed actions in light of other threats, including climate change, and have concluded that even in light of the ongoing impacts of these activities and conditions, the conclusions reached above do not change. Based on the analysis presented herein, the proposed actions are not likely to appreciably reduce the survival and recovery of the NWA DPS of loggerhead sea turtles.

## **9.0 CONCLUSION**

After reviewing the best available information on the status of endangered and threatened species under our jurisdiction, the environmental baseline for the action area, the effects of the action, and the cumulative effects, it is our biological opinion that the proposed action may adversely affect but is not likely to jeopardize the continued existence of any DPS of Atlantic sturgeon, Kemp's ridley or green sea turtles or the Northwest Atlantic DPS of loggerhead sea turtles and is not likely to adversely affect leatherback sea turtles, hawksbill sea turtles, shortnose sturgeon, fin whales, sei whales, blue whale, sperm whales, and North Atlantic right whales. As described above, it is our biological opinion that the proposed action is not likely to adversely affect critical habitat for the Chesapeake Bay DPS of Atlantic sturgeon designated in the action area.

## **10.0 INCIDENTAL TAKE STATEMENT**

Section 9 of the ESA prohibits the take of endangered species of fish and wildlife. “Fish and wildlife” is defined in the ESA “as any member of the animal kingdom, including without limitation any mammal, fish, bird (including any migratory, non-migratory, or endangered bird for which protection is also afforded by treaty or other international agreement), amphibian, reptile, mollusk, crustacean, arthropod or other invertebrate, and includes any part, product, egg, or offspring thereof, or the dead body or parts thereof.” 16 U.S.C. 1532(8). “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 us to include any act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including breeding, spawning, rearing, migrating, 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. “Otherwise lawful activities” are those actions that meet all State and Federal legal requirements except for the prohibition against taking in ESA Section 9 (51 FR 19936, June 3, 1986), which would include any state endangered species laws or regulations. Section 9(g) makes it unlawful for any person “to attempt to commit, solicit another to commit, or cause to be committed, any offense defined [in the ESA.]” 16 U.S.C. 1538(g). See also 16 U.S.C. 1532(13)(definition of “person”). Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by you so that they become binding conditions for the exemption in section 7(o)(2) to apply. You have a continuing duty to regulate the activity covered by this Incidental Take Statement. If you (1) fail to assume and implement the terms and conditions or (2) fail to require any contractors to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added contracts or other documents as appropriate, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, you must report the progress of the action and its impact on the species to us as specified in the Incidental Take Statement [50 CFR §402.14(i)(3)] (See U.S. Fish and Wildlife Service and National Marine Fisheries Service’s Joint Endangered Species Act Section 7 Consultation Handbook (1998) at 4-49).

### **10.1 Amount or Extent of Incidental Take**

The proposed dredging project has the potential to directly affect green, loggerhead and Kemp’s ridley sea turtles, and individuals from the New York Bight, Gulf of Maine, Chesapeake Bay, South Atlantic and Carolina DPSs of Atlantic sturgeon which may become entrained in or interact with the dredge. These interactions are likely to cause mortality. This level of take is expected to occur over the duration of the project and is not likely to jeopardize the continued existence of listed species.

This ITS exempts the following incidental take over the life span of the project:

<b>Species</b>	<b>Non-lethal Capture</b>	<b>Mortality</b>
NWA DPS of Loggerhead sea turtle	937	748
Kemp's ridley sea turtle	275	66
North Atlantic DPS of Green sea turtle	38	18
NYB DPS of Atlantic sturgeon	350	68
SA DPS of Atlantic sturgeon	150	29
CB DPS of Atlantic sturgeon	100	23
GOM DPS of Atlantic sturgeon	100	18
Carolina DPS of Atlantic sturgeon	50	10

The tables below illustrate our expectations of where these takes will occur:

***Hopper Dredging***

**Sea Turtle Takes Incidental to Construction Dredging**

Project	Total Volume	Number of Interactions			
		Total Sea Turtles	Loggerhead	Kemp's ridley	Green
Atlantic Ocean Channel	16,074,736	50	45	4	1
Thimble Shoals Channel	18,069,823	56	50	4	2
Thimble Shoals Channel Meeting Area #1 & #2	7,191,000	22	20	2	0
Sewells Point to Lamberts Bend	12,147,318	38	34	3	1
Anchorage F	1,914,788	6	5	1*	1*
Newport News Channel	4,906,284	15	14	1	0
CIEE	19,500,000	61	55	5	1
<b>TOTAL:</b>			<b>223</b>	<b>20</b>	<b>6</b>

\*1 Kemp's ridley or green

### Sea Turtle Take Incidental to Maintenance Dredging over the Project Life Span

Project	Total Volume (cubic yards)	Number of Interactions			
		Total Sea Turtles	Loggerhead	Kemp's ridley	Green
Atlantic Ocean Channel	15,191,112	47	42	4	1
Thimble Shoals Channel	24,331,540	76	68	6	2
Thimble Shoals Channel Meeting Area #1 & #2	3,640,924	11	10	1	0
Sewells Point to Lamberts Bend	42,346,689	132	119	10	3
Anchorage F	7,590,328	24	22	2	0
Newport News Channel	6,676,305	21	19	2	0
<b>TOTAL:</b>			<b>280</b>	<b>25</b>	<b>6</b>

Project	Total Volume (cubic yards)	Number of Interactions			
		Total Sea Turtles	Loggerhead	Kemp's ridley	green
Baltimore Harbor Entrance Channels	64,500,000	215	194	17	4
Virginia Beach Hurricane Project (TSS and AO borrow areas)	4,400,000	15	13	1*	1*
Sandbridge Shoal	12,500,000	42	38	3	1
<b>TOTAL:</b>			<b>245</b>	<b>21</b>	<b>6</b>

\*1 Kemp's ridley or green



### Atlantic Sturgeon Takes Incidental to Construction Dredging

Project	Total Volume	Number of Interactions					
		Total Atlantic sturgeon	NYB DPS	SA DPS	CB DPS	GOM DPS	Carolina DPS
Atlantic Ocean Channel	16,074,736	8	4	2	1	1	0
Thimble Shoals Channel	18,069,823	9	5	2	1	1	0
Thimble Shoals Meeting Areas #1 & #2	7,191,000	4	2	1	1	0	0
Sewell's Point to Lamberts Bend	12,147,318	6	3	1	1	1	0
Anchorage F	1,914,788	1	1*	1*	1*	1*	1*
Newport News Channel	4,906,284	3	1	1	1*	1*	1*
CIEE	19,500,000	10	5	2	1	1	1
<b>Total:</b>			<b>21</b>	<b>10</b>	<b>7</b>	<b>6</b>	<b>3</b>

\*Using the 1 fish per 2 mil cy of dredge material method for estimating takes from entrainment in hopper dredges described above, we estimated take of <1 sturgeon, so using our mixed-stock analysis the individual could originate from any one of the these DPSs.

**Atlantic Sturgeon Takes Incidental to Maintenance Dredging over the Project Life Span**

Project	Total Volume (cubic yards)	Number of Interactions					
		Total Atlantic sturgeon	NYB DPS	SA DPS	CB DPS	GOM DPS	Carolina DPS
Atlantic Ocean Channel	15,191,112	8	4	2	1	1	0
Thimble Shoals Channel	24,331,540	12	6	2	2	1	1
Thimble Shoals Meeting Areas #1 & #2	3,640,924	2	1	1*	1*	1*	1*
Sewell's Point to Lamberts Bend	42,346,689	21	11	4	3	2	1
Anchorage F	7,590,328	4	2	1	1	0	0
Newport News Channel	6,676,305	3	3	1	1*	1*	1*
<b>Total:</b>			<b>27</b>	<b>11</b>	<b>9</b>	<b>6</b>	<b>4</b>

\*Using the 1 fish per 2 mil cy of dredge material method for estimating takes from entrainment in hopper dredges described above, we estimated take of <1 sturgeon, so using our mixed-stock analysis the individual could originate from any one of the these DPSs.

**Atlantic Sturgeon Takes Incidental to Maintenance Dredging over the Project Life Span**

Project	Total Volume (cubic yards)	Number of Interactions					
		Total Atlantic sturgeon	NYB DPS	SA DPS	CB DPS	GOM DPS	Carolina DPS
Baltimore Harbor Entrance Channels	64,500,000	32	16	6	5	4	1
Virginia Beach Hurricane Project	4,400,000	2	1	1*	1*	1*	1*
Sandbridge Shoal	12,500,000	6	3	1	1	1*	1*
<b>Total:</b>			<b>20</b>	<b>8</b>	<b>7</b>	<b>6</b>	<b>3</b>

\*Using the 1 fish per 2 mil cy of dredge material method for estimating takes from entrainment in hopper dredges described above, we estimated take of <1 sturgeon, so using our mixed-stock analysis the individual could originate from any one of the these DPSs.

### ***Cutterhead Dredging***

<b>DPS</b>	<b>Number of Atlantic Sturgeon over Project Period</b>
New York Bight	25
South Atlantic	10
Chesapeake Bay	8
Gulf of Maine	5
Carolina	2

### ***Mechanical Dredging***

One Atlantic sturgeon (any DPS) at CIEE and one (any DPS) in Norfolk Harbor

### ***Relocation Trawling***

<b>Species</b>	<b>Number Captured over project period</b>	<b>Number of Mortalities over project period</b>
<i>Sea Turtles</i>	<b><i>1,250</i></b>	<b><i>50</i></b>
Loggerhead	938	37
Kemp's Ridley	275	11
Green	37	2
<i>Atlantic sturgeon</i>	<b><i>700 total</i></b>	<b><i>0</i></b>
NYB DPS	≤350	0
SA DPS	≤150	0
CB DPS	≤100	0
GOM DPS	≤100	0
Carolina DPS	≤50	0

When a hopper dredge is used, NMFS-approved endangered species observers are typically required on board the dredge to monitor for the entrainment of sea turtles and sturgeon. The endangered species observer program has been in place on hopper dredges since 1994 and is effective at monitoring take during hopper dredge operations. The use of observers relies on screening placed on the draghead being large enough to allow large sized pieces of biological material to pass through and be caught in cages that retain material that is then inspected by the observer. When UXO screening is in place on the draghead, the size of material that can pass through the dredge is significantly smaller, making detection by an observer extremely unlikely. As described in the *Description of the Action* section, due to safety concerns, you are likely to require UXO screening for dredges working in the following areas: Thimble Shoals Channel; Atlantic Ocean Channel; Cape Henry Channel; Thimble Shoal Surround Borrow Area; and Sandbridge Shoal. It is likely that only internal soft tissue (e.g., intestine) or small, fragmented, external parts (e.g., pieces of shell) of the crushed/impinged animal would be entrained. These parts are extremely unlikely to be detected by ESA observers, and if detected, are likely to be too small to be identifiable as a particular species (pers. comm. Chris Slay, Coast Wise Consulting, Inc.; Trish Bargo, East Coast Observers, Inc.; April 4, 2012).

Additionally, animals may impinge on the UXO screens. Animals impinged on the UXO screen may free or dislodge themselves from the screen once the suction of the dredge has been turned off. Animals that free themselves may suffer severe injuries that may result in death. As the entire interaction occurs underwater, it would not be observed by an on-board observer. As such, in these cases, we have determined that it is not reasonable and appropriate to require endangered species observers on the dredge. As there is no practical way for on board endangered species observers to monitor the impingement/entrainment of listed species during hopper dredging operations with UXO screening in place, we explored several alternatives, for monitoring the interactions as described below.

We considered the following alternatives to (1) monitor take of listed species during hopper dredge operations with UXO screening in place or (2) modify the activity to eliminate the potential for take, thereby eliminating the need to monitor take.

1. Install a camera near the draghead: A camera installed on a draghead would allow users at the surface to observe underwater interactions. However, there are technical challenges to using video, including visibility due to water clarity and available light, improper focus, inappropriate camera angle, and the range of the viewing field. The use of video would require additional resources, and it is unlikely that it would be effective for monitoring this type of dredge work. For these dredges, turbidity levels (i.e., up to 450 mg/l) near the draghead while dredging operations are underway are too high to visually detect any animal impinged on or within the vicinity of the draghead. Therefore, this is not a reasonable and appropriate means to monitor take.
2. Use of sonar/fish finder: Sonar can be used to detect animals within the water and within the vicinity of the dredge. However, studies would need to take place to establish the signatures of sea turtles and sturgeon so that they could be readily identified electronically; this information is not currently available. As such, at this time, sonar alone could not indicate the take of an individual animal or identify the species

potentially being taken. As such, the use of such devices would not be reasonable or appropriate for monitoring take.

3. Placement of observers on the shoreline: Observers placed on the shoreline may be able to detect stranded animals either in the water or on the shore. However, animals may not strand in the direct vicinity of the operation or at a time concurrent with when the operations are active. Typically, injured or deceased animal do not immediately float to the surface and it may take days for the animal to wash up on the shore. While the fortuitous reporting of stranded sea turtles and subsequent necropsy to determine cause of death is a good method to monitor take, it is not a reasonable and appropriate means to observe for take during dredging operations.
4. Relocation trawling: While relocation could reduce the number of sea turtles and Atlantic sturgeon in the area being dredged and therefore minimize take, using relocation trawling would not serve to monitor the number of animals affected during dredging. Additionally, while relocation trawling can minimize the number of animals in the area to be dredged and minimize the potential for take, it does not eliminate the potential for take. Therefore, we could not require relocation trawling and assume that no interactions with the dredge would occur.
5. Time of year restriction: If there was a time of year when no listed species were likely to occur in the action area, dredging could be scheduled to occur in that time of year. This would eliminate the potential for take and negate the need for monitoring. However, because Atlantic sturgeon occur in the action area year round and safety and navigational concerns require dredging year-round, this is not practicable.
6. Use of alternate dredge types: The use of a mechanical dredge would eliminate the potential for sea turtle takes and would greatly reduce the number of Atlantic sturgeon takes; similar benefits could be obtained by requiring the use of a cutterhead dredge. However, you choose the type of dredge based on practical and technological constraints, including water depth, oceanic conditions, vessel traffic and maneuverability, substrate type and distance to the disposal area. Therefore, while use of alternate dredge types may minimize take, it is not practicable to require that mechanical or cutterhead dredges be used in all instances.

Both agencies agreed that none of these methods would serve to eliminate the potential for take or were reasonable or appropriate for monitoring take. In situations where individual takes cannot be observed, a proxy must be considered. This proxy must be rationally connected to the taking and provide a clear standard for when the authorized level of take has been exceeded, thus, triggering reinitiation of consultation. As explained in section 6.0 of this Opinion, the estimated number of sea turtles and Atlantic sturgeon to be adversely affected by this action is related to the volume of material removed via dredge, the time of year and the duration of dredging activity.

Therefore, the volume of material removed from the action area can serve as a proxy for monitoring actual take. As explained in the *Effects of the Action*, one sea turtle is entrained for

every 320,000 cy of material dredged; one Atlantic sturgeon is entrained for every 2 mcy. This estimate provides a proxy for monitoring the amount of incidental take during hopper and cutterhead dredging operations when UXO screening is in place and direct observations of impingements cannot occur. This will be used as the primary method of determining whether incidental take has occurred; that is, we will consider that one sea turtle (Kemp's ridley or loggerhead) has been taken for every 320,000 cubic yards material removed during hopper dredging operations involving a UXO screen. Similarly, we will consider that one subadult Atlantic sturgeon has been taken for every 2.0 million cubic yards of material removed during hopper dredging operations involving a UXO screen or each time that a cutterhead dredge is used. In addition, there is a possibility that a sea turtle or an Atlantic sturgeon may remain impinged on UXO screens after the suction has been turned off. These animals can be visually observed, via a lookout, when the draghead is lifted above the water. Animals documented on the draghead by the lookout will be considered a take and this monitoring will be considered as a part of the monitoring of the actual take level. Similarly, if we receive any reports of injured or killed sea turtles or sturgeon in the area (i.e., via the STSSN) and we determine that interaction with the hopper dredge operating during this project was the cause of death, we will consider those animals to be taken by this action.

Once you reach the authorized number of sea turtles or Atlantic sturgeon takes provided in this Incidental Take Statement (either through observed takes or by proxy, or a combination of the two), any additional entrainment of a sea turtle or Atlantic sturgeon will exceed the exempted level of take and reinitiation is required.

If a cutterhead dredge is used without UXO screening, inspectors will visually inspect the area where sand is being placed; this is expected to detect any Atlantic sturgeon entrained in the cutterhead dredge.

## **10.2 Reasonable and Prudent Measures**

The following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize and monitor impacts of incidental take resulting from the proposed actions. In order to be exempt from prohibitions of section 9 of the ESA, you must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize and monitor the impact of incidental take that might otherwise result from the proposed actions. Specifically, these RPMs and Terms and Conditions will keep us informed of when and where dredging activities and relocation trawling are taking place and will require you to report any take in a reasonable amount of time, as well as implement measures to monitor for entrainment during dredging and relocation trawling. The third column below explains why each of these RPMs and Terms and Conditions are necessary and appropriate to minimize or monitor the level of incidental take associated with the proposed action and how they represent only a minor change to the action as proposed by you.

RPMs, TCs, and Justifications Applicable to Norfolk Harbor Channels and Craney Island Eastward Improvements Projects

Reasonable and Prudent Measures (RPMs)	Terms and Conditions (TCs)	Justifications for RPMs & TCs
<i>RPMs Applicable for All Dredge Activities</i>		
<p>1. We must be contacted prior to the commencement of dredging and again upon completion of the dredging activity.</p>	<p>1. You must contact us at <a href="mailto:incidental.take@noaa.gov">incidental.take@noaa.gov</a> 3 days before the commencement of each dredging activity and again within 3 days of the completion of the activity. This correspondence will serve both to alert us of the commencement and cessation of dredging activities and to give us an opportunity to provide you with any updated contact information or reporting forms.</p> <p>At the start of dredging activities, you must include the total volume and area you anticipate removing, the Reach where dredging will occur (with RKM) and the type of dredge to be used. At the end of the dredging event, you must report to us the actual volume and area removed, location where dredging occurred (with RKM), and the equipment used (type of dredge).</p>	<p>These RPMs and TCs are necessary and appropriate because they serve to ensure that we are aware of the dates and locations of all dredging that may result in take.</p> <p>This will allow us to monitor the duration and seasonality of dredging activities as well as give us an opportunity to provide you with any updated species information or contact information for our staff. This is only a minor change because it is not expected to result in any delay to the project and will merely involve occasional e-mails between you and our staff.</p>
<p>2. All dredges must be operated in a manner that will reduce</p>	<p>2. If sea turtles are present during dredging or material transport, vessels transiting the area must post a bridge watch, avoid</p>	<p>These RPMs and TCs are necessary and appropriate as they will require that dredge operators use best</p>

<p>the risk of interactions with listed species.</p>	<p>intentional approaches closer than 100 yards when in transit, and reduce speeds to below 4 knots if bridge watch identifies a listed species in the immediate vicinity of the dredge as determined by the line of sight from the vessel bridge.</p>	<p>management practices, including slowing down to 4 knots should listed species be observed, that will minimize the likelihood of take. This represents only a minor change as following these procedures should not increase the cost of the dredging operation or result in any delays of reduction of efficiency of the dredging project.</p>
<p>3. All Atlantic sturgeon captured must have a fin clip taken for genetic analysis. This sample must be transferred to a NMFS-approved laboratory capable of performing the genetic analysis.</p>	<p>3. You must ensure that fin clips are taken (according to the procedure outlined in Appendix D) of any Atlantic sturgeon captured during the project (including relocation trawling) and that the fin clips are sent to a NMFS approved laboratory capable of performing genetic analysis. Fin clips must be taken prior to preservation of other fish parts or whole bodies. To the extent authorized by law, you are responsible for the cost of the genetic analysis.</p>	<p>These RPMs and TCs are necessary and appropriate to ensure the proper handling and documentation of any interactions with listed species as well as requiring that these interactions are reported to us in a timely manner with all of the necessary information. This is essential for monitoring the level of incidental take associated with the proposed action. Genetic analysis must be conducted on Atlantic sturgeon samples to determine the appropriate DPS of origin and accurately record take of this species. These RPMs and TCs represent only a minor change as compliance will not result in delay of the project or decrease in the</p>

		efficiency of the dredging operations.
4. Any dead sturgeon must be transferred to us or to an appropriately permitted research facility identified by us so that a necropsy can be undertaken to attempt to determine the cause of death. Sturgeon should be held in cold storage.	4. In the event of any lethal takes of Atlantic sturgeon, any dead specimens or body parts must be photographed, measured, and preserved (refrigerate or freeze) until disposal procedures are discussed with us. The form included as Appendix F (sturgeon salvage form) must be completed and submitted to us.	These RPMs and TCs are necessary and appropriate to ensure the proper handling and documentation of any interactions with listed species as well as requiring that these interactions are reported to us in a timely manner with all of the necessary information. This is essential for monitoring the level of incidental take associated with the proposed action. These RPMs and TCs represent only a minor change as compliance will not result in any increased cost, delay of the project or decrease in the efficiency of the dredging operations.
5. Any dead sea turtles must be held until proper disposal procedures can be discussed with us. Turtles should be held in cold storage.	5. In the event of any lethal takes of sea turtles, any dead specimens or body parts must be photographed, measured, and preserved (refrigerate or freeze) until disposal procedures are discussed with us.  If a decomposed turtle or turtle part is captured or entrained during dredging operations, an incident report must be completed and the specimen must be photographed. Any turtle parts that are considered 'not fresh' (i.e., they were	These RPMs and TCs are necessary and appropriate to ensure the documentation of any interactions with listed species as well as requiring that these interactions are reported to us in a timely manner with all of the necessary information. In some cases, when the cause of death is uncertain, a necropsy may be necessary to aid in the determination of whether or not a mortality should count toward the

	<p>obviously dead prior to the dredge take and you anticipate that they will not be counted towards the ITS) must be frozen and transported to a nearby stranding or rehabilitation facility for review. You must ensure that the observer submits the incident report for the decomposed turtle part, as well as photographs, to us within 24 hours of the take (see Appendix G) and request concurrence that this take should not be attributed to the Incidental Take Statement. We shall have the final say in determining if the take should count towards the Incidental Take Statement.</p>	<p>ITS. This is essential for monitoring the level of incidental take associated with the proposed action. These RPMs and TCs represent only a minor change as compliance will not result in any increased cost, delay of the project or decrease in the efficiency of the dredging operations</p>
<p>7. All sturgeon captures, injuries, or mortalities in the immediate dredging area must be reported to us within 24 hours.</p>	<p>6. In the event of any captures or entrainment of Atlantic sturgeon (lethal or non-lethal), you must follow the Sturgeon Take Standard Operating Procedures (SOPs) found at: <a href="http://www.greateratlanticfisheries.noaa.gov/protected/section7/reporting.html">www.greateratlanticfisheries.noaa.gov/protected/section7/reporting.html</a></p> <p>We shall have the final say in determining if the take should count towards the Incidental Take Statement.</p> <p>7. If the cause of death is unknown (e.g., dead sturgeon incidentally collected during dredging or relocation trawling</p>	<p>These RPMs and TCs are necessary and appropriate to ensure the documentation of any interactions with listed species as well as requiring that these interactions are reported to us in a timely manner with all of the necessary information. In some cases, when the cause of death is uncertain, a necropsy may be necessary to aid in the determination of whether or not a mortality should count toward the ITS. This is essential for monitoring the level of incidental take associated with the proposed action. These RPMs and TCs represent</p>

	<p>in the Norfolk Harbor Navigation Channels) NMFS will have the mortality assigned to the incidental take statement if a necropsy determines that the death was due to injuries sustained from an interaction with dredge gear.</p>	<p>only a minor change as compliance will not delay of the project or decrease in the efficiency of the dredging operations.</p>
<p>8. All sea turtle captures, injuries, or mortalities and any sea turtle sightings in the immediate dredging area must be reported to us within 12 hours.</p>	<p>9. In the event of any captures or entrainment of sea turtles (lethal or non-lethal), you must follow the Sea Turtle Take Standard Operating Procedures (SOPs) found at: <a href="http://www.greateratlanticfisheries.noaa.gov/protected/section7/reporting.html">www.greateratlanticfisheries.noaa.gov/protected/section7/reporting.html</a></p> <p>We shall have the final say in determining if the take should count towards the Incidental Take Statement.</p> <p>10. If the cause of death is unknown, dead sea turtles found along the coastline (e.g., beaches) within two weeks of when dredge operations occurred in the Norfolk Harbor Navigation Channels and in an area where the carcass reasonably could have drifted from dredge operations, will have the mortality assigned to the incidental take statement if a necropsy determines that the death was due to injuries sustained from an interaction with dredge gear (using the process</p>	<p>These RPMs and TCs are necessary and appropriate to ensure the documentation of any interactions with listed species as well as requiring that these interactions are reported to us in a timely manner with all of the necessary information. In some cases, when the cause of death is uncertain, a necropsy may be necessary to aid in the determination of whether or not a mortality should count toward the ITS. This is essential for monitoring the level of incidental take associated with the proposed action. These RPMs and TCs represent only a minor change as compliance will not result in delay of the project or decrease in the efficiency of the dredging operations</p>

	<p>outlined in Appendix L, the November 27, 2017, stranding/dredge take memo).</p> <p>Sea turtle injuries consistent with hopper dredge interactions may include:</p> <ul style="list-style-type: none"> <li>- crushing wounds/injuries;</li> <li>- partial carapace or body part;</li> <li>- jagged edges to injury;</li> <li>- internal organs completely or partially missing or displaced;</li> <li>- excoriated skin injuries; or</li> <li>- peeling or missing scutes, not related to decomposition, around injury area</li> </ul>	
<p>8. You shall implement measures that would reduce the number of sea turtles in the dredging channel so that the possibility of entrainment would be minimized.</p>	<p>11. Sea turtle relocation trawling must be initiated following the take of two (2) turtles (any species) in a 24-hour time period or four (4) turtles within a two month period, or in other circumstances that we deem appropriate. Such circumstances include a large number of cumulative takes during the project (e.g., ½ of the anticipated incidental take level for the channel being dredged reached before the anticipated amount of volume is removed that dredge cycle), or other evidence indicating that protected species presence is high. All trawls must follow the standard protocol described in Appendix H. The trawling and relocation survey</p>	<p>These RPMs and TCs are necessary and appropriate as they will serve to minimize risk of long term injury and mortality during dredging. This represents only a minor change as following these procedures should not increase the cost of the dredging operation or result in any delays of reduction of efficiency of the dredging project.</p>

	<p>must be initiated within 24 hours of the incidental take or you must suspend dredging operations until such trawling can be initiated. Trawling must continue for at least 5 consecutive days, unless precluded by inclement weather, after which we may continue or suspend the survey. After the trawling survey is completed, we shall immediately discuss with you the results of the trawling to determine if additional measures are needed to relocate turtles found in the channel.</p> <p>12. The results of each turtle take from the relocation trawl trawling survey must be recorded on the Sea Turtle Relocation Trawling Data Report (Appendix I), or a similar form including the same information. The preliminary results of the trawling survey must be submitted to us immediately after the survey is completed so that we can determine if additional trawling is warranted. A final report summarizing the results of the trawling and any takes of listed species must be submitted to us within 30 working days of completion of the trawling survey.</p>	
<p><b><i>RPMs Applicable for All Hopper Dredges</i></b></p>		

<p>9. You shall ensure that all hopper dredges are outfitted with state-of-the-art sea turtle deflectors on the draghead and operated in a manner that will reduce the risk of interactions with sea turtles.</p>	<p>13. All hopper dredges must be equipped with the rigid deflector draghead as designed by your Engineering Research and Development Center, formerly the Waterways Experimental Station (WES), or if that is unavailable, a rigid sea turtle deflector attached to the draghead. Deflectors must be checked and/or adjusted by a designated expert prior to a dredge operation to insure proper installation and operation during dredging. The deflector must be checked after every load throughout the dredge operation to ensure that proper installation is maintained. Since operator skill is important to the effectiveness of the WES-developed draghead, operators must be properly instructed in its use. Dredge inspectors must ensure that all measures to protect sea turtles are being followed during dredge operations.</p>	<p>These RPMs and TCs are necessary and appropriate as the use of draghead deflectors is accepted standard practice for hopper dredges operating in places and at times of year when sea turtles are known to be present and has been documented to reduce the risk of entrainment for sea turtles, thereby minimizing the potential for take of these species. This represents only a minor change as all of the hopper dredges likely to be used for this project, including the McFarland which may be used for maintenance dredging, already have draghead deflectors, dredge operators are already familiar with their use, and the use will not affect the efficiency of the dredging operation. Additionally, maintenance of the existing channel is conducted with draghead deflectors in place.</p>
<p><b><i>RPMs for when UXO Screening Not In Place on Hopper Dredge</i></b></p>		
<p>10. For all hopper dredge operations where UXO screening is not in place, a NMFS-approved observer must be present on board the hopper dredge any time it is operating. You shall ensure</p>	<p>14. You must ensure that all contracted personnel involved in operating hopper dredges receive thorough training on measures of dredge operation that will minimize takes of sea turtles. Training shall include measures discussed in Appendix J.</p>	<p>These RPMs and TCs are necessary and appropriate because they require that you have sufficient observer coverage to ensure the detection of any interactions with listed species. This is necessary for</p>

<p>that dredges are equipped and operated in a manner that provides endangered/threatened species observers with a reasonable opportunity for detecting interactions with listed species and that provides for handling, collection, and resuscitation of turtles injured during project activity. Full cooperation with the endangered/threatened species observer program is essential for compliance with the ITS.</p>	<p>15. When UXO screening is not in place, observer coverage on hopper dredges must be sufficient for 100% monitoring of hopper dredging operations. This monitoring coverage must involve the placement of a NMFS-approved observer on board the dredge for every day that dredging is occurring. You must ensure that your dredge operators and/or any dredge contractor adhere to the attached “Monitoring Specifications for Hopper Dredges” with trained NMFS-approved observers, in accordance with the attached “Observer Protocol” and “Observer Criteria” (Appendix J). No observers can be deployed to the dredge site until you have written confirmation from us that they have met the qualifications to be a “NMFS-approved observer” as outlined in Appendix J. If substitute observers are required during dredging operations, you must ensure that our approval is obtained before those observers are deployed on dredges.</p> <p>16. You shall require of the dredge operator that, when the observer is off watch, the cage shall not be opened unless it is clogged. You shall also require that if it is necessary to clean the cage when the observer is off</p>	<p>the monitoring of the level of take associated with the proposed action.</p> <p>The inclusion of these RPMs and TCs is only a minor change as you included some level of observer coverage in the original project description and the increase in coverage (i.e., the addition of any months/activities that were not previously subject to observer coverage) will represent only a small increase in the cost of the project and will not result in any delays. These also represent only a minor change as in many instances they serve to clarify the duties of the inspectors or observers.</p>
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	<p>watch, any aquatic biological material is left in the cage for the observer to document and clear out when he/she returns on duty. In addition, the observer shall be the only one allowed to clean off the overflow screen.</p>	
<p>11. You shall ensure that all measures are taken to protect any turtles or sturgeon that survive entrainment in a hopper dredge.</p>	<p>17. The procedures for handling live sea turtles must be followed in the unlikely event that a sea turtle survives entrainment in the dredge (Appendix K). Any live sturgeon must be photographed, weighed and measured if possible, and released immediately overboard while the dredge is not operating.</p> <p>You must make arrangements with a NMFS-approved facility that agrees to receive any sea turtles injured during dredging. This arrangement must include procedures for transferring these turtles to the care of the facility. To the extent authorized by law, arrangements must address funding of any necessary care and/or rehabilitation. This plan must be developed in cooperation with our Sea Turtle Stranding Coordinator and is subject to approval by us. This plan must be in place and approved before December 31, 2019.</p>	<p>These RPMs and TCs are necessary and appropriate as they will require that dredge operators use best management practices that will minimize the likelihood of take. This represents only a minor change as following these procedures should not result in any delays of reduction of efficiency of the dredging project.</p> <p>Further, they are necessary and appropriate to ensure that any sea turtles or sturgeon that survive entrainment in a hopper dredge are given the maximum probability of remaining alive and not suffering additional injury or subsequent mortality through inappropriate handling. This represents only a minor change as following these procedures will not result in any delays to the proposed project.</p>
<p><b><i>RPMs for UXO Screening on Hopper Dredge</i></b></p>		

