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

December 20, 2018

Operations Branch

Louis A. Chiarella
Assistant Regional Administrator
NOAA Fisheries
Habitat Conservation Division
55 Great Republic Drive
Gloucester, MA 01930

Subject: Federal Agency Response - Sandbridge Beach Erosion Control and Hurricane Protection Project Essential Fish Habitat Conservation Recommendations

Mr. Chiarella:

This letter is in response to the Essential Fish Habitat (EFH) conservation recommendations for the Sandbridge Beach Erosion Control and Hurricane Protection Project located in Virginia Beach, Virginia. Pursuant to Section 305(b)(4)(A) of the Magnuson-Stevens Fisheries Conservation and Management Act (MSA), the National Marine Fisheries Service (NMFS) provided numerous conservation recommendations to the U.S. Army Corps of Engineers, Norfolk District (USACE) and their cooperating agency, the Bureau of Ocean Energy Management (BOEM). Since the initial Sandbridge Beach Erosion Control and Hurricane Protection project was constructed in 1998, there have been three beach nourishment maintenance cycles (2002, 2007, and 2013) with dredged material placed from the Sandbridge Shoal Borrow Sites A and B. The following is the USACE's formal response to those recommendations for the Sandbridge Beach Erosion Control and Hurricane Protection Project as required by 50 Code of Federal Regulations (CFR) 600.920.

<u>Responses to General EFH Conservation Recommendations:</u>

- *Conduct a pre-dredge vibracore survey to identify shoal areas of beach quality sand to minimize the dredge footprint and duration which the dredge operates and review these findings with us prior to dredging.*

Vibracore sampling of the Sandbridge borrow sites was performed in 2018. Due to funding constraints, vibracore sampling was not performed throughout the entire borrow site areas. Within the areas that were sampled in the borrow areas, it was determined that there are 28.5 million cubic yards of beach compatible sand. Attached is a copy of the report.

- *While dredging, follow the existing bottom contours to the maximum extent practicable to maintain seafloor ridge and swale heterogeneity. Do not exceed 6.6 ft. (2 m) of dredge cut to any ridge or swale. Incorporate the proposed operational BMPs into hydraulic dredge operation to minimize entrainment of aquatic organisms.*

Dredging will follow the existing bottom contours to the maximum extent practicable to maintain seafloor ridge and swale heterogeneity. Limiting dredging to 6.6 feet would impact a greater surface area due to the need for wider geographical coverage to achieve the same volume of material at lower allowable dredge depth. It would also increase hopper transit and construction costs to obtain borrow material. In coordination with BOEM, dredging will not exceed 10 feet to prevent the formation of deep pits with the potential for anoxic zones. This slightly deeper depth will minimize the surficial dredging footprint while maintaining existing suitable benthic and fish habitat. Best management plans such as the use of turtle deflectors, placement of the drag head on the bottom during priming, and shutting down pumps prior to raising the drag arm will minimize entrainment of aquatic organisms.

- *Conduct pre-and post-dredging bathymetric surveys across borrow areas A and B where dredging will occur to determine geomorphic changes from pre- to post-construction. Compile survey data in a database to provide valuable baseline information for the planning and implementation of future beach nourishment/sand mining projects.*

  USACE will conduct pre- and post-dredging bathymetric surveys of borrow areas where dredging will be performed to determine geomorphic changes from pre- to post-construction conditions. The data will be provided to BOEM to compile survey data in a database (developed as the Marine Minerals Information System [MMIS]) to provide valuable baseline information for the planning and implementation of future beach nourishment/sand mining projects.

- *Coordinate with BOEM and us to develop a long-term strategy and management plan for Sandbridge Shoal that identifies criteria for rotation dredging based on natural accretion and pre-and post-construction bathymetry and benthic community data.*

  USACE will coordinate with BOEM, NMFS, the City of Virginia Beach, and other relevant stakeholders on the development of a long-term strategy and management plan for Sandbridge Shoal. Currently, Norfolk District is working with USACE, North Atlantic Division and other Districts to optimize the use of available sand sources by developing a system approach for the long-term management of sand sources.

- *Based on survey data, incorporate rotational dredging to the maximum extent practicable to focus dredging in areas which have not been previously mined or have sufficiently accreted since previous events. This will help preclude the mining of the same sand ridge during sequential dredging events and assist in recovery of the benthic community.*

  The last maintenance cycle for the Sandbridge Beach project in 2013 used Sandbridge Borrow Site A as the primary borrow site and B as the secondary site; however, a 2015 nourishment event of Dam Neck (which dredged a smaller volume of approximately 600,000 cubic yards) focused dredging in Borrow Site B. BOEM recently changed its leasing strategy for Sandbridge and is now leasing a smaller portion of the borrow sites rather than the full areas, so that BOEM and USACE have better control over where dredging occurs. For this maintenance cycle, dredging will focus on a designated area within Borrow Site B as the primary site for beach nourishment. USACE has identified and requested as a potential secondary site an area within Borrow Site A. BOEM will continue to implement this strategy of leasing smaller areas for future events, taking into consideration where recent dredging has occurred and any areas of accretion.

- *Coordinate with us to develop benthic and fisheries sampling and monitoring plans used to determine recovery rates and community composition of dredged areas of Sandbridge Shoal.*

  USACE initiated a benthic study of the Sandbridge borrow sites in November 2018 to help determine recovery rates and community composition of dredged areas of Sandbridge Shoal. If dredging is completed as scheduled by the end of August 2019, the post-dredging recovery surveys would start in October 2019 and again in 2020 pending fund availability. The results of these findings will be provided to NMFS and BOEM in 2020.

Responses to Atlantic Coast Highly Migratory Species EFH Conservation Recommendations:

- *Sand mining and beach nourishment should not be allowed in HMS EFH during seasons when HMS are using the area, particularly during spawning and pupping seasons.*

  The Norfolk District has voluntarily implemented a conservation measure to avoid hopper dredging from September 1 to November 14 to minimize impacts to threatened and endangered species. Limiting the project activities for use during other times may result in project delays and additional project costs due to the lack of available industry hopper dredges. As such, any additional time-of-year restrictions may significantly affect the constructability of the project that serves as hurricane protection.

- *Sand and gravel extraction operations should be managed to avoid or minimize impacts to the bathymetric structure in estuarine and nearshore areas.*

  No sand extraction operations will occur within estuarine or nearshore areas.

- *An integrated environmental assessment, management, and monitoring program should be a part of any gravel or sand extraction operation, and encouraged at Federal and state levels.*

  An Environmental Assessment (EA) was completed by USACE in 2009 that described the affected environment, evaluated potential environmental impacts (initial construction and nourishment events), and considered alternatives to the proposed action. This EA was subsequently updated and adopted by BOEM in 2012 in association with the most recent 2013 Sandbridge nourishment effort (available at https://www.boem.gov/Virginia-Projects/). For this maintenance cycle, the EA was updated by BOEM to supplement and summarize the aforementioned 2012 analyses. USACE and BOEM will continue to use the most current and accurate information available in subsequent dredging and nourishment events. For every nourishment cycle, USACE and BOEM will ensure that the project is in compliance with state and federal regulations.

  As previously noted, a benthic study is currently underway. Previous benthic monitoring studies were completed in 2005 and 2001. In addition, pre- and post-bathymetric surveys are performed of the borrow sites.

- *Planning and design of mining activities should avoid significant resource areas important as HMS EFH.*

  As previously noted, several best management practices are integrated into the specifications to minimize impacts of dredging activities to significant resource areas. USACE and BOEM assess impacts to borrow areas in environmental documents prior to BOEM issuing a lease. These borrow areas are used intermittently, with the most recent dredging of Sandbridge Shoal occurring in 2015 for Dam Neck. Additionally, BOEM limits the dredge areas within the borrow sites. The project impacts are, therefore, temporary and localized and are not anticipated to result in substantial adverse impacts to EFH for Atlantic highly migratory species.

  BOEM welcomes feedback on specific "significant resource areas" and potential impacts of concern from NMFS to better inform Marine Mineral Program studies.

- *Given the increase in sea level rise and potentially growing need to re-nourish beaches, this activity needs to be closely monitored in areas that are adjacent to or located in HMS EFH.*

  Due to the potential increase in sea level rise and growing need to renourish beaches, surveys of Sandbridge Beach are performed by the City of Virginia Beach to closely monitor beach erosion. Also, USACE performs surveys of the beach and borrow areas before and after completion of project.

In addition to the above, the USACE will incorporate the Mid-Atlantic Fishery Management Council's policies, as appropriate. BOEM will lease smaller areas within Sandbridge Borrow Site A and B for the Sandbridge Beach Nourishment project to better limit the footprint of potential impacts. Pre- and post-bathymetric surveys will be performed of the designated borrow areas that will be dredged. As previously noted, a benthic study is currently underway to assess community composition and recovery rates. BOEM will also use data collected to better identify areas of higher dredge intensity as well as areas of accretion. Best management practices will be used to the maximum extent that is practicable.

USACE and BOEM consider the EFH consultation complete. Should you have any questions or require further information on this submittal, please contact Ms. Teri Nadal by email at teresita.i.nadal@usace.army.mil or call (757) 201-7299. Thank you for your cooperation and assistance.

Sincerely,

Keith B. Lockwood

Keith B. Lockwood
Chief, Operations Branch

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

DEC 6 - 2018

Mr. Gregory Steele, Chief
Operations, Planning and Policy Branch
Norfolk District
U.S. Army Corps of Engineers
803 Front Street
Norfolk, VA 23510-1096

Re: Sandbridge Beach Erosion Control and Hurricane Protection Project; Virginia Beach, VA
Supplemental Essential Fish Habitat Assessment

Dear Mr. Steele:

We have reviewed the supplemental 2018 essential fish habitat (EFH) assessment prepared pursuant to Section 305 (b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) for the Sandbridge Beach Erosion Control and Hurricane Protection project, located in the City of Virginia Beach, Virginia. The supplemental assessment was produced in part to address amendments and modifications to EFH designations since 2012, including removal of EFH designations for juvenile and adult scalloped hammerhead shark (*Sphyrna lewini*), winter skate (*Leucoraja ocellata*), and habitat area of particular concern (HAPC) for sandbar shark (*Carcharhinus plumbeus*) from the action areas. The assessment also incorporates modifications to designated EFH since 2012 for a number of federally managed species including sharks and tunas.

The current proposal uses the same design criteria as the last several Sandbridge Beach nourishment maintenance events; mining of beach-compatible sand for the creation of a 50 ft. wide berm at an elevation of 6 ft. (NGVD) with a foreshore slope of 1:20 along five miles of beach from the U.S. Navy's Dam Neck Fleet Training Center, south to the U.S. Fish and Wildlife Service's Back Bay National Wildlife Refuge. The Sandbridge Shoal borrow area, a 13,500-acre area located approximately three nautical miles from shore has been used as the source of sand for this project in the past and is proposed for this and future beach nourishment cycles. Because the borrow area is located on the Outer Continental Shelf, beyond Virginia state waters, Bureau of Ocean Energy Management (BOEM) is a cooperating agency on this project.

Since initial project construction in 1998, there have been three maintenance cycles occurring on average every three to five years (1998, 2002, 2007, 2013, 2015) with material dredged from the Sandbridge Shoal borrow areas A and B. Approximately 1-2 million cubic yards (cy) of material has been mined during each maintenance event. In addition to using Sandbridge Shoal to re-nourish Sandbridge Beach, the borrow area was used in 1996 (800,000 cy), 2003 (700,000 cy), and 2015 (647,637 cy) to re-nourish beaches along the U.S. Navy's Dam Neck Fleet Training Center. The continued nourishment of Sandbridge Beach is conservatively estimated to continue on a four to five-year maintenance cycle for the life of the project (1998-2048).

The contract for the current beach nourishment cycle is scheduled to be awarded in January 2019 with dredging and sand placement to be conducted sometime later that year. The continued use of Sandbridge Shoal is proposed as the source of sand, but the specific locations within shoal areas A and B, and the total area to be mined has not yet been identified at this stage of project planning, but will be identified prior to dredging. Previous sampling has indicated the principal sediment grain size is fine to medium sand. Sand mining for the proposed 2019 maintenance event will require dredging approximately 2.2 million cubic yards of material using a trailing suction hopper dredge. We anticipate the mining and placement operations will be conducted as in previous maintenance events, where sandy material is dredged, transported by hopper dredge to an offshore pump-out buoy, conveyed to the beach via a pipeline and distributed using heavy equipment to produce the designed 1:20 beach profile. According to the information provided to us, vibracore sampling is proposed prior to the 2019 maintenance event to ensure that there is sufficient, compatible material and to minimize potential impacts

**Magnuson Stevens Fishery Conservation and Management Act (MSA)**
As identified in the current EFH assessment, the project area including Sandbridge Beach and Sandbridge Shoal has been designated as EFH for thirty two federally managed species including demersal, pelagic and highly migratory species. We agree with your determination that the proposed sand mining of Sandbridge Shoal and beach nourishment of Sandbridge Beach will adversely affect EFH. However, we are unable to determine the scale or severity of the impacts with respect to the previous, current, and future maintenance events based on the information provided, or to concur with your determination that the impacts will be temporary and localized, due to the absence of data to support this position. As we have expressed to you in reviewing previous Sandbridge Beach and U.S. Navy beach nourishment maintenance projects, we remain concerned about the long-term, cumulative impacts to Sandbridge Shoal, EFH, managed species and their prey species based on the frequency of the historic and projected continued use of Sandbridge Shoal as a source of beach-compatible sand given the lack of site specific biological and geological data.

The EFH assessment cites two estimates of the sand reserves at Sandbridge Shoal; 39.8 million cubic yards (mcy) and 104 mcy. The cumulative extracted-to-date volume of 9,786,559 cy for all previous projects comprises 24.6% and 9.4% of these estimated volumes respectively. The proposed action to dredge 2,200,000 cy of material this maintenance event would comprise 30.1% and 11.5% respectively of these estimated volumes. We are concerned with the large difference between estimated volumes of sand reserves, especially given the findings of the draft environmental assessment (EA) for this project produced in 2009 which indicated Sandbridge Shoal exhibits relatively little volumetric recovery between dredging events, leading to the long-term reduction in the surface area of bottom habitat. In the 2009 EA, it was also stated that previous sand mining and beach nourishment projects have cumulatively extracted nearly 25% of the estimated sand volume at Sandbridge Shoal. By projecting the historic maintenance cycle and extraction rate into the future, it appears the sand reserves at Sandbridge Shoal will be exhausted before the end of Sandbridge Beach's 50-year project life in 2048. Should the shoal itself disappear or be significantly altered by ongoing dredging, impacts to aquatic organisms and our trust resources utilizing the shoal habitat would be substantial and unacceptable.

Given the continued and projected future dredging of Sandbridge Shoal by the Corps and Navy, the biological data collected to date on and adjacent to Sandbridge Shoal (Diaz et al., 2006) is insufficient to conclude that the cumulative, long-term impacts of sand mining on EFH and managed species are not significant. To illustrate the importance of sand shoal habitat to NOAA trust resources, our 2009 EFH assessment response letter referenced a study by Vasslides and Able (2008) that analyzed two trawl survey time series totaling 14 years of data off the coast of New Jersey, and concluded that sand ridges are important features of the inner continental shelf, influencing fish assemblages and abundance.

The EFH assessment states that full recovery of the benthos within the borrow sites is anticipated to occur within a few months to years. However, sand mining at Sandbridge Shoal and the resulting destruction of the benthic epifauna and infauna communities every 1 to 5 years may prohibit the benthos from ever fully recovering, resulting in significant adverse effects to EFH and higher trophic levels including managed species. The 2012 draft EA and EFH assessment stated that despite multiple dredging events, no negative impacts to the macrobenthic and fish communities have been documented to date and that monitoring between dredged and non-dredged control areas has revealed no significant differences in macrofauna abundance. However, the 2012 draft EA also states that "some of the sand shoal ridges have been dredged during more than one construction cycle, increasing the likelihood and severity of impact". As a result, additional study is necessary to determine the full nature and extent of the effects of repeated sand mining activities on the microbenthic and fisheries communities of the borrow area.

Based on the frequency that Sandbridge Shoal is dredged for beach nourishment, further study by the Corps and BOEM is warranted to determine the degree of impact to fisheries, the benthic community and their rate of recovery. Based on new survey data, rotational dredging should be incorporated into the current and future projects to focus dredging in areas which have not been previously mined or have sufficiently accreted since previous dredge events. This will help preclude the mining of the same sand ridge during sequential dredging events and assist in recovery of the benthic community. A determination of the timelines associated with the re-establishment of successional communities, fishery and benthic species abundance, richness and diversity, etc. would also benefit our collective future decision making and help determine whether or not additional mitigation measures or compensation is appropriate to minimize or offset project impacts.

**Essential Fish Habitat Conservation Recommendations**

As we have recommended in previous consultations with you, we continue to support the use of best management practices during project construction and provide the following conservation recommendations pursuant to Section 305(b)(4)(A) of the MSA:

- Conduct a pre-dredge vibracore survey to identify shoal areas of beach quality sand to minimize the dredge footprint and duration which the dredge operates and review these findings with us prior to dredging.
- While dredging, follow the existing bottom contours to the maximum extent practicable to maintain seafloor ridge and swale heterogeneity. Do not exceed 6.6 ft. (2 m) of dredge

cut to any ridge or swale. Incorporate the proposed operational BMPs into hydraulic dredge operation to minimize entrainment of aquatic organisms.

- Conduct pre-and post-dredging bathymetric surveys across borrow areas A and B where dredging will occur to determine geomorphic changes from pre- to post-construction. Compile survey data in a database to provide valuable baseline information for the planning and implementation of future beach nourishment/sand mining projects.
- Coordinate with BOEM and us to develop a long-term strategy and management plan for Sandbridge Shoal that identifies criteria for rotation dredging based on natural accretion and pre-and post-construction bathymetry and benthic community data.
- Based on survey data, incorporate rotational dredging to the maximum extent practicable to focus dredging in areas which have not been previously mined or have sufficiently accreted since previous events. This will help preclude the mining of the same sand ridge during sequential dredging events and assist in recovery of the benthic community.
- Coordinate with us to develop benthic and fisheries sampling and monitoring plans used to determine recovery rates and community composition of dredged areas of Sandbridge Shoal.

*Atlantic Coastal Highly Migratory Species*

The June 2009 Amendment 1 to the Consolidated Highly Migratory Species (HMS) Fisheries Management Plan (NOAA 2009) states that non–fishing activities such as mining for sand (e.g., for beach nourishment projects), gravel, and shell stock in estuarine and coastal waters have adverse impacts to sandbars shark EFH due to water column effects, such as changing circulation patterns, increasing turbidity, and decreasing oxygen concentrations. The 2009 amendment also include a number of EFH conservation recommendations for dredging and beach nourishment projects proposed within EFH for highly migratory species. These general EFH conservation recommendations include:

- Sand mining and beach nourishment should not be allowed in HMS EFH during seasons when HMS are using the area, particularly during spawning and pupping seasons.
- Sand and gravel extraction operations should be managed to avoid or minimize impacts to the bathymetric structure in estuarine and nearshore areas.
- An integrated environmental assessment, management, and monitoring program should be a part of any gravel or sand extraction operation, and encouraged at Federal and state levels.
- Planning and design of mining activities should avoid significant resource areas important as HMS EFH.
- Given the increase in sea level rise and potentially growing need to re-nourish beaches, this activity needs to be closely monitored in areas that are adjacent to or located in HMS EFH.

We are happy to discuss with your staff the conservation recommendations provided above, and in developing benthic and fisheries sampling and monitoring plans with the goal of using those data to help avoid and minimize the cumulative adverse effects of sand mining and beach nourishment on managed species, their prey species and other aquatic resources over the life of the project.

Section 305(b)(4)(B) of the MSA requires you provide us with a detailed written response to our EFH conservation recommendations, including a description of measures adopted by the Corps for avoiding, mitigating, or offsetting the impact of the project on EFH. In the case of a response that is inconsistent with our recommendations, you must explain your reasons for not following the recommendations, including the scientific justification for any disagreements with us over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects pursuant to 50 CFR 600.920(k). In addition, if new information becomes available or the project is revised in such a manner that affects the basis for the above EFH conservation recommendations the EFH consultation must be reinitiated pursuant to 50 CFR 600.920(l). Any changes to EFH designations, the identification of new EFH or HAPCs also trigger the need to reinitiate consultation.

*Mid-Atlantic Fisheries Management Council Policies*
A number of the federally managed species for which EFH has been designated in the project area are managed by the Mid-Atlantic Fisheries Management Council (Council). The Council has developed a policy statement on beach nourishment activities that may affect federally managed species under their purview including summer flounder (*Paralichthys dentatus*), scup (*Stenotomus chrysops*), black sea bass (*Centropristis striata*), and butterfish (*Peprilus triacanthus*). These policies are intended to articulate the Council's position on various development activities and facilitate the protection and restoration of fisheries habitat and ecosystem function.

The Mid-Atlantic Fishery Management Council's policies on beach nourishment are:

- Avoid sand mining in areas containing sensitive fish habitats (e.g., spawning and feeding sites, hard bottom, cobble/gravel substrate, shellfish beds).
- Avoid mining sand from sandy ridges, lumps, shoals, and rises that are named on maps. The naming of these is often the result of the area being an important fishing ground.
- Existing sand borrow sites should be used to the extent possible. Mining sand from new areas introduces additional impacts.
- Conduct beach nourishment during the winter and early spring, when productivity for benthic infauna is at a minimum.
- Seasonal restrictions and spatial buffers on sand mining should be used to limit negative impacts during fish spawning, egg development, young-of-year development, and migration periods, and to avoid secondary impacts to sensitive habitat areas such as SAV.
- Preserve, enhance, or create beach dune and native dune vegetation in order to provide natural beach habitat and reduce the need for nourishment.
- Each beach nourishment activity should be treated as a new activity (i.e., subject to review and comment), including those identified under a programmatic environmental assessment or environmental impact statement.
- Bathymetric and biological monitoring should be conducted before and after beach nourishment to assess recovery in beach borrow and nourishment areas.
- The effect of noise from mining operations on the feeding, reproduction, and migratory behavior of marine mammals and finfish should be assessed.
- The cost effectiveness and efficacy of investments in traditional beach nourishment projects should be evaluated and consider alternative investments such as non-structural

responses and relocation of vulnerable infrastructure given projections of sea level rise and extreme weather events.

These policies should be incorporated, as appropriate, into this project.

**Endangered Species Act (ESA)**
Federally threatened or endangered species under our jurisdiction including marine mammals, sea turtles, shortnose and Atlantic sturgeon may be present in the project area. The proposed maintenance activity has been previously reviewed and is covered under a current biological opinion (BiOp) with our Protected Resources Division (PRD). However, please contact Ms. Julie Crocker by email (julie.crocker@noaa.gov) or phone (978) 282-8480 or Mr. Brian Hopper, PRD (brian.d.hopper@noaa.gov) at 410-573-4592 to review your proposed action and obligations under the September 7, 2012 BiOp and Section 7 of the ESA.

Thank you for the opportunity to review and comment on the supplemental 2018 EFH assessment for the Sandbridge Beach Erosion Control and Hurricane Protection Project. Please contact David L. O'Brien in our Gloucester Point, VA field office (david.l.o'brien@noaa.gov) at 804-684-7828 if you have any questions regarding these recommendations.

Sincerely,

Louis A. Chiarella
Assistant Regional Administrator
for Habitat Conservation

cc: T. Nadal, R. Pruhs, NAO Corps
B. Hopper, PRD
S. Ellis, OSED
R. Owen, VMRC
L. Varnell, VIMS
C. Moore, MAFMC
T. Nies, NEFMC
L. Havel, ASFMC

## Literature Cited

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

September 10, 2018

Operations Branch

Mr. David O'Brien
NOAA Fisheries
Habitat Conservation Division
1375 Greate Rd.
P.O. Box 1346
Gloucester Point, VA 23062

RE: Supplemental Essential Fish Habitat Assessment for Sandbridge Beach Nourishment and Hurricane Protection Project

Dear Mr. O'Brien:

The U.S. Army Corps of Engineers (USACE), Norfolk District is responsible for the maintenance of the Sandbridge Beach Nourishment and Hurricane Protection Project at Sandbridge Beach, Virginia Beach, Virginia. The USACE, acting as the lead agency, plans to utilize Sandbridge Shoals as borrow areas through a Memorandum of Agreement with the Bureau of Ocean Energy Management (BOEM), a cooperating agency. Sandbridge Beach Project is authorized by the Water Resources Development Acts of 1974, 1992, and 2000, as amended. The project was constructed to provide protection from erosion-induced and storm damages with initial construction completed in 1998.

The scope of the project has not changed since the last Essential Fish Habitat (EFH) consultation was completed with NOAA Fisheries Service Habitat Conservation Division with a concurrence of no substantial adverse effect on EFH or HAPC. This Supplemental EFH assessment has been prepared by the USACE, acting as lead Federal agency, in cooperation with the BOEM. As newly designated EFH for additional species and/or life stages has been identified since the last EFH consultation, a Supplemental EFH assessment is being submitted to present new potential impacts that could result from the project as a result of the newly designated EFH for additional species and/or life stages.

We have determined that the proposed project may have adverse effects, but adverse effects will largely be localized and are not substantial. The project is not anticipated to have a substantial adverse impact on EFH species or habitat that may be in the project area.

USACE and BOEM request your review and concurrence for maintenance of the Sandbridge Beach Nourishment and Hurricane Protection Project. This project does not have the potential to substantially adversely affect EFH for the species of concern by loss of forage and/or shelter habitat. We have made the determination that the proposed activity may affect, but is not likely to substantially adversely affect EFH.

Should you have any questions or require further information on this submittal, please contact Ms. Teri Nadal by email at teresita.i.nadal@usace.army.mil or call (757) 201-7299. Thank you for your cooperation and assistance.

Sincerely,

Keith B. Lockwood

Keith B. Lockwood
Chief, Operations Branch

# SUPPLEMENTAL ESSENTIAL FISH HABITAT ASSESSMENT
SANDBRIDGE BEACH EROSION CONTROL
AND
HURRICANE PROTECTION PROJECT
VIRGINIA BEACH, VIRGINIA

## Contents

## 1. Introduction and Project Background

The U.S. Army Corps of Engineers (USACE), Norfolk District is responsible for the maintenance of the Sandbridge Beach Nourishment and Hurricane Protection Project at Sandbridge Beach, Virginia Beach, Virginia. The Sandbridge Beach Project is authorized by the Water Resources Development Acts of 1974, 1992, and 2000, as amended. Section 101 (22) of Public Law 102-580 authorized a beach erosion control and hurricane protection project consistent with the Chief of Engineers report dated 29 June 1992. Section 338 of Public Law 106-541 (WRDA 2000) authorized the provision of 50 years of periodic nourishment beginning in 1998 and ending in 2048. The USACE, acting as the lead agency, plans to utilize Sandbridge Shoals as borrow areas through a Memorandum of Agreement with the Bureau of Ocean Energy Management (BOEM), a cooperating agency. Approximately 2.2 million cubic yards (cy) of material from Sandbridge Shoals will be dredged and placed as beach nourishment along Sandbridge Beach; dredging is planned to begin in the winter of 2018.

Sandbridge Beach is located on a barrier island along coastal southeast Virginia that separates the Atlantic Ocean on the east from Back Bay, a shallow freshwater sound, to the west. It is a residential community of mostly year round residents, rental properties, and summer homes located approximately 5 miles south of Virginia Beach's "resort strip." Several major storms, nor'easters, and hurricanes have struck the area in past years, causing severe losses of sand and coastal flooding; the oceanfront is susceptible to wave attack on the beach berm and dunes. Sandbridge Beach extends from the U.S. Naval Fleet Anti-Air Warfare Training Center at Dam Neck to the north to Back Bay National Wildlife Refuge to the south. The project dimensions include a 50-foot wide berm at an elevation of six feet North American Vertical Datum (NGVD) with a foreshore slope of approximately 1:20 (one vertical foot to 20 horizontal feet) for a distance of approximately five miles.

The initial beach nourishment for the Sandbridge Beach project dredged 1.1 million cy in 1998. Since the initial project construction, there have been three maintenance cycles every four to five years for beach nourishment of Sandbridge Beach using approximately 2 million cy of dredged material from the Sandbridge Shoal borrow areas (Sandbridge Shoal A and B) for each event. In addition to the renourishment of Sandbridge Beach, the shoal has been used to renourish the U.S. Navy's Dam Neck complex; from 1996 to 2015, three construction cycles have dredged from 647,637 to 808,600 cy from Sandbridge Shoal. Dredging for both projects over the past 22 years has removed just under 9.8 million cy.

The designated borrow sites, Sandbridge Shoal A and B are located approximately three nautical miles from the shoreline, outside of Virginia's territorial sea (Figure 1). In places, the shoal is approximately 20 feet thick. Previous sampling has indicated that the principal sediment is fine to medium sand. There are two designated borrow areas on Sandbridge Shoal: Area B to the north and Area A to the south. Depths at borrow areas range from 30 to 65 feet. The region between the two borrow sites is a no-dredge zone due to the presence of a buried Navy submarine communications cable. Geophysical surveys and vibracore samples of the Sandbridge Shoal borrow area will be analyzed prior to construction to improve understanding of the geomorphology, volume, and type of sediment in the shoal.

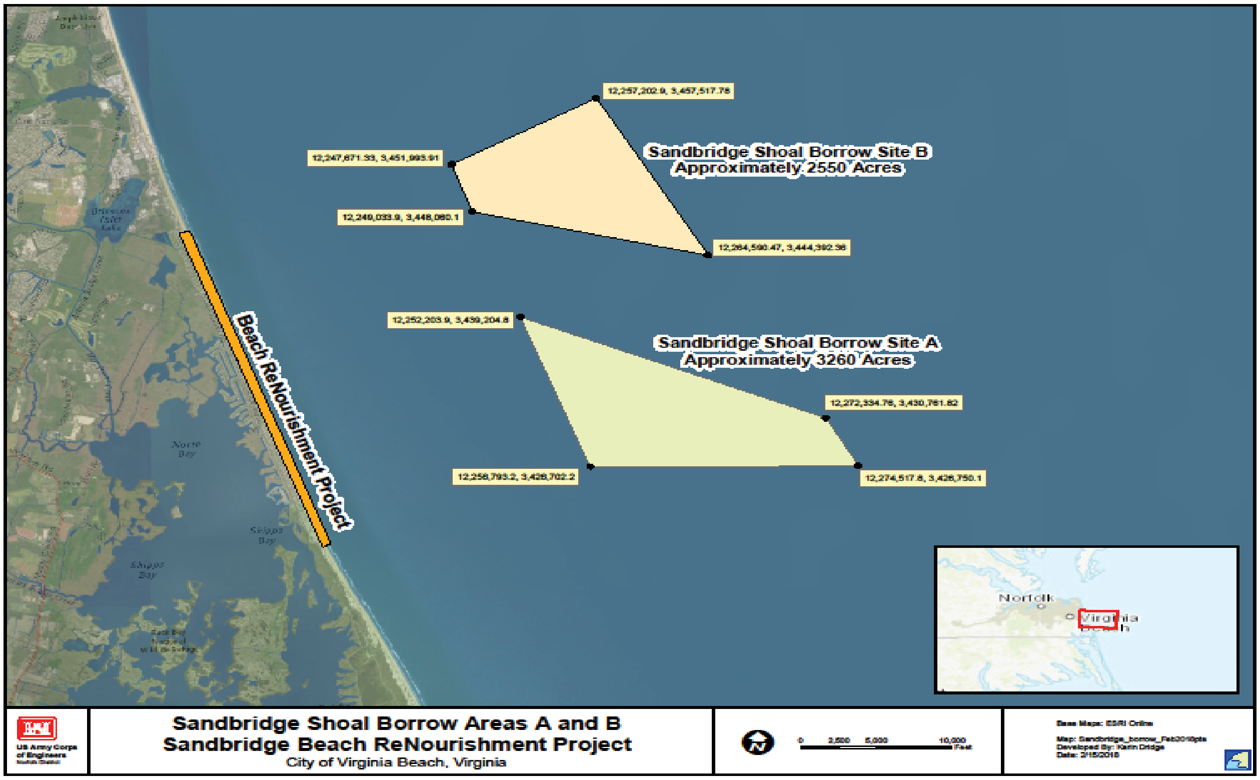


**Figure 1: Overview Map of Sandbridge Beach Project**

The most recent Sandbridge Beach nourishment cycle was completed in 2013. The next maintenance cycle is planned to begin in the winter of 2018 with the same design criteria as previous maintenance cycles. Approximately 2.2 million cy will be dredged from the Sandbridge Shoal borrow sites and placed along Sandbridge Beach.

## 2. Purpose

The scope of the project has not changed since the last EFH coordination was completed with NOAA Fisheries Service Habitat Conservation Division with a concurrence of no substantial adverse effect on EFH or HAPC for sandbar shark. This Supplemental Essential Fish Habitat (EFH) assessment has been prepared by the USACE, acting as lead Federal agency, in cooperation with the BOEM. The purpose of this supplemental assessment is to present new potential impacts that could result from beach nourishment of the oceanfront at Sandbridge Beach and the related offshore sand extraction of Sandbridge Shoals as a result of the newly designated EFH for additional species and life stages. Designated EFH within the project area has been modified and does not include EFH for juvenile and adult scalloped hammerhead shark and winter skate. HAPC boundaries have been modified and the project is not within a HAPC for sandbar shark. Since new information about managed species and their associated habitat is available, the USACE and BOEM have reinitiated consultation for newly listed species and/or life stage (Table 1. highlighted in yellow). The prior EFH assessment, prepared in 2012, is enclosed (Appendix A). Also included is a table of this prior assessment with the species, life stages and impacts (Table 2).

Since the 2012 EFH assessment, EFH has been designated within the project area for the following species and life stages: juvenile albacore tuna; juvenile and adult angel shark; adult

Atlantic butterfish; juvenile and adult Atlantic mackerel; juvenile and adult bluefin tuna; neonate, juvenile, and adult life stages for common thresher shark; adult dusky shark; little skate juveniles; longfin inshore squid eggs; juvenile sand tiger shark; juvenile and adult skipjack tuna; neonate, juvenile, and adult life stages for smooth dogfish; and juvenile yellowfin tuna.

## 3. <u>Essential Fish Habitat</u>

Provisions of the Magnuson-Stevens Fishery Conservation and Management Act (16 USC 1801) require that EFH areas be identified for each species managed under a fishery management plan, and that all Federal agencies consult with the National Marine Fisheries Service (NMFS) on all Federal actions that may adversely affect EFH. EFH is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity”. This EFH assessment is being prepared pursuant to Section 305(b)(2) of the Magnuson-Stevens Act, and includes the following required parts: 1) a description of the proposed action; 2) identification of new species/life stages of concern; 3) an analysis of the effects of the proposed action; 4) proposed mitigation; and 5) the Federal agency's views regarding the effects of the proposed action.

The EFH mapper was used to determine potential EFH within the project footprint (Table 1). Additionally, the National Marine Fisheries Service (NMFS) “Final Amendment 10 to the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan: Essential Fish Habitat” dated September 1, 2017 was used to confirm EFH. The document is available at: http://www.nmfs.noaa.gov/sfa/hms/documents/fmp/am10/final_a10_ea_signed_fonsi.pdf.

**Table 1. Fish species and associated life stages with Essential Fish Habitat with the potential to occur in the affected area of the Sandbridge Beach Nourishment Project (highlights indicate updates since the 2012 EFH assessment)**

| Species | Eggs | Larvae/Neonate | Juveniles | Adults |
|---|---|---|---|---|
| Albacore tuna (*Thunnus alalunga*) | | | X | |
| Angel shark (*Squatina dumeril*) | | | X | X |
| Atlantic butterfish *(Peprilus triacanthus)* | | | X | X |
| Atlantic herring *(Clupea harengus)* | | | X | X |
| Atlantic mackerel *(Scomber scombrus)* | | | X | X |
| Atlantic sharpnose shark *(Rhizopriondon terraenovae)* | | | | X |
| Atlantic surf clam *(Spisula solidissima)* | | | X | |
| Black sea bass *(Centropristis striata)* | n/a | X | X | X |
| Bluefin tuna (*Thunnus thynnus*) | | | X | X |
| Bluefish *(Pomatomus saltatrix)* | | | X | X |
| Clearnose skate (Raja eglanteria) | | | X | X |
| Cobia *(Rachycentron canadum)* | X | X | X | X |
| Common thresher shark (*Alopias vulpinus*) | | X | X | X |
| Dusky shark *(Carcharhinus obscurus)* | | X | X | X |
| King mackerel *(Scomberomorus cavalla)* | X | X | X | X |
| Little skate (Leucoraja erinacea) | | | X | |
| Longfin inshore squid (*Loligo pealeii*) | X | | | |

| Species | Eggs | Larvae/Neonate | Juveniles | Adults |
|---|---|---|---|---|
| Monkfish *(Lophius americanus)* | X | X | | |
| Red drum *(Sciaenops occelatus)* | X | X | X | X |
| Red hake *(Urophycis chuss)* | X | X | X | |
| Sand tiger shark *(Carcharias taurus)* | | X | X | X |
| Sandbar shark *(Carcharhinus plumbeus)* | | X | X | X |
| Scup *(Stenotomus chrysops)* | | | X | X |
| Skipjack tuna (*Katsuwonus pelamis*) | | | X | X |
| Smooth dogfish (*Mustelus canis*) | | X | X | X |
| Spanish mackerel *(Scomberomorus maculatus)* | X | X | X | X |
| Spiny dogfish *(Squalus acanthias)* | | | X | X |
| Summer flounder *(Paralichthys dentatus)* | | | X | X |
| Tiger shark (*Galeocerdo cuvier*) | | X | X | X |
| Windowpane flounder *(Scophthalmus aquosus)* | X | X | X | |
| Witch flounder *(Glyptocephalus cynoglossus)* | X | | | |
| Yellowfin tuna (*Thunnus albacares*) | | | X | |

## 4. Managed Fish Species

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.

### 4.1 Albacore tuna *(Thunnus alalunga)*

The project occurs in an area designated as EFH for the juvenile life stage of albacore tuna. Albacore are a highly migratory pelagic fish that generally range from between the 40° to 45° North latitude to 40° South latitude in the western Atlantic Ocean (NOAA/NMFS 2017). They are generally found in surface water with temperatures between 15.6 and 19.4°C; however, larger species may be found at a wider temperature range of 13.5 to 25.2°C. 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 (m) (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 (NOAA/NMFS 2017).

Juveniles of this species are up to 90 centimeters (cm) fork length and are generally found off the east coast of the United States from Cape Hatteras, North Carolina to Cape Cod, Massachusetts (NOAA/NMFS 2017). Juveniles overwinter in central Atlantic waters, and the feeding migration to the northeastern Atlantic waters occurs in the summer.

Although albacore tuna may occur in the project area, it is unlikely that they would be impacted. They are a highly mobile species and would be able to leave any area disturbed during dredging operations. Indirect impacts on the food web would be expected to be minor, temporary, and localized when compared with available habitat throughout their distribution.

### 4.2 Angel shark (*Squatina dumeril*)

The project is in an area designated as EFH for juvenile and adult life stages of the angel shark, which is the same for both life stages. 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 (NOAA/NMFS 2017). This is a benthic-dwelling shark with a flattened body resembling a ray (NOAA/NMFS 2017). The diet of this species is largely made up of benthic organisms, including crustaceans and mollusks, though they also consume various fish species. This shark inhabits coastal waters along the east coast of the United States from Massachusetts to the Florida Keys, the Gulf of Mexico, and the Caribbean. This species migrates seasonally from shallow to deep water (Castro 2011).

Angel sharks reach maturity between 90 and 105 cm total length and are ovoviviparous, giving birth to live young (NOAA/NMFS 2017). At birth, the pups measure between 28 and 30 cm total length (NOAA/NMFS 2017).

Although juvenile and adult angel sharks may occur in the project area, it is unlikely that they would be impacted. They are a highly mobile species and would be able to leave any area disturbed during dredging operations. Indirect impacts on the food web would be expected to be minor, temporary, and localized when compared with available habitat throughout their distribution.

### 4.3 Atlantic butterfish (*Peprilus triacanthus*)

The project lies within an area designated as EFH for juvenile and adult life stages of the Atlantic butterfish which is found at salinities above 5 parts per thousand (ppt). Designated EFH for juvenile and adult Atlantic butterfish are pelagic habitats in inshore estuaries and embayments from Massachusetts Bay to North Carolina, inshore waters of the Gulf of Maine and the South Atlantic Bight, and on the inner and outer continental shelf from southern New England to South Carolina. EFH for juveniles is generally found at bottom depths between 10 to 280 m and water temperatures between 6.5 and 27°C. Juveniles feed mainly on planktonic prey. EFH for adult Atlantic butterfish is generally found at bottom depths between 10 and 250 m, water temperatures are between 4.5 and 27.5°C. Adults feed mainly on planktonic prey, including squids and fishes. Spawning occurs in inshore waters from June through August (Cross et al. 1999; Overholtz 2006). Juvenile and adult butterfish overwinter along the 100-fathom contour of the continental shelf from late autumn through early spring.

Butterfish juveniles and adults may be present in the dredge area and sand placement area. Should juvenile or adult butterfish occur in the project areas, their high mobility should allow them to relocate from either the dredging areas to avoid direct impacts. No indirect impacts to butterfish are expected because of alterations to bottom habitat since juveniles and adults are largely pelagic and therefore not closely associated with the bottom. Indirect impacts resulting from food web impacts are not expected because butterfish are planktivorous and their food items are derived from a wide area.

### 4.4 Atlantic mackerel *(Scomber scombrus)*

The project lies within an area designated as EFH for juvenile and adult life stages of the Atlantic mackerel. Pelagic habitats in embayments and inshore estuaries are designated as EFH for juvenile and adult Atlantic mackerel that range from Cape Hatteras, North Carolina to Maine.

Juveniles and adults are generally found in water temperatures between 5 to 20°C and at bottom depths of 10 to 110 m. They primarily feed on small crustaceans, larval fish, and other pelagic organisms. Adults are generally found over bottom depths of less than 170 m. Adults are opportunistic predators feeding primarily on a wider range and larger individuals of pelagic crustaceans, but also on fish and squid.

Although this species may be present in the project area, it is unlikely that Atlantic mackerel would be impacted. They are highly mobile and would be able to leave any area disturbed during dredging operations. Juveniles and adults should be able to easily avoid any direct negative impacts because of their mobility. Indirect impacts on the food web would be expected to be minor, temporary, and localized when compared with available habitat throughout their distribution.

### 4.5 Bluefin tuna (*Thunnus thynnus*)

The project occurs within an area designated as EFH for the juvenile and adult life stages of bluefin tuna. Designated EFH for juveniles are coastal and pelagic habitats of the Mid-Atlantic Bight and the Gulf of Maine, between southern Maine and North Carolina, from shore (excluding Chesapeake Bay, Delaware Bay, Long Island Sound, and Pamlico Sound) to the continental shelf break. EFH follows the continental shelf from the outer extent of the U.S. EEZ on Georges Bank to North Carolina. In the Gulf of Maine, EFH is associated with certain environmental conditions (temperatures from 16 to 19°C and depths of 0 to 40 m). In other locations, EFH is associated with temperatures ranging from 4 to 26°C and depths of less than 20 m. However, in the winter they can be found in waters that are 40 to 100 m deep. EFH for adult bluefin tuna is located from southern New England to coastal areas between the mouth of Chesapeake Bay and Onslow Bay, North Carolina.

Bluefin tuna are highly migratory and in the Western Atlantic range from 45° North latitude to the equator (Fromentin 2010). 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 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, 1970; Mathews et al 1977; Estrada et al. 2005). Juvenile bluefin tuna feed mainly on zooplanktivorous fishes and crustacteans. Juveniles of this species may reach lengths of 184 cm fork length. Adults can reach lengths up to 300 cm fork length (NOAA/NMFS 2017).

Juveniles and adults should be able to easily avoid any direct negative impacts because of their mobility. Indirect impacts on the food web would be expected to be minor, temporary, and localized when compared with available habitat throughout their distribution.

### 4.6 Common thresher shark *(Alopias vulpinus)*

The project area lies within an area designated as EFH for neonatal, juvenile, and adult life stages of the common thresher shark. At this time, there is insufficient data is available to differentiate EFH between the juvenile and adult size classes; therefore, EFH is the same for those life stages. EFH is located in the Atlantic Ocean from Georges Bank (offshore extent of the U.S. EEZ boundary) to Cape Lookout, North Carolina.

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), with seasonal abundance and north-south migrations along the U.S. East Coast (Castro 2011). The common thresher shark is thought 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, that measure 137 to 155 cm total length at birth (Castro 1983; Mancini and Amorim 2006). Depending on geographic location, the average litter size ranges from three to seven pups

(Goldman 2009; Gervelis and Natanson 2013). Nursery area characteristics in nearshore waters of North Carolina consist of temperatures from 18.2 to 20.9°C and at depths from 4.6 to 13.7 m (McCandless et al. 2002). This species reaches upwards of 573 to 760 cm in size, with males and females reaching at least 22 years and 24 years of age, respectively. Growth for both sexes has been found to be similar until ages 8 and 12, when male and female growth slows down, respectively (Gervelis and Natanson 2013). This species is known to feed on invertebrates such as squid and pelagic crabs as well as small fishes such as anchovy, sardines, hakes, and small mackerels (Preti et al. 2004).

This species should be able to easily avoid any direct negative impacts because of their mobility. Indirect impacts on the food web would be expected to be minor, temporary, and localized when compared with available habitat throughout their distribution.

### 4.7 Dusky shark *(Carcharhinus obscurus)*

The proposed project area lies within EFH for neonate/young-of-the-year (YOY), juvenile, and adult life stages of the dusky shark. EFH for neonate/YOY (≤ 98 cm fork length) in the Atlantic Ocean includes offshore areas of southern New England to North Carolina and is associated with habitat conditions that include temperatures from 18.1 to 22.2°C, salinities of 25 to 35 ppt, and depths of 4.3 to 15.5 m (NOAA/NMFS 2017). The seaward extent of EFH for this life stage in the Atlantic is 60 m in depth. EFH for juveniles and adults include coastal and pelagic waters inshore of the continental shelf break (< 200 meters in depth) along the Atlantic east coast from southern Cape Cod to Georgia, including adjacent pelagic habitats. The inshore extent for these life stages is the 20-m bathymetric line, except in New England where it is extended seaward. Adults are generally found deeper (to 2000 m depth) than juveniles; however, there is overlap in the habitats utilized by both life stages.

The dusky shark can reach up to four m 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 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, populations in the northern portion of this species' range migrate seasonally. Dusky sharks prefer oceanic salinities and do not commonly occur in estuaries, instead inhabiting waters from the coast to the outer continental shelf and adjacent pelagic waters.

Because dusky sharks frequent coastal areas, neonates and juveniles may be adversely affected by dredging operations. However, because of the mobility, of neonates and juveniles, they should be able to easily avoid any direct impacts. They are a highly mobile species and would be able to leave any area disturbed during dredging operations. Indirect impacts on the food web would be expected to be minor, temporary, and localized when compared with available habitat throughout their distribution.

### 4.8 Little skate *(Leucoraja erinacea)*

The proposed action occurs within an area designated as EFH for juvenile little skate. Designated EFH for juveniles are intertidal and sub-tidal benthic habitats with sand, gravel, and mud substrate from the Gulf of Maine and Georges Bank to Delaware Bay. Generally, little skate juveniles are found from the coast to depths of 80 m.

The disturbance of bottom habitat by dredging could displace little skate juveniles; additionally, dredging may entrain juveniles, causing direct mortality. It is expected that adverse impacts would occur during construction, and be highly localized to the footprint of the dredge area. Any indirect impacts to little skate juveniles' prey source are expected to be temporary and localized.

### 4.9 Longfin inshore squid *(Loligo pealeii)*

The proposed dredging site occurs within an area designated as EFH for the longfin squid eggs. EFH for *Loligo* eggs occurs in inshore and offshore bottom habitats from Georges Bank southward to Cape Hatteras, and generally where bottom water temperatures are between 10° and 23°C, salinities are between 30 to 32 ppt and depth is less than 50 m. Egg masses are demersal and anchored to the substrates on which they are laid, including a variety of hard bottom types such as shells, lobster pots, piers, fish traps, and rocks, as well as soft substrates like submerged aquatic vegetation, sand, and mud.

The longfin 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 cm (NEFSC 2011). Spawning occurs year-round, with a peak in the spring and summer months in bays and shallow coastal areas, where 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 longfin squid migrate offshore in the fall to overwinter in deeper waters (Cargnelli et al. 1999). In the spring, adult and juvenile longfin squid migrate inshore. The diet of adult and juvenile longfin squid consists primarily of crustaceans, polychaetes, small fish, and other squid (Cargnelli et al. 1999).

The disturbance of bottom habitat by dredging could destroy longfin squid eggs. It is expected that adverse impacts would be temporary (i.e., last the duration of construction) and highly localized to the dredge footprint.

### 4.10 Sand tiger shark *(Carcharias taurus)*

The proposed project area lies within EFH designated for neonate/YOY, juvenile, and adult life stages of sand tiger sharks. Neonate/YOY (< 109 cm fork length) EFH ranges from Massachusetts to Florida, including coastal sounds, lower Chesapeake Bay, Delaware Bay, Raleigh Bay and habitats surrounding Cape Hatteras. Juvenile (109 – 193 cm fork length) EFH includes habitat between mid-New Jersey and the mid-east coast of Florida. EFH can be described via known habitat associations in the lower Chesapeake Bay and Delaware Bay (and adjacent coastal areas) where temperatures range from 19 to 25°C, salinities range from 23 to 30 ppt, and depths range from 3 to 7 m in sand and mud areas. EFH is designated for adults (≥ 194 cm fork length) in the Atlantic along the mid-east coast of Florida through Delaware Bay. Important habitats include lower Chesapeake Bay and Delaware Bay and adjacent coastal areas where adult sand tiger sharks spend 95% of their time.

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. Inshore, the sharks are commonly found at depths ranging from 2 to 191 m in a variety of habitats, including the surf zone, shallow bays, coral and rocky reefs, and deeper areas around the outer continental shelves. This species prefers shallow waters (less than 15 m) 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 includes, in order of prevalence, small fishes, 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 9 to 10 years of age and about seven feet long (Murdy and Musick 2013). This species is ovoviviparous and give birth to live young, so there is no larval life stage. Litters are small, with only two pups every other year.

Sand tiger sharks may be present within the project area. However, because of their ready mobility, these sharks should easily be able to avoid any direct negative impacts. Indirect impacts to this species are expected to be insignificant because the habitats disturbed at the site and any detrimental food web impacts would be minimal given the availability of similar undisturbed habitat in the Mid- and South-Atlantic Bight. Any food web impacts would be temporary, further minimizing any detrimental impacts.

### 4.11 Skipjack tuna *(Katsuwonus pelamis)*

The project is located within EFH for the juvenile and adult life stage of the skipjack tuna. Designated EFH for juveniles (< 45 cm fork length) includes coastal and offshore habitats between Massachusetts and South Carolina; localized in areas off Georgia and South Carolina; and from the Blake Plateau through the Florida Straits. Juveniles are usually found at depths greater than 20 m. Designated EFH for adults includes coastal and offshore habitats between Massachusetts and North Carolina and localized areas in the Atlantic off South Carolina, Georgia, and the northern east coast of Florida.

This species is a highly migratory, pelagic fish that occurs 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). Adult Skipjack tuna can reach lengths up to 108 cm fork length and reach sexual maturity around one to 1.5 years of age (NOAA/NMFS 2017). Like other tuna species, the skipjack is an opportunistic feeder known to prey upon other readily available fish species, cephalopods, and crustaceans (NOAA/NMFS 2017). Skipjack tuna are thought to feed in surface waters; however, they are caught as bycatch at greater depths. Skipjack tuna are an epipelagic and oceanic species and may dive to a depth of 260 m during the day. 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). The optimum temperature for the species is 27ºC, with a range from 20 to 31°C (ICCAT 1995).

This species should be able to easily avoid any direct negative impacts because of their mobility. Indirect impacts on the food web would be expected to be minor, temporary, and localized relative to available habitat throughout their distribution.

### 4.12 Smooth dogfish *(Mustelus canis)*

The project is located within EFH for neonate/YOY, juvenile, and adult life stages of the smooth dogfish. There is insufficient information available for the identification of each life stage, therefore all life stages are combined in the EFH designation. EFH in Atlantic coastal areas ranges from Massachusetts to South Carolina, inclusive of inshore bays and estuaries. EFH also includes continental shelf habitats between southern New Jersey and Cape Hatteras, North Carolina. 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 m (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 also to consume bony fishes, including menhaden (NMFS 2010; Compagno 1984).

The maximum size of smooth dogfish is 150 cm total length, with males being smaller (82 cm total length) and maturing at approximately two to three years of age and females being larger (90 cm total length) and maturing between four and seven years of age (Compagno 1984; Conrath et al. 2002). The gestation period for smooth dogfish is between 11 and 12 months with litters of 3 to 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).

Smooth dogfish may be present during dredging within the borrow areas and nearshore areas near the placement site at Sandbridge Beach. However, because of their ready mobility, they should easily be able to avoid any direct negative impacts. Indirect impacts to this species are expected to be minor because the habitats disturbed at the site and any detrimental food web impacts would be minimal given the availability of similar undisturbed habitat in the Mid-Atlantic Bight. Additionally, food web impacts are expected to be limited to the footprint of the dredge site and the duration of construction.

### 4.13 Yellowfin tuna *(Thunnus albacares)*

The project is located within designated EFH for the juvenile life stage of yellowfin tuna. Designated EFH for juvenile yellowfin tuna (< 108 cm fork length) are offshore and coastal habitats from Cape Cod to the mid-east coast of Florida and the Blake Plateau. EFH is also designated in the central Gulf of Mexico from the Florida Panhandle to southern Texas.

Yellowfin tuna are circumglobal in tropical and temperate waters; in the Atlantic, they range from 45° North to 40° South latitude (NOAA/NMFS 2017). This species is an epipelagic, oceanic species, found in waters between 18 and 31°C (NOAA/NMFS 2017). They are highly migratory and often occur in mixed schools of tuna species, including skipjack and bigeye tuna. Juvenile yellowfin tuna are often found closer to shore than adults (SCRS, 1994). Yellowfin tuna are opportunistic feeders and are thought to feed primarily in surface waters down to a depth of 100 m. In the North Atlantic Ocean, cephalopods, fish, and crustaceans are important prey for yellowfin tuna (Logan et al. 2012).

This species should be able to easily avoid any direct negative impacts because of their mobility. Indirect impacts on the food web would be expected to be minor, temporary, and localized when compared with available habitat throughout their distribution.

**Table 2. Prior EFH Assessment. Species, Associated life stages with Essential Fish Habitat and Potential Impacts**

| Species | Eggs | Larvae/Neonate | Juveniles | Adults | Impacts |
|---|---|---|---|---|---|
| Atlantic butterfish *(Peprilus triacanthus)* | | | X | | Butterfish juveniles may be present in the dredge area and sand placement area, but this is unlikely since juveniles tend to prefer deeper waters as noted in the EFH description. Should juvenile butterfish be in the project areas their high mobility should allow them to relocate from either the dredging or sand placement areas to avoid direct physical harm. No indirect impacts to juvenile butterfish are expected as a consequence of alterations to bottom habitat since juveniles are largely pelagic, and not closely associated with the bottom. No indirect impacts resulting from food web impacts are expected because butterfish are planktivorous and their food items are derived from a wide area. Any food web impacts will be temporary in nature. |
| Atlantic herring *(Clupea harengus)* | | | X | X | Adult and juvenile Atlantic sea herring are unlikely to be present in the sand placement or dredge area because of their preference for greater water depths and colder water temperatures as noted in the EFH description. Therefore, no direct or indirect impacts from sand borrow or placement are expected. |
| Atlantic sharpnose shark *(Rhizopriondo n terraenovae)* | | | | X | Sharpnose sharks may be present during dredging within the borrow areas and sand placement at Sandbridge Beach assuming operations take place during the warmer months. However, adults, because of their ready mobility should easily be able to avoid any direct impacts. No detrimental indirect impacts to the sharpnose shark population are expected because of the relatively small area to be impacted compared to the range of the species and the ready availability of more preferable habitat on the mid and south-Atlantic Bight continental shelf. Any impacts to the food web are expected to be temporary and local. |
| Atlantic surf clam *(Spisula solidissima)* | | | X | | The southeastern portion of the borrow area lies within an area designated as EFH for the juvenile surf clam. Dredging may destroy some surf clam habitat and surf clams living within the dredged area would be killed. While this would represent a significant short-term loss of surf clam in the impact area, although it is expected that habitat conditions for surf clam will be equivalent to those before dredging over time. It is anticipated that surf clam populations would gradually recover to pre-project levels after a several year period. Surf clam predators, including Atlantic cod, would be affected by loss of food until such time as surf clam populations recovered in each borrow site. |

| Species | Eggs | Larvae/Neonate | Juveniles | Adults | Impacts |
|---|---|---|---|---|---|
| Black sea bass *(Centropristis striata)* | | X | X | X | Larvae may be present in the inter-tidal zone during sand placement & within the borrow areas during dredging. Demersal larvae tend to be present in association with structure (e.g., shells) & depressions on the shoal seafloor, which are not commonly found in the borrow areas. Should larvae be present, they may be drawn into the dredge & destroyed. No impacts to the larvae population are expected because there is no reason to expect that larvae will be concentrated in the dredging area. Furthermore, the area to be impacted compared with the area of the continental shelf over which the larvae are likely to occur is relatively small in scale. Juveniles & adults may be present during sand placement on the Sandbridge shoreline. However, the area does not possess pronounced benthic cover or suitable substrate to which they would orient, & their numbers would likely be few. Any black sea bass remaining on the bottom or venturing too close to the dredge intake could be entrained; juveniles would probably be more vulnerable because of their slower swimming speed. There is no reason to expect that this species will be concentrated in the dredging area, no significant impacts are expected. Juveniles & adults may suffer minor indirect impacts from food web disturbance caused by destruction of benthos & altered habitat conditions within the proposed borrow areas, Because the temporary & localized nature of the impacts, & relatively small area of bottom to be disturbed compared to the total area of comparable bottom habitat available, impacts are expected to be minor. Enhanced topography of the shoal seafloor following dredging may provide a benefit to this species by increasing bottom heterogeneity and enhancing habitat. Though, benefits would be minor because of the relatively small scale of area impacted. Any beneficial impacts would diminish as natural processes rework the seafloor and furrows fill in with material from the surrounding area. |
| Bluefish *(Pomatomus saltatrix)* | | | X | X | Juveniles & adults may be present during dredging & sand placement. Because of their high mobility they should be readily able to relocate from the project area to avoid direct detrimental impacts. Because of their open water orientation, disturbance to & alteration of bottom habitat at the borrow areas is expected to have minimal indirect impact to juveniles & adults. Food web impacts caused by the destruction of benthos & alteration of bottom habitat at the borrow areas are unlikely to impact bluefish because of the relatively small scale of the area to be impacted compared to the large abundance of comparable habitat on the continental shelf. Furthermore, prey items will be readily available from elsewhere. Food web impacts at the borrow areas will be temporary in nature, further reducing their potential impact to bluefish. |
| Clearnose skate (Raja eglanteria) | | | X | X | Water quality changes during construction of the proposed project would be minimal and temporary, limited to the immediate area of the activity. Turbidity may impact sight feeding but the skates will flee the area to feed in neighboring waters and the elevated turbidity is temporary. Additionally, juveniles and adults may be found at depths ranging from less than 3 feet up to 985 feet and is broadly distributed along the eastern United States. Therefore, the proposed project would not result in significant adverse impacts to the EFH for this species. |

| Species | Eggs | Larvae/Neonate | Juveniles | Adults | Impacts |
|---|---|---|---|---|---|
| Cobia *(Rachycentron canadum)* | X | X | X | X | Cobia may be in the project area during construction occurring from May to August. Individual eggs & larvae may be destroyed during dredging & sand placement. However, any eggs or larvae present along the Sandbridge shoreline or within the offshore borrow areas would be widely distributed & there is no reason to believe they would be concentrated in the project area. Therefore no significant impacts to the population are expected. Juveniles & adults may be present during dredging at the borrow areas. Juveniles, because of their occurrence on beaches, may be present on the Sandbridge shoreline during sand placement conducted during these months. Because cobia feed on bottom-dwelling prey, individuals could be present on the bottom. Any juveniles or adults present in the project area during construction would relocate to adjacent areas to avoid detrimental impacts. Any individuals venturing too close to the dredge intake could be entrained & destroyed. Juveniles would probably be more vulnerable than adults because of their slower swimming speed. There is no reason to expect that cobia will be concentrated in the dredging area, no significant impacts to the population are expected. Destruction of benthos & alterations of bottom habitat will likely reduce the suitability of the borrow areas as a foraging area for several months to years. These disturbances are unlikely to impact cobia because abundant undisturbed bottom will remain elsewhere on the continental shelf, and food web impacts will be temporary in nature. |
| Dusky shark ***(Carcharhinus obscurus)***[1] | | X | X | | Dusky shark may be present during dredging within the borrow areas and sand placement at Sandbridge Beach. However, neonates and juveniles, because of their ready mobility, should easily be able to avoid any direct impacts. No detrimental indirect impacts to the dusky shark population are expected because of the relatively small area to be impacted compared to the range of the species and the ready availability of comparable habitat on the mid and south- Atlantic Bight continental shelf. Any impacts to the food web are expected to be insignificant and temporary. |
| King mackerel (Scomberomorus cavalla) | X | X | X | X | King mackerel may be in the project area during construction occurring from about June to August. Any eggs or larvae present on the Sandbridge shoreline or within the offshore borrow areas would be widely distributed and there is no reason to believe they would be concentrated in the project area. Although eggs or larvae may be destroyed during construction, no significant impacts to the king mackerel population are expected. Juveniles and adults could be present during dredging, and king mackerel juveniles, because of their occurrence on beaches, may be present on the Sandbridge shoreline during sand placement conducted during these months. Any juveniles or adults that are present in the project area during construction could easily swim away and relocate to adjacent areas to avoid direct detrimental impacts. Alterations of bottom habitat and destruction of benthos are unlikely to impact king mackerel because abundant comparable bottom habitat occurs elsewhere. Food web impacts will be minimal because of the relatively small scale of impact and temporary nature of the disturbance. |
| Monkfish *(Lophius americanus)* | X | X | | | Monkfish eggs and larvae may be, in the project area during construction occurring from about May to early fall. Any monkfish eggs or larvae present at the offshore shoals would be widely distributed and there is no reason to believe they would be concentrated in the project area. Eggs would be unlikely to be entrained during dredging since they float. Since larvae are pelagic, dredging entrainment of larvae would also likely be minimal. Also, larvae generally prefer deeper water conditions than at the borrow area. Accordingly, no significant impacts to the monkfish population are expected. Alterations of bottom habitat and destruction of benthos at the borrow sites are unlikely to impact monkfish eggs or larvae because they lack an orientation to or dependency on bottom habitats. |

| Species | Eggs | Larvae/Neonate | Juveniles | Adults | Impacts |
|---|---|---|---|---|---|
| Red drum *(Sciaenops occelatus)* | X | X | X | X | Red drum eggs and larvae are not likely to be in the project areas. Spawning occurs in late summer through early fall when project construction would be completed or nearing completion. However, as eggs migrate with currents inshore to estuaries, red drum eggs could be present in the project area. Although eggs or larvae may be destroyed during construction, no significant impacts to the red drum population are expected. Additionally, larvae and eggs near the Sandbridge shoreline or at the offshore borrow areas would be widely distributed and there is no reason to believe they would be concentrated in the project area. Red drum juveniles and adults are not likely to be present during the dredging but may inhabit the surface zone during sand placement. Minor impacts to the juvenile population are expected. Juvenile and adult on the Sandbridge shoreline or at the offshore borrow areas would be widely distributed and there is no reason to believe they would be concentrated in the project area. No significant impacts to the red drum population are expected. |
| Red hake (Urophycis chuss) | X | X | X | | Red hake eggs are not likely to be present in the dredge and placement area because of their preference for water temperatures below 10ºC; therefore, it is unlikely that red hake eggs will be directly impacted by the operation. Demersal red hake larvae are unlikely to be in the project areas. They tend to be present in association with structure (e.g., shells) and depressions on the shoal seafloor, which may be found in the troughs of ridges within the borrow areas. Should demersal larvae be present they may be drawn into the dredge and destroyed. However, because there is no reason to expect that large populations of red hake larvae will be concentrated in the dredging area, and because of the relatively small scale of the area to be impacted compared with the area of the continental shelf over which larvae are likely to occur, no significant impacts to red hake populations are expected. Juvenile red hake may be in the project area during dredging; however, they tend to prefer inshore waters further north, which match their preference for colder temperatures during the spring and summer. Furthermore, red hake favor sediments which are finer than those of the sand placement and dredge areas. Should red hake be present during dredging it is expected that because of their high mobility juveniles should easily be able to avoid intake. Any red hake juveniles remaining on the bottom or venturing too close to the dredge intake could be entrained and destroyed. Detrimental impacts to the red hake population from destruction of individual juveniles are expected to be insignificant because there is no reason to expect that red hake will be concentrated at the site. Food web impacts will be temporary in nature, further minimizing detrimental impacts. Increased bathymetric relief, left by the dredge as a series of ridges and furrows, may favor red hake larvae and juveniles. This beneficial impact would be very minor because of the relatively small size of the area impacted and would be expected to gradually dissipate as physical forces rework and smooth the shoal surface. |
| Sand tiger shark (Carcharias taurus)[2] | | X | | X | Sand tiger sharks may be present during dredging within the borrow areas and placement of sand at Sandbridge Beach. However, neonates, juveniles, and adults, because of their ready mobility, should easily be able to avoid any direct negative impacts. Indirect impacts to this species are expected to be insignificant because the habitats disturbed at the site and any detrimental food web impacts would be insignificant given the pervasive availability of undisturbed habitat in the Mid- and south-Atlantic Bight. Any food web impacts would be temporary, further minimizing any detrimental impacts. |

| Species | Eggs | Larvae/Neonate | Juveniles | Adults | Impacts |
|---|---|---|---|---|---|
| Sandbar shark (Carcharhinus plumbeus)[3] | | X, HAPC | X, HAPC | X, HAPC | The sandbar shark may be present during dredging within the borrow areas & sand placement at Sandbridge Beach. Neonates, juveniles, & adults because of their ready mobility, should easily be able to avoid any direct negative impacts. However, since they are bottom dwelling, any individuals remaining on the bottom or venturing too close to the dredge intake could be entrained & destroyed. Neonates & juveniles would probably be more vulnerable than adults because of their slower swimming speed. There is no reason to expect that sandbar shark will be overly concentrated in the dredging area; therefore, no significant impacts to this species' population is expected. Because the sandbar shark is a bottom-dwelling species, indirect impacts to the food web caused by destruction of benthos & alterations in bottom habitat conditions at the borrow areas could be more detrimental. Since these impacts will be very minor in size when compared to the size of the Mid- and South Atlantic Bight, it is expected that no significant indirect impacts to sandbar shark populations will occur. Any food web impacts are expected be temporary & local in nature. |
| Scup (Stenotomus chrysops) | | | X | X | Adult scup are common in the Middle Atlantic Bight from spring to fall & generally found in schools on a variety of habitats, from open sandy bottom to structured habitats such as mussel beds, reefs, or rough bottom. Smaller-sized adult are common in larger bays & estuaries. Larger sizes tend to be in deeper waters. Scup congregate in schools, resulting in congregation in areas & complete absence in other nearby areas. Schools are size-structured. During warm months, scup stay close to shore, typically within 6 miles of the coastline. They live close to the bottom & concentrate over areas of smooth to rocky bottom. Scup feed on small, bottom-dwelling invertebrates (crabs, clams, and sea star) & young finfish. With rising water temperatures in the spring, scup return inshore. Larger fish arrive first followed by schools of subadults, which have been reported to appear off southern New England slightly later. The fish reach Chesapeake Bay by April. Since scup tend to reside within estuaries during the warmer months, they are not expected to be within the dredge or placement areas during the project timeframe of Spring/Summer. If they are in the area, it is expected that juvenile & adults should easily be able to avoid direct detrimental impacts from dredging or sand placement, & easily relocate to adjacent waters. Because they are demersal, individual scup may remain on the seafloor of the borrow areas during dredging. Any scup remaining on the bottom or venturing too close to the dredge intake may be entrained & destroyed. Juveniles would probably be more vulnerable than adults because of their slower swimming speed. There is no reason to expect that scup would be concentrated in the area to be dredged. No significant impacts are expected. Because of their demersal nature, destruction of benthos & alterations in bottom habitat impacting the food web may cause negative impacts to scup. Because of the relatively small scale of the area to be impacted compared to abundant habitat elsewhere, these are expected to be minor. The impacts will also be temporary in nature, further decreasing their significance. |
| Spanish mackerel (Scomberomorus maculatus) | X | X | X | X | Spanish mackerel may be in the project area during construction occurring from about June to August. Any eggs or larvae present on the Sandbridge shoreline or at the offshore borrow areas would be widely distributed. Therefore, although individual eggs and larvae may be destroyed, there is no reason to expect they would be concentrated in the project area. No significant impacts to the population are expected. Juveniles and adults could be present during dredging, because of their occurrence on beaches. They may be present on the Sandbridge shoreline during sand placement conducted during these months. However, any juveniles or adults that are present in the project area during construction could easily swim away and relocate to adjacent areas to avoid direct detrimental impacts. Alterations of bottom habitat are unlikely to impact Spanish mackerel because of the minor scale of impact compared to abundant bottom, and food web impacts impacting any of Spanish mackerel prey are expected to be minimal because their prey items are derived from a wide area. |

| Species | Eggs | Larvae/Neonate | Juveniles | Adults | Impacts |
|---|---|---|---|---|---|
| Spiny dogfish *(Squalus acanthias)* | | | X | X | Spiny dogfish may be present within the borrow areas during the cooler (winter-spring) months. Adults and juveniles should easily be able to avoid any direct negative impacts because of their mobility. No detrimental indirect impacts to the population are expected because of the relatively small area to be impacted compared to the range of the species and the ready availability of more preferable habitat on the mid and south-Atlantic Bight continental shelf. Any impacts to the food web are expected to be temporary and local when compared to available habitat elsewhere. |
| Summer flounder *(Paralichthys dentatus)* | | | X | X | Juveniles and adults may be in the project area during dredging and sand placement. Because of their great mobility, juvenile and adults should easily be able to relocate elsewhere and avoid any detrimental impacts. However, because they are demersal, summer flounder may remain on the bottom during dredging. Any summer flounder remaining on the bottom or venturing too close to the dredge intake could be entrained and destroyed. Juveniles would probably be more vulnerable than adults because of their slower swimming speed. No significant impacts to the summer flounder population would be expected from destruction of individuals because there is no reason to believe that summer flounder will be concentrated in the area to be dredged. Because of their demersal nature, destruction of benthos and alterations in bottom habitat impacting the food web may cause detrimental impacts to summer flounder. It is unclear whether altered habitat conditions at the borrow areas will have any other indirect impact on summer flounder. These impacts will be very minor in scale, however, when compared to abundant habitat elsewhere on the continental shelf. Food web impacts will be temporary in nature, further diminishing their impact. Any impacts associated with altered bottom habitat on the borrow areas would be expected to gradually dissipate as physical environmental forces rework and smooth the shoal surface. |
| Tiger Shark (Galeocerdo cuvier) | | X | X | X | Tiger shark may be present during dredging within the borrow areas and sand placement at Sandbridge. Neonates and juveniles should easily be able to avoid any direct negative impacts because of their ready mobility. No indirect impacts to tiger shark are expected from dredging of the borrow areas because any food web impacts resulting from this are expected to be temporary and local when compared to available habitat elsewhere. |
| Windowpane flounder (Scop hthalmus aquosus) | X | X | X | | Windowpane eggs and larvae are likely to be present in the dredge and placement area, but predominantly in pelagic waters. However, since the eggs are distributed widely over the continental shelf, egg and larvae destruction will not cause significant impacts to the butterfish population. Juveniles and adult windowpane flounders are likely to be in project waters during dredging and sand placement. Because of their great mobility, juveniles and adults should be able to avoid direct detrimental impacts at the dredging and placement sites. However, because they are demersal, individuals may remain on the bottom during dredging. Any windowpane remaining on the bottom or venturing too close to the dredge intake could be entrained and destroyed; juveniles would probably be more vulnerable than adults because of their slower swimming speed. Detrimental impacts to the windowpane flounder population is expected to be insignificant because there is no reason to expect that windowpane flounder will be concentrated at the site. Because of their demersal nature, destruction of benthos and alterations in bottom habitat impacting the food web may cause detrimental impacts to windowpane flounder. It is unclear whether altered habitat conditions at the borrow areas will have any other indirect impact on windowpane flounder. However, these impacts will be very minor because the scale of the area impacted is very minor when compared to abundant habitat elsewhere on the continental shelf. Food web impacts will be temporary in nature, further diminishing their impact. Any impacts associated with altered bottom habitat on borrow areas would be expected to gradually dissipate as physical environment forces rework and smooth the shoal surface. |

| Species | Eggs | Larvae/Neonate | Juveniles | Adults | Impacts |
|---|---|---|---|---|---|
| Witch flounder *(Glypt ocephalus cynoglossus)* | X | | | | Witch flounder eggs are unlikely to be present in the sand placement area on Sandbridge Beach because of their preference for colder water temperatures and deeper waters as noted in the EFH description. No direct or indirect impacts are expected. Since witch flounder eggs are unlikely to be found on the bottom where the dredge is drawing in sediment and water, it is unlikely that witch flounder will be directly impacts by that part of the operation. No impacts to witch flounder populations are expected. |

**[1]Dusky Shark has adult EFH now designated in project area; [2]Sand tiger shark has juvenile EFH now designated in project area; [3]No longer designated HAPC within the project area for Sandbar shark (NOAA/NMFS 2017).**

## 5. <u>Sand Resource and Estimates for Sandbridge Shoal, Virginia</u>

A review of the literature yielded two studies that contain numerical estimates of sand resources at Sandbridge Shoal: Kimball and Dame 1989 and Kimball et al. 1991. Kimball and Dame (1989) indicate a sand resource suitable for local beach nourishment needs of 39.8 million cy using an average thickness of 8.2 feet. This was based on about 60 miles of geophysical data and 5 vibracores.

Kimball et al. (1991) identified two sand-rich units at Sandbridge Shoal: QH2 and QP5. In Unit QH2, the surficial expression of the shoal is the thickest and has the largest areal extent, covering the entire feature from the 13-m isobath and shallower. It contains between 7.5 and 10 feet of clean, well-sorted medium to coarse sand. Unit QP5 lies beneath QH2 and contains 3 to 6 feet of mostly medium-grained sand. The estimated total sand resource of QH2 and QP5 is 104 million cy. This estimate was based on 18 cores and largely homogeneous sand units; however, more detailed drilling programs completed subsequently to these reports show areas of sand that do not meet the specifications for beach fill material. Thus, the above estimates are optimistic, particularly the total estimate of 104 million cy. There have now been well over 100 cores taken on Sandbridge Shoal by both the USACE and academic institutions.