<p>12. You shall ensure that for all dredge operations where UXO screening is in place, a lookout/bridge watch, knowledgeable in listed species identification, will be present on board the hopper dredge at all times to inspect the draghead each time it is removed from the water.</p>	<p>18. The lookout will inspect the draghead for impinged sea turtles or Atlantic sturgeon each time it is brought up from completing a dredge cycle. Should a sea turtle or Atlantic sturgeon be found impinged on the draghead, the incident should be recorded (Appendix G) and we must be contacted within 24 hours.</p>	<p>These RPMs and TCs are necessary and appropriate to ensure the documentation of any interactions with listed species as well as requiring that these interactions are reported to us in a timely manner with all of the necessary information. This is essential for monitoring the level of incidental take associated with the proposed action. These RPMs and TCs represent only a minor change as compliance will not result in any increased cost, delay of the project or decrease in the efficiency of the dredging operations.</p>
<p><b><i>RPMs for UXO Screening on Hopper or Cutterhead Dredge</i></b></p>		
<p>13. For all hopper or cutterhead dredge operations where UXO screening is in place, you shall provide monthly reports to us regarding the status of dredging and interactions or observations of listed species.</p>	<p>19. You will provide us with reports every 30 days, via email (<a href="mailto:brian.d.hopper@noaa.gov">brian.d.hopper@noaa.gov</a> and <a href="mailto:incidental.take@noaa.gov">incidental.take@noaa.gov</a>) recording the days that dredging occurred, summaries of the bridge watch reports on draghead inspection, the volume of material removed during the previous 30 day period and any observations of listed species.</p>	<p>These RPMs and TCs are necessary and appropriate to ensure the documentation of any interactions with listed species as well as requiring that these interactions are reported to us in a timely manner with all of the necessary information. This is essential for monitoring the level of incidental take associated with the proposed action. These RPMs and TCs represent only a minor change as compliance will not result in any</p>

		increased cost, delay of the project or decrease in the efficiency of the dredging operations.
<b><i>RPMs for when UXO Screening Not in Place on Cutterhead Dredge</i></b>		
14. Prior to finalizing contract specifications and initiating contract solicitation processes for new cutterhead dredging projects, you must work with us to develop monitoring plans for cutterhead dredges and/or dredged material disposal sites.	20. You will schedule a meeting with us prior to finalizing contract specifications and initiating contract solicitation processes for new cutterhead dredging projects to determine the scope of a monitoring plan. This monitoring plan must be agreed to by us prior to initiation of contracting processes and must be implemented in all subsequent cutterhead dredge contracts, unless modified by agreement of USACE and NMFS. The goal of the monitoring plan will be to accurately determine entrainment of Atlantic sturgeon in future cutterhead dredging projects when no UXO screening is in place; however, physical screening of dredge material by observers is not required.	These RPMs and TCs are necessary and appropriate as they serve to ensure that sturgeon have a minimized risk of injury or mortality from cutterhead dredging activities when UXO screening is not in place. The Norfolk District has been monitoring/screening inflow from cutterhead dredges at Craney Island since 2012 with no observed Atlantic sturgeon during the period; therefore, we have agreed that this does not need to be included in the monitoring plan. The monitoring plan represents only a minor change as it will not result in any significant delays to dredging or significant modifications of the dredge plan and any increased cost will be very small in comparison to the total costs of the project or changes to dredging operations.
<b><i>RPMs for Mechanical Dredging</i></b>		

<p>15. A lookout/bridge watch must be present to observe all mechanical dredging activities where dredged material will be deposited for any capture of sturgeon.</p>	<p>21. For mechanical dredging you must require a lookout to watch for captured sturgeon in the dredge bucket and to monitor the scow/hopper for sturgeon. Any interactions with sturgeon must be reported to us.</p>	<p>These RPMs and TCs are necessary and appropriate because they require that you have sufficient observer coverage to ensure the detection of any interactions with listed species. This is necessary for the monitoring of the level of take associated with the proposed action.</p> <p>The inclusion of these RPMs and TCs is only a minor change as you included some level of observer coverage in the original project description and the increase in coverage (i.e., the addition of any months/activities that were not previously subject to observer coverage) will represent only a small increase in the cost of the project and will not result in any delays. These also represent only a minor change as in many instances they serve to clarify the duties of the inspectors or observers.</p>
<p>16. You must ensure that all measures are taken to protect any sturgeon that survive capture in the mechanical dredge.</p>	<p>22. Any sturgeon observed in the dredge scow/hopper during mechanical dredging operations must be removed with a net and, if alive, returned to the water away from the dredge site.</p>	<p>These RPMs and TCs are necessary and appropriate to ensure that any sturgeon that survive capture in a mechanical dredge are given the maximum probability of remaining alive and not suffering additional injury or subsequent mortality through inappropriate handling. This represents only a minor change</p>

		as following these procedures will not result in an increase in cost or any delays to the proposed project.
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RPMs, TCs, and Justifications Applicable to Baltimore Harbor Entrance Channels, York River Entrance Channel, Sandbridge Shoal, and Virginia Beach Nourishment Projects

Reasonable and Prudent Measures (RPMs)	Terms and Conditions (TCs)	Justifications for RPMs & TCs
<i>RPMs Applicable for All Dredge Activities</i>		
<p>1. NMFS must be contacted prior to the commencement of dredging and again upon completion of the dredging activity.</p>	<p>1. To implement RPM #1, the USACE must contact NMFS (Brian D. Hopper: by email (<a href="mailto:brian.d.hopper@noaa.gov">brian.d.hopper@noaa.gov</a>) or phone (410) 573-4592) within 3 days of the commencement of each dredging cycle and again within 3 days of the completion of dredging activity. This correspondence will serve both to alert NMFS of the commencement and cessation of dredging activities and to give NMFS an opportunity to provide USACE with any updated contact information or reporting forms.</p>	<p>The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize and monitor the impact of incidental take that might otherwise result from the proposed action. Specifically, these RPMs and Terms and Conditions will keep us informed of when and where dredging activities are taking place and will require USACE to report any take in a reasonable amount of time, as well as implement measures to monitor for entrainment during dredging. USACE has reviewed the RPMs and Terms and Conditions outlined above and has agreed to implement all of these measures as described herein and in the referenced Appendices. We have determined that all of these RPMs and Terms and Conditions are necessary and appropriate to minimize or monitor the level of incidental take associated with the</p>
<p>2. All dredges must be operated in a manner that will reduce the risk of interactions with sea turtles.</p>	<p>2. To implement RPM #2, if sea turtles are present during dredging or material transport, vessels transiting the area must post a bridge watch, avoid intentional approaches closer than 100 yards when in transit, and reduce speeds to below 4 knots if bridge watch identifies a listed species in the immediate vicinity of the dredge.</p>	

<p>3. All (alive or dead) Atlantic sturgeon must have a fin clip taken for genetic analysis. This sample must be transferred to NMFS.</p>	<p>3. To implement RPM #3, the USACE must ensure that fin clips are taken (according to the procedure outlined in Appendix D) of any sturgeon captured during the project and that the fin clips are sent to NMFS for genetic analysis. Fin clips must be taken prior to preservation of other fish parts or whole bodies.</p>	<p>proposed action and represent only a minor change to the action as proposed by the USACE.</p>
<p>4. Any dead sturgeon must be transferred to us or to an appropriately permitted research facility identified by us so that a necropsy can be undertaken to attempt to determine the cause of death. Sturgeon should be held in cold storage.</p>	<p>4. To implement RPM #4, in the event of any lethal takes of Atlantic sturgeon, any dead specimens or body parts must be photographed, measured, and preserved (refrigerate or freeze) until disposal procedures are discussed with NMFS. The form included as Appendix F (sturgeon salvage form) must be completed and submitted to NMFS.</p>	
<p>5. Any dead sea turtles must be held until proper disposal procedures can be discussed with us. Turtles should be held in cold storage.</p>	<p>5. To implement RPM #5, in the event of any lethal takes of sea turtles, any dead specimens or body parts must be photographed, measured, and preserved (refrigerate or freeze) until disposal procedures are discussed with NMFS.</p> <p>6. To implement RPM #5, if a decomposed turtle or turtle part is entrained during dredging operations, an incident report must be completed and the specimen must be photographed. Any turtle parts that are</p>	

	<p>considered ‘not fresh’ (i.e., they were obviously dead prior to the dredge take and USACE anticipates that they will not be counted towards the ITS) must be frozen and transported to a nearby stranding or rehabilitation facility for review. USACE must ensure that the observer submits the incident report for the decomposed turtle part, as well as photographs, to NMFS within 24 hours of the take (see Appendix G) and request concurrence that this take should not be attributed to the Incidental Take Statement. NMFS shall have the final say in determining if the take should count towards the Incidental Take Statement.</p>	
<p>6. All sturgeon and turtle captures, injuries or mortalities associated with any dredging activity and any sturgeon and sea turtle sightings in the action area must be reported to NMFS within 24 hours.</p>	<p>7. To implement RPM #6, the USACE must contact NMFS within 24 hours of any interactions with sturgeon or sea turtles, including non-lethal and lethal takes. NMFS will provide updated contact information when alerted of the start of dredging activity. Until alerted otherwise, the USACE should provide reports by e-mail (brian.d.hopper@noaa.gov) or phone (410) 573-4592 or the Section 7 Coordinator by phone (978) 281-9306 or fax 978-281-9394). Take information should also be reported</p>	

	<p>by e-mail to: incidental.take@noaa.gov.</p> <p>8. To implement RPM #6, the USACE must photograph and measure any sturgeon or sea turtles observed during project operations (including whole sturgeon or sea turtles or body parts observed at the disposal location or on board the dredge, hopper or scow) and the corresponding form (Appendix G) must be completed and submitted to NMFS within 24 hours by fax (978-281-9394) or e-mail (incidental.take@noaa.gov).</p> <p>9. To implement RPM #6, any time that take is greater than the estimated level of take for a particular project (e.g. annual estimate for a channel or borrow area based on the volume of material removed), USACE must immediately contact NMFS to review the situation. At that time, USACE will discuss with NMFS whether any new management measures could be implemented to prevent the total incidental take level from being exceeded and will work with NMFS to determine whether the level of take during that year represents new information revealing</p>	
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	<p>effects of the action that may not have been previously considered.</p> <p>10. To implement RPM #6, the USACE must submit a final report summarizing the results of dredging and any takes of listed species to NMFS within 30 working days of the completion of each dredging contract (by mail to the attention of the Section 7 Coordinator, NMFS Protected Resources Division, 55 Great Republic Drive, Gloucester, MA 01930).</p>	
<p>7. You shall implement measures that would reduce the number of sea turtles in the dredging channel so that the possibility of entrainment would be minimized.</p>	<p>11. To implement RPM#7, sea turtle relocation trawling must be initiated following the take of two (2) turtles (any species) in a 24-hour time period or four (4) turtles within a two month period, or in other circumstances that NMFS deems appropriate. Such circumstances include a large number of cumulative takes during the project (e.g., ½ of the anticipated incidental take level for the channel being dredged based on volume to be removed that dredge cycle), or other evidence indicating that protected species presence is high. All trawls must follow the standard protocol described in Appendix H. The trawling and</p>	

	<p>relocation survey must be initiated within 24 hours of the incidental take or the ACOE must suspend dredging operations until such trawling can be initiated. Trawling must continue for at least 5 consecutive days, unless precluded by inclement weather, after which NMFS may continue or suspend the survey. After the trawling survey is completed, the NMFS and ACOE shall immediately discuss the results of the trawling to determine if additional measures are needed to relocate turtles found in the channel.</p> <p>12. To implement RPM #7, the results of each turtle take from the relocation trawl trawling survey must be recorded on the Sea Turtle Relocation Trawling Data Report (Appendix I), or a similar form including the same information. The preliminary results of the trawling survey must be submitted to NMFS immediately after the survey is completed so that NMFS can determine if additional trawling is warranted. A final report summarizing the results of the trawling and any takes of listed species must be submitted to NMFS</p>	
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	within 30 working days of completion of the trawling survey.	
<b><i>RPMs Applicable for All Hopper Dredges</i></b>		
8. The USACE shall ensure that all hopper dredges are outfitted with state-of-the-art sea turtle deflectors on the draghead and operated in a manner that will reduce the risk of interactions with sea turtles.	13. To implement RPM #8, all hopper dredges must be equipped with the rigid deflector draghead as designed by the USACE Engineering Research and Development Center, formerly the Waterways Experimental Station (WES), or if that is unavailable, a rigid sea turtle deflector attached to the draghead. Deflectors must be checked and/or adjusted by a designated expert prior to a dredge operation to insure proper installment and operation during dredging. The deflector must be checked after every load throughout the dredge operation to ensure that proper installation is maintained. Since operator skill is important to the effectiveness of the WES-developed draghead, operators must be properly instructed in its use. Dredge inspectors must ensure that all measures to protect sea turtles are being followed during dredge operations.	
<b><i>RPMs for when UXO Screening Not In Place on Hopper Dredge</i></b>		

<p>9. For all hopper dredge operations where UXO screening is not in place, a NMFS-approved observer must be present on board the hopper dredge any time it is operating. The USACE shall ensure that dredges are equipped and operated in a manner that provides endangered/threatened species observers with a reasonable opportunity for detecting interactions with listed species and that provides for handling, collection, and resuscitation of turtles injured during project activity. Full cooperation with the endangered/threatened species observer program is essential for compliance with the ITS.</p>	<p>14. To implement RPM #9, the USACE must ensure that all contracted personnel involved in operating hopper dredges receive thorough training on measures of dredge operation that will minimize takes of sea turtles. Training shall include measures discussed in Appendix J.</p> <p>15. To implement RPM #9, when UXO screening is not in place, observer coverage on hopper dredges must be sufficient for 100% monitoring of hopper dredging operations. This monitoring coverage must involve the placement of a NMFS-approved observer on board the dredge for every day that dredging is occurring. The observer must work a shift schedule appropriate to allow for the observation of at least 50% of the dredge loads (e.g., 12 hours on, 12 hours off). The USACE must ensure that USACE dredge operators and/or any dredge contractor adhere to the attached “Monitoring Specifications for Hopper Dredges” with trained NMFS-approved observers, in accordance with the attached “Observer Protocol” and “Observer Criteria” (Appendix J). No observers can be deployed to the dredge site until USACE has written</p>	
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	<p>confirmation from NMFS that they have met the qualifications to be a “NMFS-approved observer” as outlined in Appendix J. If substitute observers are required during dredging operations, USACE must ensure that NMFS approval is obtained before those observers are deployed on dredges.</p> <p>16. To implement RPM #9, the USACE shall require of the dredge operator that, when the observer is off watch, the cage shall not be opened unless it is clogged. The USACE shall also require that if it is necessary to clean the cage when the observer is off watch, any aquatic biological material is left in the cage for the observer to document and clear out when they return on duty. In addition, the observer shall be the only one allowed to clean off the overflow screen.</p>	
<p>10. The USACE shall ensure that all measures are taken to protect any turtles or sturgeon that survive entrainment in a hopper dredge.</p>	<p>17. To implement RPM #10, the procedures for handling live sea turtles must be followed in the unlikely event that a sea turtle survives entrainment in the dredge (Appendix K). Any live sturgeon must be photographed, weighed and measured if possible, and released</p>	

	immediately overboard while the dredge is not operating.	
<b><i>RPMs for UXO Screening on Hopper Dredge</i></b>		
11. The USACE shall ensure that for all dredge operations where UXO screening is in place, a lookout/bridge watch, knowledgeable in listed species identification, will be present on board the hopper dredge at all times to inspect the draghead each time it is removed from the water.	18. To implement RPM #11, the lookout will inspect the draghead for impinged sea turtles or Atlantic sturgeon each time it is brought up from completing a dredge cycle. Should a sea turtle or Atlantic sturgeon be found impinged on the draghead, the incident should be recorded (Appendix G) and NMFS contacted.	
<b><i>RPMs for UXO Screening on Hopper or Cutterhead Dredge</i></b>		
12. For all hopper or cutterhead dredge operations where UXO screening is in place, USACE shall provide monthly reports to NMFS regarding the status of dredging and interactions or observations of listed species.	19. To implement RPM #12, USACE will provide us with reports every 30 days, via email ( <a href="mailto:brian.d.hopper@noaa.gov">brian.d.hopper@noaa.gov</a> and <a href="mailto:incidental.take@noaa.gov">incidental.take@noaa.gov</a> ) recording the days that dredging occurred, summaries of the bridge watch reports on draghead inspection, the volume of material removed during the previous 30 day period and any observations of listed species.	

<b><i>RPMs for when UXO Screening Not in Place on Cutterhead Dredge</i></b>	
13. Prior to finalizing contract specifications and initiating contract solicitation processes for new cutterhead dredging projects scheduled for calendar year 2013, the USACE must work with NMFS to develop monitoring plans for cutterhead dredges and/or dredged material disposal sites.	20. To implement RPM #13, USACE will schedule a meeting with NMFS prior to finalizing contract specifications and initiating contract solicitation processes for new cutterhead dredging projects to determine the scope of a monitoring plan. This monitoring plan must be agreed to by us prior to initiation of contracting processes and must be implemented in all subsequent cutterhead dredge contracts, unless modified by agreement of USACE and NMFS. The goal of the monitoring plan will be to accurately determine entrainment of Atlantic sturgeon in future cutterhead dredging projects when no UXO screening is in place.
<b><i>RPMs for Mechanical Dredging</i></b>	
14. A lookout/bridge watch must be present to observe all mechanical dredging activities where dredged material will be deposited for any capture of sturgeon.	21. To implement RPM#14, for mechanical dredging USACE must require a lookout to watch for captured sturgeon in the dredge bucket and to monitor the scow/hopper for sturgeon. Any interactions with sturgeon must be reported to us.
15. The USACE must ensure that all measures are taken	22. To implement RPM #15, any sturgeon observed in the dredge

<p>to protect any sturgeon that survive capture in the mechanical dredge.</p>	<p>scow/hopper during mechanical dredging operations must be removed with a net and, if alive, returned to the water away from the dredge site.</p>	
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## **11.0 CONSERVATION RECOMMENDATIONS**

In addition to Section 7(a)(2), which requires agencies to ensure that all projects will not jeopardize the continued existence of listed species, Section 7(a)(1) of the ESA places a responsibility on all federal agencies to “utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species.” Conservation Recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. As such, we recommend that you consider the following Conservation Recommendations:

- (1) To the extent practicable, you should avoid dredging in the spring (March-May) and fall (September – November) when listed species are most likely to occur in the action area.
- (2) You should conduct studies in conjunction with cutterhead dredging where disposal occurs on the beach to assess the potential for improved screening to: (1) establish the type and size of biological material that may be entrained in the cutterhead dredge, and (2) verify that monitoring the disposal site without screening is providing an accurate assessment of entrained material.
- (3) You should support studies to determine the effectiveness of using a sea turtle deflector to minimize the potential entrainment of sturgeon during hopper dredging.
- (4) You should explore alternative means for monitoring for interactions with listed species when UXO screening is in place including exploring the potential for video or other electronic monitoring.
- (5) You should conduct studies using a VEMCO Positioning System (VPS) to determine what life stages of sturgeon occur in the navigation channels and the extent to which sturgeon use the navigation channels throughout the year.

## **12.0 REINITIATION OF CONSULTATION**

This concludes formal consultation on the Norfolk Harbor Navigation Improvements and Craney Island Eastward Expansion projects. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of taking specified in the incidental take statement is exceeded; (2) new information reveals effects of the action that may not have been previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species; or (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, the federal agency must reinitiate Section 7 consultation immediately. Consultation may be reinitiated by meeting any one or more of the above-identified triggers.

This is a batched biological opinion because it involves multiple projects and multiple action agencies. Whether one project, multiple projects or all projects meet a reinitiation trigger, any future consultations will be completed with the production of one consultation document (i.e., a batch biological opinion). For example, as in this case, if you or another action agency proposes

new construction in a navigation channel (trigger #3), in addition to addressing the impacts from the new activity, the new batch biological opinion would provide updates on all of the remaining projects. Our batch biological opinion will include a new analysis for the reinitiated projects as well as any necessary updates to the other projects and will replace the prior biological opinion. In addition, a batch biological opinion may include new reasonable and prudent measures (RPMs) and terms and conditions (TCs), which will only apply to the projects being reinitiated, except by written agreement. Alternatively, it may be necessary to reinitiate consultation with all action agencies on all activities, in which case new RPMs and TCs for all projects may be warranted. For example, if a new species is listed that may be affected by dredging activities throughout the action area, it would be necessary for all action agencies to coordinate and reinitiate consultation on all of the activities. The production of one biological opinion, as described above, will be the default whenever one project, multiple projects, or all projects covered under this batched biological opinion meet a reinitiation trigger. However, a circumstance may arise where NMFS and the action agencies agree to carry out a standalone consultation on an individual project covered under this batch biological opinion, which would result in a separate biological opinion for that project. Under such circumstances, this batched biological opinion will need to be revised, updated, or replaced to account for the removal of that project from the impact analysis contained herein.

### 13.0 LITERATURE CITED

- Allen PJ, Nicholl M, Cole S, Vlazny A, Cech JJ Jr. 2006. Growth of larval to juvenile green sturgeon in elevated temperature regimes. *Trans Am Fish Soc* 135:89–96
- Anchor Environmental. 2003. Literature review of effects of resuspended sediments due to dredging. June. 140pp.
- Andrews, H.V., and K. Shanker. 2002. A significant population of leatherback turtles in the Indian Ocean. *Kachhapa* 6:19.
- Andrews, H.V., S. Krishnan, and P. Biswas. 2002. Leatherback nesting in the Andaman and Nicobar Islands. *Kachhapa* 6:15-18.
- Antonelis, G.A., J.D. Baker, T.C. Johanos, R.C. Braun and A.L. Harting. 2006. Hawaiian monk seal (*Monachus schauinslandi*): status and conservation issues. *Atoll Research Bulletin* 543: 75-101
- ASMFC (Atlantic States Marine Fisheries Commission). 2002. Amendment 4 to the Interstate Fishery Management Plan for weakfish. Fishery Management Report No. 39. Washington, D.C.: Atlantic States Marine Fisheries Commission.
- ASMFC (Atlantic States Marine Fisheries Commission). 2009. Atlantic Sturgeon. In: *Atlantic Coast Diadromous Fish Habitat: A review of utilization, threats, recommendations for conservation and research needs*. Habitat Management Series No. 9. Pp. 195-253.
- ASSRT (Atlantic Sturgeon Status Review Team). 2007. Status review of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). National Marine Fisheries Service. February 23, 2007. 188 pp.
- Attrill, M.J., J. Wright, and M. Edwards. 2007. Climate-related increases in jellyfish frequency suggest a more gelatinous future for the North Sea. *Limnology and Oceanography* 52:480-485.
- Avens, L., J.C. Taylor, L.R. Goshe, T.T. Jones, and M. Hastings. 2009. Use of skeletochronological analysis to estimate the age of leatherback sea turtles *Dermochelys coriacea* in the western North Atlantic. *Endangered Species Research* 8:165-177.
- Ayers, M.A. et al. 1994. Sensitivity of Water Resources in the Delaware River Basin to Climate Variability and Change. USGS Water Supply Paper 2422. 21 pp.
- Bain, M. B. 1997. Atlantic and shortnose sturgeons of the Hudson River: Common and Divergent Life History Attributes. *Environmental Biology of Fishes* 48: 347-358.
- Bain, M., K. Arend, N. Haley, S. Hayes, J. Knight, S. Nack, D. Peterson, and M. Walsh. 1998a. Sturgeon of the Hudson River: Final Report on 1993-1996 Research. Prepared for The Hudson River Foundation by the Department of Natural Resources, Cornell University, Ithaca, New York.

- Bain, M.B., N. Haley, D. Peterson, J. R. Waldman, and K. Arend. 2000. Harvest and habitats of Atlantic sturgeon *Acipenser oxyrinchus* Mitchill, 1815, in the Hudson River Estuary: Lessons for Sturgeon Conservation. Instituto Espanol de Oceanografia. Boletin 16: 43-53.
- Bain, Mark B., N. Haley, D. L. Peterson, K. K. Arend, K. E. Mills, P. J. Sullivan. 2007. Recovery of a US Endangered Fish. PLoS ONE 2(1): e168. doi:10.1371/journal.pone.0000168
- Bain, Mark B., N. Haley, D. L. Peterson, K. K. Arend, K. E. Mills, P. J. Sullivan. 2000. Annual meeting of American fisheries Society. EPRI-AFS Symposium: Biology, Management and Protection of Sturgeon. St. Louis, MO. 23-24 August 2000.
- Baker, J.D., C.L. Littnan, and D.W. Johnston. 2006. Potential effects of sea level rise on the terrestrial habitats of endangered and endemic megafauna in the Northwestern Hawaiian Islands. *Endangered Species Research* 2:21-30.
- Balazs, G.H. 1982. Growth rates of immature green turtles in the Hawaiian Archipelago, p. 117-125. In K.A. Bjorndal (ed.), *Biology and Conservation of Sea Turtles*. Smithsonian Institution Press, Washington, D.C.
- Balazs, G.H. 1985. Impact of ocean debris on marine turtles: entanglement and ingestion. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-SWFSC-54:387-429.
- Baldwin, R., G.R. Hughes, and R.T. Prince. 2003. Loggerhead turtles in the Indian Ocean. Pages 218-232. In: A.B. Bolten and B.E. Witherington (eds.) *Loggerhead Sea Turtles*. Smithsonian Books, Washington, D.C. 319 pp.
- Bartol, S.M., J.A. Musick, and M.L. Lenhardt. 1999. Auditory evoked potentials of the loggerhead sea turtle (*Caretta caretta*). *Copeia*, 3: 836-840.
- Bass, A.L., S.P. Epperly, and J. Braun-McNeill. 2004. Multi-year analysis of stock composition of a loggerhead turtle (*Caretta caretta*) foraging habitat using maximum likelihood and Bayesian methods. *Conservation Genetics* 5:783-796.
- Bath, D.W., J.M. O'Conner, J.B. Albert and L.G. Arvidson. 1981. Development and identification of larval Atlantic sturgeon (*Acipenser oxyrinchus*) and shortnose sturgeon (*A. brevirostrum*) from the Hudson River estuary, New York. *Copeia* 1981:711-717.
- Beamesderfer, Raymond C.P. and Ruth A. Farr. 1997. Alternatives for the protection and restoration of sturgeons and their habitat. *Environmental Biology of Fishes* 48: 407-417.
- Belanger, S.E., J.L. Farris, D.S. Cherry, and J. Cairns, Jr. 1985. Sediment preference of the freshwater Asiatic clam, *Corbicula fluminea*. *The Nautilus* 99(2-3):66-73.
- Berlin, W.H., R.J. Hesselberg, and M.J. Mac. 1981. Chlorinated hydrocarbons as a factor in the reproduction and survival of lake trout (*Salvelinus namaycush*) in Lake Michigan. Technical Paper 105 of the U.S. Fish and Wildlife Service, 42 pages.
- Bigelow, H.B. and W.C. Schroeder. 1953. Sea Sturgeon. In: *Fishes of the Gulf of Maine*. Fishery Bulletin 74. Fishery Bulletin of the Fish and Wildlife Service, vol. 53.

- Bilkovic, D.M, Angstadt, K. and D. Stanhope. 2009. Atlantic Sturgeon Spawning Habitat on the James River, Virginia: Final Report to NOAA/NMFS Chesapeake Bay Office. Virginia Institute of Marine Science, Gloucester Point, Virginia.
- Birstein, V.J., Bemis, W.E. and J.R. Waldman. 1997. The threatened status of acipenseriform species: a summary. *Environmental Biology of Fishes* 48: 427-435.
- Bjork, M., F. Short, E. McLeod, and S. Beers. 2008. Managing seagrasses for resilience to climate change. IUCN, Gland.
- Bjorndal, K.A. 1997. Foraging ecology and nutrition of sea turtles. Pages 199-233 In: Lutz, P.L. and J.A. Musick, eds., *The Biology of Sea Turtles*. CRC Press, New York. 432 pp.
- Blalock, H.N., and J.J. Herod. 1999. A comparative study of stream habitat and substrate utilized by *Corbicula fluminea* in the New River, Florida. *Florida Scientist* 62:145-151.
- Blumenthal, J.M., J.L. Solomon, C.D. Bell, T.J. Austin, G. Ebanks-Petrie, M.S. Coyne, A.C. Broderick, and B.J. Godley. 2006. Satellite tracking highlights the need for international cooperation in marine turtle management. *Endangered Species Research* 2:51-61.
- Bolten, A.B. 2003. Variation in sea turtle life history patterns: neritic vs. oceanic developmental stages. Pages 243-257 in P.L. Lutz, J.A. Musick, and J. Wyneken, eds. *The Biology of Sea Turtles*, Vol. 2. Boca Raton, Florida: CRC Press.
- Bolten, A.B., J.A. Wetherall, G.H. Balazs, and S.G. Pooley (compilers). 1996. Status of marine turtles in the Pacific Ocean relevant to incidental take in the Hawaii-based pelagic longline fishery. U.S. Dept. of Commerce, NOAA Technical Memorandum, NOAA-TM-NOAA Fisheries SWFSC-230.
- Bolten, A.B., K.A. Bjorndal, H.R. Martins, T. Dellinger, M.J. Biscoito, S.E. Encalada, and B.W. Bowen. 1998. Transatlantic developmental migrations of loggerhead sea turtles demonstrated by mtDNA sequence analysis. *Ecological Applications* 8(1):1-7.
- Boreman, J. 1997. Sensitivity of North American sturgeons and paddlefish to fishing mortality. *Environmental Biology of Fishes* 48: 399-405.
- Borodin, N. 1925. Biological observations on the Atlantic sturgeon, *Acipenser sturio*. *Transactions of the American Fisheries Society* 55: 184-190.
- Boulon, R., Jr. 2000. Trends in sea turtle strandings, U.S. Virgin Islands: 1982 to 1997. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SEFSC-436:261-263.
- Bowen, B.W. 2003. What is a loggerhead turtle? The genetic perspective. Pages 7-27 in A.B. Bolten and B.E. Witherington, (eds). *Loggerhead Sea Turtles*. Washington, D.C.: Smithsonian Press.
- Bowen, B.W. , A. L. Bass, S. Chow, M. Bostrom, K. A. Bjorndal, A. B. Bolten, T. Okuyama, B. M. Bolker, S. Epperley, E. Lacasella, D. Shaver, M. Dodd, S. R. Hopkins-Murphy, J. A. Musick, M. Swingle, K. Rankin-Baransky, W. Teas, W. N. Witzell, and P. H. Dutton. 1992. Natal

- homing in juvenile loggerhead turtles (*Caretta caretta*). *Molecular Ecology* (2004) 13: 3797-3808.
- Bowen, B.W., A.L. Bass, L. Soares, and R.J. Toonen. 2005. Conservation implications of complex population structure: lessons from the loggerhead turtle (*Caretta caretta*). *Molecular Ecology* 14:2389-2402.
- Bowen, B.W., and S.A. Karl. 2007. Population genetics and phylogeography of sea turtles. *Molecular Ecology* 16:4886-4907.
- Boysen, K. A. and Hoover, J. J. (2009), Swimming performance of juvenile white sturgeon (*Acipenser transmontanus*): training and the probability of entrainment due to dredging. *Journal of Applied Ichthyology*, 25: 54–59.
- Braun, J., and S.P. Epperly. 1996. Aerial surveys for sea turtles in southern Georgia waters, June 1991. *Gulf of Mexico Science* 1996(1):39-44.
- Braun-McNeill, J. , C.R. Sasso, S.P.Epperly, C. Rivero. 2008. Feasibility of using sea surface temperature imagery to mitigate cheloniid sea turtle–fishery interactions off the coast of northeastern USA. *Endangered Species Research: Vol. 5: 257–266, 2008.*
- Braun-McNeill, J., and S.P. Epperly. 2004. Spatial and temporal distribution of sea turtles in the western North Atlantic and the U.S. Gulf of Mexico from Marine Recreational Fishery Statistics Survey (MRFSS). *Marine Fisheries Review* 64(4):50-56.
- Brewer, K., M. Gallagher, P. Regos, P. Isert, and J. Hall. 1993. Kuvlum #1 Exploration Prospect: Site Specific Monitoring Program, Final Report. Prepared by Coastal Offshore Pacific Corporation, Walnut Creek, CA, for ARCO Alaska, Inc., Anchorage, AK. 80pp.
- Brodeur, R.D., C.E. Mills, J.E. Overland, G.E. Walters, and J.D. Schumacher. 1999. Evidence for a substantial increase in gelatinous zooplankton in the Bering Sea, with possible links to climate change. *Fisheries Oceanography* 8(4):296-306.
- Brown, J.J. and G.W. Murphy. 2010. Atlantic sturgeon vessel strike mortalities in the Delaware River. *Fisheries* 35(2):72-83.
- Brundage, H. 1986. Radio tracking studies of shortnose sturgeon in the Delaware River for the Merrill Creek Reservoir Project, 1985 Progress Report. V.J. Schuler Associates, Inc.
- Brundage, H.M. and J. C. O’Herron. 2009. Investigations of juvenile shortnose and Atlantic sturgeons in the lower tidal Delaware River. *Bull. N.J. Acad. Sci.* 54(2), pp1-8. Weber, R.G. 2001. Preconstruction Horeshoe Crab Egg Density Monitoring and Habitat Availability at Kelly Island, Port Mahon and Broadkill Beach Study Areas, Delaware. Submitted to the USACE Philadelphia District. Available at: <http://www.nap.usace.army.mil/cenap-pl/b10.pdf>
- Brundage, H.M. and R.E. Meadows. 1982. The Atlantic sturgeon in the Delaware River estuary. *Fisheries Bulletin* 80:337-343.
- Brundage, H.M., III and R.E. Meadows. 1982a. Occurrence of the endangered shortnose sturgeon, *Acipenser brevirostrum*, in the Delaware River estuary. *Estuaries* 5:203-208.

- Bryant, L.P. 2008. Governor's Commission on Climate Change. Final Report: A Climate Change Action Plan. Virginia Department of Environmental Quality.
- Burlas, M., G. L Ray, & D. Clarke. 2001. The New York District's Biological Monitoring Program for the Atlantic Coast of New Jersey, Asbury Park to Manasquan Section Beach Erosion Control Project. Final Report. U.S. Army Engineer District, New York and U.S. Army Engineer Research and Development Center, Waterways Experiment Station.
- Burton, W. 1993. Effects of bucket dredging on water quality in the Delaware River and the potential for effects on fisheries resources. Prepared by Versar, Inc. for the Delaware Basin Fish and Wildlife Management Cooperative, unpublished report. 30 pp.
- Burton, W.H. 1994. Assessment of the Effects of Construction of a Natural Gas Pipeline on American Shad and Smallmouth Bass Juveniles in the Delaware River. Prepared by Versar, Inc. for Transcontinental Gas Pipe Line Corporation.
- Bushnoe, T. M., Musick, J.A. and D.S. Ha. 2005. Essential spawning and nursery habitat of Atlantic sturgeon (*Acipenser oxyrinchus*) in Virginia. Provided by Jack Musick, Virginia Institute of Marine Science, Gloucester Point, Virginia.
- Caillouet, C., C.T. Fontaine, S.A. Manzella-Tirpak, and T.D. Williams. 1995. Growth of head-started Kemp's ridley sea turtles (*Lepidochelys kempi*) following release. *Chelonian Conservation and Biology*. 1(3):231-234.
- Cameron, P., J. Berg, V. Dethlefsen, and H. Von Westernhagen. 1992. Developmental defects in pelagic embryos of several flatfish species in the southern north-sea. *Netherlands Journal of Sea Research* 29: 239-256.
- Cameron, S. 2012. "Assessing the Impacts of Channel Dredging on Atlantic Sturgeon Movement and Behavior". Presented to the Virginia Atlantic Sturgeon Partnership Meeting. Charles City, Virginia. March 19, 2012.
- Carlson, D.M., and K.W. Simpson. 1987. Gut contents of juvenile shortnose sturgeon in the upper Hudson estuary. *Copeia* 1987:796-802
- Caron, F., D. Hatin, and R. Fortin. 2002. Biological characteristics of adult Atlantic sturgeon (*Acipenser oxyrinchus*) in the Saint Lawrence River estuary and the effectiveness of management rules. *Journal of Applied Ichthyology* 18: 580-585.
- Carr, A.R. 1963. Pan specific reproductive convergence in *Lepidochelys kempi*. *Ergebn. Biol.* 26: 298-303.
- Carreras, C., S. Pont, F. Maffucci, M. Pascual, A. Barceló, F. Bentivegna, L. Cardona, F. Alegre, M. SanFélix, G. Fernández, and A. Aguilar. 2006. Genetic structuring of immature loggerhead sea turtles (*Caretta caretta*) in the Mediterranean Sea reflects water circulation patterns. *Marine Biology* 149:1269-1279.

- Casale, P., P. Nicolosi, D. Freggi, M. Turchetto, and R. Argano. 2003. Leatherback turtles (*Dermochelys coriacea*) in Italy and in the Mediterranean basin. *Herpetological Journal* 13: 135-139.
- Castroviejo, J., J.B. Juste, J.P. Del Val, R. Castelo, and R. Gil. 1994. Diversity and status of sea turtle species in the Gulf of Guinea islands. *Biodiversity and Conservation* 3: 828-836.
- Cetacean and Turtle Assessment Program (CeTAP). 1982. Final report of the cetacean and turtle assessment program, University of Rhode Island, to Bureau of Land Management, U.S. Department of the Interior. Ref. No. AA551-CT8-48. 568 pp.
- Chan, E.H., and H.C. Liew. 1996. Decline of the leatherback population in Terengganu, Malaysia, 1956-1995. *Chelonian Conservation and Biology* 2(2): 192-203.
- Chevalier, J., X. Desbois, and M. Girondot. 1999. The reason for the decline of leatherback turtles (*Dermochelys coriacea*) in French Guiana: a hypothesis p.79-88. In Miaud, C. and R. Guyétant (eds.), *Current Studies in Herpetology, Proceedings of the ninth ordinary general meeting of the Societas Europea Herpetologica, 25-29 August 1998 Le Bourget du Lac, France.*
- Church, J., J.M. Gregory, P. Huybrechts, M. Kuhn, K. Lambeck, M.T. Nhuan, D. Qin, P.L. Woodworth. 2001. Changes in sea level. In: Houghton, J.T., Y. Ding, D.J. Griggs, M. Noguer, P.J. Vander Linden, X. Dai, K. Maskell, C.A. Johnson CA (eds.) *Climate change 2001: the scientific basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge University Press, Cambridge, p 639–694
- Clarke, D. 2011. Sturgeon Protection. Presented to the Dredged Material Assessment and Management Seminar 24-26 May, 2011 Jacksonville, FL
- Clarke, D. G., and Wilber, D. H. 2000. Assessment of potential impacts of dredging operations due to sediment resuspension. DOER Technical Notes Collection. U.S. Army Engineer Research and Development Center, Vicksburg, MS.
- Clausner, J.; Jones, D., 2004: Prediction of flow fields near the intakes of hydraulic dredges. Web based tool. Dredging Operation and Environmental Research (DOER) Program. U.S. Army Engineer Research and Development Center, Vicksburg, MS. Available at: <http://el.erdc.usace.army.mil/dots/doer/flowfields/dtb350.html>
- Cliffton, K., D.O. Cornejo, and R.S. Felger. 1982. Sea turtles of the Pacific coast of Mexico. Pages 199-209 in K.A. Bjorndal, ed. *Biology and Conservation of Sea Turtles.* Washington, D.C.: Smithsonian Institution Press.
- Colligan, M., Collins, M., Hecht, A., Hendrix, M., Kahnle, A., Laney, W., St. Pierre, R., Santos, R., and Squiers, T. 1998. Status Review of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). U.S. Department of the Interior and U.S. Department of Commerce.
- Collins, M. R., and T. I. J. Smith. 1997. Distribution of shortnose and Atlantic sturgeons in South Carolina. *North American Journal of Fisheries Management* 17: 995-1000.

- Collins, M. R., S. G. Rogers, and T. I. J. Smith. 1996. Bycatch of sturgeons along the Southern Atlantic Coast of the USA. *North American Journal of Fisheries Management* 16: 24-29.
- Collins, M.R., T.I.J. Smith, W.C. Post, and O. Pashuk. 2000. Habitat Utilization and Biological Characteristics of Adult Atlantic Sturgeon in Two South Carolina Rivers. *Transactions of the American Fisheries Society* 129: 982–988.
- Conant, T.A., P.H. Dutton, T. Eguchi, S.P. Epperly, C.C. Fahy, M.H. Godfrey, S.L. MacPherson, E.E. Possardt, B.A. Schroeder, J.A. Seminoff, M.L. Snover, C.M. Upite, and B.E. Witherington. 2009. Loggerhead sea turtle (*Caretta caretta*) 2009 status review under the U.S. Endangered Species Act. Report of the Loggerhead Biological Review Team to the National Marine Fisheries Service, August 2009. 222 pp.
- Coutant, C.C., 1987. Thermal preference: when does an asset become a liability? *Environmental Biology of Fishes* 18:161-172.
- Coyne, M. and A.M. Landry, Jr. 2007. Population sex ratios and its impact on population models. In: Plotkin, P.T. (editor). *Biology and Conservation of Ridley Sea Turtles*. Johns Hopkins University Press, Baltimore, Maryland. p. 191-211.
- Coyne, M.S. 2000. Population Sex Ratio of the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*): Problems in Population Modeling. PhD Thesis, Texas A&M University. 136pp.
- Crance, J. H. 1987. Habitat suitability index curves for anadromous fishes. In: *Common Strategies of Anadromous and Catadromous Fishes*, M. J. Dadswell (ed.). Bethesda, Maryland, American Fisheries Society. Symposium 1: 554.
- Dadswell, M. 2006. A review of the status of Atlantic sturgeon in Canada, with comparisons to populations in the United States and Europe. *Fisheries* 31: 218-229.
- Damon-Randall, K. et al. 2010. Atlantic sturgeon research techniques. NOAA Technical Memorandum NMFS-NE-215. Available at: [http://www.nero.noaa.gov/prot\\_res/atlsturgeon/tm215.pdf](http://www.nero.noaa.gov/prot_res/atlsturgeon/tm215.pdf)
- Damon-Randall, K., M. Colligan, and J. Crocker. 2012. Composition of Atlantic Sturgeon in Rivers, Estuaries, and in Marine Waters. National Marine Fisheries Service, NERO, Unpublished Report. 32 pages.
- Daniels, R.C., T.W. White, and K.K. Chapman. 1993. Sea-level rise: destruction of threatened and endangered species habitat in South Carolina. *Environmental Management* 17(3):373-385.
- Davenport, J. 1997. Temperature and the life-history strategies of sea turtles. *Journal of Thermal Biology* 22(6):479-488.
- Davenport, J., and G.H. Balazs. 1991. 'Fiery bodies' – Are pyrosomas an important component of the diet of leatherback turtles? *British Herpetological Society Bulletin* 37: 33-38.
- Dees, L. T. 1961. Sturgeons. United States Department of the Interior Fish and Wildlife Service, Bureau of Commercial Fisheries, Washington, D.C.

- DFO (Fisheries and Oceans Canada). 2011. Atlantic sturgeon and shortnose sturgeon. Fisheries and Oceans Canada, Maritimes Region. Summary Report. U.S. Sturgeon Workshop, Alexandria, VA, 8-10 February, 2011. 11pp.
- Diaz, R.J. 1994. Response of tidal freshwater macrobenthos to sediment disturbance. *Hydrobiologia* 278: 201-212.
- Dodd, C.K. 1988. Synopsis of the biological data on the loggerhead sea turtle *Caretta caretta* (Linnaeus 1758). U.S. Fish and Wildlife Service Biological Report 88(14):1-110.
- Dodd, M. 2003. Northern Recovery Unit - Nesting Female Abundance and Population Trends. Presentation to the Atlantic Loggerhead Sea Turtle Recovery Team, April 2003.
- Doughty, R.W. 1984. Sea turtles in Texas: A forgotten commerce. *Southwestern Historical Quarterly*. pp. 43-70.
- Dovel, W. L. and T. J. Berggren. 1983. Atlantic sturgeon of the Hudson River Estuary, New York. *New York Fish and Game Journal* 30: 140-172.
- Dovel, W.J. 1978. The Biology and management of shortnose and Atlantic sturgeons of the Hudson River. Performance report for the period April 1, to September 30, 1978. Submitted to N.Y. State Department of Environmental Conservation.
- Dovel, W.J. 1979. Biology and management of shortnose and Atlantic sturgeon of the Hudson River. New York State Department of Environmental Conservation, AFS9-R, Albany.
- Duarte, C.M. 2002. The future of seagrass meadows. *Environmental Conservation* 29:192-206.
- Dunton, K.J., A. Jordaan, K.A. McKown, D.O. Conover, and M.J. Frisk. 2010. Abundance and distribution of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) within the Northwest Atlantic Ocean, determined from five fishery-independent surveys. *Fishery Bulletin* 108:450-465.
- Durbin, E, G. Teegarden, R. Campbell, A. Cembella, M.F. Baumgartner, B.R. Mate. 2002. North Atlantic right whales, *Eubalaena glacialis*, exposed to Paralytic Shellfish Poisoning (PSP) toxins via a zooplankton vector, *Calanus finmarchicus*. *Harmful Algae* 1: 243-251.
- Dutton, P.H., B.W. Bowen, D.W. Owens, A. Barragan, and S.K. Davis. 1999. Global phylogeography of the leatherback turtle (*Dermochelys coriacea*). *Journal of Zoology* 248: 397-409.
- Dutton, P.H., C. Hitipeuw, M. Zein, S.R. Benson, G. Petro, J. Pita, V. Rei, L. Ambio, and J. Bakarbesy. 2007. Status and genetic structure of nesting populations of leatherback turtles (*Dermochelys coriacea*) in the Western Pacific. *Chelonian Conservation and Biology* 6(1):47-53.
- Dwyer, F. James, Douglas K. Hardesty, Christopher G. Ingersoll, James L. Kunz, and David W. Whites. 2000. Assessing contaminant sensitivity of American shad, Atlantic sturgeon, and

- shortnose sturgeon. Final Report. U.S. Geological Survey. Columbia Environmental Research Center, 4200 New Have Road, Columbia, Missouri.
- Dwyer, K.L., C.E. Ryder, and R. Prescott. 2002. Anthropogenic mortality of leatherback sea turtles in Massachusetts waters. Poster presentation for the 2002 Northeast Stranding Network Symposium.
- Eckert, S.A. 1999. Global distribution of juvenile leatherback turtles. Hubbs Sea World Research Institute Technical Report 99-294.
- Eckert, S.A. and J. Lien. 1999. Recommendations for eliminating incidental capture and mortality of leatherback sea turtles, *Dermochelys coriacea*, by commercial fisheries in Trinidad and Tobago. A report to the Wider Caribbean Sea Turtle Conservation Network (WIDECAST). Hubbs-Sea World Research Institute Technical Report No. 2000-310, 7 pp.
- Eckert, S.A., D. Bagley, S. Kubis, L. Ehrhart, C. Johnson, K. Stewart, and D. DeFreese. 2006. Internesting and postnesting movements of foraging habitats of leatherback sea turtles (*Dermochelys coriacea*) nesting in Florida. *Chel. Cons. Biol.* 5(2): 239-248.
- Ehrhart, L.M., D.A. Bagley, and W.E. Redfoot. 2003. Loggerhead turtles in the Atlantic Ocean: geographic distribution, abundance, and population status. Pages 157-174 in A.B. Bolten and B.E. Witherington, eds. *Loggerhead Sea Turtles*. Washington, D.C.: Smithsonian Institution Press.
- Ehrhart, L.M., W.E. Redfoot, and D.A. Bagley. 2007. Marine turtles of the central region of the Indian River Lagoon System, Florida. *Florida Scientist* 70(4): 415-434.
- Encyclopedia Britannica. 2010. Neritic Zone. Accessed 12 January 2010. <http://www.britannica.com/eb/article-9055318>.
- Environmental Protection Agency (EPA). 1986. Quality Criteria for Water. EPA 440/5-86-001.
- Epperly, S., L. Avens, L. Garrison, T. Henwood, W. Hoggard, J. Mitchell, J. Nance, J. Poffenberger, C. Sasso, E. Scott-Denton, and C. Yeung. 2002. Analysis of sea turtle bycatch in the commercial shrimp fisheries of southeast U.S. waters and the Gulf of Mexico. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-SEFSC-490, 88pp.
- Epperly, S.P. 2003. Fisheries-related mortality and turtle excluder devices. In: P.L. Lutz, J.A.
- Epperly, S.P. and J. Braun-McNeill. 2002. The use of AVHRR imagery and the management of sea turtle interactions in the Mid-Atlantic Bight. National Marine Fisheries Service, Southeast Fisheries Science Center, Miami, FL. 8pp.
- Epperly, S.P., and W.G. Teas. 2002. Turtle Excluder Devices - Are the escape openings large enough? *Fishery Bulletin* 100:466-474.
- Epperly, S.P., J. Braun, A.J. Chester, F.A. Cross, J.V. Merriner and P.A. Tester. 1995b. Winter distribution of sea turtles in the vicinity of Cape Hatteras and their interactions with the summer flounder trawl fishery. *Bull. of Marine Sci.* 56(2): 547-568.

- Epperly, S.P., J. Braun, and A. Veishlow. 1995c. Sea turtles in North Carolina waters. *Conservation Biology* 9(2):384-394.
- Epperly, S.P., J. Braun, and A.J. Chester. 1995a. Aerial surveys for sea turtles in North Carolina inshore waters. *Fishery Bulletin* 93:254-261.
- Epperly, S.P., J. Braun-McNeill, and P.M. Richards. 2007. Trends in catch rates of sea turtles in North Carolina, USA. *Endangered Species Research* 3: 283-293.
- ERC (Environmental Research and Consulting, Inc.) 2012. Acoustic telemetry study of the movements of juvenile sturgeons in reach B of the Delaware River during dredging operations. Prepared for the US Army Corps of Engineers. 38 pp.
- ERC, Inc. (Environmental Research and Consulting, Inc.). 2002. Contaminant analysis of tissues from two shortnose sturgeon (*Acipenser brevirostrum*) collected in the Delaware River. Prepared for National Marine Fisheries Service. 16 pp. + appendices.
- ERC, Inc. (Environmental Research and Consulting, Inc.). 2007. Preliminary acoustic tracking study of juvenile shortnose sturgeon and Atlantic sturgeon in the Delaware River. May 2006 through March 2007. Prepared for NOAA Fisheries. 9 pp.
- Erickson, D. L., A. Kahnle, M. J. Millard, E. A. Mora, M. Bryja, A. Higgs, J. Mohler, M. DuFour, G. Kenney, J. Sweka, and E. K. Pikitch. 2011. Use of pop-up satellite archival tags to identify oceanic-migratory patterns for adult Atlantic Sturgeon, *Acipenser oxyrinchus oxyrinchus* Mitchell, 1815. *J. Appl. Ichthyol.* 27: 356–365.
- Ernst, C.H. and R.W. Barbour. 1972. *Turtles of the United States*. Univ. Press of Kentucky, Lexington. 347 pp.
- Eyler, S., M. Mangold, and S. Minkinen. 2004. Atlantic coast sturgeon tagging database. USFWS, Maryland Fishery Resources Office. Summary Report. 60 pp.
- Eyler, Sheila M., Jorgen E. Skjveland, Michael F. Mangold, and Stuart A. Welsh. 2000. Distribution of Sturgeons in Candidate Open Water Dredged Material Placement Sites in the Potomac River (1998-2000). U.S. Fish and Wildlife Service, Annapolis, MD. 26 pp.
- Fernandes, S.J. 2008. Population demography, distribution, and movement patterns of Atlantic and shortnose sturgeons in the Penobscot River estuary, Maine. University of Maine. Masters thesis. 88 pp.
- Ferreira, M.B., M. Garcia, and A. Al-Kiyumi. 2003. Human and natural threats to the green turtles, *Chelonia mydas*, at Ra's al Hadd turtle reserve, Arabian Sea, Sultanate of Oman. Page 142 in J.A. Seminoff, compiler. *Proceedings of the Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation*. NOAA Technical Memorandum NMFS-SEFSC-503.
- Finkbeiner, E.M., B.P. Wallace, J.E. Moore, R.L. Lewison, L.B. Crowder, and A.J. Read. 2011. Cumulative estimates of sea turtle bycatch and mortality in USA fisheries between 1990 and 2007. *Biological Conservation* 144(11): 2719-2727.

- Fish, M.R., I.M. Cote, J.A. Gill, A.P. Jones, S. Renshoff, and A.R. Watkinson. 2005. Predicting the impact of sea-level rise on Caribbean sea turtle nesting habitat. *Conservation Biology* 19:482-491.
- Flournoy, P.H., S.G. Rogers, and P.S. Crawford. 1992. Restoration of shortnose sturgeon in the Altamaha River, Georgia. Final Report to the U.S. Fish and Wildlife Service, Atlanta, Georgia.
- Fox, D.A. and M.W. Breece. 2010. Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) in the New York Bight DPS: Identification of critical habitat and rates of interbasin exchange; Final Report Submitted to NOAA (Award NA08NMF4050611). 62 p.
- FPL (Florida Power and Light Company) and Quantum Resources. 2005. Florida Power and Light Company, St. Lucie Plant Annual Environmental Operating Report, 2002. 57 pp.
- Frazer, N.B., and L.M. Ehrhart. 1985. Preliminary growth models for green, *Chelonia mydas*, and loggerhead, *Caretta caretta*, turtles in the wild. *Copeia* 1985: 73-79.
- Fritts, T.H. 1982. Plastic bags in the intestinal tracts of leatherback marine turtles. *Herpetological Review* 13(3): 72-73. 2003. 9pp.
- Gagosian, R.B. 2003. Abrupt climate change: should we be worried? Prepared for a panel on abrupt climate change at the World Economic Forum, Davos, Switzerland, January 27,
- Garner, J.A, and S.A. Garner. 2007. Tagging and nesting research of leatherback sea turtles (*Dermochelys coriacea*) on Sandy Point St. Croix, U.S. Virgin Islands. Annual Report to U.S. Fish and Wildlife Service. WIMARCS Publication.
- Garrison, L.P., and L. Stokes. 2012. Estimated bycatch of marine mammals and sea turtles in the U.S. Atlantic pelagic longline fleet during 2010. NOAA Technical Memorandum NMFS-SEFSC-624:1-53.
- GCRP (U.S. Global Change Research Program). 2009. Global Climate Change Impacts in the United States. <http://www.globalchange.gov/usimpacts>
- Geoghegan, P., M.T. Mattson and R.G Keppel. 1992. Distribution of shortnose sturgeon in the Hudson River, 1984-1988. IN *Estuarine Research in the 1980s*, C. Lavett Smith, Editor. Hudson River Environmental Society, Seventh symposium on Hudson River ecology. State University of New York Press, Albany NY, USA.
- George, R.H. 1997. Health Problems and Diseases of Sea Turtles. Pages 363-386 in P.L. Lutz and J.A. Musick, eds. *The Biology of Sea Turtles*. Boca Raton, Florida: CRC Press.
- Germano, J. D., and Cary, D. 2005. "Rates and effects of sedimentation in the context of dredging and dredged material placement," *DOER Technical Notes Collection* (ERDC TN-DOER-E19), U.S. Army Engineer Research and Development Center, Vicksburg, MS.
- GHD. 2005. Port of Hay Point Apron Areas and Departure Path Capital Dredging: Draft EIS. GHD Pty Ltd.

- Giesy, J.P., J. Newsted, and D.L. Garling. 1986. Relationships between chlorinated hydrocarbon concentrations and rearing mortality of chinook salmon (*Oncorhynchus tshawytscha*) eggs from Lake Michigan. *Journal of Great Lakes Research* 12(1):82-98.
- Gilbert, C.R. 1989. Atlantic and shortnose sturgeons. United States Department of Interior Biological Report 82, 28 pages.
- Girondot, M. and J. Fretey. 1996. Leatherback turtles, *Dermochelys coriacea*, nesting in French Guiana 1978-1995. *Chelonian Conserv Biol* 2: 204–208.
- Girondot, M., M.H. Godfrey, L. Ponge, and P. Rivalan. 2007. Modeling approaches to quantify leatherback nesting trends in French Guiana and Suriname. *Chelonian Conservation and Biology* 6(1): 37-46.
- Glen, F. and N. Mrosovsky. 2004. Antigua revisited: the impact of climate change on sand and nest temperatures at a hawksbill turtle (*Eretmochelys imbricata*) nesting beach. *Global Change Biology* 10:2036-2045.
- Glen, F., A.C. Broderick, B.J. Godley, and G.C. Hays. 2003. Incubation environment affects phenotype of naturally incubated green turtle hatchlings. *Journal of the Marine Biological Association of the United Kingdom* 83(5): 1183-1186.
- GMFMC (Gulf of Mexico Fishery Management Council). 2007. Amendment 27 to the Reef Fish FMP and Amendment 14 to the Shrimp FMP to end overfishing and rebuild the red snapper stock. Tampa, Florida: Gulf of Mexico Fishery Management Council. 490 pp. with appendices.
- Goff, G.P. and J.Lien. 1988. Atlantic leatherback turtle, *Dermochelys coriacea*, in cold water off Newfoundland and Labrador. *Can. Field Nat.* 102(1):1-5.
- Goldenberg, S.B., C.W. Landsea, A.M. Mestas-Nunez, W.M. Gray. 2001. The recent increase in Atlantic hurricane activity: causes and implications. *Science* 293:474–479
- Gottfried, P.K., and J.A. Osborne. 1982. Distribution, abundance and size of *Corbicula manilensis* (Philippi) in a spring-fed central Florida stream. *Florida Scientist* 45(3):178-188.
- Graff, D. 1995. Nesting and hunting survey of the turtles of the island of São Tomé. Progress Report July 1995, ECOFAC Componente de São Tomé e Príncipe, 33 pp.
- Greene CH, Pershing AJ, Cronin TM and Ceci N. 2008. Arctic climate change and its impacts on the ecology of the North Atlantic. *Ecology* 89:S24-S38.
- Greene, K. 2002. Beach Nourishment: A Review of the Biological and Physical Impacts. Atlantic States Marine Fisheries Commission (ASMFC) Habitat Management Series #7. 179 pp.
- Greene, R.J. Jr. 1987. Characteristics of oil industry dredge and drilling sounds in the Beaufort Sea. *Journal of Acoustical Society of America* 82: 1315-1324.
- Grunwald, C., J. Stabile, J.R. Waldman, R. Gross, and I. Wirgin. 2002. Population genetics of shortnose sturgeon (*Acipenser brevirostrum*) based on mitochondrial DNA control region sequences. *Molecular Ecology* 11: 000-000.

- Guerra-Garcia, J.M. and J. C. Garcia-Gomez. 2006. Recolonization of defaunated sediments: Fine versus gross sand and dredging versus experimental trays. *Estuarine Coastal and Shelf Science* 68 (1-2): 328-342
- Guilbard, F., J. Munro, P. Dumont, D. Hatin, and R. Fortin. 2007. Feeding ecology of Atlantic sturgeon and Lake sturgeon co-occurring in the St. Lawrence Estuarine Transition Zone. *American Fisheries Society Symposium*. 56: 85-104.
- Haley, N. 1996. Juvenile sturgeon use in the Hudson River Estuary. Master's thesis. University of Massachusetts, Amherst, MA, USA.
- Hamann, M., C.J. Limpus, and M.A. Read. 2007. Chapter 15 Vulnerability of marine reptiles in the Great Barrier Reef to climate change. In: Johnson JE, Marshall PA (eds) *Climate change and the Great Barrier Reef: a vulnerability assessment*, Great Barrier Reef Marine Park Authority and Australia Greenhouse Office, Hobart, p 465–496.
- Hansen, P.D. 1985. Chlorinated hydrocarbons and hatching success in Baltic herring spring spawners. *Marine Environmental Research* 15:59-76.
- Hatase, H., M. Kinoshita, T. Bando, N. Kamezaki, K. Sato, Y. Matsuzawa, K. Goto, K. Omuta, Y. Nakashima, H. Takeshita, and W. Sakamoto. 2002. Population structure of loggerhead turtles, *Caretta caretta*, nesting in Japan: Bottlenecks on the Pacific population. *Marine Biology* 141:299-305.
- Hatin, D., R. Fortin, and F. Caron. 2002. Movements and aggregation areas of adult Atlantic sturgeon (*Acipenser oxyrinchus*) in the St. Lawrence River estuary, Québec, Canada. *Journal of Applied Ichthyology* 18: 586-594.
- Hatin, D., Lachance, S., D. Fournier. 2007a. Effect of Dredged Sediment Deposition on use by Atlantic Sturgeon and Lake Sturgeon at an Open-water Disposal Site in the St. Lawrence Estuarine Transition Zone. *American Fisheries Society Symposium* 56:235-255.
- Hatin, D., J. Munro, F. Caron, and R. D. Simons. 2007. Movements, home range size, and habitat use and selection of early juvenile Atlantic sturgeon in the St. Lawrence estuarine transition zone. Pp. 129-155 in J. Munro, D. Hatin, J.E. Hightower, K. McKown, K.L. Sulak, A.W. Kahnle, and F. Caron (eds.) *Anadromous sturgeon: habitat, threats, and management*. *American Fisheries Society Symposium* 56, Bethesda, MD 215 pp.
- Hawkes, L. A. Broderick, M. Godfrey and B. Godley. 2005. Status of nesting loggerhead turtles, *Caretta caretta*, at Bald Head Island (North Carolina, USA) after 24 years of intensive monitoring and conservation. *Oryx*. 39(1): 65-72.
- Hawkes, L.A., A.C. Broderick, M.H. Godfrey, and B.J. Godley. 2007. Investigating the potential impacts of climate change on a marine turtle population. *Global Change Biology* 13: 1-10.
- Hawkes, L.A., A.C. Broderick, M.H. Godfrey, and B.J. Godley. 2009. Climate change and marine turtles. *Endangered Species Research* 7:137-154.