The entire Sandbridge Shoal complex is about 5 miles long and 3 miles wide, covering an area of approximately 13,500 acres. Over the past 22 years, a total of **9,786,559** cy of sand has been removed from Sandbridge Shoal for seven projects:

| | |
|---|---|
| 1. Dam Neck Naval Facility (1996) | 808,600 cy |
| 2. Sandbridge Beach (1998) | 1,100,000 cy |
| 3. Sandbridge Beach (2002) | 2,000,000 cy |
| 4. Dam Neck Naval Facility (2003) | 700,000 cy |
| 5. Sandbridge Beach (2007) | 2,395,472 cy |
| 6. Sandbridge Beach (2013) | 2,134,850 cy |
| 7. Dam Neck & Ft. Story (2015) | 647,637 cy |

Expected future:

| | |
|---|---|
| 8. Sandbridge Beach (2018) | 2,200,000 cy |

The extracted-to-date volume of 9,786,559 cy is 24.6% of the 39.8 million cy estimate and 9.4% of the 104 million cy estimate. Accounting for the anticipated 2018 extraction, a total of 11,986,559 cy would constitute 30.1% and 11.5%, respectively, of those estimated volumes. Additional hydrographic surveys and vibracore data collected before the 2018 dredge event will likely improve these volume estimates.

## 6. Project Impacts

The presence of managed species in waters within the project impact area is highly variable, both spatially and temporally. Some species are found strictly offshore, while others may occupy offshore and nearshore waters. Some species may be suited for pelagic waters or open-ocean, while others may be more oriented to bottom or demersal waters. Habitat preference can also vary between life stages of federally managed species. Additionally, seasonal abundance is highly variable, as many species are highly migratory.

Direct impacts to species were evaluated largely based on their likelihood of being physically present and, therefore, potentially physically harmed at either the proposed borrow areas or areas nearshore of beach fill placement sites during the project construction. Dredging has the potential to directly affect several designated species with egg and larval life stages within the project area. Managed species could be directly impacted at the borrow area during sand dredging by being entrained or struck by the dredge plant. At Sandbridge Beach, direct impacts to managed species could potentially occur while sand is being pumped from the dredge and placed along the beach and in the surf zone. With the exception of some less motile juvenile species, most pelagic and demersal species are highly mobile and should be able to avoid entrainment in the dredge. While some species will likely be entrained into the dredge and destroyed, no substantial adverse impacts to the populations are expected from the proposed project.

Indirect impacts to managed species could occur due to several aspects of the project. Increased turbidity and decreased dissolved oxygen content during the dredging and placement, or temporary changes in local bottom habitat conditions can temporarily impact EFH species. The Dissolved oxygen and turbidity impacts would cease once construction activities are complete. Increases in turbidity, both offshore and nearshore, may alter the ability of a species to locate prey; however, this effect would be short-term and would not be expected to cause significant adverse effects on species in the area, because similar undisturbed areas would be easily accessible. Dredging would limit feeding within the borrow area, but prey would still be accessible in nearby non-affected areas. Increased turbidity may also irritate fishes' gills, causing temporary respiration stress; these effects are not expected to be severe or long-term, since most animals would be able to move away from the affected area. Additionally, areas near the shoal, and the biota that inhabit them, could also experience increased turbidity and sedimentation, but these impacts are anticipated to be temporary and minor. Eggs and larvae (neonates) are the life stages that would most likely be directly affected by a temporary increase in turbidity and potential decrease in dissolved oxygen concentrations caused by dredging. These life stages are more sensitive and less able to migrate from the affected area and, therefore, would be more susceptible to impacts compared to juveniles and adults.

The primary adverse effect of dredging and sand placement along Sandbridge Beach on all managed fish and invertebrate species would be on the local benthic community. Dredging would directly impact this community through entrainment of epifauna and infauna that reside in the sediment. Non-motile benthos, such as polychaetes and molluscs, will be destroyed in the dredging area; this may result in local loss of prey items following dredging until benthic communities recover. The primary direct impact of sand placement along Sandbridge Beach would be the burial of the benthic community. The benthos within the nearshore area may consist of worms, snails, aquatic insects, and crustaceans. Dredged material placement along the beach would bury benthic organisms; however, many of the larger mobile benthic species in the intertidal zone have the ability to burrow through the sand, reducing impacts on these species (Burlas et al. 2001). The recovery time of the benthos within both the dredging area and surf zone of the placement area at Sandbridge Beach is expected to be relatively rapid. While overall density and biomass may recover in as little as 3 months, a return to the original benthic community composition may take 2.5 to 5 years (Brooks et al. 2006). Organisms like polychaetes recover more quickly than others, like deep-burrowing molluscs (Brooks et al. 2006). The last nourishment of Sandbridge Beach was completed 5 years ago in 2013, with a smaller, subsequent nourishment of Dam Neck in 2015 (Figure 2). The areas only used in 2013 are expected to have had enough time to be fully recovered, though the area where the 2013 dredging overlapped may have still been in an earlier successional stage. Since there has been approximately 3 years of recovery since the 2015 event, it is likely that the biomass recovered, though there is a small chance that the species composition is still building. Since the 2013 project dredged less than 1/3 of the 2015 volumes, the overall impact is expected to be less. Because recolonization likely occurs more rapidly in high energy, sandy environments compared to low energy, silty environments (Dernie et al 2003), shoal ridges are expected to recolonize more rapidly than troughs. Dredging usually targets shoal crests and areas of accretion, and avoids creating deep depressions, which could promote recovery. The recolonization of the borrow area substrate by benthos is also expected to be facilitated by the likely presence of undisturbed bottom on the ridges between the furrows within the otherwise dredged area, as well as large regions of the shoal that are not dredged. Indirect impacts on managed species would include a diminished availability of bottom-dwelling food resources such as crustaceans and other invertebrates, at the dredge and placement site. The benthic prey species found on the shoals and sand bottom would likely be impacted during dredging operations. Although certain benthic species may take longer to recover, the biomass of infauna is expected to recover within several months, minimizing the amount of time fish are without a prey base. Additionally, dredging in the winter months would avoid peak spring/summer recruitment periods for benthos. Therefore, impacts on the food web would be minor, temporary, and localized when compared with available habitat throughout their distribution.

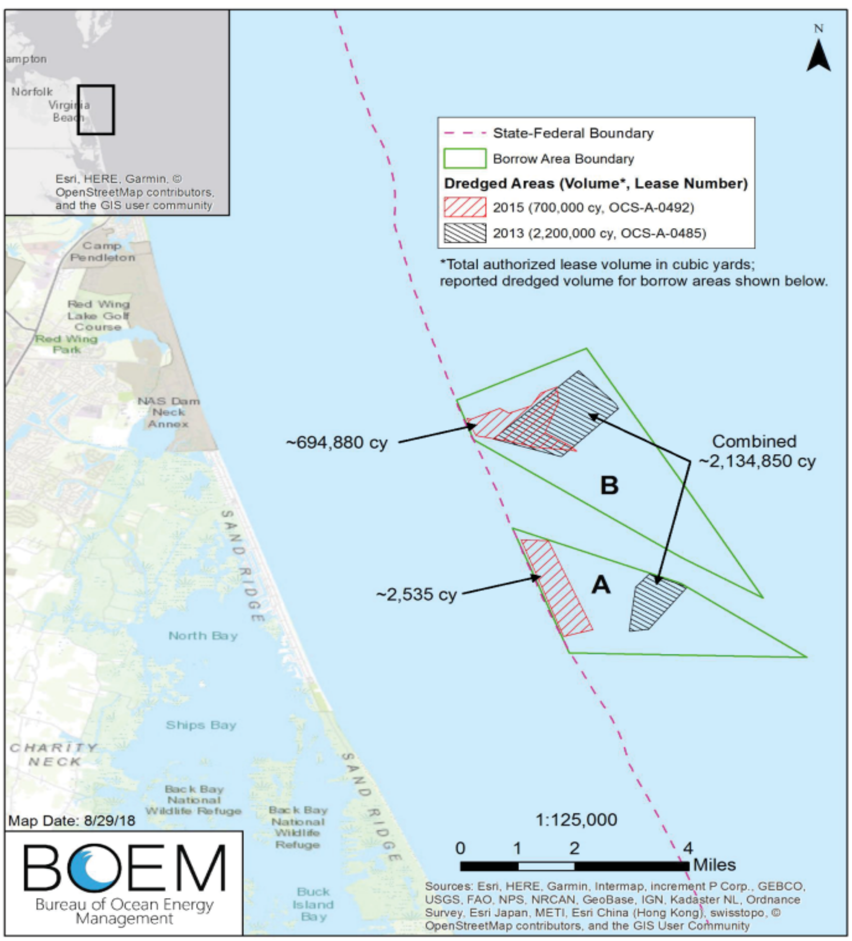

Figure 2: Most recent dredge events at Sandbridge Shoal

Dredging may also result in physical alterations to the substrate and seafloor morphology. Changes in substrate could result in changes to benthic community assemblages after recolonization, or in unsuitable substrate for the spawning of some fish species. For instance, should an area of the shoal be dredged too extensively, a substrate of coarse sandy material could be replaced with a substrate of higher fines content (fine sands and silts). However, changes in substrate are not expected because dredging depths would generally be limited to depths characterized by beach-compatible sand while maintaining a buffer of similar sediment beneath; these suitable dredge depths will be based on vibracore data and minimize the probability of dissimilar substrates being exposed. Indirect impacts to fish could potentially occur along the shoreline as shallow ocean water surf zone habitat is converted to inter-tidal and supra-tidal beach habitat. The seaward translation of the shoreline, profile equilibration, alongshore spread, and “loss” of nearshore open water habitat is not expected to cause any significant indirect impacts to managed species; in a general sense, this habitat will only be transformed seaward rather than “lost” because of the relative vastness of the seafloor.

If hydrodynamics and sediment transport are locally modified because of dredging, physical changes to the seafloor geomorphology may occur (e.g., substrate type and composition, surface texture, water circulation, and nutrient distribution). Some of the localized physical changes that have been observed in other locations following dredging include: 1) lower sand content; 2) higher silt/clay content; 3) poorer sorting (greater variation in grain size of sediment); and 4) accumulation of fine sediment (Jutte et al., 2002; Diaz et al., 2004). These changes have not been observed to date at Sandbridge Shoal (Diaz et al., 2006). Areas that have high rates of sediment transport (sand, not fine-grained sediment), such as depositional shoals, may experience rapid refilling rates, but that also assumes physical depressions are being created during dredging operations (Greene 2002). Utilizing hopper dredges to extract thin layers of sediment (approximately 3 feet) over larger areas, rather than dredging single shoals to greater depths over smaller areas, often creates a complex fabric of meso-ridges and furrows. The ridges are essentially the areas missed by the hopper dredge dragarm due to the dredge’s inability to completely remove all of the sediment. Shallow cuts are expected to have a smaller impact on waves and currents at the borrow area and presumably decrease the likelihood of exposure of and/or infilling by finer-grained sediments. One of the primary concerns regarding the impact of dredging is whether the removal of sand from the shoal will somehow disrupt the physical processes that maintain the shape of sand ridges and shoal bodies. The concern would be that the shoal might deflate or unravel, losing its form over time. Ridge crests are intensely stirred by relatively high wave energy and consist of mixed coarse sediment with low organic material (Diaz et al. 2004; Hayes and Nairn 2004). Comparatively, the trailing slope of the feature (up wave) is often characterized by a very gentle slope, moderate surface sediment mixing, and deposition of organically enriched fines. There may be at least two other unique physical habitats common to ridge features: 1) the leading side of the ridge is steeper and is depositional in nature (many ridges will be slowly migrating in the direction of this side of the ridge); and 2) deep troughs between the ridges that are relatively sheltered from wave action (due to both depth and breaking of waves over the crest of the ridge) often feature relatively finer sediments. The benthic communities and fish populations associated with each of these habitats are likely to be different (Diaz et al. 2004). It may be inferred that if a shoal did deflate due to dredging impacts, these different community structures could be adversely impacted.

Despite the prevalence of these features along the east coast, little is documented about the ecological relationships of these features and their associated biological communities (Slacum et al. 2006; Vasslides and Able 2008). Physical impacts caused by dredging are important only if they result in a coupled biological impact, either directly or indirectly. Dredging will lead to direct mortality of the benthic infauna that live in the substrate. Analysis of sediment core samples taken after dredging has demonstrated that remaining epibenthics are decimated (Parr et al. 1978). Studies investigating the recovery of benthic communities following dredging indicate that communities of similar total abundance and diversity typically re-colonize dredge sites within several years (Blake et al. 1996; Newell et al. 1998; Van Dolah et al. 1992; Van Dolah et al. 1998; Brooks et al. 2006; Diaz et al. 2006). Off the coast of Panama City, Florida, benthic community characteristics, such as species diversity, faunal abundance, and species composition, were equivalent to those of the surrounding communities within 3 months of the sediment disturbance (Saloman et al. 1982). However, there is uncertainty whether the new benthic communities will fill the same trophic function and provide the same energy transfer to higher trophic levels as the original communities (Michel et al. 2007).

Regional research has noted significant seasonal and inter-annual variations in species richness and abundance at shoals and reference sites in the Mid-Atlantic Bight (Slacum et al. 2006). A study, sponsored by the Minerals Management Service (now BOEM), investigated impacts of sand dredging on benthos of the southwest Florida shallow continental shelf. At the Egmont Key study site, benthos were collected before, during, and after dredging activities at three stations (two dredged and one control). Post-dredging sampling occurred at 9 months and 17 months following completion of dredging. Statistical analyses demonstrated that each of the three stations experienced different temporal patterns in benthic community composition. The two dredged stations showed more temporal variation from one another than the control station. However, it was not possible to establish that the differences between the benthic community in the control stations and the dredged stations were due solely to dredging disturbances (Blake et al. 1995). In some instances, natural variability may be greater than any influence of dredging, especially in physically-dominated environments.

Fish species could potentially be harmed at the borrow area by entrainment in the dredge. However, the extent of the impact may depend on seasonal and daily conditions, as recent research as shown that pelagic fish use such habitat differently between day and night (Slacum et al. 2006). Adult pelagic species, such as bluefish and Atlantic butterfish, should be able to avoid the entrainment into the dredge due to their high mobility. Demersal species, such as the windowpane flounder and the summer flounder, are mobile and should be able to avoid dredge entrainment as well. However, because of their demersal nature, individuals that remain on the seafloor of the borrow area during dredging could be entrained and destroyed; demersal eggs may be entrained as well. Juveniles are likely more vulnerable than adults due to their slower swimming speed. Species that have eggs and larvae in surface waters may be impacted by the hopper dredge making numerous transits through the borrow area; any eggs in the path of the dredge are likely to be destroyed by the ship's propeller. Because eggs and larvae are widely distributed over the continental shelf, egg destruction is not expected to cause significant impacts to fish populations. While some individual species will likely be entrained into the dredge and destroyed, no detrimental impacts to populations of any species are expected from the proposed project. Dredging may also result in physical alterations to the substrate of EFH, which could result in unsuitable substrate for spawning of some species. However, significant changes in substrate are not expected because dredging cut depths would be based on vibracore data to minimize dissimilar substrates.

Fish and benthic species could also be harmed in the surf zone and foreshore while sand is being pumped onto the beach. The project shoreline is 27,815 linear feet (5.26 miles, 4.57 nautical miles) in length. Approximately 80 acres of shallow water or surf zone habitat will be impacted through the placement of the borrow material along the shoreline during beach nourishment operations. Characteristic of high-energy beaches, benthic communities exhibit low species diversity and are typically highly adaptive. Typical benthic communities in the nearshore habitat of Sandbridge Beach include polychaete worms, bivalve mollusks, and amphipod crustaceans. The dominant epibenthos are blue mussel (*Mytilus edulis*), common squid (*Loligo pealei*), hermit crab (*Paragus longicarpus*), windowpane flounder (*Scopthalmus aquosus*), and spotted hake (*Urophycis regia*).The majority of fish living nearshore are motile and can easily escape from sand placement. For many shellfish and other sessile invertebrates, it would be more difficult to avoid sand placement. The greatest impacts of sand placement are the initial decrease in fish abundance, potential for gill clogging caused by increased turbidity, and direct burial of demersal fish. These impacts would be short-term and localized, and they would not cause significant impacts to populations of any species. In July 2001, the USACE ERDC released results of an $8.6 million, eight-year biological monitoring program of beach nourishment activities at the Asbury Park to Manasquan Inlet Beach Erosion Control Project in New Jersey (Burlas et al. 2001). Primary findings included: 1) no long-term and systematic impacts to surf zone fish distribution and abundance patterns; 2) no sustained biological indicator (i.e., fish abundance or distribution pattern) that distinguished nourished from non-nourished beach habitat; and 3) bluefish were essentially absent during nourishment, while benthic feeders (silversides and kingfish) were potentially attracted to the nourishment area, either related to resuspended benthic material (silversides) or the general nourished condition (kingfish). Feeding habits of benthic-feeding surf zone fish, including northern kingfish, rough silverside, and Atlantic silverside, were also examined. They found that the percentage of fish with filled stomachs did not differ, nor did the relative composition of prey items. Finally, the study also investigated the effects to surf zone on nearshore ichthyoplankton. Comparisons of reference and control beaches revealed no obvious differences in surf zone ichthyoplankton abundance, size, and species composition.

There may be an increase in turbidity and sedimentation associated with dredging and sand placement, but the adverse impacts of such changes will be localized and temporary. It is generally viewed that elevated levels of turbidity generated by trailing suction hopper dredge operations in open ocean waters does not represent a significant ecological impact (W.F. Baird & Associates and Research Planning 2004). Given their mobility, sharks and tunas can avoid turbidity plumes and, if necessary, survive short-term elevated turbidity.

## 7. Cumulative Impacts

Habitat and morphology changes within Sandbridge Shoal have been monitored since 1989, most often before and after dredging projects. An initial survey of the shoal indicated approximately 39.8 million cy of compatible beach material (Kimball and Dame 1989). Another survey expanded this estimate to over 104 million cy of usable sand (Kimball et al. 1991). Dredging over the last 22 years has removed just under 9.8 million cy of material for beach nourishment of Sandbridge Beach and Dam Neck. It is possible that infilling has occurred; however, although BOEM requires that bathymetric surveys be conducted pre- and post-construction to continue monitoring physical changes, actual rates of infilling have not been recently calculated.

The extracted-to-date volume of 9,786,559 cy is 24.6% of the 39.8 million cy estimate and 9.4% of the 104 million cy estimate. Accounting for the anticipated 2018 extraction, a total of 11,986,559 cy would constitute 30.1% and 11.5% of those volumes, respectively, of those estimated volumes. If historical trends continue, conservative sand volume estimates indicate an annual amount of 450,000 cy (the historical average) can be dredged for just over 66 years. Bathymetry surveys, sediment sampling, and biological monitoring will improve these estimates. Coordination among stakeholders and resource managers will also provide insight into needs and alternatives.

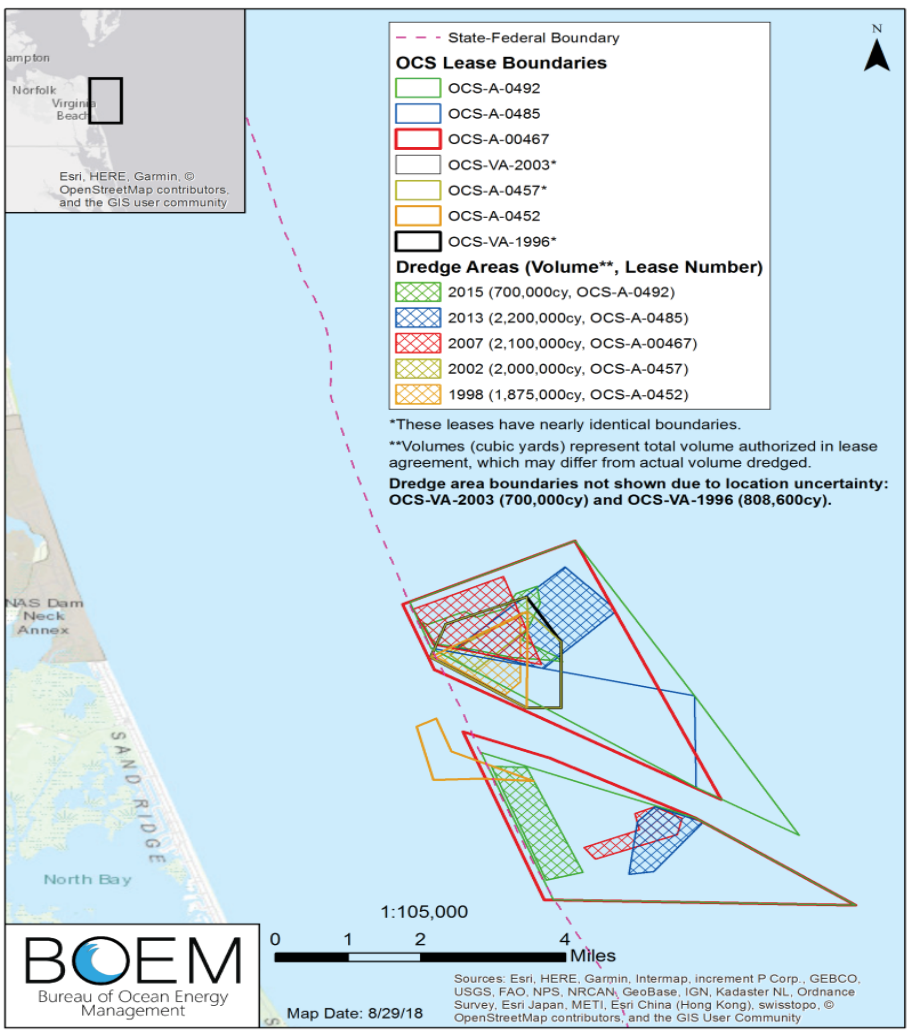


**Figure 3: All dredge events at Sandbridge Shoal**

Dredging has occurred primarily at large ridges of high relief, a typical dredging tactic that results in retention of some ridge relief. The shoal remains structurally complete and exposed to the wave-current influence. However, because recovery of sand volume may be relatively slow between dredging events, continued dredging may reduce the total surface area of the shoal over time.

It is anticipated that next nourishment of Sandbridge Beach will occur in 2018 with an estimated 2.2 million cy of sand dredged from the borrow areas and placed along Sandbridge Beach. Impacts to EFH occur from a vast array of sources, including neighboring navigation channel dredging. The most influential of those sources are impacts from regulated fishing activities that conduct unsustainable fishing practices and policies. Nearly one third of U.S. marine fisheries have been officially designated as overfished or nearly so. Recreational and commercial fishing activities (scallop dredges, trawls, anchoring, and vessel operations), all directly contact habitats utilized by EFH species. As a result of these impacts, commercial harvesting is now being forced to level off after decades of impressive growth.

There are several commercial fisheries that occur in the general area that may have impacts to both species of concern and their habitat. Gillnets are used in several fisheries, including those for spiny dogfish and striped bass; however, gillnets are a passive fishing gear, and thus, non-target species are caught as bycatch, which could impact the populations of these non-target species. Many commercially-caught fish species, such as bluefish and Atlantic croaker, are caught by rod and reel or hand line. Impacts include post-release mortality of undersized or non-target species. If anchoring takes place, there may be some bottom disturbance as well. Stable sand environments often support colonial epifauna such as sponges and bryzoans. When the epiflora is repeatedly removed by bottom fishing, the habitat may become less suitable for commercially valuable fish and shellfish species (Bradstock and Gordon 1983; Poiner and Kennedy 1984; Sainsbury 1988).

In recent years, trawl fisheries for various fish and invertebrate species also occur in this general area. Trawl fisheries target bottom fish, such as grey seatrout and summer flounder, or water column species such as bluefish. Traditional bottom trawls may remove bottom dwelling organisms, such as brittle stars, urchins, colonial tube-dwelling worms, and hydroids (Collie et al. 2000). Colonial epifauna, which provide habitat for prey species of many commercially fished species, such as shrimp, polychaetes, and small fish, have also been shown to be less abundant in areas disturbed by bottom trawling. Seafloor areas that have been heavily trawled may bear tracks where trawl doors have gouged into the sediment, changing the sediment surface; in other areas, the trawl has flattened the sediment surface reducing habitat for managed species and their prey. Traditional trawl techniques are nonselective in their catch and thus, have the potential to reduce both prey species and year classes of managed species that are not yet mature. Longline fishing may occur for species like some coastal sharks. Longlining may result in the death of some juvenile and non-target fish species.

Pots and traps may be used for blue crabs and fish species such as black sea bass. During storms, these pots and traps may be dragged along the seafloor bottom tearing up benthic habitat and damaging sessile organisms. If these pots and traps break away during storms, they may be impossible to recover and will continue to “fish” as ghost gear for marine organisms that will become trapped and unable to escape.

Recreational anglers have also caught designated EFH species within the vicinity of the borrow areas (i.e. bluefish, cobia, striped bass, king mackerel) via rod and reel and spear fishing. Mortality of some species is expected due to bycatch of non-target species and sub-legal catches. Additionally, disruption of bottom habitat can occur from the anchoring of recreational boats. Benthos and fish impacted by the anchor may be destroyed. Repeated anchoring in same location can lead to patches void of benthic organisms. It can reasonably be assumed that states will continue to license and permit recreational vessels and operations, which do not fall under the purview of a Federal agency. As the recreational activity increases, mortalities of EFH species will continue to increase as well.

Impacts to EFH can be exacerbated by non-point source pollution. Pollution in Chesapeake Bay and various smaller estuaries in the area can influence fish habitat within the project area because of buoyant plumes that move south along the coast. Runoff from agriculture, stormwater, and other sources carry toxic chemicals and excess nutrients into coastal waters. These can lead to reproductive failure, deformations, and death of organisms, as well as anoxic habitats. This is of particular concern in estuaries and wetland where reproduction, migration, and larval development occur for many of the EFH species found within the project area. Impacts from the non-point sources of pollution are expected to continue.

Impacts from natural sources, such as large meteorological events, can also influence EFH species. Hurricanes and nor'easters, typified by increased system energetics, can increase turbidity and destroy bottom habitat used by EFH species and their prey. This can result in detrimental indirect impacts to fish through changes in the food web. The magnitudes of these impacts vary greatly depending on their intensity. Usually they are only temporary in nature.

There is no new information in regards to physical impacts that suggests there is the potential for significantly different effects to benthic habitat or communities not previously considered. The previous conclusions remain valid; expected effects on this resource is to be localized, moderate, and long-term due to the loss of substrate within the borrow area although some degree of infilling is to be expected.

The shoal's function as habitat may be adversely affected, but, to date, there has been limited evidence of any sustained disturbance beyond transient and localized impacts to a wide range of benthic and pelagic biota (Diaz et al. 2006). Areas of the shoal where sediment grain-size is incompatible with the replenishment grainsize requirements, as well as other no-dredge areas such as the submarine cable zone, would remain undisturbed, thus serving as feeder zones for benthic recolonization and natural bottom habitat. Additionally, since borrow areas are not typically dredged perfectly flat relative to the adjacent seafloor, portions of the dredged areas would remain morphologically intact.

The shoal may not naturally recover the total volume of the sand that is dredged. However, prior research sponsored by BOEM suggests dredging will not threaten the geomorphic integrity of the shoal. To date there has been limited evidence of any sustained disturbance beyond transient and localized impacts. Overall, cumulative impacts on coastal geography and physical oceanography would be minor as no permanent changes in offshore geology would be expected.

Overall, the impacted area would not increase, and the nature of the impacts would not change. The intervening periods between replenishments generally allow for physical and biological recovery and equilibration of the subaerial beach and surf zones.

Given the cumulative impacts associated with the current and future planned beach nourishment projects, this project will most likely not cause additional substantial adverse effects to EFH impacts over time.

## 8. Best Management Practices/Mitigation Measures

Every measure that is technically and economically viable will be pursued to avoid and minimize effects on EFH. In the past, minimization has included implementation of best management practices, extensive consultation with Federal and state agencies, and sampling of beach quality material at the offshore sand source areas to pre-select shoal areas that are most likely to contain beach quality sand. Sand lenses will be mined selectively, following existing bottom contours to the maximum extent practicable. For this maintenance cycle, USACE and BOEM determined that vibracore sampling of the Sandbridge Shoal borrow sites are warranted prior to construction. This will ensure that dredging only occurs where there is material that is compatible with the Sandbridge Beach Nourishment and Hurricane Protection Project, so that recolonization of the dredge and placements sites occurs rapidly and potential environmental impacts are minimized.
Pre-dredge vibracore samples will be collected to identify the exact location of shoal areas with these sand lenses. This will minimize the dredge footprint and the hours over which the dredge must operate. UXO screens will be used at all times on the draghead/cutterhead, which will minimize potential entrainment. Depending on the method of dredging, measures would be implemented to minimize disturbances to the environment. Hopper dredges will not begin dredging until the draghead is in direct contact with the substrate; similarly, operation of the cutterhead would not start until it is in immediate contact with the substrate. For both types of hydraulic dredges, this measure reduces the intake of water and sediment, the potential uptake and entrainment of eggs and larvae, and potential entrainment of juvenile and adult fishes, thus minimizing potential impacts and losses of fish species. Pre- and post-dredging bathymetric surveys will be conducted across those portions of the borrow areas where dredging is conducted to determine geomorphic changes from pre- to post-construction. Rotational dredging will be practiced to the maximum extent practicable to focus dredging in areas that have not been previously mined or have sufficiently accreted since previous events. This will prevent the mining of the same sand ridge during sequential dredging projects and assist in recovery of the benthic community. For the 2018 event, the majority of vibracores (~60%) are focused in the southern borrow area (A) to investigate new resources, since there has been minimal dredging in the most recent (2015, 2013) events. While dredging, the existing bottom contours will be followed to the maximum extent practicable to maintain seafloor ridge and swale heterogeneity, as well as to avoid creating deep pits.

Impacts will be minimized by attaching a state-of-the-art sea turtle deflector, which is also useful to prevent entrainment of large fish, on the drag head of the hopper dredge. The draghead will be operated in a manner that will: 1) reduce the risk of interactions with fish species that may be present in the action area; 2) maintain shoal morphology; 3) leave undisturbed sections of benthic habitat within the designated dredged area(s) to facilitate benthic re-colonization and recovery; and 4) target beach-quality sand with a low content of fine sediments and organic materials to reduce the potential for increased turbidity. The hopper inflow and suction will be shut off in the draghead when it is lifted off the bottom to prevent possible entrainment of fish species.

Norfolk District has been working with USACE, North Atlantic Division and other Districts to optimize the use of available sand sources by developing a system approach for the long-term sand management of sand sources. Agencies that will be invited to participate include the Navy, Virginia Port Authority, and BOEM.

Similar to the benefits of knowledge sharing within the district, the establishment of regular coordination within the Division as well as other agencies, to include BOEM and the Navy, will allow understanding of best practices, potential solutions, and ideas for optimizing existing sand sources.

## 9. Conclusion

The areas that have been designated as EFH in the project area have been given this classification because they are believed to be "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U. S. C. 1802). HAPC, a separate designation within EFH, is based on one or more of the following considerations: 1) the importance of the ecological function, 2) extent to which the habitat is sensitive to human-induced degradation, 3) whether and to what extent development activities are stressing the habitat type, or 4) rarity of habitat type [50 CFR 600.815(a)(8)]. The severity of the impact to EFH and supported species is dictated by: 1) the spatial extent of the impact and 2) the chronic or long-term nature of the impact.

The two borrow areas within Sandbridge Shoal are Area B to the north and Area A to the south. During each dredging cycle, approximately 150 to 500 acres of benthic habitat within these borrow areas has the potential to be adversely impacted to obtain needed borrow material. Compared to the entire shoal complex habitat and the ridge and swale topography in the Mid-Atlantic Bight offshore Virginia, the area of potential impact is relatively small.

As discussed and evaluated in this assessment, offshore dredging, dredge transit, and placement along the Sandbridge Beach shoreline are not expected to significantly impact "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" to any appreciable extent over a significantly large area or over any significant period of time. Impacts would be limited and temporary. For fishes, demersal species are expected to be most impacted. The other pelagic species should only be minimally impacted. Given the relatively smallsize of the impacted area relative to the large geographic ranges of transitory fishes, the proposed activities, even when considered cumulatively under present conditions, would have only minor impacts on the populations of fishes evaluated in this analysis.

Accordingly, USACE and BOEM have determined that the proposed project may have adverse effects on EFH for Federally managed species, but adverse effects on EFH species, due to construction, will largely be localized within the dredged footprints and beach nourishment areas in the surf zone. The adverse effects on EFH are not substantial. In conclusion, the project is not anticipated to have a substantial adverse impact on EFH species or habitat that may be in the project area.

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# Appendix A

**APPENDIX A**

**ESSENTIAL FISH HABITAT ASSESSMENT**
SANDBRIDGE BEACH EROSION CONTROL
AND
HURRICANE PROTECTION PROJECT
VIRGINIA BEACH, VIRGINIA

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**ESSENTIAL FISH HABITAT ASSESSMENT**
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## I. Introduction and Background

Sandbridge Beach is located on a barrier island along coastal southeast Virginia separating the Atlantic Ocean on the east from Back Bay, a shallow freshwater sound, to the west. It is a residential community of mostly year round residents, rental properties, and summer homes located approximately 5 miles south of Virginia Beach's "resort strip." Several major storms, nor'easters, and hurricanes have struck the area in past years causing severe losses of sand and coastal flooding; the oceanfront is susceptible to wave attack on the beach berm and dunes. During the initial development of Sandbridge Beach as a residential community, sand dunes were lowered, bulldozed, and in some cases, removed for construction near the shoreline. Flooding in the winter of 1991 caused about $2 million in damages. In 1992, 166 oceanfront lots were fortified with bulkheads to control erosion; by 1996, storm damage left only 122 properties protected by bulkheads.

A Phase I Advanced Engineering and Design Study for Beach Erosion and Hurricane Protection at Virginia Beach, including Sandbridge Beach, was authorized by Section 1(a) of the Water Resources Development Act of 1974 (Public Law 93-251, 93rd Congress, H.R. 10203, 7 March 1974). In March 1992, the U.S. Army Corps of Engineers (USACE) completed a Final Feasibility Report and Environmental Assessment (EA) for Sandbridge Beach evaluating economic, engineering, and environmental concerns. The Minerals Management Service (MMS) prepared a supplemental EA in 1997, 2001, and 2006 to support the extraction and use of Outer Continental Shelf (OCS) sand in the project.

This Essential Fish Habitat (EFH) assessment was prepared by the USACE, acting as lead Federal agency, in cooperation with the MMS, to present the potential impacts that could result from beach nourishment of the oceanfront at Sandbridge Beach and the related offshore extraction of beach borrow material. The proposed maintenance project would begin in Spring/Summer 2010 and incorporate the same design criteria as previous projects.

The designated borrow site is Sandbridge Shoal, located approximately 3 nautical miles from the shoreline, outside of Virginia's territorial sea (Figure 1). Estimated sand reserves are 40 million cy (Hardaway et al., 1998). In places, the shoal is about 20 ft thick. The principal sediment is fine to medium sand. There are two designated borrow areas on Sandbridge Shoal, Area B to the north and Area A to the south; depths here range from 30 to 65 feet (~10-15 m in the areas actively being dredged). The region between the two borrow sites is a no-dredge zone due to the presence of a buried Navy submarine communications cable.

Approximately 6,810,000 cy of sand were removed from Sandbridge Shoal between 1996 and 2007 for use in beach nourishment and coastal restoration projects (Figure 2). Sandbridge Shoal was first used in 1996 when 810,000 cy were dredged from Area B for shoreline protection at

Dam Neck. Dam Neck was renourished a second time by the Navy in 2003 with 700,000 cy dredged from Area B. Beach nourishment for Sandbridge Beach actually began in 1998, using 1,100,000 cy from Area B. Sandbridge Beach was renourished again in 2002 with 2,000,000 cy dredged from Area B and 2,200,000 cy in 2007 dredged from areas A and B.

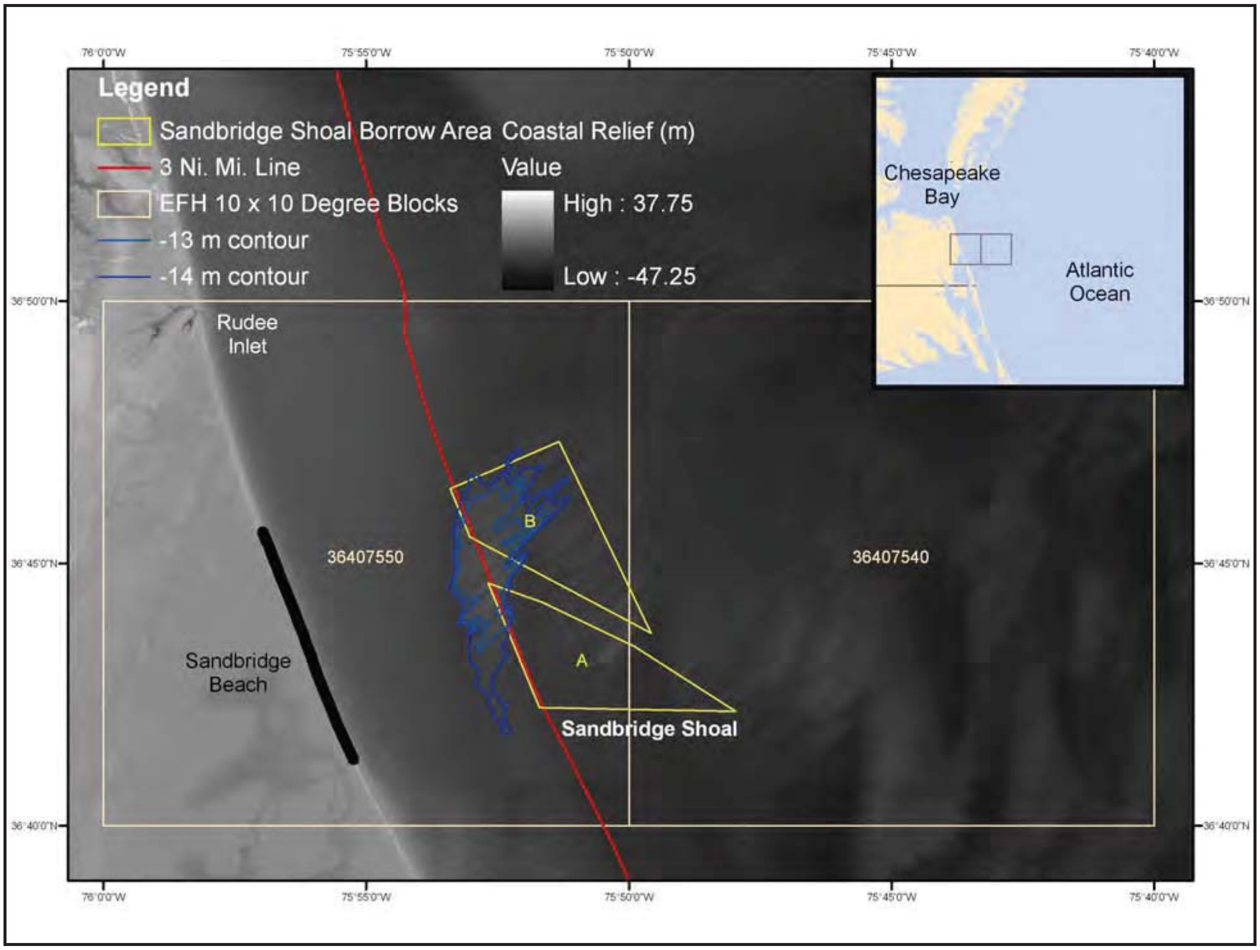



Figure 1: Location map of Sandbridge Shoal and Sandbridge Beach

## II. Purpose

Provisions of the Magnuson-Stevens Fishery Conservation and Management Act (16 USC 1801) require that EFH areas be identified for each species managed under a fishery management plan, and that all Federal agencies consult with the National Marine Fisheries Service (NMFS) on all Federal actions that may adversely affect EFH. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." The EFH areas have been designated by the Fishery Management Councils and were published in March 1999 by NMFS. This EFH assessment is being prepared pursuant to Section 305(b)(2) of the Magnuson-Stevens Act, and includes the following required parts: 1) identification of species of concern; 2) a description of the proposed action; 3) an analysis of the effects of the proposed action; 4) proposed mitigation; and 5) the Federal agency's views regarding the effects of the proposed action. The purpose of this consultation process is to address specific federal actions that may adversely affect EFH, but do not have the potential to cause substantial adverse impact.

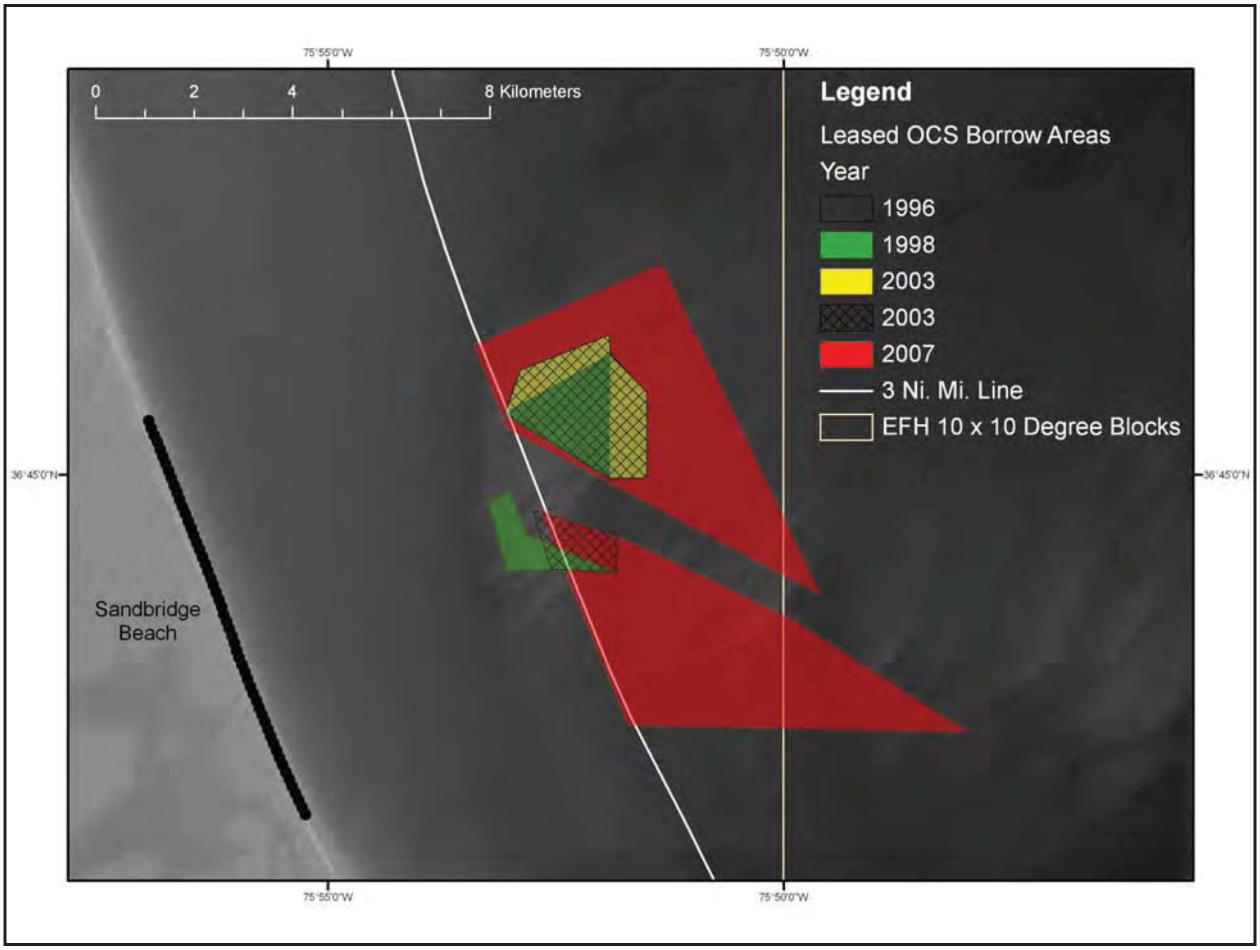


Figure 1: Location map showing borrow areas used since 1996 to obtain sand for beach nourishment projects at Sandbridge Beach and Dam Neck Naval Facility. Material was dredged from much smaller regions with each approved lease area.

## III. Proposed Project

Approximately 1.5 to 2.0 million cubic yards (cy) of beach quality sand would be placed on the beach approximately every 3 years depending upon weather conditions, availability of funding, and behavior of subsequently placed material at the project site. The cycle may occur less often, but probably no less than once every 5 years. 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 National Wildlife Refuge to the south. The project dimensions include a 50-foot wide berm at an elevation of 6 feet North American Vertical Datum (NGVD) with a foreshore slope of approximately 1:20 (one vertical foot to 20 horizontal feet) for a distance of approximately 5 miles.

The designated borrow area for the planned spring/summer 2010 project is Borrow Area B; higher relief sand ridges on the crest of main shoal body are the primary target for dredging (Figure 3). Borrow Area A would still remain an option in the event it is deemed necessary to dredge in that location. Approximately 1.5 to 2.0 million cubic yards of beach quality sand would be removed by trailing suction hopper dredge. A hydraulic cutterhead suction dredge may be operated, but is highly unlikely; this type of dredge has not been previously utilized. The specifications for the project call for a duration of approximately 90-120 days.

A hopper dredge digs material from the bottom by making passes over the site, typically moving at 1 to 2 knots. The hopper dredge is equipped with dragarms, dragheads, and a hopper which collects and decants slurried sand. In the case of a twin-arm dredge, the material is dug in two swaths that are each the width of the draghead (typically 6-8 ft wide). To get a full load, a typical hopper dredge may make two or three passes along the target shoal. The dragheads house the pumping system, typically have teeth and pressure jets to loosen the material being dredged, and are fitted with turtle deflectors. When the hopper is full, material is transported to a pump out buoy located offshore. The material is then pumped through a discharge pipeline, which runs along the ocean floor, and up onto the beach where bulldozers and graders will distribute the material along the subaerial beach and foreshore. The project schedule would require either two medium-size hopper dredges (4,000-5,000 cubic yards capacity) delivering a total of six loads per day (three each), or one large hopper dredge (9,000 to 12,000 cy) delivering two or three loads per day.

A cutter-suction dredge uses a rotating cutterhead around the intake of a suction pipe to break up or loosen bottom material. The cutter-suction dredge is typically anchored in fixed position by a three-wire anchoring arrangement or spuds; the position is changed as the dredge finishes removing all the material it can reach. The dredge digs material from the bottom by swinging the cutterhead back and forth across an arc of 150 to 300 feet. Winches on the bow of the dredge pull the cutterhead back and forth and advance it ahead in the cut in 4- to 6-foot steps. A large centrifugal pump removes the loosened material from the ocean bottom and pumps it as a sediment-water slurry through a discharge pipeline to the placement site. But in cases where the distance from the dredge location to the placement site is beyond a few miles, the slurry is often pumped into scows for transport to the placement site. The dredge plant is supported by one or more small work boats used for surveying, line handling, anchor placement, and transporting workers. In the case of a barge-based project, operation would include one or two tugboats and one or two barges.

Historically, dredging and placement for the Sandbridge Beach project has occurred between the months of January and October. Future dredging could potentially occur during any month of the year, but substantial winter dredging would be unlikely because of hopper dredge availability, greater ocean wave energy and resultant higher risk to ships and crew, as well as difficulty of operation. Dredging and placement operations, conducted since 1996, have typically taken between 10-15 weeks to complete, but depend on the number of hopper dredges deployed.

## IV. EFH Consultation History

Since EFH areas along coastal Virginia were first designated by the Mid-Atlantic Fishery Management Council and published by NOAA Fisheries in 1999, formal consultation was not initiated for initial construction at the Dam Neck Naval Facility in 1996 or Sandbridge Beach in 1998.

MMS submitted an EFH assessment in October 2001 to support leasing OCS sand from Sandbridge Shoal for the first maintenance cycle of the Corps' Sandbridge Beach Erosion Control and Hurricane Protection Project planned for 2002-2003. The assessment determined that 740 acres of EFH may experience adverse effects, with the most impact on demersal fishes. In January 2002, the Northeast Region of NOAA Fisheries offered conservation recommendations to mitigate potential impacts and monitor the extent of impacts and potential recovery of managed species and their associated habitat. The MMS responded in February 2002 indicating its intention to follow the specified measures to the maximum extent practicable. In June 2002, the MMS submitted an assessment addendum given that the timing of the proposed action had changed - the original assessment and addendum covered species present in both fall and spring. In August 2002, NOAA Fisheries determined that the assessment and addendum adequately addressed potential impacts on managed species and their habitat and found that no additional conservation recommendations were necessary.

In July 2003, the Navy submitted a new EFH assessment that considered the potential effects of using another 700,000 cubic yards of OCS sand from Sandbridge Shoal to replenish the Dam Neck Annex Beach. The assessment, addressing impacts of dredging over the fall and winter months, determined that the proposed project may have adverse effects on EFH for Federally managed species. In September 2003, Tim Goodger (NOAA Fisheries) emailed the Navy providing the identical conservation recommendations as provided to the MMS in 2002.

The MMS attempted to consult with NOAA Fisheries in 2006 for the second maintenance cycle of the Sandbridge Beach Erosion Control and Hurricane Protection Project planned for summer 2007, but did not receive any response to multiple phone or email communications.

Since new information about managed species and their associated habitat is available, the Corps and MMS have reinitiated consultation.

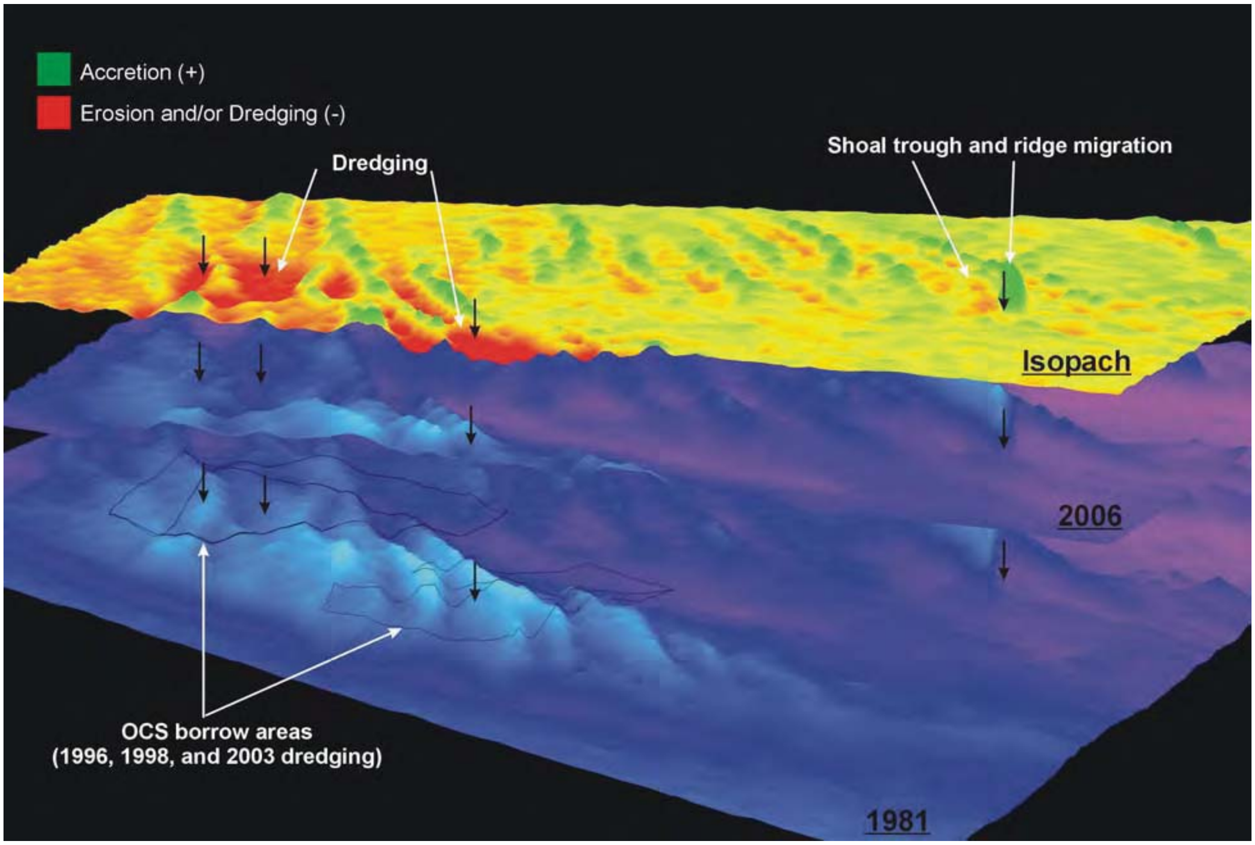


Figure 2: Bathymetric elevation models represent the seafloor in the vicinity of Sandbridge Shoal. The isopach shows the difference between the two surfaces and the physical evolution of the shoal complex during the 25 year intervening period.

## V. Benthic Habitat and Biota Monitoring on Sandbridge Shoal

Physical processes dominate the sand-rich habitat of Sandbridge Shoal and the seaward series of high relief secondary shoals (Figure 3). The shoal environment is frequently exposed to high wave and current energy given its relatively shallow water depth. The seafloor of the main shoal body is characterized by fine to medium sands. Smooth-crested wave-orbital bedforms have been repeatedly documented in benthic video and stillshots (Cutter and Diaz, 1998; Diaz et al., 2003). The bottom substrate east of the shoal is increasingly silty sand and patchy, where biological activity tends to be higher.

Over decadal timeframes, the ridge and swale topography imprinted on the larger shoal body is actively migrating to the south-southwest under coupled wave-current forcing. Figure 3, which compares 1981 and 2006 bathymetric surfaces, shows three physical signatures: 1) the southward migration of trough and ridges (see as alternating bands of erosion and accretion); 2) trough deepening and ridge crest growth and steepening; and 3) localized, persistent effects of dredging along shoal flanks and crests in limited subregions of Areas A and B.

Figure 4 shows pre- and post-dredging conditions in 1998 and 2003 for a subregion of Area B, while Figure 5 shows pre- and post-dredging conditions in 2007 for a subregion of Area A. Two different dredging approaches are illustrated: (1) shallow dredging of multiple shoal ridges and (2) targeted extraction from a single shoal ridge.  Some of the same shoal ridges have been dredged during more than one construction cycle, increasingly the likelihood and severity of impact. However, the shoal ridges typically targeted for dredging are large scale and high relief features. Consequently, they are not entirely eliminated during dredging. Although shoal relief and footprint are significantly reduced, the shoals are morphologically intact and continually shaped by the same physical processes. Between dredging episodes, the shoals show relatively little volumetric recovery, leading to a long-term reduction in the surface area of bottom habitat.

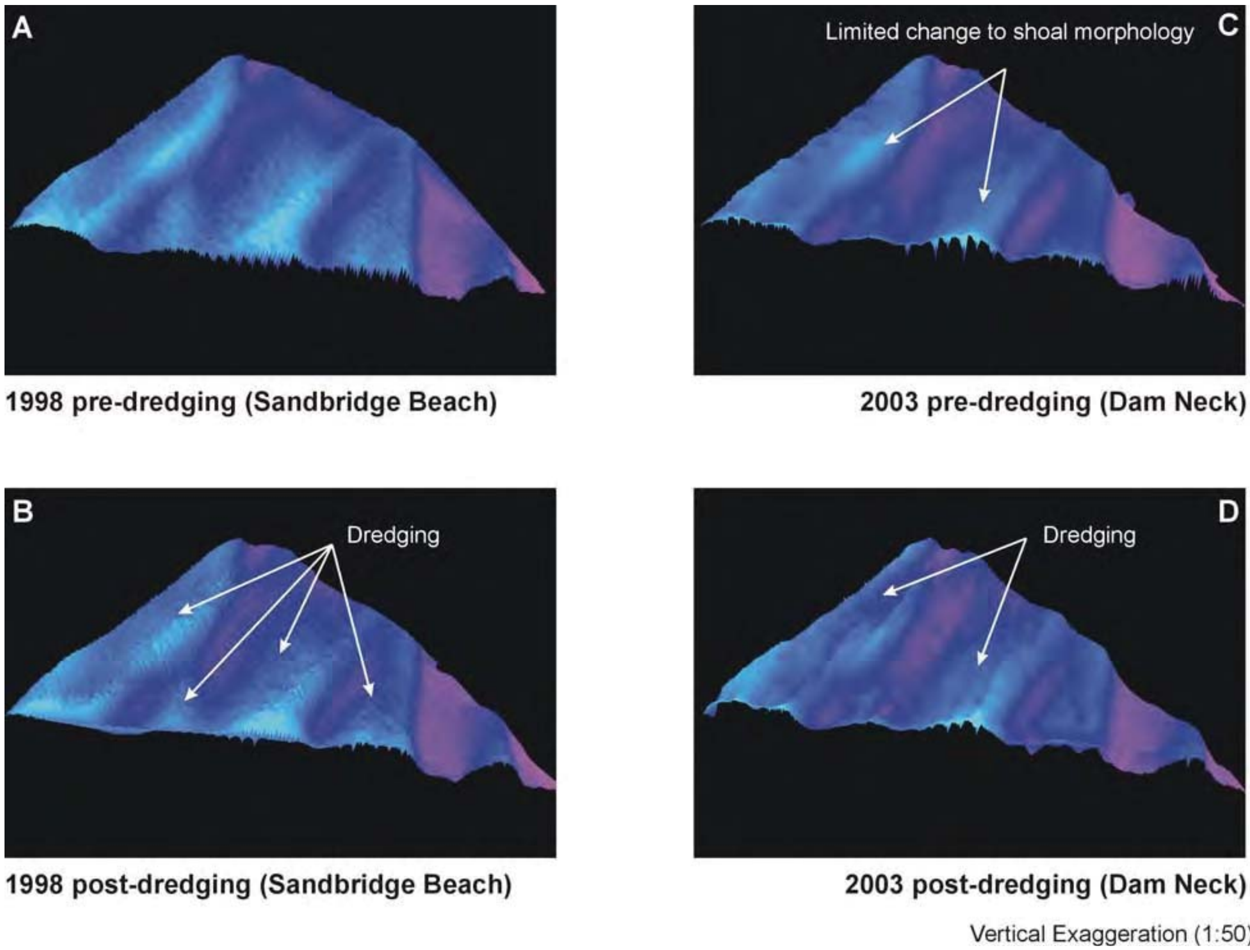



Figure 3: Pre- and post-dredging conditions in 1998 and 2003 for a subregion of Area B.

From 2002 to 2005, VIMS implemented a rigorous biological monitoring program that focused on possible biological impacts associated with dredging of Area B (Diaz et al., 2006). Results from that field campaign were compared to earlier benthic assessments (Cutter and Diaz, 1998). During survey periods in 2002, 2004, and 2005, physical processes were predominant in structuring sediment surfaces for all sampling stations in all years. Observations in 1996 and 1997 showed increasingly biologically dominated habitats with increasing distance off shoal (Cutter and Diaz, 1998). Diaz et al. (2006) have attributed some of the spatial and temporal heterogeneity to 1) energetic storms which expose and rework surface sediments, 2) infrequent, but significant benthic recruitment events, and 3) seasonal variability. Despite multiple dredging events, the shoal environment continues to host robust macrobenthic and fish communities. In the vicinity of historic dredging, no negative impacts for macrobenthos or demersal fishes were documented.

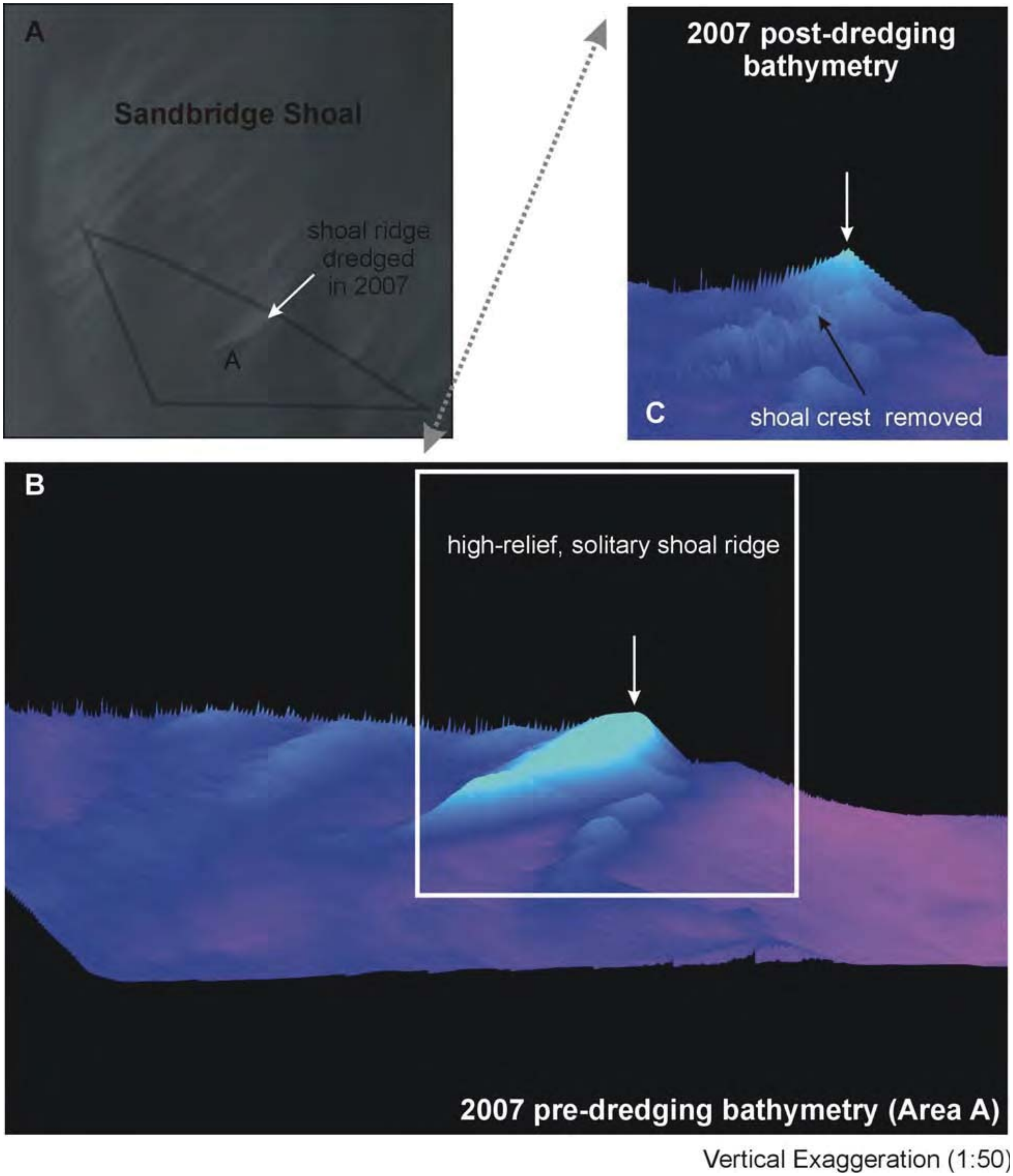



Figure 4: Pre- and post-dredging conditions in 2007 for a subregion of Area A.

The most abundant benthic, taxonomic group observed during monitoring was polychaetes. Other benthic species observed included amphiods, bivalves, lancelets, and to a lesser extent, decapods, nemerteans, echinoderms, anemonies, isopods, gastropods, phoronids, and tunicates. Interestingly, Diaz et al. (2006) observed that macrobenthic production east and west of the shoal was about 2.5 times more productive than the shoal crest. Cutter and Diaz (1998) also found benthic production to be higher off shoal relative to on shoal. The community composition on and around Sandbridge Shoal for 2002-2005 was similar to previous work. Cutter and Diaz (1998) found polychaetes, amphipods, decapods, bivalves, sand dollars, and lancelets to be the dominant groups. The average macrofaunal abundance in 1996 and 1997 was 1.5 to 2.5 times lower than 2002 to 2005 conditions. Monitoring revealed no significant difference in macrofaunal abundance between dredged areas (Area B) and controls, suggesting that dredging within Area B has had little impact on habitat value.

During the three-year monitoring period, a total of 1,600 fishes and skates, representing 12 taxa, and 1,000 invertebrates, representing 12 taxa, were collected. The most common fishes were the sea robins, accounting for 32% of all fishes. Spotted hake was the second most abundant and accounted for 26% of the fishes, even though it did not occur in any trawl in 2002. Butterfish were 16% of the fishes, even though it did not occur in 2002. Pinfish and smallmouth flounder were 16% and 6% of the fishes, respectively. Other flounders, mostly summer flounder, and black sea bass were about 1% of the fishes. The trawls also collected mobile and sessile invertebrates that were not collected quantitatively by grab sampling. The most abundant being hermit crabs (*Pagurus* spp.), and sand shrimp (*Crangon septemspinosa*), followed by the Atlantic brief squid (*Lolliguncula brevis*), and one individual of the Atlantic bobtail squid (*Rossia* sp.). There were no significant differences between sampling locations (on and off shoal) or between years in the abundance of sea robins, smallmouth flounder, or pinfish. Diaz et al. (2006) reported no statistically significant preference in use of habitat, but noted that the odds of occurrence varied through time, showing off shoal preference for some years, and on shoal for others. For the most abundant fishes, there were no differences in habitat utilization, but fishes generally showed broad preference for sandy habitat (Diaz et al., 2003). Following dredging, most demersal fishes, except the spotted hake and smallmouth flounder, were more likely to be on shoal. Gut content and stable isotopic analyses were conducted during the multi-year monitoring effort. The most common food items consumed by demersal fishes were epifaunal and/or infaunal species in the decapod, amphipod, and mysid taxonomic groups. There were notable differences in diets between fish species, but no differences in feeding patterns were observed within particular species across sampling locations or years. The food web in the vicinity of Sandbridge Shoal was generally limited to two trophic levels beyond the primary producers; primary consumers, such as bivalves and amphipods, supported secondary consumers and demersal fish at the third trophic level. Top level species were spotted hake and weakfish.

## VI. Identification of Managed Species

**Square I**

**10' x 10' Square Coordinates:**

| Boundary | North | East | South | West |
|---|---|---|---|---|
| Coordinate | 36° 50.0' N | 75° 50.0' W | 36° 40.0' N | 76° 00.0' W |

Square Description: Waters within the Atlantic Ocean within the square affecting North Bay, Shipps Bay, and southern Virginia Beach. These waters affect the following: Muddy Creek, Porpoise Pt., and northern Long I., and affect Virginia Beach from Rudee Inlet on the north, south past Sandbridge Beach, VA., to east of half way down Long I., just north of the Wash Flats.

**Square II**

**10' x 10' Square Coordinates:**

| Boundary | North | East | South | West |
|---|---|---|---|---|
| Coordinate | 36° 50.0' N | 75° 40.0' W | 36° 40.0' N | 75° 50.0' W |

Square Description: Waters within the Atlantic Ocean within the square one square east of the square affecting and within North Bay and Shipps Bay and affecting southern Virginia Beach.

## Compiled Species List: Square Coordinates I and II

| Species | Eggs | Larvae | Juveniles | Adults |
|---|---|---|---|---|
| red hake *(Urophycis chuss)* | X | X | X | |
| witch flounder *(Glyptocephalus cynoglossus)* | X | | | |
| windowpane flounder *(Scopthalmus aquosus)* | X | X | X | |
| Atlantic sea herring *(Clupea harengus)* | | | X | X |
| monkfish *(Lophius americanus)* | X | X | | |
| bluefish *(Pomatomus saltatrix)* | | | X | X |

| Species | Eggs | Larvae | Juveniles | Adults |
|---|---|---|---|---|
| Atlantic butterfish *(Peprilus triacanthus)* | | | X | |
| summer flounder *(Paralicthys dentatus)* | | | X | X |
| scup *(Stenotomus chrysops)* | n/a | n/a | X | X |
| black sea bass *(Centropristus striata)* | n/a | X | X | X |
| surf clam *(Spisula solidissima)* | n/a | n/a | X | |
| spiny dogfish *(Squalus acanthias)* | n/a | n/a | X | X |
| king mackerel *(Scomberomorus cavalla)* | X | X | X | X |
| Spanish mackerel *(Scomberomorus maculatus)* | X | X | X | X |
| cobia *(Rachycentron canadum)* | X | X | X | X |
| red drum *(Sciaenops occelatus)* | X | X | X | X |
| sand tiger shark *(Odontaspis taurus)* | | X | | X |
| Atl. sharpnose shark *(Rhizopriondon terraenovae)* | | | | X |
| dusky shark *(Charcharinus obscurus)* | | X | X | |
| sandbar shark *(Charcharinus plumbeus)* | | X | X | X |
| sandbar shark *(Charcharinus plumbeus)* | | HAPC | HAPC | HAPC |
| scalloped hammerhead shark *(Sphyrna lewini)* | | | X | |
| tiger shark *(Galeocerdo cuvieri)* | | X | X | X |
| winter skate *(Leucoraja ocellata)* | | | X | |
| clearnose skate *(Raja eglanteria)* | | | X | X |

Source: National Marine Fisheries Service: “Summary of EFH Designation” posted on the internet at http://www.nero.noaa.gov/hcd/webintro.html and EFH Designations for New England Skate Complex posted at http://www.nero.noaa.gov/hcd/skateefhmaps.htm

The notation "X" in a table indicates that EFH has been designated within the square for a given species and life stage.

The notation "n/a" in the tables indicates some of the species either have no data available on the designated lifestages, or those lifestages are not present in the species' reproductive cycle. These species are: redfish, which have no eggs (larvae born already hatched); long finned squid, short finned squid, surf clam, and ocean quahog which are referred to as pre-recruits and recruits (this corresponds with juveniles and adults in the tables); spiny dogfish, which have no eggs or larvae (juveniles born live); scup and black sea bass, for which there is insufficient data for the life stages listed, and no EFH designation has been made as of yet (some estuary data is available for all the life stages of these species, and some of the estuary squares will reflect this).

## VII. Evaluation of Impacts on EFH Species

This section contains official EFH description language, relevant background information and an evaluation of potential impacts at Sandbridge Shoal and Sandbridge Beach for each species. Official EFH description language for all species is excerpted from the NMFS "Guide to Essential Fish Habitat Description" website http://www.nero.noaa.gov/hcd/list.htm. The descriptions describe the geographical extent in which the EFH is found, as well as the type of habitats utilized by each lifestage of the species evaluated in this report. NMFS groups three of the species, king mackerel, Spanish mackerel, and cobia, and describes them collectively under the category of "coastal migratory pelagics." EFH descriptions contained below for these individual species have been subdivided from this group. The life stages of bony and cartilaginous fish are distinct from each other at subadult stages. EFH is designated for egg, larval, juvenile, and adult life history stages of bony fish. EFH is designated for egg, neonate/early juvenile, late juvenile/subadult, and adult life history stages of cartilaginous fish. Portions of the area are designated as Habitat of Particular Concern (HAPC) for the sandbar shark.

Fish occupation of waters within the project impact area is highly variable, both spatially and temporally. Some of the species are found strictly offshore, while others may occupy both nearshore and offshore waters. Some species may be suited for open-ocean or pelagic waters, while others may be more oriented to bottom or demersal waters. This can also vary between life stages of federally managed species. Additionally, seasonal abundance is highly variable, as many species are highly migratory.

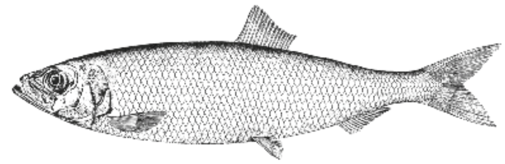
Direct impacts to each finfish species are evaluated largely based on their likelihood of being physically present, and therefore potentially physically harmed at either the proposed borrow areas or beach fill placement areas during project construction. Finfish could be directly impacted during dredging of sand by being entrained into the dredge or by being struck by the dredge plant. At Sandbridge Beach, direct impacts to finfish could potentially occur while sand is being pumped off the hopper dredge and placed (or moved along) the beach and in the surf zone. With the exception of some less motile juvenile species, most pelagic and demersal species are highly mobile and should be able to avoid entrainment in the dredge. While individual finfish of a number of species will likely be entrained into the dredge and destroyed, no detrimental impacts to the populations of any finfish are expected from the proposed project.

Indirect impacts to each finfish species could occur as a result of several aspects of the project. EFH species can be adversely impacted temporarily due to increased turbidity and decreased dissolved oxygen content during the dredging and placement, or temporary changes in local bottom habitat conditions (W.F. Baird & Associates and Research Planning, 2004). The turbidity and dissolved oxygen impacts would subside upon cessation of construction activities. There is only a minor portion of fine-grained sediment within the material to be dredged and placed, and turbidity can be pronounced locally at both sites naturally as a result of wave re-suspension of bottom sediments at any time of year. For these reasons it is assumed that indirect impacts from turbidity will be short-lived and localized (MMS, 1999). In addition, because of the open nature of Sandbridge Shoal, turbidity should decrease as the particles in the water column rapidly dissipate into the surrounding coastal ocean waters.

Relatively non-motile benthos, such as polychaetes and molluscs, will be destroyed over much of the area to be dredged; this may result in local loss of prey items for finfish following dredging until benthic communities recover. Recovery time of the benthos within both the dredging area and within the seawardly-translated surf zone of Sandbridge Beach is expected to be relatively rapid. Substantial recovery of both areas should occur within several months. Full recovery of both sites by benthos to a condition resembling pre-project conditions may take several years (Nelson, 1993; Newell et al., 1998; USACE, 2001; Jutte et al., 2002; Posey and Alphin, 2002). Naturally-occurring physical processes, often magnified by tropical and extra-tropical storms, are expected to be the foremost control on benthic habitat conditions and benthic community at any given time (Diaz et al., 2006). Recolonization of the borrow area substrate by benthos is expected to be facilitated by the likely presence of undisturbed bottom on the ridges between the furrows within the otherwise dredged area, as well as large regions of the shoal that are not dredged. Changes to the benthic community and habitat quality could result in impacts to the foodweb. These impacts are expected to be short-lived and localized.

Dredging may also result in physical alterations to the substrate and seafloor morphology. Changes in substrate could result in changes to benthic community assemblages after recolonization, or in unsuitable substrate for the spawning of some finfish species. For instance, should an area of the shoal be dredged too extensively, a substrate of course sandy material could be replaced with a substrate of clays. However, changes in substrate are not expected because dredging depths would generally be limited to depths characterized by beach-compatible sand; these suitable dredge depths are based on extensive vibracore data and minimize the probability of dissimilar substrates being exposed. Indirect impacts to finfish could potentially occur along the shoreline as shallow ocean water surf zone habitat is converted to inter-tidal and supra-tidal beach habitat. Seaward translation of the shoreline, profile equilibration, alongshore spreading, and "loss" of nearshore open water habitat is not expected to cause any significant indirect impacts to finfish; in a general sense, this habitat will only be translated seaward rather than "lost" because of the relative vastness of the seafloor.

## 1. Atlantic Herring (*Clupea harengus*)



**A.** EFH for Atlantic Herring:

Juveniles: Pelagic waters and bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras as depicted in Figure 3.3. Generally, the following conditions exist where Atlantic herring juveniles are found: water temperatures below 10° C, water depths from 15 - 135 meters, and a salinity range from 26 -32%.

Adults: Pelagic waters and bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras. Generally the following conditions exist where Atlantic herring adults are found: water temperatures below 10º C water depth from 20-130 meters, and salinity above 28 ppt.