- Hawkes, L.A., A.C. Broderick, M.S. Coyne, M.H. Godfrey, L.-F. Lopez-Jurado, P. Lopez-Suarez, S.E. Merino, N. Varo-Cruz, and B.J. Godley. 2006. Phenotypically linked dichotomy in sea turtle foraging requires multiple conservation approaches. *Current Biology* 16: 990-995.
- Hays, G.C., A.C. Broderick, F. Glen, B.J. Godley, J.D.R. Houghton, and J.D. Metcalfe. 2002. Water temperature and interesting intervals for loggerhead (*Caretta caretta*) and green (*Chelonia mydas*) sea turtles. *Journal of Thermal Biology* 27: 429-432.
- Heppell, S.S., D.T. Crouse, L.B. Crowder, S.P. Epperly, W. Gabriel, T. Henwood, R. Marquez, and N.B. Thompson. 2005. A population model to estimate recovery time, population size, and management impacts on Kemp's ridley sea turtles. *Chelonian Conservation and Biology* 4(4):767-773.
- Hildebrand, H. 1982. A historical review of the status of sea turtle populations in the western Gulf of Mexico, P. 447-453. In K.A. Bjorndal (ed.), *Biology and conservation of sea turtles*. Smithsonian Institution Press, Washington, D.C.
- Hilterman, M.L. and E. Goverse. 2004. Annual report of the 2003 leatherback turtle research and monitoring project in Suriname. World Wildlife Fund - Guianas Forests and Environmental Conservation Project (WWF-GFECF) Technical Report of the Netherlands Committee for IUCN (NC-IUCN), Amsterdam, the Netherlands, 21p.
- Hirth, H.F. 1971. Synopsis of biological data on the green sea turtle, *Chelonia mydas*. FAO Fisheries Synopsis No. 85: 1-77.
- Hirth, H.F. 1997. Synopsis of the biological data of the green turtle, *Chelonia mydas* (Linnaeus 1758). USFWS Biological Report 97(1): 1-120.
- Holland, B.F., Jr. and G.F. Yelverton. 1973. Distribution and biological studies of anadromous fishes offshore North Carolina. North Carolina Department of Natural and Economic Resources, Division of Commercial and Sports Fisheries, Morehead City. Special Scientific Report 24:1-132.
- Hoover, J.J., Boysen, K.A., Beard, J.A., and H. Smith. 2011. Assessing the risk of entrainment by cutterhead dredges to juvenile lake sturgeon (*Acipenser fulvescens*) and juvenile pallid sturgeon (*Scaphirhynchus albus*). *Journal of Applied Ichthyology* 27:369-375.
- Hoover, J.J., Killgore, K.J., Clarke, D.G., Smith, H., Turnage, A., and Beard, J. 2005. Paddlefish and sturgeon entrainment by dredges: Swimming performance as an indicator of risk. DOER Technical Notes Collection (ERDC-TN-DOER-E22), U.S. Army Engineer Research and Development Center, Vicksburg, MS.
- Hulin, V., and J.M. Guillon. 2007. Female philopatry in a heterogenous environment: ordinary conditions leading to extraordinary ESS sex ratios. *BMC Evolutionary Biology* 7:13
- Hulme, P.E. 2005. Adapting to climate change: is there scope for ecological management in the face of global threat? *Journal of Applied Ecology* 43: 617-627. IPCC (Intergovernmental Panel on Climate Change) 2007. Fourth Assessment Report. Valencia, Spain.

Innis, C., C. Merigo, K. Dodge, M. Tlusty, M. Dodge, B. Sharp, A. Myers, A. McIntosh, D. Wunn, C. Perkins, T.H. Herdt, T. Norton, and M. Lutcavage. 2010. Health Evaluation of Leatherback Turtles (*Dermochelys coriacea*) in the Northwestern Atlantic During Direct Capture and Fisheries Gear Disentanglement. *Chelonian Conservation and Biology*, 9(2):205-222.

Intergovernmental Panel on Climate Change (IPCC). 2007a. Climate Change 2007 – Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the IPCC. IPCC, Geneva.

Intergovernmental Panel on Climate Change (IPCC). 2007b. Climate Change 2007 - The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC. IPCC, Geneva.

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

James, M.C., C.A. Ottensmeyer, and R.A. Myers. 2005b. Identification of high-use habitat and threats to leatherback sea turtles in northern waters: new directions for conservation. *Ecol. Lett.* 8: 195-201.

James, M.C., R.A. Myers, and C.A. Ottenmeyer. 2005a. Behaviour of leatherback sea turtles, *Dermochelys coriacea*, during the migratory cycle. *Proc. R. Soc. B*, 272: 1547-1555.

Jenkins, W.E., T.I.J. Smith, L.D. Heyward, and D.M. Knott. 1993. Tolerance of shortnose sturgeon, *Acipenser brevirostrum*, juveniles to different salinity and dissolved oxygen concentrations. *Proceedings of the Southeast Association of Fish and Wildlife Agencies*, Atlanta, Georgia.

Johnson, and P.J. Eliazar (Compilers) *Proceedings of the Fourteenth Annual Symposium on Sea Turtle Biology and Conservation*. NOAA Technical Memorandum NMFS-SEFSC-351, 323 pp.

Johnson, J. H., D. S. Dropkin, B. E. Warkentine, J. W. Rachlin, and W. D. Andrews. 1997. Food habits of Atlantic sturgeon off the central New Jersey coast. *Transactions of the American Fisheries Society* 126: 166-170.

Johnson, M. P. & P.L. Tyack. 2003. A digital acoustic recording tag for measuring the response of wild marine mammals to sound. *IEEE J. Oceanic Engng* 28: 3–12.

Johnston Jr., S.A. 1981. Estuarine Dredge and Fill Activities: A Review of Impacts. *Environmental Management* 5(5): 427-440.

Jones A.R., W. Gladstone, N.J. Hacking. 2007. Australian sandy beach ecosystems and climate change: ecology and management. *Aust Zool* 34:190–202

Kahnle, A.W., K.A. Hattala, K.A. McKown. 2007. Status of Atlantic sturgeon of the Hudson River Estuary, New York, USA. *American Fisheries Society Symposium*. 56:347-363.

- Kasperek, M., B.J. Godley, and A.C. Broderick. 2001. Nesting of the green turtle, *Chelonia mydas*, in the Mediterranean: a review of status and conservation needs. *Zoology in the Middle East* 24: 45-74.
- Keevin, Thomas M. and Hempen, G. L. 1997. The Environmental Effects of Underwater Explosions with Methods to Mitigate Impacts. U. S. Army Corps of Engineers, St. Louis District.
- Kreeger, D., J. Adkins, P. Cole, R. Najjar, D. Velinsky, P. Conolly, and J. Kraeuter. May 2010. Climate Change and the Delaware Estuary: Three Case Studies in Vulnerability Assessment and Adaptation Planning. Partnership for the Delaware Estuary, PDE Report No. 10-01. 1–117 pp.
- Kelle, L., N. Gratiot, I. Nolibos, J. Therese, R. Wongsopawiro, and B. DeThoisy. 2007. Monitoring of nesting leatherback turtles (*Dermochelys coriacea*): contribution of remote-sensing for real time assessment of beach coverage in French Guiana. *Chelonian Conserv Biol* 6: 142–149.
- Ketten, D.R. and S.M. Bartol. (2005). Functional Measures of Sea Turtle Hearing. ONR Award No: N00014-02-1-0510.
- Kieffer and Kynard in review [book to be published by AFS]. Kieffer, M. C., and B. Kynard. In review. Pre-spawning and non-spawning spring migrations, spawning, and effects of hydroelectric dam operation and river regulation on spawning of Connecticut River shortnose sturgeon.
- Kieffer, M.C. and B. Kynard. 1993. Annual movements of shortnose and Atlantic sturgeons in the Merrimack River, Massachusetts. *Transactions of the American Fisheries Society* 122: 1088-1103.
- Kocan, R.M., M.B. Matta, and S. Salazar. 1993. A laboratory evaluation of Connecticut River coal tar toxicity to shortnose sturgeon (*Acipenser brevirostrum*) embryos and larvae. Final Report to the National Oceanic and Atmospheric Administration, Seattle, Washington.
- Kuller, Z. 1999. Current status and conservation of marine turtles on the Mediterranean coast of Israel. *Marine Turtle Newsletter* 86: 3-5.
- Kynard, B. and M. Horgan. 2002. Ontogenetic behavior and migration of Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus*, and shortnose sturgeon, *A. brevirostrum*, with notes on social behavior. *Environmental Behavior of Fishes* 63: 137-150.
- LaCasella, E.L., P.H. Dutton, and S.P. Epperly. 2005. Genetic stock composition of loggerheads (*Caretta caretta*) encountered in the Atlantic northeast distant (NED) longline fishery using additional mtDNA analysis. Pages 302-303 in Frick M., A. Panagopoulou, A.F. Rees, and K. Williams (compilers). *Book of Abstracts of the Twenty-sixth Annual Symposium on Sea Turtle Biology and Conservation*. International Sea Turtle Society, Athens, Greece.
- Lageux, C.J., C. Campbell, L.H. Herbst, A.R. Knowlton and B. Weigle. 1998. Demography of marine turtles harvested by Miskitu Indians of Atlantic Nicaragua. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SEFSC-412: 90.

- Lalli, C.M. and T.R. Parsons. 1997. *Biological oceanography: An introduction – 2nd Edition*. Pages 1-13. Butterworth-Heinemann Publications. 335 pp.
- Laney, R.W., J.E. Hightower, B.R. Versak, M.F. Mangold, W.W. Cole Jr., and S.E. Winslow. 2007. Distribution, habitat use, and size of Atlantic sturgeon captured during cooperative winter tagging cruises, 1988–2006. Pages 167-182. In: J. Munro, D. Hatin, J. E. Hightower, K. McKown, K. J. Sulak, A. W. Kahnle, and F. Caron, (editors), *Anadromous sturgeons: habits, threats, and management*. Am. Fish. Soc. Symp. 56, Bethesda, MD.
- Larson, K. and Moehl, C. 1990. “Fish entrainment by dredges in Grays Harbor, Washington”. Effects of dredging on anadromous Pacific Coast fishes. C.A. Simenstad ed., Washington Sea Grant Program, University of Washington, Seattle. 102-12 pp.
- LaSalle, M.W. 1990. Physical and chemical alterations associated with dredging. C.A. Simenstad editor. Proceedings of the workshop on the effects of dredging on anadromous Pacific coast fishes. Washington Sea Grant Program, Seattle. 1-12 pp.
- Laurent, L., J. Lescure, L. Excoffier, B. Bowen, M. Domingo, M. Hadjichristophorou, L. Kornaraki, and G. Trabuchet. 1993. Genetic studies of relationships between Mediterranean and Atlantic populations of loggerhead turtle *Caretta caretta* with a mitochondrial marker. *Comptes Rendus de l'Academie des Sciences (Paris), Sciences de la Vie/Life Sciences* 316:1233-1239.
- Laurent, L., P. Casale, M.N. Bradai, B.J. Godley, G. Gerosa, A.C. Broderick, W. Schroth, B. Schierwater, A.M. Levy, D. Freggi, E.M. Abd El-Mawla, D.A. Hadoud, H.E. Gomati, M. Domingo, M. Hadjichristophorou, L. Kornaraki, F. Demirayak, and C. Gautier. 1998. Molecular resolution of the marine turtle stock composition in fishery bycatch: A case study in the Mediterranean. *Molecular Ecology* 7: 1529-1542.
- Leland, J. G., III. 1968. A survey of the sturgeon fishery of South Carolina. Bears Bluff Labs. No. 47, 27 pp.
- Lewis, R.L., L.B. Crowder, and D.J. Shaver. 2003. The impact of turtle excluder devices and fisheries closures on loggerhead and Kemp’s ridley strandings in the western Gulf of Mexico. *Conservation Biology* 17(4): 1089-1097.
- Lewis, R.L., S.A. Freeman, and L.B. Crowder. 2004. Quantifying the effects of fisheries on threatened species: the impact of pelagic longlines on loggerhead and leatherback sea turtles. *Ecology Letters*. 7: 221-231.
- Limpus, C.J. and D.J. Limpus. 2000. Mangroves in the diet of *Chelonia mydas* in Queensland, Australia. *Mar Turtle Newsl* 89: 13–15.
- Limpus, C.J. and D.J. Limpus. 2003. Loggerhead turtles in the equatorial Pacific and southern Pacific Ocean: A species in decline. In: Bolten, A.B., and B.E. Witherington (eds.), *Loggerhead Sea Turtles*. Smithsonian Institution.
- Longwell, A.C., S. Chang, A. Hebert, J. Hughes and D. Perry. 1992. Pollution and developmental abnormalities of Atlantic fishes. *Environmental Biology of Fishes* 35:1- 21.

- Lutcavage, M.E. and P. Plotkin, B. Witherington, and P.L. Lutz. 1997. Human impacts on sea turtle survival, p.387-409. In P.L. Lutz and J.A. Musick, (eds.), *The Biology of Sea Turtles*, CRC Press, Boca Raton, Florida. 432pp.
- Lutcavage, M.E. and P.L. Lutz. 1997. Diving Physiology. Pp. 277-296 in *The Biology of Sea Turtles*. P.L. Lutz and J.A. Musick (Eds). CRC Press.
- Mac, M.J., and C.C. Edsall. 1991. Environmental contaminants and the reproductive success of lake trout in the Great Lakes: An epidemiological approach. *Journal of Toxicology and Environmental Health* 33:375-394.
- MacLeod, C.D. 2009. Global climate change, range changes and potential implications for the conservation of marine cetaceans: a review and synthesis. *Endang Species Res* 7: 125-136.
- Magnuson, J.J., J.A. Bjorndal, W.D. DuPaul, G.L. Graham, D.W. Owens, C.H. Peterson, P.C.H. Prichard, J.I. Richardson, G.E. Saul, and C.W. West. 1990. *Decline of Sea Turtles: Causes and Prevention*. Committee on Sea Turtle Conservation, Board of Environmental Studies and Toxicology, Board on Biology, Commission of Life Sciences, National Research Council, National Academy Press, Washington, D.C. 259 pp.
- Maier, P. P., A. L. Segars, M. D. Arendt, J. D. Whitaker, B. W. Stender, L. Parker, R. Vendetti, D. W. Owens, J. Quattro, and S. R. Murphy. 2004. Development of an index of sea turtle abundance based on in-water sampling with trawl gear. Final report to the National Marine Fisheries Service. 86 pp.
- Mangin, E. 1964. Croissance en Longueur de Trois Esturgeons d'Amerique du Nord: *Acipenser oxyrinchus*, *Mitchill*, *Acipenser fulvescens*, *Rafinesque*, et *Acipenser brevirostris* LeSueur. *Verh. Int. Ver. Limnology* 15: 968-974.
- Mansfield, K. L. 2006. Sources of mortality, movements, and behavior of sea turtles in Virginia. Chapter 5. Sea turtle population estimates in Virginia. pp.193-240. Ph.D. dissertation. School of Marine Science, College of William and Mary.
- Mansfield, K.L., V.S. Saba, J.A. Keinath, and J.A. Musick. 2009. Satellite tracking reveals a dichotomy in migration strategies among juvenile loggerhead turtles in the Northwest Atlantic. *Marine Biology* 156:2555–2570.
- Marcano, L.A. and J.J. Alio-M. 2000. Incidental capture of sea turtles by the industrial shrimping fleet off northwestern Venezuela. U.S. department of Commerce, NOAA Technical Memorandum NMFS-SEFSC-436:107.
- Marcano, L.A. and J.J. Alio-M. 2000. Incidental capture of sea turtles by the industrial shrimping fleet off northwestern Venezuela. U.S. department of Commerce, NOAA Technical Memorandum NMFS-SEFSC-436:107.
- Margaritoulis, D., R. Argano, I. Baran, F. Bentivegna, M.N. Bradai, J.A. Camiñas, P. Casale, G. De Metrio, A. Demetropoulos, G. Gerosa, B.J. Godley, D.A. Haddoud, J. Houghton, L. Laurent, and B. Lazar. 2003. *Loggerhead turtles in the Mediterranean Sea: Present knowledge and*

- conservation perspectives. Pages 175-198. In: A.B. Bolten and B.E. Witherington (eds.) *Loggerhead Sea Turtles*. Smithsonian Books, Washington, D.C. 319 pp.
- Márquez, M.R., A. Villanueva O., and M. Sánchez P. 1982. The population of the Kemp's ridley sea turtle in the Gulf of Mexico – *Lepidochelys kempii*. In: K.A. Bjorndal (editor), *Biology and Conservation of Sea Turtles*. Washington, D.C. Smithsonian Institute Press. p. 159-164.
- Márquez, R. 1990. *FAO Species Catalogue, Vol. 11. Sea turtles of the world, an annotated and illustrated catalogue of sea turtle species known to date*. FAO Fisheries Synopsis, 125. 81pp.
- Martin, R.E. 1996. Storm impacts on loggerhead turtle reproductive success. *Mar Turtle Newsl* 73:10–12.
- Mayfield RB, Cech JJ Jr. 2004. Temperature effects on green sturgeon bioenergetics. *Trans Am Fish Soc* 133:961–970
- Mazaris A.D., G. Mastinos, J.D. Pantis. 2009. Evaluating the impacts of coastal squeeze on sea turtle nesting. *Ocean Coast Manag* 52:139–145.
- McCauley, J.E., Parr, R.A. and D. R. Hancock. 1977. Benthic Infauna and Maintenance Dredging: A Case Study. *Water Research* 11: 233-242.
- McClellan, C.M., and A.J. Read. 2007. Complexity and variation in loggerhead sea turtle life history. *Biology Letters* 3: 592-594.
- McCord, J.W., M.R. Collins, W.C. Post, and T.J. Smith. 2007. Attempts to develop an index of abundance for age-1 Atlantic sturgeon in South Carolina, USA. *Am. Fisheries Society Symposium* 56: 397-403.
- McEnroe, M., and J.J. Cech. 1987. Osmoregulation in white sturgeon: life history aspects. *American Fisheries Society Symposium* 1:191-196.
- McMahon, C.R., and G.C. Hays. 2006. Thermal niche, large-scale movements and implications of climate change for a critically endangered marine vertebrate. *Global Change Biology* 12:1330-1338.
- Meylan, A. 1982. Estimation of population size in sea turtles. In: K.A. Bjorndal (ed.) *Biology and Conservation of Sea Turtles*. Smithsonian Inst. Press, Wash. D.C. p 135-138.
- Meylan, A., B. Schroeder, and A. Mosier. 1995. Sea turtle nesting activity in the state of Florida. *Fla. Mar. Res. Publ.* 52: 1-51.
- Meylan, A., B.E. Witherington, B. Brost, R. Rivero, and P.S. Kubitlis. 2006. Sea turtle nesting in Florida, USA: Assessments of abundance and trends for regionally significant populations of *Caretta*, *Chelonia*, and *Dermochelys*. pp 306-307. In: M. Frick, A. Panagopoulou, A. Rees, and K. Williams (compilers). *26th Annual Symposium on Sea Turtle Biology and Conservation Book of Abstracts*.

- Mitchell, G.H., R.D. Kenney, A.M. Farak, and R.J. Campbell. 2003. Evaluation of occurrence of endangered and threatened marine species in naval ship trial areas and transit lanes in the Gulf of Maine and offshore of Georges Bank. NUWC-NPT Technical Memo 02-121A. March 2003. 113 pp.
- Mohler, J. W. 2003. Culture manual for the Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus*. U.S. Fish and Wildlife Service, Hadley, Massachusetts. 70 pp.
- Monzón-Argüello, C., A. Marco., C. Rico, C. Carreras, P. Calabuig, and L.F. López-Jurado. 2006. Transatlantic migration of juvenile loggerhead turtles (*Caretta caretta*): magnetic latitudinal influence. Page 106 in Frick M., A. Panagopoulou, A.F. Rees, and K. Williams (compilers). Book of Abstracts of the Twenty-sixth Annual Symposium on Sea Turtle Biology and Conservation. International Sea Turtle Society, Athens, Greece.
- Morgan, R.P., V.J. Rasin and L.A. Noe. 1973. Effects of Suspended Sediments on the Development of Eggs and Larvae of Striped Bass and White Perch. Natural resources Institute, Chesapeake Biological Laboratory, U of Maryland, Center for Environmental and Estuarine Studies. 20 pp.
- Morreale, S.J. and E.A. Standora. 1990. Occurrence, movement, and behavior of the Kemp's ridley and other sea turtles in New York waters. Annual report for the NYSDEC, Return A Gift To Wildlife Program, April 1989 - April 1990.
- Morreale, S.J. and E.A. Standora. 1998. Early life stage ecology of sea turtles in northeastern U.S. waters. U.S. Dep. Commer. NOAA Tech. Mem. NOAA Fisheries-SEFSC-413, 49 pp.
- Morreale, S.J., and E.A. Standora. 1993. Occurrence, movement, and behavior of the Kemp's ridley and other sea turtles in New York waters. Okeanos Ocean Research Foundation Final Report April 1988-March 1993. 70 pp.
- Morreale, S.J., C.F. Smith, K. Durham, R.A. DiGiovanni, Jr., and A.A. Aguirre. 2005. Assessing health, status, and trends in northeastern sea turtle populations. Interim report - Sept. 2002 - Nov. 2004. Gloucester, Massachusetts: National Marine Fisheries Service.
- Moser, M.L. and S.W. Ross. 1995. Habitat use and movements of shortnose and Atlantic sturgeons in the lower Cape Fear River, North Carolina. Transactions of the American Fisheries Society 124:225-234.
- Moser, Mary. 1999. Cape Fear River Blast Mitigation Tests: Results of Caged Fish Necropsies, Final Report to CZR, Inc. under Contract to US Army Corps of Engineers, Wilmington District.
- Mrosovsky, N. 1981. Plastic jellyfish. Marine Turtle Newsletter 17: 5-6.
- Mrosovsky, N., G.D. Ryan, M.C. James. 2009. Leatherback turtles: The menace of plastic. Marine Pollution Bulletin 58: 287-289.
- Munro, J. 2007. Anadromous sturgeons: Habitats, threats, and management - synthesis and summary. Am. Fisheries Society Symposium 56: 1-15.

- Murawski, S.A. and A.L. Pacheco. 1977. Biological and fisheries data on Atlantic sturgeon, *Acipenser oxyrinchus* (Mitchill). National Marine Fisheries Service Technical Series Report 10: 1-69.
- Murdoch, P. S., J. S. Baron, and T. L. Miller. 2000. Potential effects of climate change on surface-water quality in North America. *JAWRA Journal of the American Water Resources Association*, 36: 347–366.
- Murphy, T.M. and S.R. Hopkins. 1984. Aerial and ground surveys of marine turtle nesting beaches in the southeast region. United States Final Report to NMFS-SEFSC. 73pp.
- Murphy, T.M., S.R. Murphy, D.B. Griffin, and C. P. Hope. 2006. Recent occurrence, spatial distribution and temporal variability of leatherback turtles (*Dermochelys coriacea*) in nearshore waters of South Carolina, USA. *Chel. Cons. Biol.* 5(2): 216-224.
- Murray, K.T. 2004. Bycatch of sea turtles in the Mid-Atlantic sea scallop (*Placopecten magellanicus*) dredge fishery during 2003. NEFSC Reference Document 04-11; 25 pp.
- Murray, K.T. 2006. Estimated average annual bycatch of loggerhead sea turtles (*Caretta caretta*) in U.S. Mid-Atlantic bottom otter trawl gear, 1996-2004. NEFSC Reference Document 06-19; 26 pp.
- Murray, K.T. 2007. Estimated bycatch of loggerhead sea turtles (*Caretta caretta*) in U.S. Mid-Atlantic scallop trawl gear, 2004-2005, and in sea scallop dredge gear, 2005. NEFSC Reference Document 07-04; 30 pp.
- Murray, K.T. 2008. Estimated average annual bycatch of loggerhead sea turtles (*Caretta caretta*) in U.S. Mid-Atlantic bottom otter trawl gear, 1996-2004 (2nd edition). NEFSC Reference Document 08-20; 32 pp.
- Murray, K.T. 2009a. Characteristics and magnitude of sea turtle bycatch in US mid-Atlantic gillnet gear. *Endangered Species Research* 8:211-224.
- Murray, K.T. 2009b. Proration of estimated bycatch of loggerhead sea turtles in U.S. Mid-Atlantic sink gillnet gear to vessel trip report landed catch, 2002-2006. NEFSC Reference Document 09-19; 7 pp.
- Murray, K.T. 2011. Sea turtle bycatch in the U.S. sea scallop (*Placopecten magellanicus*) dredge fishery, 2001–2008. *Fish Res.* 107:137-146.
- Musick, and J. Wyneken (editors). *The Biology of Sea Turtles Vol. II*, CRC Press, Boca Raton, Florida. p. 339-353.
- Musick, J.A. and C.J. Limpus. 1997. Habitat utilization and migration in juvenile sea turtles. Pp. 137-164 In: Lutz, P.L., and J.A. Musick, eds., *The Biology of Sea Turtles*. CRC Press, New York. 432 pp.
- NAST (National Assessment Synthesis Team). 2000. *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change*, US Global Change Research Program, Washington DC, 2000.

NAST (National Assessment Synthesis Team). 2008. Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change, US Global Change Research Program, Washington DC, 2000

<http://www.usgcrp.gov/usgcrp/Library/nationalassessment/1IntroA.pdf>

National Research Council (NRC). 1990. Decline of the Sea Turtles: Causes and Prevention. Committee on Sea Turtle Conservation. Natl. Academy Press, Washington, D.C. 259 pp.

Nicholls, R.J. 1998. Coastal vulnerability assessment for sea level rise: evaluation and selection of methodologies for implementation. Technical Report R098002, Caribbean Planning for Adaption to Global Climate Change (CPACC) Project. Available at: [www.cpacc.org](http://www.cpacc.org).

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

NMFS (National Marine Fisheries Service) and USFWS (U.S. Fish and Wildlife Service). 1991. Recovery plan for U.S. population of Atlantic green turtle *Chelonia mydas*. Washington, D.C.: National Marine Fisheries Service. 58 pp.

NMFS (National Marine Fisheries Service) and USFWS (U.S. Fish and Wildlife Service). 1992. Recovery plan for leatherback turtles *Dermochelys coriacea* in the U.S. Caribbean, Atlantic, and Gulf of Mexico. Washington, D.C.: National Marine Fisheries Service. 65 pp.

NMFS (National Marine Fisheries Service) and USFWS (U.S. Fish and Wildlife Service). 1995. Status reviews for sea turtles listed under the Endangered Species Act of 1973. Silver Spring, Maryland: National Marine Fisheries Service. 139 pp.

NMFS (National Marine Fisheries Service) and USFWS (U.S. Fish and Wildlife Service). 1998a. Recovery Plan for U.S. Pacific Populations of the Leatherback Turtle (*Dermochelys coriacea*). Silver Spring, Maryland: National Marine Fisheries Service. 65 pp.

NMFS (National Marine Fisheries Service) and USFWS (U.S. Fish and Wildlife Service). 1998b. Recovery Plan for U.S. Pacific Populations of the Green Turtle (*Chelonia mydas*). Silver Spring, Maryland: National Marine Fisheries Service. 84 pp.

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

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

NMFS (National Marine Fisheries Service) and USFWS (U.S. Fish and Wildlife Service). 2007c. Kemp's ridley sea turtle (*Lepidochelys kempii*) 5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 50 pp.

NMFS (National Marine Fisheries Service) and USFWS (U.S. Fish and Wildlife Service). 2007d. Green sea turtle (*Chelonia mydas*) 5 year review: summary and evaluation. Silver Spring, Maryland: National Marine Fisheries Service. 102 pp.

NMFS (National Marine Fisheries Service) and USFWS (U.S. Fish and Wildlife Service). 2008. Recovery plan for the Northwest Atlantic population of the loggerhead turtle (*Caretta caretta*), Second revision. Washington, D.C.: National Marine Fisheries Service. 325 pp.

NMFS (National Marine Fisheries Service) NEFSC (Northeast Fisheries Science Center). 2011. Preliminary summer 2010 regional abundance estimate of loggerhead turtles (*Caretta caretta*) in northwestern Atlantic Ocean continental shelf waters. US Dept Commerce, Northeast Fisheries Science Center Reference Document 11-03; 33 pp.

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

NMFS (National Marine Fisheries Service). 2002. Endangered Species Act Section 7 Consultation on Shrimp Trawling in the Southeastern United States, under the Sea Turtle Conservation Regulations and as Managed by the Fishery Management Plans for Shrimp in the South Atlantic and Gulf of Mexico. Biological Opinion. December 2, 2002.

NMFS (National Marine Fisheries Service). 2004. Endangered Species Act Section 7 Consultation on the Proposed Regulatory Amendments to the Fisheries Management Plan for the Pelagic Fisheries of the Western Pacific. Biological Opinion. February 23, 2004.

NMFS (National Marine Fisheries Service). 2004. Endangered Species Act Section 7 Reinitiated Consultation on the Continued Authorization of the Atlantic Pelagic Longline Fishery under the Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks (HMS FMP). Biological Opinion. June 1, 2004.

NMFS (National Marine Fisheries Service). 2006. Endangered Species Act Section 7 Consultation on the Proposed Renewal of an Operating License for the Oyster Creek Nuclear Generating Station, Barnegat Bay, New Jersey. Biological Opinion. November 22, 2006.

NMFS (National Marine Fisheries Service). 2008b. Summary Report of the Workshop on Interactions Between Sea Turtles and Vertical Lines in Fixed-Gear Fisheries. M.L. Schwartz (ed.), Rhode Island Sea Grant, Narragansett, Rhode Island. 54 pp.

NMFS (National Marine Fisheries Service). 2011. Biennial Report to Congress on the Recovery Program for Threatened and Endangered Species, October 1, 2008 – September 30, 2010. Washington, D.C.: National Marine Fisheries Service. 194 pp.

NMFS (National Marine Fisheries Service). 2012. Reinitiation of Endangered Species Act (ESA) Section 7 Consultation on the Continued Implementation of the Sea Turtle Conservation Regulations, as Proposed to Be Amended, and the Continued Authorization of the Southeast U.S. Shrimp Fisheries in Federal Waters under the Magnuson-Stevens Act. Biological Opinion. May 8, 2012.

- NMFS and USFWS. 1992. Recovery plan for leatherback turtles in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C. 65 pp.
- NMFS and USFWS. 1995. Status reviews for sea turtles listed under the Endangered Species Act of 1973. National Marine Fisheries Service, Silver Spring, Maryland. 139 pp.
- NMFS and USFWS. 1998b. Recovery Plan for the U.S. Pacific Population of the Leatherback Turtle (*Dermochelys coriacea*). National Marine Fisheries Service, Silver Spring, Maryland.
- NMFS and USFWS. 2007b. Leatherback sea turtle (*Dermochelys coriacea*) 5 year review: summary and evaluation. National Marine Fisheries Service, Silver Spring, Maryland. 79 pp.
- NMFS SEFSC (Southeast Fisheries Science Center). 2009. An assessment of loggerhead sea turtles to estimate impacts of mortality reductions on population dynamics. NMFS SEFSC Contribution PRD-08/09-14. 45 pp.
- NMFS Southeast Fisheries Science Center. 2001. Stock assessments of loggerheads and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic. U.S. Department of Commerce, National Marine Fisheries Service, Miami, FL, SEFSC Contribution PRD-00/01-08; Parts I-III and Appendices I-IV. NOAA Tech. Memo NMFS-SEFSC-455, 343 pp.
- NMFS. 1998. Recovery plan for the shortnose sturgeon (*Acipenser brevirostrum*). Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland 104 pp.
- NRC (National Research Council). 1990. Decline of the Sea Turtles: Causes and Prevention. Washington, D.C.: National Academy Press. 259 pp.
- NYHS (New York Historical Society as cited by Dovel as Mitchell. S. 1811). 1809. Volume 1. Collections of the New-York Historical Society for the year 1809.
- NYSDEC (New York State Department of Environmental Conservation). 2003. "Final Environmental Impact Statement Concerning the Applications to Renew New York State Pollutant Discharge Elimination System (SPDES) Permits for the Roseton 1 and 2 Bowline 1 and 2 and IP2 and IP3 2 and 3 Steam Electric Generating Stations, Orange, Rockland and Westchester Counties" (Hudson River Power Plants FEIS). June 25, 2003.
- O'Herron, J.C. and R.W. Hastings. 1985. A Study of the Shortnose Sturgeon (*Acipenser brevirostrum*) population in the upper tidal Delaware River: Assessment of impacts of maintenance dredging (Post-dredging study of Duck Island and Perriwig ranges), Draft final report. Prepared for the U.S. Army Corps of Engineers, Philadelphia District by the Center for Coastal and Environmental Studies, Rutgers, the State University of New Jersey, New Brunswick, NJ.
- Palka, D. 2000. Abundance and distribution of sea turtles estimated from data collected during cetacean surveys. In: Bjorndal, K.A. and A.B. Bolten. Proceedings of a workshop on assessing abundance and trends for in-water sea turtle populations. U.S. Dep. Commer. NOAA Tech. Mem. NMFS-SEFSC-445, 83pp.

- Palmer M.A., C.A. Reidy, C. Nilsson, M. Florke, J. Alcamo, P.S. Lake, and N. Bond. 2008. Climate change and the world's river basins: anticipating management options. *Frontiers in Ecology and the Environment* 6:81-89.
- Parmesan, C., and G. Yohe. 2003. A globally coherent fingerprint of climate change impacts across natural systems. *Nature* 421:37-42.
- Pearce, A.F. 2001. Contrasting population structure of the loggerhead turtle (*Caretta caretta*) using mitochondrial and nuclear DNA markers. Master's thesis, University of Florida.
- Pearce, A.F. and B.W. Bowen. 2001. Final report: Identification of loggerhead (*Caretta caretta*) stock structure in the southeastern United States and adjacent regions using nuclear DNA markers. Project number T-99-SEC-04. Submitted to the National Marine Fisheries Service, May 7, 2001. 79 pp.
- Pike, D.A. and J.C. Stiner. 2007. Sea turtle species vary in their susceptibility to tropical cyclones. *Oecologia* 153: 471-478.
- Pike, D.A., R.L. Antworth, and J.C. Stiner. 2006. Earlier nesting contributes to shorter nesting seasons for the loggerhead sea turtle, *Caretta caretta*. *Journal of Herpetology* 40(1): 91-94.
- Pikitch, E.K., P. Doukakis, L. Lauck, P. Chakrabarty, and D.L. Erickson. 2005. Status, trends and management of sturgeon and paddlefish fisheries. *Fish and Fisheries* 6: 233-265.
- Pisces Conservation Ltd. 2008. The status of fish populations and ecology of the Hudson River. Prepared by R.M. Seaby and P.A. Henderson. <http://www.riverkeeper.org/wp-content/uploads/2009/06/Status-of-Fish-in-the-Hudson-Pisces.pdf>
- Plaziat, J.C., and P.G.E.F. Augustinius. 2004. Evolution of progradation/ erosion along the French Guiana mangrove coast: a comparison of mapped shorelines since the 18th century with Holocene data. *Mar Geol* 208: 127-143.
- Polis, D.F., S.L. Kupferman, and K. Szekiolda. 1973. Physical oceanography. Delaware Bay Report Series, Vol. 4. University of Delaware, Newark, DE.
- Pritchard, P.C.H. 1982. Nesting of the leatherback turtle, *Dermochelys coriacea*, in Pacific, Mexico, with a new estimate of the world population status. *Copeia* 1982: 741-747.
- Pritchard, P.C.H. 2002. Global status of sea turtles: An overview. Document INF-001 prepared for the Inter-American Convention for the Protection and Conservation of Sea Turtles, First Conference of the Parties (COP1IAC), First part August 6-8, 2002.
- Prusty, G., S. Dash, and M.P. Singh. 2007. Spatio-temporal analysis of multi-date IRS imageries for turtle habitat dynamics characterisation at Gahirmatha coast, India. *Int J Remote Sens* 28: 871-883
- Rahmstorf, S. 1997. Risk of sea-change in the Atlantic. *Nature* 388: 825-826.
- Rahmstorf, S. 1999. Shifting seas in the greenhouse? *Nature* 399: 523-524.

- Rankin-Baransky, K., C.J. Williams, A.L. Bass, B.W. Bowen, and J.R. Spotila. 2001. Origin of loggerhead turtles stranded in the northeastern United States as determined by mitochondrial DNA analysis. *Journal of Herpetology* 35(4):638-646.
- Rebel, T.P. 1974. Sea turtles and the turtle industry of the West Indies, Florida and the Gulf of Mexico. Univ. Miami Press, Coral Gables, Florida.
- Rees, A.F., A. Saad, and M. Jony. 2005. Marine turtle nesting survey, Syria 2004: discovery of a “major” green turtle nesting area. Page 38 in Book of Abstracts of the Second Mediterranean Conference on Marine Turtles. Antalya, Turkey, 4-7 May 2005.
- Reine, K., and Clarke, D. 1998. Entrainment by hydraulic dredges—A review of potential impacts. Technical Note DOER-E1. U.S. Army Engineer Research and Development Center, Vicksburg, MS.
- Revelles, M., C. Carreras, L. Cardona, A. Marco, F. Bentivegna, J.J. Castillo, G. de Martino, J.L. Mons, M.B. Smith, C. Rico, M. Pascual, and A. Aguilar. 2007. Evidence for an asymmetrical size exchange of loggerhead sea turtles between the Mediterranean and the Atlantic through the Straits of Gibraltar. *Journal of Experimental Marine Biology and Ecology* 349:261-271.
- Rhoads, D.C. and J.D. Germano. 1982. Characterization of Benthic Processes Using Sediment Profile Imaging: an Efficient Method of Remote Ecological Monitoring on the Seafloor (REMOTS System). *Marine Ecology Progress Series* 8:115-128
- Richardson A.J., A. Bakun, G.C. Hays, and M.J. Gibbons. 2009. The jellyfish joyride: causes, consequences and management responses to a more gelatinous future. *Trends in Ecology and Evolution* 24:312-322.
- Ridgway, S.H., E.G. Weaver, J.G. McCormick, J. Palin, and J.H. Anderson. 1969. Hearing in the Giant Sea Turtle, *Chelonia mydas*. *Proceedings of the National Academy of Sciences* 64(3): 884-890.
- Rivalan, P., P.H. Dutton, E. Baudry, S.E. Roden, and M. Girondot. 2005. Demographic scenario inferred from genetic data in leatherback turtles nesting in French Guiana and Suriname. *Biol Conserv* 1: 1–9.
- Robinson, M.M., H.J. Dowsett, and M.A. Chandler. 2008. Pliocene role in assessing future climate impacts. *Eos, Transactions of the American Geophysical Union* 89(49):501-502.
- Rochard, E., M. Lepage, and L. Meauzé. Identification et caractérisation de l'aire de répartition marine de l'esturgeon européen *Acipenser sturio* a partir de déclarations de captures. 1997. *Aquat. Living. Resour.* 10: 101-109.
- Rogers, S.G., and W. Weber. 1995b. Status and restoration of Atlantic and shortnose sturgeons in Georgia. Final Report to the National Marine Fisheries Service, Southeast Regional Office, St. Petersburg, Florida.

- Rosenthal, H. and D. F. Alderdice. 1976. Sublethal effects of environmental stressors, natural and pollutional, on marine fish eggs and larvae. *Journal of the Fisheries Research Board of Canada* 33: 2047-2065.
- Ross, J.P. 1996. Caution urged in the interpretation of trends at nesting beaches. *Marine Turtle Newsletter* 74: 9-10.
- Ross, J.P. 2005. Hurricane effects on nesting *Caretta caretta*. *Mar Turtle Newsl* 108:13-14.
- Ruben, H.J, and S.J. Morreale. 1999. Draft Biological Assessment for Sea Turtles in New York and New Jersey Harbor Complex. Unpublished Biological Assessment submitted to National Marine Fisheries Service.
- Ruelle, R. and C. Henry. 1992. Organochlorine compounds in pallid sturgeon. *Contaminant*
- Ruelle, R. and C. Henry. 1994. Life history observations and contaminant evaluation of pallid sturgeon. Final Report U.S. Fish and Wildlife Service, Fish and Wildlife Enhancement, South Dakota Field Office, 420 South Garfield Avenue, Suite 400, Pierre, South Dakota 57501-5408.
- Ruelle, R., and K.D. Keenlyne. 1993. Contaminants in Missouri River pallid sturgeon. *Bull. Environ. Contam. Toxicol.* 50: 898-906.
- Sarti Martinez, L., A.R. Barragan, D.G. Munoz, N. Garcia, P. Huerta, and F. Vargas. 2007. Conservation and biology of the leatherback turtle in the Mexican Pacific. *Chelonian Conservation and Biology* 6(1): 70-78.
- Sarti, L., S. Eckert, P. Dutton, A. Barragán, and N. García. 2000. The current situation of the leatherback population on the Pacific coast of Mexico and central America, abundance and distribution of the nestings: an update. Pages 85-87 In: H. Kalb and T. Wibbels, compilers. *Proceedings of the Nineteenth Annual Symposium on Sea Turtle Conservation and Biology*. NOAA Technical Memorandum NMFS-SEFSC-443.
- Sarti, L., S.A. Eckert, N. Garcia, and A.R. Barragan. 1996. Decline of the world's largest nesting assemblage of leatherback turtles. *Marine Turtle Newsletter* 74: 2-5.
- Savoy, T. 2007. Prey eaten by Atlantic sturgeon in Connecticut waters. *Am. Fisheries Society Symposium* 56: 157-165.
- Savoy, T., and D. Pacileo. 2003. Movements and important habitats of subadult Atlantic sturgeon in Connecticut waters. *Transactions of the American Fisheries Society*. 132: 1-8.
- Schmid, J.R., and W.N. Witzell. 1997. Age and growth of wild Kemp's ridley turtles (*Lepidochelys kempi*): cumulative results of tagging studies in Florida. *Chelonian Conservation and Biology* 2(4): 532-537.
- Schubel, J.R., H.H. Carter, R.E. Wilson, W.M. Wise, M.G. Heaton, and M.G. Gross. 1978. Field investigations of the nature, degree, and extent of turbidity generated by open-water pipeline disposal operations. Technical Report D-78-30; U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss., 245 pp.

- Schueller, P. and D.L. Peterson. 2006. Population status and spawning movements of Atlantic sturgeon in the Altamaha River, Georgia. Presentation to the 14th American Fisheries Society Southern Division Meeting, San Antonio, February 8-12th, 2006.
- Schultz, J.P. 1975. Sea turtles nesting in Surinam. *Zoologische Verhandelingen (Leiden)*, Number 143: 172 pp.
- Scott, W. B., and M. C. Scott. 1988. Atlantic fishes of Canada. *Canadian Bulletin of Fisheries and Aquatic Science* No. 219. pp. 68-71.
- Scott, W.B. and E.J. Crossman. 1973. Freshwater fishes of Canada. *Fisheries Research Board of Canada. Bulletin* 184. pp. 80-82.
- Seaturtle.org. Sea turtle tracking database. Available at <http://www.seaturtle.org>.
- Secor, D. H. 2002. Atlantic sturgeon fisheries and stock abundances during the late nineteenth century. Pages 89-98 In: W. Van Winkle, P. J. Anders, D. H. Secor, and D. A. Dixon, (editors), *Biology, management, and protection of North American sturgeon*. American Fisheries Society Symposium 28, Bethesda, Maryland.
- Secor, D.H. and J.R. Waldman. 1999. Historical abundance of Delaware Bay Atlantic sturgeon and potential rate of recovery. *American Fisheries Society Symposium* 23: 203-
- Secor, D.J. and E.J. Niklitschek. 2002. Sensitivity of sturgeons to environmental hypoxia: A review of physiological and ecological evidence, p. 61-78 In: R.V. Thurston (Ed.) *Fish Physiology, Toxicology, and Water Quality*. Proceedings of the Sixth International Symposium, La Paz, MX, 22-26 Jan. 2001. U.S. Environmental Protection Agency Office of Research and Development, Ecosystems Research Division, Athens, GA. EPA/600/R-02/097. 372 pp.
- Sella, I. 1982. Sea turtles in the Eastern Mediterranean and Northern Red Sea. Pages 417-423 in K.A. Bjorndal, ed. *Biology and Conservation of Sea Turtles*. Washington, D.C.: Smithsonian Institution Press.
- Seminoff, J.A. 2004. *Chelonia mydas*. In 2007 IUCN Red List of Threatened Species. Accessed 31 July 2009. <http://www.iucnredlist.org/search/details.php/4615/summ>.
- Shamblin, B.M. 2007. Population structure of loggerhead sea turtles (*Caretta caretta*) nesting in the southeastern United States inferred from mitochondrial DNA sequences and microsatellite loci. Master's thesis, University of Georgia. 59 pp.
- Sherk, J.A. J.M. O'Connor and D.A. Neumann. 1975. Effects of suspended and deposited sediments on estuarine environments. In: *Estuarine Research Vol. II. Geology and Engineering*. L.E. Cronin (editor). New York: Academic Press, Inc.
- Sherk, J.A. 1972. Current Status of the Knowledge of the Biological Effects of Suspended and Deposited Sediments in Chesapeake Bay. *Chesapeake Science*, vol. 13, Supplement: Biota of the Chesapeake Bay pp. S137-S144.
- Sherk, J.A. 1971. Effects of suspended and deposited sediments on estuarine organisms. Chesapeake Biological Laboratory, University of Maryland. Contribution No. 443.

Shirey, C., C. C. Martin, and E. D. Stetzar. 1999. Atlantic sturgeon abundance and movement in the lower Delaware River. DE Division of Fish and Wildlife, Dover, DE, USA. Final Report to the National Marine Fisheries Service, Northeast Region, State, Federal & Constituent Programs Office. Project No. AFC-9, Grant No. NA86FA0315. 34 pp.

Shoop, C.R. 1987. The Sea Turtles. Pages 357-358 in R.H. Backus and D.W. Bourne, eds. Georges Bank. Cambridge, Massachusetts: MIT Press.

Shoop, C.R. and R.D. Kenney. 1992. Seasonal distributions and abundances of loggerhead and leatherback sea turtles in waters of the northeastern United States. Herpetological Monographs 6: 43-67.

Short, F.T. and H.A. Neckles. 1999. The effects of global climate change on seagrasses. *Aquat Bot* 63: 169–196.

Simpson, P.C. 2008. Movements and habitat use of Delaware River Atlantic sturgeon. Master Thesis, Delaware State University, Dover, DE 128 p.

Skjveland, Jorgen E., Stuart A. Welsh, Michael F. Mangold, Sheila M. Eyler, and Seaberry Nachbar. 2000. A Report of Investigations and Research on Atlantic and Shortnose Sturgeon in Maryland Waters of the Chesapeake bay (1996-2000). U.S. Fish and Wildlife Service, Annapolis, MD. 44 pp.

Slay, C.K. and J.I. Richardson. 1988. King's Bay, Georgia: Dredging and Turtles. Schroeder, B.A. (compiler). Proceedings of the eighth annual conference on sea turtle biology and conservation. NOAA Technical Memorandum NMFS-SEFC-214, pp. 109-111.

Smith, Hugh M. and Barton A. Bean. 1899. List of fishes known to inhabit the waters of the District of Columbia and vicinity. Prepared for the United States Fish Commission. Washington Government Printing Office, Washington, D.C.

Smith, T. I. J., D. E. Marchette, and G. F. Ulrich. 1984. The Atlantic sturgeon fishery in South

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

Smith, T.I.J. 1985. The fishery, biology, and management of Atlantic sturgeon, *Acipenser oxyrinchus*, in North America. *Environmental Biology of Fishes* 14(1): 61-72.

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

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

Snover, M.L., A.A. Hohn, L.B. Crowder, and S.S. Heppell. 2007. Age and growth in Kemp's ridley sea turtles: evidence from mark-recapture and skeletochronology. Pages 89-106 in P.T.

Plotkin, ed. *Biology and Conservation of Ridley Sea Turtles*. Baltimore, Maryland: Johns Hopkins University Press.

Snyder, D.E. 1988. Description and identification of shortnose and Atlantic sturgeon larvae. *American Fisheries Society Symposium* 5:7-30.

South Carolina Department of Natural Resources. 2007. Examination of Local Movement and Migratory Behavior of Sea Turtles during spring and summer along the Atlantic coast off the southeastern United States. Unpublished report submitted to NMFS as required by ESA Permit 1540. 45 pp.

Spells, A. 1998. Atlantic sturgeon population evaluation utilizing a fishery dependent reward program in Virginia's major western shore tributaries to the Chesapeake Bay. U.S. Fish and Wildlife Service, Charles City, Virginia.

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

Spotila, J.R., R.D. Reina, A.C. Steyermark, P.T. Plotkin, and F.V. Paladino. 2000. Pacific leatherback turtles face extinction. *Nature* 405(6786):529-530.

Squiers, T. And M. Robillard. 1997. Preliminary report on the location of overwintering sites for shortnose sturgeon in the estuarial complex of the Kennebec River during the winter of 1996/1997. Unpublished report, submitted to the Maine Department of Transportation.

Squiers, T., L. Flagg, and M. Smith. 1982. American shad enhancement and status of sturgeon stocks in selected Maine waters. Completion report, Project AFC-20.

Stein, A.B., K.D. Friedland, and M. Sutherland. 2004. Atlantic sturgeon marine bycatch and mortality on the continental shelf of the Northeast United States. *North American Journal of Fisheries Management* 24: 171-183.

Stephens, S.H., and J. Alvarado-Bremer. 2003. Preliminary information on the effective population size of the Kemp's ridley (*Lepidochelys kempii*) sea turtle. Page 250 In: J.A. Seminoff, compiler. *Proceedings of the Twenty-Second Annual Symposium on Sea Biology and Conservation*. NOAA Technical Memorandum NMFS-SEFSC-503.

Stetzar, E. J. 2002. Population Characterization of Sea Turtles that Seasonally Inhabit the Delaware Estuary. Master of Science thesis, Delaware State University, Dover, Delaware. 136pp.

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

Stewart, K., C. Johnson, and M.H. Godfrey. 2007. The minimum size of leatherbacks at reproductive maturity, with a review of sizes for nesting females from the Indian, Atlantic and Pacific Ocean basins. *Herp. Journal* 17:123-128.

- Stewart, K., M. Sims, A. Meylan, B. Witherington, B. Brost, and L.B. Crowder. 2011. Leatherback nests increasing significantly in Florida, USA; trends assessed over 30 years using multilevel modeling. *Ecological Applications*, 21(1): 263–273.
- Stocker, T.F. and A. Schmittner. 1997. Influence of CO<sub>2</sub> emission rates on the stability of the thermohaline circulation. *Nature* 388: 862–865.
- Suárez, A. 1999. Preliminary data on sea turtle harvest in the Kai Archipelago, Indonesia. Abstract, 2nd ASEAN Symposium and Workshop on Sea Turtle Biology and Conservation, July 15-17, 1999, Sabah, Malaysia.
- Suárez, A., P.H. Dutton, and J. Bakarbesy. 2000. Leatherback (*Dermochelys coriacea*) nesting on the North Vogelkop Coast of Irian Jaya, Indonesia. Page 260 in H.J. Kalb and T. Wibbels, compilers. *Proceedings of the Nineteenth Annual Symposium on Sea Turtle Biology and Conservation*. NOAA Technical Memorandum NMFS-SEFSC-443.
- Taub, S.H. 1990. Interstate fishery management plan for Atlantic sturgeon. Fisheries Management Report No. 17. Atlantic States Marine Fisheries Commission, Washington, D.C. 73 pp.
- Taubert, B.D. 1980b. Biology of shortnose sturgeon (*Acipenser brevirostrum*) in the Holyoke Pool, Connecticut River, Massachusetts. Ph.D. Thesis, University of Massachusetts, Amherst, 136 p.
- Taubert, B.D., and M.J. Dadswell. 1980. Description of some larval shortnose sturgeon (*Acipenser brevirostrum*) from the Holyoke Pool, Connecticut River, Massachusetts, USA, and the Saint John River, New Brunswick, Canada. *Canadian Journal of Zoology* 58:1125-1128.
- Taylor, A.C. 1990. The hopper dredge. In: Dickerson, D.D. and D.A. Nelson (Comps.); *Proceedings of the National Workshop of Methods to Minimize Dredging Impacts on Sea Turtles*, 11-12 May 1988, Jacksonville, Florida. Miscellaneous Paper EL-90-5. Department of the Army, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. February, 1990. Pp. 59-63.
- Teleki, G.C. and A.J. Chamberlain. 1978. Acute Effects of Underwater Construction Blasting in Fishes in Long Point Bay, Lake Erie. *J. Fish. Res. Board Can.* 35: 1191-1198.
- TEWG (Turtle Expert Working Group). 1998. An assessment of the Kemp's ridley (*Lepidochelys kempii*) and loggerhead (*Caretta caretta*) sea turtle populations in the Western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-409:1-96.
- TEWG (Turtle Expert Working Group). 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-444:1-115.
- TEWG (Turtle Expert Working Group). 2007. An assessment of the leatherback turtle population in the Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-555:1-116.

TEWG (Turtle Expert Working Group). 2009. An assessment of the loggerhead turtle population in the Western North Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-575:1-131.

TEWG. 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. U.S. Dep. Commer. NOAA Tech. Mem. NMFS-SEFSC-444, 115 pp.

TEWG. 2007. An assessment of the leatherback turtle population in the Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-555, 116 pp.

TEWG. 2009. An assessment of the loggerhead turtle population in the Western North Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-575: 1-131.

Titus, J.G. and V.K. Narayanan. 1995. The probability of sea level rise. U.S. Environmental Protection Agency EPA 230-R-95-008. 184 pp.

Turtle Expert Working Group (TEWG). 1998. An assessment of the Kemp's ridley (*Lepidochelys kempii*) and loggerhead (*Caretta caretta*) sea turtle populations in the Western North Atlantic. NOAA Technical Memorandum NOAA Fisheries-SEFSC-409. 96 pp.

Tynan, C.T. and D.P. DeMaster. 1997. Observations and predictions of Arctic climatic change: potential effects on marine mammals. *Arctic* 50: 308-322.

U.S. Army Corps of Engineers (USACE). 2006. Biological Assessment for Research and Compilation of Baseline Data for the Use of Bed-leveling Devices at Port of Palm Beach, Palm Beach County, Florida. Prepared for USACE-Jacksonville District. March.

U.S. Army Corps of Engineers (USACE). 1994. Beach Erosion Control and Hurricane Protection Study, Virginia Beach, Virginia- General Reevaluation Report, Main Report, Environmental Assessment, and Appendices. Norfolk District.

U.S. Army Corps of Engineers (USACE), Norfolk District. 2012. Supplemental Biological Assessment for the Potential Impacts to Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) Resulting from Beach Nourishment Activities at Sandbridge Beach Utilizing the Sandbridge Shoal Borrow Areas. Submitted to NMFS Northeast Regional Office, April 2012. Norfolk, Virginia. 39 pp.

U.S. Army Corps of Engineers (USACE), Savannah District. 2004. Biological Assessment of Threatened and Endangered Species for Brunswick Harbor Deepening Modification to Allow Use of Bed-leveling Mechanical Dredging, Glynn County, Georgia. July.

U.S. Fish and Wildlife Service (USFWS). 1997. Synopsis of the biological data on the green turtle, *Chelonia mydas* (Linnaeus 1758). Biological Report 97(1). U.S. Fish and Wildlife Service, Washington, D.C. 120 pp.

Uhler, P.R. and O. Lugger. 1876. List of fishes of Maryland. Rept. Comm. Fish. MD. 1876: 67-176.

USACE Environmental Laboratory. Sea Turtle Data Warehouse. Available at <http://el.erdc.usace.army.mil/seaturtles/index.cfm>.

USDOI (United States Department of Interior). 1973. Threatened wildlife of the United States. Shortnose sturgeon. Office of Endangered Species and International Activities, Bureau of Sport Fisheries and Wildlife, Washington, D.C. Resource Publication 114 (Revised Resource Publication 34).

USFWS (U.S. Fish and Wildlife Service) and NMFS (National Marine Fisheries Service). 1992. Recovery plan for the Kemp's ridley sea turtle (*Lepidochelys kempi*). Original. St. Petersburg, Florida: National Marine Fisheries Service. 40 pp.

USFWS and NMFS. 1992. Recovery plan for the Kemp's ridley sea turtle (*Lepidochelys kempii*). NMFS, St. Petersburg, Florida. hatching. *Curr Biol* 17: R590.

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

Van Eenennaam, J.P., and S.I. Doroshov. 1998. Effects of age and body size on gonadal development of Atlantic sturgeon. *Journal of Fish Biology* 53: 624-637.

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

Van Houtan, K.S. and J.M. Halley. 2011. Long-Term Climate Forcing in Loggerhead Sea Turtle Nesting. *PLoS ONE* 6(4): e19043. doi:10.1371/journal.pone.0019043.

Van Houtan, K.S. and O.L. Bass. 2007. Stormy oceans are associated with declines in sea turtle

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

Vinyard, L. and W.J. O'Brien. 1976. Effects of light and turbidity on the reactive distance of bluegill (*Lepomis macrochirus*) *J. Fish. Res. Board Can.* 33: 2845-2849.

Vladykov, V.D. and J.R. Greeley. 1963. Order Acipenseroidea. Pages 24-60 in *Fishes of the Western North Atlantic*. Memoir Sears Foundation for Marine Research 1(Part III). xxi + 630 pp.

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

- Waldman JR, Grunwald C, Stabile J, Wirgin I. 2002. Impacts of life history and biogeography on genetic stock structure in Atlantic Sturgeon, *Acipenser oxyrinchus oxyrinchus*, Gulf sturgeon *A. oxyrinchus desotoi*, and shortnose sturgeon, *A. brevirostrum*. *J Appl Ichthyol* 18:509-518
- Waldman, J.R., J.T. Hart, and I.I. Wirgin. 1996. Stock composition of the New York Bight Atlantic sturgeon fishery based on analysis of mitochondrial DNA. *Transactions of the American Fisheries Society* 125: 364-371.
- Wallace, B.P., S.S. Heppell, R.L. Lewison, S. Kelez, and L.B. Crowder. 2008. Impacts of fisheries bycatch on loggerhead turtles worldwide inferred from reproductive value analyses. *J Appl Ecol* 45:1076-1085.
- Walsh, M.G., M.B. Bain, T. Squires, J.R. Walman, and Isaac Wirgin. 2001. Morphological and genetic variation among shortnose sturgeon *Acipenser brevirostrum* from adjacent and distant rivers. *Estuaries* Vol. 24, No. 1, p. 41-48. February 2001.
- Waluda, C.M., P.G. Rodhouse, G.P. Podesta, P.N. Trathan, and G.J. Pierce. 2001. Surface oceanography of the inferred hatching grounds of *Illex argentinus* (Cephalopoda: Ommastrephidae) and influences on recruitment variability. *Marine Biology* 139: 671-679.
- Warden, M. and K. Bisack 2010. Analysis of Loggerhead Sea Turtle Bycatch in Mid-Atlantic Bottom Trawl Fisheries to Support the Draft Environmental Impact Statement for Sea Turtle Conservation and Recovery in Relation to Atlantic and Gulf of Mexico Bottom Trawl Fisheries. NOAA NMFS NEFSC Ref. Doc.010. 13 pp.
- Warden, M.L. 2011a. Modeling loggerhead sea turtle (*Caretta caretta*) interactions with US Mid-Atlantic bottom trawl gear for fish and scallops, 2005-2008. *Biological Conservation* 144:2202-2212.
- Warden, M.L. 2011b. Proration of loggerhead sea turtle (*Caretta caretta*) interactions in U.S. Mid-Atlantic bottom otter trawls for fish and scallops, 2005-2008, by managed species landed. U.S. Department of Commerce, Northeast Fisheries Science Center Reference Document 11-04. 8 p.
- Waters, Thomas F. 1995. *Sediment in Streams*. American Fisheries Society Monograph 7. American Fisheries Society, Bethesda, MD. Pages 95-96.
- Webster, P.J., G.J. Holland, J.A. Curry, H.R. Chang. 2005. Changes in tropical cyclone number, duration, and intensity in a warming environment. *Science* 309:1844-1846.
- Wehrell, S. 2005. A survey of the groundfish caught by the summer trawl fishery in Minas Basin and Scots Bay. Honours Thesis. Department of Biology, Acadia University, Wolfville, Canada.
- Weishampel, J.F., D.A. Bagley, and L.M. Ehrhart. 2004. Earlier nesting by loggerhead sea turtles following sea surface warming. *Global Change Biology* 10: 1424-1427.
- Welsh, S. A., S. M. Eyler, M. F. Mangold, and A. J. Spells. 2002. Capture locations and growth rates of Atlantic sturgeon in the Chesapeake Bay. Pages 183-194 In: W. Van Winkle, P. J. Anders, D. H. Secor, and D. A. Dixon, (editors), *Biology, management, and protection of North American sturgeon*. American Fisheries Society Symposium 28, Bethesda, Maryland.