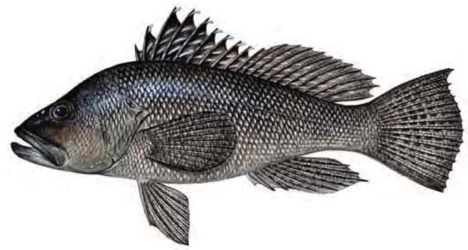
**B.** Background

The Atlantic herring is a coastal pelagic species that inhabits both sides of the North Atlantic Ocean (Reid et al., 1999), as well as the northeast Pacific Ocean (Robins et al., 1986). In the western North Atlantic they range from Labrador to Cape Hatteras. Juveniles and adults undergo complex north-south and inshore-offshore migrations for feeding, spawning, and overwintering. The Georges Bank/Nantucket Shoals stock overwinter south of Cape Cod and along the mid-Atlantic coast. The stock moves north onto Georges Bank and into the Gulf of Maine in the spring before congregating on spawning grounds southeast of Nantucket and on Georges Bank in the fall. The migrations of coastal adults are less well known. Adults in the western Gulf of Maine may migrate southwest along the coast after spawning and overwinter at the western extreme of their migratory path, possibly south of Cape Cod. Vertical migrations linked to changing light intensity are pronounced and are probably related to movements of prey and avoidance of predatory seabirds. Adults have a diet dominated by krill shrimp, arrow worms, copepods, amphipods, and flying snails (pteropods). Spring and autumn spawing populations support major commercial fisheries (Reid et al., 1999). Atlantic herring were extremely abundant in northeastern U.S. waters during the 1960's and were fished intensively by a large foreign fleet. In the early 1970's the Georges Bank-Nantucket Shoals fishery stock collapsed. Landings remained low for about 10 years, but stock biomass is now high and apparently increasing. The stock complex is underutilized, although the Gulf of Maine portion of the complex may be fully exploited (Reid et al., 1999). As of 1997, Atlantic herring was not overfished (NMFS, 2001). Favored habitat for the species are pelagic waters and bottom habitats in the middle Atlantic south to Cape Hatteras in water temperatures below 50°F (10°C), water depth from 20 to 130 m (65 to 426 ft).

**C.** Project Impacts

Adult and juvenile Atlantic sea herring are unlikely to be present in the sand placement or dredge area because of their preference for greater water depths and colder water temperatures as noted in the EFH description. Therefore, no direct or indirect impacts from sand borrow or placement are expected.

**2. Black sea bass** *(Centropristis striata)*



**A.** EFH for Black sea bass:

Larvae: 1) North of Cape Hatteras, EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all ranked ten-minute squares of the area where black sea bass larvae are collected in the MARMAP survey. 2) EFH includes estuaries where black sea bass were identified as common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones. Generally, the habitats for the transforming (to juveniles) larvae are near the coastal areas and into marine parts of estuaries between Virginia and New York. When larvae become demersal, they are generally found on structured inshore habitat such as sponge beds.

Juveniles**:** 1) Offshore, EFH is the demersal waters over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all the ranked squares of the area where juvenile black sea bass are collected in the NEFSC trawl survey. 2) Inshore, EFH is the estuaries where black sea bass are identified as being common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones. Juveniles are found in the estuaries in the summer and spring. Generally, juvenile black sea bass are found in waters warmer than 43$^{o}$ F with salinities greater than 18 ppt and coastal areas between Virginia and Massachusetts, but winter offshore from New Jersey and south. Juvenile black sea bass are usually found in association with rough bottom, shellfish and eelgrass beds, man-made structures in sandy-shelly areas; offshore clam beds and shell patches may also be used during the wintering.

Adults: 1) Offshore, EFH is the demersal waters over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all the ranked ten-minute squares of the area where adult black sea bass are collected in the NEFSC trawl survey. 2) Inshore, EFH is the estuaries where adult black sea bass were identified as being common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones. Black sea bass are generally found in estuaries from May through October. Wintering adults (November through April) are generally offshore, south of New York to North Carolina. Temperatures above 43$^{o}$ F seem to be the minimum requirements. Structured habitats (natural and man-made), sand and shell are usually the substrate preference.

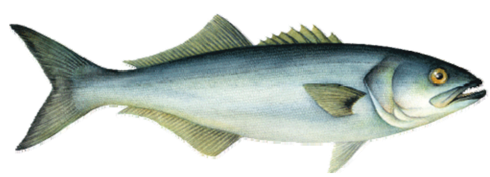
**B.** Background

Black sea bass is a warm temperate, demersal species that utilizes open water and structured benthic habitats for feeding and shelter. They occur from Nova Scotia to Florida in the Atlantic (Steimle et al., 1999), and throughout the entire Gulf of Mexico (Robins et al., 1986). Their distribution changes seasonally as they migrate from coastal areas to the outer continental shelf when water temperatures decline in the Fall. They also migrate from the outer shelf to inshore areas as temperatures warm in the Spring (Steimle et al., 1999). Juveniles are typically found in areas with structures, including shells, sponge beds, and cobbles and not commonly found on open unvegetated bottoms. Juveniles prey upon small epibenthic invertebrates, especially crustaceans and molluscs. Black sea bass support a commercial and recreational fishery (Steimle et al., 1999). Within the Mid-Atlantic States, recreational landings are comparable to or exceed the commercial fishery (MMS, 1999). The black sea bass population in the mid-Atlantic is overexploited (Steimle et al., 1999).

**C.** Project Impacts

Black sea bass larvae may be present in the inter-tidal zone during sand placement and within the borrow areas during dredging. Demersal larvae tend to be present in association with structure (e.g., shells) and depressions on the shoal seafloor, which are not commonly found in the borrow areas. Should demersal larvae be present, they may be drawn into the dredge and destroyed. No impacts to the larvae population are expected because there is no reason to expect that black sea bass larvae will be concentrated in the dredging area. Furthermore, the area to be impacted compared with the area of the continental shelf over which the larvae are likely to occur is relatively small in scale. Juveniles and adults may be present during sand placement on the Sandbridge shoreline. However, the area does not possess pronounced benthic cover or suitable substrate to which they would orient, and their numbers would likely be few. However, any black sea bass remaining on the bottom or venturing too close to the dredge intake could be entrained; juveniles would probably be more vulnerable because of their slower swimming speed. There is no reason to expect that black sea bass will be concentrated in the dredging area, therefore no significant impacts to the black sea bass population are expected (Diaz et al., 2006). Black sea bass juveniles and adults may suffer minor indirect impacts from food web disturbance caused by destruction of benthos and altered habitat conditions within the proposed borrow areas. However, because of the temporary and localized nature of the impacts, and relatively small area of bottom to be disturbed compared to the total area of comparable bottom habitat available, impacts are expected to be very minor. Enhanced topography on the shoal seafloor following dredging may provide a benefit to black sea bass by increasing bottom heterogeneity and enhancing habitat. Though, benefits would be very minor because of the relatively small scale of the area impacted. Any beneficial impacts will diminish as natural processes rework the seafloor and furrows fill in with material from the surrounding area.

**3. Bluefish** *(Pomatomus saltatrix)*



**A.** EFH for Bluefish:

Juveniles: 1) North of Cape Hatteras, EFH is pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ) from Nantucket Island, Massachusetts south to Cape Hatteras, in the highest 90% of the area where juvenile bluefish are collected in the NEFSC trawl survey. 2) South of Cape Hatteras, EFH is 100% of the pelagic waters over the Continental Shelf (from the coast out to the eastern wall of the Gulf Stream) through Key West, Florida. 3) EFH also includes the "slope sea" and Gulf Stream between latitudes 29° 00 N and 40° 00 N. 4) Inshore, EFH is all major estuaries between Penobscot Bay, Maine and St. Johns River, Florida. Generally juvenile bluefish occur in North Atlantic estuaries from June through October, Mid-Atlantic estuaries from May through October, and South Atlantic estuaries March through December, within the "mixing" and "seawater" zones. Distribution of juveniles by temperature, salinity, and depth over the continental shelf is undescribed (Fahay et al., 1999).

Adults: 1) North of Cape Hatteras, EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from Cape Cod Bay, Massachusetts south to Cape Hatteras, in the highest 90% of the area where adult bluefish were collected in the NEFSC trawl survey. 2) South of Cape Hatteras, EFH is 100% of the pelagic waters over the Continental Shelf (from the coast out to the eastern wall of the Gulf Stream) through Key West, Florida. 3) Inshore, EFH is all major estuaries between Penobscot Bay, Maine and St. Johns River, Florida. Adult bluefish are found in North Atlantic estuaries from June through October, Mid-Atlantic estuaries from April through October, and in South Atlantic estuaries from May through January in the "mixing" and "seawater" zones. Bluefish adults are highly migratory and distribution varies seasonally and according to the size of the individuals comprising the schools. Bluefish generally found in normal shelf salinity (> 25 ppt).

**B.** Background

Bluefish occur in the western north Atlantic from Nova Scotia to Bermuda and in the western south Atlantic from northern South America to Argentina. They are widely but irregularly distributed elsewhere in the Atlantic and Indian Oceans (Robins et al., 1986). They travel in schools of like-sized individuals and undertake seasonal migrations, moving into the mid-Atlantic Bight during spring and south and farther offshore during fall. Bluefish adults are highly migratory and distribution varies seasonally and according to the size of the individuals comprising the schools. Adults are generally found in areas characterized with oceanic salinities of greater than 25 ppt. Eggs and larvae occur in ocean waters; juveniles have been recorded from all mid-south Atlantic Bight estuaries surveyed (Fahay et al., 1999). Typically, juvenile bluefish remain offshore until the onset of cooling water induces southern migrations. Some juveniles from the summer spawn will migrate into coastal and bay regions for the early portion of fall. They prey upon Atlantic silversides *(Menidia menidia),* herrings, striped bass *(Morone saxatilis),* bay anchovy, and other fish. Large population fluctuations are common (Fahay et al., 1999). Within the Mid and South Atlantic Bight, bluefish is one of the most important recreational species. Among sportfish, bluefish ranked first in the bight from 1979-1989 with catches occurring inshore and offshore. Recreational landings historically exceed commercial landings in the mid-Atlantic region which peaked in 1980 and declined steadily since that time and the stock was considered overharvested. Some improvements to the stock have been reported since 2004.

**C.** Project Impacts

Juveniles and adult bluefish may be present during dredging and sand placement. However, because of their high mobility they should be readily able to relocate from the project area to avoid direct detrimental impacts. Because of their open water orientation, disturbance to and alteration of bottom habitat at the borrow areas is expected to have minimal indirect impact to bluefish juveniles and adults. Food web impacts caused by the destruction of benthos and alteration of bottom habitat at the borrow areas are unlikely to impact bluefish because of the relatively small scale of the area to be impacted compared to the large abundance of comparable habitat on the continental shelf. Furthermore, prey items will be readily available from elsewhere. Food web impacts at the borrow areas will be temporary in nature, further reducing their potential impact to bluefish.

**4. Atlantic Butterfish** *(Peprilus triacanthus)*

**A.** EFH for Butterfish:

Juveniles: Offshore, EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina in areas that comprise the highest 75% of the catch where juvenile butterfish were collected in the NEFSC trawl surveys. Inshore, EFH is the "mixing" and/or "seawater" portions of all the estuaries where juvenile butterfish are "common," "abundant," or "highly abundant" on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia. Generally, juvenile butterfish are collected in depths between 33 ft and 1200 ft and temperatures between 37°F and 82°F.

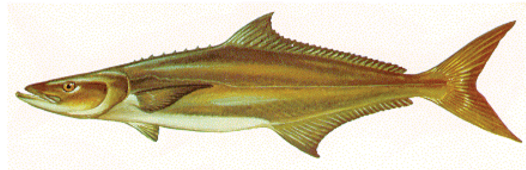
**B.** Background

Atlantic butterfish range along the Atlantic coast from Newfoundland to Florida, but they are most abundant from the Gulf of Maine to Cape Hatteras. They winter near the outer edge of the continental shelf in the mid-Atlantic Bight and migrate inshore in the spring. During the summer, they occur over the entire mid-Atlantic shelf, including estuaries. In late fall, butterfish move southward and offshore in response to falling water temperatures. Butterfish are primarily pelagic, and form loose schools that feed upon small fish, squid, and crustaceans. They have a high natural mortality rate and are preyed upon by many species including silver hake, bluefish, swordfish, and long-finned squid. During summer, juvenile butterfish associate with jellyfish to avoid predators. Juveniles feed mainly on planktonic prey. Butterfish support a commercial fishery (Cross et al., 1999). The stock is at a low to medium biomass level; although recruitment levels have remained high, the stock size of adults is currently well below average (Mid-Atlantic Fishery Management Council, 2000). Overall, it appears that the butterfish stock is not over fished (Overholtz, 2000).

**C.** Impact Assessment

Butterfish juveniles may be present in the dredge area and sand placement area, but this is unlikely since juveniles tend to prefer deeper waters as noted in the EFH description. Should juvenile butterfish be in the project areas their high mobility should allow them to relocate from either the dredging or sand placement areas to avoid direct physical harm. No indirect impacts to juvenile butterfish are expected as a consequence of alterations to bottom habitat since juveniles are largely pelagic, and not closely associated with the bottom. No indirect impacts resulting from food web impacts are expected because butterfish are planktivorous and their food items are derived from a wide area. Any food web impacts will be temporary in nature.

## 5. **Cobia** *(Rachycentron canadum)*



### **A.** EFH for Cobia

Essential fish habitat for cobia includes sandy shoals of capes and offshore bars, high profile rocky bottom and barrier island ocean-side waters, from the surf to the shelf break zone, but from the Gulf Stream shoreward, including *Sargassum.* In addition, all coastal inlets, all state-designated nursery habitats of particular importance to cobia. For cobia, essential fish habitat also includes high salinity bays, estuaries, and seagrass habitat. In addition the Gulf Stream is an essential fish habitat because it provides a mechanism to disperse coastal migratory pelagic larvae. For cobia, essential fish habitat occurs in the South Atlantic and Mid-Atlantic Bights.

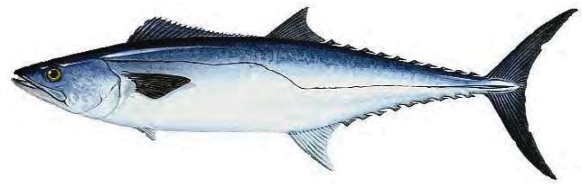
### **B.** Background

Cobia occurs nearly worldwide in warm waters. Within the Atlantic, cobia occurs from Massachusetts to Argentina. Cobia habitat includes the coastal to open ocean; they are common around sea buoys and other floating shelter (Robins et al., 1986), and congregate in the shade of wrecks and pilings (Mills, 2000). Larval habitat is the water column. They move from one area to another and seek prey wherever local resources happen to be abundant (South Atlantic Fishery Management Council, 1998). They forage on bottom-dwelling prey such as shrimp, crab, and sinall fishes (Mills, 2000). Many of their prey species are estuarine-dependent in that they spend all or a portion of their lives in estuaries. They prefer high salinity and temperature governs the occurrence of cobia (South Atlantic Fishery Management Council, 1998). Cobia tend to move about as individuals or occasionally in small groups of two or three (Mills, 2000). East coast cobia stocks move up the coast from the Carolinas reaching tile Chesapeake Bay area in late May and early June when water temperatures rise over 20°C (68°F). Fish in the Chesapeake region migrate out of the region to deeper offshore and more southerly waters in September. Cobia support commercial and recreational fisheries. In the U.S., the cobia recreational catch is speculated to be greater than the commercial catch. Commercial harvests steadily increased along the Atlantic and Gulf coasts over the period from 1981 through the early 1990s, and have remained relatively constant through the 1990s. Current levels of fishing mortality are unknown (Mills, 2000).

### **C.** Project Impacts

Cobia may be in the project area during construction occurring from about May to August. Individual eggs and larvae may be destroyed during dredging and sand placement. However, any cobia eggs or larvae present on the Sandbridge shoreline or within the offshore borrow areas would be widely distributed and there is no reason to believe they would be concentrated in the project area; therefore no significant impacts to the cobia population are expected. Cobia juveniles and adults may be present during dredging at the borrow areas, and cobia juveniles, because of their occurrence on beaches, may be present on the Sandbridge shoreline during sand placement conducted during these months. Because cobia feed on bottom-dwelling prey, individuals could be present on the bottom. Any cobia juveniles or adults that are present in the project area during construction could easily swim away and relocate to adjacent areas to avoid detrimental impacts. Any individuals venturing too close to the dredge intake could be entrained and destroyed, however; juveniles would probably be more vulnerable than adults because of their slower swimming speed.  There is no reason to expect that cobia will be concentrated in the dredging area, therefore no significant impacts to the cobia population are expected. Destruction of benthos and alterations of bottom habitat will likely reduce the suitability of the borrow areas as a foraging area for several months to years following dredging.  These disturbances are unlikely to impact cobia because abundant undisturbed bottom will remain elsewhere on the continental shelf, and food web impacts will be temporary in nature.

**6.  King Mackerel** (*Scomberomorus cavalla*)



**A.** EFH for King Mackerel

Essential fish habitat for king mackerel includes sandy shoals of capes and offshore bars, high profile rocky bottom and barrier island ocean-side waters, from the surf to the shelf break zone, but from the Gulf Stream shoreward, including *Sargassum.* In addition, all coastal inlets, all state-designated nursery habitats of particular importance to king mackerel.  For king mackerel, essential fish habitat also includes high salinity bays, estuaries, and seagrass habitat. In addition the Gulf Stream is an essential fish habitat because it provides a mechanism to disperse coastal migratory pelagic larvae.  For king mackerel, essential fish habitat occurs in the South Atlantic and Mid-Atlantic Bights.

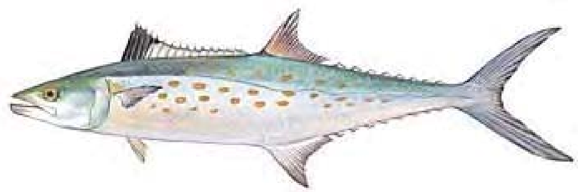
**B.** Background

King mackerel inhabit Atlantic coastal waters from Maine to Brazil (Godcharles and Murphy, 1986).  King mackerel are surface-dwelling and occur in the nearshore in association with wrecks, towers, reefs, and other structures.  The king mackerel migrate in large schools of similarly sized individuals over considerable distances along the Atlantic coast (Murdy et al., 1997).  Temperature governs the occurrence of the species; it is seldom found in water temperatures less than 20°C (68°F) and they prefer high salinity (South Atlantic Fishery Management Council, 1998).  King mackerel spawn in the south Atlantic (Godcharles and Murphy, 1986).  Larval habitat is the water column.  The species moves from one area to another and seeks prey wherever local resources happen to be abundant.  Many of their prey species are estuarine-dependent in that they spend all or a portion of their lives in estuaries (South Atlantic Fishery Management Council, 1998).  King mackerel principally eat fish, but shrimps and squid are also eaten (Murdy et al., 1997).  They support important commercial and recreational fisheries along the Atlantic coast and throughout the Gulf of Mexico.  Recent stock assessments indicate that management measures in the South Atlantic have been successful at rebuilding the stock.  However, they are still in need of protection.

**C.** Project Impacts

King mackerel may be in the project area during construction occurring from about June to August. Any king mackerel eggs or larvae present on the Sandbridge shoreline or within the offshore borrow areas would be widely distributed and there is no reason to believe they would be concentrated in the project area. Therefore, although eggs or larvae may be destroyed during construction, no significant impacts to the king mackerel population are expected.  King mackerel juveniles and adults could be present during dredging, and king mackerel juveniles, because of their occurrence on beaches, may be present on the Sandbridge shoreline during sand placement conducted during these months. However, any juveniles or adults that are present in the project area during construction could easily swim away and relocate to adjacent areas to avoid direct detrimental impacts. Alterations of bottom habitat and destruction of benthos are unlikely to impact king mackerel because abundant comparable bottom habitat occurs elsewhere. Food web impacts will be minimal because of the relatively small scale of impact and temporary nature of the disturbance.

**7. Spanish Mackerel** (*Scomberomorus maculatus*)



**A.** EFH for Spanish mackerel

Essential fish habitat for Spanish mackerel includes sandy shoals of capes and offshore bars, high profile rocky bottom and barrier island ocean-side waters, from the surf to the shelf break zone, but from the Gulf Stream shoreward, including *Sargassum.* In addition, all coastal inlets, all state-designated nursery habitats of particular importance to Spanish mackerel. For Spanish mackerel, essential fish habitat also includes high salinity bays, estuaries, and seagrass habitat. In addition the Gulf Stream is an essential fish habitat because it provides a mechanism to disperse coastal migratory pelagic larvae. For Spanish mackerel, essential fish habitat occurs in the South Atlantic and Mid-Atlantic Bights.

**B.** Background

Spanish mackerel inhabit coastal waters from Maine to Mexico (Godcharles and Murphy, 1986). They are a near shore surface-dwelling species (Murdy et al., 1997). Temperature governs the occurrence of the species as it is seldom found in water temperatures less than 20°C. Spanish mackerel move northward each spring, spending summer in the northern part of their range, and migrating south in fall (Godcharles and Murphy, 1986). They spawn from Florida to New York (Godcharles and Murphy, 1986). The species moves from one area to another and seeks prey wherever local resources happen to be abundant. Many of their prey species are estuarine-dependent in that they spend all or a portion of their lives in estuaries (South Atlantic Fishery Management Council, 1998). Spanish mackerel principally eat small fish, shrimp, and squid (Murdy et al., 1997). They support important commercial and recreational fisheries along the Atlantic coast and throughout the Gulf of Mexico. Recent stock assessments indicate that management measures in the South Atlantic have been successful at rebuilding the stock. However, they are still in need of protection.

**C.** Project Impacts

Spanish mackerel may be in the project area during construction occurring from about June to August. Any Spanish mackerel eggs or larvae present on the Sandbridge shoreline or at the offshore borrow areas would be widely distributed. Therefore, although individual eggs and larvae may be destroyed, there is no reason to expect they would be concentrated in the project area. No significant impacts to the Spanish mackerel population are expected. Spanish mackerel juveniles and adults could be present during dredging, because of their occurrence on beaches.

They may be present on the Sandbridge shoreline during sand placement conducted during these months. However, any juveniles or adults that are present in the project area during construction could easily swim away and relocate to adjacent areas to avoid direct detrimental impacts. Alterations of bottom habitat are unlikely to impact Spanish mackerel because of the minor scale of impact compared to abundant bottom, and food web impacts impacting any of Spanish mackerel prey are expected to be minimal because their prey items are derived from a wide area.

**8. Red Drum** (*Sciaenops ocellatus*)

**A.** EFH for Red Drum:

Essential fish habitat includes all of the following habitats to a depth of 50 meters offshore: tidal freshwater; estuarine emergent vegetated wetlands (flooded salt marshes, brackish marsh, tidal creeks); estuarine scrub/shrub (mangrove fringe); submerged rooted vascular plants (sea grasses); oyster reefs and shell banks; unconsolidated bottom (soft sediments); ocean high salinity surf zones; and artificial reefs. The area covered includes Virginia through the Florida Keys.

**B.** Background

Red drumlive in coastal and estuarine waters from Massachusetts to Mexico, feeding on the bottom for crabs, shrimp, menhaden, mullet and spot. Most reach sexual maturity during their fourth year, when they are about 30 to 37 inches long. Spawning occurs in near-shore coastal waters–along beaches and near inlets and passes–from late summer and into the fall. Red drum are prolific spawners, bearing up to 2 million eggs in a single season. Their eggs hatch within 24 hours and are carried throughout the sounds and estuaries by the tides and winds. Currents into estuaries carry eggs spawned in the ocean where they hatch from August through September. Juvenile drum in these areas feed on zooplankton and invertebrates such as small crabs and shrimp. In N. Carolina, the updated stock assessment indicates that overfishing is no longer occurring and that management action, taken as a result of the 2001 Red Drum FMP, appears to have been effective. In the NMFS' most recent stock status report in 2000, it was noted there has not been a sufficient number of juvenile red drum reaching maturity and subsequently listed the stock as "overfished." Virginia's commercial catch, once as high as 180,000 pounds per year, has been insignificant since 1965.

**C.** Project Impacts

Red drum eggs and larvae are not likely to be in the project areas. Spawning occurs in late summer through early fall when project construction would be completed or nearing completion. However, as eggs migrate with currents inshore to estuaries, red drum eggs could be present in the project area. Although eggs or larvae may be destroyed during construction, no significant impacts to the red drum population are expected. Additionally, larvae and eggs near the Sandbridge shoreline or at the offshore borrow areas would be widely distributed and there is no reason to believe they would be concentrated in the project area. Red drum juveniles and adults are not likely to be present during the dredging but may inhabit the surface zone during sand placement. Minor impacts to the juvenile population are expected. Juvenile and adult on the

Sandbridge shoreline or at the offshore borrow areas would be widely distributed and there is no reason to believe they would be concentrated in the project area. No significant impacts to the red drum population are expected.

**9. Red Hake** *(Urophycis chuss)*

**A.** EFH for Red Hake:

Eggs: Surface waters of the Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where hake eggs are found: sea surface temperatures below 10°C along the inner continental shelf with salinity less than 25%. Red hake eggs are most often observed during the months from May - November, with peaks in June and July.

Larvae: Surface waters of Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where red hake larvae are found: sea surface temperatures below 19° C, water depths less than 200 meters, and salinity greater than 0.5%. Red hake larvae are most often observed from May through December, with peaks in September - October.

Juveniles: Bottom habitats with a substrate of shell fragments, including areas with an abundance of live scallops, in the Gulf of Maine, on Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where red hake juveniles are found: water temperatures below 16° C, depths less than 100 meters and a salinity range from 31 - 33%.

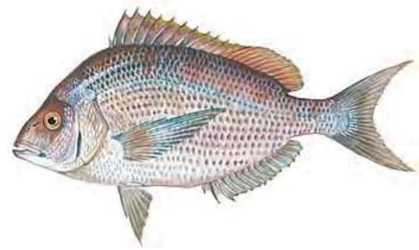
**B.** Background

Red hake is a demersal fish that occurs from North Carolina to Southern Newfoundland and is most abundant between Georges Bank and New Jersey. Red hake make seasonal migrations to follow preferred temperature ranges. During the warmer months, they are commonly found in depths less than 100 m. During the colder months, they are most commonly found in depths greater than 100 m. Major spawning areas occur on the southwest part of Georges Bank and on the continental shelf off southern New England and eastern Long Island, and in southern New England estuaries during the summer. The pelagic eggs of red hake are not separated from eggs of similar species in field collections; thus, the characteristics of the habitat in which red hake eggs are commonly found are poorly known. Eggs are buoyant and float near the water surface. During December through April, the undifferentiated eggs of hake species have been collected mostly at the edge of the continental shelf on southern Georges Bank and the Middle Atlantic Bight. During warmer months, hake eggs have been collected across the entire shelf in this area. Larval red hake dominate the summer ichthyoplankton in the Middle Atlantic Bight and were most abundant at mid-and outer continental shelf stations. Larval red hake have been collected in the upper water column from May through December and have been collected most abundantly during surveys in September-October. Red hake larvae have been collected on the middle to outer continental shelf of the Middle Atlantic Bight at temperatures between 8 and 23°C (most were collected between 11-19°C) within water depths between 10 and 200 m, with a few deeper occurrences. The distribution of juveniles varies with season. Recently metamorphosed juveniles remain pelagic for about two months. They then gradually descend to the bottom. Demersal settlement generally occurs between September and December with peaks in October-November. Shelter is a critical habitat requirement for red hake. Juveniles occur in depressions on the open seabed, often with living sea scallops *(Placopecten magellanicus),* Atlantic surf clam *(Spisula solidissima)* shells, biogenic depressions, moon snail egg, anemone and polychaete tubes, submerged man-made objects, debris, and artificial reefs. Larger juveniles remain near scallop beds and other structures in coastal areas and embayments; later they join older fish in an offshore migration in the Middle Atlantic Bight. In the Middle Atlantic Bight, red hake juveniles occur most frequently in coastal waters in the spring and fall; they move offshore to avoid the warm summer temperatures. In the winter, most of the population moves offshore. Winter migrants return inshore the following spring. In bottom trawl surveys, juvenile red hake were most abundant at temperatures of 3-16°C and at depths < 120 m; there were seasonal shifts in apparent preferences. Red hake may prefer silty, fine sand sediments. Larvae prey mainly on micro-crustaceans. Juvenile red hake leave shelter at night and commonly prey on small benthic and pelagic crustaceans, bristle worms, and arrow worms. Red hake (presumably mostly juveniles) are eaten by larger predatory fish, harbor porpoise *(Phocoena phocoena)* and other predators. Red hake supports a commercial fishery and is managed as two stocks, northern and southern, separated by Georges Bank. The southern stock (or overall stock) is currently considered overfished (Steimle, 1999).

**C.** Project Impacts

Red hake eggs are not likely to be present in the dredge and placement area because of their preference for water temperatures below 10º C; therefore, it is unlikely that red hake eggs will be directly impacted by the operation. Demersal red hake larvae are unlikely to be in the project areas. They tend to be present in association with structure (e.g., shells) and depressions on the shoal seafloor, which may be found in the troughs of ridges within the borrow areas. Should demersal larvae be present they may be drawn into the dredge and destroyed. However, because there is no reason to expect that large populations of red hake larvae will be concentrated in the dredging area, and because of the relatively small scale of the area to be impacted compared with the area of the continental shelf over which larvae are likely to occur, no significant impacts to red hake populations are expected. Juvenile red hake may be in the project area during dredging; however, they tend to prefer inshore waters further north, which match their preference for colder temperatures during the spring and summer. Furthermore, red hake favor sediments which are finer than those of the sand placement and dredge areas. Should red hake be present during dredging it is expected that because of their high mobility juveniles should easily be able to avoid intake. Any red hake juveniles remaining on the bottom or venturing too close to the dredge intake could be entrained and destroyed. Detrimental impacts to the red hake population from destruction of individual juveniles are expected to be insignificant because there is no reason to expect that red hake will be concentrated at the site. Food web impacts will be temporary in nature, further minimizing detrimental impacts. Increased bathymetric relief, left by the dredge as a series of ridges and furrows, may favor red hake larvae and juveniles. This beneficial impact would be very minor because of the relatively small size of the area impacted and would be expected to gradually dissipate as physical forces rework and smooth the shoal surface.

**10. Scup** *(Stenotomus chrysops)*



**A.** EFH for Scup:

Juveniles: 1) Offshore, EFH is the demersal waters over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all the ranked ten-minute squares of the area where juvenile scup are collected in the NEFSC trawl survey. 2) Inshore, EFH is the estuaries where scup are identified as being common, abundant, or highly abundant in the ELMR database for the “mixing” and “seawater” salinity zones. Juvenile scup, in general during the summer and spring are found in estuaries and bays between Virginia and Massachusetts, in association with various sands, mud, mussel and eelgrass bed type substrates and in water temperatures greater than 45$^{o}$ F and salinity greater than 15 ppt.

Adults: 1) Offshore, EFH is the demersal waters over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all the ranked ten-minute squares of the area where adult scup are collected in the NEFSC trawl survey. 2) Inshore, EFH is the estuaries where scup were identified as being common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones. Generally, wintering adults (November through April) are usually offshore, south of New York to North Carolina, in waters above 45$^{o}$F.

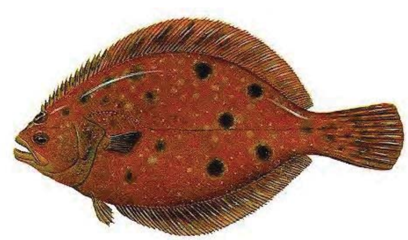
**B.** Background

Scup occur in the Atlantic from Nova Scotia to Florida (Robins et al., 1986), but primarily from Massachusetts to South Carolina. Scup are a temperate, demersal species that use several benthic habitats from open water to structured areas for feeding and possibly shelter. Their distribution changes seasonally as fish migrate from estuaries to the edge of the continental shelf as water temperatures decline in the winter and return from the edge of the continental shelf to inshore areas as water temperatures rise in the spring. During warmer months, juveniles live inshore in a variety of coastal habitats. Juveniles utilize biogenic depressions, troughs, and possibly mollusc shells, particularly during colder months. Adult habitats include soft sandy bottoms, on or near structures, such as rocky areas and manmade structures. Juveniles feed on small benthic invertebrates, fish eggs, and larvae. Adults prey on benthic and near bottom invertebrates, and small fish. Scup supports a commercial and recreational fishery. The mid-Atlantic stock of scup is currently considered overfished.

**C.** Project Impacts

Adult scup are common residents in the Middle Atlantic Bight from spring to fall and are generally found in schools on a variety of habitats, from open sandy bottom to structured habitats such as mussel beds, reefs, or rough bottom. Smaller-sized adult scup are common in larger bays and estuaries, but larger sizes tend to be in deeper waters. Scup usually congregate in schools, resulting in congregation in some areas and complete absence in other nearby areas. Schools are reported to be size-structured. During the warm months, scup stay close to shore, typically within 6 miles of the coastline. They live close to the bottom and concentrate over areas of smooth to rocky bottom. Scup feed on small, bottom-dwelling invertebrates (crabs, clams, starfish) and young finfish. With rising water temperatures in the spring, scup return inshore. Larger fish arrive first followed by schools of subadults, which have been reported to appear off southern New England slightly later. The fish reach Chesapeake Bay by April and southern New England by early May. Since scup tend to reside within estuaries during the warmer months, they are not expected to be within the dredge or placement areas during the project timeframe of Spring/Summer. If they are in the area, it is expected that juvenile and adult scup should easily be able to avoid direct detrimental impacts from dredging or sand placement, and easily relocate to adjacent waters. However, because they are demersal, individual scup may remain on the seafloor of the borrow areas during dredging. Any scup remaining on the bottom or venturing too close to the dredge intake could be entrained and destroyed. Juveniles would probably be more vulnerable than adults because of their slower swimming speed. There is no reason to expect that scup would be concentrated in the area to be dredged; therefore, no significant impacts to the scup population are expected. Because of their demersal nature, destruction of benthos and alterations in bottom habitat impacting the food web may cause negative impacts to scup. Because of the relatively small scale of the area to be impacted compared to abundant habitat elsewhere, these are expected to be minor. The impacts will also be temporary in nature, further decreasing their significance.

**11. Summer flounder** *(Paralichthys dentatus)*



**A.** EFH for Summer flounder:

Juveniles: 1) North of Cape Hatteras, EFH is the demersal waters over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all the ranked ten-minute squares for the area where juvenile summer flounder are collected in the NEFSC trawl survey. 2) South of Cape Hatteras, EFH is the waters over the Continental Shelf (from the coast out to the limits of the EEZ) to depths of 500 ft, from Cape Hatteras, North Carolina to Cape Canaveral, Florida. 3) Inshore, EFH is all of the estuaries where summer flounder were identified as being present (rare, common, abundant, or highly abundant) in the ELMR database for the "mixing" and "seawater" salinity zones. In general, juveniles use several estuarine habitats as nursery areas, including salt marsh creeks, seagrass beds, mudflats, and open bay areas in water temperatures greater than 37$^{o}$ F and salinity from 10 to 30 ppt range.

Adults: 1) North of Cape Hatteras, EFH is the demersal waters over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina, in the highest 90% of all the ranked ten-minute squares for the area where adult summer flounder are collected in the NEFSC trawl survey. 2) South of Cape Hatteras, EFH is the waters over the Continental Shelf (from the coast out to the limits of the EEZ) to depths of 500 ft, from Cape Hatteras, North Carolina to Cape Canaveral, Florida. 3) Inshore, EFH is the estuaries where summer flounder were identified as being common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones. Generally summer flounder inhabit shallow coastal and estuarine waters during warmer months and move offshore on the outer Continental Shelf at depths of 500 ft in colder months.

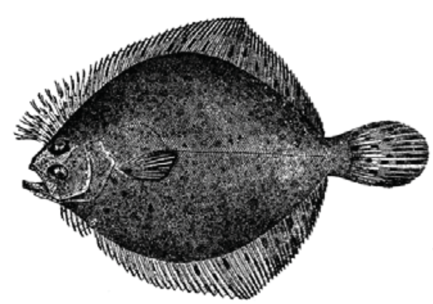
**B.** Background

Summer flounder, or fluke, inhabit shallow estuarine waters on the outer continental shelf from Nova Scotia to Florida, with a center of abundance in the mid-Atlantic. They exhibit strong seasonal inshore-offshore movements. Adult and juveniles normally inhabit shallow coastal and estuarine waters during the warmer months of the year, and remain offshore during the fall and winter. Smaller juveniles feed upon infauna such as polychaetes while larger juveniles feed upon fish, shrimp, and crabs in relation to their environmental abundance. Adults are opportunistic feeders with fish and crustaceans making up a substantial portion of their diet (Packer et al., 1999). Summer flounder are important both commercially and recreationally in the mid-Atlantic Bight. There is a significant offshore commercial fishery that occurs during the spring inshore migration and fall offshore migration and continues during the winter. During the summer, commercial and recreational fisheries are concentrated in coastal and estuarine waters. The stock is at a medium level of historical abundance and is over-exploited (Packer et al., 1999).

**C.** Project Impacts

Juveniles and adults may be in the project area during dredging and sand placement. Because of their great mobility, juvenile and adult summer flounder should easily be able to relocate elsewhere and avoid any detrimental impacts. However, because they are demersal, summer flounder may remain on the bottom during dredging. Any summer flounder remaining on the bottom or venturing too close to the dredge intake could be entrained and destroyed. Juveniles would probably be more vulnerable than adults because of their slower swimming speed. No significant impacts to the summer flounder population would be expected from destruction of individuals because there is no reason to believe that summer flounder will be concentrated in the area to be dredged. Because of their demersal nature, destruction of benthos and alterations in bottom habitat impacting the food web may cause detrimental impacts to summer flounder (Diaz et al., 2006). It is unclear whether altered habitat conditions at the borrow areas will have any other indirect impact on summer flounder. These impacts will be very minor in scale, however, when compared to abundant habitat elsewhere on the continental shelf. Food web impacts will be temporary in nature, further diminishing their impact. Any impacts associated with altered bottom habitat on the borrow areas would be expected to gradually dissipate as physical environmental forces rework and smooth the shoal surface.

**12. Windowpane flounder** *(Scophthalmus aquosus)*



**A.** EFH for Windowpane flounder:

Eggs: Surface waters around the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where windowpane flounder eggs are found: sea surface temperatures less than 20º C and water depths less than 70 meters. Windowpane flounder eggs are often observed from February to November with peaks in May and October in the middle Atlantic and July through August on Georges Bank.

Larvae: Pelagic waters around the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where windowpane flounder larvae are found: sea surface temperatures less than 20° C and water depths less than 70 meters. Windowpane flounder larvae are often observed from February to November with peaks in May and October in the middle Atlantic and July through August on Georges Bank.

Juveniles: Bottom habitats with a substrate of mud or fine-grained sand around the perimeter of the Gulf of Maine, on Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where windowpane flounder juveniles are found: water temperatures below 25° C, depths from 1 – 100 meters, and salinity between 5.5-36%.

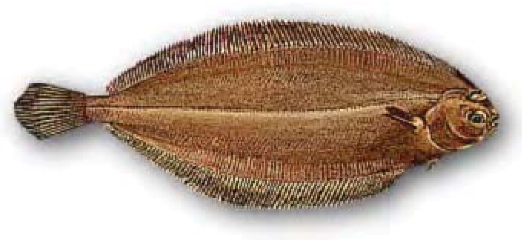
**B.** Background

Windowpane range from the Gulf of Saint Lawrence to northern Florida (Robins et al, 1986); in the northwest Atlantic they inhabit estuaries, nearshore waters, and the continental shelf. Windowpane juveniles that settle in shallow inshore waters move to deeper waters as they grow migrating to nearshore or estuarine habitats in the southern mid-Atlantic Bight in the autumn. Juvenile and adult windowpane feed on small crustaceans and various fish larvae. Windowpane flounder is not recreationally fished (Murdy et al., 1997), nor a target of the commercial fishing industry (Chang et al., 1999).

**C.** Project Impacts

Windowpane eggs and larvae are likely to be present in the dredge and placement area, but predominantly in pelagic waters. However, since the eggs are distributed widely over the continental shelf, egg and larvae destruction will not cause significant impacts to the butterfish population. Juveniles and adult windowpane flounders are likely to be in project waters during dredging and sand placement. Because of their great mobility, juveniles and adults should be able to avoid direct detrimental impacts at the dredging and placement sites. However, because they are demersal, individuals may remain on the bottom during dredging. Any windowpane remaining on the bottom or venturing too close to the dredge intake could be entrained and destroyed; juveniles would probably be more vulnerable than adults because of their slower swimming speed. Detrimental impacts to the windowpane flounder population is expected to be insignificant because there is no reason to expect that windowpane flounder will be concentrated at the site. Because of their demersal nature, destruction of benthos and alterations in bottom habitat impacting the food web may cause detrimental impacts to windowpane flounder. It is unclear whether altered habitat conditions at the borrow areas will have any other indirect impact on windowpane flounder. However, these impacts will be very minor because the scale of the area impacted is very minor when compared to abundant habitat elsewhere on the continental shelf. Food web impacts will be temporary in nature, further diminishing their impact. Any impacts associated with altered bottom habitat on borrow areas would be expected to gradually dissipate as physical environment forces rework and smooth the shoal surface.

**13. Witch flounder** (*Glyptocephalus cynoglossus*)



**A.** EFH for Witch flounder:

Eggs: Surface waters of the Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where witch flounder eggs are found: sea surface temperatures below 13°C (55°F) over deep water with high salinity. Witch flounder eggs are most often observed during the months from March through October.

**B.** Background

The witch flounder, or grey sole, range throughout the Gulf of Maine and also occur in deeper areas on Georges Bank and along the shelf edge as far south as Cape Hatteras. Witch flounder appear to be sedentary, preferring moderately deep areas; few fish are taken shallower than 27 m (88 ft) and most are caught between 110 and 275 m (360-902 ft). Spawning occurs in late spring and summer. Witch flounder are a rather sedentary species and do not appear to undertake long-distance migrations. They concentrate in selected water suitable for spawning, then disperse in the surrounding areas for feeding. A significant aspect of this species is that they appear to have a "built-in" conservation mechanism for the first several years of life. Young witch flounder are either pelagic (midwater) or they live in very deepwater areas. Witch flounder is commercially harvested but populations are currently being maintained.

**C.** Project Impacts

Witch flounder eggs are unlikely to be present in the sand placement area on Sandbridge Beach because of their preference for colder water temperatures and deeper waters as noted in the EFH description. No direct or indirect impacts are expected. Since witch flounder eggs are unlikely to be found on the bottom where the dredge is drawing in sediment and water, it is unlikely that witch flounder will be directly impacts by that part of the operation. No impacts to witch flounder populations are expected.

**14. Monkfish** (*Lophius americanus*)

**A.** EFH for Monkfish

Eggs: Surface waters of the Gulf of Maine, Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras, North Carolina. Generally, the following conditions exist where monkfish egg veils are found: sea surface temperatures below 18°C (64°F) and water depths from 15-1000 meters (49-3,280 ft). Monkfish egg veils are most often observed during the months from March to September.

Larvae: Pelagic waters of the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras, North Carolina. Generally, the following conditions exist where monkfish larvae are found: water temperatures 15°C (59°F) and water depths from 25-

1000 meters (82-3,280 ft). Monkfish larvae are most often observed during the months from March to September.

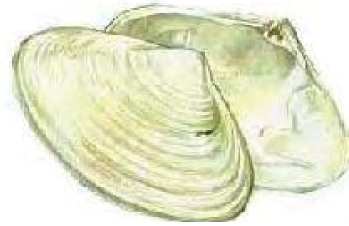
**B.** Background

The monkfish or goosefish, is a large, slow-growing, bottom-dwelling anglerfish. It occurs from the southern and eastern parts of the Grand Banks, (Newfoundland) and the northern side of the Gulf of St. Lawrence, to the east coast of Florida (to about 29 °N), but is common only north of Cape Hatteras, N. Carolina. They are occasional visitors to the lower Chesapeake Bay from late fall to early spring. The species is easily recognized because of its large spiny head and wide mouth filled with fang-like teeth. Monkfish have very broad, depressed heads (head is as wide as the fish is long) and enormous mouths with long, sharp teeth. They have a modified spine called an "esca." This spine is quite mobile and can be angled forward so it can dangle in front of the fish's mouth and be wiggled like bait to lure its prey. It is a solitary ambush predator of invertebrates. Monkfish are marine bottom-dwelling fishes they inhabit sand, mud, and broken shell bottoms from inshore areas to depths greater than 800 m (2,300 ft). Adults spend most of their time resting on the bottom, often in a depression or partially covered in sediment. Monkfish reach maturity between ages 3 and 4, and spawning can take place from spring through early fall depending on latitude. The species has several unusual aspects to its life history, including releasing its eggs in long, floating, mucus veils. Females lay a non-adhesive, buoyant gelatinous egg mass that floats as a broad raft on the water's surface. Larvae and juveniles are pelagic and remain in this stage for several months before they settle to the bottom at a size of about 3 inches. They live in the water column during the egg and larval stages and shift to a benthic existence during their juvenile and adult stages. For most or all of this life stage, the eggs occur within the mucus veil in the upper part of the water column. Severe weather can damage the veil and release isolated eggs. Eggs were collected near Cape Lookout, North Carolina in March and April, in May off Cape Hatteras, and off southern New England, but not after September (NMFS, 1999). In the NEFSC Marine Resources Monitoring, Assessment and Prediction (MARMAP) ichthyoplankton survey, larvae were first collected over deeper (>984 ft), offshore waters in the Middle Atlantic Bight during March-April; later, larvae were most abundant across the continental shelf at depths between 30 to 90 m (95 to 295 ft) and larvae were most abundant at integrated water column temperatures between 10-16° C (50° to 61° F), although there was one collection at 4° C (39°F) in January. Peak catches generally occurred at 11-15° C (52° to 59° F) regardless of the month or area.

**C.** Project Impacts

Monkfish eggs and larvae may be, in the project area during construction occurring from about May to early fall. Any monkfish eggs or larvae present at the offshore shoals would be widely distributed and there is no reason to believe they would be concentrated in the project area. Eggs would be unlikely to be entrained during dredging since they float. Since larvae are pelagic, dredging entrainment of larvae would also likely be minimal. Also, larvae generally prefer deeper water conditions than at the borrow area. Accordingly, no significant impacts to the monkfish population are expected. Alterations of bottom habitat and destruction of benthos at the borrow sites are unlikely to impact monkfish eggs or larvae because they lack an orientation to or dependency on bottom habitats.

**15. Surfclams** (*Spisula solidissima*)



**A.** EFH for surfclams

Juveniles and adults: Throughout the substrate, to a depth of three feet below the water/sediment interface, within federal waters from the eastern edge of Georges Bank and the Gulf of Maine throughout the Atlantic EEZ, in areas that encompass the top 90% of all the ranked ten-minute squares for the area where surfclams were caught in the NEFSC surfclam and ocean quahog dredge surveys. Surfclams generally occur from the beach zone to a depth of about 200 feet, but beyond about 125 feet abundance is low.

**B.** Background

The Atlantic surfclam is a bivalve mollusk that inhabits sandy continental shelf habitats from the southern Gulf of St. Lawrence to Cape Hatteras, North Carolina. Commercial concentrations are found primarily off New Jersey, the Delmarva Peninsula, and on Georges Bank. In the Mid-Atlantic region, surfclams are found from the intertidal zone to a depth of about 60 m (197 ft) but densities are low at depths greater than 40 m (130 ft). They occur in both state (≤ 3 mi from shore) and federal waters (i.e. the Exclusive Economic Zone or "EEZ", between 3 and 200 mi from shore). The greatest concentrations of Atlantic surfclams are usually found in well-sorted, medium sand, but they may also occur in fine sand and silty-fine sand (NMFS, 1999). Maximum size is about 22.5 cm (8.9 in.) shell length and maximum age can reach 30 years. Atlantic surfclam are found in areas where bottom temperatures rarely exceed 25°C (77°F) and where salinities are higher than 28 ppt. In the Middle Atlantic Bight, spawning occurs primarily during summer, although some activity has also been documented in autumn. Full sexual maturity is attained in the second year of life at a shell length of 45 to 85 mm. Eggs and sperm are shed directly into the water column and recruitment to the bottom occurs after a planktonic larval period of about three weeks. Spawning begins and ends earlier in the south. In Virginia, for example, it may begin in May and end in July. There may be a second, minor spawning in October, caused by breakdown of the thermocline. In cold years, the second spawning may not occur. Currents play an important role in determining patterns of distribution and settlement of developing juveniles. Oceanic storms and currents may displace adults considerable distance from burrows; survivors reburrow at new sites (Cargnelli, 1999).

**C.** Project Impacts

The southeastern portion of the borrow area lies within an area designated as EFH for the juvenile surf clam. Dredging may destroy some surf clam habitat and surf clams living within the dredged area would be killed. While this would represent a significant short-term loss of surf clam in the impact area, although it is expected that habitat conditions for surf clam will be equivalent to those before dredging over time. It is anticipated that surf clam populations would gradually recover to pre-project levels after a several year period. Surf clam predators, including Atlantic cod, would be affected by loss of food until such time as surf clam populations recovered in each borrow site.

**16. Spiny dogfish** *(Squalus acanthias)*

**A.** EFH for Spiny dogfish

Juveniles: 1) North of Cape Hatteras, EFH is the waters of the Continental shelf from the Gulf of Maine through Cape Hatteras, North Carolina in areas that encompass the highest 90% of all ranked ten-minute squares for the area where juvenile dogfish were collected in the NEFSC trawl surveys. 2) South of Cape Hatteras, EFH is the waters over the Continental Shelf from Cape Hatteras, North Carolina through Cape Canaveral, Florida, to depths of 1280 ft. 3) Inshore, EFH is the "seawater" portions of the estuaries where dogfish are common or abundant on the Atlantic coast, from Passamaquoddy Bay, Maine to Cape Cod Bay, Massachusetts. Generally, juvenile dogfish are found at depths of 33 to 1,280 ft in water temperatures ranging between 37°F and 82°F.

Adults: 1) North of Cape Hatteras, EFH is the waters of the Continental shelf from the Gulf of Maine through Cape Hatteras, North Carolina in areas that encompass the highest 90% of all ranked ten-minute squares for the area where adult dogfish were collected in the NEFSC trawl surveys. 2) South of Cape Hatteras, EFH is the waters over the Continental Shelf from Cape Hatteras, North Carolina through Cape Canaveral, Florida, to depths of 1,476 ft. 3) Inshore, EFH is the "seawater" portions of the estuaries where dogfish are common or abundant on the Atlantic coast, from Passamaquoddy Bay, Maine to Cape Cod Bay, Massachusetts. Generally, adult dogfish are found at depths of 33 to 1,476 ft in water temperatures ranging between 37°F and 82°F.

**B.** Background

Spiny dogfish are a highly migratory species swimming in large schools with individuals of the same size class staying together as they grow. They are found primarily north of Cape Cod in the summer and move south to Long Island in the fall and as far south as North Carolina in the winter. The spiny dogfish is probably the most abundant shark species in the Western N. Atlantic (NMFS, 1999). Seasonal inshore-offshore movements and coastal migrations are related to water temperature. Generally, spiny dogfish spend summers in inshore waters and overwinter in deeper offshore waters. They are usually epibenthic, but occur throughout the water column and are found from nearshore shallows to offshore shelf waters to 900 m (2,952 ft). In the spring, juveniles and adults occur in deeper, generally warmer waters on the outer shelf from North Carolina to Georges Bank. In the fall, they occur in the shallower, moderately warm waters from southern New England into the Gulf of Maine. Dogfish are transient visitors to estuaries where they prefer higher salinities. The species bears live young, with a gestation period of about 18 to 22 months. Young dogfish, referred to as “pups,” are born head-first. Litter sizes range from 1-15 pups, but usually average 6-7 pups. Spiny dogfish are well known for their voracious and opportunistic predatory behavior. Swimming in large “packs,” they will attack schools of fishes smaller than themselves, including cod, haddock, capelin, mackerel, and herring.

**C.** Project Impacts

Spiny dogfish may be present within the borrow areas during the cooler (winter-spring) months. Adults and juveniles should easily be able to avoid any direct negative impacts because of their mobility. No detrimental indirect impacts to the population are expected because of the relatively small area to be impacted compared to the range of the species and the ready availability of more preferable habitat on the mid and south-Atlantic Bight continental shelf. Any impacts to the food web are expected to be temporary and local when compared to available habitat elsewhere.

**17. Atlantic sharpnose shark** (*Rhizoprionodon terraenovae*)

**A.** EFH for Atlantic Sharpnose***:***

Adults (85 cm TL): From Cape May, NJ south to the North Carolina/ South Carolina border; shallow coastal areas north of Cape Hatteras, NC to the 25 m isobath; south of Cape Hatteras between the 25 and 100 m isobaths; offshore St. Augustine, FL to Cape Canaveral, FL from inshore to the100 m isobath, Mississippi Sound from Perdido Key to the Mississippi River Delta to the 50 m isobath; coastal waters from Galveston to Laguna Madre, TX to the 50 m isobath.

**B.** Background

This sharpnose ranges as far north as New Brunswick but is rarely found north of North Carolina. The Atlantic sharpnose shark is a small shark that attains a maximum size of 1.2 meters (4 feet). Sexual maturity is reached when an individual is approximately 83 cm (33 inches). Juveniles tend to prefer the inshore environment and are found in common bays, estuaries and even in the surf and adults are primarily found in deeper, offshore waters. They prefer subtropical waters near the continental shelves from the intertidal zone out to deeper waters. They are often found near the surf zone of sandy beaches and in enclosed bays, sounds, harbors, estuaries, and river mouths. This shark is able to tolerate lower salinity levels but, they do not venture into freshwater. The young are nourished within the female, as development is viviparous. Litters of 4 to 7 pups are born in June in shallow waters or estuaries. The newborns are 22 to 35 cm (9 to 14 inches) in length. The principal diet of the sharpnose consists of shrimp, molluscs and small fishes.

**C.** Project Impacts

Sharpnose sharks may be present during dredging within the borrow areas and sand placement at Sandbridge Beach assuming operations take place during the warmer months. However, adults, because of their ready mobility should easily be able to avoid any direct impacts. No detrimental indirect impacts to the sharpnose shark population are expected because of the relatively small area to be impacted compared to the range of the species and the ready availability of more preferable habitat on the mid and south-Atlantic Bight continental shelf. Any impacts to the food web are expected to be temporary and local.

**18. Dusky shark** (*Carcharhinus obscurus*)

**A**. EFH for Dusky Shark***:***

Neonate/early juveniles (115 cm TL):
Shallow coastal waters, inlets and estuaries to the 25 m isobath from the eastern end of Long Island, NY at 72° W south to Cape Lookout, NC at 34.5° N; from Cape Lookout south to West Palm Beach, FL (27.5° N), shallow coastal waters, inlets and estuaries and offshore areas to the 100 m isobath.

Late juveniles/subadults (116 to 300 cm TL): Off the coast of southern New England from 70° W west and south, coastal and pelagic waters between the 25 and 200 m isobaths; shallow coastal waters, inlets and estuaries to the 200 m isobath from Assateague Island at the Virginia/Maryland border (38° N) to Jacksonville, FL at 30° N; shallow coastal waters, inlets and estuaries to the 500 m isobath continuing south to the Dry Tortugas, FL at 83° W.

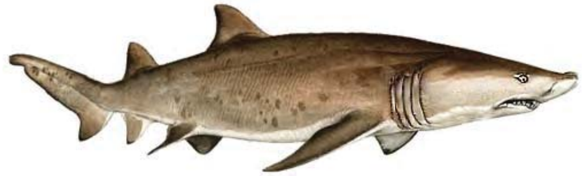
**B.** Background

The dusky shark is a common species of temperate and tropical waters nearly worldwide (Robins et al., 1986). Along the East Coast it ranges from Georges Bank to Florida and the Gulf of Mexico (Castro, 1993) from the surf zone to far offshore and from the surface to water depths of 400 m. It feeds on numerous species of bony fishes and smaller sharks (Castro, 1993), as well as crustaceans, molluscs, and sea stars (Murdy et al., 1997). Dusky shark migrates north and south with the seasons along the Atlantic coast. Coastal waters are nursery areas. Neonates occur in coastal waters of Chesapeake Bay from April through July (NMFS, 1999), although Murdy and others (1997) note that the species does not normally enter estuaries and is infrequently encountered in Chesapeake Bay. It is an important recreational fishery species (Murdy et al., 1997). The species is particularly vulnerable to overfishing because of its long period until maturity (17 years), slow growth, and limited reproductive potential. The Highly-Migratory-Species Fisheries Management Plan prohibits possession of dusky shark because of significant declines in catch rates in the last two decades (NMFS, 1999).

**C.** Project Impacts

Dusky shark may be present during dredging within the borrow areas and sand placement at Sandbridge Beach. However, neonates and juveniles, because of their ready mobility, should easily be able to avoid any direct impacts. No detrimental indirect impacts to the dusky shark population are expected because of the relatively small area to be impacted compared to the range of the species and the ready availability of comparable habitat on the mid and south-Atlantic Bight continental shelf. Any impacts to the food web are expected to be insignificant and temporary.

**19. Sand tiger shark** (*Carcharias taurus*)



**A.** EFH for Sand Tiger Shark***:***

Neonate/early juveniles (125 cm TL):
Shallow coastal waters from Barnegat Inlet, NJ south to Cape Canaveral, FL to the 25m isobath.

Adults (221 cm TL): Shallow coastal waters to the 25m isobath from Barnegat Inlet, NJ to Cape Lookout; from St. Augustine to Cape Canaveral, FL.

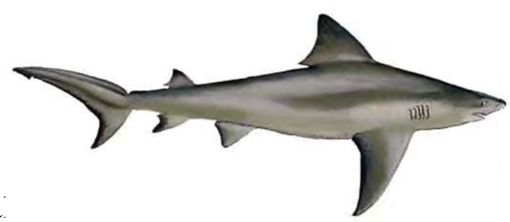
**B.** Background

This is a coastal species found in tropical and warm temperate waters worldwide (NMFS, 1999). In Atlantic waters, the species ranges from Maine to Florida and also from Brazil to Argentina. It was perhaps the most common shark found in coastal waters from Cape Cod to Chesapeake Bay (Robins et al., 1986). It is often found in shallow coastal waters less than 4 m deep. Sand tigers are the only shark known to come to the surface and gulp air. They store the air in their stomachs, which allows them to float motionless in the water, seeking prey. The neonates are born in March and April in southern portions of its range and migrate northward to summer nurseries in coastal estuaries. Sand tiger shark is extremely vulnerable to overfishing because adults congregate in large numbers in coastal areas during the mating season. There was a severe population decline in the 1990s, and in 1997 NMFS prohibited possession of this species in U.S. waters (NMFS, 1999).

**C.** Project Impacts

Sand tiger sharks may be present during dredging within the borrow areas and placement of sand at Sandbridge Beach. However, neonates, juveniles, and adults, because of their ready mobility, should easily be able to avoid any direct negative impacts. Indirect impacts to this species are expected to be insignificant because the habitats disturbed at the site and any detrimental food web impacts would be insignificant given the pervasive availability of undisturbed habitat in the Mid- and south-Atlantic Bight. Any food web impacts would be temporary, further minimizing any detrimental impacts.

**20. Sandbar shark** (*Carcharhinus plumbeus*)



**A.** EFH for Sandbar Shark***:***

Neonates/early juveniles (90 cm): Shallow coastal areas to the 25 m isobath from Montauk, Long Island, NY at 72° W, south to Cape Canaveral, FL at 80.5° W(all year); nursery areas in shallow coastal waters from Great Bay, NJ to Cape Canaveral, FL, especially Delaware and Chesapeake Bays (seasonal-summer); also shallow coastal waters to up to a depth of 50 m on the west coast of Florida and the Florida Keys from Key Largo at 80.5° W north to south of Cape San Blas, FL at 85.25° W. Typical parameters: salinity-greater than 22 ppt; temperatures-greater than 21° C.

Late juveniles/subadults (91 to 179 cm): Offshore southern New England and Long Island, all waters, coastal and pelagic, north of 40° N and west of 70° W; also, south of 40° N at Barnegat Inlet, NJ, to Cape Canaveral, FL (27.5° N), shallow coastal areas to the 25 m isobath; also, in the winter, from 39° N to 36° N, in the Mid-Atlantic Bight, at the shelf break, benthic areas between the 100 and 200 m isobaths; also, on the west coast of Florida, from shallow coastal waters to the 50 m isobath, from Florida Bay and the Keys at Key Largo north to Cape San Blas, FL at 85.5° W.

Adults (180 cm): On the east coast of the United States, shallow coastal areas from the coast to the 50 m isobath from Nantucket, MA, south to Miami, FL; also, shallow coastal areas from the coast to the 100 m isobath around peninsular Florida to the Florida panhandle at 85.5° W, near Cape San Blas, FL including the Keys and saline portions of Florida Bay.

Habitat Areas of Particular Concern: Important nursery and pupping grounds have been identified in shallow areas and the mouth of Great Bay, NJ, lower and middle Delaware Bay, lower Chesapeake Bay, MD and near the Outer Banks, NC, in areas of Pamlico Sound adjacent to Hatteras and Ocracoke Islands and offshore those islands.

**B.** Background

The sandbar shark is commonly found over muddy or sandy bottoms in shallow coastal waters such as bays, estuaries, harbors, or the mouths of rivers, but also swims in deeper waters (200 m or more) as well as intertidal zones. They tend to swim alone or gather in sex-segregated schools that vary in size. They are most active at night, at dawn, and at dusk. All life stages of sandbar shark are found along the Virginia coast; neonates are found from March through July in the mid and south Atlantic. The adult sandbar shark undergoes seasonal migrations. These movements are influenced mainly by temperature although it is believed that ocean currents also play a significant role. In the western North Atlantic, adult sandbars move as far north as Cape Cod during the warmer summer months and return south at the start of cooler weather. It tends to prefer waters on continental shelves, oceanic banks, and island terraces but is also commonly found in harbors, estuaries, at the mouths of bays and rivers, and shallow turbid water. The species is highly vulnerable to overfishing because of its long period until maturity (15 or more years) and two-year reproductive cycle. It is one of the most important commercial species in the shark fishery of the southeastern U.S. There have been declines in catch per unit effort in U.S. fisheries for this species as a consequence of heavy fishing pressure (NMFS, 1999).

**C.** Project Impacts

The sandbar shark may be present during dredging within the borrow areas and sand placement at Sandbridge Beach. Neonates, juveniles, and adults because of their ready mobility, should easily be able to avoid any direct negative impacts. However, since they are bottom dwelling, any individuals remaining on the bottom or venturing too close to the dredge intake could be entrained and destroyed. Neonates and juveniles would probably be more vulnerable than adults because of their slower swimming speed. There is no reason to expect that sandbar shark will be overly concentrated in the dredging area; therefore, no significant impacts to this species' population is expected. Because the sandbar shark is a bottom-dwelling species, indirect impacts to the food web caused by destruction of benthos and alterations in bottom habitat conditions at the borrow areas could be more detrimental. However, since these impacts will be very minor in size when compared to the size of the Mid- and South Atlantic Bight, it is expected that no significant indirect impacts to sandbar shark populations will occur. Any food web impacts are expected be temporary and local in nature.

**21. Scalloped hammerhead** (*Sphyrna lewini*)

**A.** EFH for Scalloped Hammerhead***:***

Neonate/early juveniles (45 cm TL):
Shallow coastal waters of the South Atlantic Bight, off the coast of South Carolina, Georgia, and Florida, west of 79.5° W and north of 30° N, from the shoreline out to 25 miles offshore. Additionally, shallow coastal bays and estuaries less than 5 m deep, from Apalachee Bay to St. Andrews Bay, FL.

Late juveniles/subadults (46 to 249 cm TL): All shallow coastal waters of the U.S. Atlantic seaboard from the shoreline to the 200 m isobath from 39° N, south to the vicinity of the Dry Tortugas and the Florida Keys at 82° W; also in the Gulf of Mexico, in the area of Mobile Bay, AL and Gulf Islands National Seashore, all shallow coastal waters from the shoreline out to the 50 m isobath.

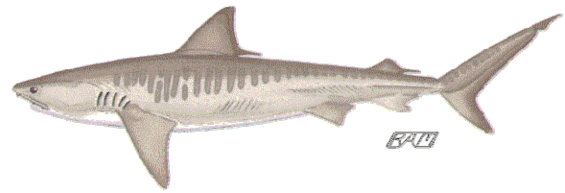
**B.** Background

Scalloped hammerhead ranges from New Jersey to Uruguay in the western Atlantic, and nearly worldwide in tropical waters (Robins et al., 1986). It is a warm water species seldom found in water cooler than 22°C (72° F). It is a common species found both in coastal and in oceanic waters (Castro, 1993). Juveniles utilize shallow coastal bay and estuarine habitat in waters less than 5 m deep from April through October. Adults utilize both inshore and offshore waters. Scalloped hammerhead school and migrate seasonally north-south along the eastern United States. Because it forms large schools in coastal areas, many fisheries target it and its fins are highly valued. It is probably vulnerable to overfishing (NMFS, 1999).

**C.** Project Impacts

Scalloped hammerhead juveniles may be in project waters during any construction that takes place between July and August. Juveniles should easily be able to avoid any direct negative impacts of either dredging or sand placement because of their ready mobility. No indirect impacts to scalloped hammerhead are expected from dredging of the borrow areas because any food web impacts resulting from this are expected to be temporary and local when compared to available habitat elsewhere.

**22. Tiger shark** (*Galeocerdo cuvieri*)



**A.** EFH for Tiger Shark***:***

Neonate/early juveniles (120cm TL): From shallow coastal areas to the 200 m isobath from Cape Canaveral, FL north to offshore Montauk, Long Island, NY (south of Rhode Island); and from offshore southwest of Cedar Key, FL north to the Florida/Alabama border from shallow coastal areas to the 50 m isobath.

Late juveniles/subadults (121 to 289cm TL): Shallow coastal areas from Mississippi Sound (just west of Mississippi/Alabama border) to the 100 m isobath south to the Florida Keys; around the peninsula of Florida to the 100 m isobath to the Florida/Georgia border; north to Cape Lookout, NC from the 25 to100 m isobath; from Cape Lookout north to just south of the Chesapeake Bay, MD from inshore to the 100 m isobath; north of the mouth of Chesapeake Bay to offshore Montauk, Long Island, NY (to south of Rhode Island between the 25 and 100 m isobaths; south and southwest coasts of Puerto Rico from inshore to the 2,000 m isobath.

Adults (290 cm TL): Offshore from Chesapeake Bay, MD south to Ft. Lauderdale, FL to the western edge of the Gulf Stream; from Cape San Blas, FL to Mississippi Sound between the 25 and 200 m isobaths; off the south and southwest coasts of Puerto Rico from inshore to the 2,000 m isobath.

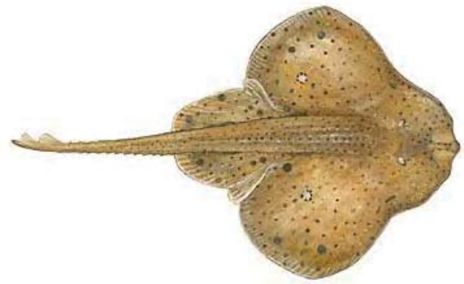
**B.** Background

The tiger shark ranges from Massachusetts to Uruguay, but is most common from Florida to the Caribbean. It is mostly pelagic, but commonly enters shallow bays and harbors to feed, particularly at night (Robins et al., 1986). Very little is known about the tiger shark's distribution and habitat characteristics. Nursery areas are believed to be offshore, but have not been fully described. The neonates/juveniles occur in shallow coastal waters (NMFS, 1999). The tiger shark feeds on all kinds of marine animals, including turtles, horseshoe crabs, bony fishes, smaller sharks, ray egg cases, and seagulls. It is also one of the few species of sharks that will scavenge dead animals (Castro, 1993). The tiger shark is frequently caught in coastal shark fisheries, but is usually discarded due to low fin and meat value (NMFS, 1999).

**C.** Project Impacts

Tiger shark may be present during dredging within the borrow areas and sand placement at Sandbridge. Neonates and juveniles should easily be able to avoid any direct negative impacts because of their ready mobility. No indirect impacts to tiger shark are expected from dredging of the borrow areas because any food web impacts resulting from this are expected to be temporary and local when compared to available habitat elsewhere.

**23. Winter Skate** (*Leucoraja ocellata*)



**A.** EFH for winter skate:

The map below represents the designation of EFH for the juvenile life history stage based on the areas of highest relative abundance of this species. Only habitats with soft bottom, rocky or gravelly substrates that occur within the shaded (blue) areas are designated as EFH.

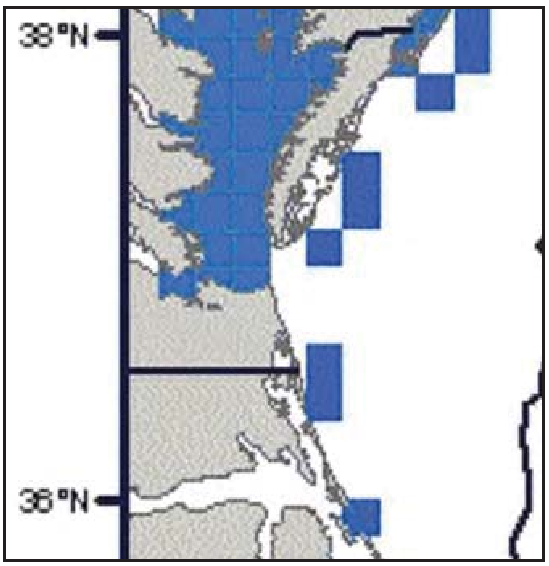


Figure 5: EFH for juvenile Winter Skate

**B.** Background:

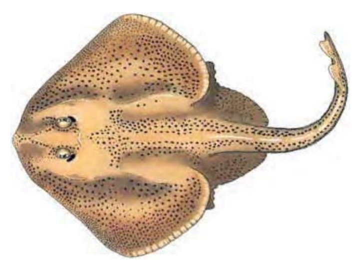
The winter skate occurs in waters from the surface to 90 m (300 feet) in depth, it prefers sand and gravel bottoms in shoal water in the northern portion of its range. The causes of the decline in population status have not been established, but bycatch in fisheries targeting other species is believed to be an important contributing factor. Juveniles are generally found in higher salinity, although some juveniles are found at salinities less than the 20.2 ppt. It is relatively inactive during the day remaining buried in depressions, with most activity occurring during the night time hours (Packer, 2003). The species does not undertake large scale migrations, moving mainly in response to changes in water temperature. Individuals move offshore in summer and early autumn, and move inshore during the winter. Winter skate have been termed a "winter periodic" because their seasonal migration suggests a preference for cool temperatures. The spring and fall distributions of juvenile winter skate are relative to bottom water temperature, depth, and salinity. In spring, they were found in waters between 2°C to 15°C (36°F-59°F) from southern Nova Scotia to Cape Hatteras and their depth range during that season was between about 11-70 m (36-230 ft). They were found at salinities between 32-33 ppt. During the fall, juvenile winter skate were caught over a temperature range of 5°C to 21°C (41°F-70°F) and found at depths between about 21-80 m (69-262 ft). They were found at salinities between 32-33 ppt. Its center of abundance is on Georges Bank and in the northern portion of the Mid-Atlantic Bight. Skate diets consist primarily of polychaetes, amphipods, decapod crustaceans, squid, bivalves, and small fish. Until 2000, the U.S. population of winter skate was considered to be in an overfished state. However, its status has been changed such that it is no longer considered to be in an overfished condition (NMFS 2002). In its 2002 report to Congress, NMFS (2002) reported that the most recent survey index for winter skate indicated that the current biomass was above the minimum stock size threshold and that winter skate were now officially listed as "not overfished". This status for winter skate was reaffirmed by NMFS in its 2003 report to Congress (NMFS 2003). Although winter skate are no longer considered overfished in U.S. waters, winter skate remain at comparatively low levels of abundance.

**C.** Project Impacts:

Turbidity may impact sight feeding, but the skates will likely flee the area to feed in neighboring waters where turbidity is reduced. Dredging, which usually occurs in late spring or early summer, does not coincide with peak abundance, as the skates have a preference for cooler waters. Although dredging activities may affect feeding success, this will be a temporary occurrence in a relatively small area. Additionally the wide range of prey increases the potential for feeding opportunities. Therefore, no more than minimal impact to the species or feeding success should occur to winter skate.

**24. Clearnose Skate** *(Raja eglanteria)*

The maps below represent the designation of juvenile and adult EFH for this life history stage based on the areas of highest relative abundance of this species. Only bottom habitats with mud, gravel, soft bottom, rocky or gravelly substrates and sand substrates that occur within the shaded (blue) areas in U.S. waters are designated as EFH.



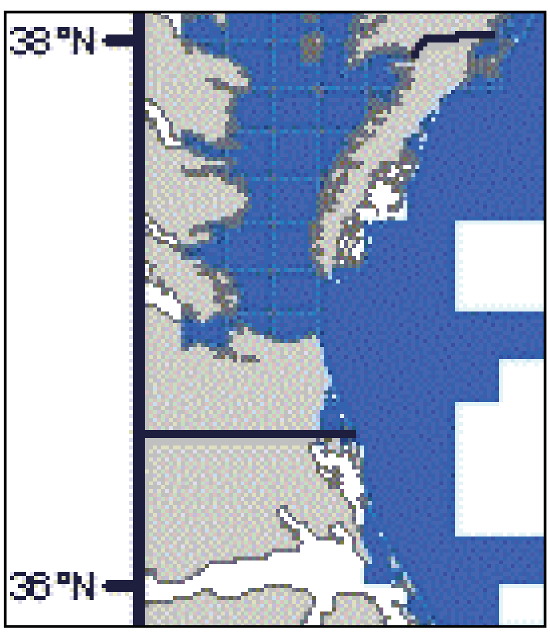



Figure 7: EFH for juvenile Clearnose Skate

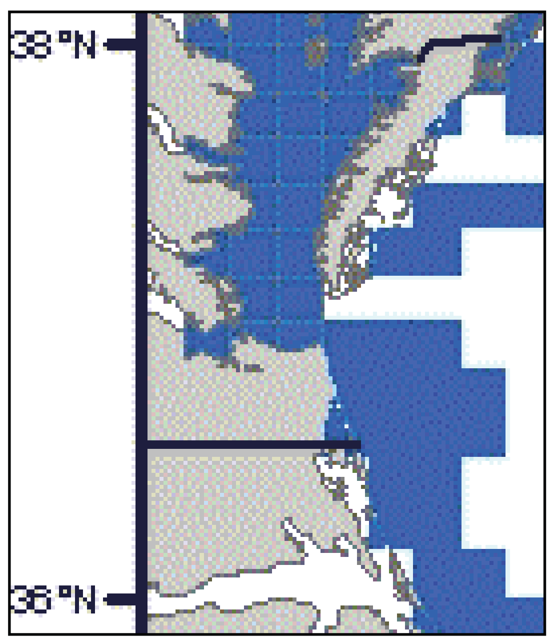



Figure 8: EFH for adult Clearnose Skate

**B.** Background

The clearnose skate is found in the mild, shallow shores of the Atlantic Ocean (from Massachusetts to south Florida) and in the Gulf of Mexico. It will sometimes be seen as far north as Canada. It is only a warm season visitor in the northern parts of its range, migrating south during the fall and winter. North of Cape Hatteras, it moves inshore and northward along the continental shelf during the spring and early summer, and offshore and southward during autumn and early winter when water temperatures cool to 13-16°C. Most clearnose skates are found at salinities of greater than 22 ppt and temperatures from 6°C- 27°C (43°F- 80°F). Both juveniles and adults can be found in a depth range of between 1-300m (3-985 ft.). NEFSC autumn survey biomass indices increased from the mid 1980's to 2000 but have since declined. The 2003-2005 average biomass index of 0.63 kg/tow is above both the biomass threshold reference point (0.28 kg/tow) and the Bmsy proxy (0.56 kg/tow), and hence the species is not overfished. The 2003-2005 index is lower than the 2002-2004 index of 0.75 by 16% but not by 30% (the average CV), and therefore overfishing is not occurring.