- Welsh, Stuart A., Michael F. Mangold, Jorgen E. Skjeveland, and Albert J. Spells. 2002. Distribution and Movement of Shortnose Sturgeon (*Acipenser brevirostrum*) in the Chesapeake Bay. *Estuaries* Vol. 25 No. 1: 101-104.
- Wibbels, T. 2003. Critical approaches to sex determination in sea turtle biology and conservation. In: P. Lutz et al. (editors), *Biology of Sea Turtles*, Vol 2. CRC Press Boca Raton. p. 103-134.
- Wilber, D.H., D.G. Clarke & M.H. Burlas. (2006). Suspended sediment concentrations associated with a beach nourishment project on the northern coast of New Jersey. *Journal of Coastal Research* 22(5): 1035 – 1042.
- Wilber, Dara H. and Douglas C. Clarke. 2001. Biological Effects of Suspended Sediments: A review of suspended sediment impacts on fish and shellfish with relation to dredging activities in estuaries. *North American Journal of Fisheries Woodland, R. J.* 2005. Age, growth, and recruitment of Hudson River shortnose sturgeon (*Acipenser brevirostrum*). Master's thesis. University of Maryland, College Park.
- Wirgin, I. and T.L. King. 2011. Mixed stock analysis of Atlantic sturgeon from coastal locales and a non-spawning river. Presentation of the 2011 Sturgeon Workshop, Alexandria, VA, February 8-10.
- Wirgin, I., Grunwald, C., Carlson, E., Stabile, J., Peterson, D.L. and J. Waldman. 2005. Range-wide population structure of shortnose sturgeon *Acipenser brevirostrum* based on sequence analysis of mitochondrial DNA control region. *Estuaries* 28:406-21.
- Witherington, B., P. Kubilis, B. Brost, and A. Meylan. 2009. Decreasing annual nest counts in a globally important loggerhead sea turtle population. *Ecological Applications* 19: 30-54.
- Witt, M.J., A.C. Broderick, D.J. Johns, C. Martin, R. Penrose, M.S. Hoogmoed, and B.J. Godley. 2007. Prey landscapes help identify potential foraging habitats for leatherback turtles in the NE Atlantic. *Marine Ecology Progress Series* 337: 231-243.
- Witt, M.J., A.C. Broderick, M. Coyne, A. Formia and others. 2008. Satellite tracking highlights difficulties in the design of effective protected areas for critically endangered leatherback turtles *Dermochelys coriacea* during the inter-nesting period. *Oryx* 42: 296–300.
- Witzell, W.N. 2002. Immature Atlantic loggerhead turtles (*Caretta caretta*): suggested changes to the life history model. *Herpetological Review* 33(4): 266-269.
- Witzell, W.N., A.L. Bass, M.J. Bresette, D.A. Singewald, and J.C. Gorham. 2002. Origin of immature loggerhead sea turtles (*Caretta caretta*) at Hutchinson Island, Florida: evidence from mtDNA markers. *Fish. Bull.* 100:624-631.
- Woodland, R.J. and D. H. Secor. 2007. Year-class strength and recovery of endangered shortnose sturgeon in the Hudson River, New York. *Transaction of the American Fisheries Society* 136:72-81.
- Wynne, K. and M. Schwartz. 1999. Guide to marine mammals and turtles of the U.S. Atlantic and Gulf of Mexico. Rhode Island Sea Grant, Narragansett, Rhode Island. 114 pp.

Young, J. R., T. B. Hoff, W. P. Dey, and J. G. Hoff. 1998. Management recommendations for a Hudson River Atlantic sturgeon fishery based on an age-structured population model. Fisheries Research in the Hudson River. State of University of New York Press, Albany, New York. pp. 353.

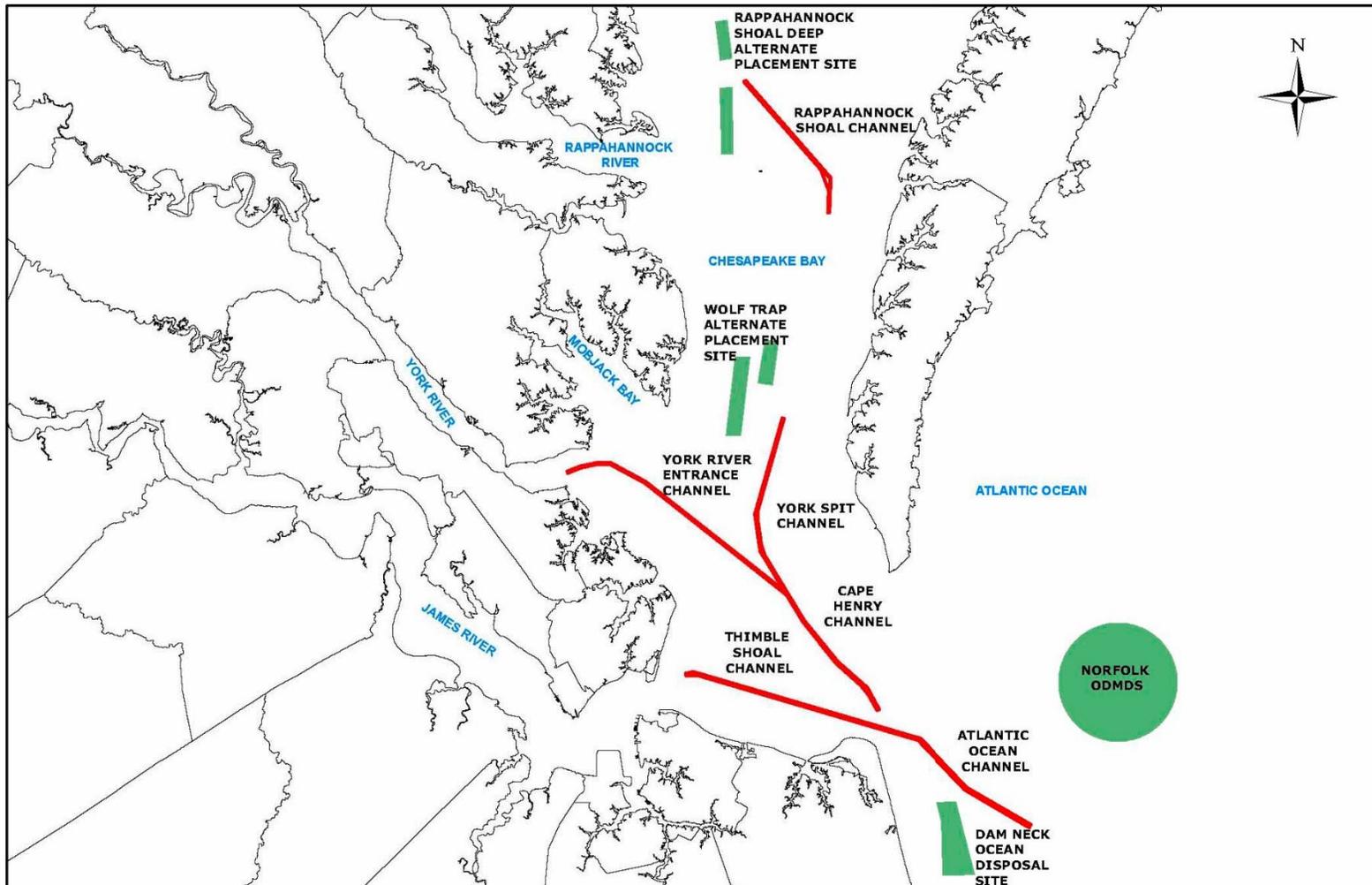
Ziegeweid, J.R., C.A. Jennings, and D.L. Peterson. 2008a. Thermal maxima for juvenile shortnose sturgeon acclimated to different temperatures. *Environmental Biology of Fish* 3: 299-307.

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

Zug, G.R., and J.F. Parham. 1996. Age and growth in leatherback turtles, *Dermochelys coriacea*: a skeletochronological analysis. *Chelonian Conservation and Biology* 2(2): 244-249.

Zurita, J.C., R. Herrera, A. Arenas, M.E. Torres, C. Calderon, L. Gomez, J.C. Alvarado, and R. Villavicencio. 2003. Nesting loggerhead and green sea turtles in Quintana Roo, Mexico. Pp. 125-127. In: J.A. Seminoff (compiler). *Proceedings of the Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation*. NOAA Tech. Memo. NMFS-SEFSC-503, 308 p.





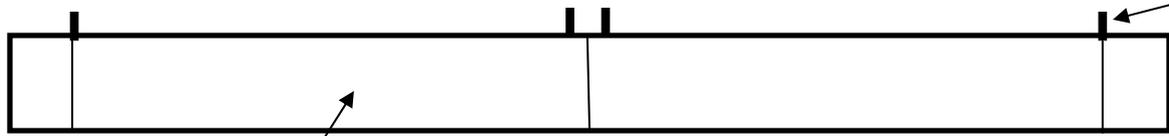
 <p>US Army Corps of Engineers Norfolk District</p>	<p><b>LOWER CHESAPEAKE BAY FEDERAL NAVIGATION PROJECT CHANNELS AND DREDGED MATERIAL PLACEMENT SITES:</b>  <b>ATLANTIC OCEAN CHANNEL, CAPE HENRY CHANNEL, RAPPAHANNOCK SHOAL CHANNEL, THIMBLE SHOAL CHANNEL, YORK RIVER ENTRANCE CHANNEL, YORK SPIT CHANNEL AND DAM NECK OCEAN DISPOSAL SITE, NORFOLK OCEAN DREDGED MATERIAL DISPOSAL SITE, WOLF TRAP ALTERNATE PLACEMENT SITE, AND RAPPAHANNOCK SHOAL DEEP ALTERNATE PLACEMENT SITE</b></p>	<p>0 47,500 95,000 Feet  1 inch = 53,750 feet</p> <p><b>Legend</b></p> <ul style="list-style-type: none"> <li><span style="color: red;">—</span> Lower Chesapeake Bay Channels</li> <li><span style="color: green;">■</span> Dredged Material Placement Sites</li> </ul>	<p>Projection: Virginia State Plane South Zone - NAD 83 U.S. Survey Feet</p> <p>Data Source: Operations Branch GIS Data</p>	<p>Project Manager: Keith Lockwood  E-mail: keith.b.lockwood@usace.army.mil  Phone: (757) 201-7004</p> <p>Prepared by: Katy Damico  CENAO-WR-OT</p> <p>Map File: Lower_ChesBay_Channels_Map.mxd  Map Date: 13 JUNE 2011</p>
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ABRASION-RESISTANT PLATE

### SECTION B - B

PAD EYES

SQUARE TUBE



HOLE FILL & DRAIN TYPE

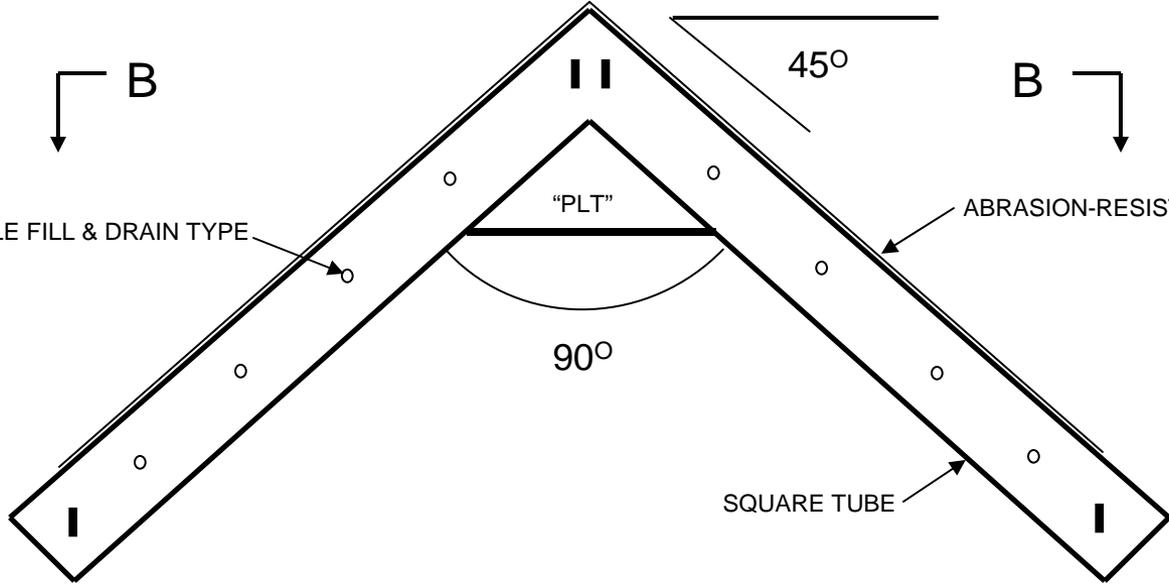
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ABRASION-RESISTANT PLATE

SQUARE TUBE

### PLAN VIEW

### LEFT SIDE VIEW

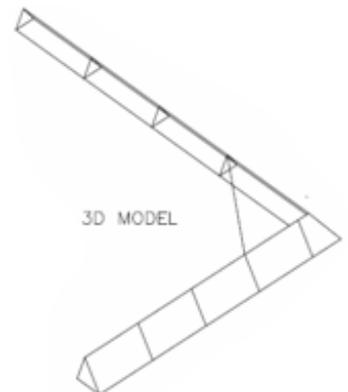
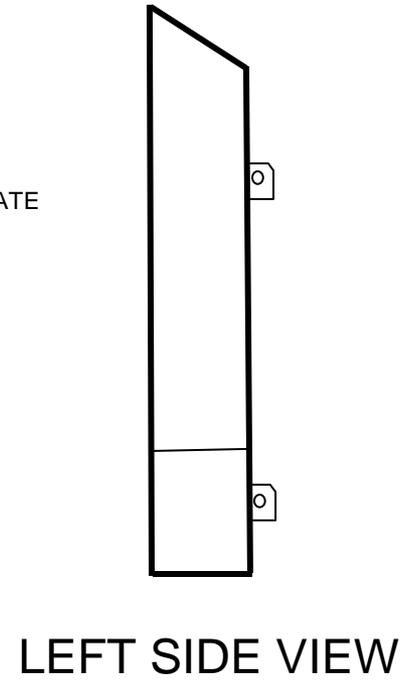
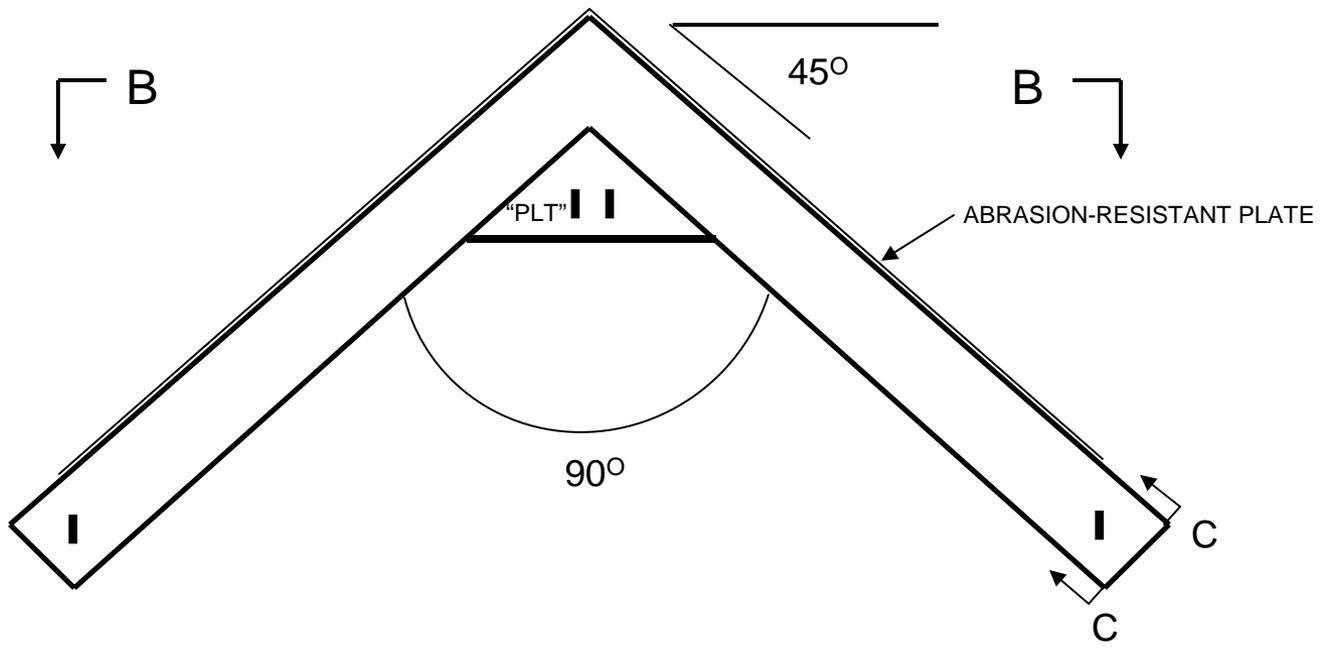
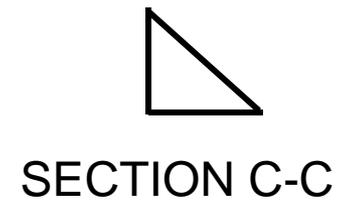
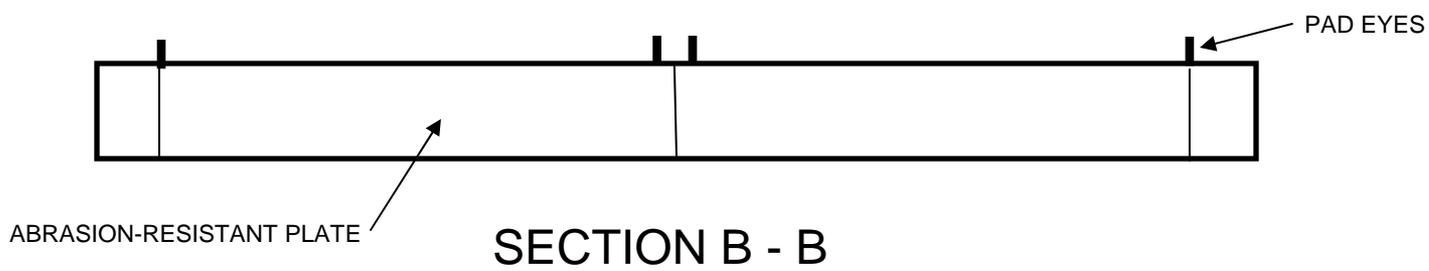


Appendix B  
Bed Leveler Information

# 90 DEGREE BED LEVELER CONCEPTUAL DESIGN

# 90 DEGREE BED LEVELER MODEL PHOTOGRAPHS

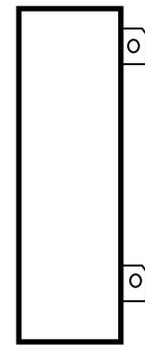
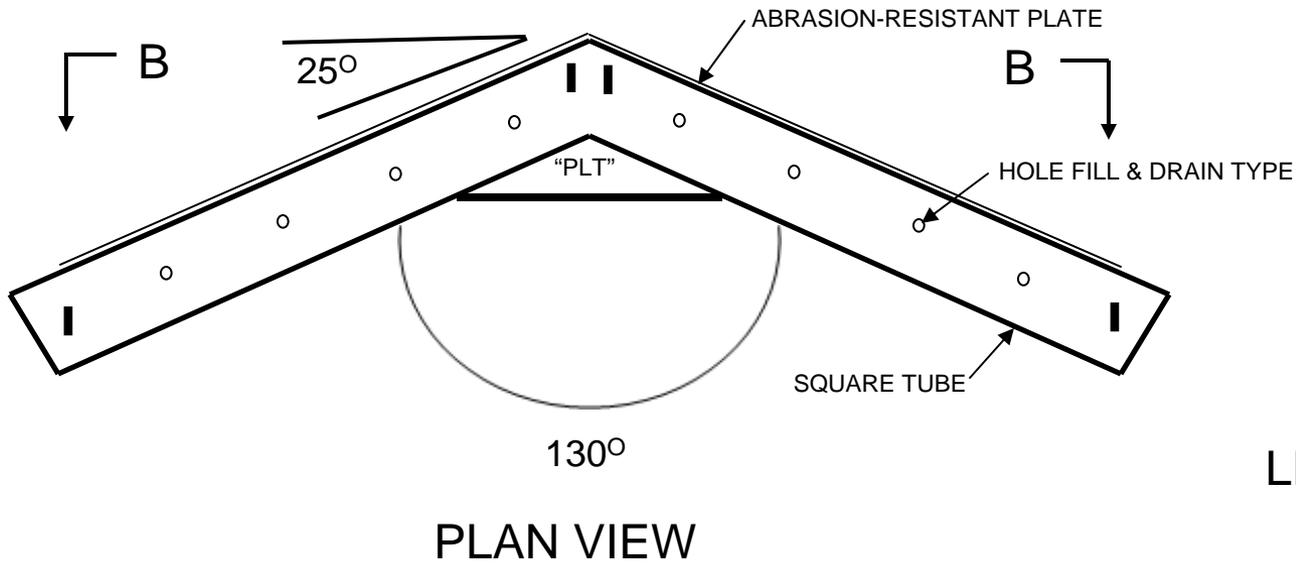
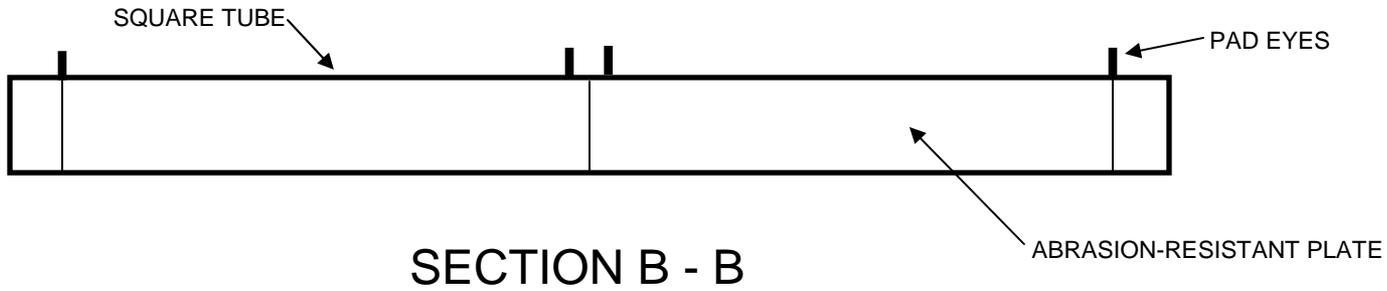




**90 DEGREE RAKED BED LEVELER  
CONCEPTUAL DESIGN**

# 90 DEGREE RAKED BED LEVELER MODEL PHOTOGRAPHS

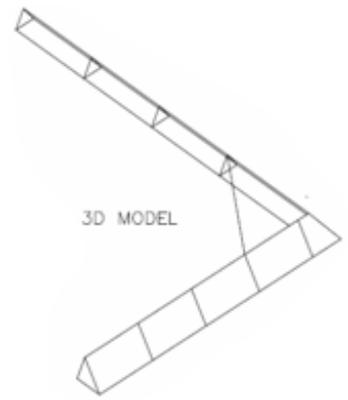
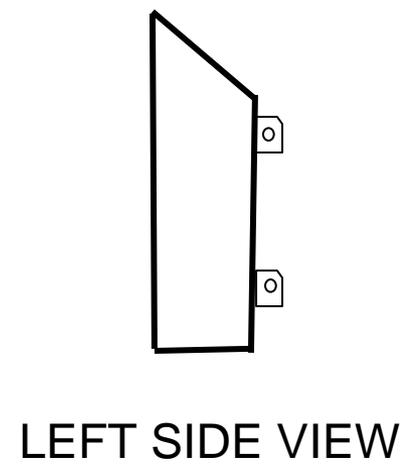
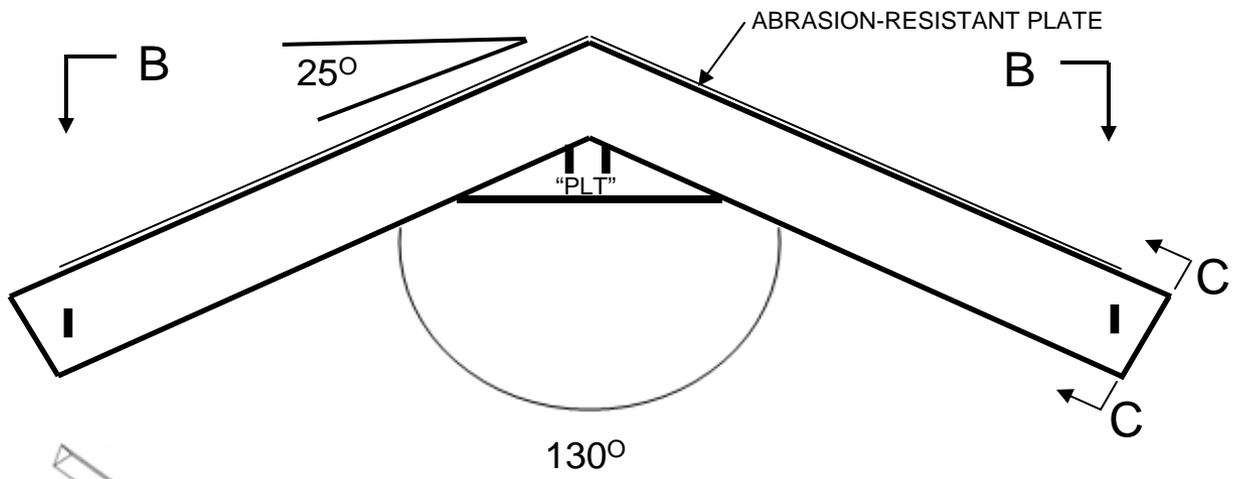
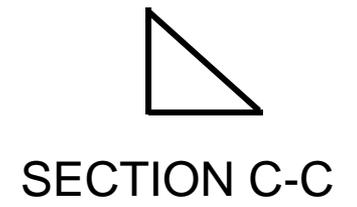
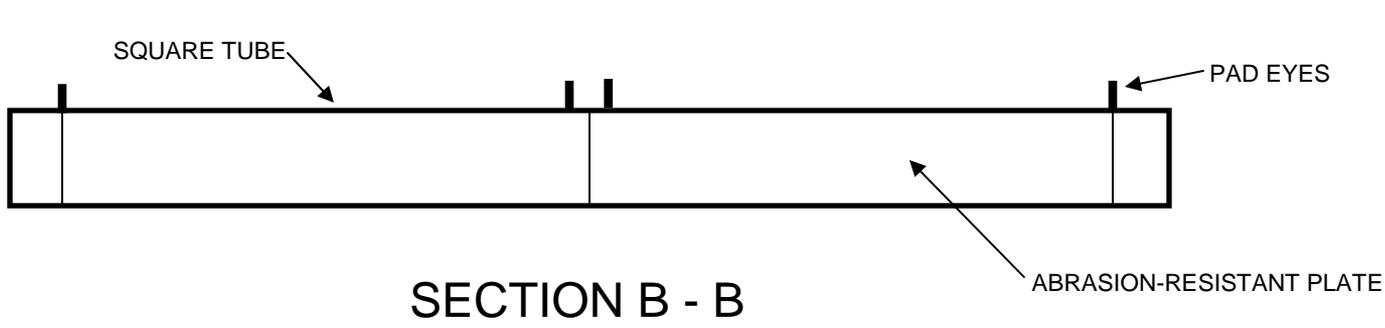




# 130 DEGREE BED LEVELER CONCEPTUAL DESIGN

# 130 DEGREE BED LEVELER MODEL PHOTOGRAPHS





PLAN VIEW

**130 DEGREE RAKED BED LEVELER  
CONCEPTUAL DESIGN**

Appendix C  
Historical Take Records of Sturgeon

Sturgeon Take Records from Dredging Operations 1990 - Mar 2012										
Take #	Date	Corps District	Location	Sp	Dredge Type/ Name	Status	Specimen Description	Notes	Photos	Documentation
1	30 Oct 90	SAC	Winyah Bay Georgetown	A	H <i>Ouchita</i>	Dead	~69cm, rear half	Overflow Screening	N	Chris Slay pers com Observer report DACW 60-90-C-0067
2	15 Jan 94	SAS	Savannah Harbor	A	H <i>RN Weeks</i>	NA	NA	Found by Turtle observer	No	Steve Calver pers com 14 Jun 05 Observer load sheet and final rpt #DACW21-93-C-0072
3	07 Dec 94	SAS	Savannah Harbor	A	H <i>Dodge Island</i>	Live released	71cm, whole fish	Starboard Skimmer Screening	Yes We have efile	Chris Slay pers com Observer report
4	07 Dec 94 Different Load	SAS	Savannah Harbor	A	H <i>Dodge Island</i>	Dead	77.5cm, whole fish	Starboard Skimmer Screening	Yes We have efile	Chris Slay pers com Observer report
5	Feb 96	NAP	Delaware River Newbold Island	S	P <i>Ozark</i>	Dead	83cm, female w/eggs	In DMA Money Island		NMFS memo for record From Laurie Silva 19 Apr 96
6	Feb 96	NAP	Delaware River Newbold Island	S	P <i>Ozark</i>	Dead	63cm, mature male	In DMA Money Island		NMFS memo for record From Laurie Silva 19 Apr 96
7	06 Jan 98	NAP	Delaware River Kinkora Range	S	P ??	Dead	Either 657mm or 573mm ???	In DMA Money Island	Y Not e-file	Memo for file 20 Jan 98 From Greg Wacik NAP
8	12 Jan 98	NAP	Delaware River Florence Range	S	P ??	Dead	Either 657mm or 573mm ???	In DMA Money Island	Y Not e-file	Memo for file 20 Jan 98 From Greg Wacik NAP
9	13 Jan 98	NAP	Delaware River Florence Range	S	P ??	Dead	Either 657mm or 573mm ???	In DMA Money Island	Y Not e-file	Memo for file 20 Jan 98 From Greg Wacik NAP
10	7 Sep 98	SAW	Wilmington Har Cape Fear River	A	H <i>McFarland</i>	Dead	Head only (1 ft long)	In turtle Inflow screen		Observer incident report Pers com Bill Adams- SAW 26 Jul 04
11	01 Mar 00	SAC	Charleston Harbor	A	H <i>Stuyvesant</i>	Dead	Missing head and tail	Main Overflow Screening	No	Chris Slay pers com Observer reporting forms
12	12 Apr 00	SAC	Charleston Harbor	A	H <i>Stuyvesant</i>	Dead	71.6cm, whole fish	Starboard Overflow screening	No	Chris Slay pers com Observer reporting forms
13	03 Dec 00	SAW	Wilmington Har MOTSU	A	C <i>New York</i>	Dead	82.5cm, whole fish decomposing	In bucket	Y Not e-file Payonk? ?	Chris Slay pers com Phil Payonk pers com 30 Jul 04 Bill Adams pers com 28 Jul 04 #DACW54-00-C-0013