**C.** Project Impacts

Water quality changes during construction of the proposed project would be minimal and temporary, limited to the immediate area of the activity. Turbidity may impact sight feeding but the skates will flee the area to feed in neighboring waters and the elevated turbidity is temporary. Additionally, juveniles and adults may be found at depths ranging from less than 3 feet up to 985 feet and is broadly distributed along the eastern United States. Therefore, the proposed project would not result in significant adverse impacts to the EFH for this species.

## VIII. Cumulative Impacts

It is anticipated that next nourishment of Sandbridge Beach will occur in 2010 with an estimated 1.5 - 2.0 million cubic yards of sand. The U.S. Navy will likely re-nourish the beach and berm at the Dam Neck Naval Training Facility between 2011-2012. The Navy plans to access Sandbridge Shoal to obtain no more than 1.0 million cy. The south portion of the Dam Neck facility beach abuts the northern portion of Sandbridge Beach (the two reaches are separated by a sand fence).

The 1.5 - 2.0 million cy of sand proposed to be removed from Sandbridge Shoal for placement on Sandbridge Beach represents 6 % of the estimated remaining volume of the main shoal body. If the volume present in isolated shoals located seaward of the main shoal body are included, the fraction is even less. Considered in combination with the previous dredging operations, the cumulative volume of sand removed by 2010 will represent less than 25% of the conservative estimates of the volume of Sandbridge Shoal.

It is expected that the shoal will not naturally recover the volume of the sand that is dredged. However, current research sponsored by MMS suggests dredging will not threaten the geomorphic integrity of the shoal (Rob Nairn, personal communication). However, its function as habitat may be adversely affected, but to date, there has been limited evidence of any sustained disturbance beyond transient and localized impacts. The main body of the shoal, when defined by the 13 m isobath and 14 m isobaths (Figure 1), is approximately 1650 acres and 3000 acres respectively. The entire Sandbridge Shoal complex consists of more than 13,500 acres of sand to muddy sand substrate, provided the secondary sand ridges in the immediate vicinity of borrow areas A and B are included. The currently planned project is expected to impact a relative small fraction, approximately 150-300 acres, but no more than 500 acres. The impact can be minimized temporally by rotating borrow areas and disallowing repeated dredging in the same locale. Areas of the shoal where sediment grain-size is incompatible with nourishment grain size requirements, as well as other no-dredge areas such as the submarine cable zone, will also remain intact and undisturbed, serving as feeder zone for benthic recolonization. Additionally, since borrow areas are not typically dredged perfectly flat relative to the adjacent seafloor, a portion of the dredge areas will remain morphologically intact.

Impacts to EFH occur from a vast array of sources, including neighboring navigation channel dredging. The most influential of those sources are impacts from State regulated fishing activities that conduct unsustainable fishing practices and policies. Nearly one third of U.S. marine fisheries have been officially designated as overfished or nearly so. Recreational and commercial fishing activities (scallop dredges, trawls, anchoring, and vessel operations), all directly contact habitats utilized by EFH species. As a result of these impacts commercial harvesting is now being forced to level off after decades of impressive growth. For example, bluefish landings ranked first in the mid and south Atlantic bight from 1979-1989 with catches occurring inshore and offshore. In 1980, commercial and recreational landings of bluefish peaked. Landings have steadily declined since that time and the stock is now considered overharvested.

There are several commercial fisheries that may occur in the general area have impacts to both species of concern and their habitat. Gillnet fishing may be conducted for fish species such as the spiny dogfish and striped bass. Some bycatch is caught along with the targeted species, and this could potentially reduce the population numbers of non-targeted organisms, sublegal size fish and prey species. Many commercially-caught fish species, such as bluefish and Atlantic croaker, are caught by rod and reel or hand line. Impacts include mortality of catch released because of size limits or species prohibitions. If anchoring takes place, there may be some bottom disturbance as well. Stable sand environments often support colonial epifauna such as sponges and bryzoans. When the epiflora is repeatedly removed by bottom fishing, the habitat may become less suitable for commercially valuable fish and shellfish species (Bradstock and Gordon, 1983; Poiner and Kennedy, 1984; Sainsbury, 1988).

Pots and traps may be used for blue crabs and fish species such as black sea bass. During storms these pots and traps may be dragged along the seafloor bottom tearing up benthic habitat and damaging sessile organisms. If these pots and traps break away during storms, they will continue to "fish" for marine organisms that will become trapped and unable to escape.

Trawl fisheries for various fish and invertebrate species have also fished this general area in recent years. Trawl fisheries have targeted bottom fish such as grey seatrout and summer flounder or water column species such as bluefish. Traditional bottom trawls have been shown to remove bottom dwelling organisms such as brittle stars and urchins as well as plant-like organisms and colonial worm tubes (Collie et al., 2000). Colonial epifauna have also been shown to be less abundant in areas disturbed by bottom trawling. This epifauna provides habitat for shrimp, polychaetes and small fish which are potential prey species for commercially desirable fish species. Seafloor areas that have been heavily trawled may bear tracks where trawl doors have gouged into the sediment, changing the sediment surface and in other areas the trawl has flattened the sediment surface reducing habitat for managed species and their prey. Traditional trawl techniques were known to be nonselective in their catch thus having the potential to reduce both prey species and year classes of managed species not yet mature.

Longline fishing for species such as some coastal sharks may occur. Longlining may result in the death of some juvenile and non-target fish species.

Recreational anglers have also caught designated EFH species within the vicinity of the borrow areas (i.e. bluefish, cobia, striped bas, king mackerel) via rod and reel and spear fishing. Mortality of some species is expected from the bycatch of non-target species and sub-legal catches. Additionally, disruption of bottom habitat can occur from the anchoring of recreational boats. Benthos and fish caught by the anchor may be destroyed. Repeated anchoring in same location can lead to patches void of benthic organisms. It can reasonably be assumed that States will continue to license and permit recreational vessels and operations, which do not fall under the purview of a Federal agency. As the recreational activity increases the number moralities will continue to increase as well.

Impacts to EFH can be exacerbated by non-point source pollution. Pollution in Chesapeake Bay and various smaller estuaries in the area can influence fish habitat within the project area because of buoyant plumes that move south along the coast. Runoff from agriculture, stormwater and other sources; carry toxic chemicals and excess nutrients into coastal waters. These can lead to reproductive failure, deformations, death and anoxic habitats. This is of particular concern in estuaries and wetland where reproduction, migration and larval development occur for many of the EFH species found within the project area. Impacts from the non point sources of pollution are expected to continue.

Impacts from natural sources, such as large meteorological events, can also influence EFH species. Hurricanes and nor'easters, typified by increased system energetics, can increase turbidity and destroy bottom habitat used by EFH species and their prey. This can result in detrimental indirect impacts to finfish through changes in the food web. The magnitudes of these impacts range greatly depending on their intensity. Usually they are only temporary in nature.

Given the cumulative impacts associated with the current and future planned beach nourishment projects this project will most likely not add significantly to EFH impacts over time.

## IX. Mitigation Measures

Every measure that is technically and economically viable will be pursued to avoid and minimize effects on EFH. Minimization has included implementation of best management practices, extensive consultation with Federal and state agencies, and sampling of beach quality material at the offshore sand source areas to pre-select shoal areas that are most likely to contain beach quality sand. Sand lenses will be mined selectively, following existing bottom contours to the maximum extent practicable. Rotational dredging will be practiced to the maximum extent practicable. Vibracore surveys have been collected to identify the exact location of these sand lenses to minimize the footprint and the hours over which the dredge must operate. Restrictions on open-ocean dredging operations posed by winter weather conditions limit the opportunity to dredge during colder times of the year.

The Corps and MMS will consider all mitigation and recommendations that NMFS proposes through this consultation. Several measures have already been considered and integrated in project plans for reducing impacts to sea turtles and whales. The measures set forth to protected listed species will likely benefit the fish species and habitat described in this assessment. Additionally, the following measures have already been identified:

1) Implement best engineering and management practices.

2) Complete a hydrographic survey before and after dredging covering the entire area where the dredged is expected to operate.

3) Coordinate with NMFS to develop a long-term strategy and dredging management plan to be implemented after the next renourishment cycle that identifies rotation criteria and advance schedule for specific shoal use.

## X. Conclusion and Agency View

The severity of the impact to EFH and supported species is dictated by: 1) the spatial extent of the impact and 2) the chronic or long-term nature of the impact. The areas that have been designated as EFH in the project area have been given this classification because they are believed to be "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U. S. C. 1802). HAPC, a separate designation within EFH, is based on one or more of the following considerations: 1) the importance of the ecological function, 2) extent to which the habitat is sensitive to human-induced degradation, 3) whether and to what extent development activities are stressing the habitat type, or 4) rarity of habitat type [50 CFR 600.815(a)(8)].

The two borrow areas within Sandbridge Shoal are Area B to the north and Area A to the south. Area B is approximately 3,519 acres, and Area A is approximately 2,325 acres. During each dredging cycle, approximately 150 to 500 acres of benthic habitat may actually be adversely impacted within those borrow areas in order to obtain needed borrow material. Previous estimates, in excess of 500 acres, were calculated presuming the entire leased area was actually dredged. Compared to the entire shoal complex habitat and the ridge and swale topography in the Mid-Atlantic Bight offshore Virginia, the area of potential impact is relatively small.

If hydrodynamics and sediment transport are locally modified because of dredging, physical changes to the seafloor geomorphology may occur (e.g., substrate type and composition, surface texture, water circulation, and nutrient distribution). Some of the localized physical changes that have been observed in other locations following dredging include: 1) lower sand content; 2) higher silt/clay content; 3) poorer sorting (greater variation in grain size of sediment); and 4) accumulation of fine sediment (Jutte et al., 2002; Diaz et al., 2004). These changes have not been observed to date at Sandbridge Shoal (Diaz et al., 2006). Areas that have high rates of sediment transport (sand, not fine-grained sediment), such as depositional shoals, may experience rapid refilling rates, but that also assumes physical depressions are being created during dredging operations (Greene, 2002). Utilizing hopper dredges to extract thin layers of sediment (approximately 3 ft) over larger areas, rather than dredging single shoals to greater depths over smaller areas, often creates a complex fabric of meso-ridges and furrows. The ridges are essentially the areas missed by the hopper dredge dragarm due to the dredge's inability to completely remove all of the sediment. Shallow cuts are expected to have a smaller impact on waves and currents at the borrow area and presumably decrease the likelihood of exposure of and or infilling by finer-grained sediments. One of the primary concerns regarding the impact of dredging is whether the removal of sand from the shoal will somehow disrupt the physical processes that maintain the shape of sand ridges and shoal bodies. The concern would be that the shoal might deflate or unravel, losing its form over time. Ridge crests are intensely stirred by relatively high wave energy and consist of mixed coarse sediment with low organic material (Diaz et al., 2004; Hayes and Nairn, 2004). Comparatively, the trailing slope of the feature (up wave) is often characterized by a very gentle slope, moderate surface sediment mixing, and deposition of organically enriched fines. There may be at least two other unique physical habitats common to ridge features: 1) the leading side of the ridge is steeper and is depositional in nature (many ridges will be slowly migrating in the direction of this side of the ridge); and 2) deep troughs between the ridges that are relatively sheltered from wave action (due to both depth and breaking of waves over the crest of the ridge) often feature relatively finer sediments. The benthic communities and fish populations associated with each of these habitats are likely to be different (Diaz et al., 2004). It may be inferred that if a shoal did deflate due to dredging impacts, these different community structures could be adversely impacted.

Despite the prevalence of these features along the East Coast, little is documented about the ecological relationships of these features and their associated biological communities (Slacum et al., 2006; Vasslides and Able, 2008). Physical impacts caused by dredging are important only if they result in a coupled biological impact, either directly or indirectly. Dredging will lead to direct mortality of the benthic infauna that live in the substrate. Analysis of sediment core samples taken after dredging has demonstrated that remaining epibenthics are decimated (Parr et al., 1978). Studies investigating the recovery of benthic communities following dredging (Blake et al., 1996; Newell et al., 1998; Van Dolah et al., 1992; Van Dolah et al., 1998; Brooks et al., 2006; Diaz et al., 2006) have indicated that communities of similar total abundance and diversity can be expected to re-colonize dredge sites within several years. In a study off the coast of Panama City, Florida (Saloman et al., 1982), benthic community characteristics, such as species diversity, faunal abundance, and species composition, were equivalent to those of the surrounding communities within 3 months of the sediment disturbance. However, there is uncertainty whether the new benthic communities will fill the same trophic function and provide the same energy transfer to higher trophic levels, as did the original communities (Michel et al., 2007).

Regional research has noted significant seasonal and inter-annual variations in species richness and abundance at shoals and reference sites in the Mid-Atlantic Bight (Slacum et al., 2006). A study, sponsored by the Minerals Management Service, investigated impacts of sand dredging on benthos of the southwest Florida shallow continental shelf. At the Egmont Key study site, benthos were collected before, during, and after dredging activities at three stations (two dredged and one control). Post-dredging sampling occurred at 9 months and 17 months following completion of dredging. Statistical analyses demonstrated that each of the three stations experienced different temporal patterns in benthic community composition. The two dredged stations showed more temporal variation from one another than the control station. However, it was not possible to establish that the differences between the benthic community in the control stations and the dredged stations were due solely to dredging disturbances (Blake at al, 1995). In some instances, the natural variability may be larger than any influence of dredging, especially in physically-dominated environments.

Finfish species could potentially be harmed at the borrow area by entrainment in the dredge. But the extent of the impact may depend on seasonal and daily conditions, as recent research as shown that pelagic fish use such habitat differently between day and night (Slacum et al., 2006). Adult pelagic species, such as bluefish and Atlantic butterfish, should be able to avoid the entrainment into the dredge due to their high mobility. Demersal species, such as the windowpane flounder and the summer flounder, are mobile and should be able to avoid dredge entrainment as well. However, because of their demersal nature, individuals that remain on the seafloor of the borrow area during dredging, could be entrained and destroyed; demersal eggs may be entrained as well. Juveniles are likely more vulnerable than adults due to their slower swimming speed. Finfish species that have eggs and larvae in surface waters may be impacted by the hopper dredge making numerous transits through the borrow area; any eggs in the path of the dredge are likely to be destroyed by the ship's propeller. Because eggs and larvae are widely distributed over the continental shelf, egg destruction is not expected to cause significant impacts to fish populations. While some individual finfish will likely be entrained into the dredge and destroyed, no detrimental impacts to populations of any finfish are expected from the proposed project. Dredging may also result in physical alterations to the substrate of EFH which could result in unsuitable substrate for spawning of some finfish species. However, significant changes in substrate are not expected because dredging cut depths would be based on vibracore data to minimize dissimilar substrates (MMS, 2006).

Finfish and benthic species could also be harmed in the surf zone and foreshore while sand is being pumped onto the beach. The project shoreline is 27,815 linear feet (5.26 miles, 4.57 nautical miles) in length. Approximately 80 acres of shallow water or surf zone habitat will be impacted through the placement of the borrow material along the shoreline during beach nourishment operations. Characteristic of high-energy beaches, benthic communities exhibit low species diversity and are typically highly adapative. Typical benthic communities in the nearshore habitat of Sandbridge Beach include polychaete worms, bivalve mollusks and amphipod crustaceans. The dominant epibenthos are blue mussel (*Mytilus edulis*), common squid (*Loligo pealei*), hermit crab (*Paragus longicarpus*), windowpane flounder *(Scopthalmus aquosus*) and spotted hake (*Urophycis regia*).The majority of fish living nearshore are motile and can easily escape from sand placement. For many shellfish and other invertebrates it would be more difficult. The greatest impacts of sand placement are the initial decrease in fish abundance, potential for gill clogging caused by increased turbidity and direct burial of demersal fish. These impacts would be short-term and localized, and they would not cause significant impacts to populations of any finfish. In July 2001, the USACE ERDC released results of an $8.6 million dollar, eight year biological monitoring program of beach nourishment activities at the Asbury Park to Manasquan Inlet Beach Erosion Control Project in New Jersey (Burlas et al., 2001). Primary findings included: 1) no long-term and systematic impacts to surf zone finfish distribution and abundance patterns; 2) there was no sustained biological indicator (i.e., fish abundance or distribution pattern that distinguished nourished from non-nourished beach habitat); and 3) bluefish were essentially absent during nourishment, while benthic feeders (silversides and kingfish) were potentially attracted to the nourishment area, either related to re-suspended benthic material (silversides) or the general nourished condition (kingfish). Feeding habits of benthic-feeding surf zone fish were also examined, including northern kingfish, rough silverside, and Atlantic silverside. They found that the percentage of fish with filled stomachs did not differ, nor did the relative composition of prey items. Finally, the study also investigated the effects to surf zone and nearshore ichthyoplankton. Comparisons of reference and control beaches revealed no obvious differences in surf zone ichthyoplankton abundance, size and species composition.

The sandbar shark (*Charcharinus plumbeus*), is designated as having a Habitat Area of Particular Concern (HAPC), which is described in regulations as a subset of EFH that is rare; particularly susceptible to human-induced degradation, especially ecologically important; or located in an environmentally-stressed area. There may be an increase in turbidity and sedimentation associated with dredging and sand placement, but the adverse impacts of such changes will be localized and temporary. It is generally viewed that elevated levels of turbidity generated by trailing suction hopper dredge operations in open ocean waters does not represent a significant ecological impact (W.F. Baird & Associates and Research Planning, 2004). Given their mobility, sharks can avoid turbidity plumes and, if necessary, survive short-term elevated turbidity. The beach nourishment area (surf zone) and borrow area are not located within nursery or pupping grounds for the Sandbar Shark. Given that the shark can be found from the intertidal zone to waters more than 655 feet deep and are widely distributed along the East Coast, the borrow area represents a fraction of available forage habitat.

As discussed and evaluated in this Assessment and in the accompanying EA, offshore dredging, dredge transit, and placement along the Sandbridge Beach shoreline are not expected to impact "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" to any appreciable extent over a significantly large area or over any significant period of time. Impacts would be limited and short-lived. Also, HAPC for the sandbar shark is not anticipated to be impacted by the project in any of the following ways: 1) the importance its ecological function, 2) by human-induced or long-term degradation, 3) by stressing the habitat type, or 4) by compromising or jeopardizing the habitat, fully considering the rarity of habitat type. From a finfish perspective, demersal species will be most impacted. The other pelagic species should only be minimally impacted. Given the relatively small-size of the impacted area relative to the large geographic ranges of transitory fishes, the proposed activities, even when considered cumulatively under present conditions, would have only minor impacts on the populations of finfish evaluated in this analysis.

Accordingly, USACE and MMS have determined that the proposed project may have adverse effects on EFH for Federally managed species, but adverse effects on EFH species, due to construction, will largely be temporary and localized within the dredged footprints and beach nourishment areas in the surf zone. In conclusion, the project is not anticipated to significantly impact EFH species or habitat (including HAPC) that may be in the project area.

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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 30, 2017

Operations Branch

Ms. Kimberly Damon-Randall
Protected Resources Division
NMFS Greater Atlantic Fisheries Office
55 Great Republic Drive
Gloucester, MA 01930-2276

Dear Ms. Damon-Randall:

The U.S. Army Corps of Engineers (USACE), Norfolk District is responsible for the maintenance of the Sandbridge Beach Nourishment and Hurricane Protection Project at Sandbridge Beach, Virginia Beach, VA. The USACE, acting as the lead agency, plans to utilize Sandbridge Shoals as borrow areas through a Memorandum of Agreement with the Bureau of Ocean Energy Management (BOEM), a cooperating agency. The Sandbridge project involves the placement of sand at Sandbridge Beach, an area approximately 5 miles long and 125 feet wide, in order to provide protection from erosion-induced damages, especially as a result of storms.

This letter is to provide notification and request concurrence under Section 7 of the Endangered Species Act (ESA) from NOAA Fisheries Protected Resources Division (PRD) for a project led by USACE, Norfolk District. The proposed project would place 2,000,000 cubic yards (cy) of dredged material from Sandbridge Shoals at Sandbridge Beach, VA for beach protection from erosion-induced damages in calendar year 2018. A hopper dredge is expected to be used for all dredging activity. The borrow areas for this project are Area B to the north and Area A to the south, located within Sandbridge Shoals about 3 nautical miles from shore. The last renourishment event occurred in 2012-2013 and was authorized to dredge 2,138,850 cy from Sandbridge Shoals; this project fulfilled its ESA Section 7 consultation requirements with a project-specific BO.

In cooperation with BOEM, USACE has determined that the proposed project is covered in the NOAA Fisheries' Batched Biological Opinion (BO) (F/NER/2012/01586) finalized on October 16, 2012. In that analysis, renourishment events were estimated to occur as the dredging and placement of 500,000 cy every 2 years; however, since it will have been 6 years between events, the proposed renourishment event requires additional material (2,000,000 cy total). Since the events have been spaced farther apart in time, thus increasing recovery time, it is believed that the current BO accurately assesses project-related impacts, even with the increased volume. There have been no other changes since the last consultation. The 2012 BO assessed the impacts to species listed under the Endangered Species Act (ESA) and concluded that the proposed project was not likely to adversely affect shortnose sturgeon, hawksbill sea turtles, and sperm, blue, North

Atlantic right, humpback or fin whales; the project may adversely affect Atlantic sturgeon and loggerhead, Kemp's ridley, green or leatherback sea turtles. The proposed project is not likely to jeopardize the continued existence of any ESA-listed species. Since the BO was finalized in 2012, there have been no new listings or critical habitat designations in the project area.

The use of screens on the draghead are required because of documented munitions of explosive concern (MEC) and unexploded ordnance (UXO) in the area. As a result, injury and death of animals cannot be directly observed. A proxy estimate is used in place of an onboard marine endangered species observer. Based on the Incidental Take Statement for the proposed dredged volume (2,000,000 cy), this project assumes a take of one Atlantic sturgeon for work year-round, and seven sea turtles (90% loggerheads, 8% Kemp's ridley, and 2% green) for work conducted from April 1st through November 30th. The USACE will adhere to all non-discretionary terms and conditions and reasonable and prudent measures established during the course of consultation with your office to minimize and monitor impacts to threatened and endangered species resulting from this project. Turtle excluder devices (TED) or "deflectors" will be installed on the hopper dredge drag-heads year around to minimize entrainment of Atlantic sturgeon and sea turtle species that may be present in the sand borrow area. Between May 1st and November 30th, sections of the beach undergoing re-nourishment will be monitored for sea turtles, their nests and nesting activities. If nesting occurs, project activities will be modified to avoid potential impacts to turtles.

In this letter, USACE and BOEM request concurrence from NOAA Fisheries PRD based on the 2012 Batched BO that the use and placement of Outer Continental Shelf (OCS) sand for this Sandbridge Beach renourishment event is covered, and requests acknowledgement from NOAA Fisheries PRD that USACE and BOEM have met their ESA Section 7 requirements for this project.

Should you have any questions or require further information on this submittal, please contact Ms. Teri Nadal by email at teresita.i.nadal@usace.army.mil or call (757) 201-7299. Thank you for your cooperation and assistance.

Sincerely,

Keith B. Lockwood

Keith B. Lockwood
Chief, Operations Branch

ec: Geoffrey Wikel
Chief, Branch of Environmental Coordination

# FW: [EXTERNAL] Sandbridge Beach Nourishment Project - ESA sec 7 coordination (UNCLASSIFIED)

1 message

**Nadal, Teresita I CIV USARMY CENAO (US)** <Teresita.I.Nadal@usace.army.mil> Fri, Dec 22, 2017 at 4:02 PM
To: "Hansen, Deena" <deena.hansen@boem.gov>
Cc: "leighann.brandt@boem.gov" <leighann.brandt@boem.gov>

CLASSIFICATION: UNCLASSIFIED

Deena,
I am glad to see these moving along so quickly.
ESA coordination is complete with NMFS-PRD.

Vr,

Teri

-----Original Message-----
From: Brian D Hopper - NOAA Federal [mailto:brian.d.hopper@noaa.gov]
Sent: Friday, December 22, 2017 8:52 AM
To: Nadal, Teresita I CIV USARMY CENAO (US) <Teresita.I.Nadal@usace.army.mil>
Subject: Re: [EXTERNAL] Sandbridge Beach Nourishment Project - ESA sec 7 coordination (UNCLASSIFIED)

yes about the first part and, with regard to the second part, although some actions under the 2012 BiOp may be outside of it, the recent designation of critical habitat for Atlantic sturgeon triggers re-initiation on the entire 2012 BiOp (one of the things we need to discuss with the Norfolk District). however, you may only need to supply a supplemental BA for the projects that are actually changing/being revised/or are added. i don't think that is the case with the Sandbridge project, correct?

On Fri, Dec 22, 2017 at 8:35 AM, Nadal, Teresita I CIV USARMY CENAO (US) <Teresita.I.Nadal@usace.army.mil <mailto:Teresita.I.Nadal@usace.army.mil> > wrote:

CLASSIFICATION: UNCLASSIFIED

Brian,

So, are you in agreement that the Sandbridge Beach Nourishment project is covered under the existing BiOp and re-initiation is not warranted for the Sandbridge Beach project?

Vr,

Teri

From: Brian D Hopper - NOAA Federal [mailto:brian.d.hopper@noaa.gov <mailto:brian.d.hopper@noaa.gov> ]
Sent: Friday, December 22, 2017 8:04 AM
To: Nadal, Teresita I CIV USARMY CENAO (US) <Teresita.I.Nadal@usace.army.mil <mailto:Teresita.I.Nadal@usace.army.mil> >
Cc: Christine Vaccaro - NOAA Federal <christine.vaccaro@noaa.gov <mailto:christine.vaccaro@noaa.gov> >; Mark Murray-Brown <mark.murray-brown@noaa.gov <mailto:mark.murray-brown@noaa.gov> >
Subject: Re: [EXTERNAL] Sandbridge Beach Nourishment Project - ESA sec 7 coordination (UNCLASSIFIED)

okay. thanks for the quick response!  recently, we've gotten several BAs regarding projects that were previously batched together under the 2012 BiOp, as well as this letter about the Sandbridge beach nourishment project, and are not sure our workloads can accommodate this many formal consultations at the same time. therefore, in light of our current workloads and staff limitations, we have had several internal discussions about how to develop a game plan to address them all in an efficient and streamlined manner.  the other day, Chris sent an email to your office about setting up a meeting after the new year to share our strategy and discuss how we should proceed.  hopefully, that email is getting shared around your office so that staff can fill out the doodle poll and we can schedule a call.  i look forward to working with you and the other PMs in Norfolk.  please let me know if you have any questions.

On Fri, Dec 22, 2017 at 7:32 AM, Nadal, Teresita I CIV USARMY CENAO (US) <Teresita.I.Nadal@usace.army.mil <mailto:Teresita.I.Nadal@usace.army.mil> > wrote:

Yes.

-----Original Message-----
From: Brian D Hopper - NOAA Federal [mailto:brian.d.hopper@noaa.gov <mailto:brian.d.hopper@noaa.gov> ]
Sent: Friday, December 22, 2017 7:00 AM
To: Nadal, Teresita I CIV USARMY CENAO (US) <Teresita.I.Nadal@usace.army.mil <mailto:Teresita.I.Nadal@usace.army.mil> >
Cc: Christine Vaccaro - NOAA Federal <christine.vaccaro@noaa.gov <mailto:christine.vaccaro@noaa.gov> >
Subject: Re: [EXTERNAL] Sandbridge Beach Nourishment Project - ESA sec 7 coordination (UNCLASSIFIED)

Hi Teri,

I've taken a look at your letter and wanted to clarify that you are asking us to confirm that re-initiation of the 2012 BiOp for the beach nourishment project is not warranted?

-Brian

On Thu, Dec 21, 2017 at 1:58 PM, Nadal, Teresita I CIV USARMY CENAO (US) <Teresita.I.Nadal@usace.army.mil <mailto:Teresita.I.Nadal@usace.army.mil>  <mailto:Teresita.I.Nadal@usace.army.mil <mailto:Teresita.I.Nadal@usace.army.mil> > > wrote:

CLASSIFICATION: UNCLASSIFIED

Brian,
Hope all is well.
When can I expect to receive a response for Sandbridge?
Please let me know if you have any questions>
Happy holidays!

Teri

-----Original Message-----
From: Brian D Hopper - NOAA Federal [mailto:brian.d.hopper@noaa.gov <mailto:brian.d.hopper@noaa.gov>  <mailto:brian.d.hopper@noaa.gov <mailto:brian.d.hopper@noaa.gov> > ]
Sent: Friday, December 1, 2017 9:49 AM
To: Nadal, Teresita I CIV USARMY CENAO (US) <Teresita.I.Nadal@usace.army.mil <mailto:Teresita.I.Nadal@usace.army.mil> <mailto:Teresita.I.Nadal@usace.army.mil <mailto:Teresita.I.Nadal@usace.army.mil> > >
Cc: Christine Vaccaro - NOAA Federal <christine.vaccaro@noaa.gov <mailto:christine.vaccaro@noaa.gov>  <mailto:christine.vaccaro@noaa.gov <mailto:christine.vaccaro@noaa.gov> > >
Subject: [EXTERNAL] Sandbridge Beach Nourishment Project - ESA sec 7 coordination

Hi Teri,
Just following up on your email to Chris to let you know that I will be your NMFS POC for this action.

-Brian

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Brian D. Hopper
Protected Resources Division
NOAA Fisheries
Greater Atlantic Regional Fisheries Office
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Annapolis, MD 21401 <Blockedhttps://maps.google.com/?q=177+Admiral+Cochrane+Dr.+%0D+%C2%A0+%C2%A0+%C2%A0+%C2%A0+Annapolis,+MD+21401&entry=gmail&source=g>
(410) 573-4592 <tel:%28410%29%20573-4592>  <tel:%28410%29%20573-4592>
Brian.D.Hopper@noaa.gov <mailto:Brian.D.Hopper@noaa.gov>  <mailto:Brian.D.Hopper@noaa.gov <mailto:Brian.D.Hopper@noaa.gov> > <mailto:brian.d.hopper@noaa.gov <mailto:brian.d.hopper@noaa.gov>  <mailto:brian.d.hopper@noaa.gov <mailto:brian.d.hopper@noaa.gov> > >
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CLASSIFICATION: UNCLASSIFIED

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Brian D. Hopper
Protected Resources Division
NOAA Fisheries
Greater Atlantic Regional Fisheries Office
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Annapolis, MD 21401 <Blockedhttps://maps.google.com/?q=177+Admiral+Cochrane+Dr.+%0D+Annapolis,+MD+21401&entry=gmail&source=g>
(410) 573-4592 <tel:%28410%29%20573-4592>
Brian.D.Hopper@noaa.gov <mailto:Brian.D.Hopper@noaa.gov> <mailto:brian.d.hopper@noaa.gov <mailto:brian.d.hopper@noaa.gov> >
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Brian D. Hopper
Protected Resources Division
NOAA Fisheries
Greater Atlantic Regional Fisheries Office

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Annapolis, MD 21401 <Blockedhttps://maps.google.com/?q=177+Admiral+Cochrane+Dr.%0D+%0D+%0D+Annapolis,+MD+21401&entry=gmail&source=g>
(410) 573-4592 <tel:(410)%20573-4592>
Brian.D.Hopper@noaa.gov <mailto:brian.d.hopper@noaa.gov>
BlockedBlockedhttp://www.greateratlantic.fisheries.noaa.gov/

CLASSIFICATION: UNCLASSIFIED

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CLASSIFICATION: UNCLASSIFIED

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

OCT 16 2012

Mark T. Mansfield, Chief
Planning and Policy Branch
Department of the Amy
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

Elizabeth Waring, Chief
Operations Branch
Department of the Amy
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

Dear Mr. Mansfield and Ms. Waring,

Please find enclosed a copy of the Biological Opinion 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.

This work will be carried out by the U.S. Army Corps of Engineers (USACE) or their contractors. Other Federal agencies with a role in authorizing, funding or carrying out the proposed actions are the Bureau of Ocean Energy Management, the U.S. Navy, and the U.S. Environmental Protection Agency (EPA). The USACE, Norfolk District, is the lead Federal agency for this consultation. In this Opinion, we conclude that the proposed actions are likely to adversely affect, but not likely to jeopardize the continued existence of the Northwest Atlantic Distinct Population Segment (DPS) of loggerhead sea turtles, or Kemp's ridley, green or leatherback sea turtles or the threatened Gulf of Maine DPS of Atlantic sturgeon or the endangered New York Bight, Chesapeake Bay, Carolina or South Atlantic DPSs of Atlantic sturgeon. We also conclude that the proposed actions may affect but are not likely to adversely affect shortnose sturgeon, hawksbill sea turtles, or North Atlantic right, humpback or fin whales.

This Opinion replaces the following Opinions which are hereby withdrawn: Thimble Shoals and Atlantic Ocean Channel (April 25, 2002), Virginia Beach Hurricane Protection Project – Thimble Shoals Surround and Atlantic Ocean Channel Borrow Area (December 2, 2005), Cape Henry, York Spit, York River Entrance Channel and Rappahanock Shoals (July 24, 2003), and Sandbridge Beach (April 2,1993, amended on August 20, 2001).

Our Opinion includes an Incidental Take Statement (ITS). 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, 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 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 ITS exempts the take of sea turtles due to entrainment in hopper dredges and capture in relocation trawls and exempts the take of Atlantic sturgeon due to entrainment in hopper and cutterhead dredges, capture in relocation trawls and capture in mechanical dredges. The take levels provided in the ITS cover the entire 50-year duration of the proposed action.

The ITS specifies reasonable and prudent measures necessary to minimize and monitor take of Atlantic sturgeon and listed sea turtles. The measures described in the ITS are non-discretionary and must be implemented for the exemption in section 7(o)(2) to apply. USACE, as the lead Federal agency, has a continuing duty to regulate the activity covered by this ITS. If you (1) fail to assume and implement the terms and conditions or (2) fails to require your 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 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).

This Opinion concludes formal consultation for the proposed action as currently defined. Reinitiation of this consultation is required if: (1) the amount or extent of taking specified in the ITS is exceeded; (2) 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; (3) project activities are subsequently modified in a manner that causes an effect to the listed species that was not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the identified action.

Depending on the circumstances associated with the cause for reinitiation, it may not be necessary to reinitiate consultation for all of the actions considered here. For example, if a new species is listed that may be affected by dredging activities, it would likely be necessary to reinitiate consultation on all of the activities considered here. However, if the cause for reinitiation has effects that are limited to one action (for example, a change in dredge type, dredge volume or disposal area), reinitiation of consultation on only that action would be necessary. We expect that determinations about the scope of any future reinitiation(s) will be made in cooperation between the USACE and us.

Should you have any questions regarding this Opinion please contact Julie Crocker of my staff at (978) 282-8480 or by e-mail (Julie.Crocker@noaa.gov). I look forward to continuing to work with you and your staff on issues related to listed species and Chesapeake Bay dredging projects.

Sincerely,

for John K. Bullard
Regional Administrator

ec: Crocker - F/NER3
O'Brien – F/NER4
Underwood, Pruhs – ACOE NAO
BOEM
EPA
Navy

File Code: Sec 7 ACOE Norfolk – Chesapeake Bay entrance 2012
PCTS: F/NER/2012/01586

**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:** Maintenance of Chesapeake Bay Entrance Channels and use of sand borrow areas for beach nourishment
**F/NER/2012/01586**

**Conducted by:** National Marine Fisheries Service
Northeast Region

**Date Issued:** 10/16/12

**Approved by:** [signature] for John Bullard

# TABLE OF CONTENTS

## 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.

This Opinion is based on information provided in the Biological Assessments (BA) dated April, May and July 2012, 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 Northeast Regional Office. This Opinion replaces the following Opinions which are hereby withdrawn: Thimble Shoals and Atlantic Ocean Channel (April 25, 2002), Virginia Beach Hurricane Protection Project – Thimble Shoals Surround and Atlantic Ocean Channel Borrow Area (December 2,2005), Cape Henry, York Spit, York River Entrance Channel and Rappahanock Shoals (July 24, 2003), and Sandbridge Beach (April 2,1993, amended on August 20, 2001). Consultation was initiated on May 23, 2012. A draft of the Reasonable and Prudent Measures and Terms and Conditions was sent to USACE on August 29, 2012. A complete draft of the Biological Opinion was provided to USACE on September 28, 2012; comments were received on September 6 and October 4, 2012 and incorporated as appropriate.

## 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 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).

The USACE 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 these Opinions are similar, they take place in the same geographic area, and affect 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 in one consultation. As such, while there are seven independent actions considered here (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 are producing one Biological Opinion. This type of "multi-action" consultation is contemplated in the NMFS-USFWS Section 7 Consultation Handbook (see page 5-5). Below, we detail the consultation history for each of these activities.

In the future, reinitiation of consultation may be necessary (see 50 CFR§ 402.16). Depending on the circumstances associated with the cause for reinitiation, it may not be necessary to reinitiate consultation for all of the actions considered here. For example, if a new species is listed that may be affected by dredging activities, it would likely be necessary to reinitiate consultation on all of the activities considered here. However, if the cause for reinitiation has effects that are limited to one action (for example, a change in dredge type, dredge volume or disposal area), reinitiation of consultation on only that action would be necessary. We expect that determinations about the scope of any future reinitiation(s) will be made in cooperation between the USACE and us.

### 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 BO was issued on May 30, 2001. The Corps 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, the Corps re-initiated consultation in regards to 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. We issued the most recent Biological Opinion on April 25, 2002. In this 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 Opinion, exempting the lethal take of up to 18 loggerheads and 4 Kemp's ridley during each dredge event and the non-lethal capture of an "unquantifiable" number of loggerheads and Kemp's ridleys during each relocation trawling event.

### 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. A biological opinion was issued 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; a new Opinion was issued on January 24, 2002. In letters dated January 15 and February 6, 2003, the Corps requested reinitiation of consultation as the exempted level of take was exceeded in 2002. A new Opinion was issued on July 24, 2003. In this Opinion, we concluded that the proposed dredging was not likely to jeopardize the continued existence of any listed species. An ITS was included with this Opinion, exempting the annual lethal take of up to 18 loggerheads, up to 4 Kemp's ridleys and 1 green, 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) 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.

### 2.3 Sandbridge Shoal

Formal consultation for the use of the Sandbridge Shoal borrow area was initiated in May 1992. A Biological Opinion was issued by NMFS on April 2, 1993. This 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, USACE 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 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 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 reinitiated in 2012. In September 2012, we issued a new 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. 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. Use of the Sandbridge Shoal borrow areas requires coordination with the Bureau of Ocean Energy Management (BOEM); the USACE 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 the submittal of a BA by the USACE in January 2005. We issued a Biological Opinion on December 2, 2005. In this 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 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.

## 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 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.

## 2.6 Craney Island Eastward Expansion

Consultation between NMFS and USACE on the Craney Island Eastward Expansion project was completed informally 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.

## 3.0 DESCRIPTION OF THE PROPOSED ACTION

This Opinion considers the effects of future new work dredging, continued maintenance dredging, and sand borrow operations in several Federal navigation channels located in the Chesapeake Bay and Atlantic Ocean as well as the use of three sand borrow areas. These activities are carried out by the USACE or the U.S. Navy and their contractors as independent actions as detailed below. 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 ocean disposal sites.

## 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. These channels provide access for all ships calling on port facilities, naval bases, and shipyards in the Hampton Roads areas. 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. 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 location of TSC and AOC is depicted in Appendix A.

The proposed action involves continued ongoing sand borrow operations, maintenance and future new work 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. The AOC and TSC are preferred sand borrow sources for beach nourishment and port development projects in the Hampton Roads region.  Projects that have historically used, or are proposing to borrow from, the TSC and AOC includes 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 work 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 restrictions, availability of suitable dredge plant, emergencies, and others.  It is important to note that the areas within the channel that are dredged during each cycle are 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. WRDA authorized the USACE to construct the AOC as part of the Norfolk Harbor and Channels, Virginia. The AOC consists of a channel 11.1 miles long, 1,300 feet wide, and 60 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. Although authorized to a depth of 60 feet, the channel has not been dredged past the current depth of 52 feet. The channel is currently maintained to full width and a depth of 52 feet to enable loaded colliers to transit the channel with ship drafts as great as 50 feet. The AOC is managed by the Norfolk District.

*Thimble Shoal Federal Navigation Project*

The TSC was authorized by the River and Harbor Act of  August 8, 1917, and modified by the River and Harbor Act of September 3, 1954, October 27, 1965, and the WRDA of 1986.  The project consists of a channel 55 feet deep, 1,000 feet wide, and approximately 13.4 miles long between 55-foot contours and is located in the southern part of the Chesapeake Bay, just off the shoreline of the City of Norfolk and City of Virginia Beach. Deepening work for the Thimble Shoal channel to -52 feet was completed in 2003. The Thimble Shoal Channel is managed by the Norfolk District.

## 3.2 Port of Baltimore Approach Channels

Cape Henry Channel (CHC), York Spit Channel (YSC) and Rappahanock 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; however, the budget for maintenance dredging of these channels is the responsibility of Baltimore District.

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. 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 in which each shoal is dredged is dependent on several factors. These factors include, but are not limited to: environmental conditions, funding, location, degree of shoaling, time of year restrictions, 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 CHC.

*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 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 involves continued ongoing maintenance dredging of YREC 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 YREC normally requires dredging every two to five years; dredging is typically located in distinct shoaled areas within the channel 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 in which each shoal is dredged is dependent on several factors. These factors include, but are not limited to: environmental conditions, funding, location, degree of shoaling, time of year restrictions, availability of suitable dredge plant, navigation emergencies, and others.

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 the current project under Section 107 of the River and Harbor Act of 1960. The YREC project consists 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 l, l994, 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 19,60 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 between the 3-mile limit and just outside the 3-mile limit 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 Back Bay 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 National Wildlife Refuge (NWR) to the south. The project dimensions include a 50-foot wide berm at an elevation of 6 feet North American Vertical Datum (NGVD) 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).

The hopper dredge is a self-propelled vessel equipped with trailing suction dragheads and a hopper that collects sand. When the hopper is full, material is transported to a pump-out buoy located offshore. The material would then be pumped through a pipeline, which runs along the ocean floor, and up onto the beach where bulldozers and graders will distribute the sand. There are known ordinance issues located within the Sandbridge Shoals area, UXO screening will be required for this action. This is due to training operations at the U.S. Naval Fleet Anti-Air Warfare Training Center at Dam Neck. Ordinances have been found in earlier dredging actions for this on-going project.

A hydraulic pipeline dredge uses a cutterhead to loosen or dislodge sediments to hydraulically capture the material. The sluried sediment is transported through a pipeline to the placement site. Because pipeline dredges pump directly to the placement site, they can operate continuously and can be very productive, and cost efficient. Once the material is placed on the beach similar construction methods are used to distribute the material properly.

USACE states the purpose of the proposed action is to provide protection from erosion induced damages including limited protection to the beach and to residential structures from storm damage. Several alternatives were considered in the feasibility phase of the project including structural, non-structural and a no action alternative. Neither one nor a combination of the other alternatives discussed provided an acceptable solution in terms of feasibility and/or economics, environmental, and technical concerns, to the existing beach erosion and hurricane protection needs; and, thus were eliminated from further consideration as viable solutions to coastal erosion and storm problems at Sandbridge Beach.

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 include 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. The authorized project 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;
- 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);
- 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 work 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 work dredging (deepening) to authorized depths, environmental conditions and windows, funding, location, 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 work dredging projects 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 work construction (deepening) may significantly exceed average maintenance dredging volumes. However, this may also be dependent on how Congress funds the project for the fiscal year. The primary objective of maintenance and new work dredging is to provide vessels with safe, navigable passage to the Port of Hampton Roads in support of commerce and national defense.

*Norfolk Harbor Channel - Sewells Point to Lamberts Bend*
The Norfolk Harbor Channel Sewells Point to Lamberts Bend consists of a channel 55-feet deep and 800 feet to 1,500 feet in width from the 55-foot contour in Hampton Roads near the Hampton Roads Bridge-Tunnel to Lamberts Bend a distance of approximately 8.0 miles. The channel is currently maintained to a depth of 50 feet.

*Norfolk Harbor Channel - Lamberts Bend to Paradise Creek*
The Norfolk Harbor Channel Lamberts Bend to Paradise Creek consists of a channel 45 feet deep and 350 feet to 750 feet in width from Lamberts Bend to Paradise Creek near the N&W Railroad Bridge. This channel is located in the main stem and southern branch of the Elizabeth River from Lamberts Bend to Paradise Creek in the cities of Norfolk, Portsmouth, and Chesapeake. The channel is maintained to a depth of 50 feet from Lamberts Bend to the U.S. Navy Deperm Station and a depth of 47 feet from The U.S. Navy Deperm Station to the Norfolk Naval Shipyard. These depths are to provide safe navigation for an aircraft carrier corridor for naval vessels accessing the shipyard. This element may be maintained by the U.S. Navy or USACE with military construction funding. The remaining channel from the Norfolk Naval Shipyard to Paradise Creek at the N&W Railroad Bridge is currently maintained to a depth of 40 feet.

*Norfolk Harbor - Southern Branch Channel*
The Norfolk Harbor - Southern Branch Channel consists of a channel 40 feet deep and 250 feet to 500 feet wide from the Norfolk Southern Railway Bridge to the U.S. Routes 460 and 13 Highway Bridge; thence 35 feet deep and 250 to 300 feet wide to a point 0.8 miles above the Interstate 64 high level bridge. The channel is located from the Norfolk and Western Railroad Bridge at Paradise Creek to the turning basin at Newton Creek and then to a point 0.8-mile above Interstate 64 high level bridge. The project includes a turning basin at the mouth of St. Julians Creek, 40 feet deep, 400 to 600 feet long, and 800 feet wide; a turning basin not yet constructed at the mouth of Milldam Creek, 40 feet deep and 800 feet square; a turning basin at the mouth of Newton Creek 35 feet deep and 600 feet square; and a turning basin at the mouth of Mains Creek, the upstream bend of the project, 35 feet deep and 800 feet square. All 40-foot features authorized by the 1986 WRDA have not yet been constructed. The Southern Branch Channel is currently maintained to a depth of 35 feet.

*Norfolk Harbor – Eastern Branch Channel*
The Eastern Branch Channel is located at the junction of the Elizabeth River main stem, southern branch, and eastern branch and extends 2.5 miles upstream in the eastern branch of the Elizabeth River.The Norfolk Harbor – Eastern Branch Channel consists of a channel 25 feet deep and 500 feet wide from the junction of the Elizabeth River branches to the N&W Railroad Bridge, from the N&W Railroad Bridge a channel 25 feet deep and 300 feet wide to the Campostella Bridge, thence a channel 25 feet deep and 200 feet wide to the N&W Railroad Bridge (formerly Virginian), including a turning basin 25 feet deep and approximately 55 acres in size located at the upstream end of the project.

*Norfolk Harbor – Western Branch Channel*
The Western Branch Channel is located at the junction of the Elizabeth River main stem with the western branch and extends 1.72 miles upstream in the western branch of the Elizabeth River. The Norfolk Harbor – Western Branch Channel consists of a channel 24 feet deep and 300 feet wide to a point 0.78 mile from the 40-foot channel; thence a channel 24 feet deep and 200 feet wide for a distance of 0.37 mile; thence a channel 18 feet deep and 150 feet wide and 0.57 mile in length to a point 0.34 mile above the West Norfolk Bridge.

*Norfolk Harbor – Scotts Creek Channel*
Scotts Creek Channel is located at the junction of the Elizabeth River main stem with Scotts Creek and extends 0.73 miles upstream in Scotts Creek. The Norfolk Harbor – Scotts Creek Channel consists of a channel 12-feet deep and 100 feet wide and 0.73 mile in length from its junction with the 40-foot channel.

*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 consists of a channel 55 feet deep and 800 feet wide from Norfolk Harbor Channel in Hampton Roads to Newport News, 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.

*Norfolk Harbor Anchorages*
The Norfolk Harbor Fifty-Foot Anchorages consists of three fixed mooring anchorage facilities with a depth of 55 feet, each capable of accommodating two large vessels simultaneously with a swinging radius of 1,200 feet. The Norfolk Harbor Sewells Point Anchorages consists of two anchorages 45 feet deep with a swinging radius of 1,200 feet.

### 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 authorization established a fifty percent cost share of the Federal government for the development of the new dredged material containment cell. 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.

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 a new marine terminal at the completion of filling of the containment cell. The site may also serve as a logistical and tactical area supporting deployment of national defense forces. The proposed Federal action will consists of new work dredging of the main dike footprint, access channels, and wharf access area to remove unsuitable marine clays underlying the marine terminal and to establish safe navigable depths for deep-draft vessels accessing the terminal wharf. Perimeter and division dikes will be constructed through the placement of suitable sand and rock caisson fill in the main dike footprint and sand fill in the south and north perimeter dikes and division dike.

The proposed project activity will involve multiple construction phases of new work dredging and fill elements over a period of approximately 15-years to construct the new containment cell, access channel, and wharf access elements. The project includes the entire footprint of the 522-acre containment cell, access channels, and wharf access area, plus the entire footprint of the associated dredged material placement sites. The duration of dredging, the amount of material removed and/or filled during each dredging or fill phase will be contingent on Federal and state funding. The entire footprint of the main dike, access channels, wharf access area, north and south perimeter dikes, and division dike will be dredged and/or filled over multiple construction phases to the required depths and elevations. The volumes of new work dredging and fill activities for each construction element are presented in Table 1.

The project includes the following elements:

- New work dredging totaling approximately 31.3 million cubic yards of dredged material for the main dike, access channels, and wharf access construction. Approximately 6.8 million cubic yards will be removed with a hydraulic pipeline dredge and placed upland in CIDMMA and 24.5 million cubic yards will be dredged with a mechanical dredge, transported by barge placed at the Norfolk Ocean Disposal Area (NODS); and,
- Dike construction (main dike, perimeter and division dikes) will require approximately 16.2 million cubic yards of sand fill and 3.3 million cubic yards of quarry rock for suitable infill.

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**. Fill Activity at CIEE

| Fill Activity | Total Volume |
|---|---|
| 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 |
| ***TOTAL FILL VOLUME 19,500,000*** | |

*New Work Dredging of Main Dike, Access Channels, and Wharf Access*
The main dike footprint extends approximately 8,500 feet running north-south, forming the east perimeter of the Eastward Expansion. New work dredging of the main dike footprint will remove 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 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.

The access channels consist of two channels to a depth of 50 feet, 300 feet wide, and approximately 1,200 feet long from the Norfolk Harbor Channel – Sewells Point to Lamberts Bend to the CIEE main dike.

The wharf access dredging will consists of new work dredging to a depth of 50 feet from the Norfolk Harbor Channel – Sewells Point to Lamberts Bend to the completed terminal to provide wharf access for deep-draft vessels to the terminal.

*Construction of Perimeter and Division Dikes*
The construction of the perimeter and division dikes for the new containment cell will consist of placement of suitable fill for the main dike footprint, south and north perimeter dikes, and the division dike. Main dike dimensions will consists of a dike approximately 8,500 linear feet in length, and 240 feet top width. 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 Disposal Areas
Any material that is not used for hurricane protection at Craney Island,Virginia Beach, Sandbridge Beach or Ft. Story will 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 9-square nautical miles. The average water depth in the placement site is 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. Placement activities at DNODS placement area are performed primarily by hopper dredge. The DNODS was designed to accommodate approximately 50 million cubic yards of dredge material. The DNODS is located approximately 4 nautical miles off the coast 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 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 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 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 NODS has unlimited capacity and was designated for use as a placement site for suitable materials from the Inner Harbor channels within the Port of Hampton Roads and other lower Chesapeake Bay dredged material. The only prior use of the NODS was by the U.S. Navy in August of 1993 for the placement of dredged material from the Naval Supply Center Cheatham Annex and the Yorktown Naval Weapons Station. Future placement at the NODS may include the Craney Island Eastern Expansion project, the Midtown Tunnel/Downtown Tunnel/MLK Expressway Project, and Baltimore Harbor Federal navigation project channels.  The NODS is located in the Atlantic Ocean approximately 17 miles east of Cape Henry and approximately 2 statute miles north/northwest of The Chesapeake Light Tower. The NODS is approximately 50 square nautical miles in size with a circular radius of 4 nautical miles and water depths ranging from 43 to 85 feet.   The center point coordinate of the site is north latitude 36° 59’ and west longitude 75° 39’.

*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 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.

## 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, USACE has indicated that a hydraulic cutterhead dredge is the preferred dredging method for Norfolk Harbor and CIEE project elements within economic pumping distances of CIDMMA. Additionally, hydraulic cutterhead dredge may beused at Sandbridge Shoal and/or at AOO. A mechanical dredge will be used for some of the dredging at CIEE and in some of the Norfolk Harbor channels.

### *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. 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 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

USACE has indicated that in certain circumstances, a dredge contractor may employ a bed-leveler device to smooth the channel bottom or to reduce the heights of disposal mounds created during hydraulic placement operations. The USACE has reported that they are not aware of any instances where bed-leveling has been utilized in the action area. However, 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 during this dredge cycle.

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 F of USACE’s BA (Appendix B of this Opinion).

### 3.10 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 not identified any interrelated or interdependent actions.

### 3.11 Summary of Proposed Action

The proposed activity has a 50-year life; therefore, this consultation considers effects of the actions described above from now through 2062. 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 table summarizes the anticipated dredging during this period:

**Table 2**. Anticipated dredging considered in this consultation

| **Channel** | **Type of Dredge** | **Typical Volume Removed** | **Frequency of Dredge Events** | **Number of events in 50 years** | **Volume Removed in 50 years** |
|---|---|---|---|---|---|
| **Baltimore Harbor Entrance Channels** | | | | | |
| *Cape Henry* | *H* | *1.1 mcy* | *1-2 years* | *25-50* | *Up to 50 mcy* |
| *York Spit Channel* | *H* | *0.5 mcy* | *2 years* | *25* | *12.5 mcy* |
| *Rappahannock Shoals Channel* | *H* | *no maintenance dredging to date* | *Every 20 years* | *2* | *Up to 2 mcy* |
| **Total: 64.5 MCY** | | | | | |
| **York River Entrance Channel** | **H** | **0.5 mcy** | **Every 3 years** | **13** | **6.5 mcy** |
| **Hampton Roads Approach Channels** | | | | | |
| *Thimble Shoals Channel-maintenance* | *H* | *0.75 mcy* | *Every 3 years* | *13* | *10 mcy* |
| *Thimble Shoals Channel – Willoughby Spit & Vicinity HPP Borrow* | *H* | *1.0 mcy* | *Every 5 years* | *10* | *5.0 mcy* |
| *Atlantic Ocean Channel-maintenance* | *H* | *0.33 mcy* | *Every 3 years* | *13* | *4.5 mcy* |
| *Atlantic Ocean Channel-VBHPP Borrow* | *H* | *0.5 mcy* | *Every 3years* | *16* | *8.1 mcy* |
| *Atlantic Ocean Channel – CIEE Borrow* | *H* | *Subject to Federal Funding* | *Subject to Federal Funding* | *Subject to Federal Funding* | *16.2 mcy* |
| *Atlantic Ocean Channel – JEB Fort Story Borrow* | *H* | *0.65 mcy* | *Every 10 years* | *5* | *6.5 mcy* |
| **Total: 14.5 mcy** | | | | | |
| **VA Beach Hurricane Protection** | **H** | **0.27 mcy** | **Every 3 years** | **16** | **4.4 mcy** |
| **Sandbridge** | **H or C** | **0.5 mcy** | **Every 2 years** | **25** | **12.5 mcy** |
| **Norfolk Harbor Channels** | | | | | |
| *Norfolk Harbor Channel – Sewells Point to Lamberts Bend* | *C or M* | *1 mcy* | *annually* | *50* | *50 mcy* |
| *Norfolk Harbor Channel – Lamberts Bend to Paradise Creek* | *C or M* | *0.4 mcy* | *3 years* | *16* | *6.4 mcy* |
| *Norfolk Harbor - Southern Branch* | *M* | *0.1 mcy* | *3 years* | *16* | *1.6 mcy* |

| | | | | | |
|---|---|---|---|---|---|
| *Channel* | | | | | |
| *Norfolk Harbor – Eastern Branch Channel* | *M* | *0.1 mcy* | *15 years* | *3* | *0.3 mcy* |
| *Norfolk Harbor – Western Branch Channel* | *M* | *0.1 mcy* | *15 years* | *3* | *0.3 mcy* |
| *Norfolk Harbor – Scotts Creek Channel* | *M* | *0.03 mcy* | *15 years* | *3* | *0.09 mcy* |
| *Channel To Newport News* | *C* | *0.75 mcy* | *5 years* | *10* | *7.5 mcy* |
| *Craney Island Rehandling Basin* | *C* | *1.5 mcy* | 1.5 years | *33* | *49.5 mcy* |
| Sewells Point and Fifty-foot Anchorages, Newport News Anchorages | *C* | *0.25 mcy each anchorage* | 10 years | *5* | *2.5 mcy* |
| **Total: 118.19 mcy** | | | | | |
| **Craney Island Eastward Expansion** | | | | | |
| CIEE – Main Dike dredging (8,500 linear feet) | *C or M* | *Subject to Federal Funding* | *Subject to Federal Funding* | *Subject to Federal Funding* | 22,400,000 |
| CIEE – Access Channel dredging | *C or M* | *Subject to Federal Funding* | *Subject to Federal Funding* | *Subject to Federal Funding* | 1,600,000 |
| CIEE – Wharf Access dredging | *C or M* | *Subject to Federal Funding* | *Subject to Federal Funding* | *Subject to Federal Funding* | 7,300,000 |
| **Total: 31.3 mcy (6.8 mcy cutterhead; 24.5 mcy mechanical)** | | | | | |

### 3.12 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 includes the area affected by dredging and disposal activities as well as the area transited by dredges and dredged material disposal vessels. The action area, therefore, includes 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.

## 4.0 Species that are not likely to be adversely affected by the proposed action

### 4.1 SHORTNOSE STURGEON

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. Shortnose sturgeon occur in 19 rivers along the U.S. Atlantic coast. Shortnose sturgeon historically occurred in the Chesapeake Bay, but prior to 1996, the best available information suggested that the species was either extirpated from the area or present in extremely low numbers. Before 1996, there were only 15 published historic records of shortnose sturgeon in the Chesapeake Bay, and most of these were based on personal observations from the upper Chesapeake Bay during the 1970s and 1980s (Dadswell et al. 1984). From February through November 1997, a Fish and Wildlife Service reward program was in effect for Atlantic sturgeon in Virginia's major tributaries (James, York, and Rappahannock Rivers). A sturgeon captured from the Rappahannock River in May 1997 was confirmed as a shortnose sturgeon (Spells 1998). This capture represents the only recent capture of a shortnose sturgeon in Virginia. On October 22, 2003, an endangered species observer initially reported the capture of one shortnose sturgeon in a sea turtle relocation trawling operation in Thimble Shoals Channel. Several Atlantic sturgeon were captured during the relocation trawl and due to the difficulty in distinguishing these species, the fish was initially reported as a shortnose sturgeon. The captured fish was reported as 123 cm fork length (FL), which is close to the maximum length of shortnose sturgeon in northern river systems reported in the literature (130 cm FL) and far greater than the maximum length of shortnose sturgeon in southern river systems (97 cm FL). Further analysis resulted in the observer correcting the report and stating that the fish was actually an Atlantic sturgeon.

Despite numerous studies that have occurred to document the presence of Atlantic sturgeon in Virginia waters, only one shortnose sturgeon has been captured. Because we anticipate that shortnose sturgeon would have been captured in sampling gear if present, and that these captures would be reported to NMFS, we believe this lack of captures is indicative of the rarity of shortnose sturgeon in Virginia waters of the Chesapeake Bay. We do not anticipate that shortnose sturgeon would be present in the action area and therefore, any effects to shortnose sturgeon are extremely unlikely to occur. The lack of any interactions with shortnose sturgeon during dredging or relocation trawling associated with any of the channels or borrow areas to date, supports this determination. Because any effects to shortnose sturgeon are extremely unlikely to occur, all effects to this species are discountable. As such, we have determined that the proposed action is not likely to adversely affect this species and it is not considered further in this Opinion.

## 4.2 HAWKSBILL SEA TURTLE

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 the Gulf States and along the east coast of the U.S. as far north as Massachusetts, but sightings north of Florida are rare. Many of these strandings in the North Atlantic were observed after hurricanes or offshore storms. Aside from Florida, Texas is the only other U.S. state where hawksbills are sighted with any regularity.

Only two hawksbill sea turtles have been documented in Virginia waters since 1979 (Mansfield 2006) and no hawksbill sea turtles have ever been documented in the Chesapeake Bay. The occurrence of Hawksbill sea turtles in the Chesapeake Bay would be an extremely rare occurrence. Because Hawksbill sea turtles are so unlikely to occur in the action area, impacts to this species are considered extremely unlikely. The lack of any interactions with hawksbills during dredging or relocation trawling associated with any of the channels or borrow areas to date, supports this determination. Because any effects to hawksbills are extremely unlikely to occur, all effects to hawksbill sea turtles are discountable. As such, we have determined that the proposed action is not likely to adversely affect this species and it is not considered further in this Opinion.

## 4.3 SPERM, BLUE, RIGHT, HUMPBACK AND FIN WHALES

Sperm whales and blue whales are listed as endangered. During surveys for the Cetacean and Turtle Assessment Program (CeTAP), sperm whales were observed along the shelf edge, centered around the 1,000 m depth contour but extending seaward out to the 2,000 m depth contour (CeTAP 1982). Although blue whales are occasionally seen in U.S. waters, they are more commonly found in Canadian waters and are rare in continental shelf waters of the eastern U.S. (Waring *et al.* 2000). Given the predominantly offshore distribution of these two cetacean species, both are highly unlikely to occur in the action area or to be affected by the actions considered in this Opinion.

The Chesapeake Bay is not a high use area for whales. Transient individual right, humpback and fin whales may occasionally be present in the lower Bay 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 in the lower Bay. Because any effects to whales are extremely unlikely to occur, all effects to whales are discountable. As such, we have determined that the proposed action is not likely to adversely affect right, humpback or fin whales. These species will not be considered further in this Opinion.

# 5.0 STATUS OF LISTED SPECIES IN THE ACTION AREA THAT MAY BE AFFECTED BY THE PROPOSED ACTIONS

Several species listed under NMFS' jurisdiction occur in the action area for this consultation. NMFS has determined that the action being considered in this biological opinion may affect the following endangered or threatened species under NMFS' jurisdiction:

***Sea Turtles***
Northwest Atlantic DPS of Loggerhead sea turtle (*Caretta caretta*) Threatened
Leatherback sea turtle (*Dermochelys coriacea*) Endangered
Kemp's ridley sea turtle (*Lepidochelys kempi*) Endangered
Green sea turtle (*Chelonia mydas*)
Endangered/Threatened[1]

***Fish***
Gulf of Maine DPS of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) Threatened
New York Bight DPS of Atlantic sturgeon Endangered
Chesapeake Bay DPS of Atlantic sturgeon Endangered
South Atlantic DPS of Atlantic sturgeon Endangered
Carolina DPS of Atlantic sturgeon Endangered

This section will focus on the status of the various species within the action area, summarizing information necessary to establish the environmental baseline and to assess the effects of the proposed action.

## 5.1 OVERVIEW OF STATUS OF SEA TURTLES

With the exception of loggerheads, sea turtles are listed under the ESA at the species level rather than as subspecies or distinct population segments (DPS). Therefore, information on the range-wide status of leatherback, Kemp's ridley and green sea turtles is included to provide the status of each species overall. Information on the status of loggerheads 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; Hirth 1997; Marine Turtle Expert Working Group [TEWG] 1998, 2000, 2007, 2009; NMFS and USFWS 2007a, 2007b, 2007c, 2007d; Conant *et al.* 2009), and recovery plans for the loggerhead sea turtle (NMFS and USFWS 2008), Kemp's ridley sea turtle (NMFS *et al.* 2011), leatherback sea turtle (NMFS and USFWS 1992, 1998a), Kemp's ridley sea turtle (NMFS *et al.* 2011)and green sea turtle (NMFS and USFWS 1991, 1998b).

*2010 BP Deepwater Horizon Oil Spill*

The April 20, 2010, explosion of the Deepwater Horizon oil rig affected sea turtles in the Gulf of Mexico. There is an on-going assessment of the long-term effects of the spill on Gulf of Mexico marine life, including sea turtle populations. Following the spill, juvenile Kemp's ridley, green, and loggerhead sea turtles were found in *Sargassum* algae mats in the convergence zones, where currents meet and oil collected. Sea turtles found in these areas were often coated in oil and/or had ingested oil. Approximately 536 live adult and juvenile sea turtles were recovered from the Gulf and brought into rehabilitation centers; of these, 456 were visibly oiled (these and the following numbers were obtained from http://www.nmfs.noaa.gov/pr/health/oilspill/). To date, 469 of the live recovered sea turtles have been successfully returned to the wild, 25 died during

1 Pursuant to NMFS regulations at 50 CFR § 223.205, the prohibitions of Section 9 of the Endangered Species Act apply to all green turtles, whether endangered or threatened.

rehabilitation, and 42 are still in care but are expected to be returned to the wild eventually. During the clean-up period, 613 dead sea turtles were recovered in coastal waters or on beaches in Mississippi, Alabama, Louisiana, and the Florida Panhandle. As of February 2011, 478 of these dead turtles had been examined. Many of the examined sea turtles showed indications that they had died as a result of interactions with trawl gear, most likely used in the shrimp fishery, and not as a result of exposure to or ingestion of oil.

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

A thorough assessment of the long-term effects of the spill on sea turtles has not yet been completed. The spill resulted in the direct mortality of many sea turtles and may have had sublethal effects or caused environmental damage that will impact other sea turtles into the future. The population level effects of the spill and associated response activity are likely to remain unknown for some period into the future.

## 5.2 Northwest Atlantic DPS of loggerhead sea turtle

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 5-year status review of the species, which discussed a variety of threats to loggerheads including climate change, NMFS and FWS determined that loggerhead sea turtles should not be delisted or reclassified as endangered. However, we 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 FWS 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 the 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 will 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) will 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. Currently, no critical habitat is designated for any DPS of loggerhead sea turtles, and therefore, no critical habitat for any DPS occurs in the action area.

*Presence of Loggerhead Sea Turtles in the Action Area*
The effects of this proposed action are only experienced within the Atlantic Ocean. NMFS has considered the available information on the distribution of the 9 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 reflect a shared common haplotype and lack of representative sampling at Eastern Atlantic rookeries rather than an actual presence of Mediterranean DPS turtles in US 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 Northeast Atlantic loggerhead DPS or the Mediterranean loggerhead DPS (Peter Dutton, NMFS, Marine Turtle Genetics Program, Program Leader, personal communication, September 10, 2011). Given that the action area is a subset of the area fished by US fleets, it is reasonable to assume that based on this new analysis, no individuals from the Mediterranean DPS or Northeast Atlantic 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 only 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 5-year status review for loggerheads (NMFS and USFWS 2007a), the TEWG report (2009), 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 41° N to 42° N latitude are used for foraging by juveniles, as well as adults (Shoop 1987; Shoop and Kenney 1992; Ehrhart *et al.* 2003; Mitchell *et al.* 2003). 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; Braun-McNeill *et al.* 2008; Mitchell *et al.* 2003). Loggerheads have been observed in waters with surface temperatures of 7°C to 30°C, but water temperatures ≥11°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 m to 49 m 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 United States (*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 United States.

**Table 3.** Typical values of life history parameters for loggerheads nesting in the U.S.

| Life History Parameter | Data |
|---|---|
| Clutch size | 100-126 eggs[1] |
| Egg incubation duration (varies depending on time of year and latitude) | 42-75 days[2,3] |
| Pivotal temperature (incubation temperature that produces an equal number of males and females) | 29.0°C[5] |
| Nest productivity (emerged hatchlings/total eggs) x 100 (varies depending on site specific factors) | 45-70%[2,6] |
| Clutch frequency (number of nests/female/season) | 3-5.5 nests[7] |
| Internesting interval (number of days between successive nests within a season) | 12-15 days[8] |
| Juvenile (<87 cm CCL) sex ratio | 65-70% female[4] |
| Remigration interval (number of years between successive nesting migrations) | 2.5-3.7 years[9] |
| Nesting season | late April-early September |
| Hatching season | late June-early November |
| Age at sexual maturity | 32-35 years[10] |
| Life span | >57 years[11] |

1 Dodd 1988.
2 Dodd and Mackinnon (1999, 2000, 2001, 2002, 2003, 2004).
3 Blair Witherington, FFWCC, personal communication, 2006 (information based on nests monitored throughout Florida beaches in 2005, n=865).
4 National Marine Fisheries Service (2001); Allen Foley, FFWCC, personal communication, 2005.
5 Mrosovsky (1988).
6 Blair Witherington, FFWCC, personal communication, 2006 (information based on nests monitored throughout Florida beaches in 2005, n=1,680).
7 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.
8 Caldwell (1962), Dodd (1988).
9 Richardson *et al*. (1978); Bjorndal *et al*. (1983); Ehrhart, unpublished data.
10 Melissa Snover, NMFS, personal communication, 2005; see Table A1-6.
11 Dahlen *et al*. (2000).

*Population Dynamics and Status*

By far, the majority of Atlantic nesting occurs on beaches of the southeastern United States (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 United States. The fifth recovery unit is composed of all other nesting assemblages of loggerheads within the Greater Caribbean, outside the United States, 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).

The 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.

Note that 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 2008-2010, the trend line changes showing a very slight negative trend, but the rate of decline is not statistically different from zero (76 FR 58868, September 22, 2011). The nesting data presented in the Recovery Plan (through 2008) is described below, with updated trend information through 2010 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). The NRU, the second largest nesting assemblage of loggerheads in the United States, 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). Through 2008, there was strong statistical data to suggest the NRU has experienced a long-term decline, but with the inclusion of nesting data through 2010, nesting for the NRU is showing possible signs of stabilizing (76 FR 58868, September 22, 2011). 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). 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). They are: (1) for the NRU, a mean of 5,215 loggerhead nests per year (from 1989-2008) with approximately 1,272 females nesting per year; (2) for the PFRU, a mean of 64,513 nests per year (from 1989-2007) with approximately 15,735 females nesting per year; (3) for the DTRU, a mean of 246 nests per year (from 1995-2004, excluding 2002) with approximately 60 females nesting per year; and (4) for the NGMRU, a mean of 906 nests per year (from 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 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. Note that 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 East Coast U.S. 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 turtle nesting assemblages documented in different east coast foraging habitats to a complex interplay of currents and the relative size and proximity of nesting beaches.

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 United States, one site showed no discernible trend, and the two sites located in the northeast United States 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 United States (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 4 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).

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 (NMFS 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 in the summer of 2010. AMAPPS is a multi-agency initiative to assess marine mammal, sea turtle, and seabird abundance and distribution in the Atlantic. Aerial surveys were conducted from Cape Canaveral, Florida to the Gulf of St. Lawrence, Canada. Satellite tags on juvenile loggerheads were deployed in two locations – off the coasts of northern Florida to South Carolina (n=30) and off the New Jersey and Delaware coasts (n=14). As presented in NMFS NEFSC (2011), 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 2011). 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, North Carolina, 30% in the southern Mid-Atlantic Bight, and 6% in the northern Mid-Atlantic Bight. Although they have been seen farther north in previous studies (*e.g.*, Shoop and Kenney 1992), no loggerheads were observed during the aerial surveys conducted in the summer of 2010 in the more northern zone encompassing Georges Bank, Cape Cod Bay, and the Gulf of Maine. 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 surveys and research to improve the abundance estimates are anticipated in 2011-2014, depending on available funds.

*Threats*

The diversity of a 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 5-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; underwater explosions; hopper dredging; offshore artificial lighting; power plant entrainment and/or impingement; entanglement in debris; ingestion of marine debris; marina and dock construction and operation; boat collisions; poaching; and fishery interactions.

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., Biological 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 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 2002a; Lewison *et al.* 2003). The current section 7 consultation on the U.S. South Atlantic and Gulf of Mexico shrimp fisheries was completed in 2002 and estimated the total annual level of take for loggerhead sea turtles to be 163,160 interactions (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 takes being lethal (NMFS 2002a).

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 are 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 projected in the 2002 Opinion. In 2008, the estimated annual number of interactions between loggerheads and shrimp trawls in the Gulf of Mexico shrimp fishery is 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). A new Biological Opinion on the Shrimp FMP was completed in May 2012; this Opinion does not contain a quantitative estimate of the number of interactions between loggerheads and the shrimp fishery.

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 5-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. While loggerhead bycatch in U.S. Mid-Atlantic bottom otter trawl gear was previously estimated for the period 1996-2004 (Murray 2006, 2008), a recent bycatch analysis estimated the number of loggerhead sea turtle interactions with U.S. Mid-Atlantic bottom trawl gear from 2005-2008 (Warden 2011a). Northeast Fisheries Observer Program data from 1994-2008 were used to develop a model of interaction rates and those predicted rates were applied to 2005-2008 commercial fishing data to estimate the number of interactions for the trawl fleet. The number of predicted average annual loggerhead interactions for 2005-2008 was 292 (CV=0.13, 95% CI=221-369), with an additional 61 loggerheads (CV=0.17, 95% CI=41-83) interacting with trawls but being released through a TED. Of the 292 average annual observable loggerhead interactions, approximately 44 of those were adult equivalents. Warden (2011b) found that latitude, depth and SST were associated with the interaction rate, with the rates being highest south of 37°N latitude in waters < 50 m deep and SST > 15°C. This estimate is a decrease from the average annual loggerhead bycatch in bottom otter trawls during 1996-2004, estimated to be 616 sea turtles (CV=0.23, 95% CI over the 9-year period: 367-890) (Murray 2006, 2008).

There have been several published estimates of the number of loggerheads taken annually as a result of 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) recently 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 (CV = 0.14, 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 (CV = 0.48, 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 (CV = 0.15, 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 sea surface temperature, depth, and use of a chain mat. Results from this recent analysis suggest that chain mats and fishing effort reductions have contributed to the decline in estimated loggerhead sea turtle interactions with scallop dredge gear after 2006 (Murray 2011).

An estimate of the number of loggerheads taken annually in U.S. Mid-Atlantic gillnet fisheries has also recently been published (Murray 2009a, b). From 1995-2006, the annual bycatch of loggerheads in U.S. Mid-Atlantic gillnet gear was estimated to average 350 turtles (CV=0.20, 95% CI over the 12-year period: 234 to 504). Bycatch rates were correlated with latitude, sea surface temperature, and mesh size. The highest predicted bycatch rates occurred in warm waters of the southern Mid-Atlantic in large-mesh gillnets (Murray 2009a).