## Sturgeon Take Records from Dredging Operations 1990 - Mar 2012

Take #	Date	Corps District	Location	Sp	Dredge Type/ Name	Status	Specimen Description	Notes	Photos	Documentation
14	24 Feb 01	SAS	Brunswick Harbor	A	H <i>RN Weeks</i>	Dead	Head only	Just mentions take on all forms, no other info.	No	Daily and Weekly Reports, Load sheet.
15	19 Jun 01	NAE	Kennebec River Bath Iron Works	A	C ??	Live released		Put in scow, released unharmed		Julie Crocker NMFS pers com 19 Jul 04 2003 Chesapeake BA, Section 7.2 Normandeau Associates, Inc 2001
16	30 Apr 03	NAE	Kennebec River Bath Iron Works	S	C Reed and Reed dredge company	Dead	Fish nearly cut in half		Y We have e-file	Julie Crocker NMFS pers com 19 Jul 04 2003 Chesapeake BA, Section 7.2 Normandeau Associates, Inc 2001
17	6 Oct 03	NAE	Kennebec River Doubling Point	S	H <i>Padre Island</i>	Dead	38.1 inches	In hopper	Y We have e-file	Observer incident report Kennebec River BA Jul 04 Memo for Commander, from Bill Kavanaugh, 1 Jul 04 Bill Kavanaugh pers com 15 Jul 04 Julie Crocker pers com 19 Jul 04
18	6 Oct 03	NAE	Kennebec River Doubling Point	S	H <i>Padre Island</i>	Dead	37.0 inches	In hopper Did not dive Probably died	Y We have e-file	Observer incident report Kennebec River BA Jul 04 Memo for Commander, from Bill Kavanaugh, 1 Jul 04 Bill Kavanaugh pers com 15 Jul 04 Julie Crocker pers com 19 Jul 04
19	6 Oct 03	NAE	Kennebec River Doubling Point	S	H <i>Padre Island</i>	Live	Swam away	In hopper	Y We have e-file	Observer incident report Kennebec River BA Jul 04 Memo for Commander, from Bill Kavanaugh, 1 Jul 04 Bill Kavanaugh pers com 15 Jul 04 Julie Crocker pers com 19 Jul 04

## Sturgeon Take Records from Dredging Operations 1990 - Mar 2012

Take #	Date	Corps District	Location	Sp	Dredge Type/ Name	Status	Specimen Description	Notes	Photos	Documentation
20	06 Oct 03	NAE	Kennebec River Doubling Point	S	H <i>Padre Island</i>	Dead	Found alive	In hopper	Y We have e-file	Observer incident report Kennebec River BA Jul 04 Memo for Commander, from Bill Kavanaugh, 1 Jul 04 Bill Kavanaugh pers com 15 Jul 04 Julie Crocker pers com 19 Jul 04
21	08 Oct 03	NAE	Kennebec River Doubling Point	S	H <i>Padre Island</i>	Live	Good condition	In hopper	Y We have e-file	Observer incident report Kennebec River BA Jul 04 Memo for Commander, from Bill Kavanaugh, 1 Jul 04 Bill Kavanaugh pers com 15 Jul 04 Julie Crocker pers com 19 Jul 04
22	07 Jan 04	SAC	Charleston Harbor	A	H <i>Manhattan Island</i>	Live	Whole fish 49 inches total length May have died later when released	Found by Coastwise turtle observers	Yes (We Have e-file)	Robert Chappell pers com 28 Jun 04 Observer daily report 7 Jan 04
23	13 Dec 04	SAM	Gulfport Harbor Channel	G	H <i>Bayport</i>	Dead	Trunk of fish 59.5cm	Found by turtle observers		Observer incident report Susan Rees pers com 7 Jan 05
24a	28 Dec 04	SAM	Mobile Bar Channel	G	H <i>Padre Island</i>	Dead	Trunk of fish 2 ft, 1inch	Found by Turtle observers	Yes (We Have e-file)	Observer incident report Susan Rees pers com 7 Jan 05 #W91278-04-C-0049
24b	01 Jan 05	SAM	Mobile Bar Channel	G	H <i>Padre Island</i>	Dead	Head only of fish 22.5cm	2 <sup>nd</sup> part of take on 28 Dec 04	Yes taken But we Have not received	Observer incident report Susan Rees pers com 7 Jan 05 #W91278-04-C-0049
25	2 Mar 05	SAS	Brunswick Harbor	A	H <i>RN Weeks</i>	Dead	Posterior section only 60 cm section w/tail	Found by turtle observer	Yes (We Have e-file)	Chris Slay pers com 7 Jun 05 Steve Calver pers com 14 Jun 05
26	26 Dec 06	SAS	Brunswick	A	H <i>Newport</i>	Dead	Head only	Caught in port screen and	Black and	Incident and load report

## Sturgeon Take Records from Dredging Operations 1990 - Mar 2012

Take #	Date	Corps District	Location	Sp	Dredge Type/ Name	Status	Specimen Description	Notes	Photos	Documentation
								turtle part caught in starboard screen	White	
27	17 Jan 07	SAS	Savannah Entrance Channel	A	H <i>Glenn Edwards</i>	Dead	Whole fish, FL 104 cm	Fresh Dead, 60 Horseshoe crab in with load	Coastwise took photo	Incident and Load report
28	2 Mar 09	SAS	Savannah Entrance Channel	A	H <i>Dodge Island</i>	Dead	Total Length 111 cm	Fresh Dead, found in starboard aft inflow box, load #42		Incident, Load and Daily report
29	6 Feb 10	SAS	Brunswick Entrance Channel	A	H <i>Glenn Edwards</i>	Dead	No measurements	Fore screen contents, Load #19 with 12 Horseshoe crab		No incident report, just listed on load sheet and daily summary
30	7 Feb 10	SAS	Brunswick Entrance Channel	A	H <i>Glenn Edwards</i>	Dead	No measurements	Fore screen contents, Load #25 with 20 Horseshoe crab		No incident report, just listed on load sheet and daily summary
31	2 Feb 10	SAS	Brunswick Entrance Channel	A	H <i>Bayport</i>	Dead	No measurements, head to mid body in load #193 and mid body to tail recovered in load #194.	Stbd screen contents, load #193 and overflow screen in #194,		No incident report, just listed on load sheet and daily summary
32	7 Dec 10	SAW	Wilmington Harbor	A	H Terrapin Island	Dead	Whole fish, FL 61 cm	Fresh Dead, water temp 12 C, air 2 C, load 6	Coastwise took photo	Incident and Load report
33	10 Apr 11	NAO	York Spit Channel	A	H Terrapin Island	Dead	Total Length 24.5" in, Fork Length 13.5", Middle of anus to Anal Fin 3.8"	During Clean up. Torn in half, only posterior from pectoral region to tail, no head. Fins and tail torn but complete		Hopper daily report from, QCR, e-mail, incident report, daily report, load sheets

## Sturgeon Take Records from Dredging Operations 1990 - Mar 2012

Take #	Date	Corps District	Location	Sp	Dredge Type/ Name	Status	Specimen Description	Notes	Photos	Documentation
34	11Apr 11	NAO	York Spit Channel	A	H Liberty Island	Dead		During cleanup. Another piece taken on 4/13/11 matches perfectly.	Y	E-mail
35	14 Mar 12	SAC	Charleston Harbor Channel	A	H Glenn Edwards	Dead	Fresh dead, body part 26"-30" long X 13" width, no head or tail	Load 129 (0024-0345) found in starboard draghead, during cleanup mode. Given to South Carolina DNR	Yes	E-mail, load sheet, incident report
NT	25 May 05	NAO	York Spit Channel	?	H <i>McFarland</i>	Dead	Approx. 2 ft estimate from photos	Too decomposed to identify	Yes (We Have e-file)	Observer final report, REMSA 2004
NDNEF	26 Jun 96	NAN	East Rock Away Long Island	?	H Dodge Island	Dead	(~3'), couldn't identify and doesn't mention condition (fresh or dead already)? Chris Starbird.	Load sheet states Carp or sturgeon	No	Load sheet, Daily and Weekly Summary mentions. No way to confirm.
NDNEF	About 98	SAW	Wilmington Har Cape Fear River	A	P ??	Dead				NMFS 1998 Shortnose Recovery Plan p. 53
NDNEF	About 98	SAW	Wilmington Har Cape Fear River	A	C	Dead				NMFS 1998 Shortnose Recovery Plan p. 53
NDNEF	About 98	SAJ or SAS	Kings Bay	A	H ??	Dead				NMFS 1998 Shortnose Recovery Plan p. 52 Chris Slay pers com

Sp=sturgeon species

A=Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*)

S=Shortnose sturgeon (*Acipenser brevirostrum*)

G=Gulf sturgeon (*Acipenser oxyrinchus desotoi*)

NT = Non-take incident by dredge

SAC=Charleston

SAW=Wilmington  
SAS=Savannah  
SAJ=Jacksonville  
SAM=Mobile  
NAE=New England  
NAO=Norfolk  
NAN=New York  
NAP=Philadelphia  
H=Hopper  
P=Hydraulic Cutterhead pipeline  
C=Mechanical clamshell or bucket, bucket and barge  
DMA=Dredged material disposal area  
NDNEF=No documentation, no evidence found to confirm citation

## APPENDIX D

### Procedure for obtaining fin clips from sturgeon for genetic analysis

1. Wash hands and use disposable gloves. Ensure that any knife, scalpel or scissors used for sampling has been thoroughly cleaned and wiped with alcohol to minimize the risk of contamination.
2. For any sturgeon, after the specimen has been measured and photographed, take a one-cm square clip from the pelvic fin.
3. Place fin clips in small screw top vials (2 ml screw top plastic vials are preferred) with preservative. Avoid using glass vials.
4. Label each vial with fish's unique ID number that matches the ID number you record on the metadata sheet. This is critical for accurate tracking and record keeping .
5. RNAlater™ is the preferred preservative and is not hazardous. Ninety-five percent absolute ETOH (un-denatured) is an accepted alternative. Note that ETOH is a Class 3 Hazardous Material due to its flammable nature.
6. If non-screw top vials are used, seal individual vials with leak proof positive measure (e.g., tape).
7. Package vials together (e.g., in one box) with an absorbent material within a double-sealed container (e.g., zip lock baggie).
8. If using excepted quantities of ETOH, follow DOT and IATA packaging regulations, including affixing ETOH warning label to air package. Accepted quantities of ETOH is 30 mL per inner package and 1 L for the total package.
9. A sub-sample of the fin clip must be sent to the sturgeon genetics archive at the USGS facility in Leetown, WV.
  - a. Submit sample metadata to [rjohnson1@usgs.gov](mailto:rjohnson1@usgs.gov) with a cc to [incidental.take@noaa.gov](mailto:incidental.take@noaa.gov). Electronic metadata must be provided in order to properly identify and archive samples. A copy of the electronic metadata was emailed to the Federal agency point of contact for this Opinion and a list of the metadata fields is included below. Retain a copy of metadata sheets for your records.
  - b. Mail samples to:  
  

Robin Johnson  
U.S. Geological Survey  
Leetown Science Center  
Aquatic Ecology Branch  
11649 Leetown Road  
Kearneysville, WV 25430
10. Send a subsample and associated metadata to the NMFS-approved lab for processing to determine DPS or river of origin per the agreement you have with that facility.

Metadata to be recorded for each genetic sample submitted to USGS and other NMFS-approved lab:

- Collection Date
- Species (ATS/SNS)
- Collector
- Collector Email
- Collector Phone Number
- Permit/Biological Opinion Number
- Permit Holder, Responsible Party (RP), or Principal Investigator (PI)
- Holder, RP, or PI Email
- Holder, RP, or PI Phone Number
- Unique Fish ID
- PIT Tag Number
- Location Collected
- Latitude
- Longitude
- Fork Length (mm)
- Total Length (mm)
- Weight (g)
- Sex
- Preservative
- Tag Info Available (Y/N)
- Tag Info
- Mortality (Y/N)
- Mortality Type
- Release of Information to Interested Party
- Recapture (Y/N)
- Comments

## **APPENDIX E**

### **Protocol for Collecting Tissue from Sea Turtles for Genetic Analysis**

#### **Materials for Collecting Genetic Tissue Samples**

- < surgical gloves
- < alcohol swabs
- < betadine swabs
- < sterile disposable biopsy punches
- < sterile disposable scalpels
- < permanent marker to externally label the vials
- < scotch tape to protect external labels on the vials
- < pencil to write on internal waterproof label
- < waterproof label, 1/4" x 4"
- < screw-cap vial of saturated NaCl with 20% DMSO\*, wrapped in parafilm
- < piece of parafilm to wrap the cap of the vial after sample is taken
- < vial storage box

\* The 20% DMSO buffer within the vials is nontoxic and nonflammable. Handling the buffer without gloves may result in exposure to DMSO. This substance soaks into skin very rapidly and is commonly used to alleviate muscle aches. DMSO will produce a garlic/oyster taste in the mouth along with breath odor. The protocol requires that you wear gloves each time you collect a sample and handle the buffer vials. **DO NOT** store the buffer where it will experience extreme heat. The buffer must be stored at room temperature or cooler, such as in a refrigerator.

Please collect two small pieces of muscle tissue from all live, comatose, and dead stranded loggerhead, green, leatherback, and hybrid sea turtles (and any hawksbills, although this would be a rare incident). A muscle sample can be obtained no matter what stage of decomposition a carcass is in. Please utilize the equipment in these kits for genetic sampling of **turtles only** and contact the NMFS sea turtle stranding coordinator when you need additional biopsy supplies.

#### **Sampling Protocol for Dead Turtles**

1. Put on a pair of surgical gloves. The best place to obtain the muscle sample is on the ventral side where the front flippers insert near the plastron. It is not necessary to cut very deeply to get muscle tissue.
2. Using a new (sterile and disposable) scalpel cut out two pieces of muscle of a size that will fit in the vial.
3. Transfer both samples directly from the scalpel to a single vial of 20% DMSO saturated with salt.
4. Use the pencil to write the stranding ID, date, species ID and SCL on the waterproof label and place it in the vial with the samples.

5. Label the outside of the vial using the permanent marker with stranding ID, date, species ID and SCL .
6. Apply a piece of clear scotch tape over the what you have written on the outside of the vial to protect the label from being erased or smeared.
7. Wrap parafilm around the cap of the vial by stretching as you wrap.
8. Place the vial in the vial storage box.
9. Complete the Sea Turtle Biopsy Sample Collection Log.
10. Attach a copy of the STSSN form to the Collection Log - be sure to indicate on the STSSN form that a genetic sample was taken.
11. Dispose of the used scalpel and gloves. It is very important to use a new scalpel for each animal to avoid cross contamination.

**At the end of the calendar year submit all genetic samples to:**

**Sea Turtle Stranding Coordinator  
NMFS Protected Resources Division  
55 Great Republic Drive  
Gloucester, MA 01930  
(978)281-9328**

# STURGEON SALVAGE FORM

For use in documenting dead sturgeon in the wild under ESA permit no. 17273 (version 7-24-2015)

**INVESTIGATORS'S CONTACT INFORMATION**  
 Name: First \_\_\_\_\_ Last \_\_\_\_\_  
 Agency Affiliation \_\_\_\_\_ Email \_\_\_\_\_  
 Address \_\_\_\_\_  
 \_\_\_\_\_  
 Area code/Phone number \_\_\_\_\_

**UNIQUE IDENTIFIER (Assigned by NMFS)**  
 \_\_\_\_\_

**DATE REPORTED:**  
 Month  Day  Year 20

**DATE EXAMINED:**  
 Month  Day  Year 20

**SPECIES: (check one)**  
 shortnose sturgeon  
 Atlantic sturgeon  
 Unidentified *Acipenser* species  
 Check "Unidentified" if uncertain.  
 See reverse side of this form for aid in identification.

**LOCATION FOUND:**  Offshore (Atlantic or Gulf beach)  Inshore (bay, river, sound, inlet, etc)  
 River/Body of Water \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_  
 Descriptive location (be specific) \_\_\_\_\_  
 \_\_\_\_\_  
 Latitude \_\_\_\_\_ N (Dec. Degrees) Longitude \_\_\_\_\_ W (Dec. Degrees)

**CARCASS CONDITION at time examined: (check one)**  
 1 = Fresh dead  
 2 = Moderately decomposed  
 3 = Severely decomposed  
 4 = Dried carcass  
 5 = Skeletal, scutes & cartilage

**SEX:**  
 Undetermined  
 Female  Male  
 How was sex determined?  
 Necropsy  
 Eggs/milt present when pressed  
 Borescope

**MEASUREMENTS:** Circle unit  
 Fork length \_\_\_\_\_ cm / in  
 Total length \_\_\_\_\_ cm / in  
 Length  actual  estimate  
 Mouth width (inside lips, see reverse side) \_\_\_\_\_ cm / in  
 Interorbital width (see reverse side) \_\_\_\_\_ cm / in  
 Weight  actual  estimate \_\_\_\_\_ kg / lb

**TAGS PRESENT?** Examined for external tags including fin clips?  Yes  No Scanned for PIT tags?  Yes  No

Tag #	Tag Type	Location of tag on carcass
_____	_____	_____
_____	_____	_____

**CARCASS DISPOSITION: (check one or more)**  
 1 = Left where found  
 2 = Buried  
 3 = Collected for necropsy/salvage  
 4 = Frozen for later examination  
 5 = Other (describe) \_\_\_\_\_

**Carcass Necropsied?**  
 Yes  No  
 Date Necropsied: \_\_\_\_\_  
 Necropsy Lead: \_\_\_\_\_  
 \_\_\_\_\_

**PHOTODOCUMENTATION:**  
 Photos/video taken?  Yes  No  
 Disposition of Photos/Video: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**SAMPLES COLLECTED?**  Yes  No

Sample	How preserved	Disposition (person, affiliation, use)
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

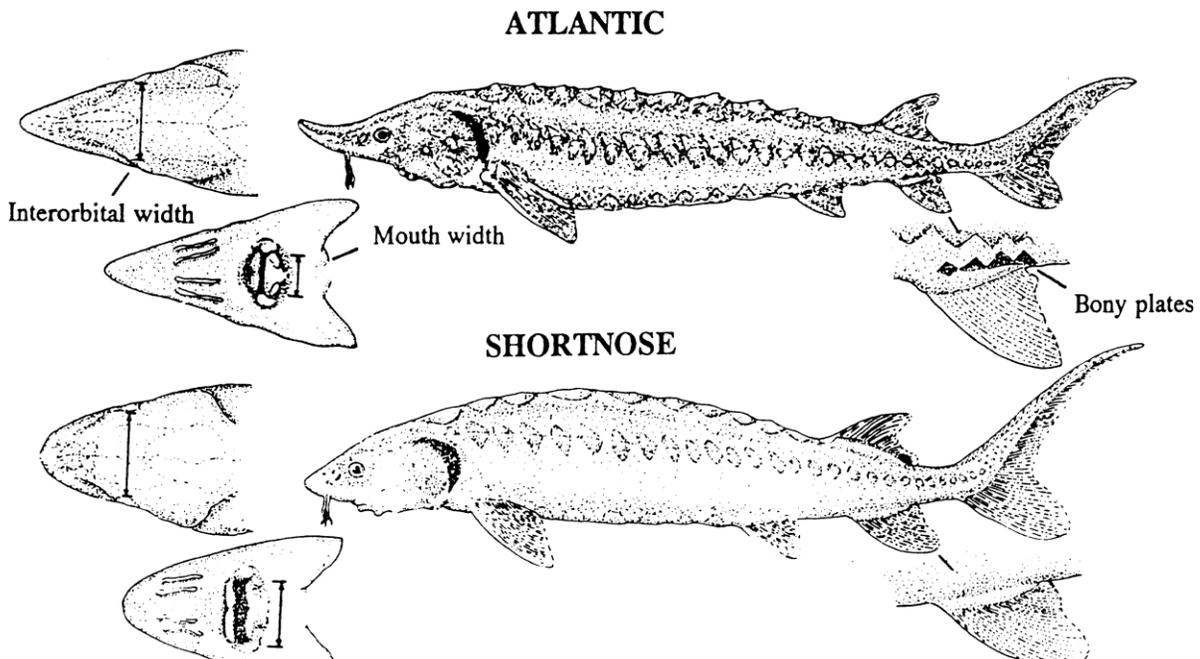
Comments:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Distinguishing Characteristics of Atlantic and Shortnose Sturgeon (version 7-24-2015)

Characteristic	Atlantic Sturgeon, <i>Acipenser oxyrinchus</i>	Shortnose Sturgeon, <i>Acipenser brevirostrum</i>
Maximum length	> 9 feet/ 274 cm	4 feet/ 122 cm
Mouth	Football shaped and small. Width inside lips < 55% of bony interorbital width	Wide and oval in shape. Width inside lips > 62% of bony interorbital width
*Pre-anal plates	Paired plates posterior to the rectum & anterior to the anal fin.	1-3 pre-anal plates almost always occurring as median structures (occurring singly)
Plates along the anal fin	Rhombic, bony plates found along the lateral base of the anal fin (see diagram below)	No plates along the base of anal fin
Habitat/Range	Anadromous; spawn in freshwater but primarily lead a marine existence	Freshwater amphidromous; found primarily in fresh water but does make some coastal migrations

\* From Vecsei and Peterson, 2004



Describe any wounds / abnormalities (note tar or oil, gear or debris entanglement, propeller damage, etc.). Please note if no wounds / abnormalities are found.

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Data Access Policy: Upon written request, information submitted to National Marine Fisheries Service (NOAA Fisheries) on this form will be released to the requestor provided that the requestor credit the collector of the information and NOAA Fisheries. NOAA Fisheries will notify the collector that these data have been requested and the intent of their use.

**Submit completed forms (within 30 days of date of investigation) to: Greater Atlantic Regional Fisheries Office**  
**Contacts** – Edith Carson ([Edith.Carson@noaa.gov](mailto:Edith.Carson@noaa.gov), 978-282-8490) or Lynn Lankshear ([Lynn.Lankshear@noaa.gov](mailto:Lynn.Lankshear@noaa.gov), 978-282-8473);  
**Southeast Region Contact**- Stephania Bolden ([Stephania.Bolden@noaa.gov](mailto:Stephania.Bolden@noaa.gov), 727-551-5768).

**Take Report Form for ESA-Listed Species**  
 Use one form per individual animal taken

**Biological Opinion PCTS No.**

**Species taken:**

Green sea turtle	Atlantic sturgeon
Kemp’s ridley sea turtle	Shortnose sturgeon
Leatherback sea turtle	Unknown sturgeon
Loggerhead sea turtle	Atlantic salmon
Unknown sea turtle	

**Condition when taken (select one):**

Alive	Fresh Dead	Moderately Decomposed
Severely Decomposed	Dried	Skeletal

**Date take observed:**

**Animal was:**

Released alive with no visible injuries

Released alive with visible injuries

Released dead

Held for Necropsy

Transferred to rehabilitation (sea turtles only)

Date: \_\_\_\_\_

Rehabilitation facility: \_\_\_\_\_

**SPECIES CONDITION KEY**

Fresh dead – no foul smell

Moderately decomposed – scutes and skin are intact or just beginning to peel, internal organs intact

Severely decomposed – foul smell with scutes lifting or gone, skin peeling, internal organs beginning to liquefy

Dried carcass – leathery, internal organs have decomposed

Skeletal remains - bones only

**Location of the take:**

Latitude and Longitude in Decimal Degrees to six places:

Latitude: \_\_\_\_\_

Longitude: \_\_\_\_\_

Sediment type in area (e.g., SAV, cobble, silt/mud, shellfish present): \_\_\_\_\_

**Body of water where take occurred:**

Atlantic Ocean

River (name): \_\_\_\_\_

Bay or Sound (name): \_\_\_\_\_

Creek (name): \_\_\_\_\_

**Take activity (select all that apply):**

Pile Driving	Vessel Operation
Bridge/Road Construction	Relocation trawling
Dredging	Blasting
Beach Renourishment	

**If dredging project:**

Type of dredge/name:

Load number:

Location on dredge mechanism where specimen was found (screen, hopper):

Was draghead deflector used:            Yes                    No

Was rigid deflector used:                Yes                    No

Condition of deflector:

Condition of screening or UXO screen:

**If construction project:**

Vessel or Rig Name:

Exclusion Zone, if required:

If installing or extracting piles:

Tools:    Impact Hammer

          Vibratory Hammer

          Other (specify) \_\_\_\_\_

If pile driving:

          Pile Type

          Diameter

          Number

\_\_\_\_\_

If using explosives:

          Type

          Size

          Number

\_\_\_\_\_

**Refer to your Biological Opinion for guidance on handling and resuscitating live animals**

**Indicate type and location of visible injuries (see diagrams). Check all that apply:**

Type of Injury

Dorsal Surface    Ventral Surface -

Cuts/Gashes (not severed)

Severed body, limbs, or organs

Describe injuries and list any missing body parts:

**For live animals - indicate behavior when taken:**

Active (alert, moving head, fins or flippers)

Slow and lethargic (minimal movement and responsiveness)

No movement but may or may not respond to reflex test

**For dead animals, does the BiOp require necropsy:**

Yes

No

**Was resuscitation attempted:**

Yes, length of time \_\_\_\_\_ hours

Outcome:    Alive

Dead

No

N/A, animal confirmed dead, or alive and moving when taken

**Fish measurements in centimeters – measurements should be exact.**

**Provide the reason for any estimated measure (e.g., tail missing)**

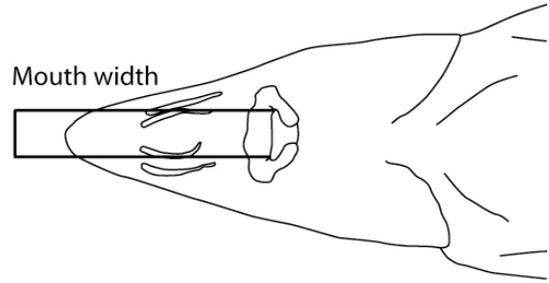
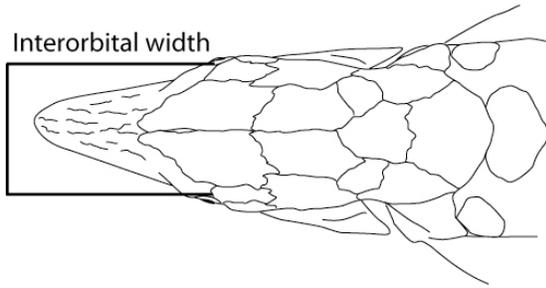
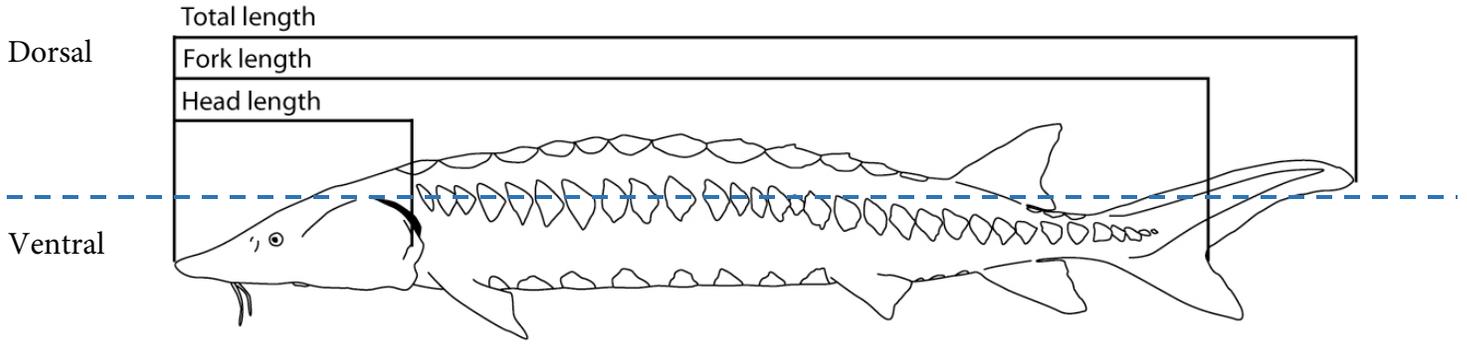
	Exact	Estimated	Reason for Estimated Measure
Total Length: _____ cm			_____
Fork Length: _____ cm			_____
Mouth Width: _____ cm			_____
Interorbital Width: _____ cm			_____

**Turtle measurements in centimeters – measurements should be exact.**

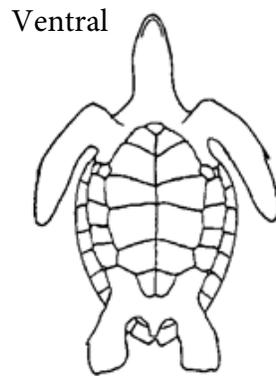
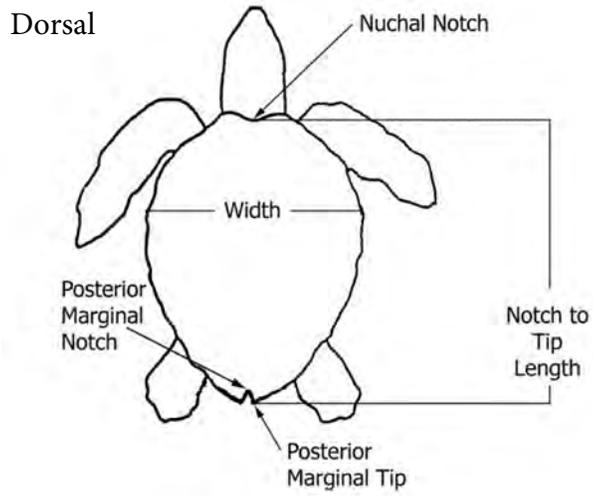
**Provide the reason for any estimated measure (e.g., shell crushed and flattened)**

	Exact	Estimated	Reason for Estimated Measure
Curved Carapace Length: _____ cm (notch to tip length with measuring tape)			_____
Straight Carapace Length: _____ cm (notch to tip length with calipers)			_____
Straight Carapace Width: _____ cm (widest points with calipers)			_____
Weight: _____ kg			_____

# Shortnose and Atlantic Sturgeon -



# Sea Turtles -



**Checklist for samples required to be collected and submitted per the  
BiOp's Standard Operating Procedures, RPMs, and T&Cs**

**Photographs and/or Video:** Submit with this form to **incidental.take@noaa.gov**

**Biopsy punch (sea turtles):** Current Disposition (person/affiliation):

**Fin Clip (fish):** Current Disposition (person/affiliation):

<b>Tags present<sup>1</sup>:</b>	<b>Type (e.g., PIT, flipper)</b>	<b>Number</b>	<b>Location on animal</b>
----------------------------------	----------------------------------	---------------	---------------------------

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

<b>Tags inserted or applied<sup>1</sup>:</b>	<b>Type (e.g., PIT, flipper)</b>	<b>Number</b>	<b>Location on animal</b>
--	----------------------------------	---------------	---------------------------

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

<sup>1</sup> For sturgeon, also send PIT tag #, date, location, and length to [Mike\\_mangold@fws.gov](mailto:Mike_mangold@fws.gov).