The U.S. tuna and swordfish longline fisheries that are managed under the Highly Migratory Species (HMS) FMP are estimated to capture 1,905 loggerheads (no more than 339 mortalities) for each 3-year period starting in 2007 (NMFS 2004a). 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 2010). In 2010, there were 40 observed interactions between loggerhead sea turtles and longline gear used in the HMS fishery (Garrison and Stokes 2011a, 2011b). All of the loggerheads were released alive, with the vast majority released with all gear removed. While 2010 total estimates are not yet available, in 2009, 242.9 (95% CI: 167.9-351.2) loggerhead sea turtles are estimated to have been taken in the longline fisheries managed under the HMS FMP based on the observed takes (Garrison and Stokes 2010). The 2009 estimate is considerably lower than those in 2006 and 2007 and is consistent with historical averages since 2001 (Garrison and Stokes 2010). 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 takes also occur in other fishery gear types and by non-fishery mortality sources (*e.g.*, hopper dredges, power plants, vessel collisions), but quantitative estimates are unavailable. Past and future impacts of global climate change are considered in Section 6.0 below.

*Summary of Status for Loggerhead Sea Turtles*

Loggerheads are a long-lived species and reach sexual maturity relatively late at around 32-35 years in the Northwest Atlantic (NMFS and USFWS 2008). The species continues 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 recently published by NMFS and FWS 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 subpopulations 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.

## 5.3 Status of Kemp's Ridley Sea Turtles

*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, leatherback, and green 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).

Kemp's ridleys mature at 10-17 years (Caillouet *et al.* 1995; Schmid and Witzell 1997; Snover *et al.* 2007; NMFS and USFWS 2007c). 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 2 years (Marquez *et al.* 1982; TEWG 1998, 2000).

Once they leave the nesting beach, hatchlings presumably enter the Gulf of Mexico where they feed on available S*argassum* 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 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 m (NMFS and USFWS 2007c). 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 2007c).

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 autumn, juvenile Kemp's ridleys migrate down the coast, passing Cape Hatteras in December and January (Musick and Limpus 1997). These larger juveniles are joined by juveniles of the same size from North Carolina sounds and smaller juveniles from New York and New England to form one of the densest concentrations of Kemp's ridleys outside of the Gulf of Mexico (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 United States, but are typically rare in the northeastern U.S. waters of the Atlantic (TEWG

2000). Adults are primarily found in nearshore waters of 37 m or less that are rich in crabs and have a sandy or muddy bottom (NMFS and USFWS 2007c).

*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 and USFWS 2007c; NMFS *et al.* 2011). There is a limited amount of scattered nesting to the north and south of the primary nesting beach (NMFS and USFWS 2007c). Nesting often occurs in synchronized emergences termed *arribadas*. The number of recorded nests reached an estimated low of 702 nests in 1985, corresponding to fewer than 300 adult females nesting in that season (TEWG 2000; NMFS and USFWS 2007c; NMFS *et al.* 2011). 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). Since the mid-1980s, the number of nests observed at Rancho Nuevo and nearby beaches has increased 14-16% per year (Heppell *et al.* 2005), allowing cautious optimism that the population is on its way to recovery. An estimated 5,500 females nested in the State of Tamaulipas over a 3-day period in May 2007 and over 4,000 of those nested at Rancho Nuevo (NMFS and USFWS 2007c). In 2008, 17,882 nests were documented on Mexican nesting beaches (NMFS 2011). There is limited nesting in the United States, most of which is located in South Texas. While six nests were documented in 1996, a record 195 nests were found in 2008 (NMFS 2011).

*Threats*

Kemp's ridleys 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 sea turtles that utilize the more northern habitats of Cape Cod Bay and Long Island Sound. In the last five years (2006-2010), the number of cold-stunned turtles on Cape Cod beaches averaged 115 Kemp's ridleys, 7 loggerheads, and 7 greens (NMFS unpublished data). The numbers ranged from a low in 2007 of 27 Kemp's ridleys, 5 loggerheads, and 5 greens to a high in 2010 of 213 Kemp's ridleys, 4 loggerheads, and 14 greens. Annual cold stun events vary in magnitude; the extent of episodic major cold stun events may be associated with numbers of 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 ridleys.

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 taken in these shrimp trawls (USFWS and NMFS 1992). Subsequently, NMFS has worked with the industry to reduce sea turtle takes in shrimp trawls and other trawl fisheries, including the development and use of turtle excluder devices (TEDs). As described above, there is lengthy regulatory history with regard to the use of TEDs in the U.S. South Atlantic and Gulf of Mexico shrimp fisheries (NMFS 2002a; Epperly 2003; Lewison *et al.* 2003). The 2002 Biological Opinion on shrimp trawling in the southeastern United States concluded that 155,503 Kemp's ridley sea turtles would be taken annually in the fishery with 4,208 of the takes resulting in mortality (NMFS 2002a).

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., Biological 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.

This species is also affected by other sources of anthropogenic impact (fishery and non-fishery related), similar to those discussed above. Three Kemp's ridley captures in Mid-Atlantic trawl fisheries were documented by NMFS observers between 1994 and 2008 (Warden and Bisack 2010), and eight Kemp's ridleys were documented by NMFS observers in mid-Atlantic sink gillnet fisheries between 1995 and 2006 (Murray 2009a). Additionally, in the spring of 2000, a total of 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 NMFS Northeast Fisheries Science Center 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 27 Kemp's ridleys (15 of which were found alive) impinged or captured on their intake screens from 1992-2006 (NMFS 2006).

*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 and USFWS 2007c; NMFS *et al.* 2011). 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 (NMFS and USFWS 2007c). Based on the number of nests laid in 2006 and the remigration interval for Kemp's ridley sea turtles (1.8-2 years), there were an estimated 7,000-8,000 adult female Kemp's ridley sea turtles in 2006 (NMFS and USFWS 2007c). 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 2007c). While there is cautious optimism for recovery, events such as the Deepwater Horizon oil release, and stranding events associated increased skimmer trawl use and poor TED compliance in the northern Gulf of Mexico may dampen 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 account for an unknown level of other mortality. Based on their 5-year status review of the species, NMFS and USFWS (2007c) determined that Kemp's ridley sea turtles should not be reclassified as threatened under the ESA. A revised bi-national recovery plan was published for public comment in 2010, and in September 2011, NMFS, USFWS, and the Services and the Secretary of Environment and Natural Resources, Mexico (SEMARNAT) released the second revision to the Kemp's ridley recovery plan.

## 5.4 Status of Green Sea Turtles

Green sea turtles are distributed circumglobally, and can be found in the Pacific, Indian, and Atlantic Oceans as well as the Mediterranean Sea (NMFS and USFWS 1991, 2007d; Seminoff 2004). In 1978, the Atlantic population of the green sea turtle was listed as threatened under the ESA, except for the breeding populations in Florida and on the Pacific coast of Mexico, which were listed as endangered. As it is difficult to differentiate between breeding populations away from the nesting beaches, all green sea turtles in the water are considered endangered.

*Pacific Ocean*

Green sea turtles occur in the western, central, and eastern Pacific. Foraging areas are also found throughout the Pacific and along the southwestern U.S. coast (NMFS and USFWS 1998b). In the western Pacific, major nesting rookeries at four sites including Heron Island (Australia), Raine Island (Australia), Guam, and Japan were evaluated and determined to be increasing in abundance, with the exception of Guam which appears stable (NMFS and USFWS 2007d). In the central Pacific, nesting occurs on French Frigate Shoals, Hawaii, which has also been reported as increasing with a mean of 400 nesting females annually from 2002-2006 (NMFS and USFWS 2007d). The main nesting sites for the green sea turtle in the eastern Pacific are located in Michoacan, Mexico and in the Galapagos Islands, Ecuador (NMFS and USFWS 2007d). The number of nesting females per year exceeds 1,000 females at each site (NMFS and USFWS 2007d). However, historically, greater than 20,000 females per year are believed to have nested in Michoacan alone (Cliffton *et al.* 1982; NMFS and USFWS 2007d). The Pacific Mexico green turtle nesting population (also called the black turtle) is considered endangered.

Historically, green sea turtles were used in many areas of the Pacific for food. They were also commercially exploited, which, coupled with habitat degradation, led to their decline in the

Pacific (NMFS and USFWS 1998b). Green sea turtles in the Pacific continue to be affected by poaching, habitat loss or degradation, fishing gear interactions, and fibropapillomatosis, which is a viral disease that causes tumors in affected turtles (NMFS and USFWS 1998b; NMFS 2004b).

*Indian Ocean*

There are numerous nesting sites for green sea turtles in the Indian Ocean. One of the largest nesting sites for green sea turtles worldwide occurs on the beaches of Oman where an estimated 20,000 green sea turtles nest annually (Hirth 1997; Ferreira *et al.* 2003). Based on a review of the 32 Index Sites used to monitor green sea turtle nesting worldwide, Seminoff (2004) concluded that declines in green sea turtle nesting were evident for many of the Indian Ocean Index Sites. While several of these had not demonstrated further declines in the more recent past, only the Comoros Island Index Site in the western Indian Ocean showed evidence of increased nesting (Seminoff 2004).

*Mediterranean Sea*

There are four nesting concentrations of green sea turtles in the Mediterranean from which data are available – Turkey, Cyprus, Israel, and Syria. Currently, approximately 300-400 females nest each year, about two-thirds of which nest in Turkey and one-third in Cyprus. Although green sea turtles are depleted from historic levels in the Mediterranean Sea (Kasparek *et al.* 2001), nesting data gathered since the early 1990s in Turkey, Cyprus, and Israel show no apparent trend in any direction. However, a declining trend is apparent along the coast of Palestine/Israel, where 300-350 nests were deposited each year in the 1950s (Sella 1982) compared to a mean of 6 nests per year from 1993-2004 (Kuller 1999; Y. Levy, Israeli Sea Turtle Rescue Center, unpublished data). A recent discovery of green sea turtle nesting in Syria adds roughly 100 nests per year to green sea turtle nesting activity in the Mediterranean (Rees *et al.* 2005). That such a major nesting concentration could have gone unnoticed until recently (the Syria coast was surveyed in 1991, but nesting activity was attributed to loggerheads) bodes well for the ongoing speculation that the unsurveyed coast of Libya may also host substantial nesting.

*Atlantic Ocean*

*Distribution and Life History*

As has occurred in other oceans of its range, green sea turtles were once the target of directed fisheries in the United States and throughout the Caribbean. In 1890, over one million pounds of green sea turtles were taken 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 western Atlantic, large juvenile and adult green sea turtles are largely herbivorous, occurring in habitats containing benthic algae and seagrasses from Massachusetts to Argentina, including the Gulf of Mexico and Caribbean (Wynne and Schwartz 1999). Green sea turtles occur seasonally in 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 western 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 Ft. 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, the Caribbean coast of Panama, and scattered areas along Colombia and Brazil (Hirth 1971). The waters surrounding the island of Culebra, Puerto Rico, and its outlying keys are designated critical habitat for the green sea turtle.

Age at maturity for green sea turtles is estimated to be 20-50 years (Balazs 1982; Frazer and Ehrhart 1985; Seminoff 2004). As is the case with the other sea turtle species described above, adult females may nest multiple times in a season (average 3 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*

Like other sea turtle species, 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 5-year status review for the species identified eight geographic areas considered to be primary sites for threatened green sea turtle nesting in the Atlantic/Caribbean, and reviewed the trend in nest count data for each (NMFS and USFWS 2007d). These include: (1) Yucatán Peninsula, Mexico, (2) Tortuguero, Costa Rica, (3) Aves Island, Venezuela, (4) Galibi Reserve, Suriname, (5) Isla Trindade, Brazil, (6) Ascension Island, United Kingdom, (7) Bioko Island, Equatorial Guinea, and (8) Bijagos Achipelago, Guinea-Bissau (NMFS and USFWS 2007d). Nesting at all of these sites is considered to be stable or increasing with the exception of Bioko Island, which may be declining. However, the lack of sufficient data precludes a meaningful trend assessment for this site (NMFS and USFWS 2007d).

Seminoff (2004) reviewed green sea turtle nesting data for eight sites in the western, eastern, and central Atlantic, including all of the above threatened nesting sites with the exception that nesting in Florida was reviewed in place of Isla Trindade, Brazil. He concluded that all sites in the central and western Atlantic showed increased nesting with the exception of nesting at Aves Island, Venezuela, while both sites in the eastern Atlantic demonstrated decreased nesting. These sites are not inclusive of all green sea turtle nesting in the Atlantic Ocean. However, other sites are not believed to support nesting levels high enough that would change the overall status of the species in the Atlantic (NMFS and USFWS 2007d).

By far, the most important nesting concentration for green sea turtles in the western Atlantic is in Tortuguero, Costa Rica (NMFS and USFWS 2007d). Nesting in the area has increased considerably since the 1970s and nest count data from 1999-2003 suggest nesting by 17,402-37,290 females per year (NMFS and USFWS 2007d). The number of females nesting per year on beaches in the Yucatán, at Aves Island, Galibi Reserve, and Isla Trindade number in the hundreds to low thousands, depending on the site (NMFS and USFWS 2007d).

The status of the endangered Florida breeding population was also evaluated in the 5-year review (NMFS and USFWS 2007d). 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 United States (NMFS and USFWS 2007d).

The statewide Florida surveys (2000-2006) have shown that a mean of approximately 5,600 nests are laid annually in Florida, with a low of 581 in 2001 to a high of 9,644 in 2005 (NMFS and USFWS 2007d). 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.

*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 be most affected in that they 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).

As with the other sea turtle species, incidental fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches. Witherington *et al.* (2009) observes 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 take levels, green sea turtles have been observed captured in the pelagic driftnet, pelagic longline, southeast shrimp trawl, and mid-Atlantic trawl and gillnet fisheries. Murray (2009a) also lists five observed captures of green turtle in Mid-Atlantic sink gillnet gear between 1995 and 2006.

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., Biological 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.

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).

*Summary of Status of Green Sea Turtles*

A review of 32 Index Sites[2] distributed globally revealed a 48-67% decline in the number of mature females nesting annually over the last three generations[3] (Seminoff 2004). An evaluation of green sea turtle nesting sites was also conducted as part of the 5-year status review of the species (NMFS and USFWS 2007d). Of the 23 threatened nesting groups assessed in that report for which nesting abundance trends could be determined, ten were considered to be increasing, nine were considered stable, and four were considered to be decreasing (NMFS and USFWS 2007d). Nesting groups were considered to be doing relatively well (the number of sites with increasing nesting were greater than the number of sites with decreasing nesting) in the Pacific, western Atlantic, and central Atlantic (NMFS and USFWS 2007d). However, nesting populations were determined to be doing relatively poorly in Southeast Asia, eastern Indian Ocean, and perhaps the Mediterranean. Overall, based on mean annual reproductive effort, the report estimated that 108,761 to 150,521 females nest each year among the 46 threatened and endangered nesting sites included in the evaluation (NMFS and USFWS 2007d). However, given the late age to maturity for green sea turtles, caution is urged regarding the status for any of the nesting groups since no area has a dataset spanning a full green sea turtle generation (NMFS and USFWS 2007d).

Seminoff (2004) and NMFS and USFWS (2007d) made comparable conclusions with regard to nesting for four nesting sites in the western Atlantic that indicate sea turtle abundance is increasing in the Atlantic Ocean. Each also concluded that nesting at Tortuguero, Costa Rica represented the most important nesting area for green sea turtles in the western Atlantic and that nesting had increased markedly since the 1970s (Seminoff 2004; NMFS and USFWS 2007d).

However, the 5-year review also noted that the Tortuguero nesting stock continued to be affected by ongoing directed take at their primary foraging area in Nicaragua (NMFS and USFWS 2007d). The endangered breeding population in Florida appears to be increasing based upon index nesting data from 1989-2010 (NMFS 2011).

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 account for an unknown level of other mortality. Based on its 5-year status review of the species, NMFS and USFWS (2007d) determined that the listing classification for green sea turtles should not be changed. 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 (NMFS and USFWS 2007d).

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2 The 32 Index Sites include all of the major known nesting areas as well as many of the lesser nesting areas for which quantitative data are available.

3 Generation times ranged from 35.5 years to 49.5 years for the assessment depending on the Index Beach site

## 5.5 Status of Leatherback Sea Turtles

Leatherback sea turtles are widely distributed throughout the oceans of the world, including the Atlantic, Pacific, and Indian Oceans, and the Mediterranean Sea (Ernst and Barbour 1972). Leatherbacks are the largest living turtles and range farther than any other sea turtle species. Their large size and tolerance of relatively low water temperatures allows them to occur in boreal waters such as those off Labrador and in the Barents Sea (NMFS and USFWS 1995).

In 1980, the leatherback population was estimated at approximately 115,000 adult females globally (Pritchard 1982). By 1995, this global population of adult females was estimated to have declined to 34,500 (Spotila *et al.* 1996). The most recent population size estimate for the North Atlantic alone is a range of 34,000-94,000 adult leatherbacks (TEWG 2007). Thus, there is substantial uncertainty with respect to global population estimates of leatherback sea turtles.

*Pacific Ocean*

Leatherback nesting has been declining at all major Pacific basin nesting beaches for the last two decades (Spotila *et al.* 1996, 2000; NMFS and USFWS 1998a, 2007b; Sarti *et al.* 2000). In the western Pacific, major nesting beaches occur in Papua New Guinea, Indonesia, Solomon Islands, and Vanuatu, with an approximate 2,700-4,500 total breeding females, estimated from nest counts (Dutton *et al.* 2007). While there appears to be overall long term population decline, the Indonesian nesting aggregation at Jamursba-Medi is currently stable (since 1999), although there is evidence to suggest a significant and continued decline in leatherback nesting in Papua New Guinea and Solomon Islands over the past 30 years (NMFS 2011). Leatherback sea turtles disappeared from India before 1930, have been virtually extinct in Sri Lanka since 1994, and appear to be approaching extinction in Malaysia (Spotila *et al.* 2000). In Fiji, Thailand, and Australia, leatherback sea turtles have only been known to nest in low densities and scattered sites.

The largest, extant leatherback nesting group in the Indo-Pacific lies on the North Vogelkop coast of West Papua, Indonesia, with 3,000-5,000 nests reported annually in the 1990s (Suárez *et al.* 2000). However, in 1999, local villagers started reporting dramatic declines in sea turtles near their villages (Suárez 1999). Declines in nesting groups have been reported throughout the western Pacific region where observers report that nesting groups are well below abundance levels that were observed several decades ago (*e.g.*, Suárez 1999).

Leatherback sea turtles in the western Pacific are threatened by poaching of eggs, killing of nesting females, human encroachment on nesting beaches, incidental capture in fishing gear, beach erosion, and egg predation by animals.

In the eastern Pacific Ocean, major leatherback nesting beaches are located in Mexico and Costa Rica, where nest numbers have been declining. According to reports from the late 1970s and early 1980s, beaches located on the Mexican Pacific coasts of Michoacán, Guerrero, and Oaxaca sustained a large portion, perhaps 50%, of all global nesting by leatherbacks (Sarti *et al.* 1996). A dramatic decline has been seen on nesting beaches in Pacific Mexico, where aerial survey data was used to estimate that tens of thousands of leatherback nests were laid on the beaches in the 1980s (Pritchard 1982), but a total of only 120 nests on the four primary index beaches (combined) were counted in the 2003-2004 season (Sarti Martinez *et al.* 2007). Since the early 1980s, the Mexican Pacific population of adult female leatherback turtles has declined to slightly more than 200 during 1998-1999 and 1999-2000 (Sarti *et al.* 2000). Spotila *et al.* (2000) reported the decline of the leatherback nesting at Playa Grande, Costa Rica, which had been the fourth largest nesting group in the world and the most important nesting beach in the Pacific. Between 1988 and 1999, the nesting group declined from 1,367 to 117 female leatherback sea turtles. Based on their models, Spotila *et al.* (2000) estimated that the group could fall to less than 50 females by 2003-2004. Another, more recent, analysis of the Costa Rican nesting beaches indicates a decline in nesting during 15 years of monitoring (1989-2004) with approximately 1,504 females nesting in 1988-1989 to an average of 188 females nesting in 2000-2001 and 2003-2004 (NMFS and USFWS 2007b), indicating that the reductions in nesting females were not as extreme as the reductions predicted by Spotila *et al.* (2000).

On September 26, 2007, NMFS received a petition to revise the critical habitat designation for leatherback sea turtles to include waters along the U.S. West Coast. On December 28, 2007, NMFS published a positive 90-day finding on the petition and convened a critical habitat review team. On January 26, 2012, NMFS published a final rule to revise the critical habitat designation to include three particular areas of marine habitat. The designation includes approximately 16,910 square miles along the California coast from Point Arena to Point Arguello east of the 3,000 meter depth contour, and 25,004 square miles from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 meter depth contour. The areas comprise approximately 41,914 square miles of marine habitat and include waters from the ocean surface down to a maximum depth of 262 feet. The designated critical habitat areas contain the physical or biological feature essential to the conservation of the species that may require special management conservation or protection. In particular, the team identified one Primary Constituent Element: the occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae, of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks.

Leatherbacks in the eastern Pacific face a number of threats to their survival. For example, commercial and artisanal swordfish fisheries off Chile, Columbia, Ecuador, and Peru; purse seine fisheries for tuna in the eastern tropical Pacific Ocean; and California/Oregon drift gillnet fisheries are known to capture, injure, or kill leatherbacks in the eastern Pacific Ocean. Given the declines in leatherback nesting in the Pacific, some researchers have concluded that the leatherback is on the verge of extinction in the Pacific Ocean (*e.g.,* Spotila *et al.* 1996, 2000).

*Indian Ocean*

Leatherbacks nest in several areas around the Indian Ocean. These sites include Tongaland, South Africa (Pritchard 2002) and the Andaman and Nicobar Islands (Andrews *et al.* 2002). Intensive survey and tagging work in 2001 provided new information on the level of nesting in the Andaman and Nicobar Islands (Andrews *et al.* 2002). Based on the survey and tagging work, it was estimated that 400-500 female leatherbacks nest annually on Great Nicobar Island (Andrews *et al.* 2002). The number of nesting females using the Andaman and Nicobar Islands combined was estimated around 1,000 (Andrews and Shanker 2002). Some nesting also occurs along the coast of Sri Lanka, although in much smaller numbers than in the past (Pritchard 2002).

*Mediterranean Sea*
Casale *et al.* (2003) reviewed the distribution of leatherback sea turtles in the Mediterranean. Among the 411 individual records of leatherback sightings in the Mediterranean, there were no nesting records. Nesting in the Mediterranean is believed to be extremely rare if it occurs at all. Leatherbacks found in Mediterranean waters originate from the Atlantic Ocean (P. Dutton, NMFS, unpublished data).

*Atlantic Ocean*
*Distribution and Life History*
Evidence from tag returns and strandings in the western Atlantic suggests that 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, Chryaora,* 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), as well as the European continental shelf on a seasonal basis (Witt *et al.* 2007).

Tagging and satellite telemetry data indicate that leatherbacks from the western North Atlantic nesting beaches use the entire North Atlantic Ocean (TEWG 2007). For example, leatherbacks tagged at nesting beaches in Costa Rica have been found in Texas, Florida, South Carolina, Delaware, and New York (STSSN database). Leatherback sea turtles tagged in Puerto Rico, Trinidad, and the Virgin Islands have also been subsequently found on U.S. beaches of southern, Mid-Atlantic, and northern states (STSSN database). Leatherbacks from the South Atlantic nesting assemblages (West Africa, South Africa, and Brazil) have not been re-sighted in the western North Atlantic (TEWG 2007).

The CETAP aerial survey of the outer Continental Shelf from Cape Hatteras, North Carolina to Cape Sable, Nova Scotia conducted between 1978 and 1982 showed leatherbacks to be present throughout the area with the most numerous sightings made from the Gulf of Maine south to Long Island. Leatherbacks were sighted in water depths ranging from 1 to 4,151 m, but 84.4% of sightings were in waters less than 180 m (Shoop and Kenney 1992). Leatherbacks were sighted in waters within a sea surface temperature range similar to that observed for loggerheads; from 7°-27.2°C (Shoop and Kenney 1992). However, leatherbacks appear to have a greater tolerance for colder waters in comparison to loggerhead sea turtles since more leatherbacks were found at the lower temperatures (Shoop and Kenney 1992). Studies of satellite tagged leatherbacks suggest that they spend 10%-41% of their time at the surface, depending on the phase of their migratory cycle (James *et al.* 2005b). The greatest amount of surface time (up to 41%) was recorded when leatherbacks occurred in continental shelf and slope waters north of 38°N (James *et al.* 2005b).

In 1979, the waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands were designated as critical habitat for the leatherback sea turtle. On February 2, 2010, NMFS received a petition to revise the critical habitat designation for leatherback sea turtles to include waters adjacent to a major nesting beach in Puerto Rico. NMFS published a 90-day finding on the petition on July 16, 2010, which found that the petition did not present substantial scientific information indicating that the petitioned revision was warranted. The original petitioners submitted a second petition on November 2, 2010 to revise the critical habitat designation to again include waters adjacent to a major nesting beach in Puerto Rico, including additional information on the usage of the waters. NMFS determined on May 5, 2011, that a revision to critical habitat off Puerto Rico may be warranted, and an analysis is underway. Note that on August 4, 2011, FWS issued a determination that revision to critical habitat along Puerto Rico should be made and will be addressed during the future planned status review.

Leatherbacks are a long lived species (>30 years). They were originally believed to mature at a younger age than loggerhead sea turtles, with a previous estimated age at sexual maturity of about 13-14 years for females with 9 years reported as a likely minimum (Zug and Parham 1996) and 19 years as a likely maximum (NMFS SEFSC 2001). However, new sophisticated analyses suggest that leatherbacks in the Northwest Atlantic may reach maturity at 24.5-29 years of age (Avens *et al.* 2009). In the United States and Caribbean, female leatherbacks nest from March through July. In the Atlantic, most nesting females average between 150-160 cm curved carapace length (CCL), although smaller (<145 cm CCL) and larger nesters are observed (Stewart *et al.* 2007, TEWG 2007). They nest frequently (up to seven nests per year) during a nesting season and nest about every 2-3 years. They produce 100 eggs or more in each clutch and can produce 700 eggs or more per nesting season (Schultz 1975). However, a significant portion (up to approximately 30%) of the eggs can be infertile. Therefore, the actual proportion of eggs that can result in hatchlings is less than the total number of eggs produced per season. As is the case with other sea turtle species, leatherback hatchlings enter the water soon after hatching. Based on a review of all sightings of leatherback sea turtles of <145 cm CCL, Eckert (1999) found that leatherback juveniles remain in waters warmer than 26°C until they exceed 100 cm CCL.

*Population Dynamics and Status*

As described earlier, sea turtle nesting survey data is important in that it provides information on the relative abundance of nesting, and the contribution of each population/subpopulation to total nesting of the species. Nest counts can also be used to estimate the number of reproductively mature females nesting annually, and as an indicator of the trend in the number of nesting females in the nesting group. The 5-year review for leatherback sea turtles (NMFS and USFWS 2007b) compiled the most recent information on mean number of leatherback nests per year for each of the seven leatherback populations or groups of populations that were identified by the Leatherback TEWG as occurring within the Atlantic. These are: Florida, North Caribbean, Western Caribbean, Southern Caribbean, West Africa, South Africa, and Brazil (TEWG 2007).

In the United States, the Florida Statewide Nesting Beach Survey program has documented an increase in leatherback nesting numbers from 98 nests in 1988 to between 800 and 900 nests in the early 2000s (NMFS and USFWS 2007b). Stewart *et al.* (2011) evaluated nest counts from 68 Florida beaches over 30 years (1979-2008) and found that nesting increased at all beaches with trends ranging from 3.1%-16.3% per year, with an overall increase of 10.2% per year. An analysis of Florida's index nesting beach sites from 1989-2006 shows a substantial increase in leatherback nesting in Florida during this time, with an annual growth rate of approximately 1.17 (TEWG 2007). The TEWG reports an increasing or stable nesting trend for all of the seven populations or groups of populations with the exception of the Western Caribbean and West Africa. The leatherback rookery along the northern coast of South America in French Guiana and Suriname supports the majority of leatherback nesting in the western Atlantic (TEWG 2007), and represents more than half of total nesting by leatherback sea turtles worldwide (Hilterman and Goverse 2004). Nest numbers in Suriname have shown an increase and the long-term trend for the Suriname and French Guiana nesting group seems to show an increase (Hilterman and Goverse 2004). In 2001, the number of nests for Suriname and French Guiana combined was 60,000, one of the highest numbers observed for this region in 35 years (Hilterman and Goverse 2004). The TEWG (2007) report indicates that using nest numbers from 1967-2005, a positive population growth rate was found over the 39-year period for French Guinea and Suriname, with a 95% probability that the population was growing. Given the magnitude of leatherback nesting in this area compared to other nest sites, negative impacts in leatherback sea turtles in this area could have profound impacts on the entire species.

The CETAP aerial survey conducted from 1978-1982 estimated the summer leatherback population for the northeastern United States at approximately 300-600 animals (from near Nova Scotia, Canada to Cape Hatteras, North Carolina) (Shoop and Kenney 1992). However, the estimate was based on turtles visible at the surface and does not include those that were below the surface out of view. Therefore, it likely underestimated the leatherback population for the northeastern United States at the time of the survey. Estimates of leatherback abundance of 1,052 turtles (C.V. = 0.38) and 1,174 turtles (C.V. = 0.52) were obtained from surveys conducted from Virginia to the Gulf of St. Lawrence in 1995 and 1998, respectively (Palka 2000). However, since these estimates were also based on sightings of leatherbacks at the surface, the author considered the estimates to be negatively biased and the true abundance of leatherbacks may be 4.27 times higher (Palka 2000).

*Threats*

The 5-year status review (NMFS and USFWS 2007b) and TEWG (2007) report provide summaries of natural as well as anthropogenic threats to leatherback sea turtles. Of the Atlantic sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear, trap/pot gear in particular. This susceptibility may be the result of their body type (large size, long pectoral flippers, and lack of a hard shell), their diving and foraging behavior, their distributional overlap with the gear, their possible attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface, and perhaps to the lightsticks used to attract target species in longline fisheries. Leatherbacks entangled in fishing gear generally have a reduced ability to feed, dive, surface to breathe, or perform any other behavior essential to survival (Balazs 1985). In addition to drowning from forced submergence, they may be more susceptible to boat strikes if forced to remain at the surface, and entangling lines can constrict blood flow resulting in tissue necrosis. The long-term impacts of entanglement on leatherback health remain unclear. Innis *et al.* (2010) conducted a health evaluation of leatherback sea turtles during direct capture (n=12) and disentanglement (n=7). They found no significant difference in many of the measured health parameters between entangled and directly captured turtles. However, blood parameters, including but not limited to sodium, chloride, and blood urea nitrogen, for entangled turtles showed several key differences that were most likely due to reduced foraging and associated seawater ingestion, as well as a general stress response.

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., Biological 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.

Leatherbacks have been documented interacting with longline, trap/pot, trawl, and gillnet fishing gear. For instance, an estimated 6,363 leatherback sea turtles were documented as caught by the U.S. Atlantic tuna and swordfish longline fisheries between 1992-1999 (NMFS SEFSC 2001). Currently, the U.S. tuna and swordfish longline fisheries managed under the HMS FMP are estimated to capture 1,764 leatherbacks (no more than 252 mortalities) for each 3-year period starting in 2007 (NMFS 2004a). In 2010, there were 26 observed interactions between leatherback sea turtles and longline gear used in the HMS fishery (Garrison and Stokes 2011a, 2011b). All leatherbacks were released alive, with all gear removed for the majority of captures. While 2010 total estimates are not yet available, in 2009, 285.8 (95% CI: 209.6-389.7) leatherback sea turtles are estimated to have been taken in the longline fisheries managed under the HMS FMP based on the observed takes (Garrison and Stokes 2010). The 2009 estimate continues a downward trend since 2007 and remains well below the average prior to implementation of gear regulations (Garrison and Stokes 2010). Since the U.S. fleet accounts for only 5%-8% of the longline hooks fished in the Atlantic Ocean, adding up the under-represented observed takes of the other 23 countries actively fishing in the area would likely result in annual take estimates of thousands of leatherbacks over different life stages (NMFS SEFSC 2001). Lewison *et al.* (2004) estimated that 30,000-60,000 leatherbacks were taken in all Atlantic longline fisheries in 2000 (including the U.S. Atlantic tuna and swordfish longline fisheries, as well as others).

Leatherbacks are susceptible to entanglement in the lines associated with trap/pot gear used in several fisheries. From 1990-2000, 92 entangled leatherbacks were reported from New York through Maine (Dwyer *et al.* 2002). Additional leatherbacks stranded wrapped in line of unknown origin or with evidence of a past entanglement (Dwyer *et al.* 2002). More recently, from 2002 to 2010, NMFS received 137 reports of sea turtles entangled in vertical lines from Maine to Virginia, with 128 events confirmed (verified by photo documentation or response by a trained responder; NMFS 2008a). Of the 128 confirmed events during this period, 117 events involved leatherbacks. NMFS identified the gear type and fishery for 72 of the 117 confirmed events, which included lobster (42[4]), whelk/conch (15), black sea bass (10), crab (2), and research pot gear (1). A review of leatherback mortality documented by the STSSN in Massachusetts suggests that vessel strikes and entanglement in fixed gear (primarily lobster pots and whelk pots) are the principal sources of this mortality (Dwyer *et al.* 2002).

Leatherback interactions with the U.S. South Atlantic and Gulf of Mexico shrimp fisheries are also known to occur (NMFS 2002). Leatherbacks are likely to encounter shrimp trawls working in the coastal waters off the U.S. Atlantic coast (from Cape Canaveral, Florida through North Carolina) as they make their annual spring migration north. For many years, TEDs that were required for use in the U.S. South Atlantic and Gulf of Mexico shrimp fisheries were less effective for leatherbacks as compared to the smaller, hard-shelled turtle species, because the TED openings were too small to allow leatherbacks to escape. To address this problem, NMFS issued a final rule on February 21, 2003, to amend the TED regulations (68 FR 8456, February 21, 2003). Modifications to the design of TEDs are now required in order to exclude leatherbacks as well as large benthic immature and sexually mature loggerhead and green sea turtles. Given those modifications, Epperly *et al.* (2002) anticipated an average of 80 leatherback mortalities a year in shrimp gear interactions, dropping to an estimate of 26 leatherback mortalities in 2009 due to effort reduction in the Southeast shrimp fishery (Memo from Dr. B. Ponwith, SEFSC, to Dr. R. Crabtree, SERO, January 5, 2011).

Other trawl fisheries are also known to interact with leatherback sea turtles although on a much smaller scale. In October 2001, for example, a NMFS fisheries observer documented the take of a leatherback in a bottom otter trawl fishing for *Loligo* squid off of Delaware. TEDs are not currently required in this fishery. In November 2007, fisheries observers reported the capture of a leatherback sea turtle in bottom otter trawl gear fishing for summer flounder.

Gillnet fisheries operating in the waters of the Mid-Atlantic states are also known to capture, injure, and/or kill leatherbacks when these fisheries and leatherbacks co-occur. Data collected by the NEFSC Fisheries Observer Program from 1994-1998 (excluding 1997) indicate that a total of 37 leatherbacks were incidentally captured (16 lethally) in drift gillnets set in offshore waters from Maine to Florida during this period. Observer coverage for this period ranged from 54%-92%. In North Carolina, six additional leatherbacks were reported captured in gillnet sets in the spring (NMFS SEFSC 2001). In addition to these, in September 1995, two dead leatherbacks were removed from an 11-inch (28.2-cm) monofilament shark gillnet set in the nearshore waters off of Cape Hatteras (STSSN unpublished data reported in NMFS SEFSC 2001). Lastly, Murray (2009a) reports five observed leatherback captures in Mid-Atlantic sink gillnet fisheries between 1994 and 2008.

Fishing gear interactions can occur throughout the range of leatherbacks. Entanglements occur in Canadian waters where Goff and Lien (1988) reported that 14 of 20 leatherbacks encountered off the coast of Newfoundland/Labrador were entangled in fishing gear including salmon net, herring net, gillnet, trawl line, and crab pot line. Leatherbacks are known to drown in fish nets set in coastal waters of Sao Tome, West Africa (Castroviejo *et al.* 1994; Graff 1995). Gillnets are one of the suspected causes for the decline in the leatherback sea turtle population in French Guiana (Chevalier *et al.* 1999), and gillnets targeting green and hawksbill sea turtles in the

[4] One case involved both lobster and whelk/conch gear.

waters of coastal Nicaragua also incidentally catch leatherback sea turtles (Lagueux *et al.*1998). Observers on shrimp trawlers operating in the northeastern region of Venezuela documented the capture of six leatherbacks from 13,600 trawls (Marcano and Alio-M. 2000). An estimated 1,000 mature female leatherback sea turtles are caught annually in fishing nets off of Trinidad and Tobago with mortality estimated to be between 50%-95% (Eckert and Lien 1999). Many of the sea turtles do not die as a result of drowning, but rather because the fishermen cut them out of their nets (NMFS SEFSC 2001).

Leatherbacks may be more susceptible to marine debris ingestion than other sea turtle species due to the tendency of floating debris to concentrate in convergence zones that juveniles and adults use for feeding (Shoop and Kenney 1992; Lutcavage *et al.* 1997). Investigations of the necropsy results of leatherback sea turtles revealed that a substantial percentage (34% of the 408 leatherback necropsies' recorded between 1885 and 2007) reported plastic within the turtles' stomach contents, and in some cases (8.7% of those cases in which plastic was reported), blockage of the gut was found in a manner that may have caused the mortality (Mrosovsky *et al.* 2009). An increase in reports of plastic ingestion was evident in leatherback necropsies conducted after the late 1960s (Mrosovsky *et al.* 2009). Along the coast of Peru, intestinal contents of 19 of 140 (13%) leatherback carcasses were found to contain plastic bags and film (Fritts 1982). The presence of plastic debris in the digestive tract suggests that leatherbacks might not be able to distinguish between prey items (*e.g.*, jellyfish) and plastic debris (Mrosovsky 1981). Balazs (1985) speculated that plastic objects may resemble food items by their shape, color, size, or even movements as they drift about, and induce a feeding response in leatherbacks.

*Summary of Status for Leatherback Sea Turtles*

In the Pacific Ocean, the abundance of leatherback sea turtles on nesting beaches has declined dramatically over the past 10 to 20 years. Nesting groups throughout the eastern and western Pacific Ocean have been reduced to a fraction of their former abundance by the combined effects of human activities that have reduced the number of nesting females and reduced the reproductive success of females that manage to nest (for example, egg poaching) (NMFS and USFWS 2007b). No reliable long term trend data for the Indian Ocean populations are currently available. While leatherbacks are known to occur in the Mediterranean Sea, nesting in this region is not known to occur (NMFS and USFWS 2007b).

Nest counts in many areas of the Atlantic Ocean show increasing trends, including for beaches in Suriname and French Guiana which support the majority of leatherback nesting (NMFS and USFWS 2007b). The species as a whole continues to face numerous threats in nesting and marine habitats. 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 pollution and habitat destruction account for an unknown level of other mortality. The long term recovery potential of this species may be further threatened by observed low genetic diversity, even in the largest nesting groups like French Guiana and Suriname (NMFS and USFWS 2007b).

Based on its 5-year status review of the species, NMFS and USFWS (2007b) determined that endangered leatherback sea turtles should not be delisted or reclassified. 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 (NMFS and USFWS 2007b).

### 5.6 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 which Atlantic sturgeon DPSs likely occur in the action area and provide information on the use of the action area by Atlantic sturgeon.

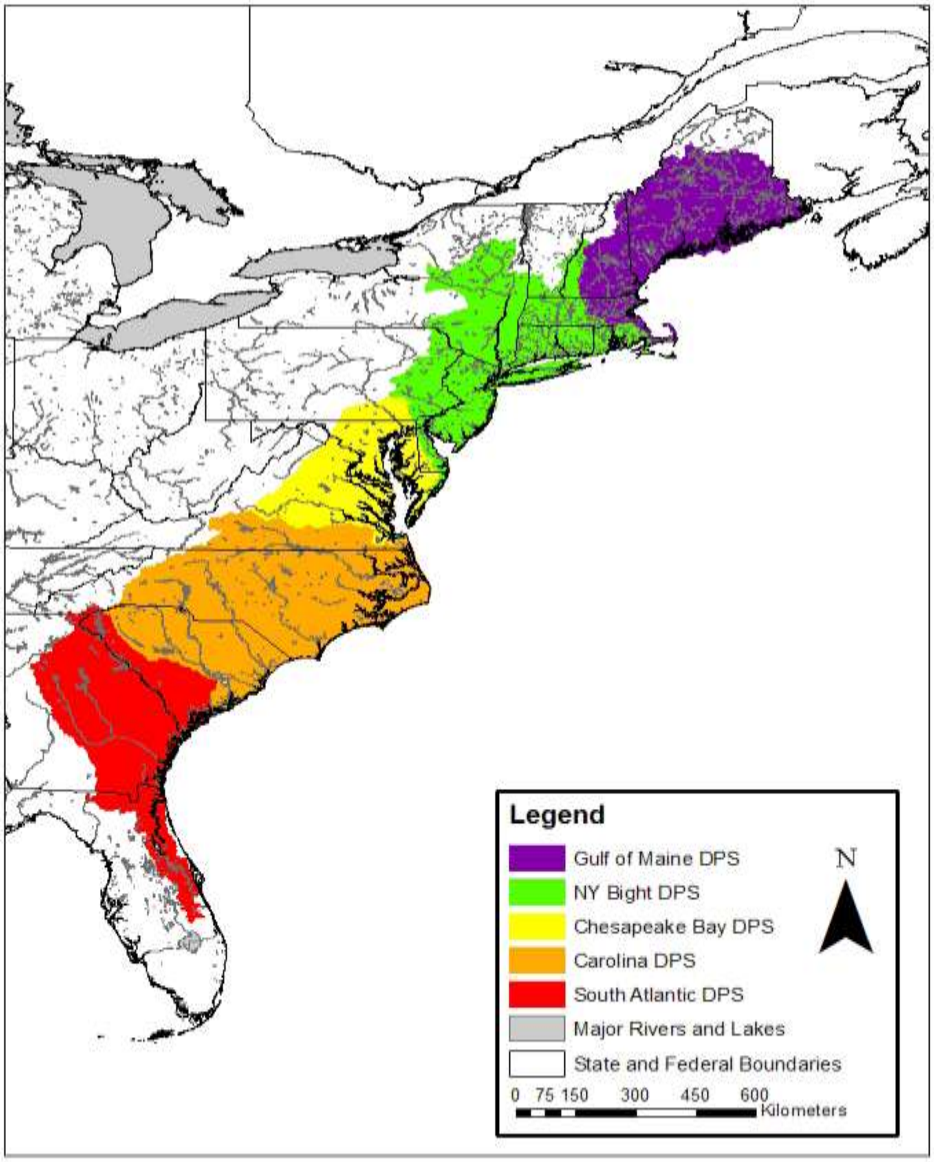
The Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) is a subspecies of sturgeon distributed along the eastern coast of North America from Hamilton Inlet, Labrador, Canada to Cape Canaveral, Florida, USA (Scott and Scott, 1988; ASSRT, 2007; T. Savoy, CT DEP, pers. comm.). NMFS has delineated U.S. populations of Atlantic sturgeon into five DPSs[5] ( 77 FR 5880 and 77 FR 5914). These are: the Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs (see Figure 3). The results of genetic studies suggest that natal origin influences the distribution of Atlantic sturgeon in the marine environment (Wirgin and King, 2011). However, genetic data as well as tracking and tagging data demonstrate sturgeon from each DPS and Canada occur throughout the full range of the subspecies. Therefore, 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.

On February 6, 2012, we published notice in the *Federal Register* that we were listing the New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs as "endangered," and the Gulf of Maine DPS as "threatened" (77 FR 5880 and 77 FR 5914). 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 the five listed DPSs may occur in the action area. Information general to all Atlantic sturgeon as well as information specific to each of the relevant DPSs, is provided below.

**Figure 3**. Map Depicting the Boundaries of the five Atlantic sturgeon DPSs

[5] 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."




### *5.6.1 Atlantic sturgeon life history*

Atlantic sturgeon are long lived (approximately 60 years), late maturing, estuarine dependent, anadromous[6] fish (Bigelow and Schroeder, 1953; Vladykov and Greeley 1963; Mangin, 1964; Pikitch *et al.*, 2005; Dadswell, 2006; ASSRT, 2007).

The life history of Atlantic sturgeon can be divided up into five general categories as described in the table below (adapted from ASSRT 2007).

[6] 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 FAQs, available at http://www.nefsc.noaa.gov/faq/fishfaq1a.html, modified June 16, 2011).

| Age Class | Size | Description |
|---|---|---|
| **Egg** | | Fertilized or unfertilized |
| **Larvae** | | Negative photo-taxic, nourished by yolk sac |
| **Young of Year (YOY)** | **0.3 grams <41 cm TL** | Fish that are > 3 months and < one year; capable of capturing and consuming live food |
| **Sub-adults** | **>41 cm and <150 cm TL** | Fish that are at least age 1 and are not sexually mature |
| **Adults** | **>150 cm TL** | Sexually mature fish |

Table 4. Descriptions of Atlantic sturgeon life history stages.

They are a relatively large fish, even amongst sturgeon species (Pikitch *et al.*, 2005). Atlantic sturgeon are bottom feeders that suck food into a ventrally-located protruding mouth (Bigelow and Schroeder, 1953). Four barbels in front of the mouth assist the sturgeon in locating prey (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). While in the river, Atlantic sturgeon feed on aquatic insects, insect larvae, and other invertebrates (Bigelow and Schroeder, 1953; ASSRT, 2007; Guilbard *et al.*, 2007).

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; and (4) the length of Atlantic sturgeon caught since the mid-late 20$^{th}$ century have typically been less than 3 meters (m) (Smith *et al.*, 1982; Smith *et al.*, 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). The largest recorded Atlantic sturgeon was a female captured in 1924 that measured approximately 4.26 m (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). However, while females are prolific with egg production ranging from

400,000 to 4 million eggs per spawning year, females spawn at intervals of 2-5 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 percent of the maximum lifetime egg production is achieved is estimated to be 29 years (Boreman, 1997). Males exhibit spawning periodicity of 1-5 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 (ASMFC, 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; ASMFC, 2009), and remain on the spawning grounds throughout the spawning season (Bain, 1997). Females begin spawning migrations when temperatures are closer to 12° C 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 cm/s and depths are 3-27 m (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; ASMFC, 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; ASMFC, 2009), and become adhesive shortly after fertilization (Murawski and Pacheco, 1977; Van den Avyle, 1983; 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 egg deposition (ASSRT, 2007).

Larval Atlantic sturgeon (i.e. less than 4 weeks old, with total lengths (TL) less than 30 mm; Van Eenennaam *et al.* 1996) are assumed to undertake a demersal existence and inhabit the same riverine or estuarine areas where they were spawned (Smith *et al.*, 1980; Bain *et al.*, 2000; Kynard and Horgan, 2002; ASMFC, 2009). Studies suggest that age-0 (i.e., young-of-year), age-1, and age-2 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 m 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.*, 2004; USFWS, 2004; 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 m during winter and spring, and in the northern portion of the Mid-Atlantic Bight at depths less than 20 m in summer and fall (Erickson *et al.*, 2011). Shirey (Delaware Department of Fish and Wildlife, unpublished data reviewed in ASMFC, 2009) found a similar movement pattern for juvenile Atlantic sturgeon based on recaptures of fish originally tagged in the Delaware River. 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, North Carolina 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 near shore fisheries with few fish reported from waters in excess of 25 m (C. Shirey, Delaware Department of Fish and Wildlife, unpublished data reviewed in ASMFC, 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 m (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.*, 2004; Wehrell, 2005; Dadswell, 2006; ASSRT, 2007; Laney *et al.*, 2007). These sites may be used as foraging sites and/or thermal refuge.

### *5.6.2 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 to determine from which DPSs individuals in the action area are likely to have originated. We have mixed-stock analyses from samples taken in a variety of coastal sampling programs; however, to date, we have no mixed-stock or individual assignment data for Atlantic sturgeon captured in the Chesapeake Bay. We have mixed-stock analysis of Atlantic sturgeon captured in waters off the coast of southern Virginia and North Carolina during the winter months. This area is a known overwintering aggregation; accordingly, we do not expect that the composition of individuals in this area during the winter months is representative of the composition of individuals in the action area year round. Genetic analysis has been completed on 173 samples obtained through NMFS NEFOP program. These fish have been captured in commercial fishing gear from Maine to North Carolina. Because this sampling overlaps with the action area, we consider it to be the best available information from which to determine the DPS composition in the action area. Based on the mixed-stock analysis resulting from the genetic assignments of the NEFOP samples, 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%. Two percent of Atlantic sturgeon in the action area may originate from the St. John's River in Canada; these fish are not included in the 2012 ESA listing. The genetic assignments have a plus/minus 5% confidence interval; however, for purposes of section 7 consultation we have selected the reported values above, which approximate the mid-point of the range, as 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 Damon-Randall *et al.* (2012a).

### *5.6.3 Distribution and Abundance*

Atlantic sturgeon underwent significant range-wide declines from historical abundance levels due to overfishing in the mid to late 19th century when a caviar market was established (Scott and Crossman, 1973; Taub, 1990; Kennebec River Resource Management Plan, 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, 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 16 U.S. rivers are known to support spawning based on available evidence (i.e., presence of young-of-year 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 four rivers (Kennebec, Hudson, Delaware, James) are known to currently support spawning from Maine through Virginia where historical records support there used to be fifteen spawning rivers (ASSRT, 2007). While spawning may also be occurring in other rivers (e.g., the Androscoggin River in Maine), we do not yet have confirmation of spawning in other Northeast rivers. Thus, there are substantial gaps in the range 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. Therefore, there are no published abundance estimates for any of the five DPSs of Atlantic sturgeon. An annual mean estimate of 863 mature adults (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, GA, based on fishery-independent data collected in 2004 and 2005 (Schueller and Peterson, 2006). Using the data collected from the Hudson River and Altamaha River 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).

Kahnle *et al.* (2007) estimated the number of total mature adults per year in the Hudson River using data from surveys in the 1980s to mid-1990s and based on mean harvest by sex divided by sex specific exploitation rate. While this data is over 20 years old, it is currently the best available data on the abundance of Hudson River origin Atlantic sturgeon. The sex ratio of spawners is estimated to be approximately 70% males and 30% females. As noted above, Kahnle *et al.* (2007) estimated a mean annual number of mature adults at 596 males and 267 females. It is important to note that the authors of this paper have stated that this is an estimate of the annual mean number of Hudson River mature adults during the 1985-1995 period, not an estimate of the number of spawners per year.

#### *5.6.4 Threats faced by Atlantic sturgeon throughout their range*

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$^{th}$ and 20$^{th}$ centuries (Taub, 1990; Smith and Clugston, 1997; Secor and Waldman, 1999).

Based on the best available information, NMFS has concluded that unintended catch of Atlantic sturgeon in fisheries, vessel strikes, poor water quality, water 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 of 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 the Labrador, Canada to Cape Canaveral, FL, 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, given that Atlantic sturgeon depend on a variety of habitats, every life stage is likely affected by one or more of the identified threats.

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 Sturgeon FMP. Complementary regulations were implemented by NMFS in 1999 that prohibit fishing for, harvesting, possessing or retaining Atlantic sturgeon or its parts in or from the Exclusive Economic Zone 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 Gulf of Maine and the New York Bight DPSs have been incidentally captured in other Bay of Fundy fisheries (DFO, 2010; 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 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 Gulf of Maine DPS, with a smaller percentage from the New York Bight DPS.

Fisheries bycatch in U.S. waters is the primary threat faced by all 5 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 (NMFS NEFSC 2011) in the Northeast 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 2011). The analysis prepared by the NEFSC estimates that from 2006 through 2010 there were 2,250 to 3,862 encounters per year in observed gillnet and trawl fisheries, with an average of 3,118 encounters. Mortality rates in gillnet gear are approximately 20%. Mortality rates in otter trawl gear are believed to be lower at approximately 5%.

### 5.7 Gulf of Maine DPS of Atlantic sturgeon

The Gulf of Maine DPS includes the following: all anadromous Atlantic sturgeons that are spawned in the watersheds from the Maine/Canadian border and, extending southward, all watersheds draining into the Gulf of Maine as far south as Chatham, MA. Within this range, Atlantic sturgeon historically spawned in the Androscoggin, Kennebec, Merrimack, Penobscot, and Sheepscot Rivers (ASSRT, 2007). Spawning still occurs in the Kennebec River, 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; however, the extent of spawning in this river is unknown. 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 percent 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) (Keiffer 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 these rivers. Atlantic sturgeons that are spawned elsewhere continue to use habitats within all of these rivers as part of their overall marine range (ASSRT, 2007). The movement of subadult and adult sturgeon between rivers, including to and from the Kennebec River and the Penobscot River, demonstrates that coastal and marine migrations are key elements of Atlantic sturgeon life history for the Gulf of Maine DPS as well as likely throughout the entire range (ASSRT, 2007; Fernandes, *et al.*, 2010).

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, 1998; NMFS and USFWS, 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) capture of 31 adult Atlantic sturgeon from June 15,1980, 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 4 ripe males and 1 ripe female captured on July 26,1980; and, (3) 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, ME (NMFS and USFWS, 1998; ASMFC 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.

Several threats play a role in shaping the current status of Gulf of Maine DPS Atlantic sturgeon. Historical records provide evidence of commercial fisheries for Atlantic sturgeon in the Kennebec and Androscoggin Rivers dating back to the 17th century (Squiers *et al.*, 1979). In 1849, 160 tons of sturgeon was caught in the Kennebec River by local fishermen (Squiers *et al.*, 1979). Following the 1880's, the sturgeon fishery was almost non-existent due to a collapse of the sturgeon stocks. All directed Atlantic sturgeon fishing as well as retention of Atlantic sturgeon by catch has been prohibited since 1998. Nevertheless, mortalities associated with bycatch in fisheries occurring in state and federal waters still occurs. In the marine range, Gulf of Maine DPS Atlantic sturgeon are incidentally captured in federal and state managed fisheries, reducing survivorship of subadult and adult Atlantic sturgeon (Stein *et al.*, 2004; ASMFC 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 Gulf of Maine region have navigation channels that are maintained by dredging. Dredging outside of Federal channels and in-water construction occurs throughout the Gulf of Maine region. 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; however, as noted above, not all projects are monitored for interactions with fish. 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 natural falls and likely represent the maximum upstream extent of sturgeon occurrence even if the dams were not present. Because no Atlantic sturgeon are known to 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. While not expected to be killed or injured during passage at a dam, the extent that Atlantic sturgeon are affected by the existence of dams and their operations in the Gulf of Maine region is currently unknown. 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 Veazie and Great Works Dams. Together these dams prevent Atlantic sturgeon from accessing approximately 29 km of habitat, including the presumed historical spawning habitat located downstream of Milford Falls, the site of the Milford Dam. While removal of the Veazie and Great Works Dams is anticipated to occur in the near future, the presence of these dams is currently preventing access to significant habitats within the Penobscot River. While Atlantic sturgeon are known to occur in the Penobscot River, it is unknown if spawning is currently occurring or whether the presence of the Veazie and Great Works Dams affects the likelihood of spawning 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. Like the Penobscot, it is unknown how the Essex Dam affects the likelihood of spawning occurring in this river.

Gulf of Maine 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 industrial discharges from pulp and paper mills. While water quality has improved and most discharges are limited through regulations, many pollutants persist in the benthic environment. 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 empirical abundance estimates for the Gulf of Maine DPS. The Atlantic sturgeon SRT (2007) presumed that the Gulf of Maine DPS was comprised of less than 300 spawning adults per year, based on abundance estimates for the Hudson and Altamaha River 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.

*Summary of the Gulf of Maine DPS*

Spawning for the Gulf of Maine DPS is known to occur in the Kennebec and recent evidence suggests it may also be occurring in the Androscoggin. Spawning may be occurring in other rivers, such as the Sheepscot or Penobscot, but has not been confirmed. There are indications of increasing abundance of Atlantic sturgeon belonging to the Gulf of Maine 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., the Saco, Presumpscot, and Charles rivers). These observations suggest that abundance of the Gulf of Maine 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 Gulf of Maine 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). There are strict regulations on the use of fishing gear in Maine state waters that incidentally catch sturgeon. In addition, 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, 2007). Atlantic sturgeon from the GOM DPS are not commonly taken as bycatch in areas south of Chatham, MA, with only 8 percent (e.g., 7 of the 84 fish) of interactions observed in the Mid Atlantic/Carolina region being assigned to the Gulf of Maine DPS (Wirgin and King, 2011). Tagging results also indicate that Gulf of Maine DPS fish tend to remain within the waters of the Gulf of Maine and only occasionally venture to points south. However, 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 percent originated from the Gulf of Maine DPS (Wirgin *et al.*, in draft).

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, 2007; Kahnle *et al.*, 2007; Brown and Murphy, 2010). NMFS has determined that the Gulf of Maine 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.

## 5.8 New York Bight DPS of Atlantic sturgeon

The New York Bight DPS includes the following: all anadromous Atlantic sturgeon spawned in the watersheds that drain into coastal waters from Chatham, MA 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 (within the last 15 years) of spawning in the Connecticut and Taunton Rivers

(ASSRT, 2007). Atlantic sturgeon that are spawned elsewhere continue to use habitats within the Connecticut and Taunton Rivers 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 prior to the onset of expanded exploitation in the 1800s is unknown but has been conservatively estimated at 10,000 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 River 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. No data on abundance of juveniles are available prior to the 1970s; however, two estimates of immature Atlantic sturgeon have been calculated for the Hudson River population, one for the 1976 year class and one for the 1994 year class. Dovel and Berggren (1983) marked immature fish from 1976-1978. Estimates for the 1976 year class at age were approximately 25,000 individuals. Dovel and Berggren estimated that in 1976 there were approximately 100,000 juvenile (non-migrant) Atlantic sturgeon from approximately 6 year classes, excluding young of year.

In October of 1994, the NYDEC stocked 4,929 marked age-0 Atlantic sturgeon, provided by a USFWS hatchery, into the Hudson Estuary at Newburgh Bay. These fish were reared from Hudson River brood stock. In 1995, Cornell University sampling crews collected 15 stocked and 14 wild age-1 Atlantic sturgeon (Peterson *et al*. 2000). A Petersen mark-recapture population estimate from these data suggests that there were 9,529 (95% CI = 1,916 – 10,473) age-0 Atlantic sturgeon in the estuary in 1994. Since 4,929 were stocked, 4,600 fish were of wild origin, assuming equal survival for both hatchery and wild fish and that stocking mortality for hatchery fish was zero.

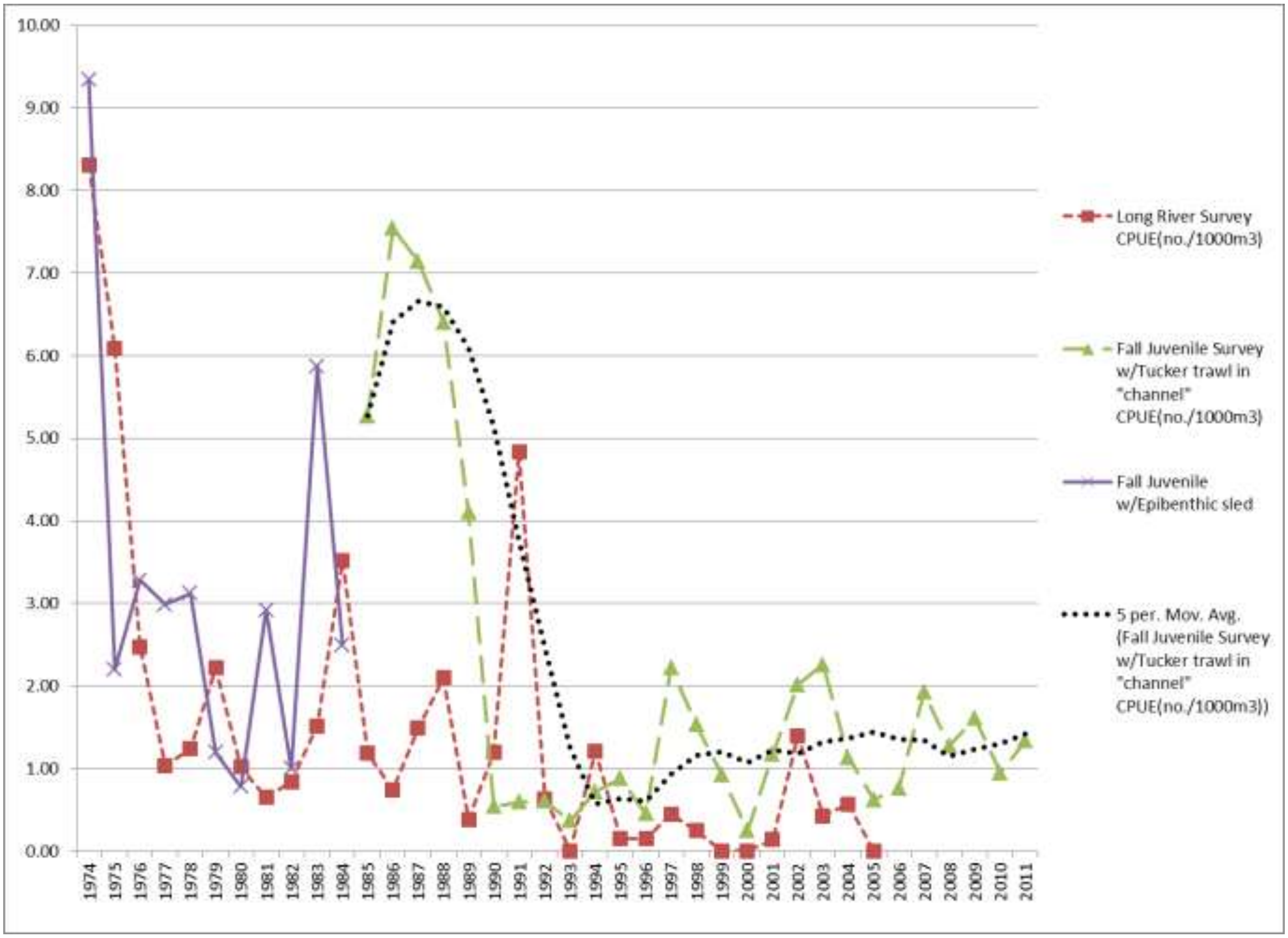
Information on trends for Atlantic sturgeon in the Hudson River are available from a number of long term surveys. From July to November during 1982-1990 and 1993, the NYSDEC sampled the abundance of juvenile fish in Haverstraw Bay and the Tappan Zee Bay. The CPUE of immature Atlantic sturgeon was 0.269 in 1982 and declined to zero by 1990. This study has not been carried out since this time.

The Long River Survey (LRS) samples ichthyoplankton river-wide from the George Washington Bridge (rkm 19) to Troy (rkm 246) using a stratified random design (CONED 1997). These data, which are collected from May-July, provide an annual index of juvenile Atlantic sturgeon in the Hudson River estuary since 1974. The Fall Juvenile Survey (FJS), conducted from July – October by the utilities, calculates an annual index of the number of fish captured per haul. Between 1974 and 1984, the shoals in the entire river (rkm 19-246) were sampled by epibenthic sled; in 1985 the gear was changed to a three-meter beam trawl. While neither of these studies were designed to catch sturgeon, given their consistent implementation over time they provide indications of trends in abundance, particularly over long time series. When examining CPUE, these studies suggest a sharp decline in the number of young Atlantic sturgeon in the early

1990s.  While the amount of interannual variability makes it difficult to detect short term trends, a five year running average of CPUE from the FJS indicates a slowly increasing trend since about 1996.  Interestingly, that is when the in-river fishery for Atlantic sturgeon closed.  While that fishery was not targeting juveniles, a reduction in the number of adult mortalities would be expected to result in increased recruitment and increases in the number of young Atlantic sturgeon in the river.  There also could have been bycatch of juveniles that would have suffered some mortality.

In 2000, the NYSDEC created a sturgeon juvenile survey program to supplement the utilities' survey; however, funds were cut in 2000, and the USFWS was contracted in 2003 to continue the program.  In 2003 – 2005, 579 juveniles were collected (N = 122, 208, and 289, respectively) (Sweka et al. 2006).  Pectoral spine analysis showed they ranged from 1 – 8 years of age, with the majority being ages 2 – 6.  There has not been enough data collected to use this information to detect a trend, but at least during the 2003-2005 period, the number of juveniles collected increased each year which could be indicative of an increasing trend for juveniles.

As evidenced by estimates of juvenile abundance, the Atlantic sturgeon population in the Hudson River has declined over time.  Peterson et al. (2000) found that the abundance of age-1 Atlantic sturgeon in the Hudson River declined 80% from 1977 to 1995.  Similarly, longterm indices of juvenile abundance (the Hudson River Long River and Fall Shoals surveys) demonstrate a longterm declining trend in juvenile abundance.  The figure below (Figure 7) illustrates the CPUE of Atlantic sturgeon in the two longterm surveys of the Hudson River.  Please note that the Fall Shoals survey switched gear types in 1985.  We do not have the CPUE data for the Long River Survey for 2006-2011.




CPUE for the Fall Juvenile Survey for the most recent five year period (2007-2011) is approximately 27% of the CPUE from 1985-1990, but is more than two times higher than the CPUE from 1991-1996 which may be suggestive of an increasing trend in juvenile abundance. Given the high variability between years, it is difficult to use this data to assess short term trends, however, when looking at a five-year moving average, the index appears to be increasing from lows in the early 1990s, but is still much lower than the 1970s and 1980s.

There is no abundance estimate for the Delaware River population of Atlantic sturgeon. Harvest records from the 1800's 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 young-of- the year (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 mm TL (Fisher, 2009) and the collection of 32 YOY Atlantic sturgeon in a separate study (Brundage and O'Herron in Calvo *et al.*, 2010). Genetics information collected from 33 of the 2009 year class YOY indicates that at least 3 females successfully contributed to the 2009 year class (Fisher, 2011). Therefore, while the capture of YOY in 2009 provides evidence that successful spawning is still occurring in the

Delaware River, the relatively low numbers suggest the existing riverine population is limited in size.

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; however, at this time we do not have information to quantify this threat or its impact to the population or the New York Bight DPS. Similar to the Hudson River, there is currently not enough information to determine a trend for the Delaware River population.

*Summary of the New York Bight DPS*
Atlantic sturgeon originating from the New York Bight DPS spawn in the Hudson and Delaware rivers. While genetic testing can differentiate between individuals originating from the Hudson or Delaware river the available information suggests that the straying rate is high between these rivers. There are no indications of increasing abundance for the New York Bight DPS (ASSRT, 2009; 2010). Some of the impact from the threats that contributed to the decline of the New York Bight 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 New York Bight DPS.

In the marine range, New York Bight DPS Atlantic sturgeon are incidentally captured in federal and state managed fisheries, reducing survivorship of subadult and adult Atlantic sturgeon (Stein *et al.*, 2004; ASMFC 2007). As explained above, currently available estimates indicate that at least 4% of adults may be killed as a result of bycatch in fisheries authorized under Northeast FMPs. Based on mixed stock analysis results  presented by Wirgin and King ( 2011), over 40 percent of the Atlantic sturgeon bycatch interactions in the Mid Atlantic Bight region were sturgeon from the New York Bight 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 New York Bight DPS. 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.

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. 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, we are also not able to quantify any effects to habitat.

In the Hudson and Delaware Rivers, dams do not block access to historical habitat. The Holyoke Dam on the Connecticut River blocks further upstream passage; however, the extent that Atlantic sturgeon would historically have used habitat upstream of Holyoke is unknown. Connectivity may be disrupted by the presence of dams on several smaller rivers in the New York Bight region. 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 that Atlantic sturgeon are affected by operations of dams in the New York Bight region is currently unknown.

New York Bight DPS Atlantic sturgeon may also be affected by degraded water quality. In general, water quality has improved in the Hudson and Delaware over the past decades (Lichter *et al.* 2006; EPA, 2008). Both the Hudson and Delaware rivers, as well as other rivers in the New York Bight region, were heavily polluted in the past from industrial and sanitary sewer 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.

Vessel strikes occur in the Delaware River. Twenty-nine mortalities believed to be the result of vessel strikes were documented in the Delaware River from 2004 to 2008, and at least 13 of these fish were large adults. 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 New York Bight DPS.

Studies have shown that to rebuild, Atlantic sturgeon can only sustain low levels of anthropogenic mortality (Boreman, 1997; ASMFC, 2007; Kahnle *et al.*, 2007; Brown and Murphy, 2010). There are no empirical abundance estimates of the number of Atlantic sturgeon in the New York Bight DPS. As described in the final listing rule, NMFS has determined that the New York Bight 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.

### 5.9 Chesapeake Bay DPS of Atlantic sturgeon

The Chesapeake Bay DPS includes the following: all anadromous Atlantic sturgeons that are spawned in the watersheds that drain into the Chesapeake Bay and into coastal waters from the Delaware-Maryland border on Fenwick Island to Cape Henry, VA. 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 percent 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 (Musick *et* *al.*, 1994; ASSRT, 2007; Greene, 2009). However, conclusive evidence of current spawning is only available for the James River. Atlantic sturgeon that are spawned elsewhere are known to use the Chesapeake Bay for other life functions, such as foraging and as juvenile nursery habitat prior to entering the marine system as subadults (Vladykov and Greeley, 1963; ASSRT, 2007; Wirgin *et al.*, 2007; Grunwald *et al.*, 2008).

Age to maturity for Chesapeake Bay 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 5 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 Chesapeake Bay DPS likely falls within these values.

Several threats play a role in shaping the current status of Chesapeake Bay 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$^{th}$ century (Hildebrand and Schroeder, 1928; Vladykov and Greeley, 1963; ASMFC, 1998; Secor, 2002; Bushnoe *et al.*, 2005; ASSRT, 2007) as well as subsistence fishing and attempts at commercial fisheries as early as the 17$^{th}$ 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 Chesapeake Bay DPS, especially since the Chesapeake Bay system is vulnerable to the effects of nutrient enrichment due to a relatively low tidal exchange and flushing rate, large surface to volume ratio, and strong stratification during the spring and summer months (Pyzik *et al.*, 2004; ASMFC, 1998; 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). 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 through 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 New York Bight DPS.

In the marine and coastal range of the Chesapeake Bay 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.*, 2004; ASMFC, 2007; ASSRT, 2007).

*Summary of the Chesapeake Bay DPS*

Spawning for the Chesapeake Bay DPS is known to occur in only the James River. Spawning may be occurring in other rivers, such as the York, but has not been confirmed. 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 Chesapeake Bay 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). We do not currently have enough information about any life stage to establish a trend for this DPS.

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 Chesapeake Bay DPS of Atlantic sturgeon. Studies have shown that Atlantic sturgeon can only sustain low levels of bycatch mortality (Boreman, 1997; ASMFC, 2007; Kahnle *et al.*, 2007). The Chesapeake Bay 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.

### 5.10 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. Sturgeon are commonly captured 40 miles offshore (D. Fox, DSU, 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. 2004, ASMFC 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 young-of-the-year (YOY) were observed, or mature adults were present, in freshwater portions of a system (Table 5). 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. This represents our current knowledge of the river systems utilized by the Carolina DPS for specific life functions, such as spawning, nursery habitat, and foraging. However, fish from the Carolina DPS likely use other river systems than those listed here for their specific life functions.

| 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 | |

**Table 5.** 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.

The riverine spawning habitat of the Carolina DPS occurs within the Mid-Atlantic Coastal Plain ecoregion (TNC 2002a), which includes bottomland hardwood forests, swamps, and some of the world's most active coastal dunes, sounds, and estuaries. Natural fires, floods, and storms are so dominant in this region that the landscape changes very quickly. Rivers routinely change their courses and emerge from their banks. The primary threats to biological diversity in the Mid-Atlantic Coastal Plain, as listed by TNC are: global climate change and rising sea level; altered surface hydrology and landform alteration (e.g., flood-control and hydroelectric dams, inter-basin transfers of water, drainage ditches, breached levees, artificial levees, dredged inlets and river channels, beach renourishment, and spoil deposition banks and piles); a regionally receding water table, probably resulting from both over-use and inadequate recharge; fire suppression; land fragmentation, mainly by highway development; land-use conversion (e.g., from forests to timber plantations, farms, golf courses, housing developments, and resorts); the invasion of exotic plants and animals; air and water pollution, mainly from agricultural activities including concentrated animal feed operations; and over-harvesting and poaching of species. Many of the Carolina DPS' spawning rivers, located in the Mid-Coastal Plain, originate in areas of marl. Waters draining calcareous, impervious surface materials such as marl are: (1) likely to be alkaline; (2) dominated by surface run-off; (3) have little groundwater connection; and, (4) are seasonally ephemeral.

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. 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 a 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, is estimated to be less than 3 percent of what they were historically (ASSRT 2007).

*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 over 60 percent 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 (DO)) 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 utilized 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 degraded water quality in the Cape Fear River. Water quality in the Waccamaw and Pee Dee rivers have 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 North Carolina Department of Environmental and Natural Resources or other resource agencies. Since the 1993 legislation requiring certificates for transfers, almost 170 mgd of interbasin water withdrawals have been authorized, with an additional 60 mgd pending certification. The removal of large amounts of water from the system will alter flows, temperature, and DO. 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 DO, 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, from which they have never rebounded. Further, continued overutilization of Atlantic sturgeon as bycatch in commercial fisheries is an ongoing impact to the Carolina DPS. 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, Carolina DPS 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 Carolina DPS, even with existing controls on some pollution sources. Current regulatory regimes are not necessarily 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., DO). Additional data regarding sturgeon use of riverine and estuarine environments is 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 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 percent of historical population sizes) 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 results 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. Because a DPS is a group of populations, the stability, viability, and persistence of individual populations affects the persistence and viability of the larger DPS. The loss of any population within a DPS will result in: (1) a long-term gap in the range of the DPS that is unlikely to be recolonized; (2) loss of reproducing individuals; (3) loss of genetic biodiversity; (4) potential loss of unique haplotypes; (5) potential loss of adaptive traits; 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, the immigration into marine habitats to grow, and then the return of adults to natal rivers to spawn.

*Summary of the Status of the Carolina DPS of Atlantic Sturgeon*

In summary, the Carolina DPS is estimated to number less than 3 percent of its historic population size. There are estimated to be less than 300 spawning adults per year (total of both sexes) in each of the major river systems occupied by the DPS in which spawning still occurs, whose freshwater range occurs 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. 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 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 over 60 percent 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 DO) 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 utilize 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 Carolina DPS have been ameliorated or reduced due to the existing regulatory mechanisms, such as the moratorium on directed fisheries for Atlantic sturgeon, bycatch is currently not being addressed through existing mechanisms. Further, access to habitat and water quality continues to be a problem even with NMFS' authority under the Federal Power Act to recommend fish passsage and existing controls on some pollution sources. The inadequacy of regulatory mechanisms to control bycatch and habitat alterations is contributing to the status of the Carolina DPS.

### 5.11 South Atlantic DPS of Atlantic sturgeon

The South Atlantic DPS includes all Atlantic sturgeon that spawn or are spawned in the watersheds (including all rivers and tributaries) of the Ashepoo, Combahee, and Edisto 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 South Atlantic DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida.

Rivers known to have current spawning populations within the range of the South Atlantic DPS include the Combahee, Edisto, Savannah, Ogeechee, Altamaha, and Satilla Rivers. We determined spawning was occurring if young-of-the-year (YOY) were observed, or mature adults were present, in freshwater portions of a system (Table 6). However, in some rivers, spawning by Atlantic sturgeon may not be contributing to population growth because of lack of suitable habitat and the presence of other stressors on juvenile survival and development. Historically, both the Broad-Coosawatchie and St. Marys Rivers were documented to have spawning populations at one time; there is also evidence that spawning may have occurred in the St. Johns River or one of its tributaries. However, the spawning population in the St. Marys River, as well as any 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. Both the St. Marys and St. Johns Rivers are used as nursery habitat by young Atlantic sturgeon originating from other spawning populations. The use of the Broad-Coosawatchie by sturgeon from other spawning populations is unknown at this time. The presence of historical and current spawning populations in the Ashepoo River has not been documented; however, this river may currently be used for nursery habitat by young Atlantic sturgeon originating from other spawning populations. This represents our current knowledge of the river systems utilized by the South Atlantic DPS for specific life functions, such as spawning, nursery habitat, and foraging. However, fish from the South Atlantic DPS likely use other river systems than those listed here for their specific life functions.

| River/Estuary | Spawning | Data |
|---|---|---|

| | Population | |
|---|---|---|
| ACE (Ashepoo, Combahee, and Edisto Rivers) Basin, SC; St. Helena Sound | Yes | 1,331 YOY (1994-2001); gravid female and running ripe male in the Edisto (1997); 39 spawning adults (1998) |
| Broad-Coosawhatchie Rivers, SC; Port Royal Sound | Unknown | |
| Savannah River, SC/GA | Yes | 22 YOY (1999-2006); running ripe male (1997) |
| Ogeechee River, GA | Yes | age-1 captures, but high inter-annual variability (1991-1998); 17 YOY (2003); 9 YOY (2004) |
| Altamaha River, GA | Yes | 74 captured/308 estimated spawning adults (2004); 139 captured/378 estimated spawning adults (2005) |
| Satilla River, GA | Yes | 4 YOY and spawning adults (1995-1996) |
| St. Marys River, GA/FL | Extirpated | |
| St. Johns River, FL | Extirpated | |

Table 6. Major rivers, tributaries, and sounds within the range of the South Atlantic DPS and currently available data on the presence of an Atlantic sturgeon spawning population in each system.

The riverine spawning habitat of the South Atlantic DPS occurs within the South Atlantic Coastal Plain ecoregion (TNC 2002b), which includes fall-line sandhills, rolling longleaf pine uplands, wet pine flatwoods, isolated depression wetlands, small streams, large river systems, and estuaries. Other ecological systems in the ecoregion include maritime forests on barrier islands, pitcher plant seepage bogs and Altamaha grit (sandstone) outcrops. Other ecological systems in the ecoregion include maritime forests on barrier islands, pitcher plant seepage bogs and Altamaha grit (sandstone) outcrops. The primary threats to biological diversity in the South Atlantic Coastal Plain listed by TNC are intensive silvicultural practices, including conversion of natural forests to highly managed pine monocultures and the clear-cutting of bottomland hardwood forests. Changes in water quality and quantity, caused by hydrologic alterations (impoundments, groundwater withdrawal, and ditching), and point and nonpoint pollution, are threatening the aquatic systems. Development is a growing threat, especially in coastal areas. Agricultural conversion, fire regime alteration, and the introduction of nonnative species are additional threats to the ecoregion's diversity. The South Atlantic DPS' spawning rivers, located in the South Atlantic Coastal Plain, are primarily of two types: brownwater (with headwaters north of the Fall Line, silt-laden) and blackwater (with headwaters in the coastal plain, stained by tannic acids).

Secor (2002) estimates that 8,000 adult females were present in South Carolina prior to 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 abundances of the remaining river populations within the DPS, each estimated to have fewer than 300 spawning adults, is estimated to be less than 1 percent of what they were historically (ASSRT 2007).

*Threats*
The South Atlantic 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 dredging and degraded water quality is contributing to the status of the South Atlantic DPS. Dredging is a present threat to the South Atlantic DPS and is contributing to their 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 DO 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 utilized by the South Atlantic DPS. Low DO is modifying sturgeon habitat in the Savannah due to dredging, and non-point source inputs are causing low DO in the Ogeechee River and in the St. Marys River, which completely eliminates juvenile nursery habitat in summer. Low DO has also been observed in the St. Johns River in the summer. Sturgeon are more sensitive to low DO and the negative (metabolic, growth, and feeding) effects caused by low DO increase when water temperatures are concurrently high, as they are within the range of the South Atlantic 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 South Atlantic 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, 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 South Atlantic DPS are likely much higher. The removal of large amounts of water from the system will alter flows, temperature, and DO. Water shortages and “water wars” are already occurring in the rivers occupied by the South Atlantic 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 DO, all of which are current stressors to the South Atlantic 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., DO). 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 (approximately 6 percent of historical population sizes in the Altamaha River, and 1 percent of historical population sizes in the remainder of the DPS) 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 results 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 fewer than 6 percent of its historical population size, with all river populations except the Altamaha estimated to be less than 1 percent of 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. 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 South Atlantic 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 South Atlantic DPS by modifying spawning, nursery, and foraging habitat. Habitat modifications through reductions in water quality are also contributing to the status of the South Atlantic DPS through reductions in DO, 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 is also a current impact to the South Atlantic 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 utilize 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 South Atlantic DPS have been ameliorated or reduced due to the existing regulatory mechanisms, such as the moratorium on directed fisheries for Atlantic sturgeon, bycatch is currently not being addressed through existing mechanisms. Further, access to habitat and water quality continues to be a problem even with NMFS' authority under the Federal Power Act to recommend fish passsage 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. Data required to evaluate water allocation issues are either very weak, in terms of determining the precise amounts of water currently being used, or non-existent, in terms of our knowledge of water supplies available for use under historical hydrologic conditions in the region. 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 South Atlantic DPS.

## 5.12 Summary of Available Information on Use of Action Area by Listed Species

### *5.12.1 Sea turtles*

Sea turtles are seasonally present in the Chesapeake Bay from April to early November each year, with the highest number of individuals present from June to October. One of the main factors influencing sea turtle presence in northern waters is seasonal temperature patterns (Ruben and Morreale 1999). Temperature is correlated with the time of year, with the 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 and depending on seasonal weather patterns, could be present from early April through November. The majority of sea turtle observations have been of loggerhead sea turtles, although all four species of sea turtles have been recorded in the 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 found that foraging turtles mainly occurred in areas where the water depth was between approximately 16 and 49 ft (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). Some of the areas to be dredged and the depths preferred by sea turtles do overlap, suggesting that if suitable forage was present, loggerheads and Kemp's ridleys may be foraging in the areas where dredging will occur.

### *5.12.2 Atlantic sturgeon in the Action Area*

Atlantic sturgeon are well distributed through the Chesapeake Bay. In the Bay area, spawning is only known to occur in the James River, which is outside of the action area. Young sturgeon are intolerant to salinity; as such, no eggs, larvae, or young of the year are likely to occur in the action area. Adult Atlantic sturgeon will pass through the action area as they move to the James River to spawn in the spring and then again as they return to the ocean. A fall spawning migration is also suspected in the James River but has not yet been confirmed. Subadult Atlantic sturgeon could be present in 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.

The Chesapeake Bay is known to be a congregation area for sturgeon from multiple DPSs; particularly during the summer. We have determined that Atlantic sturgeon in the action area are likely to originate from all five DPSs at the following frequencies: NYB 49%; South Atlantic

20%; Chesapeake Bay 14%; Gulf of Maine 11%; and Carolina 4%.

## 6.0 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: dredging operations, water quality, scientific research, shipping and other vessel traffic and fisheries, and recovery activities associated with reducing those impacts.

### 6.1 Federal Actions that have Undergone Formal or Early Section 7 Consultation

NMFS has undertaken several ESA section 7 consultations to address the effects of actions authorized, funded or carried out by Federal agencies. Each of those consultations sought to develop ways of reducing the probability of adverse impacts of the action on listed species. Consultations are detailed below.

#### *6.1.1 Maintenance of Federal Navigation Projects and Use of Sand Borrow Areas*

As explained in Section 2.0 above, USACE and NMFS have consulted previously on dredging of all channels and borrow areas considered in this Opinion. The use of endangered species observers began in 1994. Since then, a total of 64 sea turtles and two Atlantic sturgeon have been observed entrained in hopper dredges operating in the action area. All of these individuals were dead at the time of observation. Additionally, sea turtles and Atlantic sturgeon have been captured and released during sea turtle relocation trawling in association with hopper dredging. One sea turtle mortality has been recorded during relocation trawling. No interactions between sea turtles or Atlantic sturgeon have been observed during projects using a hydraulic pipeline (cutterhead) or mechanical dredge.

#### *6.1.2 Scientific Studies*

There is currently one scientific research permit issued pursuant to Section 10(a)(1)(A) of the ESA, that authorizes research on Atlantic sturgeon in the action area. Permit 16547 authorizes the US Fish and Wildlife Service to conduct research activities on Atlantic sturgeon in the Chesapeake Bay and tidal tributaries in Virginia. There is the potential for some research to take place in the action area. The permit authorizes the non-lethal capture, handling and sampling of a number of sturgeon and the unintentional mortality of three Atlantic sturgeon over the five year life of this permit. The permit expires in April 2017.

Several researchers, including the NMFS Northeast and Southeast Science Centers and several academic and independent researchers are authorized under various Section 10(a)(1)(A) permits to conduct surveys and sample sea turtles. Some of this activity may occur in the action area. More information on these permits can be obtained from: https://apps.nmfs.noaa.gov.

#### *6.1.3 Vessel Operations*

Potential adverse effects from federal vessel operations in the action area of this consultation include operations of the US Navy (USN) and the US Coast Guard (USCG), which maintain the largest federal vessel fleets, the EPA, the National Oceanic and Atmospheric Administration (NOAA), and the USACE. NMFS has conducted formal consultations with the USCG, the USN, EPA and NOAA on their vessel operations. In addition to operation of USACE vessels, NMFS has consulted with the USACE to recommend permit restrictions for operations of contract or private vessels around whales. Through the section 7 process, where applicable, NMFS has and will continue to, establish conservation measures for all these agency vessel operations to avoid adverse effects to listed species. Refer to the biological opinions for the USCG (September 15, 1995; July 22, 1996; and June 8, 1998) and the USN (May 15, 1997) for detail on the scope of vessel operations for these agencies and conservation measures being implemented as standard operating procedures. No interactions with sturgeon or sea turtles have been reported with any of the vessels considered in these Opinions.

#### *6.1.4 Authorization of Fisheries through Fishery Management Plans*

NMFS authorizes the operation of several fisheries in the action area under the authority of the Magnuson-Stevens Fishery Conservation Act and through Fishery Management Plans 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 Northeast Region (Maine through Virginia), formal ESA section 7 consultations have been conducted on the American lobster, Atlantic bluefish, Atlantic mackerel/squid/ butterfish, Atlantic sea scallop, monkfish, northeast multispecies, red crab, spiny dogfish, summer flounder/scup/black sea bass, and tilefish fisheries. These consultations have considered effects to loggerhead, green, Kemp's ridley and leatherback sea turtles. We have completed Biological Opinions on the operations of these fisheries. In each of these Opinions, we concluded that the ongoing action was likely to adversely affect but was not likely to jeopardize the continued existence of any sea turtle species. Each of these Opinions included an incidental take statement (ITS) exempting a certain amount of lethal and/or non-lethal take resulting from interactions with the fishery. These ITSs are summarized in the table below. Further, in each Opinion, we 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 sea turtle prey and/or habitat would be insignificant and discountable. We have also determined that the Atlantic herring and surf clam/ocean quahog fisheries do not adversely affect any species of listed sea turtles.

NMFS' Southeast Regional Office has carried out formal ESA section 7 consultations for several FMPs with action areas that at least partially overlap with the NEAMAP action area. These include: coastal migratory pelagics, swordfish/tuna/shark/ billfish (highly migratory species), snapper/grouper, dolphin/wahoo, and the Southeast shrimp trawl fisheries. The ITSs provided with these Opinions are included in the table below.

In addition to these consultations, NMFS has conducted a formal consultation on the pelagic longline component of the Atlantic highly migratory species FMP. Portions of this fishery occur within the NEAMAP action area. In a June 1, 2004 Opinion, NMFS concluded that the ongoing action was likely to adversely affect but was not likely to jeopardize the continued existence of loggerhead, Kemp's ridley or green sea turtles but was likely to jeopardize the continued existence of leatherback sea turtles. This Opinion included a Reasonable and Prudent Alternative that when implemented would modify operations of the fishery in a way that would remove jeopardy. This fishery is currently operated in a manner that is consistent with the RPA.

The RPA included an ITS which is reflected in the table below. Unless specifically noted, all numbers denote an annual number of captures that may be lethal or non-lethal.

**Table 7.** Information on Fisheries Opinions conducted by NMFS NERO and SERO for federally managed fisheries that operate in the action area

| **FMP** | **Date of Most Recent Opinion** | **Loggerhead** | **Kemp's ridley** | **Green** | **Leatherback** |
|---|---|---|---|---|---|
| American lobster | August 3, 2012 | 1 | 0 | 0 | 5 |
| Atlantic bluefish | October 29, 2010 | 82 (34 lethal) | 4 | 5 | 4 |
| Monkfish | October 29, 2010 | 173 (70 lethal) | 4 | 5 | 4 |
| Multispecies | October 29, 2010 | 46 in trawls (21 lethal) | 4 | 5 | 4 |
| Skate | October 29, 2010 | 39 (17 lethal) | 4 | 5 | 4 |
| Spiny dogfish | October 29, 2010 | 2 | 4 | 5 | 4 |
| Mackerel/squid/butterfish | October 29, 2010 | 62 (25 lethal) | 2 | 2 | 2 |
| Summer flounder/scup/black sea bass | October 29, 2010 | 205 (85 lethal) | 4 | 5 | 6 |
| Shark fisheries as managed under the Consolidated HMS FMP | May 20, 2008 | 679 (349 lethal) every 3 years | 2 (1 lethal) every 3 years | 2 (1 lethal) every 3 years | 74 (47 lethal) every 3 years |
| Atlantic sea scallop | July 12, 2012 | 2012: 301 (195 lethal); 2013 and beyond: 301 (115 lethal) | 3 | 2 | 2 |
| Coastal migratory pelagic | August 13, 2007 | 33 every 3 years | 4 every 3 years | 14 every 3 years | 2 every 3 years |
| Pelagic longline under the HMS FMP (per the RPA) | June 1, 2004 | 1,905 (339 lethal) every 3 years | *105 (18 lethal) every 3 years | *105 (18 lethal) every 3 years | 1764 (252 lethal) every 3 years |

**combination of 105 (18 lethal) Kemp's ridley, green, hawksbill, or Olive ridley*

We are in the process of reinitiating consultations that consider fisheries actions that may affect Atlantic sturgeon. Sturgeon originating from the five DPSs considered in this consultation are known to be captured and killed in fisheries operated in the action area. At the time of this writing, no Opinions considering effects of federally authorized fisheries on any DPS of Atlantic sturgeon have been completed. 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 action area. We are currently in the process of determining the effects of this annual loss to each of the DPSs. At this time, there is no bycatch estimate for fisheries that are regulated by NMFS SERO. Any of these fisheries that operate with sink gillnets or otter trawls are likely to interact with Atlantic sturgeon and be an additional source of mortality in the action area. Also, as noted above, NMFS SERO has reinitiated the consultation for shrimp trawling; consultation on the smooth dogfish fishery is also currently being conducted by SERO in coordination with NMFS HMS.

#### *6.1.4 Other Federally Authorized Actions*
We have completed several informal consultations on effects of in-water construction activities in the Chesapeake Bay permitted by the USACE. This includes several dock, pier and bank stabilization projects. No interactions with shortnose or Atlantic sturgeon have been reported in association with any of these projects.

We have also completed several informal consultations on effects of private dredging projects permitted by the USACE. All of the dredging was with a mechanical or cutterhead dredge. No interactions with shortnose or Atlantic sturgeon have been reported in association with any of these projects.

### 6.2 State or Private Actions in the Action Area

#### *6.2.1 State Authorized Fisheries*
Atlantic and shortnose sturgeon, and sea turtles may be vulnerable to capture, injury and mortality in fisheries occurring in state waters. The action area includes portions of Virginia state waters. Information on the number of sturgeon captured or killed in state fisheries is extremely limited and as such, efforts are currently underway to obtain more information on the numbers of sturgeon captured and killed in state water fisheries. We are currently working with the Atlantic States Marine Fisheries Commission (ASMFC) and the coastal states to assess the impacts of state authorized fisheries on sturgeon. We anticipate that some states are likely to apply for ESA section 10(a)(1)(B) Incidental Take Permits to cover their fisheries; however, to date, no applications have been submitted. Below, we discuss the different fisheries authorized by the states and any available information on interactions between these fisheries and sturgeon.

*American Eel*
American eel (*Anguilla rostrata*) is exploited in fresh, brackish and coastal waters from the southern tip of Greenland to northeastern South America. American 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*
Atlantic croaker (*Micropogonias undulates*) occur in coastal waters from the Gulf of Maine to Argentina, and are one of the most abundant inshore bottom-dwelling fish along the U.S. Atlantic coast. Atlantic croaker are managed under an ASMFC ISFMP (including Amendment 1 in 2005 and Addendum 1 in 2010), but no specific management measures are required.

Recreational fisheries for Atlantic croaker are likely to use hook and line; commercial fisheries targeting croaker primarily use otter trawls. The average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the Atlantic croaker fishery was estimated to be 70 loggerhead sea turtles (Warden 2011). Additional information on sea turtle interactions with gillnet gear, including gillnet gear used in the Atlantic croaker fishery, has also been recently published by Murray (2009a, 2009b). The average annual bycatch of loggerhead sea turtles in gillnet gear used in the Atlantic croaker fishery, based on VTR data from 2002-2006, was estimated to be 11 per year with a 95% CI of 3-20 (Murray 2009b). A quantitative assessment of the number of Atlantic sturgeon captured in the croaker fishery is not available. Mortality rates 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 observed trips for boats with federal permits only. We do not have an estimate of the number of interactions between sturgeon or sea turtles with the croaker fishery in the action area.

*Horseshoe crabs*
ASMFC manages horseshoe crabs through an Interstate Fisheries Management Plan that sets state quotas, and allows states to set closed seasons. Horseshoe crabs are present in Chesapeake Bay. 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 very low, at 0.05%. Few Atlantic sturgeon are expected to be caught in the horeshoe crab fishery in the action area. Sea turtles are not known to be captured during horseshoe crab fishing.

*Striped bass*
Striped bass are managed by ASMFC through Amendment 6 to the Interstate FMP, which requires minimum sizes for the commercial and recreational fisheries, possession limits for the recreational fishery, and state quotas for the commercial fishery (ASMFC 2003). Under Addendum 2, the coastwide striped bass quota remains the same, at 70% of historical levels. Data from the Atlantic Coast Sturgeon Tagging Database (2000-2004) shows that the striped bass fishery accounted for 43% of Atlantic sturgeon recaptures; however, no information on the total number of Atlantic sturgeon caught by fishermen targeting striped bass or the mortality rate is available. No information on interactions between sea turtles and the striped bass fishery is available.

*Weakfish*
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 gill nets, pound nets, haul seines, and trawls, with the majority of

landings occurring in the fall and winter months (ASMFC 2002). Fishing for weakfish occurs in Chesapeake Bay.

The average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the weakfish fishery was estimated to be 1 loggerhead sea turtle (Warden 2011). Additional information on sea turtle interactions with gillnet gear, including gillnet gear used in the weakfish fishery, 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 (1) per year with a 95% CI of 0-1 (Murray 2009b).

A quantitative assessment of the number of Atlantic sturgeon captured in the weakfish fishery is not available. A review of the NEFOP 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-striped 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).

*American lobster trap fishery*
An American lobster trap fishery also occurs in Chesapeake Bay. This fishery is managed under the ASMFC's ISFMP. This fishery has also been identified as a source of gear causing injuries to, and mortality of, loggerhead and leatherback sea turtles as a result of entanglement in vertical buoy lines of the pot/trap gear. Between 2002 and 2008, the lobster trap fishery in state waters was verified as the fishery involved in at least 27 leatherback entanglements in the Northeast Region. All entanglements involved the vertical line of the gear. These verified/confirmed entanglements occurred in Maine, Massachusetts, and Rhode Island state waters from June through October (Northeast Region STDN database). While no entanglements in lobster gear have been reported for Chesapeake Bay, the potential for future entanglement exists. Atlantic sturgeon are not known to interact with lobster trap gear.

*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.

*Whelk and blue crab fisheries*

A whelk fishery using pot/trap gear is known to occur in offshore Virginia. This fishery operates when sea turtles may be in the area. Sea turtles (loggerheads and Kemp's ridleys in particular) are believed to become entangled in the top bridle line of the whelk pot, given a few documented entanglements of loggerheads in whelk pots, the configuration of the gear, and the turtles' preference for the pot contents. Research is underway to determine the magnitude of these interactions and to develop gear modifications to reduce these potential entanglements. In New England waters, leatherbacks have been found entangled in whelk pot lines, so if leatherback turtles overlap with this gear in the action area, entanglement may occur. The blue crab fishery using pot/trap gear also occurs in the action area. The magnitude of interactions with these pots and sea turtles is unknown, but loggerheads and leatherbacks have been found entangled in this gear. For instance, in May and June 2002, three leatherbacks were documented entangled in crab pot gear in various areas of the Chesapeake Bay. Given the plethora of crab pot gear throughout the action area, it is possible that these interactions are more frequent than what has been documented. No interactions between Atlantic sturgeon and crab pot gear has been reported to NMFS.

## 6.3 Other Impacts of Human Activities in the Action Area

### *6.3.1 Contaminants and Water Quality*

Point source discharges (i.e., municipal wastewater, paper mill effluent, industrial or power plant cooling water or waste water) and compounds associated with discharges (i.e., metals, dioxins, dissolved solids, phenols, and hydrocarbons) contribute to poor water quality and may also impact the health of sturgeon populations. The compounds associated with discharges can alter the pH of receiving waters, which may lead to mortality, changes in fish behavior, deformations, and reduced egg production and survival. Agriculture and forestry occur within the Chesapeake Bay watershed, which potentially results in an increase in the amount of suspended sediment present in the river. Concentrated amounts of suspended solids discharged into a river system may lead to smothering of fish eggs and larvae and may result in a reduction in the amount of available dissolved oxygen.

Within the action area, sea turtles and optimal sea turtle habitat most likely have been impacted by pollution. Marine debris (e.g., discarded fishing line or lines from boats) can entangle turtles in the water and drown them. Turtles commonly ingest plastic or mistake debris for food, as observed with the leatherback sea turtle. The leatherback's preferred diet includes jellyfish, but similar looking plastic bags are often found in the turtle's stomach contents (Magnuson *et al.*. 1990).

Chemical contaminants may also have an effect on sea turtle reproduction and survival. While the effects of contaminants on turtles is relatively unclear, pollution may be linked to the fibropapilloma virus that kills many turtles each year (NMFS 1997). If pollution is not the causal agent, it may make sea turtles more susceptible to disease by weakening their immune systems. Furthermore, the Bay watershed is highly developed, which contributes to impaired water quality via stormwater runoff or point sources. The mainstem Chesapeake Bay has historically had low levels of chemical contamination (Chesapeake Bay Program Office 1999).

Excessive turbidity due to coastal development and/or construction sites could influence sea turtle foraging ability. Turtles are not very easily affected by changes in water quality or increased suspended sediments, but if these alterations make habitat less suitable for turtles and hinder their capability to forage, eventually they would tend to leave or avoid these less desirable areas (Ruben and Morreale 1999).

Water quality issues have been reported in at least localized areas of the Chesapeake Bay since the advent of the use of industrial fertilizers in the 1830s. Pollution increased in the Bay through the 19$^{th}$ century as increasing amounts of land were cleared and as industrial use of the area surrounding the Bay increased. Declines in shellfish beds were first reported in 1900 and by the 1940s advancements in fishing technology lead to decreases in fish populations in the Bay. Excess pollution to the Bay continued through to the early 1970s when regulation first began with the passage of the Clean Water Act. Also in the early 1970s, decreases in Bay grasses were recorded and a significant portion of bay grasses were destroyed by Tropical Storm Agnes in 1972. The loss of native oysters throughout the second half of the 20$^{th}$ century, largely due to introduced disease, also affected water quality in the Bay. In 1983, the first comprehensive report of Bay water quality highlighted four areas of concern: an overabundance of nitrogen and phosphorous pollution; dwindling underwater bay grasses; toxic chemical pollution; and, over-harvesting of living resources.

Since 1983, significant efforts have been made to clean up the Chesapeake Bay. While the levels of toxins and industrial pollutants have decreased, leading to largely improved water quality conditions, the Chesapeake Bay still faces many problems and remains polluted. Despite small successes in certain areas, the overall health of the Chesapeake Bay remains degraded.

Excess nutrients, such as nitrogen and phosphorous are pollutants. Rain washes nutrients off streets, rooftops, lawns, farms and industrial sites into the streams and rivers that flow into the Bay. Nutrient pollution is the largest problem currently affecting the Chesapeake Bay. Excess nutrients cause rapid growth of algae blooms which cloud the water and reduce the amount of sunlight reaching the Bay's aquatic life. When the algae blooms die, oxygen is depleted as the algae decay. Nutrients and sediment flowing into the Bay have reduced oxygen levels below what is needed by much of the aquatic life in the Bay.

Although there were improvements in the some areas of the Bay's health in 2009, the ecosystem remains in poor condition. EPA ranked the overall health of the Bay an average of 45 percent based on goals for water quality, habitats, and lower food web, and fish and shellfish abundance. This was a 6 percent increase from 2008. According to EPA, the modest gain in the health score was due to a large increase in 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 percent of the Bay and its tidal tributaries met Clean Water Act standards for dissolved oxygen between 2007-2009, a decrease of 5 percent from 2006-2008.
- 26 percent of the tidal waters met or exceeded guidelines for water clarity, a 12 percent 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 percent of the Bay-wide goal.
- The health of the Bay's bottom dwelling species reach a record high of 56 percent of the goal, improving by approximately 15% Bay-wide.
- The adult blue crab population increased to 223 million, its highest level since 1993.

## 7.0 CLIMATE CHANGE

The discussion below presents background information on global climate change and information on past and predicted future effects of global climate change throughout the range of the listed species considered here. Additionally, we present the available information on predicted effects of climate change in the action area (i.e., the lower Chesapeake Bay) and how listed sea turtles and sturgeon may be affected by those predicted environmental changes over the life of the proposed action (i.e., between now and 2062). Climate change is relevant to the Status of the Species, Environmental Baseline and Cumulative Effects sections of this Opinion; rather than include partial discussion in several sections of this Opinion, we are synthesizing this information into one discussion. Consideration of effects of the proposed action in light of predicted changes in environmental conditions due to anticipated climate change are included in the Effects of the Action section below (section 8.0 below).

### 7.1 Background Information on Global climate change

The global mean temperature has risen 0.76ºC (1.36°F) over the last 150 years, and the linear trend over the last 50 years is nearly twice that for the last 100 years (Intergovernmental Panel on Climate Change (IPCC) 2007a) and precipitation has increased nationally by 5%-10%, mostly due to an increase in heavy downpours (NAST 2000). 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 other 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 2007b); these trends are most apparent over the past few decades. Information on future impacts of climate change in the action area is discussed below.

Climate model projections exhibit a wide range of plausible scenarios for both temperature and precipitation over the next century. Both of the principal climate models used by the National Assessment Synthesis Team (NAST) project warming in the southeast by the 2090s, but at different rates (NAST 2000): the Canadian model scenario shows the southeast U.S. experiencing a high degree of warming, which translates into lower soil moisture as higher temperatures increase evaporation; the Hadley model scenario projects less warming and a significant increase in precipitation (about 20%). The scenarios examined, which assume no major interventions to reduce continued growth of world greenhouse gases (GHG), indicate that temperatures in the U.S. will rise by about $3^{o}$-$5^{o}$C ($5^{o}$-$9^{o}$F) on average in the next 100 years which is more than the projected global increase (NAST 2000). A warming of about $0.2^{o}$C (0.4°F) per decade is projected for the next two decades over a range of emission scenarios (IPCC 2007). 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 resulted in increased precipitation, river discharge, and glacial and sea-ice melting (Greene *et al.* 2008).

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 (Greene *et al.* 2008, IPCC 2006). 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 2006). The NAO impacts climate variability throughout the northern hemisphere (IPCC 2006). Data from the 1960s through the present show that the NAO index has increased from minimum values in the 1960s to strongly positive index values in the 1990s and somewhat declined since (IPCC 2006). This warming extends over 1000m (0.62 miles) deep and is deeper than anywhere in the world oceans and is particularly evident under the Gulf Stream/ North Atlantic Current system (IPCC 2006). 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 (Greene *et al.* 2008, IPCC 2006). There is evidence that the NADW has already freshened significantly (IPCC 2006). 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 whole earth system (Greene *et al.* 2008).

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 Delaware River, 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 for the U.S. Warming is very likely to continue in the U.S. over the next 25 to 50 years regardless of reduction in GHGs, 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 in the next 25 to 50 years, and it is possible that the rate of change 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).

A warmer and drier climate is expected to result in reductions in stream flows and increases in water temperatures. Expected consequences 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 other than heat 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 in the southeast 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. Within 50 years, river basins that are impacted by dams or by extensive development may experience greater changes in discharge and water stress than unimpacted, free-flowing rivers (Palmer *et al.* 2008).

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$^{o}$C (0.4°F) per decade; and 3) a rise in sea level (NAST 2000). A warmer and drier climate will reduce stream flows and increase water temperature resulting in a decrease of DO and an increase in the concentration of nutrients and toxic chemicals due to reduced flushing. Sea level is expected to continue rising: during the 20th century global sea level has increased 15 to 20 cm (6-8 inches).

## 7.2 Species Specific Information on Climate Change Effects

### *7.2.1 Loggerhead Sea Turtles*

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 increased polar melting and changes in precipitation which may lead to 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 the southern portions of the range.

Climate change 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 and 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.

However, Van Houtan and Halley (2011) recently developed climate based models to investigate loggerhead nesting (considering juvenile recruitment and breeding remigration) in the North Pacific and Northwest Atlantic. These models found that climate conditions/oceanographic influences explain loggerhead nesting variability, with climate models alone explaining an average 60% (range 18%-88%) of the observed nesting changes over the past several decades. In terms of future nesting projections, modeled climate data show a future positive trend for Florida nesting, with increases through 2040 as a result of the Atlantic Multidecadal Oscillation signal.

### *7.2.2 Kemp's Ridley Sea Turtles*

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 (PAIS) shoreline is accreting, unlike much of the Texas coast, and with nesting increasing and the sand temperatures slightly cooler than at

Rancho Nuevo, PAIS could become an increasingly important source of males for the population.

### *7.2.3 Green Sea Turtles*

The five year status review for green sea turtles (NMFS and USFWS 2007d) notes that global climate change is affecting green sea turtles and is likely to continue to be a threat. There is an increasing female bias in the sex ratio of green turtle hatchlings. While this is partly attributable to imperfect egg hatchery practices, global climate change is also implicated as a likely cause. This is because warmer sand temperatures at nesting beaches are likely to result in the production of more female embryos. At least one nesting site, Ascension Island, has had an increase in mean sand temperature in recent years (Hays *et al.* 2003 in NMFS and USFWS 2007d). Climate change may also affect 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, at this time, we do not know how much of this bias is due to hatchery practice and how much is due to increased sand temperature. Because we do not have information 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, we cannot predict the extent of any future bias. Also, we do not know to what 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.

### *7.2.4 Leatherback sea turtles*

Global climate change has been identified as a factor that may affect leatherback habitat and biology (NMFS and USFWS 2007b); however, no significant climate change related impacts to leatherback sea turtle populations have been observed to date. Over the long term, climate change related impacts will likely influence biological trajectories in the future on a century scale (Parmesan and Yohe 2003). Changes in marine systems associated with rising water temperatures, changes in ice cover, salinity, oxygen levels and circulation including shifts in ranges and changes in algal, plankton, and fish abundance could affect leatherback prey distribution and abundance. Climate change is expected to expand foraging habitats into higher latitude waters and some concern has been noted that increasing temperatures may increase the female:male sex ratio of hatchlings on some beaches (Morosovsky *et al.* 1984 and Hawkes *et al.* 2007 in NMFS and USFWS 2007b). However, due to the tendency of leatherbacks to have individual nest placement preferences and deposit some clutches in the cooler tide zone of beaches, the effects of long-term climate on sex ratios may be mitigated (Kamel and Mrosovsky 2004 in NMFS and USFWS 2007b).

Additional potential effects of climate change on leatherbacks include range expansion and changes in migration routes as increasing ocean temperatures shift range-limiting isotherms north (Robinson *et al.* 2008). Leatherbacks have expanded their range in the Atlantic north by 330 km in the last 17 years as warming has caused the northerly migration of the 15°C sea surface temperature (SST) isotherm, the lower limit of thermal tolerance for leatherbacks (McMahon and Hays 2006). Leatherbacks are speculated to be the best able to cope with climate change of all the sea turtle species due to their wide geographic distribution and relatively weak beach fidelity. Leatherback sea turtles may be most affected by any changes in the distribution of their primary jellyfish prey, which may affect leatherback distribution and foraging behavior (NMFS and USFWS 2007b). Jellyfish populations may increase due to ocean warming and other factors (Brodeur *et al.* 1999; Attrill *et al.* 2007; Richardson *et al.* 2009). However, any increase in jellyfish populations may or may not impact leatherbacks as there is no evidence that any leatherback populations are currently food-limited.

Increasing temperatures are expected to result in increased polar melting and changes in precipitation which may lead to 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 (Fish *et al.* 2005). This effect would potentially 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. While there is a reasonable degree of certainty that 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 quantifiable at this time (Hawkes *et al.* 2009).

### *7.2.5 Atlantic sturgeon*

Global climate change may affect all DPSs of Atlantic sturgeon in the future; however, effects of increased water temperature and decreased water availability are most likely to effect the South Atlantic and Carolina DPSs. 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 Atlantic sturgeon have limited tolerance to salinity and remain in waters with little to no salinity. If the salt wedge moves further upstream, Atlantic 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 saltwedge 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 saltwedge. It is unlikely that shifts in the location of the saltwedge 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 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 prefer 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 Atlantic 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.

### 7.3 Effects of Climate Change in the Action Area

In 2008, the Chesapeake Bay Program's Scientific and Technical Advisory Committee (STAC) reviewed the current understanding of climate change impacts on the tidal Chesapeake Bay and identified critical knowledge gaps and research priorities (Pyke et al. 2008). The report notes that the Bay is sensitive to climate-related forcings of atmospheric CO2 concentration, sea level, temperature, precipitation, and storm frequency and intensity and that scientists have detected significant warming and sea-level-rise trends during the 20$^{th}$ century in the Chesapeake Bay. Climate change scenarios for CO2 emissions examined by STAC suggest that the region is likely to experience significant changes in climatic conditions throughout the 21$^{st}$ century including increases in CO2 concentrations, sea level rise of 0.7 to 1.6 meters, and water temperature increasing by up to 2° to 6°C. The STAC also indicated that other changes are likely, but less certain, including increases in precipitation quantity (particularly in winter and spring), precipitation intensity, intensity of tropical and extratropical cyclones (though their frequency may decrease), and sea-level variability. Changes in annual streamflow are highly uncertain, though winter and spring flows will likely increase. The report notes that changes in human activities over the next century have the potential to either exacerbate or ameliorate the predicted climatically induced changes. Given the uncertainty in precipitation and streamflow forecasts, the direction of some changes remains unknown; however, the report states that certain consequences appear likely including increasing sea level in the Bay: increasing variability in salinity due to increases in precipitation intensity, drought, and storminess; more frequent blooms of harmful algae due to warming and higher $CO_2$ concentrations; potential decreases in the prevalence of eelgrass; possible increases in hypoxia due to warming and greater winter-spring streamflow; and, altered interactions among trophic levels, potentially favoring warm-water fish and shellfish species in the Bay.

In 2010, EPA conducted a preliminary assessment of climate change impacts on the Chesapeake Bay using a version of the Phase 5 Bay Watershed Model and tools developed for EPA's BASINS 4 system including the Climate Assessment Tool. Flows and associated nutrient and sediment loads were assessed in all river basins of the Chesapeake Bay with three key climate change scenarios reflecting the range of potential changes in temperature and precipitation in the year 2030. The three key scenarios came from a larger set of 42 climate change scenarios that were evaluated from 7 Global Climate Models, 2 scenarios from the IPCC Special Report on Emissions Scenarios storylines, and 3 assumptions about precipitation intensity in the largest events. The 42 climate change scenarios were run on the Phase 5 Watershed Model of the Monocacy River watershed, a subbasin of the Potomac River basin in the Piedmont region, using a 2030 estimated land use based on a sophisticated land use model containing socioeconomic estimates of development throughout the watershed.

The results provide an indication of likely precipitation and flow patterns under future potential climate conditions (Linker et al. 2007, 2008). Projected temperature increases tend to increase evapotranspiration in the Bay watershed, effectively offsetting increases in precipitation. The preliminary analysis indicated overall decreases in annual stream flow as well as decreases in nitrogen and phosphorus loads. The higher intensity precipitation events yielded estimated increases in annual sediment loads.

Assuming that there is a linear trend in increasing water temperatures, and that a predicted 2-6°C increase in water temperature by 2100 for the Chesaepeake Bay would also be experienced in the action area, one could anticipate a 0.02-.07°C increase each year. Because the action considered here will be complete in 50 years, we expect an increase in temperature of no more than 3.5°C in the action area over the duration of the proposed action.

### 7.4 Effects of Climate Change in the Action Area to 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; however, we have considered the available information to consider likely impacts to sturgeon in the action area. The proposed action under consideration will take place through 2062; thus, we consider here, likely effects of climate change during that period.

Over time, the most likely effect to Atlantic sturgeon would be if sea level rise was great enough to consistently shift the salt wedge far enough north in a spawning river which would restrict the range of juvenile sturgeon and may affect the development of these life stages. However, there are no spawning rivers in the action area (the nearest is the James River, maintenance of which is not considered in this Opinion).

In the action area, it is possible that changing seasonal temperature regimes could result in changes in the timing of seasonal migrations through the area as sturgeon move throughout the area. There could be shifts in the timing of spawning. Presumably, if water temperatures warm earlier in the spring, because water temperature is a primary spawning cue, spawning migrations and spawning events could occur earlier in the year. 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 or river flow by itself will affect the seasonal movements of sturgeon through the action area. However, it seems most likely that spawning would shift earlier in the year.

Any forage species that are temperature dependent may also shift in distribution as water temperatures warm. However, 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 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.

Limited information on the thermal tolerances of Atlantic sturgeon is available. Atlantic sturgeon have been observed in water temperatures above 30°C in the south (see Damon-Randall *et al.* 2010). In the laboratory, juvenile Atlantic sturgeon showed negative behavioral and bioenergetics responses (related to food consumption and metabolism) after prolonged exposure to temperatures greater than 28°C (82.4°F) (Niklitschek 2001). Tolerance to temperatures is thought to increase with age and body size (Ziegweid *et al.* 2008 and Jenkins *et al.* 1993), however, no information on the lethal thermal maximum or stressful temperatures for subadult or adult Atlantic sturgeon is available. Shortnose sturgeon, have been documented in the lab to experience mortality at temperatures of 33.7°C (92.66°F) or greater and are thought to experience stress at temperatures above 28°C. For purposes of considering thermal tolerances, we consider Atlantic sturgeon to be a reasonable surrogate for shortnose sturgeon given similar geographic distribution and known biological similarities.

Mean monthly ambient temperatures in the Chesapeake Bay range from 2-26°C[7]. As explained above, available predictions estimate an increase in ambient water temperature in the Bay of up to 3.5°C over the duration of the proposed action. This could result in shifts in the distribution of sturgeon out of certain areas during the warmer months. Information from southern river systems suggests that during peak summer heat, sturgeon are most likely to be found in deep water areas where temperatures are coolest. Thus, we could expect that over time, sturgeon would shift out of shallow habitats on the warmest days. This could result in reduced foraging opportunities if sturgeon were foraging in shallow waters; however if sufficient amounts of deep water habitat were available and suitable forage was present in those areas, there may be no negative impacts of this habitat shift. While some areas of the Chesapeake Bay are hypoxic during the summer months, this condition is not common in the action area; therefore, it is unlikely that the increase in surface temperature would result in an increase in hypoxic conditions in the action area.

As described above, over the long term, global climate change may affect Atlantic sturgeon by affecting the location of the salt wedge, distribution of prey, water temperature and water quality.

[7] Information obtained from www.nodc.noaa.gov/dsdt/cwtg/satl.html; last accessed 7-25-12.

However, there is significant uncertainty, due to a lack of scientific data, on the degree to which these effects may be experienced and the degree to which Atlantic sturgeon will be able to successfully adapt to any such changes. Any activities occurring within and outside the action area that contribute to global climate change are also expected to affect Atlantic sturgeon in the action area. While we can make some predictions on the likely effects of climate change on these species, without modeling and additional scientific data these predictions remain speculative. Additionally, these predictions do not take into account the adaptive capacity of these species which may allow them to deal with change better than predicted.

### 7.5 Effects of Climate Change in the Action Area on Sea Turtles

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 sea turtles; however, we have considered the available information to consider likely impacts to these species in the action area.

Sea turtles are most likely to be affected by climate change due to increasing sand temperatures at nesting beaches which in turn would result in increased female: male sex ratio among hatchlings, sea level rise which could result in a reduction in available nesting beach habitat, increased risk of nest inundation, 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 changes in water temperature which could possibly lead to a northward shift in their range.

Over the time period considered in this Opinion, sea surface temperatures are expected to rise up to 3.5°C in the Chesapeake Bay. It is unknown if that is enough of a change to contribute to shifts in the range or distribution 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. However, if temperature affected the distribution of sea turtle forage in a way that decreased forage in the action area, sea turtles may be less likely to occur in the action area. The nesting range of some sea turtle species may shift northward. Nesting in Virginia is relatively rare, but a small number of loggerhead nests are laid on Virginia Beach and other ocean facing beaches each year. The maximum number of nests laid in Virginia in a particular year was nine. As of the end of July 2012, seven loggerhead nests have been recorded and one Kemp's ridley nest (at Dam Neck); the first time a Kemp's ridley nest has ever been documented in Virginia and the furthest north this species has ever been documented to nest. 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. Predicted increases in water temperatures between now and 2062 are not great enough to allow successful rearing of sea turtle eggs in the action area or the survival of hatchlings that enter the water outside of the summer months. Therefore, it is unlikely that over the time period considered here, that there would be an increase in nesting activity in the action area or that hatchlings would be present in the action area.

We have considered whether the disposal of sand at Sandbridge Beach, Virginia Beach and Ft. Story would impact sea turtles. As noted above, there is the potential for a northward shift in nesting by sea turtles. Given existing nesting locations and the duration of time considered in this Opinion (50 years), it seems extremely unlikely that the range of leatherback or Kemp's ridley sea turtle nesting would shift enough so that nesting would occur on additional beaches in the Chesapeake Bay. The furthest north that leatherbacks nest is southeastern Florida. Kemp's ridleys only nest in Mexico. It is more likely that any shift in nesting to Chesapeake Bay beaches would be from loggerheads and/or green sea turtles (which normally nest as far north as North Carolina). The disposal of material at Sandbridge Beach, Virginia Beach and Ft. Story is meant to stabilize and restore eroding habitats and maintain existing beach. None of the activity is likely to reduce the suitability of these beaches for potential future nesting.

## 8.0 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 not identified any interdependent or interrelated actions. Because there is no critical habitat in the action area, there are no effects to critical habitat to consider in this Opinion.

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 fifty-year life of these projects (i.e., through 2062). 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.

### 8.1 Hopper Dredge

Hopper dredges are self-propelled seagoing vessels that are equipped with propulsion machinery, sediment containers (hoppers), dredge pumps, and trailing suction drag-heads required to perform their essential function of excavating sediments from the channel bottom. Hopper dredges have propulsion power adequate for required free-running speed and dredge against strong currents. They also have excellent maneuverability. This allows hopper dredges to provide a safe working environment for crew and equipment dredging bar channels or other areas subject to rough seas. Hopper dredges also are more practicable when interference with vessel traffic must be minimized.

A hopper dredge removes material from the bottom of the channel in relatively thin layers, usually 2-12 inches, depending upon the density and cohesiveness of the dredged material. Pumps located within the hull, but sometimes mounted on the drag arm, create a region of low pressure around the dragheads and force water and sediment up the drag arm and into the hopper. The more closely the draghead is maintained in contact with the sediment, the more efficient the dredging providing sufficient water is available to slurry the sediments (i.e. the greater the concentration of slurried sediment pumped into the hopper). Hopper dredges can efficiently dredge non-cohesive sands and more cohesive silts and low density clay. Draghead types may consist of IHC and California type dragheads.

California type dragheads sit flatter in the sediment than the IHC configuration which is more upright. Individual draghead designs (i.e. dimensions, structural reinforcing/configuration) vary between dredging contractors and hopper vessels. Port openings on the bottom of dragheads also vary between contractors and draghead design. Generally speaking the port geometry is typically rectangular or square with minimum openings of ten inch by ten inch or twelve inch by twelve inch or some rectangular variation.

Industry and government hopper dredges are equipped with various power and pump configurations and may differ in hopper capacity with different dredging capabilities. An engineering analysis of the known hydraulic characteristics of the pump and pipeline system on the USACE hopper dredge “Essayons” (i.e. a 6,423 cy hopper dredge) indicates an operational flow rate of forty cubic feet per second with a flow velocity of eleven feet per second at the draghead port openings. The estimated force exerted on a one-foot diameter turtle (i.e. one foot diameter disc shaped object) at the pump operational point in this system was estimated to be twenty-eight pounds of suction or drag force on the object at the port opening of the draghead.

Dredging is typically parallel to the centerline or axis of the channel. Under certain conditions, a waffle or crisscross pattern may be utilized to minimize trenching or during clean-up dredging operations to remove ridges and produce a more level channel bottom. This movement up and down the channel while dredging is called trailing and may be accomplished at speeds of 1-3 knots, depending on the shoaling, sediment characteristics, sea conditions, and numerous other factors. In the hopper, the slurry mixture of the sediment and water is managed by a weir system to settle out the dredged material solids and overflow the supernatant water. When an economic load is achieved, the vessel suspends dredging, the drag arms are raised, and the dredge travels to the designated placement site. Because dredging stops during the trip to the placement site, the overall efficiency of the hopper dredge is dependent on the distance between the dredging location and placement sites; the more distant to the placement site, the less efficient the dredging operation resulting in longer contract periods to accomplish the work.

Sea turtle deflectors utilized on hopper dredges are rigid V-shaped attachments on the front of the dragheads and are designed and intended to plow the sediment in front of the draghead. The plowing action creates a sand wave that rolls in front of the deflector. The propagated sand wave is intended to shed the turtle away from the deflector and out of the path of the draghead. The effectiveness of the rigid deflector design and its ability to reduce entrainment was studied by the USACE through model and field testing during the 1980s and early 1990s. The deflectors are most effective when operating on a uniform or flat bottom. However, the deflector effectiveness may be diminished when significant ridges and troughs are present that prevent the deflector from plowing and maintaining the sand wave and the dragheads from maintaining firm contact with the channel bottom.

### *8.1.1 Entrainment in 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, adult and juvenile leatherback 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.

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 USACE, no leatherback sea turtles have been entrained in hopper dredge operations operating along the U.S. Atlantic coast (USACE Sea Turtle Warehouse, 2012). 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.

Sea turtles become entrained in hopper dredges as the draghead moves along the bottom. Entrainment occurs when sea turtles do not or cannot escape from the suction of the dredge. Sea turtles can also be crushed on the bottom by the moving draghead. Mortality most often occurs when turtles are sucked into the dredge draghead, pumped through the intake pipe and then killed as they cycle through the centrifugal pump and into the hopper. Because entrainment is believed to occur primarily while the draghead is operating on the bottom, it is likely that only those species feeding or resting on or near the bottom would be vulnerable to entrainment. Turtles can also be entrained if suction is created in the draghead by current flow while the device is being placed or removed, or if the dredge is operating on an uneven or rocky substrate and rises off the bottom. Recent information from the USACE 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. Increased risk of entrainment in these conditions may also be related to reduced effectiveness of the turtle deflector when operating on uneven terrain.

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.

*8.1.1.1 Background Information on Entrainment of Sea Turtles in 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 May 2012, 74 sea turtles deaths (see Table 8) related to hopper dredge activities have been recorded in waters north of the North Carolina/Virginia border (USACE Sea Turtle Database[8]); 64 of these turtles have been entrained in dredges operating in Chesapeake Bay.

Before 1994, endangered species observers were not required on board hopper dredges and 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 8.  Sea Turtle Takes in USACE NAD Dredging Operations

| **Project Location** | **Year of Operation** | **Cubic Yardage Removed** | **Observed Takes** |
|---|---|---|---|
| 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 |

8 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.

| | | | |
|---|---|---|---|
| Thimble Shoal Channel | 2006 | 300,000 | 1 loggerhead |
| Delaware Bay | 2005 | 50,000 | 2 Loggerheads |
| Thimble Shoal Channel | 2003 | 1,828,312 | 7 Loggerheads<br>1 Kemp's ridley<br>1 unknown |
| Cape Henry | 2002 | 1,407,814 | 6 Loggerheads<br>1 Kemp's ridley<br>1 green |
| VA Beach Hurricane Protection Project (Cape Henry) | 2002 | 1,407,814 | 1 Loggerhead |
| York Spit Channel | 2002 | 911,406 | 8 Loggerheads<br>1 Kemp's ridley |
| Cape Henry | 2001 | 1,641,140 | 2 loggerheads<br>1 Kemp's ridley |
| VA Beach Hurricane Protection Project (Thimble Shoals) | 2001 | 4,000,000 | 5 loggerheads<br>1 unknown |
| Thimble Shoal Channel | 2000 | 831,761 | 2 loggerheads<br>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<br>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 |
| | | | ***TOTAL = 74 Turtles*** |

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 Opinions (i.e., prior to 1995), NMFS 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.

NMFS raised this issue to the USACE Norfolk District 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, the USACE 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. The USACE's 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 ensure that 100% observer coverage is attained 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. More recently issued Opinions have required 100% observer coverage which increases the likelihood of takes being detected and reported.

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 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 it cannot 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. 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 9.** 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 | 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 | 6/13/06- | 419,624 | 1.000 | 419,624.00 | 1 | 1 | 0 | 0 | 0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Channel | 6/30/06; 7/10/06-7/27/06 | | | | | | | | |
| York Spit Channel | 04/01/04-04/06/04; 5/23/04-5/28/04 | 93,665 | 1.000 | 93,665.00 | 0 | 0 | 0 | 0 | 0 |
| 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 | 6/26/01-11/30/01 | 4,000,000 | 1.000 | 4,000,000.00 | 6 | 5 | 0 | 0 | 1 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Protection (Thimble Shoal Channel) | | | | | | | | | |
| Cape Henry Channel | 04/08/00-06/02/00 | 541,037 | 1.000 | 541,037.00 | 0 | 0 | 0 | 0 | 0 |
| Thimble Shoal Channel | 6/22/00-7/31/00; 8/13/00-9/19/00; 12/16/99-1/23/00 | 1,370,316 | 0.667 | 914,000.77 | 3 | 2 | 0 | 0 | 1 |
| 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 |
| | | | **TOTAL:** | **18,442,566** | ***64*** | **54** | **5** | **1** | **4** |

*8.1.1.2 Predicted Entrainment in Proposed Hopper Dredging*

Based on the data in Table 9, we calculate that an average of one sea turtle is entrained for approximately every 300,000 cy removed (18,442,566 CY removed April – November divided by 64 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 300,000 cubic yards 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 64 entrained sea turtles, 60 have been identifiable to species; 54 were loggerheads, 5 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 300,000 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:

| **Project** | **Total Volume over 50 years (cubic yards)** | **Number of Interactions over 50 years** | | | |
|---|---|---|---|---|---|
| | | **Total Sea Turtles** | **Loggerhead** | **Kemp's ridley** | **green** |
| Baltimore Harbor Entrance Channels | 64,500,000 | 215 | 194 | 17 | 4 |
| York River Entrance Channel | 6,500,000 | 22 | 20 | 2 | 0 |
| Hampton Roads (TS and AOC) | 50,300,000 | 168 | 151 | 13 | 3 |

| | | | | | |
|---|---|---|---|---|---|
| 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 |
| | | **TOTAL:** | **415** | **37** | **10** |

*1 Kemp's ridley or green

*8.1.3 Hopper Dredge Entrainment – Atlantic Sturgeon*

Atlantic sturgeon are vulnerable to entrainment in hopper dredges. Entrainment is defined as the direct uptake of aquatic organisms by the suction field generated at the draghead. 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.

Entrainment of Atlantic sturgeon during hopper dredging operations in Federal navigation channels appears to be relatively rare. The USACE has documented a total of 35 incidents of sturgeon entrainment or capture of sturgeon species (all sturgeon species) on monitored projects for all types of dredge plant (mechanical, hydraulic pipeline, and hopper dredge). Twenty of the 35 documented observations were Atlantic sturgeon entrained by hopper dredge plants. A table presenting the observed sturgeon entrained or captured on monitored USACE projects between 1990 and March 2012 is presented as Appendix C. 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 9 above) with only two documented entrainments of Atlantic sturgeon.

Hydraulic dredges operate for prolonged periods underwater, with minimal disturbance, but generate continuous flow fields of suction forces while dredging. Entrainment is believed to occur primarily when the draghead is not in firm contact with the channel bottom, so the potential exist 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 Atlantic sturgeon (Reine and Clarke, 1998). These parameters also govern the ability of the dredge to entrain other species of fish, sea turtles, and shellfish.

Another 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 powerful swimmers and they are prone to bottom-holding behaviors, which make them vulnerable to entrainment when in close proximity to dragheads (Hoover et al., 2011).

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 10. Most of these interactions occurred within rivers and harbors.

**Table 10. USACE Atlantic Sturgeon Entrainment Records from Hopper Dredge Operations 1990-2012**

| Project Location | Corps Division/District * | Month/Year Interaction Observed | Cubic Yards Removed | Observed** Entrainment |
|---|---|---|---|---|
| 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 | 1 |
| Wilmington Harbor, Cape Fear River (NC) | SAD/SAW | Sep-98 | 196,400 | 1 |

| | | | | |
|---|---|---|---|---|
| Charleston Harbor (SC) | SAD/SAC | Mar-00 | 5,627,386 | 1 |
| Brunswick Harbor (GA) | SAD/SAS | 2-Feb | 1,459,630 | 1 |
| Charleston Harbor | SAD/SAC | 4-Jan | 1,449,234 | 1 |
| Brunswick Harbor | SAD/SAS | 5-Mar | 966,000 | 1 |
| Brunswick Harbor | SAD/SAS | 6-Dec | 1,198,571 | 1 |
| Savannah Entrance Channel | SAD/SAS | 7-Nov | 973,463 | 1 |
| Sandy Hook Channel (NJ) | NAD/NANY | 8-Aug | 23,500 | 1 |
| Savannah Entrance Channel | SAD/SAS | 9-Mar | 261,780 | 1 |
| Brunswick Entrance Channel | SAD/SAS | 10-Feb | 1,728,339 | 3 |
| Wilmington Harbor | SAD/SAW | 10-Dec | 857,726 | 1 |
| York Spit (VA) | NAD/NAN | 11-Apr | 1,630,713 | 2 |
| Charleston Harbor | SAD/SAC | 12-Mar | 1,100,000 | 1 |
| | | **Total** | **22,432,374** | **19** |

* 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.

In general, entrainment of large mobile animals, such as Atlantic 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.

The only instances of observed Atlantic sturgeon entrainment in hopper dredges in the NMFS Northeast 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 and one dead Atlantic sturgeon entrained in Ambrose Channel, NY in 2012. As described in the discussion of sea turtles above, many other hopper dredge projects have occurred in NMFS Northeast 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 10, 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 9) as well as projects outside the action area where interactions with Atlantic sturgeon were recorded (see table 10), 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 9) 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, only subadults and adults will be present; therefore, we anticipate that all entrained Atlantic sturgeon will be 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 11.** Expected Entrainment of Atlantic sturgeon in hopper dredges

| Project | Total Volume over 50 year period | Number of Interactions over 50 years | | | | | |
|---|---|---|---|---|---|---|---|
| | | **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 |
| York River Entrance Channel | 6,500,000 | 3 | 2 | 1* | 1* | 1* | 1* |
| Thimble Shoals and Atlantic Ocean Channel | 50,300,000 | 25 | 12 | 5 | 4 | 3 | 1 |
| Virginia Beach Hurricane Project (TSS and AO borrow areas) | 4,400,000 | 2 | 1 | 1* | 1* | 1* | 1* |
| Sandbridge Shoal | 12,500,000 | 6 | 3 | 1 | 1 | 1** | 1** |
| | **Total:** | | **34** | **14** | **10** | **8** | **3** |

*1 SA, CB, GOM or Carolina DPS Atlantic sturgeon
**1 GOM or Carolina DPS Atlantic sturgeon

### *8.1.4 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., 2007*a*).

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 2001, a study was done in the Delaware River of overflow and nonoverflow hopper dredging. 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 and Atlantic Ocean.

No information is available on the effects of total suspended solids (TSS) on juvenile and adult sea turtles. 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). 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 and any effect on sea turtle movements is likely to be insignificant. While an increase in suspended sediments may cause sea turtles to alter their normal movements, any change in behavior is likely to be insignificant as it will only involve movement to alter course out of the sediment plume, which is expected to be limited to the navigation channel and be present at any location for no more than 8 minutes. Based on this information, any increase in suspended sediment is not likely to affect the movement of sea turtles between foraging areas or while migrating or otherwise negatively affect listed species in the action area. Based on this information, it is likely that the effect of the suspension of sediment resulting from dredging operations will be 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 is likely to be insignificant as it will only involve movement further up in the water column, or movement to an area just outside of the navigation channel. Based on this information, any increase in suspended sediment is not likely to affect the movement of Atlantic sturgeon between foraging areas and/or concentration areas during any phase of dredging or otherwise negatively affect sturgeon in the action area.

### 8.2 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 that 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.

### *8.2.1 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.

### *8.2.2 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 areas where Atlantic sturgeon are known to form aggregations. 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 the deepening. 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 50 year period 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 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:

| **Number of Atlantic Sturgeon over 50 year Period** | **DPS** |
|---|---|
| 25 | New York Bight |
| 10 | South Atlantic |
| 8 | Chesapeake Bay |
| 5 | Gulf of Maine |
| 2 | Carolina |

### *8.2.3 Interactions with the Sediment Plume*

The increased turbidity and suspended sediments related to the 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 river, 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 USACE, 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 NMFS 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).

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. 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.

### 8.3 Mechanical Dredge

Mechanical dredging will be used in association with CIEE and in some of the Norfolk Harbor Channels. Bucket 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 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. 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.

#### *8.3.1 Impacts to Sea Turtles*

No sea turtles have been captured in mechanical dredges in the action area. The USACE has no records of any sea turtles being captured in mechanical dredges anywhere. As such, we do not anticipate any capture of sea turtles during any mechanical dredging considered here.

#### *8.3.2 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. 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.

### 8.4 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 extremely small area affected will cause any effects to be insignificant and discountable. While this 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, the USACE has reported 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 in the vicinity of the beach disposal sites during disposal may temporarily avoid the disposal area; however, as any effects to movements will be small and temporary, these effects will be insignificant. Similar effects of suspended sediment and turbidity will be experienced at the ocean disposal sites; as such, effects to sturgeon and sea turtles will be insignificant and discountable. Effects of disposal on prey resources are considered in section 7.5.

## 8.5 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 8.8. Other impacts are discussed here.

### *8.5.1 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. In the BAs, USACE notes that dredged material placement at the ocean disposal sites will have temporary and localized impacts to water quality but will meet applicable marine water quality criteria and the limiting permissible concentration for the liquid phase and suspended phase dredged material (USACE, 2010).

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 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.

### *8.5.2 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 May 10, 2012). By law and regulation, the significant adverse effects of dredged material disposal activities must be contained within the designated or selected disposal site and even those impacts must not degrade the area's overall ecological health. 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 results in actions 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, bioacummulation 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, USACE reports 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 will be 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 insignificant and discountable.

#### *8.5.3 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 dispsosal sites. The species that leatherback sea turtles forage on are mobile and not likely to be vulnerable to burial. 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 and leatherback 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 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. Although other demersal species may be impacted initially, long-term impacts are not anticipated after dredging operations cease. The high flushing rate, small area of impact during actual dredging will minimize water quality impacts to non-motile demersal organisms.

Some of the more common impacts to fish and their habitats include destruction of benthic communities, loss of prey species, and temporary impacts to water quality. As referenced in the Essential Fish Habitat Assessment for Gloucester Harbor, Massachusetts (Maguire Group Inc. 2001), the extent of the impact depends on hydrologic processes, sediment texture and composition, chemical content of the sediment and pore water matrices, and the behavior or life stages of the species. The new work dredging and fill activities may have minor affect the sturgeon through temporary and local impacts to water quality, including potential decreases in dissolved oxygen concentrations and minimal and localized increases in turbidity and sediment loads.

### 8.6 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. 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 CIEE was 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. The USACE has 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). The USACE has 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. Leatherbacks are unlikely to be present in the near shore waters of the CIEE. Given the degraded nature of this habitat, the loss of benthic habitat that will result from the conversion to uplands, will be insignificant to listed sea turtles.

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, the loss of future benthic foraging opportunities that will result from the conversion of this habitat to uplands, will be insignificant.

## 8.7 Effects on Benthic Resources and Foraging

### *8.7.1 Effects to Sea Turtles*

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, NMFS anticipates 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 with the sea turtles 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. As preferred sea turtle and sturgeon foraging items are present and depths are suitable for use by sea turtles, some foraging by these species likely occurs at these sites.

Dredging can cause indirect effects on sea turtles by reducing prey species through the alteration of the existing biotic assemblages. Kemp's ridley and loggerhead sea turtles typically feed on crabs, other crustaceans and mollusks. 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 sea turtle prey items.

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 direct and indirect impacts to benthic communities are anticipated to be minimal. Rapid recovery and resettlement of benthic species is expected.

Based on this analysis, while there will be a small reduction in sea turtle prey due to dredging, these effects will be insignificant to foraging loggerhead and Kemp's ridley sea turtles. No effects to the prey base of green or leatherback sea turtles are anticipated.

### *8.7.2 Effects to Atlantic sturgeon*

Atlantic sturgeon feed on a variety of benthic invertebrates. The proposed dredging is likely to entrain and kill at least some of these potential forage items. Given the limited mobility of most benthic invertebrates that sturgeon feed on, most are unlikely to be able to actively avoid the dredge. As noted above, recovery of the benthic community is expected to be rapid. Also as explained above for sea turtles, the area dredged in any particular year is a very small percentage of the available foraging habitat in the action area. Because effects to benthic prey will be limited to the area immediately surrounding the dredged area, the potential for disruption in foraging is low.

### 8.8 Dredge and Disposal Vessel Traffic

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, 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).

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 traffic of one to two vessels per day is negligible and the increased risk to Atlantic sturgeon is insignificant.

### 8.9 Unexploded Ordinance 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), the USACE 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, USACE 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 11 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.

### 8.10 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.

USACE has 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.

Subadult and adult Atlantic sturgeon are likely to be able to avoid being crushed by a bed-leveler. These fish are highly mobile. 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. As such, we do not anticipate any Atlantic sturgeon to be injured or killed if a bed leveler is used.

## 8.11 Effects of relocation trawling as required by the Incidental Take Statement

In the Incidental Take Statement accompanying this BO (see Section 11), 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.

### *8.11.1 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.

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.

#### *8.11.2 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 higher than the number of relocation captures that would occur in a typical year. However, this is our best assessment of the maximum number of turtles that would be captured during relocation trawling in any given year. 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 for fifty year and the ratio of species noted above, we expect the following total number of captures over 50-years:

| Species | Number of Captures |
|---|---|
| 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); however, the RPM requires tows to occur for 12 hours/day, not 24. 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", so this take level represents a maximum amount, or worst case scenario. 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 would be different. However, the 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, as well as 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, a total of 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 mortalties 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.

### *8.11.3 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.

### *8.11.4 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:

| **Species** | **Number Captured Per Year** | **Number of Mortalities per Year** | **Number Captured over 50 year period** | **Number of Mortalities over 50 year period** |
|---|---|---|---|---|
| ***Sea Turtles*** | ***25 total*** | ***1*** | ***1,250*** | ***50*** |
| Loggerhead | 19 | 1* | 937 | 37 |
| Kemp's Ridley | 5 | 1* | 275 | 11 |
| Green | 1 | 1* | 38 | 2 |
| Leatherback | 0 | 0 | 0 | 0 |
| ***Atlantic*** | ***14 total*** | ***0*** | ***700 total*** | ***0*** |

| | | | | |
|---|---|---|---|---|
| ***sturgeon*** | | | | |
| 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. NMFS has 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 the USACE 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 and that it will not cause any effects to sea turtles or sturgeon not considered in this Opinion, no further consultation is likely to be necessary and the proposed "captureless" trawling will be considered to be within the scope of this consultation.

## 9.0 CUMULATIVE EFFECTS

Cumulative effects, as defined in 50 CFR § 402.02, are those effects of future State or private activities, not involving Federal activities, which are reasonably certain to occur within the action area. Future Federal actions are not considered in the definition of "cumulative effects."

Actions carried out or regulated by the State of Virginia within the action area that may affect sea turtles and Atlantic sturgeon include the authorization of state fisheries and the regulation of dredged material discharges through CWA Section 401-certification and point and non-point source pollution through the National Pollutant Discharge Elimination System. We are not aware of any local or private actions that are reasonably certain to occur in the action area that may affect listed species. It is important to note that the definition of "cumulative effects" in the section 7 regulations is not the same as the NEPA definition of cumulative effects[9].

Future recreational and commercial fishing activities in state waters may take shortnose and Atlantic sturgeon. Information on interactions with sea turtles and Atlantic sturgeon for state fisheries operating in the action area is summarized in the Environmental Baseline section above, and it is not clear to what extent these future activities would affect listed species differently than the current state fishery activities described in the Status of the Species/Environmental Baseline sections. 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/environmental baseline sections.

*State NPDES Permits* – Virginia has been delegated authority to issue NPDES permits by the EPA. These permits authorize the discharge of pollutants in the action area. Permitees include municipalities for sewage treatment plants and other industrial users. The states will continue to authorize the discharge of pollutants through the SPDES permits. 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/environmental baseline section.

## 10.0 INTEGRATION AND SYNTHESIS OF EFFECTS

In the effects analysis outlined above, NMFS considered potential effects from continued 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, NMFS considered the potential for collisions between listed species and project vessels. 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. 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 50-year life of these projects:

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[9] Cumulative effects are defined for NEPA as "the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

| Species | Non-lethal Capture | Mortality |
|---|---|---|
| NWA DPS of Loggerhead sea turtle | 937 | 452 (415 in hopper dredge; 37 in trawl) |
| Kemp's ridley sea turtle | 275 | 48 (37 in hopper dredge; 11 in trawl) |
| Green sea turtle | 38 | 11 (9 in hopper dredge; 2 in trawl) |
| NYB DPS of Atlantic sturgeon | 350 | 60 (34 hopper, 25 cutterhead, 1 mechanical) |
| SA DPS of Atlantic sturgeon | 150 | 25 (14 hopper, 10 cutterhead, 1 mechanical) |
| CB DPS of Atlantic sturgeon | 100 | 19 (10 hopper, 8 cutterhead, 1 mechanical) |
| GOM DPS of Atlantic sturgeon | 100 | 14 (8 hopper, 5 cutterhead, 1 mechanical) |
| Carolina DPS of Atlantic sturgeon | 50 | 6 (3 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.

## 10.1 Atlantic sturgeon

As explained above, the proposed actions are likely to result in the mortality of a total of 124 Atlantic sturgeon from the Gulf of Maine, New York Bight, Chesapeake Bay, South Atlantic and Carolina DPSs over the 50 year 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 expect that the Atlantic sturgeon killed will be subadults. We do not anticipate the mortality of any early life stages or juveniles 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.

### *10.1.1 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%.

### *10.1.2 Gulf of Maine DPS*

We expect that 11% of the Atlantic sturgeon in the action area will originate from the GOM DPS. The GOM DPS has been 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 estimate of the number of Atlantic sturgeon in any river or for any life stage or the total population is available although the ASSRT stated that there were likely less than 300 spawners per year. 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. Over the 50-year period considered here, we anticipate the mortality of up to 14 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.

While overall we anticipate the death of 14 subadult Atlantic sturgeon from the GOM DPS over a 50-year period, we do not anticipate that there would be a loss of more than 1 GOM 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 GOM DPS.

The reproductive potential of the GOM DPS will not be affected in any way other than through a reduction in numbers of individuals. The loss of a total of 14 subadults, with no more than one per year, 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. 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 action, any effect to future year classes is anticipated to be extremely small and would not change the status of this species. Reproductive potential of Atlantic sturgeon captured during relocation trawling 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 GOM 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 GOM DPS fish.

Because we do not have a population estimate for the GOM 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 14, it is unlikely that these deaths will have a detectable effect on the numbers and population trend of the GOM DPS.

The proposed actions are not likely to reduce distribution because the actions will not impede Atlantic sturgeon from accessing any seasonal concentration areas, including foraging areas within the action area that may be used by GOM DPS subadults or adults. Further, the actions are not expected to reduce the river by river distribution of Atlantic sturgeon. Any effects to distribution will be minor and temporary and limited to the temporary avoidance of the area where suspended sediment levels are high.

Based on the information provided above, the death of up to 14 GOM DPS Atlantic sturgeon over the next 50 years, 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 one subadult GOM DPS Atlantic sturgeon in any year and the total loss of 14 subadults will not change the status or trends of the species as a whole; (3) the loss of 14 subadult GOM DPS Atlantic sturgeon is not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the loss of 14 subadult GOM DPS Atlantic sturgeon over a 50 year period is likely to have such a small effect on reproductive output that the loss of this individual 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 GOM 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 GOM DPS Atlantic sturgeon to shelter and only an insignificant effect on any 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. 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 GOM DPS can rebuild to a point where listing is no longer appropriate. No Recovery Plan for the GOM DPS has been published. 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 species must have a sustained positive trend over time and an increase in population. To allow those things to happen, a species must have enough habitat in suitable condition that allows all normal life functions to occur (i.e., spawning, foraging, resting) and have access to enough food. Here, we consider whether this proposed actions will affect the population size and/or trend in a way that would affect the 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 14 subadult GOM DPS Atlantic sturgeon over 50 years, are not likely to appreciably reduce the survival and recovery of this species.

### *10.1.3 New York Bight DPS*

The NYB DPS has been 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. As noted above, we expect all Atlantic sturgeon impinged at Indian Point will originate from the Hudson River. There is limited information on the demographics of the Hudson River population of Atlantic sturgeon. An annual mean estimate of 863 mature adults (596 males and 267 females) was calculated for the Hudson River based on fishery-dependent data collected from 1985-1995 (Kahnle *et al.* 2007).

No data on abundance of juveniles are available prior to the 1970s; however, catch depletion analysis estimated conservatively that 6,000-6,800 females contributed to the spawning stock during the late 1800s (Secor 2002, Kahnle *et al*. 2005). Two estimates of immature Atlantic sturgeon have been calculated for the Hudson River population, one for the 1976 year class and one for the 1994 year class. Dovel and Berggren (1983) marked immature fish from 1976-1978. Estimates for the 1976 year class at age were approximately 25,000 individuals. Dovel and Berggren estimated that in 1976 there were approximately 100,000 juvenile (non-migrant) Atlantic sturgeon from approximately 6 year classes, excluding young of year.

In October of 1994, the NYDEC stocked 4,929 marked age-0 Atlantic sturgeon, provided by a USFWS hatchery, into the Hudson Estuary at Newburgh Bay. These fish were reared from Hudson River brood stock. In 1995, Cornell University sampling crews collected 15 stocked and 14 wild age-1 Atlantic sturgeon (Peterson *et al*. 2000). A Petersen mark-recapture population estimate from these data suggests that there were 9,529 (95% CI = 1,916 – 10,473) age-0 Atlantic sturgeon in the estuary in 1994. Since 4,929 were stocked, 4,600 fish were of wild origin, assuming equal survival for both hatchery and wild fish and that stocking mortality for hatchery fish was zero.

Information on trends for Atlantic sturgeon in the Hudson River are available from a number of long term surveys. From July to November during 1982-1990 and 1993, the NYSDEC sampled the abundance of juvenile fish in Haverstraw Bay and the Tappan Zee Bay. The CPUE of immature Atlantic sturgeon was 0.269 in 1982 and declined to zero by 1990. This study has not been carried out since this time.

The Long River Survey (LRS) samples ichthyoplankton river-wide from the George Washington Bridge (rkm 19) to Troy (rkm 246) using a stratified random design (CONED 1997). These data, which are collected from May-July, provide an annual index of juvenile Atlantic sturgeon in the

Hudson River estuary since 1974. The Fall Juvenile Survey (FJS), conducted from July – October by the utilities, calculates an annual index of the number of fish captured per haul. Between 1974 and 1984, the shoals in the entire river (rkm 19-246) were sampled by epibenthic sled; in 1985 the gear was changed to a three-meter beam trawl. While neither of these studies were designed to catch sturgeon, given their consistent implementation over time they provide indications of trends in abundance, particularly over long time series. When examining CPUE, these studies suggest a sharp decline in the number of young Atlantic sturgeon in the early 1990s. While the amount of interannual variability makes it difficult to detect short term trends, a five year running average of CPUE from the FJS indicates a slowly increasing trend since about 1996. Interestingly, that is when the in-river fishery for Atlantic sturgeon closed. While that fishery was not targeting juveniles, a reduction in the number of adult mortalities would be expected to result in increased recruitment and increases in the number of young Atlantic sturgeon in the river. There also could have been bycatch of juveniles that would have suffered some mortality.

In 2000, the NYSDEC created a sturgeon juvenile survey program to supplement the utilities' survey; however, funds were cut in 2000, and the USFWS was contracted in 2003 to continue the program. In 2003 – 2005, 579 juveniles were collected (N = 122, 208, and 289, respectively) (Sweka et al. 2006). Pectoral spine analysis showed they ranged from 1 – 8 years of age, with the majority being ages 2 – 6. There has not been enough data collected to use this information to detect a trend, but at least during the 2003-2005 period, the number of juveniles collected increased each year which could be indicative of an increasing trend for juveniles.

NYB 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. 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. Mixed stock analysis from the NMFS NEFOP indicates that 49% of these individuals are likely to originate from the NYB and 91% of those likely originate from the Hudson River, for a total of approximately 167 adult and subadult mortalities annually. Because juveniles do not leave the river, they are not impacted by fisheries occurring in Federal waters. Bycatch and mortality also occur in state fisheries; however, the primary fishery that impacted juvenile sturgeon (shad), has now been closed and there is no indication that it will reopen soon. NYB DPS Atlantic sturgeon are killed as a result of anthropogenic activities in the Hudson River and other rivers; sources of potential mortality include vessel strikes and entrainment in dredges. As noted above, we expect the mortality of two Atlantic sturgeon as a result of the Tappan Zee Bridge replacement project; it is possible that these individuals could originate from the Hudson River. There could also be the loss of a small number of juveniles at other water intakes in the River including the Danskammer and Roseton plants.