**Contact information for person completing this form**

Name:

Email:

Phone Number:

Agency/Organization name if other than the Federal Action Agency for the BiOp:

## APPENDIX H

### **Sea Turtle Trawling and Relocation Guidelines** (as derived from ACOE South Atlantic Division protocol)

Note that: In this BO, NMFS has determined that relocation trawling is necessary to minimize the take of sea turtles in dredging operations. NMFS has also determined that handling and measuring as outlined in the ITS is necessary to monitor the take of sea turtles. Additionally, NMFS has determined that genetic sampling of dead sea turtles is necessary to monitor take. However, external or internal sampling procedures (e.g., flipper tagging, PIT tagging, blood letting, skin tag sampling, laparoscopies, gastric lavages, mounting satellite or radio transmitters, genetics sampling, etc.) performed on live sea turtles are not permitted under this BO unless the observer holds a valid sea turtle research permit (obtained pursuant to section 10 of the ESA, from the NMFS' Office of Protected Resources, Permits Division) authorizing sampling, either as the permit holder, or as designated agent of the permit holder.

#### **Sea turtle trawling procedures**

1. Trawling shall be conducted under the supervision of a biologist approved by the NMFS. A letter stating that NMFS has approved the supervising biologist must be obtained prior to the commencement of trawling.
2. Sea turtles captured pursuant to relocation trawling shall be handled in a manner designed to ensure their safety and viability, and shall be released over the side of the vessel, away from the propeller, and only after ensuring that the vessel's propeller is in the neutral, or disengaged, position (i.e., not rotating). Captured turtles shall be kept moist, and shaded whenever possible, until they are released. Resuscitation guidelines are included in part in Appendix C.
3. Any turtles captured during the survey shall be measured in accordance with standard biological sampling procedures prior to release, and weighed when possible. Sampling data shall be recorded on the Sea Turtle Relocation Report (Appendix I).
4. Turtles shall be kept no longer than 12 hours prior to release and shall be released at least 3 miles away from the dredge site (if it can be done safely, turtles may be transferred onto another vessel for transport to the release area to enable the relocation trawler or relative abundance trawler to keep sweeping the dredge site without interruption).
7. The trawler will be equipped with two 60-foot nets constructed from 8-inch mesh (stretch) fitted with mud rollers and flats as specified in the Turtle Trawl Nets Specifications. Paired net tows will be made for 10 to 12 hours per day or night. Trawling will be conducted with the tidal flow using repetitive 15-30 minute (total time) tows in the channel. Tows will be made in the center, green and red sides of the channel such that the total width of the channel bottom is sampled. Positions at the beginning and end of each tow will be determined from GPS Positioning equipment. Trawl speeds shall not exceed 3.5 knots. Tow speed will be recorded at the approximate midpoint of each tow.

7. Methods and equipment will be standardized including data sheets, nets, trawling direction to tide, length of station, length of tow, and number of tows per station. Water temperature measurements will be taken at the water surface each day using a laboratory thermometer. Data on each tow, including weather conditions, air temperature, wind velocity and direction, sea state-wave height, and precipitation, will be recorded on the Sea Turtle Trawling Report.
8. Before trawling begins, the necessary state permits for trawling in Virginia state waters must be obtained from the appropriate party (e.g., State of Virginia, Virginia Marine Resources Commission).

## Turtle Trawl Nets Specifications

**DESIGN:** 4 seam, 4 legged, 2 bridal trawl net

**WEBBING:** 4 inch bar, 8 inch stretch

top - 36 gauge twisted nylon dipped

side - 36 gauge twisted nylon dipped

bottom - 84 gauge braided nylon dipped

**NET LENGTH:** 60 ft from cork line to cod end

**BODY TAPER:** 2 to 1

**WING END HEIGHT:** 6 ft

**CENTER HEIGHT:** Dependent on depth of trawl 14 to 18 ft

**COD END:** Length 50 meshes x 4" = 16.7 ft

Webbing 2 inch bar, 4 inch stretch, 84 gauge braid nylon dipped, 80 meshes around, 40 rigged meshes with 1/4 x 2 inch choker rings, 1 each 1/2 x 4 inch at end

cod end cover - none

chaffing gear - none

**HEAD ROPE:** 60 ft 1/2 inch combination rope (braid nylon with stainless cable center)

**FOOT ROPE:** 65 ft 1/2 inch combination rope

**LEG LINE:** top - 6 ft, bottom 6 - ft

**FLOATS:** size - tuna floats (football style), diameter - 7 inch length - 9 inch, number - 12 each, spacing - center on top net 2 inches apart

**MUD ROLLERS:** size 5 inch diameter 5.5 inch length, number - 22 each, spacing - 3 ft attached with 3/8 inch polypropelene rope (replaced with snap on rollers when broken)

**TICKLER CHAINS:** NONE (discontinued- but previously used 1/4 inch x 74 ft galvanized chain)

**WEIGHT:** 20 ft of 1/4 inch galvanized chain on each wing, 40 ft per net looped and tied

**DOOR SIZE:** 7 ft x 40 inches (or 8 ft x 40 inches), Shoe - 1 inch x 6 inch, bridles - 3/8 inch high test chain

**CABLE LENGTH** (bridle length, total): 7/16 inch x 240-300 ft varies with bottom conditions

**FLOAT BALL:** none

**LAZY LINES:** 1 inch nylon

**PICKUP LINES:** 3/8 inch polypropelene

**WHIP LINES:** 1 inch nylon

**APPENDIX I**

**RELOCATION TRAWLING REPORT**

**Part 1 - Sea Turtle Relocation Report**

*(Note that any other reporting form submitted for turtles taken in trawling activities related to maintenance dredging should include the following information.)*

Channel: \_\_\_\_\_ Date: \_\_\_\_\_  
Tow #: \_\_\_\_\_ Net (circle): Port Starboard  
Day of trawling effort (e.g., 3<sup>rd</sup> day) \_\_\_\_\_ Hour of trawling effort (that day) \_\_\_\_\_  
Water depth \_\_\_\_\_ Water temperature \_\_\_\_\_  
Other environmental  
conditions \_\_\_\_\_

Describe capture location (include state, county, lat and long): \_\_\_\_\_

Describe capture method and/or type of gear in use when turtle was caught: \_\_\_\_\_

**Species Information:** *(please designate cm/m or inches.)*

Species \_\_\_\_\_ Weight (kg or lbs) \_\_\_\_\_  
Sex (circle): Male Female Unknown How was sex determined? \_\_\_\_\_  
Straight carapace length \_\_\_\_\_ Straight carapace width \_\_\_\_\_  
Curved carapace length \_\_\_\_\_ Curved carapace width \_\_\_\_\_  
Plastron length \_\_\_\_\_ Plastron width \_\_\_\_\_  
Tail length \_\_\_\_\_ Head width \_\_\_\_\_  
Condition of specimen/description of animal \_\_\_\_\_

**Existing Flipper Tag Information**

Left \_\_\_\_\_ Right \_\_\_\_\_  
PIT Tag # \_\_\_\_\_

**Miscellaneous:**

Genetic biopsy taken: YES NO  
Photos Taken: YES NO Is this a Recapture: YES NO

**Turtle Release Information:**

Date \_\_\_\_\_ Time \_\_\_\_\_  
Lat \_\_\_\_\_ Long \_\_\_\_\_  
State \_\_\_\_\_ County \_\_\_\_\_

**Remarks:** (note if turtle was involved with tar or oil, gear or debris entanglement, wounds or mutilations, propellor damage, papillomas, old tag locations, etc.)

\_\_\_\_\_  
\_\_\_\_\_

Part 2-

### Sturgeon Relocation Form

Channel: \_\_\_\_\_ Date: \_\_\_\_\_  
Tow #: \_\_\_\_\_ Net (circle): Port Starboard  
Day of trawling effort (e.g., 3<sup>rd</sup> day) \_\_\_\_\_ Hour of trawling effort (that day) \_\_\_\_\_  
Water depth \_\_\_\_\_ Water temperature \_\_\_\_\_  
Other environmental  
conditions \_\_\_\_\_

Describe capture location (include state, county, lat and long): \_\_\_\_\_

Describe capture method and/or type of gear in use when turtle was caught: \_\_\_\_\_

**Species Information:** *(please designate cm/m or inches.)*

Species \_\_\_\_\_ Weight (kg or lbs) \_\_\_\_\_  
Length (TL) \_\_\_\_\_ Length (FL) \_\_\_\_\_  
Condition of specimen/description of animal \_\_\_\_\_

**Existing Tag Information**

PIT Tag # \_\_\_\_\_

**Other Tags:** \_\_\_\_\_

**Miscellaneous:**

Fin clip taken: YES NO

Photos Taken: YES NO

Is this a Recapture: YES NO

**Release Information:**

Date \_\_\_\_\_ Time \_\_\_\_\_

Lat \_\_\_\_\_ Long \_\_\_\_\_

State \_\_\_\_\_ County \_\_\_\_\_

**Remarks:** (note if fish was involved with tar or oil, gear or debris entanglement, wounds or mutilations, propellor damage, old tag locations, etc.)

\_\_\_\_\_  
\_\_\_\_\_

## APPENDIX J

### MONITORING SPECIFICATIONS FOR DREDGES

#### Part 1. – HOPPER DREDGES

##### I. EQUIPMENT SPECIFICATIONS

###### A. Baskets or screening

Baskets or screening must be installed over the hopper inflows with openings no smaller than 4 inches by 4 inches to provide 100% coverage of all dredged material and shall remain in place during all dredging operations. Baskets/screening will allow for better monitoring by observers of the dredged material intake for sea turtles, sturgeon and their remains. The baskets or screening must be safely accessible to the observer and designed for efficient cleaning.

###### B. Draghead

The draghead of the dredge shall remain on the bottom **at all times** during a pumping operation, except when:

- 1) the dredge is not in a pumping operation, and the suction pumps are turned completely off;
- 2) the dredge is being re-oriented to the next dredge line during borrow activities; and
- 3) the vessel's safety is at risk (i.e., the dragarm is trailing too far under the ship's hull).

At initiation of dredging, the draghead shall be placed on the bottom during priming of the suction pump. If the draghead and/or dragarm become clogged during dredging activity, the pump shall be shut down, the dragarms raised, whereby the draghead and/or dragarm can be flushed out by trailing the dragarm along side the ship. If plugging conditions persist, the draghead shall be placed on deck, whereby sufficient numbers of water ports can be opened on the draghead to prevent future plugging.

Upon completion of a dredge track line, the drag tender shall:

- 1) throttle back on the RPMs of the suction pump engine to an idling speed (e.g., generally less than 100 RPMs) **prior to** raising the draghead off the bottom, so that no flow of material is coming through the pipe into the dredge hopper. Before the draghead is raised, the vacuum gauge on the pipe should read zero, so that no suction exists both in the dragarm and draghead, and no suction force exists that can impinge a turtle on the draghead grate;
- 2) hold the draghead firmly on the bottom with no flow conditions for approximately 10 to 15 seconds before raising the draghead; then, raise the draghead quickly off the bottom and up to a mid-water column level, to further reduce the potential for any adverse interaction with nearby turtles;

- 3) re-orient the dredge quickly to the next dredge line; and
- 4) re-position the draghead firmly on the bottom prior to bringing the dredge pump to normal pumping speed, and re-starting dredging activity.

#### C. Floodlights

Floodlights must be installed to allow the NMFS-approved observer to safely observe and monitor the baskets or screens.

#### D. Intervals between dredging

Sufficient time must be allotted between each dredging cycle for the NMFS-approved observer to inspect and thoroughly clean the baskets and screens for sea turtles and/or turtle parts and document the findings. Between each dredging cycle, the NMFS-approved observer should also examine and clean the dragheads and document the findings.

## II. OBSERVER PROTOCOL

#### A. Basic Requirement

A NMFS-approved observer with demonstrated ability to identify sea turtle and sturgeon species must be placed aboard the dredge(s) being used, starting immediately upon project commencement to monitor for the presence of listed species and/or parts being entrained or present in the vicinity of dredge operations.

#### B. Duty Cycle

Observers are required at times and locations outlined in the ITS. While onboard, the observer must work a shift schedule appropriate to allow for the observation of at least 50% of the dredge loads (e.g., 12 hours on, 12 hours off). The USACE shall require of the dredge operator that, when the observer is off watch, the cage shall not be opened unless it is clogged. The USACE shall also require that if it is necessary to clean the cage when the observer is off watch, any aquatic biological material is left in the cage for the observer to document and clear out when they return on duty. In addition, the observer shall be the only one allowed to clean off the overflow screen.

#### C. Inspection of Dredge Spoils

During the required inspection coverage, the trained NMFS-approved observer shall inspect the galvanized screens and baskets at the completion of each loading cycle for evidence of sea turtles or shortnose sturgeon. The Endangered Species Observation Form shall be completed for each loading cycle, whether listed species are present or not. If any whole (alive or dead) or turtle parts are taken incidental to the project(s), NMFS Protected Resources Division must be contacted by phone (978-281-9328) or e-mail ([incidental.take@noaa.gov](mailto:incidental.take@noaa.gov)) within 24 hours of the take. An incident report for sea turtle/shortnose sturgeon take (Appendix E) shall also be completed by the observer and sent via FAX 978) 281-9394 or e-mail ([incidental.take@noaa.gov](mailto:incidental.take@noaa.gov)) within 24 hours of the take. Incident reports shall be completed for

every take regardless of the state of decomposition. NMFS will determine if the take should be attributed to the incidental take level, after the incident report is received. Every incidental take (alive or dead, decomposed or fresh) should be photographed, and photographs shall be sent to NMFS either electronically ([incidental.take@noaa.gov](mailto:incidental.take@noaa.gov)) or through the mail. Weekly reports, including all completed load sheets, photographs, and relevant incident reports, as well as a final report, shall be submitted to NMFS NER, Protected Resources Division, 55 Great Republic Drive, Gloucester, MA 01930-2298.

#### D. Information to be Collected

For each sighting of any endangered or threatened marine species (including whales as well as sea turtles), record the following information on the Endangered Species Observation Form (Appendix E):

- 1) Date, time, coordinates of vessel
- 2) Visibility, weather, sea state
- 3) Vector of sighting (distance, bearing)
- 4) Duration of sighting
- 5) Species and number of animals
- 6) Observed behaviors (feeding, diving, breaching, etc.)
- 7) Description of interaction with the operation

#### E. Disposition of Parts

If any whole turtles or sturgeon (alive or dead, decomposed or fresh) or turtle or shortnose sturgeon parts are taken incidental to the project(s), NMFS Protected Resources must be contacted within 24 hours of the take (phone: 978-281-9328 or e-mail ([incidental.take@noaa.gov](mailto:incidental.take@noaa.gov))). All whole dead sea turtles or sturgeon, or turtle or shortnose sturgeon parts, must be photographed and described in detail on the Incident Report of Sea Turtle Mortality (Appendix E). The photographs and reports should be submitted by email ([incidental.take@noaa.gov](mailto:incidental.take@noaa.gov)) or mail (Attn: Section 7 Coordinator, NMFS, Protected Resources Division, 55 Great Republic Drive, Gloucester, MA 01930-2298). After NMFS is notified of the take, it may instruct the observer to save the animal for future analysis if there is freezer space. Disposition of dead sea turtles/ sturgeon will be determined by NMFS at the time of the take notification. If the species is unidentifiable or if there are entrails that may have come from a turtle, the subject should be photographed, placed in plastic bags, labeled with location, load number, date and time taken, and placed in cold storage.

Live turtles (both injured and uninjured) should be held onboard the dredge until transported as soon as possible to the appropriate stranding network personnel for rehabilitation (Appendix C). No live turtles should be released back into the water without first being checked by a qualified veterinarian or a rehabilitation facility. The NMFS Stranding Network Coordinator ((978) 282-8470) should also be contacted immediately for any marine mammal injuries or mortalities.

### III. OBSERVER REQUIREMENTS

Submission of resumes of endangered species observer candidates to NMFS for final approval ensures that the observers placed onboard the dredges are qualified to document takes of endangered and threatened species, to confirm that incidental take levels are not exceeded, and to provide expert advice on ways to avoid impacting endangered and threatened species. NMFS does not offer certificates of approval for observers, but approves observers on a case-by-case basis.

#### A. Qualifications

Observers must be able to:

- 1) differentiate between leatherback (*Dermochelys coriacea*), loggerhead (*Caretta caretta* , Kemp's ridley (*Lepidochelys kempii*), green (*Chelonia mydas*), and hawksbill (*Eretmochelys imbricata*) turtles and their parts, and shortnose (*Acipenser brevirostrum* and Atlantic (*Acipenser oxyrinchus oxyrinchus*) sturgeon and their parts;
- 2) handle live sea turtles and sturgeon and resuscitate and release them according accepted procedures;
- 3) correctly measure the total length and width of live and whole dead sea turtle and sturgeon species;
- 4) observe and advise on the appropriate screening of the dredge's overflow, skimmer funnels, and dragheads; and
- 5) identify marine mammal species and behaviors.

#### B. Training

Ideally, the applicant will have educational background in marine biology, general experience aboard dredges, and hands-on field experience with the species of concern. For observer candidates who do not have sufficient experience or educational background to gain immediate approval as endangered species observers, the below observer training is necessary to be considered admissible by NMFS. We can assist the USACE by identifying groups or individuals capable of providing acceptable observer training. Therefore, at a minimum, observer training must include:

- 1) instruction on how to identify sea turtles and sturgeon and their parts;
- 2) instruction on appropriate screening on hopper dredges for the monitoring of sea turtles and sturgeon (whole or parts);
- 3) demonstration of the proper handling of live sea turtles and sturgeon incidentally captured during project operations. Observers may be required to resuscitate sea turtles according to accepted procedures prior to release;
- 4) instruction on standardized measurement methods for sea turtle and sturgeon lengths and widths; and

- 5) instruction on how to identify marine mammals; and
- 6) instruction on dredging operations and procedures, including safety precautions onboard a vessel.

## **Part 2. MECHANICAL DREDGES**

### **I. EQUIPMENT SPECIFICATIONS**

#### **A. Floodlights**

Should dredging occur at night or in poor lighting conditions, floodlights must be installed to allow the NMFS-approved observer to safely observe and monitor dredge bucket and scow.

#### **B. Intervals between dredging**

Sufficient time must be allotted between each dredging cycle for the NMFS-approved observer to inspect the dredge bucket and scow for shortnose sturgeon and/or sturgeon parts and document the findings.

### **II. OBSERVER PROTOCOL**

#### **A. Basic Requirement**

A NMFS-approved observer with demonstrated ability to identify shortnose sturgeon must be placed aboard the dredge(s) being used; starting immediately upon project commencement to monitor for the presence of listed species and/or parts being taken or present in the vicinity of dredge operations.

#### **B. Duty Cycle**

A NMFS-approved observer must be onboard during dredging until the project is completed. While onboard, observers shall provide the required inspection coverage to provide 100% coverage of all dredge-cycles.

#### **C. Inspection of Dredge Spoils**

During the required inspection coverage, the NMFS-approved observer shall observe the bucket as it comes out of the water and as the load is deposited into the scow during each dredge cycle for evidence of shortnose sturgeon. If any whole sturgeon (alive or dead) or sturgeon parts are taken incidental to the project(s), NMFS must be contacted **within 24 hours** of the take (phone: 978-281-9328 or email ([incidental.take@noaa.gov](mailto:incidental.take@noaa.gov))). An incident report for sturgeon take shall also be completed by the observer and sent to NMFS via FAX (978) 281-9394 or e-mail ([incidental.take@noaa.gov](mailto:incidental.take@noaa.gov)) within 24 hours of the take. Incident reports shall be completed for every take regardless of the state of decomposition. Every incidental take (alive or dead, decomposed or fresh) must be photographed. A final report including all completed load sheets,

photographs, and relevant incident reports are to be submitted to the attention of the Section 7 Coordinator, NMFS Protected Resources Division, 55 Great Republic Drive, Gloucester, MA 01930.

#### D. Inspection of Disposal

The NMFS-approved observer shall observe all disposal operations to inspect for any whole sturgeon or sturgeon parts that may have been missed when the load was deposited into the scow. If any whole sturgeon (alive or dead) or sturgeon parts are observed during disposal operation, the procedure for notification and documentation outlined above should be completed.

#### E. Disposition of Parts

As required above, NMFS must be contacted as soon as possible following a take. Any dead sturgeon should be refrigerated or frozen until disposition can be discussed with NMFS. Under no circumstances should dead sturgeon be disposed of without confirmation of disposition details with NMFS.

### III. OBSERVER REQUIREMENTS

Submission of resumes of endangered species observer candidates to NMFS for final approval ensures that the observers placed onboard the dredges are qualified to document takes of endangered and threatened species, to confirm that incidental take levels are not exceeded, and to provide expert advice on ways to avoid impacting endangered and threatened species. NMFS does not offer certificates of approval for observers, but approves observers on a case-by-case basis.

#### A. Qualifications

Observers must be able to:

- 1) differentiate between shortnose (*Acipenser brevirostrum*) and Atlantic (*Acipenser oxyrinchus oxyrinchus*) sturgeon and their parts;
- 2) handle live sturgeon;
- 3) correctly measure the total length and width of live and whole dead sturgeon species;

#### B. Training

Ideally, the applicant will have educational background in biology, general experience aboard dredges, and hands-on field experience with the species of concern. For observer candidates who do not have sufficient experience or educational background to gain immediate approval as endangered species observers, we note below the observer training necessary to be considered admissible by NMFS. We can assist the USACE by identifying groups or individuals capable of providing acceptable observer training. Therefore, at a minimum, observer training must include:

- 1) instruction on how to identify sturgeon and their parts;
- 2) instruction on appropriate screening on hopper dredges for the monitoring of sturgeon whole or parts);
- 3) demonstration of the proper handling of live sturgeon incidentally captured during project operations;
- 4) instruction on standardized measurement methods for sturgeon lengths and widths; and
- 5) instruction on dredging operations and procedures, including safety precautions onboard.

## SEA TURTLE HANDLING AND RESUSCITATION REQUIREMENTS



**IF YOU ENCOUNTER AN ENTANGLED, INJURED OR UNRESPONSIVE SEA TURTLE,**  
*please immediately call the National Marine Fisheries Service Northeast Region Hotline:*

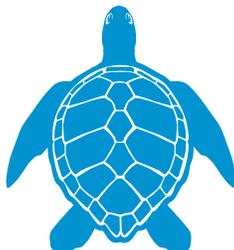
**866-755-NOAA (6622)**

Any sea turtle taken incidentally during fishing must be handled with care to prevent injury, observed for activity, and returned to the water according to the following procedures:

**A** A SEA TURTLE THAT IS ACTIVELY MOVING OR IS DEAD (THAT IS, IF MUSCLES ARE STIFF AND/OR THE FLESH HAS BEGUN TO ROT) MUST BE RELEASED OVER THE VESSEL'S STERN ONLY:

- When fishing gear is not in use,
- When the engine is in neutral, and
- In areas where the turtle is unlikely to be recaptured or injured by vessels.

OTHERWISE, YOU MUST CONSIDER THE TURTLE UNRESPONSIVE AND ATTEMPT RESUSCITATION AS DESCRIBED IN **B**.



You are strongly encouraged to read the full regulation, which can be found at 50 CFR 223.206(d)(1).

**B** YOU MUST ATTEMPT RESUSCITATION ON SEA TURTLES THAT ARE UNRESPONSIVE AS FOLLOWS:

**1** Place the turtle top shell up\* and elevate its hindquarters at least 6" (or 15-30°) for at least 4 hours and up to 24 hours.

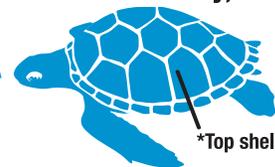
- The amount of elevation depends on the turtle's size; larger turtles require greater elevation.
- In warm weather (over 60 °F), keep the turtle shaded and moist, preferably by placing a damp towel over the head, shell, and flippers. You must NOT place the turtle into a container of water.

**2** Periodically rock the turtle gently side to side by holding the outer edge of the shell and lifting one side about 3", then alternate to the other side.

**3** Periodically gently touch the eye and pinch the tail (reflex tests) to see if there is a response.

**C** IF THE TURTLE REVIVES AND BECOMES ACTIVE DURING RESUSCITATION EFFORTS, you must release it over the vessel's stern as described in **A**.

If the turtle does not respond to the reflex test (as described in **B 3**) or move within 4 hours (up to 24 hours, if possible), you must return the turtle to the water in the same manner.



## APPENDIX K

### Sea turtle handling and resuscitation measures as found at 50 CFR 223.206(d)(1).

(d) (1) (i) Any specimen taken incidentally during the course of fishing or scientific research activities must be handled with due care to prevent injury to live specimens, observed for activity, and returned to the water according to the following procedures.

(A) Sea turtles that are actively moving or determined to be dead as described in (d)(1)(i)(C) of this section must be released over the stern of the boat. In addition, they must be released only when fishing or scientific collection gear is not in use, when the engine gears are in neutral position, and in areas where they are unlikely to be recaptured or injured by vessels.

(B) Resuscitation must be attempted on sea turtles that are comatose, or inactive, as determined in paragraph (d)(1) of this section by:

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

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

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

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

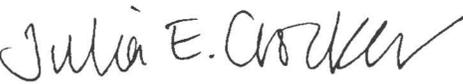


UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL MARINE FISHERIES SERVICE  
GREATER ATLANTIC REGIONAL FISHERIES OFFICE  
55 Great Republic Drive  
Gloucester, MA 01930-2276

NOV 27 2017

**MEMORANDUM FOR:** The File

**FROM:**

Julie Crocker   
Acting Assistant Regional Administrator for Protected Resources

**SUBJECT:**

Characteristics and process for when strandings should be considered hopper dredge takes

Sea turtles are occasionally taken in hopper dredging activities. Observers are typically placed on hopper dredges to monitor the intake for turtles or turtle parts. Turtles that interact with hopper dredges often have the same characteristics. Sometimes, strandings are found with injuries that are consistent with those seen by observers onboard hopper dredges. Such strandings can involve dead turtles washed up on the beach, found in the dredge material or pipeline, or found floating in nearshore waters. In the Greater Atlantic Region, most of the sea turtle/hopper dredge interactions have occurred in Virginia. The Incidental Take Statement (ITS) of the 2012 Biological Opinion on the maintenance of Chesapeake Bay Entrance Channels notes that "...should we receive any reports of injured or killed sea turtles or sturgeon in the area (i.e., via the STSSN [Sea Turtle Stranding and Salvage Network]) and necropsy documents that interactions with the hopper dredge operating during this project was the cause of death, we will consider those animals to be taken by this action." As such, it is important to explore the characteristics of hopper dredge interactions in order to determine when a dredge can be positively identified as the cause of death in a stranding. This information is critical for monitoring sea turtle takes against the authorized takes contained in the ITS of a Biological Opinion.

The characteristics outlined below have been observed in sea turtle interactions with hopper dredges; however, not every dredge interaction shows all of these characteristics. The Virginia Aquarium and Marine Science Center previously explored this issue to determine whether trauma in stranded turtles is consistent with observed dredge takes (Trapani *et al.* 2008). We referred to this information in the development of these criteria. The 2012 Chesapeake Bay dredging Biological Opinion notes that a necropsy is needed to document dredging as the cause of death. We will share these criteria with the appropriate STSSN partner and work with them to ensure necropsies are conducted, whenever possible, on strandings that exhibit potential dredge-related injuries (as outlined below). A necropsy isn't necessarily required to determine a stranding was related to dredge activity (through the process outlined below); however, a necropsy may be needed to attribute the take towards the ITS in some Biological Opinions (e.g., Chesapeake Bay dredging). These criteria will apply to all areas where suspect dredge strandings are found, not only in Virginia.



## Characteristics

### **Injury type**

To assign take of a turtle with an unknown cause of death to a dredge ITS, the turtle must exhibit injuries inconsistent with another mortality source (e.g., no ligature injuries or serial parallel wounds as would be seen in fishery interactions or vessel strikes, respectively). The types of injuries occurring from hopper dredge interactions may include:

- Crushing wounds/injuries;
- Partial carapace or body part<sup>1</sup>;
- Jagged edges to injury;
- Internal organs completely or partially missing or displaced;
- Excoriated skin injuries; or
- Peeling or missing scutes, not related to decomposition, around injury area.

### **Other characteristics**

- Heavy inundation of the body cavity, organs, and/or tissue (especially open wounds) by mud, silt, or other sediment; or
- Hopper dredging occurring in the area within the last one to two weeks.  
When evaluating whether a stranding would be attributable to a dredging ITS, all possible mortality sources will be considered. Any mortality source that may result in characteristics similar to those outlined here will be reviewed. Current and past hopper dredging activity and location (within two states of the stranding location) will be documented and environmental conditions (e.g., currents, wind patterns) will be evaluated to determine if a stranding in a certain location may be related to local dredge activity. The condition of the stranding in relation to the location of the dredging activity will also be considered.

## Process

When a stranding is documented with one or more of the injury characteristics noted above, the following steps will occur in order to ascertain whether the dredge was the cause of turtle death.

- STSSN responder will fill out the STSSN form and note on the top of the form that the case is a suspect dredge interaction.
- STSSN responder will perform a necropsy, if possible.
- The STSSN form and any necropsy results will be forwarded to the GARFO STSSN coordinator within three working days.
- A team of three GARFO Protected Resources Division biologists<sup>2</sup> will review the case, considering the characteristics presented in this memo, as well as the STSSN data. If a necropsy was not completed, the team will review all relevant information available, as the completion of a necropsy should not preclude a determination.
- The team will discuss the case and make a consensus determination as to whether the stranding represents a dredge take and should be counted towards an ITS. The relevant ITS will also be identified.

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<sup>1</sup> A partial carapace or body part may also be seen with vessel strikes, so this injury descriptor would need to be evaluated in conjunction with the other injury types.

<sup>2</sup> The team will include two sea turtle biologists and one section 7 biologist. While staff may change, the team currently includes Zach Jylkka, Kate Sampson, and Carrie Upite (lead).

- A memo from the team lead to the GARFO Assistant Regional Administrator for Protected Resources will be prepared with the team's rationale.
- GARFO section 7 staff will inform and distribute the associated rationale to the lead action agency (typically the Army Corps of Engineers).
- If determined to be a dredge take, the interaction will be included in the respective incidental take reporting logs.

#### **Literature Cited**

Trapani, C.M., D.D. Boyd and P.D. Bargo. 2008. Sea Turtle/Dredge Interactions in Virginia, USA: A Diagnostic View of Observed Takes vs. Strandings. Page 131 in: Kalb, H., Rohde, A., Gayheart, K. and Shanker, K., compilers. Proceedings of the Twenty-Fifth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-582. 204 pp.