We expect that 49% of the Atlantic sturgeon in the action area originate from the NYB DPS. 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 60 subadult Atlantic sturgeon from the NYB DPS over a 50-year period, 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 Delaware River 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 60 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 60 NYB Atlantic sturgeon likely to be killed, five are likely to originate from the Delaware River and 55 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 60 subadult Atlantic sturgeon from the NYB DPS over a 50-year period, 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[10] (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 60 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 actions is not likely to reduce distribution because the actions will not impede NYB DPS Atlantic sturgeon from accessing any seasonal concentration areas, including foraging, spawning or overwintering grounds in the Delaware or Hudson River or elsewhere. Any effects to distribution will be minor and temporary and limited to the temporary avoidance of the area immediately surrounding an active dredge.

Based on the information provided above, the death of up to 60 NYB DPS Atlantic sturgeon over the 50 year period 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 these subadult NYB DPS Atlantic sturgeon over a 50-year period represents an extremely small percentage of the species as a whole; (2) the death of these subadult NYB DPS Atlantic sturgeon will not change the status or trends of the species as a whole; (3) the loss of these 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 these 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

[10] 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).

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 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 NYB DPS 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 NYB DPS can rebuild to a point where listing is no longer appropriate. No Recovery Plan for the NYB DPS has been published. 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 species must have a sustained positive trend over time and an increase in population. To allow those things to happen, a species must have enough habitat in suitable condition that allows all normal life functions to occur (i.e., spawning, foraging, resting) and have access to enough food. 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 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 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 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 60 subadult NYB DPS Atlantic sturgeon over 50 years, is not likely to appreciably reduce the survival and recovery of this species.

#### *10.1.4 Chesapeake Bay DPS*
We expect that 14% of the Atlantic sturgeon in the action area will originate from the CB DPS. The CB DPS has been listed as endangered. While Atlantic sturgeon occur in several rivers in

the CB DPS, recent spawning has only been documented in the James River. Chesapeake Bay 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 the James River spawning population or for the DPS as a whole. Over the 50-year period considered here, we anticipate the mortality of up to 19 subadult CB DPS Atlantic sturgeon and the non-lethal capture of up to 100 subadult and adult 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 19 subadult Atlantic sturgeon from the CB DPS over a 50-year period, we do not anticipate that there would be a loss of more than 1 CB 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 CB DPS.

While overall we anticipate the death of eighteen subadult Atlantic sturgeon from the CB DPS over a 50-year period, we do not anticipate that there would be a loss of more than 1 CB DPS subadult per year. 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 19 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 19, it is unlikely that these deaths will have a detectable effect on the numbers and population trend of the CB DPS.

The proposed actions are not likely to reduce distribution because the actions will not impede Atlantic sturgeon from accessing any seasonal concentration areas, including foraging areas within the action area that may be used by CB DPS subadults or adults. Further, the actions are not expected to reduce the river by river distribution of Atlantic sturgeon. Any effects to distribution will be minor and temporary and limited to the temporary avoidance of the area where suspended sediment levels are high.

Based on the information provided above, the death of up to 19 CB DPS Atlantic sturgeon over the next 50 years, 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 subadult CB DPS Atlantic sturgeon in any year and the total loss of 19 subadults will not change the status or trends of the species as a whole; (3) the loss of 19 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 19 subadult CB DPS Atlantic sturgeon over a 50 year period is likely to have such a small effect on reproductive output that the loss of this individual 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 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 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 CB DPS 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 CB DPS can rebuild to a point where listing is no longer appropriate. No Recovery Plan for the CB DPS has been published. 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 species must have a sustained positive trend over time and an increase in population. To allow those things to happen, a species must have enough habitat in suitable condition that allows all normal life functions to occur (i.e., spawning, foraging, resting) and have access to enough food. Here, we consider whether this proposed actions will affect the population size and/or trend in a way that would affect the 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 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 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 19 subadult CB DPS Atlantic sturgeon over 50 years, is not likely to appreciably reduce the survival and recovery of this species.

#### *10.1.5 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 6 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 6 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 6 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 6, it is unlikely that these deaths will have a detectable effect on the numbers and population trend of the CA DPS.

The proposed actions are not likely to reduce distribution because the actions will not impede Atlantic sturgeon from accessing any seasonal concentration areas, including foraging areas within the action area that may be used by CA DPS subadults or adults. Further, the actions are not expected to reduce the river by river distribution of Atlantic sturgeon. Any effects to distribution will be minor and temporary and limited to the temporary avoidance of the area where suspended sediment levels around the dredge are high.

Based on the information provided above, the death of up to 6 CA DPS Atlantic sturgeon over the next 50 years, 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 one subadult CA DPS Atlantic sturgeon in any year and the total loss of 6 subadults will not change the status or trends of the species as a whole; (3) the loss of 6 subadult CA DPS Atlantic sturgeon is not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the loss of 6 subadult CA DPS Atlantic sturgeon over a 50 year period is likely to have such a small effect on reproductive output that the loss of this individual 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 CA 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 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 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 CA DPS 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 CA DPS can rebuild to a point where listing is no longer appropriate. No Recovery Plan for the CA DPS has been published. 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 species must have a sustained positive trend over time and an increase in population. To allow those things to happen, a species must have enough habitat in suitable condition that allows all normal life functions to occur (i.e., spawning, foraging, resting) and have access to enough food. Here, we consider whether this proposed actions will affect the population size and/or trend in a way that would affect the 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 (six individuals over 50 years) 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. This 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 threatened. 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 six subadult CA DPS Atlantic sturgeon over 50 years, is not likely to appreciably reduce the survival and recovery of this species.

#### *10.1.6 South Atlantic DPS*

We expect that 20% of the Atlantic sturgeon in the action area will originate from the SA DPS. The SA DPS is listed as endangered. The SA DPS consists of Atlantic sturgeon originating from at least six rivers where spawning is still thought to occur. Schueller and Peterson (2006) estimate that there were 343 adults spawning in the Altamaha River, GA in 2004 and 2005. This represents a percentage of the total adult population for the Altamaha River. Males spawn every 1-5 years and females spawn every 2-5 years; thus, the total Altamaha River adult population, assuming a 2:1 ratio of males: females as seen on the Hudson River, could range from 457 - 1,715. Spawning occurs in at least five other rivers in this DPS, thus the number of Atlantic sturgeon in the Altamaha River population is only a portion of the total DPS. No estimate of the number of Atlantic sturgeon in any of the other spawning rivers or for the DPS as a whole is available. Information from commercial fisheries bycatch indicates that the ratio of subadults to adults in the ocean may be 3:1. This suggests that there could be three times as many subadults as adults in the DPS. Using the estimate of Altamaha River adults, we could estimate 1,371-5,145 Altamaha River origin adults. Over the 50-year period considered here, we anticipate the mortality of up to 25 subadult SA DPS Atlantic sturgeon and 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.

While overall we anticipate the death of 25 subadult Atlantic sturgeon from the SA DPS over a 50-year period, 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. At this time we do not have sufficient genetic information to determine what percentage of SA DPS sturgeon encountered in the action area are likely to originate from each of the six spawning rivers.

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 25 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.

Because we do not have a population estimate for the SA DPS, it is difficult to evaluate the effect of the mortality caused by this 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 25, it is unlikely that these deaths will have a detectable effect on the numbers and population trend of the SA DPS.

The proposed actions are not likely to reduce distribution because the actions will not impede Atlantic sturgeon from accessing any seasonal concentration areas, including foraging areas within the actions area that may be used by SA DPS subadults or adults. Further, the actions are not expected to reduce the river by river distribution of Atlantic sturgeon. Any effects to distribution will be minor and temporary and limited to the temporary avoidance of the area where suspended sediment levels are high.

Based on the information provided above, the death of up to 25 SA DPS Atlantic sturgeon over the next 50 years, 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 one subadult CB DPS Atlantic sturgeon in any year and the total loss of 25 subadults will not change the status or trends of the species as a whole; (3) the loss of 25 subadult SA DPS Atlantic sturgeon is not likely to have an effect on the levels of genetic heterogeneity in the population; (4) the loss of 25 subadult SA DPS Atlantic sturgeon over a 50 year period is likely to have such a small effect on reproductive output that the loss of this individual 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 SA 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 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 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 SA DPS 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 SA DPS can rebuild to a point where listing is no longer appropriate. No Recovery Plan for the SA DPS has been published. 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 species must have a sustained positive trend over time and an increase in population. To allow those things to happen, a species must have enough habitat in suitable condition that allows all normal life functions to occur (i.e., spawning, foraging, resting) and have access to enough food. 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 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 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 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 25 subadult SA DPS Atlantic sturgeon over 50 years, is not likely to appreciably reduce the survival and recovery of this species.

### 10.2 Green sea turtles

Green sea turtles are listed as both threatened and endangered under the ESA. Breeding colony populations in Florida and on the Pacific Coast of Mexico are considered endangered while all others are considered threatened. Due to the inability to distinguish between these populations away from the nesting beach, for this Opinion, green sea turtles are considered endangered wherever they occur in U.S. waters. Green sea turtles are distributed circumglobally and can be found in the Pacific, Indian, and Atlantic Oceans as well as the Mediterranean Sea (NMFS and USFWS 1991; Seminoff 2004; NMFS and USFWS 2007d). As is also the case with the other sea turtle species, green sea turtles face numerous threats on land and in the water that affect the survival of all age classes.

A review of 32 Index Sites distributed globally revealed a 48% to 67% decline in the number of mature females nesting annually over the last three generations (Seminoff 2004). For example, in the eastern Pacific, the main nesting sites for the green sea turtle are located in Michoacan, Mexico, and in the Galapagos Islands, Ecuador, where the number of nesting females exceeds 1,000 females per year at each site (NMFS and USFWS 2007d). Historically, however, greater than 20,000 females per year are believed to have nested in Michoacan alone (Cliffton *et al.* 1982; NMFS and USFWS 2007d). However, the decline is not consistent across all green sea turtle nesting areas. Increases in the number of nests counted and, presumably, the numbers of mature females laying nests were recorded for several areas (Seminoff 2004; NMFS and USFWS 2007d). Of the 32 index sites reviewed by Seminoff (2004), the trend in nesting was described as: increasing for 10 sites, decreasing for 19 sites, and stable (no change) for 3 sites. Of the 46 green sea turtle nesting sites reviewed for the 5-year status review, the trend in nesting was described as increasing for 12 sites, decreasing for 4 sites, stable for 10 sites, and unknown for 20 sites (NMFS and USFWS 2007d). The greatest abundance of green sea turtle nesting in the western Atlantic occurs on beaches in Tortuguero, Costa Rica (NMFS and USFWS 2007d). Nesting in the area has increased considerably since the 1970s and nest count data from 1999-2003 suggest nesting by 17,402-37,290 females per year (NMFS and USFWS 2007d). One of the largest nesting sites for green sea turtles worldwide is still believed to be on the beaches of Oman in the Indian Ocean (Hirth 1997; Ferreira *et al.* 2003; NMFS and USFWS 2007d). However, nesting data for this area has not been published since the 1980s and updated nest numbers are needed (NMFS and USFWS 2007d).

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. However, the ESA-listing of green sea turtles as a species across ocean basins means that the effects of a proposed actions must, ultimately, be considered at the species level for section 7 consultations. NMFS recognizes that the nest count data available for green sea turtles in the Atlantic clearly indicates increased nesting at many sites. However, NMFS also recognizes 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 USFWS 2007d).

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 the "Effects of the Action" section above, 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 11 green sea turtles and the non-lethal capture of 38 green sea turtles over the 50 year project life. We determined that all other effects of these actions on this species will be insignificant and discountable. While this estimate is based on the best available information, it is likely that this is an overestimate of the number of green sea turtles that will be encountered during hopper dredging because it: (1) assumes 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 11 if some of the dredging occurred between December and March and if more of it was carried out with a cutterhead dredge, both of which are likely to occur. No mortalities of green sea turtles are expected whenever a cutterhead dredge. 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 11 green sea turtles from the action area over a fifty year period 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 11 over 50 years, 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 11 greens represents less than 0.07% 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 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 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 11 green sea turtles over 50 years 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 increasing; (2) the death of 11 green sea turtles represents an extremely small percentage of the species as a whole; (3) the loss of 11 green sea turtles will not change the status or trends of the species as a whole; (4) the loss of 11 green sea turtles is not likely to have an effect on the levels of genetic heterogeneity in the population; (5) the loss of 11 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 be delisted, 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 this 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 a total of 11 green sea turtles, with the loss of no more than one per year; however, as explained above, 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 one individual, these effects will be undetectable over the long-term and the actions 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.

Despite the threats faced by individual green sea turtles inside and outside of the action area, the proposed actions 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 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 11 green sea turtles over 50 years, is not likely to appreciably reduce the survival and recovery of this species.

### 10.3 Leatherback sea turtles

As noted in sections above, the physical disturbance of sediments and entrainment of associated benthic resources could reduce the availability of sea turtle prey in the affected areas, but these reductions will be localized and temporary, and foraging turtles are not likely to be limited by the reductions and any effects will be insignificant. Also, as explained above, no leatherback sea turtles are likely to be entrained in any dredge operating during any of the projects considered here and this species is not likely to be involved in any collision with a project vessel. No leatherback sea turtles are likely to be captured during relocation trawling. As all effects to leatherback sea turtles from the proposed actions are likely to be insignificant or discountable, these actions are not likely to adversely affect this species.

### 10.4 Kemp's ridley sea turtles

In the "Effects of the Action" section above, 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 48 Kemp's ridley sea turtles and the non-lethal capture of 275 Kemp's ridley sea turtles over the 50 year 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, it is likely that this is an overestimate of the number of Kemp's ridley sea turtles that will be encountered during hopper dredging because it: (1) assumes 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 48 if some of the dredging occurred between December and March and if any of it was carried out with a cutterhead dredge, both of which are likely to occur. No mortalities of sea turtles are expected whenever a cutterhead dredge is used; no sea 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 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; USFWS and NMFS 1992; NMFS and USFWS 2007c).

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 turtle 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 (USFWS 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). Current estimates suggest an adult female population of 7,000-8,000 Kemp's ridleys (NMFS and USFWS 2007c).

The most recent review of the Kemp's ridleys suggests that this species is in the early stages of recovery (NMFS and USFWS 2007b). Nest count data indicate increased nesting and increased numbers of nesting females in the population. NMFS also takes into account a number of 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 in general (NMFS and USFWS 2007b). We expect this increasing trend to continue over the time period considered in this Opinion.

The mortality of 48 Kemp's ridleys over a 50 year time period represents a very small percentage of the Kemp's ridleys worldwide. Even taking into account just nesting females, the death of 48 Kemp's ridley represents less than 0.8% 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 48 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 or its stable to increasing trend 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. In 2006, the most recent year for which data is available, there were an estimated 7-8,000 nesting females. 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 48 over 50 years 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 to increasing 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 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.

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 increasing and at worst is stable.

Based on the information provided above, the death of 48 Kemp's ridley sea turtles over the next 50 years 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 species' nesting trend is increasing; (2) the death of 48 Kemp's ridleys represents an extremely small percentage of the species as a whole; (3) the death of 48 Kemp's ridleys will not change the status or trends of the species as a whole; (4) the loss of these Kemp's ridleys is not likely to have an effect on the levels of genetic heterogeneity in the population; (5) the loss of these Kemp's ridleys 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 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 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 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[11];
2. An increase in the recruitment of hatchlings[12];
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,
5. Maintenance of sufficient foraging, migratory, and inter-nesting habitat.

[11]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

[12] 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).

Kemp's ridleys have an increasing trend; 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 as a result 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.

Despite the threats faced by individual Kemp's ridley sea turtles inside and outside of the actions area, the proposed actions 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 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.

### 10.5 Northwest Atlantic DPS of Loggerhead sea turtles

In the "Effects of the Action" section above, 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 50-year period considered here, the proposed actions are likely to result in the mortality of 452 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. While this estimate is based on the best available information, it is likely that this is an overestimate of the number of loggerhead sea turtles that will be encountered during hopper dredging because it: (1) assumes 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 452 if some of the dredging occurred between December and March and if any of it was carried out with a cutterhead dredge, both of which are likely to occur. No mortalities of sea turtles are expected whenever a cutterhead dredge is used.

No sea 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 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 whose success 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.

As stated above, we expect the lethal entrainment of 452 loggerheads over the 50-year time period considered here; with an average mortality rate of approximately 9 loggerheads per year. The lethal removal of up to 452 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 necessarily 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).

Although limited information is available on the genetic makeup of loggerheads in an area as extensive as the action area, it is likely that loggerheads in the action area originate from several, if not all of the recovery units. 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 407 of the loggerheads will be from the PFRU, 14 from the NRU, 27 from the GCRU, 7 from the NGMRU, and 2 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 407 loggerheads over a 50-year period (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 0.06% of the population. Similarly, the loss of no more than 1 loggerhead from the NRU for 14 of the 50 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 0.3% of the population. The loss of no more than 1 loggerhead for 27 of the 50 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 for 7 of the 50 years from the NGMRU, represents a very small percentage 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 for 2 of the 50 years from the DTRU, which is expected to support at least 60 nesting females, represents a very small percentage 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 50 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 the actions will not impede loggerheads from accessing foraging grounds or cause more than a temporary disruption to other migratory behaviors. Additionally, given the small percentage of the species that will be killed as a result of the deepening and maintenance, 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 452 loggerheads over the next 50 years 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 species' nesting trend is stabilizing; (2) the death of these loggerheads represents an extremely small percentage of the species as a whole; (3) the death of these loggerheads will not change the status or trends of the species as a whole; (4) the loss of these loggerheads is not likely to have an effect on the levels of genetic heterogeneity in the population; (5) the loss of these loggerheads 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 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 an increasing trend; as explained above, the loss of 452 loggerheads over 50-years as a result 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 endangered or threatened.

Despite the threats faced by individual loggerhead sea turtles inside and outside of the action area, the proposed actions 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 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.

## 11.0 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 NMFS' 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. Because no critical habitat is designated in the action area, none will be affected by the proposed action.

## 12.0 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 NMFS 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 USACE so that they become binding conditions for the exemption in section 7(o)(2) to apply. USACE has a continuing duty to regulate the activity covered by this Incidental Take Statement. If USACE (1) fails to assume and implement the terms and conditions or (2) fails 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, USACE 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).

### 12.1 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 the dredge. These interactions are likely to cause mortality. This level of take is expected to occur over the entire 50 year period and is not likely to jeopardize the continued existence of listed species. While we have completed one Biological Opinion, the actions considered here consist of five independent actions carried out by the USACE and their contractors. As such, at the request of USACE, we have organized the ITS for dredging by project.

This ITS exempts the following incidental take over the 50 year period:

| Species | Non-lethal Capture | Mortality |
|---|---|---|
| NWA DPS of Loggerhead sea turtle | 937 | 452 |
| Kemp's ridley sea turtle | 275 | 48 |
| Green sea turtle | 38 | 11 |
| NYB DPS of Atlantic sturgeon | 350 | 60 |
| SA DPS of Atlantic sturgeon | 150 | 25 |
| CB DPS of Atlantic sturgeon | 100 | 19 |
| GOM DPS of Atlantic sturgeon | 100 | 14 |
| Carolina DPS of Atlantic sturgeon | 50 | 6 |

The tables below illustrate our expectations of where these takes will occur:

***Hopper Dredging***

| **Project** | **Total Volume** | **Number of Interactions over 50 years** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Total Sea Turtles** | **Loggerhead** | **Kemp's ridley** | **green** | **Total Atlantic sturgeon** | **NYB DPS** | **SA DPS** | **CB DPS** | **GOM DPS** | **Carolina DPS** |
| Baltimore Harbor Entrance Channels | 64.5 MCY | 215 | 194 | 17 | 4 | 32 | 16 | 6 | 5 | 4 | 1 |
| York River Entrance Channel | 6.5 MCY | 22 | 20 | 2 | 0 | 3 | 2 | 1* | 1* | 1* | 1* |
| Hampton Roads (TS and AOC) | 14.5 MCY | 168 | 151 | 13 | 3 | 25 | 12 | 5 | 4 | 3 | 1 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Virginia Beach Hurricane Project (TSS and AO borrow areas) | 10 MCY | 15 | 13 | 1** | 1** | 2 | 1 | 1* | 1* | 1* | 1* |
| Sandbridge Shoal | 12.5 MCY | 42 | 38 | 3 | 1 | 6 | 3 | 1 | 1 | 1*** | 1*** |
| | | | | | | | | | | | |

*1 CB, GOM or Carolina DPS Atlantic sturgeon
** 1 Kemp's ridley or green sea turtle
***1 GOM or Carolina DPS Atlantic sturgeon

### *Cutterhead Dredging*

| DPS | Number of Atlantic Sturgeon over 50 year Period |
|---|---|
| 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***

| **Species** | **Number Captured over 50 year period** | **Number of Mortalities over 50 year period** |
|---|---|---|
| ***Sea Turtles*** | ***1,250*** | ***50*** |
| Loggerhead | 938 | 37 |
| Kemp's Ridley | 275 | 11 |
| Green | 37 | 2 |
| Leatherback | 0 | 0 |
| ***Atlantic sturgeon*** | ***700 total*** | ***0*** |
| 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, due to safety concerns, USACE is likely to require UXO screening for dredges working on 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.

The USACE and NMFS 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. Injured or deceased animal may not float to the surface immediately (i.e., it may take days for this to occur) or may drift far from the incident where injury occurred. Therefore, an injured or deceased stranded animal often cannot be definitively attributed to a specific action. As such, this is not a reasonable and appropriate means to monitor take.

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. Therefore, while this is a good method to minimize hopper dredge takes it is not a reasonable and appropriate means to monitor take.

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, the USACE chooses 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 an obvious threshold of exempted take that, if exceeded, provides a basis for reinitiating consultation. As explained in section 8.0 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 300,000 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 300,000 cubic yards material removed during hopper dredging operations. 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 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, should we receive any reports of injured or killed sea turtles or sturgeon in the area (i.e., via the STSSN) 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 soon as the estimated number of sea turtles are observed or believed to be taken (e.g., if the total was six turtles: five takes via proxy or one observed impinged and four via proxy, etc.), any additional entrainment of a sea turtle will be considered to exceed the exempted level of take. We expect exceedance of the exempted amount of take to be unlikely given the conservative assumptions made in calculating this estimate, particularly the assumption that all hopper dredging would occur between April and November when it is much more likely that some, if not all dredging will occur outside of this time of year. Lookouts will be present on the vessel and volumes of material removed will be continuously monitored during hopper dredge operations. Therefore, take levels can be detected and assessed early in the project and, if needed, consultation can be reinitiated.

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.

### 12.2 Reasonable and prudent measures

NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize and monitor impacts of incidental take resulting from the proposed action:

***RPMs Applicable for All Dredge Activities***

1. NMFS must be contacted prior to the commencement of dredging and again upon completion of the dredging activity.

2. All dredges must be operated in a manner that will reduce the risk of interactions with sea turtles.

3. All (alive or dead) Atlantic sturgeon must have a fin clip taken for genetic analysis. This sample must be transferred to NMFS.

4. All dead loggerhead sea turtles must have a sample for genetic analysis. This sample must be transferred to NMFS.

5. Any dead sturgeon must be transferred to NMFS or an appropriately permitted research facility NMFS will identify so that a necropsy can be undertaken to attempt to determine the cause of death. Sturgeon should be held in cold storage.

6. Any dead sea turtles must be held until proper disposal procedures can be discussed with NMFS. Turtles should be held in cold storage.

7. 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.

8. The ACOE shall implement measures that would reduce the number of sea turtles in the dredging channel so that the possibility of entrainment would be minimized.

***RPMs Applicable for all hopper dredges***

9. 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.

***RPMs Applicable when UXO screening is not in place on a hopper dredge***

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. 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.

11. The USACE shall ensure that all measures are taken to protect any turtles or sturgeon that survive entrainment in a hopper dredge.

***RPMs Applicable when UXO screening is in place on a hopper dredge***

12. 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.

***RPMs Applicable when UXO screening is in place on a hopper or cutterhead dredge***

13. 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.

***RPMs Applicable when UXO screening is not in place on a cutterhead dredge***

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.

***RPMs Applicable during Mechanical Dredging***

14. A lookout/bridge watch must be present to observe all mechanical dredging activities where dredged material will be deposited to monitor for any capture of sturgeon.

15. The ACOE must ensure that all measures are taken to protect any sturgeon that survive capture in the mechanical dredge.

## 12.3 Terms and conditions

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

1. To implement RPM #1, the USACE must contact NMFS (Julie Crocker: by email (julie.crocker@noaa.gov) or phone (978) 282-8480 or (978)-281-9328)) 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.

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.

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.

4. To implement RPM #4, if a dead loggerhead sea turtle is taken in dredging or relocation trawling operations, a genetic sample must be taken following the procedure outlined in Appendix E.

5. To implement RPM #5, 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.

6. To implement RPM #6, 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.

7. To implement RPM #6, 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 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.

8. To implement RPM #7, 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 (julie.crocker@noaa.gov) or phone (978) 282-8480 or the Section 7 Coordinator by phone (978)281-9328 or fax 978-281-9394). Take information should also be reported by e-mail to: incidental.take@noaa.gov.

9. To implement RPM #7, 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).

10. To implement RPM #7, 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 effects of the action that may not have been previously considered.

11. To implement RPM #7, 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).

12. To implement RPM#8, 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 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.

13. To implement RPM #8, 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 within 30 working days of completion of the trawling survey.

14. To implement RPM #9, 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.

15. To implement RPM #10, 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.

16. To implement RPM #10, 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 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.

17. To implement RPM #10, 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.

18. To implement RPM #11, 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.

19. To implement RPM #12, 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.

20. To implement RPM #13, USACE will provide NMFS reports every 30 days, via email (Julie.Crocker@noaa.gov and incidental.take@noaa.gov) 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.

21. To implement RPM #14, USACE will schedule a meeting with NMFS prior to finalizing contract specifications and initiating contract solicitation processes for new cutterhead dredging projects scheduled for calendar year 2013 to determine the scope of a monitoring plan. This monitoring plan must be agreed to by NMFS 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.

22. To implement RPM#15, 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 NMFS as required by RPM #5.

23. To implement RPM #16, 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.

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 proposed action and represent only a minor change to the action as proposed by the USACE.

## 13.0 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, NMFS recommends that the USACE consider the following Conservation Recommendations:

(1) To the extent practicable, the USACE 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) The USACE 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) The USACE should support studies to determine the effectiveness of using a sea turtle deflector to minimize the potential entrainment of sturgeon during hopper dredging.

(4) The USACE 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.

## 14.0 REINITIATION OF CONSULTATION

This concludes formal consultation on the proposed action. 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, Section 7 consultation must be reinitiated immediately.

As noted in Section 2.0, in the future, reinitiation of consultation may be necessary (see 50 CFR§

402.16). Depending on the circumstances associated with the cause for reinitiation, it may not be necessary to reinitiate consultation for all of the actions considered here. For example, if a new species is listed that may be affected by dredging activities, it would likely be necessary to reinitiate consultation on all of the activities considered here. However, if the cause for reinitiation has effects that are limited to one action (for example, a change in dredge type, dredge volume or disposal area), reinitiation of consultation on only that action would be necessary. We expect that determinations about the scope of any future reinitiation(s) will be made in cooperation between the USACE and us.

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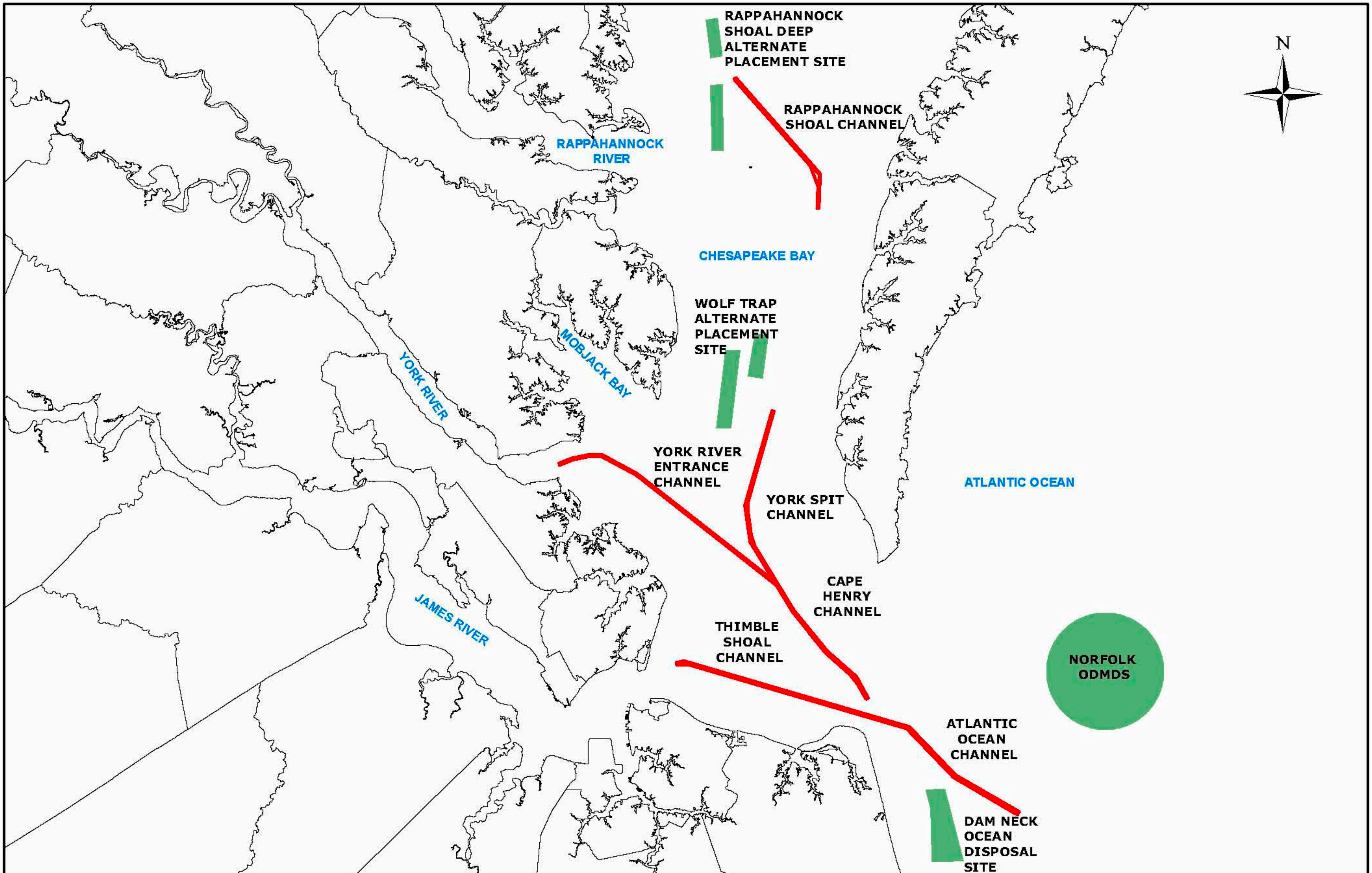
## Appendix A - Project Locations




US Army Corps of Engineers
Norfolk District

**LOWER CHESAPEAKE BAY FEDERAL NAVIGATION PROJECT CHANNELS AND DREDGED MATERIAL PLACEMENT SITES: ATLANTIC OCEAN CHANNEL, CAPE HENRY CHANNEL, RAPPHANNOCK 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**

0 47,500 95,000 Feet

1 inch = 53,750 feet

**Legend**

Lower Chesapeake Bay Channels

Dredged Material Placement Sites

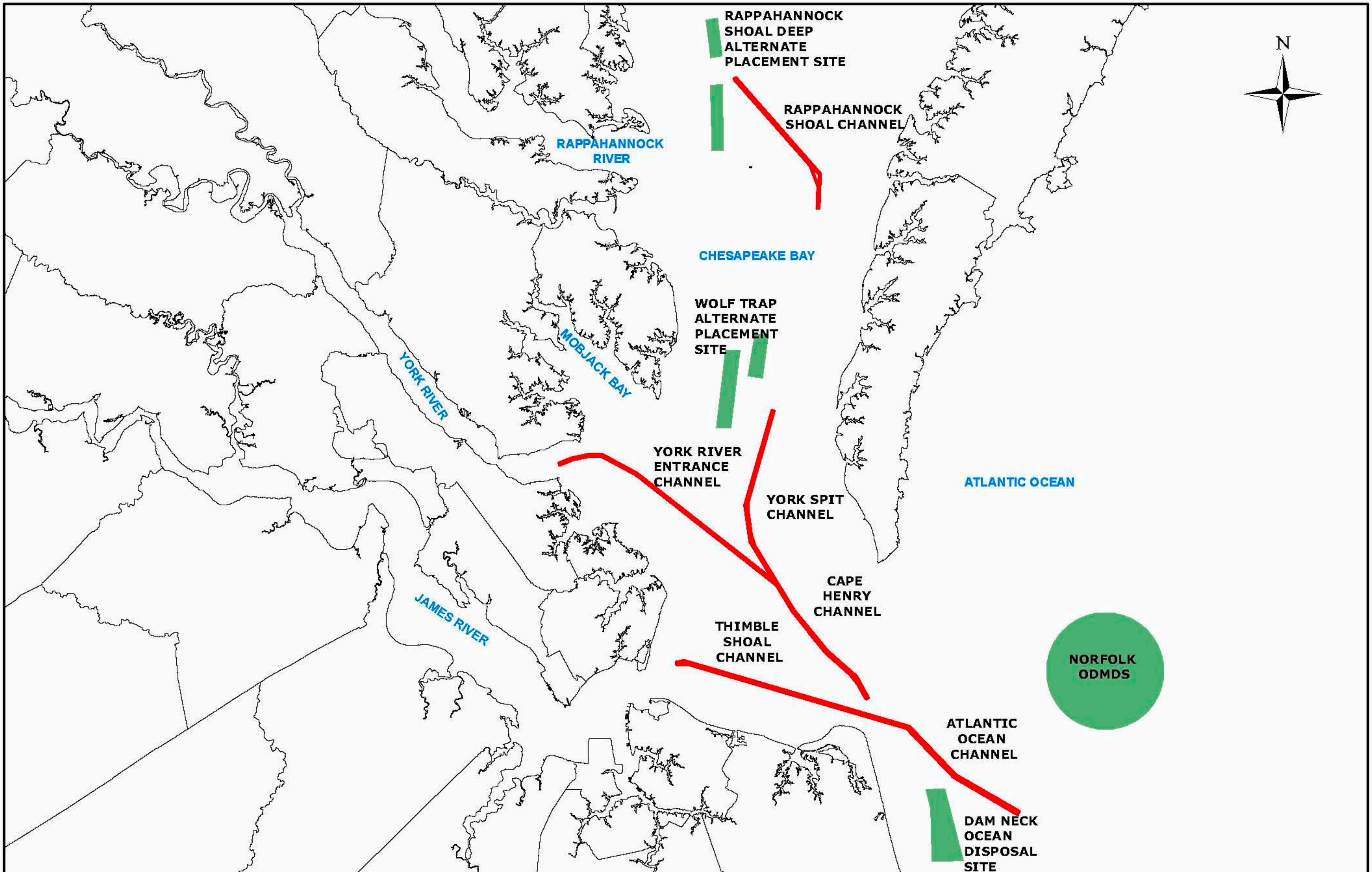
Projection:
Virginia State Plane
South Zone - NAD 83
U.S. Survey Feet

Data Source: Operations
Branch GIS Data

Project Manager: Keith Lockwood
E-mail: keith.b.lockwood@usace.army.mil
Phone: (757) 201-7004

Prepared by: Katy Damico
CENAO-WR-OT

Map File: Lower_ChesBay_Channels_Map.mxd
Map Date: 13 JUNE 2011




US Army Corps of Engineers
Norfolk District

**LOWER CHESAPEAKE BAY FEDERAL NAVIGATION PROJECT CHANNELS AND DREDGED MATERIAL PLACEMENT SITES: ATLANTIC OCEAN CHANNEL, CAPE HENRY CHANNEL, RAPPHANNOCK 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**

0 47,500 95,000 Feet

1 inch = 53,750 feet

**Legend**

Lower Chesapeake Bay Channels

Dredged Material Placement Sites

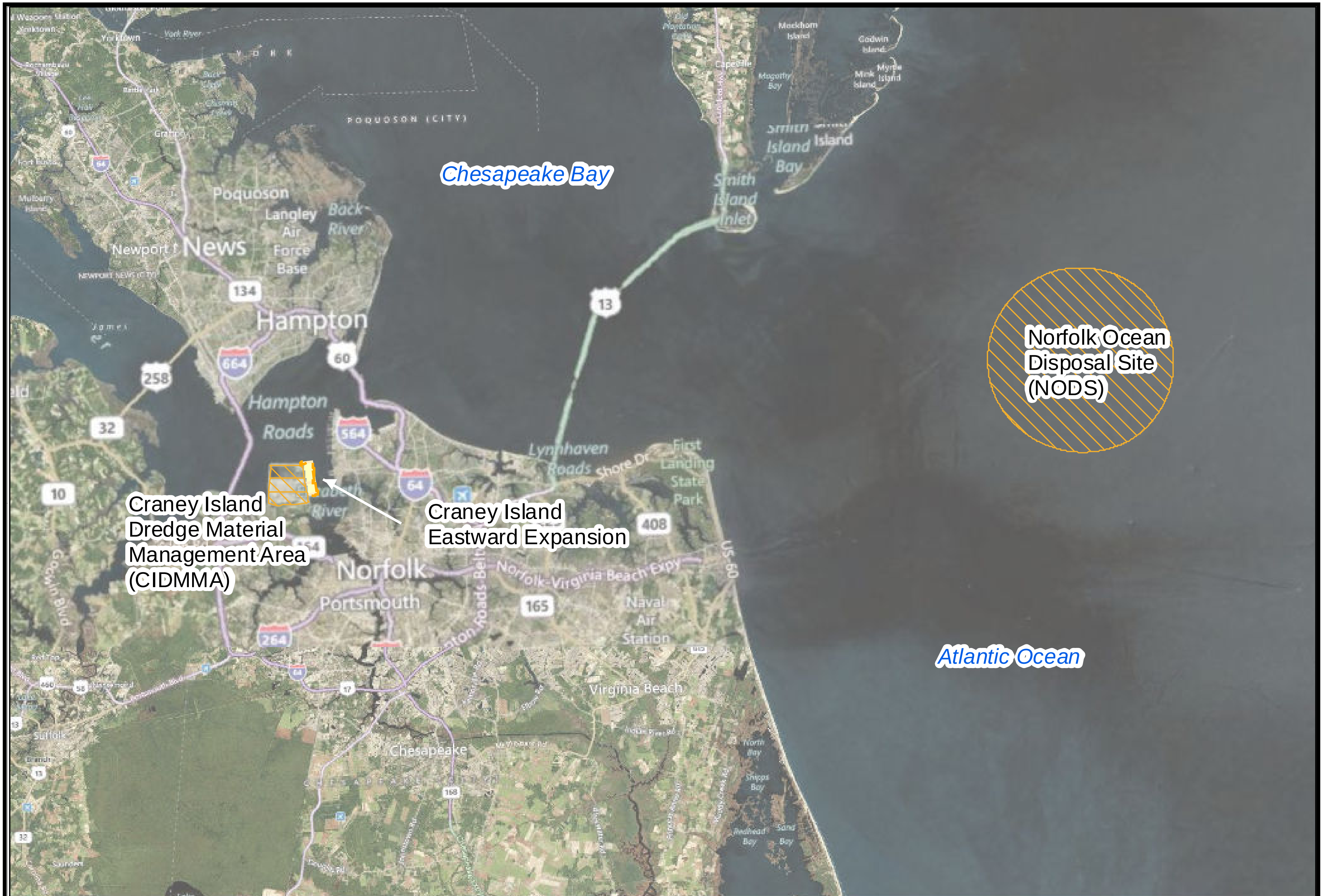
Projection:
Virginia State Plane
South Zone - NAD 83
U.S. Survey Feet

Data Source: Operations Branch GIS Data

Project Manager: Keith Lockwood
E-mail: keith.b.lockwood@usace.army.mil
Phone: (757) 201-7004

Prepared by: Katy Damico
CENAO-WR-OT

Map File: Lower_ChesBay_Channels_Map.mxd
Map Date: 13 JUNE 2011




US Army Corps of Engineers Norfolk District

# Craney Island Eastward Expansion

| | |
|---|---|
| Federal Navigation Channel | Access Channels |
| Eastward Expansion Dike Area | Berthing Area |
| Eastward Expansion Fill Area | Dredge Material Placement Area |

PM: Mike Anderson
michael.a.anderson@usace.army.mil
Map: CIEE Stage2A_EPA_Permit.mxd
Developed By: Jeff Swallow
Date of Map: 07/23/2012
0 500 1,000 2,000 Feet


US Army Corps of Engineers Norfolk District

# Craney Island Eastward Expansion

| | |
|---|---|
| Federal Navigation Channel | Access Channel |
| Eastward Expansion Dike Area | Wharf Access Area |
| Eastward Expansion Fill Area | Dredge Material Placement Area |

PM: Mike Anderson
michael.a.anderson@usace.army.mil
Map: CIEE Stage2A_EPA_Permit.mxd
Developed By: Jeff Swallow/Karin Dridge
Date of Map: 07/30/2012

0 1,000 2,000 4,000 Feet

N


Federal Navigation Channels and Anchorages Serving the Port of Hampton Roads

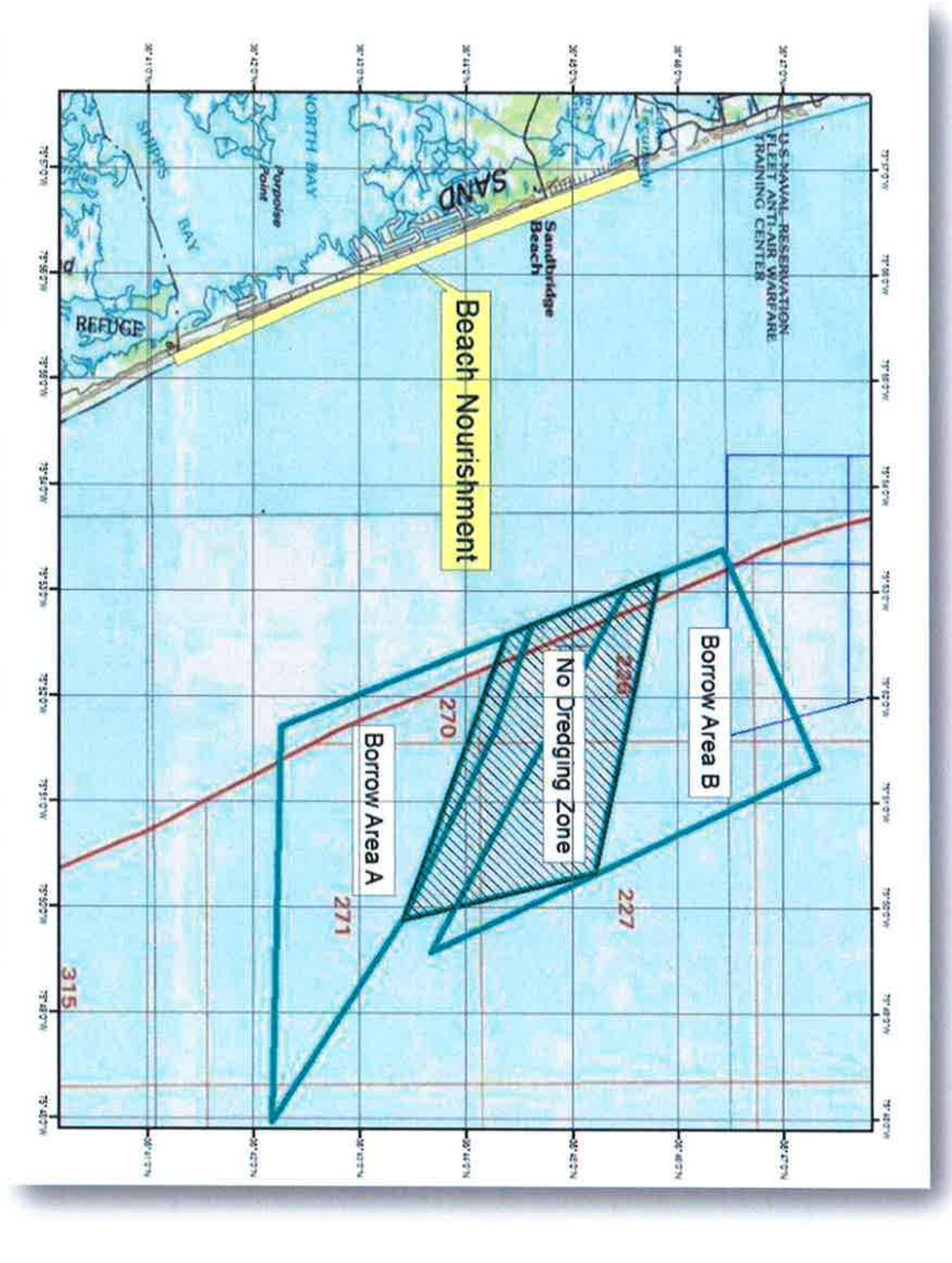
PM: Steve Powell
Map: NorfolkHarborSturgeon.mxd
Developed By: Jeff Swallow
Date of Map: 07/10/2012

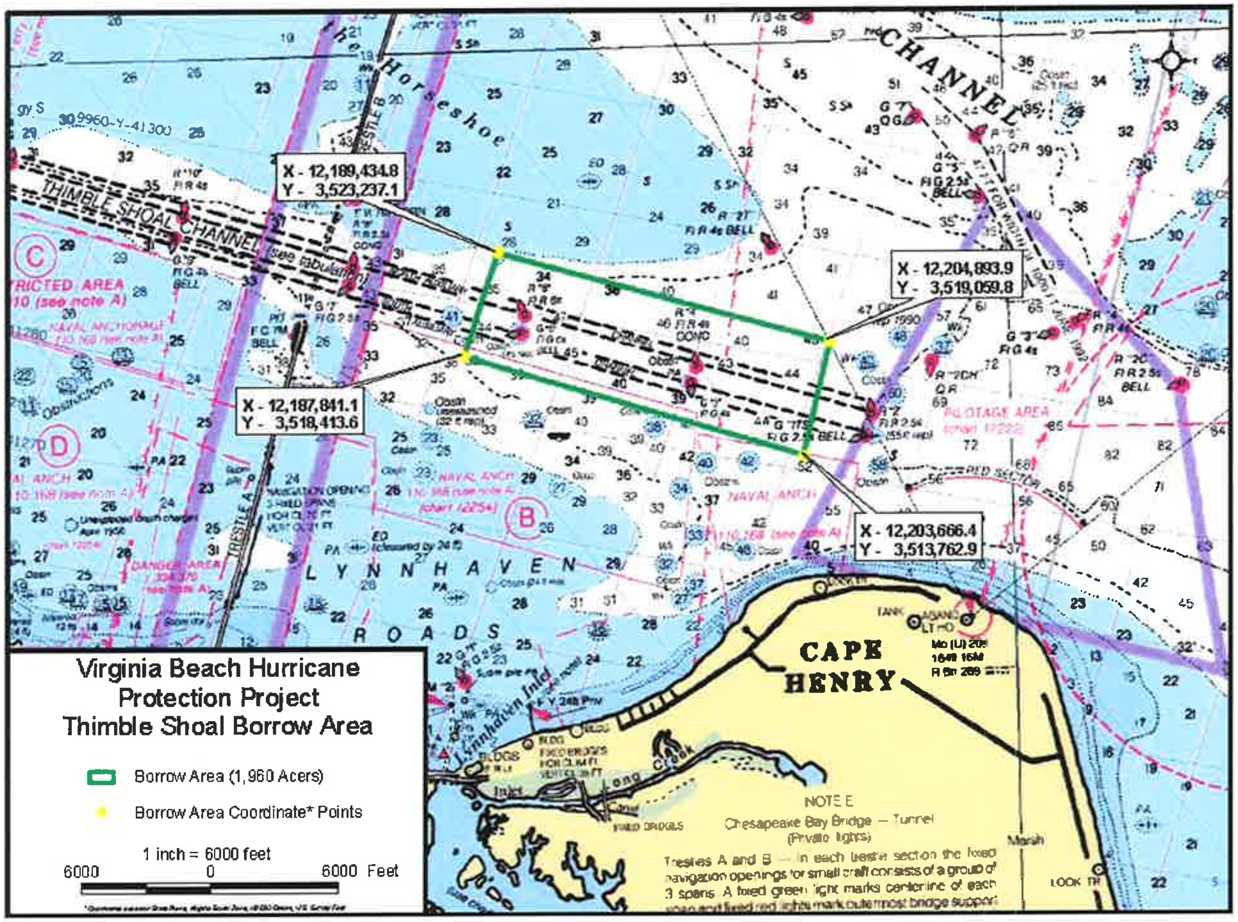

Dredge Material Placement Areas Serving the Port of Hampton Roads

0 4 8 Miles

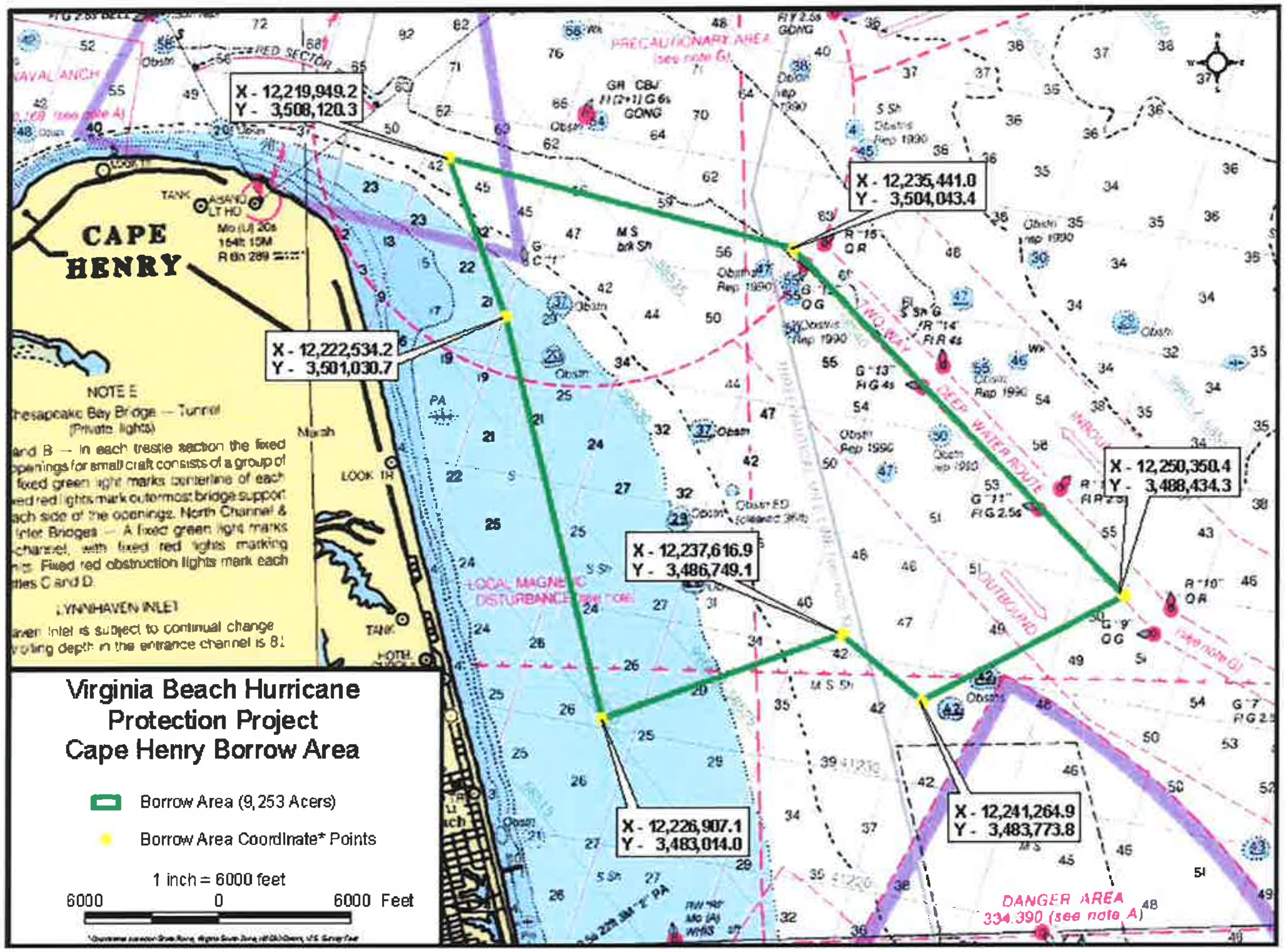
PM: Steve Powell
Map: NorfolkHarborSturgeon.mxd
Developed By: Jeff Swallow
Date of Map: 07/10/2012

## Appendix A

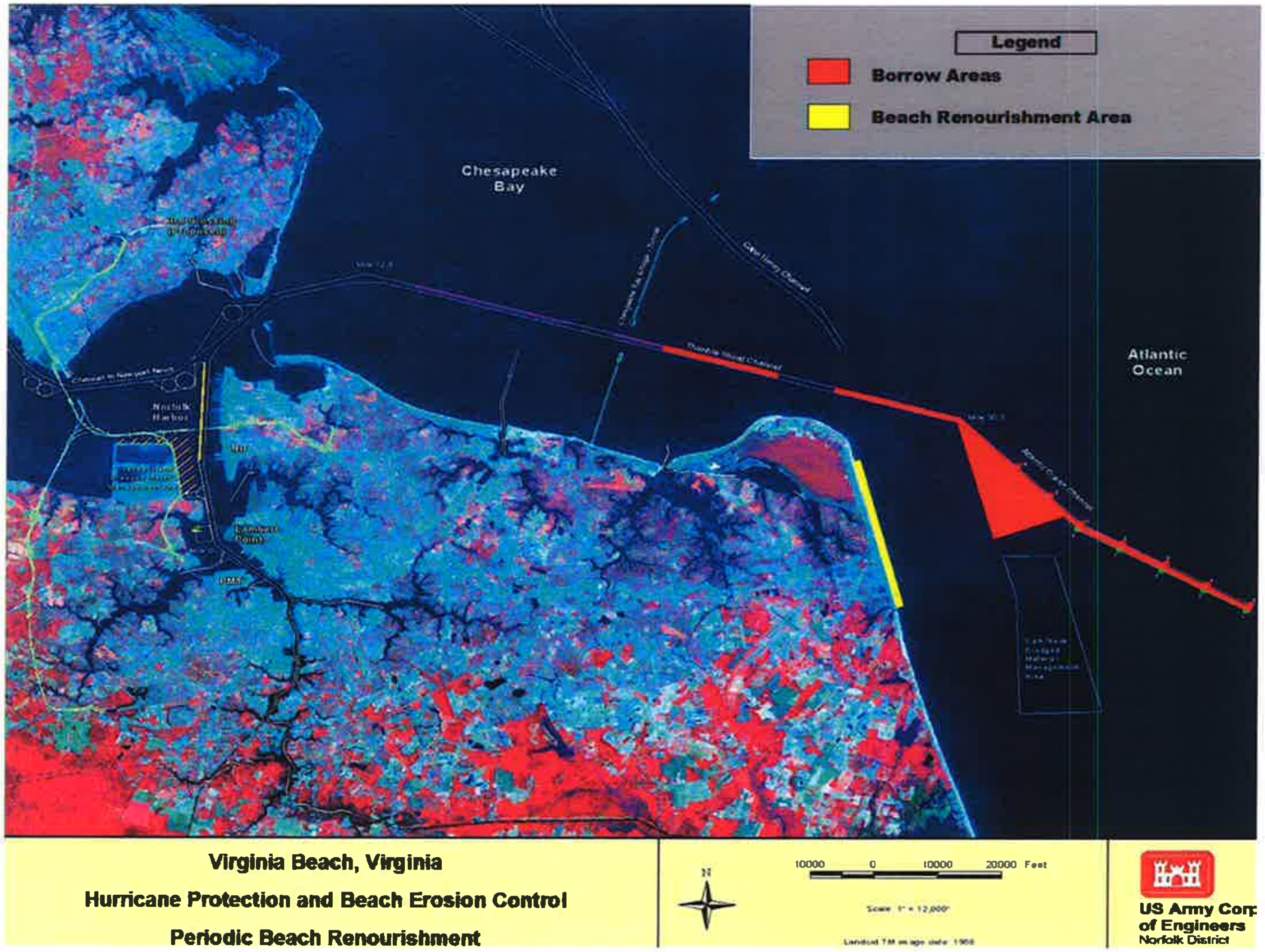

Beach Nourishment
Borrow Area A
Borrow Area B
No Dredging Zone
Sandbridge Beach
U.S. NAVAL RESERVATION FLEET ANTI-AIR WARFARE TRAINING CENTER
REFUGE
Porpoise Point
NORTH BAY
SAND
270
271
227
315


Virginia Beach Hurricane
Protection Project
Thimble Shoal Borrow Area
Borrow Area (1,960 Acers)
Borrow Area Coordinate* Points
1 inch = 6000 feet
6000
0
6000 Feet
X - 12,189,434.8
Y - 3,523,237.1
X - 12,204,893.9
Y - 3,519,059.8
X - 12,187,841.1
Y - 3,518,413.6
X - 12,203,666.4
Y - 3,513,762.9
THIMBLE SHOAL CHANNEL
CHANNEL
LYNNHAVEN
ROADS
CAPE
HENRY
NAVAL ANCH
PILOTAGE AREA
DANGER AREA
NOTE E
Chesapeake Bay Bridge – Tunnel
(Private lights)

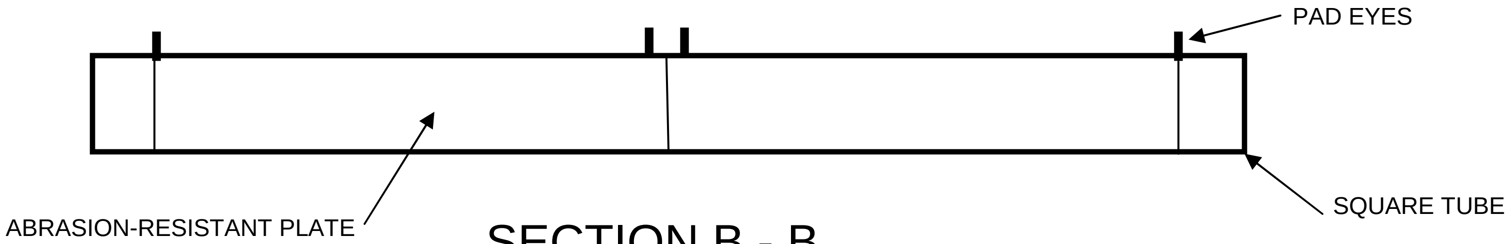
Appendix B


Virginia Beach Hurricane Protection Project
Cape Henry Borrow Area
Borrow Area (9,253 Acers)
Borrow Area Coordinate* Points
1 inch = 6000 feet
6000 0 6000 Feet
X - 12,219,949.2 Y - 3,508,120.3
X - 12,235,441.0 Y - 3,504,043.4
X - 12,222,534.2 Y - 3,501,030.7
X - 12,250,350.4 Y - 3,488,434.3
X - 12,237,616.9 Y - 3,486,749.1
X - 12,226,907.1 Y - 3,483,014.0
X - 12,241,264.9 Y - 3,483,773.8
CAPE HENRY
NOTE E
LYNNHAVEN INLET
PRECAUTIONARY AREA
LOCAL MAGNETIC DISTURBANCE
DANGER AREA 334.390 (see note A)

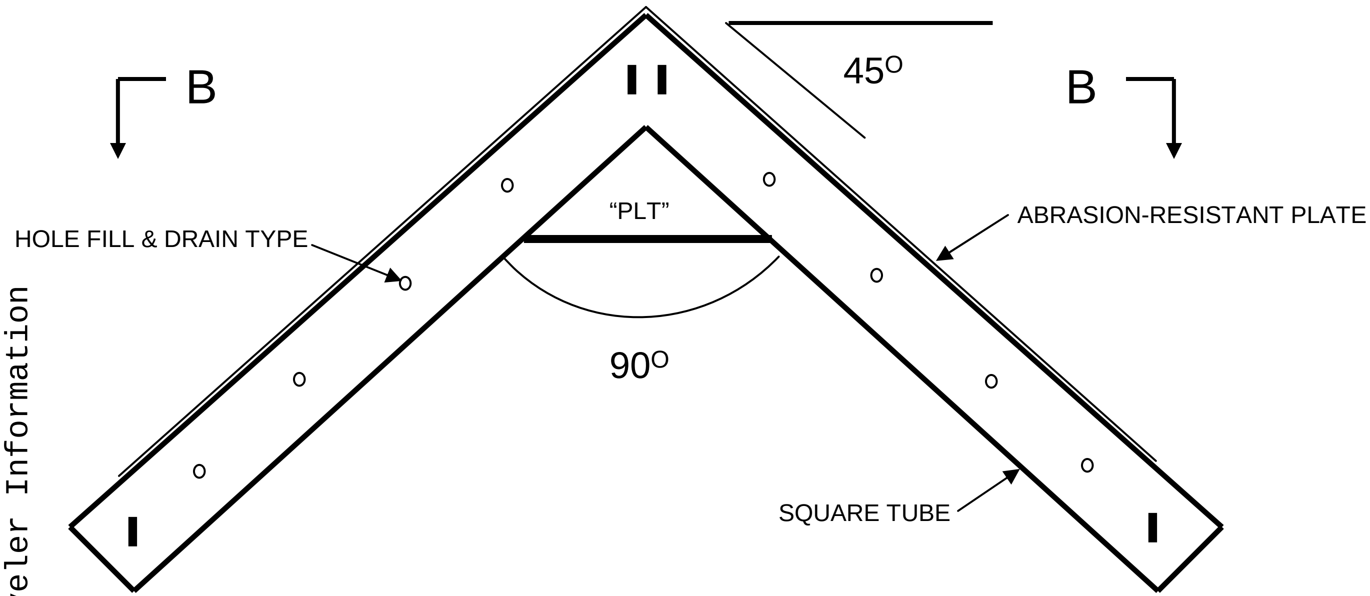
Appendix C



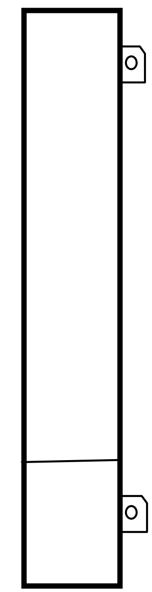
Legend
Borrow Areas
Beach Renourishment Area
Chesapeake Bay
Atlantic Ocean
Norfolk Harbor
Virginia Beach, Virginia
Hurricane Protection and Beach Erosion Control
Periodic Beach Renourishment
N
10000 0 10000 20000 Feet
Scale 1" = 12,000'
US Army Corp
of Engineers
Norfolk District




SECTION B - B



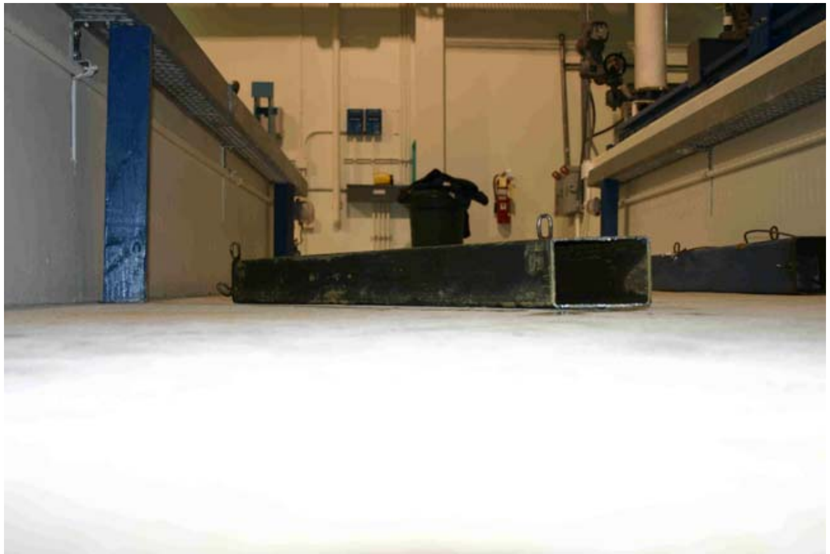

PLAN VIEW

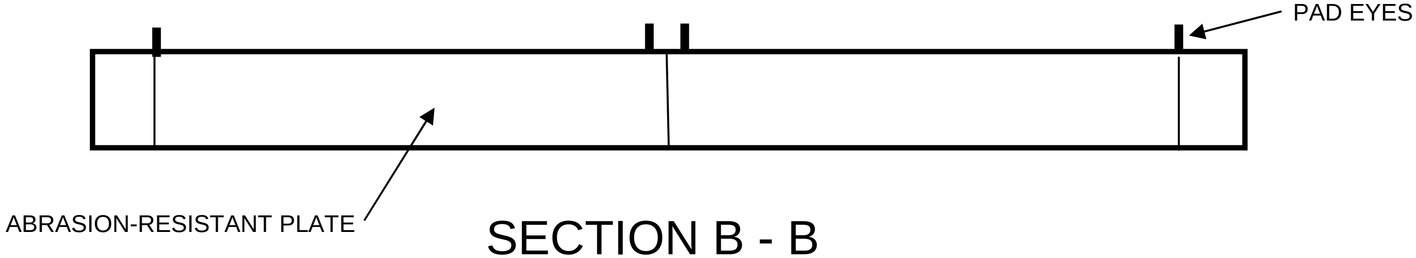


LEFT SIDE VIEW

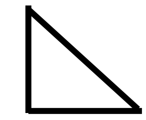
**90 DEGREE BED LEVELER**
**CONCEPTUAL DESIGN**

# 90 DEGREE BED LEVELER MODEL PHOTOGRAPHS

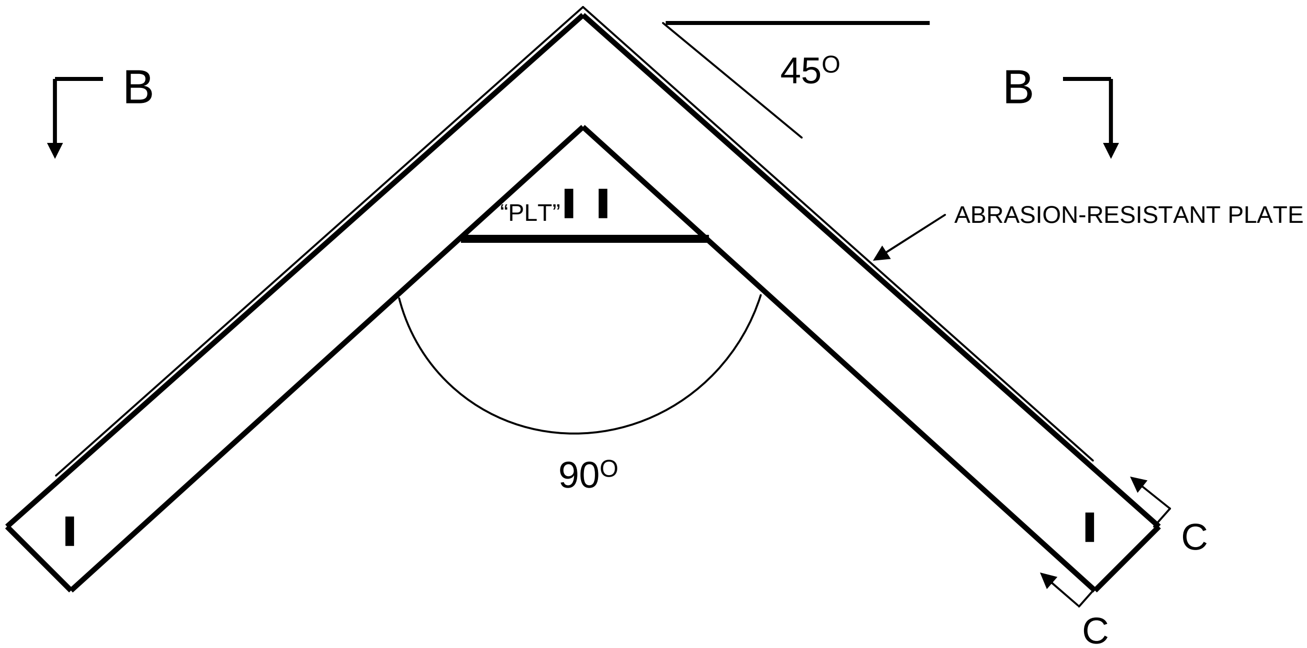




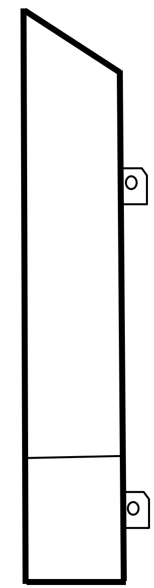

SECTION B - B



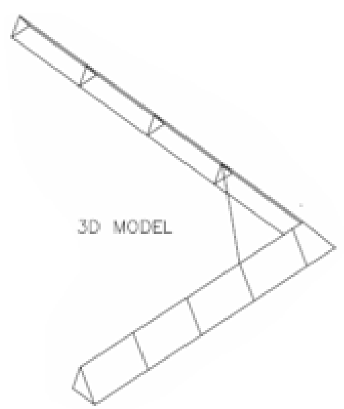
SECTION C-C




PLAN VIEW

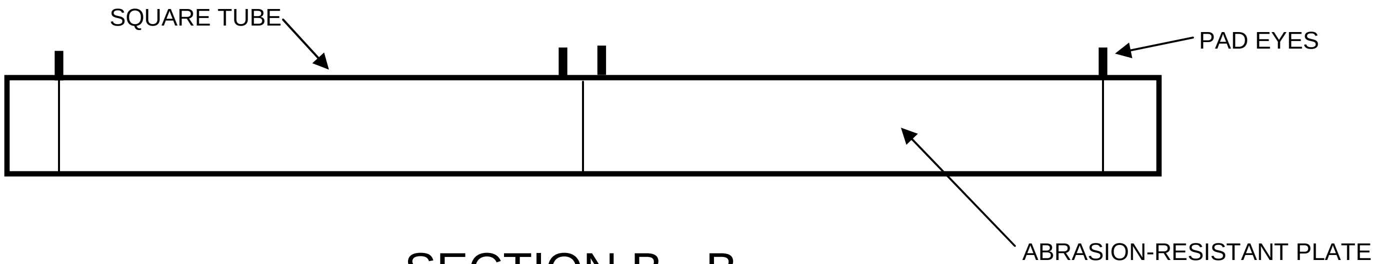


LEFT SIDE VIEW

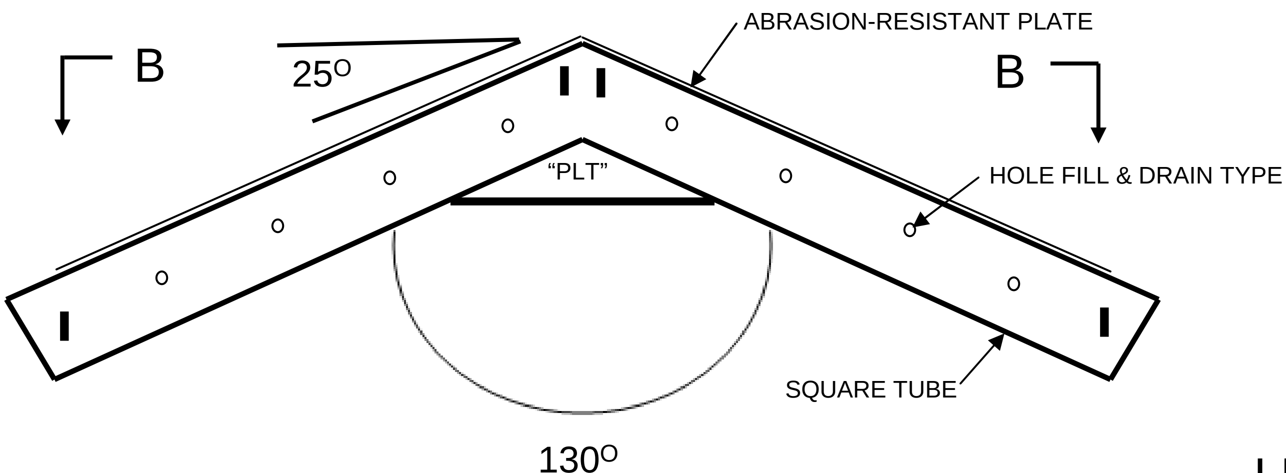



**90 DEGREE RAKED BED LEVELER**
**CONCEPTUAL DESIGN**

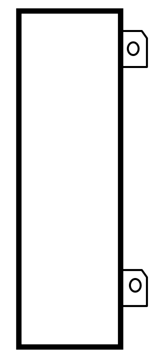
# 90 DEGREE RAKED BED LEVELER MODEL PHOTOGRAPHS




SECTION B - B



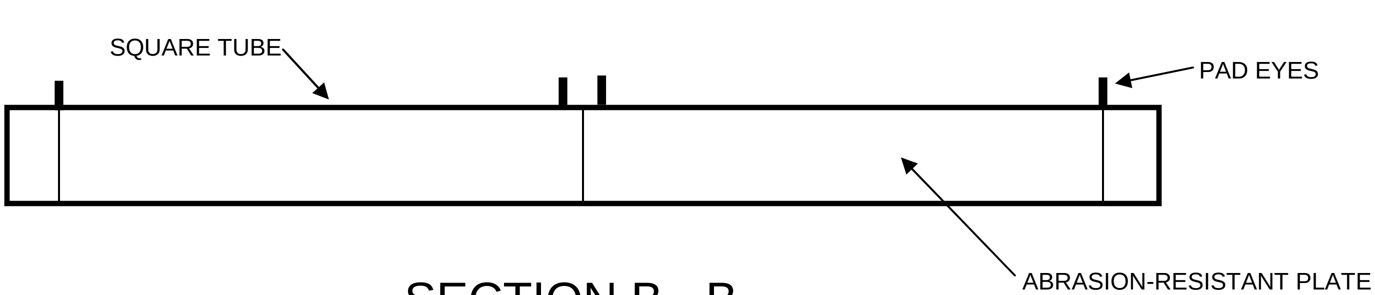

PLAN VIEW



LEFT SIDE VIEW

**130 DEGREE BED LEVELER**
**CONCEPTUAL DESIGN**

# 130 DEGREE BED LEVELER MODEL PHOTOGRAPHS

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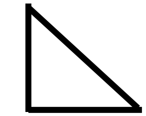
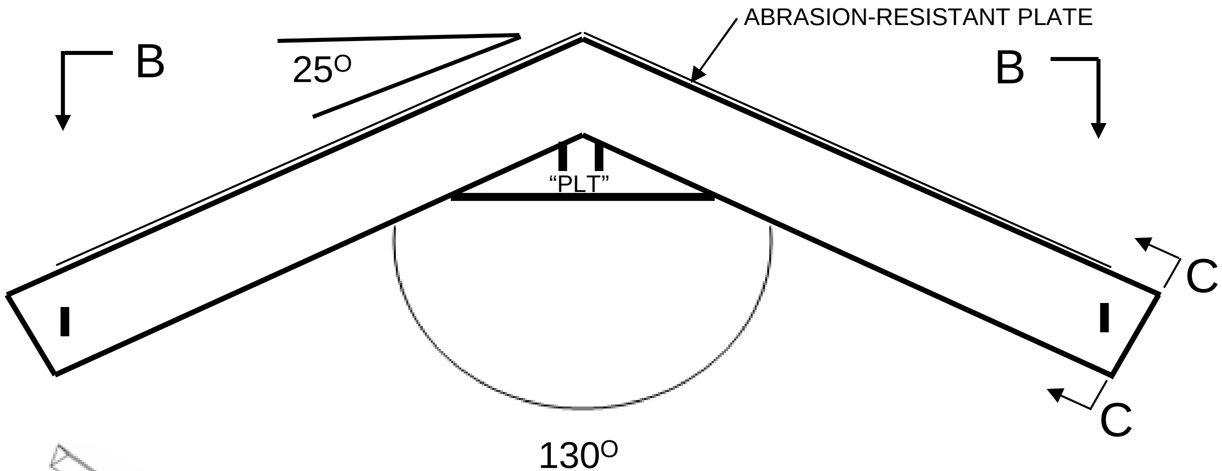
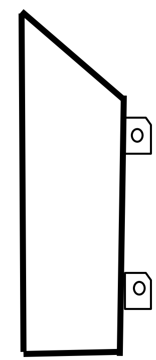


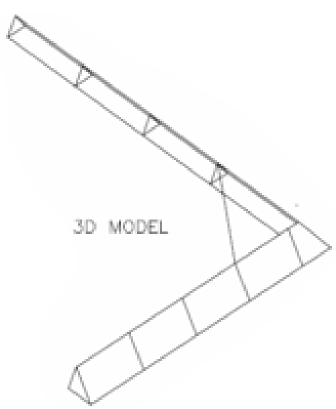
SECTION C-C




PLAN VIEW



LEFT SIDE VIEW




**130 DEGREE RAKED BED LEVELER**
**CONCEPTUAL DESIGN**

## 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 *Ouchita* | Dead | ~69cm, rear half | Overflow Screening | N | Chris Slay pers com<br>Observer report<br>DACW 60-90-C-0067 |
| 2 | 15 Jan 94 | SAS | Savannah Harbor | A | H *RN Weeks* | NA | NA | Found by Turtle observer | No | Steve Calver pers com 14 Jun 05<br>Observer load sheet and final rpt<br>#DACW21-93-C-0072 |
| 3 | 07 Dec 94 | SAS | Savannah Harbor | A | H *Dodge Island* | Live released | 71cm, whole fish | Starboard Skimmer Screening | Yes<br>We have efile | Chris Slay pers com<br>Observer report |
| 4 | 07 Dec 94 Different Load | SAS | Savannah Harbor | A | H *Dodge Island* | Dead | 77.5cm, whole fish | Starboard Skimmer Screening | Yes<br>We have efile | Chris Slay pers com<br>Observer report |
| 5 | Feb 96 | NAP | Delaware River Newbold Island | S | P *Ozark* | Dead | 83cm, female w/eggs | In DMA Money Island | | NMFS memo for record<br>From Laurie Silva 19 Apr 96 |
| 6 | Feb 96 | NAP | Delaware River Newbold Island | S | P *Ozark* | Dead | 63cm, mature male | In DMA Money Island | | NMFS memo for record<br>From Laurie Silva<br>19 Apr 96 |
| 7 | 06 Jan 98 | NAP | Delaware River Kinkora Range | S | P *??* | Dead | Either 657mm or 573mm **???** | In DMA Money Island | Y<br>Not e-file | Memo for file 20 Jan 98<br>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<br>Not e-file | Memo for file 20 Jan 98<br>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<br>Not e-file | Memo for file 20 Jan 98<br>From Greg Wacik NAP |
| 10 | 7 Sep 98 | SAW | Wilmington Har Cape Fear River | A | H *McFarland* | Dead | Head only (1 ft long) | In turtle Inflow screen | | Observer incident report<br>Pers com Bill Adams- SAW 26 Jul 04 |
| 11 | 01 Mar 00 | SAC | Charleston Harbor | A | H *Stuyvesant* | Dead | Missing head and tail | Main Overflow Screening | No | Chris Slay pers com<br>Observer reporting forms |
| 12 | 12 Apr 00 | SAC | Charleston Harbor | A | H *Stuyvesant* | Dead | 71.6cm, whole fish | Starboard Overflow screening | No | Chris Slay pers com<br>Observer reporting forms |
| 13 | 03 Dec 00 | SAW | Wilmington Har MOTSU | A | C *New York* | Dead | 82.5cm, whole fish decomposing | In bucket | Y<br>Not e-file<br>Payonk?<br>? | Chris Slay pers com<br>Phil Payonk pers com<br>30 Jul 04<br>Bill Adams pers com<br>28 Jul 04<br>#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<br>*RN Weeks* | 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<br>2003 Chesapeake BA, Section 7.2<br>Normandeau Associates, Inc 2001 |
| 16 | 30 Apr 03 | NAE | Kennebec River Bath Iron Works | S | C<br>Reed and Reed dredge company | Dead | Fish nearly cut in half | | Y<br>We have e-file | Julie Crocker NMFS pers com 19 Jul 04<br>2003 Chesapeake BA, Section 7.2<br>Normandeau Associates, Inc 2001 |
| 17 | 6 Oct 03 | NAE | Kennebec River Doubling Point | S | H<br>*Padre Island* | Dead | 38.1inches | In hopper | Y<br>We have e-file | Observer incident report<br>Kennebec River BA Jul 04<br>Memo for Commander, from Bill Kavanaugh, 1 Jul 04<br>Bill Kavanaugh pers com 15 Jul 04<br>Julie Crocker pers com 19 Jul 04 |
| 18 | 6 Oct 03 | NAE | Kennebec River Doubling Point | S | H<br>*Padre Island* | Dead | 37.0 inches | In hopper<br>Did not dive<br>Probably died | Y<br>We have e-file | Observer incident report<br>Kennebec River BA Jul 04<br>Memo for Commander, from Bill Kavanaugh, 1 Jul 04<br>Bill Kavanaugh pers com 15 Jul 04<br>Julie Crocker pers com 19 Jul 04 |
| 19 | 6 Oct 03 | NAE | Kennebec River Doubling Point | S | H<br>*Padre Island* | Live | Swam away | In hopper | Y<br>We have e-file | Observer incident report<br>Kennebec River BA Jul 04<br>Memo for Commander, from Bill Kavanaugh, 1 Jul 04<br>Bill Kavanaugh pers com 15 Jul 04<br>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 *Padre Island* | 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 *Padre Island* | 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 *Manhattan Island* | 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 *Bayport* | 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 *Padre Island* | 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 *Padre Island* | Dead | Head only of fish 22.5cm | 2nd 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 *RN Weeks* | 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 *Newport* | 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 *Glenn Edwards* | 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 *Dodge Island* | 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 *Glenn Edwards* | 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 *Glenn Edwards* | 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 *Bayport* | 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 *McFarland* | 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 oxyrhynchus oxyrhynchus*)
S=Shortnose sturgeon (*Acipenser brevirostrum*)
G=Gulf sturgeon (*Acipenser oxyrhynchus 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

***Obtaining Sample***

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. Each fin clip should be placed into a vial of 95% non-denatured ethanol and the vial should be labeled with the species name, date, name of project and the fork length and total length of the fish along with a note identifying the fish to the appropriate observer report. All vials should be sealed with a lid and further secured with tape Please use permanent marker and cover any markings with tape to minimize the chance of smearing or erasure.

***Storage of Sample***

1. If possible, place the vial on ice for the first 24 hours. If ice is not available, please refrigerate the vial. Send as soon as possible as instructed below.

***Sending of Sample***

1. Vials should be placed into Ziploc or similar resealable plastic bags. Vials should be then wrapped in bubble wrap or newspaper (to prevent breakage) and sent to:

Julie Carter
NOAA/NOS – Marine Forensics
219 Fort Johnson Road
Charleston, SC 29412-9110
Phone: 843-762-8547

a. Prior to sending the sample, contact Russ Bohl at NMFS Northeast Regional Office (978-282-8493) to report that a sample is being sent and to discuss proper shipping procedures.

**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**

# STURGE~~ON~~ SALVAGE FORM

For use in documenting dead sturgeon in the wild under ESA permit no. 1614 (version 05-16-2012)

**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/vide taken? ☐ Yes ☐ No
Disposition of Photos/Video:__________
______________________________
______________________________

**SAMPLES COLLECTED?** ☐ Yes ☐ No

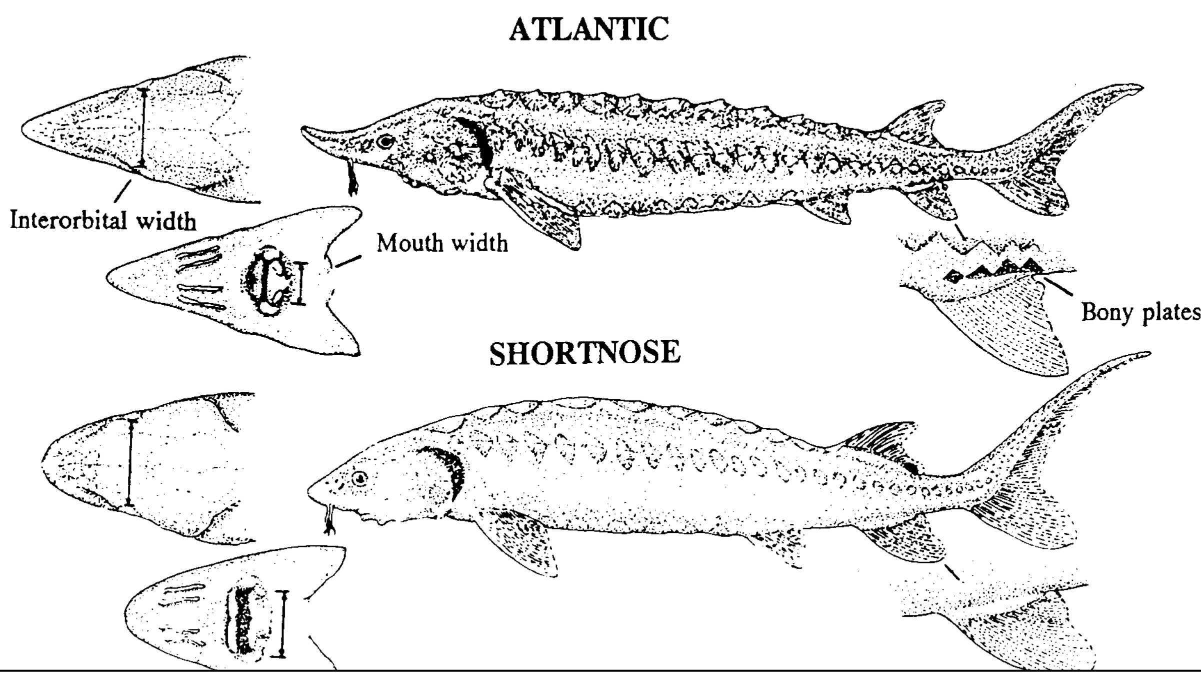
| Sample | How preserved | Disposition (person, affiliation, use) |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

Comments:
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

Distinguishing Characteristics of Atlantic and Shortnose Sturgeon (version 07-20-2009)

| Characteristic | Atlantic Sturgeon, ***Acipenser oxyrinchus*** | Shortnose Sturgeon, ***Acipenser brevirostrum*** |
|---|---|---|
| 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.**

________________________________________________

________________________________________________

________________________________________________

________________________________________________

________________________________________________

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**: **Northeast Region Contacts** – Shortnose Sturgeon Recovery Coordinator (Jessica Pruden, Jessica.Pruden@noaa.gov, 978-282-8482) or Atlantic Sturgeon Recovery Coordinator (Lynn Lankshear, Lynn.Lankshear@noaa.gov, 978-282-8473); **Southeast Region Contacts**- Shortnose Sturgeon Recovery Coordinator (Stephania Bolden, Stephania.Bolden@noaa.gov, 727-824-5312) or Atlantic Sturgeon Recovery Coordinator (Kelly Shotts, Kelly.Shotts@noaa.gov, 727-551-5603).

**APPENDIX G**
**INCIDENTAL TAKE REPORT**

**Daily Report**

Date: ________________________________
Geographic Site:____________________________________________________________
Location: Lat/Long ____________________ Vessel Name ___________________________

Weather conditions:__________________________________________________________
___________________________________________________________________________
Water temperature: Surface ____________ Below midwater (if known) ____________

Condition of screening apparatus: _____________________________________________
___________________________________________________________________________
___________________________________________________________________________
Incidents involving endangered or threatened species? (Circle) Yes No
(*If yes, fill out Incident Report of Sea Turtle/ Sturgeon Mortality*)

Comments (type of material, biological specimens, unusual circumstances, etc:)
_________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

Observer's Name: ______________________________________________
Observer's Signature: ___________________________________________

| Species | # of Sightings | # of Animals | Comments |
|---|---|---|---|
| | | | |
| | | | |
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| | | | |

**Incident Report of Sea Turtle Take**

Species _____________ Date _______________ Time (specimen found) ________________

Geographic Site _______________________________________________________________
Location: Lat/Long _____________________________________________________________
Vessel Name _________________________ Load # ______________________________
Begin load time _______________________ End load time_________________________
Begin dump time ______________________ End dump time _______________________

Sampling method ______________________________________________________________
Condition of screening __________________________________________________________
Location where specimen recovered_______________________________________________
_____________________________________________________________________________
Draghead deflector used? YES NO Rigid deflector draghead? YES NO
Condition of deflector ____________________________________________________________
_____________________________________________________________________________
Weather conditions_______________________________________________________________
_____________________________________________________________________________
Water temp: Surface ________________ Below midwater (if known) ______________________

**Species Information**: *(please designate cm/m or inches.)*
Head width __________________________ Plastron length ___________________________
Straight carapace length ________________ Straight carapace width______________________
Curved carapace length _________________ Curved carapace width ______________________

Condition of specimen/description of animal (please complete attached diagram)
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________

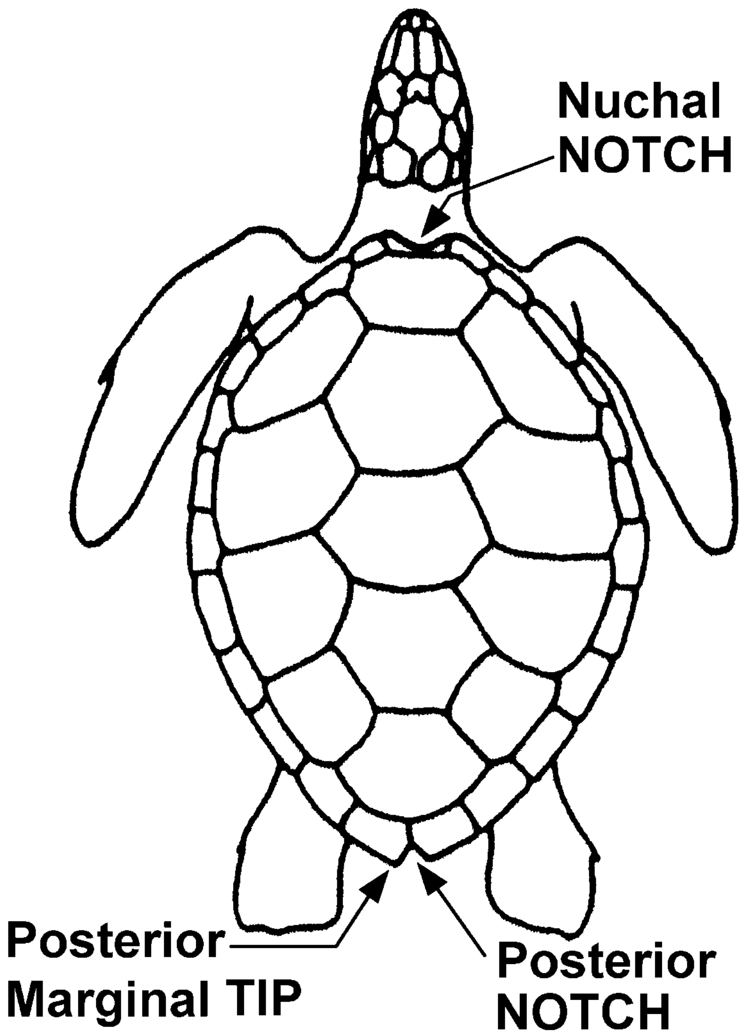
Turtle Decomposed: NO SLIGHTLY MODERATELY SEVERELY

Turtle tagged: YES NO *Please record all tag numbers.* Tag # ______________________
Genetic sample taken: YES NO
Photograph attached: YES NO
(please label *species, date, geographic site* and *vessel name* on back of photograph)

Comments/other (include justification on how species was identified) _____________________
_____________________________________________________________________________
_____________________________________________________________________________
Observer's Name ________________________________________
Observer's Signature ___________________________________

**Incident Report of Sea Turtle Take**

Draw wounds, abnormalities, tag locations on diagram and briefly describe below.




Description of animal:

**Incident Report of Sturgeon Take**

*Photographs should be taken and the following information should be collected from all sturgeon (alive and dead)*

Date ________________ Time (specimen found) _________________

Geographic Site___________________________________________________________
Location: Lat/Long_____________________________________________________________
Vessel Name ___________________________ Load # _____________________________
Begin load time _________________________ End load time_________________________
Begin dump time ________________________ End dump time _______________________

Sampling method ____________________________________________________________
Condition of screening __________________________________________________________
Location where specimen
recovered____________________________________________________________________________
__________________________________________________________

Draghead deflector used? YES NO Rigid deflector draghead? YES NO
Condition of deflector __________________________________________________________
__________________________________________________________________________

Weather conditions____________________________________________________________________
_____________________________________________________________________________

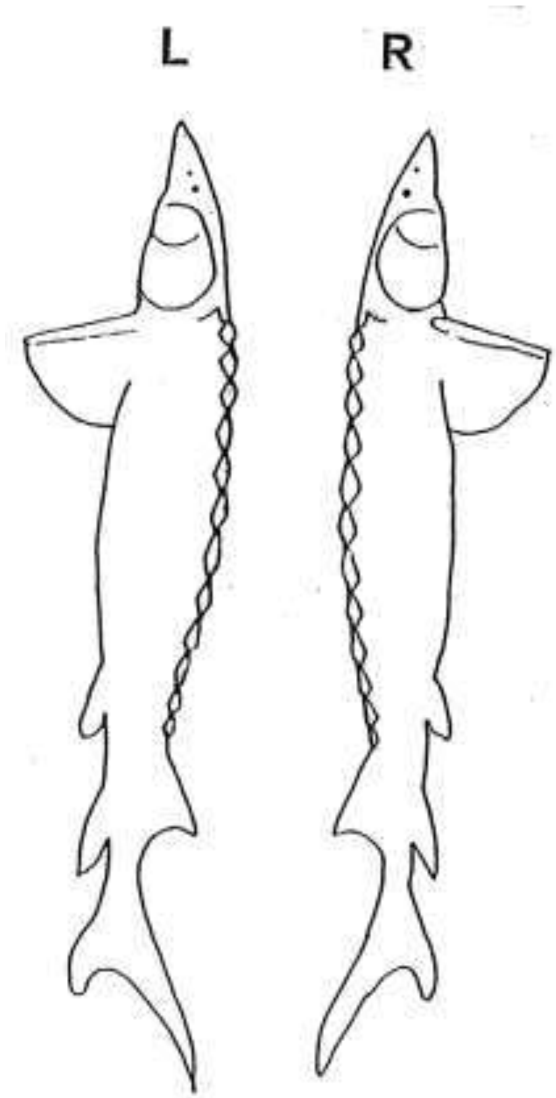
Water temp: Surface _________________ Below midwater (if known) ________________

**Species Information**: *(please designate cm/m or inches.)*
Fork length (or total length) ______________________ Weight ______________________

Condition of specimen/description of animal
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________

Fish Decomposed: NO SLIGHTLY MODERATELY SEVERELY
Fish tagged: YES / NO *Please record all tag numbers.* Tag # _________________
Genetic sample taken: YES NO
Photograph attached: YES / NO
(please label *species, date, geographic site* and *vessel name* on back of photograph)
Comments/other (include justification on how species was identified)
___________________________________________________________________________________
_______________________________________________________________________
Observer's Name ____________________Observer’s Signature______________________

Draw wounds, abnormalities, tag locations on diagram and briefly describe below




Description of fish condition:

## 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 E).

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 ½ x 4 inch at end
cod end cover - none
chaffing gear - none
**HEAD ROPE:** 60 ft ½ inch combination rope (braid nylon with stainless cable center)
**FOOT ROPE:** 65 ft ½ 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., 3rd 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., 3rd 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 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 ACOE shall require of the dredge operator that, when the observer is off watch, the cage shall not be opened unless it is clogged. The ACOE 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) within 24 hours of the take. An incident report for sea turtle/shortnose sturgeon take (Appendix D) shall also be completed by the observer and sent via FAX (978) 281-9394 or e-mail (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) 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 D):

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).  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 D).  The photographs and reports should be submitted by email (incidental.take@noaa.gov) or mail (Attn: Section 7 Coodinator, 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 ACOE 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.

## APPENDIX K

### Sea Turtle Handling and Resuscitation

It is unlikely that sea turtles will survive entrainment in a hopper dredge, as the turtles found in the dragheads are usually dead, dying, or dismantled. However, the procedures for handling live sea turtles follow in case the unlikely event should occur. These guidelines are adapted from 50 CFR § 223.206(d)(1).

*Please photograph all turtles (alive or dead) and turtle parts found during dredging activities and complete the Incident Report of Sea Turtle Take.*

**Dead sea turtles**
The procedures for handling dead sea turtles and parts are described in Appendix D.

**Live sea turtles**
When a sea turtle is found in the dredge gear, observe it for activity and potential injuries.

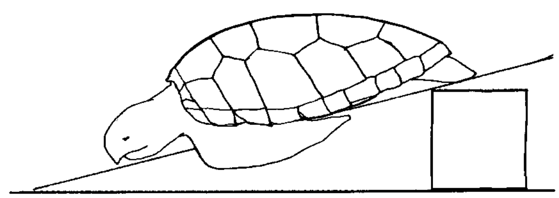
- **If the turtle is actively moving**, it should be retained onboard until evaluated for injuries by a permitted rehabilitation facility. Due to the potential for internal injuries associated with hopper entrainment, it is necessary to transport the live turtle to the nearest rehabilitation facility as soon as possible, following these steps:
  1) Contact the nearest rehabilitation facility to inform them of the incident. If the rehabilitation personnel cannot be reached immediately, please contact NMFS stranding hotline at 866-755-6622 or NMFS Sea Turtle Stranding Coordinator at 978-281-9328.
  2) Keep the turtle shaded and moist (e.g., with a water-soaked towel over the eyes, carapace, and flippers), and in a confined location free from potential injury.
  3) Contact the crew boat to pick up the turtle as soon as possible from the dredge (within 12 to 24 hours maximum). The crew boat should be aware of the potential for such an incident to occur and should develop an appropriate protocol for transporting live sea turtles.
  4) Transport the live turtle to the closest permitted rehabilitation facility able to handle such a case.

  Do not assume that an inactive turtle is dead. The onset of rigor mortis and/or rotting flesh are often the only definite indications that a turtle is dead. Releasing a comatose turtle into any amount of water will drown it, and a turtle may recover once its lungs have had a chance to drain.

- **If a turtle appears to be comatose** (unconscious), contact the designated stranding/rehabilitation personnel immediately. Once the rehabilitation personnel has been informed of the incident, attempts should be made to revive the turtle at once. Sea turtles have been known to revive up to 24 hours after resuscitation procedures have been followed.
  - Place the animal on its bottom shell (plastron) so that the turtle is right side up and elevate the hindquarters at least 6 inches for a period of 4 up to 24 hours. The

degree of elevation depends on the size of the turtle; greater elevations are required 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 then alternate to the other side.
- Periodically, gently touch the eye and pinch the tail (reflex test) to see if there is a response.
- Keep the turtle in a safe, contained place, shaded, and moist (e.g., with a water-soaked towel over the eyes, carapace, and flippers) and observe it for up to 24 hours.
- If the turtle begins actively moving, retain the turtle until the appropriate rehabilitation personnel can evaluate the animal. The rehabilitation facility should eventually release the animal in a manner that minimizes the chances of re-impingement and potential harm to the animal (i.e., from cold stunning).
- Turtles that fail to move within several hours (up to 24) must be handled in the manner described, or transported to a suitable facility for necropsy (if the condition of the sea turtle allows and the rehabilitation facility wants to necropsy the animal).



**Stranding/rehabilitation contacts**

**NMFS Stranding Hotline**: 866-755-6622 or NERStranding.staff@noaa.gov

**Virginia State Coordinator: Sea Turtle Stranding and Salvage Network**
Mark Swingle (Co-Coordinator, James River South and VA Eastern Shore)
Virginia Aquarium Stranding Program
717 General Booth Boulevard
Virginia Beach, VA 23451
Office: 757-437-6022; Fax: -4976
Stranding Hotline: 757-437-6159
mswingle@vbgov.com

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

October 19, 2017

Operations Branch

Ms. Sumalee Hoskin
U. S. Fish and Wildlife Service
Virginia Field Office
6669 Short Lane
Gloucester, VA 23061

Dear Ms. Hoskin:

The U.S. Army Corps of Engineers (USACE), Norfolk District is responsible for the maintenance of the Virginia Beach Erosion and Storm Protection Project at Sandbridge Beach, Virginia Beach, VA. The USACE, acting as the lead agency, plans to utilize Sandbridge Shoals as borrow areas through a Memorandum of Agreement with the Bureau of Ocean Energy Management (BOEM), a cooperating agency. The Sandbridge project involves the placement of sand at Sandbridge Beach, an area approximately 5 miles long and 125 feet wide, in order to provide protection from erosion-induced damages, especially as a result of storms.

This letter is to provide notification and request concurrence under Section 7 of the Endangered Species Act (ESA) from the U.S. Fish and Wildlife Service (USFWS) for a project led by USACE, Norfolk District. The proposed project would place 2,000,000 cubic yards (cy) of dredged material from Sandbridge Shoals at Sandbridge Beach, VA, for beach protection from erosion-induced damages in calendar year 2018. A hopper dredge is expected to be used for all dredging activity. The borrow areas for this project are Area B to the north and Area A to the south, located within Sandbridge Shoal about 3 nautical miles from shore.

The last renourishment event occurred in 2012-2013 and was authorized to dredge 2,138,850 cy from Sandbridge Shoals. Previous coordination with the USFWS according to ESA Section 7 requirements were completed in 2008, with concurrence again in 2012 due to project delays (Attachment A). The action considered in this determination was the placement of 1 to 2 million cy of dredged material from Sandbridge Shoals Areas A and B on an area of 5 miles long and 125 feet wide on Sandbridge Beach. In these previous determinations, USFWS concluded that, as long as protective measures were followed, the project was not likely to adversely affect any threatened or endangered species or their critical habitat.

The USFWS Service currently lists under their jurisdiction 73 listed threatened and/or endangered species in Virginia, some of which are jointly managed with NOAA Fisheries. Of those species, the following may occur along the Atlantic Coast of Southern Virginia:

Mammals
T - Northern Long-eared Bat (Myotis septentrionalis)

Birds
E - Roseate tern (*Sterna dougallii dougallii)*; Atlantic coast
T - Piping plover (*Charadrius melodus)*; non-Great Lakes watershed
T - Red knot (*Calidris canutus rufa)*

Fish
E - Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*); New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPS
T - Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*); Gulf of Maine DPS
E - Shortnose sturgeon (*Acipenser brevirostrum*)

Turtles
T - Loggerhead sea turtle (*Caretta caretta)*; Northwest Atlantic DPS
T - Green sea turtle (*Chelonia mydas*); North Atlantic DPS
E - Leatherback sea turtle (*Dermochelys coriacea)*
E - Hawksbill sea turtle (*Eretmochelys imbricate*)
E - Kemp's ridley sea turtle (*Lepidochelys kempii)*

The previous determinations in 2008 and 2012 considered impacts to species listed at that time; since that analysis, the northern long eared bat, red knot, and Atlantic sturgeon have been listed under the ESA.

The northern long-eared bat inhabits cavities or crevices in live and dead trees during the summer. During the winter months, they typically hibernate in caves and mines. No impacts are anticipated to the northern long-eared bat as their preferred habitat does not occur within the project area.

Red knots are characterized by their large, bulky sandpiper body form and a short, straight bill that tapers at the tip. No critical habitat has been designated for this species. Red knots have the potential to forage in the project area. No impacts are anticipated, as they are highly transient in nature.

Previous coordination with the USFWS has considered effects of Sandbridge Beach renourishment on sea turtles. Additional analysis of impacts to threatened and endangered species in a 2012 Environmental Assessment concluded with a Finding of No Significant Impact; however, this document was finalized before the Atlantic sturgeon was listed. On October 12, 2012, NOAA Fisheries Protected Resources Division (PRD) issued a Biological Opinion (BO) for borrow area dredging and placement for Sandbridge Beach renourishment (Attachment B). This BO considered all ESA-listed species in the project area, including Atlantic sturgeon; there have been no changes since this last consultation with NOAA Fisheries PRD. NOAA Fisheries concluded that the project may adversely affect Atlantic sturgeon, and loggerhead, Kemp's ridley, green, and leatherback sea turtles, but will not jeopardize the continued existence of any population, provided mitigation measures are followed. The USACE, in cooperation with BOEM, determined that the BO fulfills the proposed project's ESA Section 7 requirements. The use of munitions screens on the draghead are required because of documented munitions of explosive concern (MEC) and unexploded ordnance (UXO) in the area, so injury and death of animals cannot be directly observed. A proxy estimate is used in place of an onboard marine species observer. Based on the Incidental Take Statement issued by NOAA Fisheries PRD and calculated specifically for the proposed dredged volume (2,000,000 cy), this project assumes a take of one Atlantic sturgeon for work year-round, and seven sea turtles (90% loggerheads, 8% Kemp's ridley, and 2% green) for work conducted from April 1$^{st}$ through November 30$^{th}$. The USACE will adhere to all non-discretionary terms and conditions and reasonable and prudent measures established during the course of consultations with your office and NOAA Fisheries PRD to minimize and monitor impacts to threatened and endangered species resulting from this project. Turtle excluder devices (TED) or "deflectors" will be installed on the hopper dredge drag-heads year around to minimize entrainment of Atlantic sturgeon and sea turtle species that may be present in the sand borrow area. Between May 1$^{st}$ and November 30$^{th}$, sections of the beach undergoing re-nourishment will be monitored for sea turtles, their nests and nesting activities. If nesting occurs, project activities will be modified to avoid potential impacts to turtles.

Based on this information, the USACE and BOEM finds that the proposed activity would not adversely affect any listed threatened and/or endangered species in USFWS' jurisdiction. We are requesting your concurrence with the determination and acknowledgement that USACE and BOEM have met their ESA Section 7 requirements for this project.

Should you have any questions or require further information on this submittal, please contact Ms. Teri Nadal by email at teresita.i.nadal@usace.army.mil or call (757) 201-7299. Thank you for your cooperation and assistance.

Sincerely,

Keith B. Lockwood

Keith B. Lockwood
Chief, Operations Branch

Enclosures

# United States Department of the Interior

FISH AND WILDLIFE SERVICE

Virginia Field Office
6669 Short Lane
Gloucester, VA 23061


Date: December 21, 2017

**Self-Certification Letter**

Project Name: Virginia Erosion & Storm Protection Project at Sandbridge Beach

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), and the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c, 54 Stat. 250), as amended (Eagle Act). 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 and Eagle Act conclusions. These conclusions resulted in:

- "no effect" determinations for proposed/listed species and/or proposed/designated critical habitat; and/or
- "may affect, not likely to adversely affect" determinations for proposed/listed species and/or proposed/designated critical habitat; and/or
- "may affect, likely to adversely affect" determination for the Northern long-eared bat (*Myotis septentrionalis*) and relying on the findings of the January 5, 2016 Programmatic Biological Opinion for the Final 4(d) Rule on the Northern long-eared bat; and/or
- "no Eagle Act permit required" determinations for eagles.

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 “no effect” or “not likely to adversely affect” determinations for proposed and listed species and proposed and designated critical habitat; the “may affect” determination for Northern long-eared bat; and/or the “no Eagle Act permit required” determinations for eagles. 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, or bald eagles 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. If you have any questions, please contact Troy Andersen of this office at (804) 824-2428.

Sincerely,

Cynthia A Schulz

Cindy Schulz
Field Supervisor
Virginia Ecological Services

Enclosures - project review package

Hansen, Deena <deena.hansen@boem.gov>

# FW: [EXTERNAL] Virginia Beach Erosion and Storm Protection Project at Sandbridge Beach (UNCLASSIFIED)

2 messages

**Nadal, Teresita I CIV USARMY CENAO (US)** <Teresita.I.Nadal@usace.army.mil> Fri, Dec 22, 2017 at 9:30 AM
To: "Hansen, Deena" <deena.hansen@boem.gov>
Cc: "leighann.brandt@boem.gov" <leighann.brandt@boem.gov>

CLASSIFICATION: UNCLASSIFIED

Good news, FWS coordination is complete.

Happy holidays!

Teri

**From:** Stephenson, Chelsey [mailto:chelsey_stephenson@fws.gov]
**Sent:** Thursday, December 21, 2017 4:25 PM
**To:** Nadal, Teresita I CIV USARMY CENAO (US) <Teresita.I.Nadal@usace.army.mil>
**Subject:** Re: [EXTERNAL] Virginia Beach Erosion and Storm Protection Project at Sandbridge Beach (UNCLASSIFIED)

Hi Teri,

Thanks--- that looks good.  We have completed our review of this project and have no further comments.

Best,

Chelsey

> On Thu, Dec 21, 2017 at 2:40 PM, Nadal, Teresita I CIV USARMY CENAO (US) <Teresita.I.Nadal@usace.army.mil <mailto:Teresita.I.Nadal@usace.army.mil> > wrote:
>
> Chelsey,
> Attached is the Self Certification letter and updated spreadsheet.
> Will I receive an email that coordination is complete?

Happy Hoildays!

Teri

CLASSIFICATION: UNCLASSIFIED

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**2 attachments**

**SANDBRIDGE_USFWS.pdf**
589K

**Sandbridge.xlsx**
3045K

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**Hansen, Deena** <deena.hansen@boem.gov> Tue, Dec 26, 2017 at 9:23 AM
To: "Nadal, Teresita I CIV USARMY CENAO (US)" <Teresita.I.Nadal@usace.army.mil>

Great to hear-- thanks for sharing!

Deena Hansen
Oceanographer
BOEM, Office of Environmental Programs
45600 Woodland Road
Sterling VA 20166
703-787-1653
[Quoted text hidden]

# Species Conclusions Table

| | |
|---|---|
| Project Manager: Teri Nadal | Project Name: Sandbridge Beach Nourishment |
| Date: December 8, 2017 | Project Number: Consultation Code:05E2VA00-2018-SLI-0831 |

Project Description: The project involves the placement of 2M cy from Sandbridge Shoals Borrow Areas at Sandbridge Beach, an area approximately 5 miles long and 125 feet wide, in order to provide protection from erosion-induced damages, especially as a result of storms. The last renourishment event occurred in 2013 and was authorized to dredge 2,138,850 cy from Sandbridge Shoals. Previous coordination with the USFWS were completed in 2008, with concurrence again in 2012.The next replenishment cycle is anticipated to occur in July 2018 through the end of August 2018. In the event the project is delayed, dredging would start in mid-November 2018 and be completed within approximately 120 days pending weather conditions.On October 12, 2012, NOAA Fisheries Protected Resources Division issued a Biological Opinion (BO) for borrow area dredging and placement for Sandbridge Beach renourishment. This BO considered all ESA-listed species in the project area, including Atlantic sturgeon; there have been no changes since this last consultation with NOAA Fisheries PRD. The USACE will adhere to all non-discretionary terms and conditions and reasonable and prudent measures established during the course of consultations with your office and NOAA Fisheries PRD to minimize and monitor impacts to threatened and endangered species resulting from this project. Turtle excluder devices (TED) or “deflectors” will be installed on the hopper dredge drag-heads year around to minimize entrainment of Atlantic sturgeon and sea turtle species that may be present in the sand borrow area. Between May 1st and November 30th, sections of the beach undergoing re-nourishment will be monitored for sea turtles, their nests and nesting activities. If nesting occurs, project activities will be modified to avoid potential impacts to turtles.Based on this information, the USACE and BOEM finds that the proposed activity would not adversely affect any listed threatened and/or endangered species in USFWS’ jurisdiction.

Species Under the Jurisdiction of FWS:

| Species/Resource Name | Conclusion | ESA Section 7 / Eagle Act Determination | Species Info / Habitat Description | Notes / Determination |
|---|---|---|---|---|

# Species Conclusions Table

| Date: December 8, 2017 | Project Number: Consultation Code:05E2VA00-2018-SLI-0831 |
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|---|---|---|---|---|
| Northern long-eared bat (Myotis septentrionalis) | No suitable habitat present | No effect | "Northern long-eared bats spend winter hibernating in caves and mines, called hibernacula. They typically use large caves or mines with large passages and entrances; constant temperatures; and high humidity with no air currents. Specific areas where they hibernate have very high humidity, so much so that droplets of water are often seen on their fur. Within hibernacula, surveyors find them in small crevices or cracks, often with only the nose and ears visible.<br><br>During summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. Males and non-reproductive females may also roost in cooler places, like caves and mines. This bat seems opportunistic in selecting roosts, using tree species based on suitability to retain bark or provide cavities or crevices. It has also been found, rarely, roosting in structures like barns and sheds." | No habitat present to be impacted, therefore the proposed project will not effect the species. |
| Piping plover (Charadrius melodus) | No critical habitat present | No effect | "Piping plovers occur in three disjunct populations in North America: Northern Great Plains, Great Lakes, and Atlantic Coast. The piping plover is a 5 ½ inch long" The piping plover nesting season is from late April to late July with one brood raised per year. If there is a disturbance or the nest is lost, the birds may renest. Plovers nest on beaches, dunes, and washover areas. They also | |

# Species Conclusions Table

| Date: December 8, 2017 | Project Number: Consultation Code:05E2VA00-2018-SLI-0831 |
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|---|---|---|---|---|
| Red Knot<br>(Calidris canutus rufa) | Suitable habitat present, species not present | Not likely to adversely affect | nesting areas in mid- and high arctic latitudes and southern nonbreeding habitats as far north as the coastal United States (low numbers) and southward to southern South America. Populations including subspecies rufa migrate in large flocks northward through the contiguous United States mainly March-early June, southward July-August (Harrington 2001). Arrival in breeding areas occurs in late May or early June; most have departed breeding areas by mid-August. The migration stops of red knots that spend the boreal winter in Tierra del Fuego and Patagonian Argentina (subspecies rufa) are mainly along the Atlantic coast of South America (mainly Chile, Argentina, and Brazil) and the Atlantic and Gulf of Mexico coasts of North America (González et al. 2006), including staging areas on the coasts of Hudson and James bays (Harrington 2001). Knots that visit Delaware Bay in spring come mostly from South America, and these have strong fidelity to migration stopover sites; those that winter in Florida (subspecies?) are underrepresented during migration in New Jersey and Massachusetts. This species typically makes long flights between stops (Hayman et al. 1986). See Piersma and Davidson (1992) for information on knot migration."*<br>(NatureServe. 2014. NatureServe Explorer: An online encyclopedia of life [web application]. | Habitat may be present along the beach, however, due to the projects location adjacent to an existing highly developed residential subdivision along the public beach the project is not likely to adversely impact the species. |

# Species Conclusions Table

| Date: December 8, 2017 | Project Number: Consultation Code:05E2VA00-2018-SLI-0831 |
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|---|---|---|---|---|
| Roseate tern (Sterna dougallii dougallii) | Suitable habitat present, species not present | Not likely to adversely affect | "Roseate terns breed in colonies almost exclusively on small offshore islands, rarely on large islands. The northeastern colonies are on rocky offshore islands, barrier beaches, or salt marsh islands. Most colonies are close to shallow water fishing sites with sandy bottoms, bars, or shoals. The Caribbean birds nest in relatively open areas, often with no cover nearby. They breed on a variety of small cays or islands with rocky, grassy, coral rubble, or sand substrate. There is little information on the habitat of the wintering range. Some birds have been found roosting on sandbars or beaches at river mouths, estuaries, or ocean front. " | Habitat may be present along the beach, however, due to the projects location adjacent to an existing highly developed residential subdivision along the public beach the project is not likely to adversely impact the species. |
| Hawksbill sea turtle (Eretmochelys imbricata) | No suitable habitat present | No effect | "Hawksbills frequent rocky areas, coral reefs, shallow coastal areas, lagoons or oceanic islands, and narrow creeks and passes. They are seldom seen in water deeper than 65 feet. Hatchlings are often found floating in masses of sea plants, and nesting may occur on almost any undisturbed deep-sand beach in the tropics. Adult females are able to climb over reefs and rocks to nest in beach vegetation" | See BO dated 10/16/2012. Between May 1st and November 30th, sections of the beach undergoing re-nourishment will be monitored for sea turtles, their nests and nesting activities. If nesting occurs, project activities will be modified to avoid potential i |

# Species Conclusions Table

| Date: December 8, 2017 | Project Number: Consultation Code:05E2VA00-2018-SLI-0831 |
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| Kemp's ridley sea turtle (Lepidochelys kempii) | Suitable habitat present, species not present | Not likely to adversely affect | “Outside of nesting, the major habitat for Kemp's ridleys is the nearshore and inshore waters of the northern Gulf of Mexico. Adult and sub-adult Kemp's ridleys primarily occupy nearshore habitats that contain muddy or sandy bottoms where prey can be found. Kemp’s ridley hatchlings and small juveniles inhabit a very different environment than adults. After emerging from the nest, hatchlings enter the water and quickly swim offshore to open ocean developmental habitat where they associate with floating Sargassum seaweed. They passively drift within the Sargassum, feeding on a wide variety of floating items. Some of these juvenile turtles remain within Gulf of Mexico currents while others are swept out of the Gulf and into the Atlantic Ocean by the Gulf Stream. This developmental period is estimated to last approximately 2 years or until the turtles reach a carapace length of about 8 inches, at which time these sub-adult turtles return to neritic zones of the Gulf of Mexico or northwestern Atlantic Ocean where they feed and continuing growing until they reach maturity.” | See BO dated 10/16/2017. Between May 1st and November 30th, sections of the beach undergoing nourishment will be monitored for sea turtles, their nests and nesting activities. If nesting occurs, project activities will be modified to avoid potential impacts to turtles. It is our detrmination that the project may effect but is not likely to adversely affect the species. |
| Leatherback sea turtle (Dermochelys coriacea) | No suitable habitat present | No effect | ”The leatherback is the most pelagic of the sea turtles. Adult females require sandy nesting beaches backed with vegetation and sloped sufficiently so the distance to dry sand is limited. Their preferred beaches have proximity to deep water and generally rough seas.” | See BO dated 10/16/2017. Between May 1st and November 30th, sections of the beach undergoing nourishment will be monitored for sea turtles, their nests and nesting activities. If nesting occurs, project activities will be modified to avoid potential impacts to turtles. It is our detrmination that the project may effect but is not likely to adversely affect the species. |

# Species Conclusions Table

| Date: December 8, 2017 | Project Number: Consultation Code:05E2VA00-2018-SLI-0831 |
|---|---|

| | | | | |
|---|---|---|---|---|
| Loggerhead sea turtle (Caretta caretta) | Species (listed/proposed) present | Not likely to adversely affect | “The loggerhead sea turtle occurs in the Atlantic, Indian and Pacific Oceans; the Gulf of Mexico; and the Caribbean and Mediterranean Seas. In Virginia, loggerhead sea turtles are found throughout the Chesapeake Bay, around the barrier islands off the Eastern Shore, and off the coast in the Atlantic Ocean.” “This turtle is a marine species and spends most of its time in the ocean and estuaries where it feeds, breeds, and migrates. Loggerheads feed mainly on horseshoe crabs, but their diet also includes mollusks, crustaceans, jellyfish, fish, and various sea grasses. The loggerhead is the only sea turtle that nests as far north as Virginia. Loggerheads nest in small numbers along Virginia’s coast and nesting usually occurs from April through September. Females dig shallow pits on the beach to deposit their eggs. Hatchlings emerge as a group and begin to crawl rapidly toward the ocean. After reaching the water, they find food and protection among floating mats of vegetation in the Gulf Stream. They can be found in Virginia’s waters from May through November. They migrate south during the winter months.” | See BO dated 10/16/2017. Between May 1st and November 30th, sections of the beach undergoing nourishment will be monitored for sea turtles, their nests and nesting activities. If nesting occurs, project activities will be modified to avoid potential impacts to turtles. It is our detrmination that the project is not likely to adversely affect the species. |
| **Eagles (Haliaeetus leucocephalus)** | | | | |
| Eagle Nests | Unlikely to disturb nesting bald eagles | No Eagle Act permit required | | |
| Eagle Concentration Areas | Does not intersect with bald eagle concentration area | No Eagle Act permit required | | |
| **Critical Habitat** | | | | |
| N/A | | | | |
| **Other (species not listed above)** | | | | |
| | | | | |

# United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
6669 Short Lane
Gloucester, VA 23061


October 10, 2008

Colonel Dionysios Anninos
District Engineer
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

Attn: Ms. Elisabeth Sears

Re: Sandbridge Proposed Beach Nourishment Project, Virginia Beach, Virginia, Project # 2008-I-0649

Dear Colonel Anninos:

We have received your request for concurrence on your determination, made under the authority of the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq*.). You have determined that the above referenced project is not likely to adversely affect the endangered green sea turtle (*Chelonia mydias*), hawksbill sea turtle (*Eretmochelys imbricate*), Kemp's ridley sea turtle (*Lepidochelys kempi*), leatherback sea turtle (*Dermochelys coriacea*) shortnose sturgeon (*Acipenser brevirostrum*), and roseate tern (*Sterna dougallii dougallii*), and the threatened loggerhead sea turtle (*Caretta caretta),* piping plover (*Charadrius melodus*), and seabeach amaranth (*Amaranthus pumilus*). The Service has reviewed information on federally listed and proposed endangered and threatened species and designated critical habitat and provides the following comments under provisions of the.

The U.S. Army Corps of Engineers proposes to conduct beach nourishment activities along the Sandbridge oceanfront over the next four years. You plan to dredge beach quality sand from Sandbridge Shoal and nourish an area approximately 5 miles long and 125 wide. Approximately 1 to 2 million cubic yards will be placed on the beach on a bi-annual basis.

Most sea turtles in the Virginia Beach/Sandbridge area are loggerhead sea turtles, but this consultation addresses all sea turtles that could potentially be in the area: green, hawksbill, Kemp's ridley, and leatherback. As stated in your June 19, 2008, letter you have coordinated with the National Marine Fisheries Service regarding your dredging activities and agree to adhere to the previsions stated in our November 2002 letter. Specifically, you agree to use qualified personnel to monitor for sea turtle activities and nests on the sections of beach undergoing nourishment. During actual beach nourishment activities, you will have trained personnel on-site with instructions to cease activities and to contact the Service if a sea turtle attempts to nest. If nesting occurs, project activities will be modified to avoid potential impacts to turtles.

Transient listed species that travel through the area and may occasionally occur in the vicinity of the project area include the piping plover, roseate tern, and shortnose sturgeon. The piping plover is an uncommon summer resident in the lower Chesapeake Bay. They breed and forage along the barrier islands and bays on the Atlantic coast in Virginia from March to October. They have not been documented within the project area. Migrating plovers from across the northeast also pass through the area during spring and fall migration. The roseate tern is rare in the area, and may only be in the coastal area during the summer. Historically it nested on the Eastern Shore but nesting has not been documented there since 1927. The shortnose sturgeon was reported in the Potomac River in January 2006, and it is believed to have passed through the Chesapeake Bay in order to reach the Potomac. The Service believes the project may have a temporary, small effect on a small portion of the potential habitat of these transient species. During construction, the Service expects that any individuals of these species in the area immediately adjacent to the project would move to other areas. No long-term negative impacts to habitat for these species are anticipated. These effects are expected to be insignificant and discountable.

The seabeach amaranth is unlikely to occur in the project area, and has never been recorded at the site. Historically, seabeach amaranth was native to Atlantic coast barrier island beaches from Massachusetts to South Carolina, and may have occurred on the project area. The species' primary habitat consists of overwash flats at accreting ends of barrier islands, and lower foredunes and upper strands of non-eroding beaches. Because the species is not known to occur in the project area, impacts from construction are not expected to occur. The proposed project is not expected to have any long-term negative effects to habitat in the project area.

If the previously mentioned protective measures for sea turtles are followed, the Service believes the proposed action is not likely to adversely affect federally listed or proposed species or designated critical habitat. Should project plans change or if additional information on listed and proposed species becomes available, this determination may be reconsidered. If you have any questions or need further assistance, please contact Sumalee Hoskin of this office at (804) 693-6694, extension 136.

Sincerely,

Susan Lingenfelser

Susan Lingenfelser
Acting Supervisor
Virginia Field Office

cc: FWS, BBNWR (John Gallegos)
NOAA Fisheries, Gloucester, VA (David O'Brien)
NOAA Fisheries, Gloucester, MA
VDGIF, Painter, VA (Ruth Boettcher)

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

December 12, 2017

Operations Branch

Mr. Greg LaBudde
Review and Compliance Division
Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221

Dear Mr. LaBudde:

The U.S. Army Corps of Engineers (USACE), Norfolk District is responsible for the maintenance of the Virginia Beach Erosion and Storm Protection Project at Sandbridge Beach, Virginia Beach, VA. The USACE, acting as the lead agency, plans to utilize Sandbridge Shoals as borrow areas through a Memorandum of Agreement with the Bureau of Ocean Energy Management (BOEM), a cooperating agency. The Sandbridge project involves the placement of sand at Sandbridge Beach, an area approximately 5 miles long and 125 feet wide, in order to provide protection from erosion-induced damages, especially as a result of storms.

This letter is to provide an update for the next cycle of beach nourishment at Sandbridge Beach. The proposed project would dredge approximately 2,000,000 cubic yards (cy) of material from Sandbridge Shoals for placement at Sandbridge Beach for beach protection from erosion-induced damages in calendar year 2018. The borrow areas for this project are Area B to the north and Area A to the south, located within Sandbridge Shoals about 3 nautical miles from shore (Attachment A).

The last renourishment event of Sandbridge Beach occurred in 2012-2013. Previous Section 106 coordination with the Department of Historic Resources was completed in 2008, with concurrence again in 2012 (Attachment B). Approximately 2 million cy of dredged material from Sandbridge Shoals Areas A and B will be placed on Sandbridge Beach an area approximately 5 miles long and 125 feet wide, similar to previous events. In these previous determinations, DHR concluded that, as long as potential historic anomalies are avoided, the project was not likely to adversely affect any historic properties.

Previous coordination with the DHR has considered potential effects (beach and offshore borrow areas) to historic resources of the Sandbridge Beach renourishment project. Dredging and anchoring activities will be avoided in all areas within the borrow area that contain anomalies (Attachment C). The anomalies will be avoided by establishing a buffer of at least 200 feet radius around the target coordinates and 500 feet radius around two side-scan sonar targets. In addition, prior to the start of dredging operations, a marine remote sensing survey will be performed at the site of any booster or Scott's buoy/anchored pumpout buoy locations to ensure that potential historic resources are not located within the work area.

Based on this information, the USACE and BOEM find that the proposed activity would not adversely affect any potential historic sites in DHR's jurisdiction. We are requesting your concurrence with the determination and acknowledgement that USACE and BOEM have met their Section 106 requirements for this project.

Should you have any questions or require further information on this submittal, please contact Ms. Teri Nadal by email at teresita.i.nadal@usace.army.mil or call (757) 201-7299. Thank you for your cooperation and assistance.

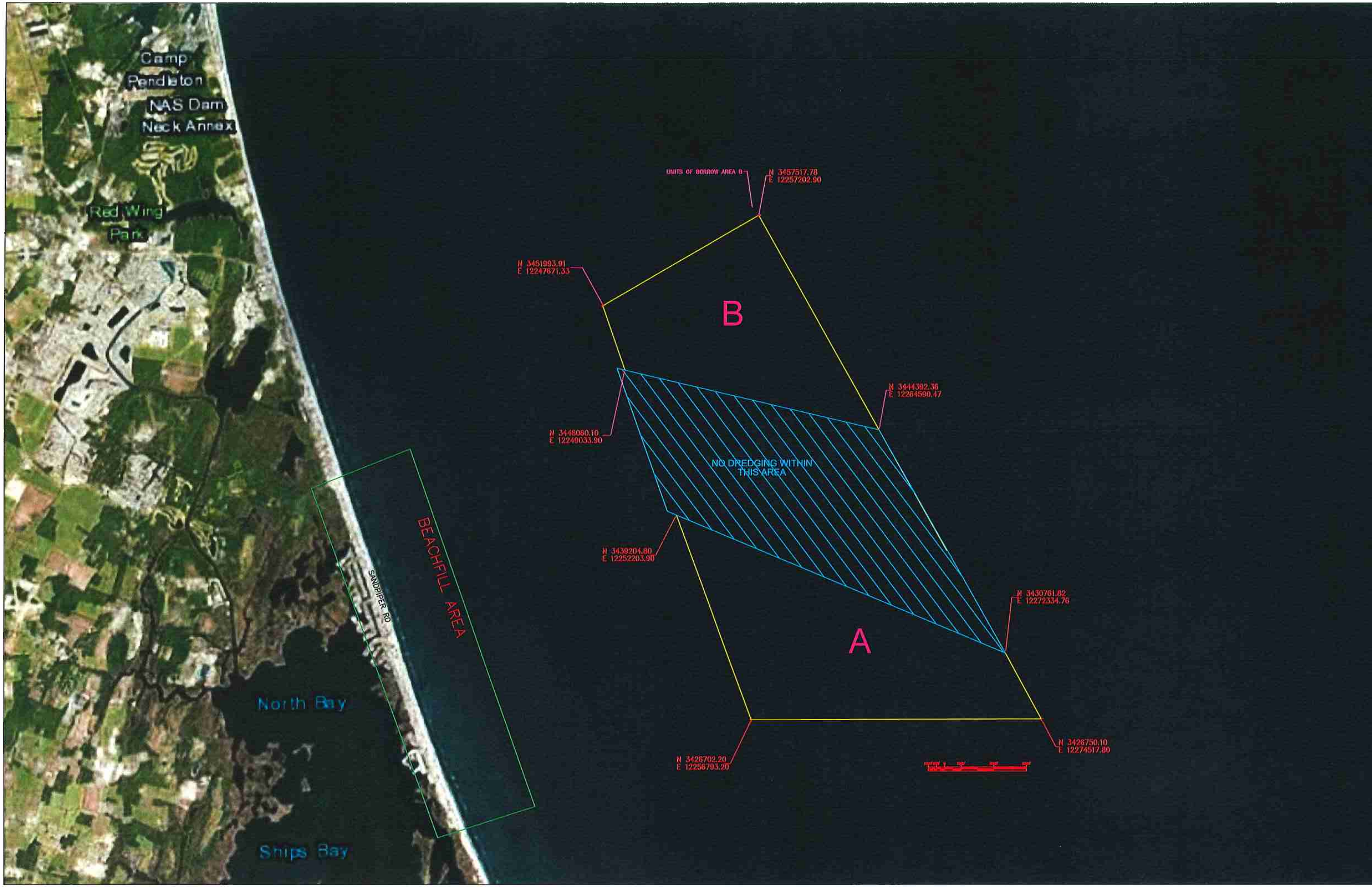
Sincerely,

Keith B. Lockwood

Keith B. Lockwood
Chief, Operations Branch

Enclosure

# Attachment A


Camp Pendleton
NAS Dam Neck Annex
Red Wing Park
North Bay
Ships Bay
SANDPIPER RD
BEACHFILL AREA
LIMITS OF BORROW AREA B
N 3457517.78
E 12257202.90
N 3451993.91
E 12247671.33
B
N 3444392.36
E 12264590.47
N 3448080.10
E 12249033.90
NO DREDGING WITHIN
THIS AREA
N 3439204.80
E 12252203.90
N 3430761.82
E 12272334.76
A
N 3426750.10
E 12274517.80
N 3426702.20
E 12256793.20

# Attachment B

From: McDonald, Brad (DHR)
[mailto:Brad.McDonald@dhr.virginia.gov]
Sent: Friday, March 09, 2012 9:58 AM
To: Haynes, John H. NAO
Subject: RE: Additional Information: Offshore Borrow and Beach Nourishment Areas, Sandbridge Beach
DHR File #2007-0458 (UNCLASSIFIED)

Hi John,

Thanks for your update on this project. The proposed additions to the contract seem reasonable and are acceptable to me. I'll add this information to the project file.

Brad McDonald
Project Review Archaeologist

-----Original Message-----
From: Haynes, John H. NAO [mailto:John.H.Haynes@usace.army.mil]
Sent: Thursday, March 08, 2012 9:33 AM
To: McDonald, Brad (DHR)
Subject: Additional Information: Offshore Borrow and Beach Nourishment Areas, Sandbridge Beach DHR
File #2007-0458 (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Brad,
I am writing to update DHR on the US Army Corps of Engineers progress on the above referenced project. While the previously surveyed borrow area has not changed, and the solicitation will include the avoidance of targets identified in the remote sensing surveys as agreed upon, no consideration was previously made of the effects of the pipeline system which shall deliver the dredged material to the beach. The configuration of pipelines would vary depending on the type of dredge used, either a 'hopper' dredge or a cutter head dredge (see Attachment A for description). If a hopper dredge is used, the vessel would transport load of sand from the borrow area to a pump out buoy anchored at the 30 foot bathyscaph, about 2500 feet off shore, and then via a fixed pipeline resting on the bottom to the beach. If a cutter head dredge is used the dredge material is transferred from the dredge via a floating pipeline to a fixed booster, and from there via a fixed pipeline resting on the bottom to the beach. The booster for the cutter head dredge would be anchored near the borrow area, about 3 miles offshore.

There is a potential for adverse effects to any submerged archaeological resources from the anchoring of the pump out buoy or booster barge, as well as the submerged pipeline. Areas potentially affected would be limited to the anchorage and pipeline route, and there would only be one or two of these. While this is a very limited area of potential effect, this section of the coast is known to have been the scene of a large number of shipwrecks (Attachment B).

Accordingly, and similar to requirements for the borrow area; we are adding the following stipulation to the contract:

1.20 Avoidance of Historic Resources

Not less than thirty calendar days from the start of dredging operations, the Contractor shall perform a marine remote sensing survey at the site(s) of any booster(s) or Scott's buoy/anchored pumpout buoy locations to ensure that potential historic resources are not located within his work area. If potential resources are identified during the survey, Contractor shall immediately notify the Contracting Officer's Representative, giving the location and nature of the findings. Contractor shall relocate his construction areas and establish a 100-ft buffer around the discovery. Do not anchor or spud in any such historic-resource, buffer zone nor disturb the buffer area in any way. A proposed revised buoy site or booster location shall be surveyed to ensure no historic resources are within any revised work area."

I am attaching copies of previous correspondence on this project for your convenience.

John H. Haynes
Archaeologist
US Army Corps of Engineers,
Norfolk District (NAO)
803 Front Street
Norfolk, VA 23510
757-201-7008
fax 757-201-7646
john.h.haynes@usace.army.mil

# COMMONWEALTH of VIRGINIA

L. Preston Bryant, Jr.
Secretary of Natural Resources

## Department of Historic Resources

2801 Kensington Avenue, Richmond, Virginia 23221-0311

Kathleen S. Kilpatrick
Director

Tel: (804) 367-2323
Fax: (804) 367-2391
TDD: (804) 367-2386
www.dhr.virginia.gov


July 17, 2008

Ms. Helene Haluska
Planning and Policy Branch
US Army Corps of Engineers, Norfolk District
803 Front Street
Norfolk, VA 23510

Re: Offshore Borrow and Beach Nourishment Areas, Sandbridge Beach
DHR File # 2007-0458

Dear Ms. Haluska:

We have received the additional information requested, and appreciate your providing this data for our review. With the understanding that all anomalies will be avoided, and with the understanding that the Coast Guard Station is located away from the proposed nourishment area, we are of the opinion that the project will not adversely affect historic properties.

If you have any questions about our comments or the Section 106 process, please call me at (804) 367-2323, Ext. 140.

Sincerely,

Joanna Wilson, Archaeologist
Office of Review and Compliance

# Attachment C

## Archaeological Avoidance Areas

| Acoustic Target | Magnetic Anomaly | Amplitude (gammas) | Duration (feet) | Coordinates (Virginia State Plane South (feet) | | Avoidance Radius (min.) |
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| **BORROW AREA A** | | | | | | |
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| **BORROW AREA B** | | | | | | |
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Hansen, Deena <deena.hansen@boem.gov>

# FW: Sandbridge Beach Offshore Borrow and Beach Nourishment Project (DHR File No. 2007-0458)) (UNCLASSIFIED)

1 message

**Nadal, Teresita I CIV USARMY CENAO (US)** <Teresita.I.Nadal@usace.army.mil> Wed, Jan 24, 2018 at 8:17 AM
To: "Hansen, Deena" <deena.hansen@boem.gov>
Cc: "leighann.brandt@boem.gov" <leighann.brandt@boem.gov>, "Mazur, Kristin CIV USARMY CENAO (US)" <Kristin.M.Mazur@usace.army.mil>

CLASSIFICATION: UNCLASSIFIED

Good news.
DHR coordination is complete.

Teri

-----Original Message-----
From: LaBudde, Gregory (DHR) [mailto:Gregory.LaBudde@dhr.virginia.gov]
Sent: Tuesday, January 23, 2018 3:54 PM
To: Nadal, Teresita I CIV USARMY CENAO (US) <Teresita.I.Nadal@usace.army.mil>
Subject: [EXTERNAL] RE: Sandbridge Beach Offshore Borrow and Beach Nourishment Project (DHR File No. 2007-0458))

Teri,

Thank you for the reminder, and please accept my apologies for the slow review. It is my understanding that there have been no changes in the project, and the present consultation is for the next cycle of dredging and beach nourishment at Sandbridge Beach. Based on the information provided, the Department of Historic Resources concurs with the U.S. Army Corps of Engineers' finding of No Adverse Effect provided that the identified submerged anomalies listed in Attachment C are avoided.

Implementation of the undertaking in accordance with the finding of No Adverse Effect as documented fulfills the federal agency's responsibilities under Section 106 of the National Historic Preservation Act. If for any reason the undertaking is not or cannot be conducted as proposed in the finding, consultation under Section 106 must be reopened. Should historic resources be encountered during project implementation, please cease all dredging in the immediate area and contact our office for guidance on the treatment of the discovery.

Thank you for your consideration of historic resources. Please contact me if you have any questions or if we may provide any further assistance.

Sincerely,

Greg LaBudde, Archaeologist
Review and Compliance Division
Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221
phone: 804-482-6103
fax: 804-367-2391
gregory.labudde@dhr.virginia.gov

-----Original Message-----
From: Nadal, Teresita I CIV USARMY CENAO (US) [mailto:Teresita.I.Nadal@usace.army.mil]
Sent: Tuesday, January 23, 2018 10:59 AM
To: LaBudde, Gregory (DHR)
Subject: FW: Sandbridge Beach Offshore Borrow and Beach Nourishment Project (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Mr. LaBudde,
Hope all is well.
When can I expect a response for the Sandbridge Beach Offshore Borrow and Beach Nourishment Project?
Please let me know if you have questions.

Thank you.

Very respectfully,

Teri

Environmental Manager
Ops Branch, Technical Support Section
U.S. Army Corps of Engineers
Norfolk District
(757) 201-7299

-----Original Message-----
From: Nadal, Teresita I CIV USARMY CENAO (US)
Sent: Tuesday, December 12, 2017 2:25 PM
To: LaBudde, Gregory (DHR) <Gregory.LaBudde@dhr.virginia.gov>
Subject: Sandbridge Beach Offshore Borrow and Beach Nourishment Project (UNCLASSIFIED)

CLASSIFICATION: UNCLASSIFIED

Mr. LaBudde,
The Corps is planning to perform beach nourishment for Sandbridge Beach next year using the Sandbridge Borrow areas.
There have been no changes to the project.
Enclosed is a coordination letter with a determination of no adverse effect as in prior consultations (attached) for your concurrence.

Please let me know if you have any questions.

Very respectfully,

Teri

Teri Nadal
Environmental Manager
Ops Branch, Technical Support Section
U.S. Army Corps of Engineers
Norfolk District
(757) 201-7299

CLASSIFICATION: UNCLASSIFIED
CLASSIFICATION: UNCLASSIFIED

CLASSIFICATION: UNCLASSIFIED

# *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
TDD (804) 698-4021
www.deq.virginia.gov

L. Preston Bryant, Jr.
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4020
1-800-592-5482

June 2, 2009

Mark T. Mansfield
Chief, Planning and Policy Branch
Department of the Army
Norfolk District, U.S. Army Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

RE: Draft Environmental Assessment and Federal Consistency Determination for the Sandbridge Beach Erosion Control and Hurricane Protection Project, Virginia Beach, Virginia, DEQ 09-078F

Dear Mr. Mansfield:

The Commonwealth of Virginia has completed its review of the above-referenced Draft Environmental Assessment (EA), which includes a federal consistency determination (FCD). The Department of Environmental Quality (DEQ) is responsible for coordinating Virginia's review of federal environmental documents prepared pursuant to the National Environmental Policy Act and responding to appropriate federal officials on behalf of the Commonwealth. DEQ is also responsible for coordinating state reviews of federal consistency determinations submitted under the Coastal Zone Management Act. The following agencies, planning district commission and locality joined in this review:

Department of Environmental Quality
Department of Game and Inland Fisheries
Department of Conservation and Recreation
Department of Mines, Minerals and Energy
Marine Resources Commission
Department of Health
Department of Historic Resources
Virginia Institute of Marine Science
Hampton Roads Planning District Commission
City of Virginia Beach

The Department of Agriculture and Consumer Services was also invited to comment.

## PROJECT DESCRIPTION

The U.S. Army Corps of Engineers (Corps) proposes beach nourishment at the Sandbridge oceanfront. The nourishment area is approximately 5 miles long and 125 feet wide and extends from the U.S. Naval Fleet Anti-Air Warfare Training Center at Dam Neck to the north to Back Bay National Wildlife Refuge to the south. Approximately 1.5 to 2.0 million cubic yards (cy) of beach quality sand would be placed on the beach approximately every 3 years depending upon weather conditions, availability of funding, and behavior of subsequently placed material at the project site.

Beach nourishment at Sandbridge began in 1998 and several beach nourishment maintenance projects have been completed since the original nourishment in 1998. This EA is an updated evaluation of the project to determine whether the proposed nourishment has the potential for creating significant impacts to the environment and to consider any changes to the environment that may have occurred since the original EA was prepared in 1992.

The designated borrow area is Sandbridge Shoal, located approximately 3 nautical miles from the shoreline, outside of Virginia's territorial sea. The two selected borrow areas within Sandbridge Shoal are Area B to the north and Area A to the south; depths range from 30 to 65 feet. Beach quality sand would most likely be removed by trailing suction hopper dredge. The hopper dredge is equipped with dragheads and a hopper which collects sand. When the hopper is full, material is transported to a pump-out buoy located offshore and then pumped through a discharge pipeline. The pipeline runs along the ocean floor and up onto the beach where bulldozers and graders will distribute the material.

## SUMMARY

In general, the Commonwealth of Virginia supports the beneficial use of suitable dredged material for beach nourishment provided it is carried out in accordance with all applicable laws, regulations, and policies. This position is consistent with the Code of Virginia § 10.1-704 which state "the beaches of the Commonwealth shall be given priority consideration as sites for the disposal of that portion of dredged material determined to be suitable for beach nourishment." Pursuant to Virginia regulation governing the placement of sandy dredged material along beaches in Virginia ( 4 VAC-20-400-50), the project should be engineered in a manner which results in the least environmental impact while providing an efficient and cost effective construction plan.

Dredging in Virginia waters for the sole purpose of obtaining beach nourishment material would require permits from the Virginia Marine Resources Commission (VMRC) and a public interest review. During its review of such dredging applications, VMRC would consider those factors identified in Section 28.2-1205 of the Code of Virginia. That would include the dredge project's effect on the following:

- Other reasonable and permissible uses of state waters and state-owned bottomlands;
- Marine and fisheries resources of the Commonwealth;
- Tidal wetlands, except when this has or will be determined under the provisions of Chapter 13 of this title;
- Adjacent or nearby properties;
- Water quality; and
- Submerged aquatic vegetation (SAV).

In the case of the Sandbridge Nourishment project, it is VMRC's understanding that the borrow area is outside Virginia's Territorial Sea (beyond 3 miles). If this is the case, VMRC has no direct permit authority over the dredging/borrow operation. However, we recommend that consideration be given, but not limited to, the project's potential impacts on existing natural resources and habitats. These include, inter alia, existing finfish, shellfish, turtle and avian species and their critical time periods for spawning, nesting and nursery functions in areas of submerged aquatic vegetation, wetlands and submerged or intertidal and beach habitat.

## GENERAL COMMENTS ON THE PROJECT DOCUMENT

The Virginia Institute of Marine Science (VIMS) reviewed the draft EA and provided the following comments to DEQ and directly to the Corps. These comments are outlined below and are also attached to report for your convenience.

- The Draft EA is not clear concerning the volume of sand within Sandbridge Shoal. Based on statements from pages 39 and 40, the volume is defined as both ~30 x106 million cubic yards (m3) or 20% less than ~30 x106 m3. As stated in the EA (page 39), "given the likelihood of future dredging at Sandbridge Shoal, it is important to fully consider the potential impacts of continued dredging." VIMS has concerns that given competing interests for the sand on the shoal (Virginia Beach, Navy, others), it is unclear if the shoal can continue to support its proposed uses over the next 40 years.

- Research of the direct effects on, and recovery of, the benthic community and cascading impacts on the pelagic and demersal fishes and crustaceans in the borrow area should continue in order to improve understanding of the impacts on ecosystem services.

- Bulrush (*Scirpus validus)* has been renamed *Schoenoplectus tabernaemontani*, and southern bayberry (*Myrica cerifera var. cerifera*), has been renamed *Morella cerifera*. This should be corrected in the final EA.

## ENVIRONMENTAL IMPACTS AND MITIGATION

1. **Water Quality.** The FCD (Enclosure 1) states that there will be no impacts to wetlands. A State Water Quality Certification under Section 401 of the Clean Water Act will be obtained. The certification is required because of discharges of sand into waters of the United States.

***1(a) Agency Jurisdiction.*** The State Water Control Board (SWCB) promulgates Virginia's water regulations, covering a variety of permits to include Virginia Pollutant Discharge Elimination System Permit (VPDES), Virginia Pollution Abatement Permit, Surface and Groundwater Withdrawal Permit, and the Virginia Water Protection (VWP) Permit. The VWP Permit is a State permit which governs wetlands, surface water, and surface water withdrawals/impoundments. It also serves as § 401 certification of the federal Clean Water Act § 404 permits for dredge and fill activities in waters of the U.S. The VWP Permit Program is under the Office of Wetlands and Water Protection and Compliance, within the DEQ Division of Water Quality Programs. In addition to Central Office staff who review and issue VWP permits for transportation and water withdrawal projects, the seven DEQ regional offices perform permit application reviews and issue permits for the covered activities.

***1(b) Finding.*** The DEQ-Tidewater Regional Office (TRO) states that a VWP permit will be required for the project. The Corps should submit a Joint Permit Application (JPA) to the Virginia Marine Resources Commission to begin the permitting process. All VWP regulatory issues will be resolved during the permitting issuance process.

***1(c) Recommendations.*** A VWP permit (water quality certification) must be obtained from DEQ prior to project implementation. For more information, contact the DEQ Tidewater Regional Office.

2. **Subaqueous Lands Management**. The FCD (Enclosure 1) states that project activities will encroach upon state-owned bottomlands. The Corps received a Virginia Marine Resources Commission (VMRC) permit for previous activities at Sandbridge (VMRC # 01-0951); however, the permit expired in 2006. The Corps will work with the VMRC to receive an updated permit.

***2(a) Agency Jurisdiction.*** The Virginia Marine Resources Commission, pursuant to Virginia Code *§ 28.2-1200* through *1400*, regulates encroachments in, on or over state-owned subaqueous beds as well as tidal wetlands throughout the Commonwealth. Also, the VMRC serves as the clearinghouse for the JPA used by the:

- U.S. Army Corps of Engineers for issuing permits pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act;
- DEQ for issuance of a Virginia Water Protection permit;
- VMRC for encroachments on or over state-owned subaqueous beds as well as tidal wetlands; and
- local wetlands board for impacts to wetlands.

The VMRC will distribute the completed JPA to the appropriate agencies. Each agency will conduct its review and respond.

***2(b) Findings.*** According to the VMRC, the proposed beach nourishment efforts along the Sandbridge Beach shoreline will require the submittal of a JPA and a permit from the VMRC.

***2(c) Recommendations.*** For additional information on requirements pertaining to the submission of the JPA, contact the VMRC.

**3. Wildlife and Fisheries Resources.** The draft EA (page 41) states that re-establishing beach habitat that supports a variety of associated flora and fauna contributes to the success and continual survival of several species such as sea turtles and shorebirds.

Also, adverse effects on Essential Fish Habitat (EFH) species, due to dredging and construction activities, will largely be temporary and minimal within the dredged footprints and beach nourishment areas in the surf zone. In general, the project is not anticipated to significantly impact EFH species or Habitat Areas of Particular Concern that may be in the project area (EA, page 33).

***3(a) Agency Jurisdiction.*** The Department of Game and Inland Fisheries (DGIF) and the VMRC administer the fisheries management enforceable policy of the VCP. Also, the Department of Game and Inland Fisheries, as the Commonwealth's wildlife and freshwater fish management agency, exercises enforcement and regulatory jurisdiction over wildlife and freshwater fish, including state or federally listed endangered or threatened species, but excluding listed insects (*Virginia Code* Title 29.1). DGIF is a consulting agency under the U.S. Fish and Wildlife Coordination Act (16 U.S.C. sections 661 *et seq.*) and provides environmental analysis of projects or permit applications coordinated through DEQ and several other state and federal agencies. DGIF determines likely impacts upon fish and wildlife resources and habitat, and recommends appropriate measures to avoid, reduce, or compensate for those impacts. For more information, see the DGIF website at www.dgif.virginia.gov.

***3(b) Comments.*** According to the information in the draft EA, the incidental take statement and biological opinion previously issued by National Marine Fisheries Service for this project are still valid.

***3(c) Findings.*** The Fisheries Management Division of the VMRC states that there would be no significant impact to blue crabs as long as there is no sediment placement in the offshore surface waters. Run off from the beach should not have an impact on the blue crab.

DGIF's records indicate that the following species have been documented in the project area:

- Loggerhead sea turtle: A federally-listed threatened species, the loggerhead sea turtle is known to nest on the beaches in the project area. As stated in the draft EA, beach nourishment and associated dredging activities are likely to adversely impact this species. However, DGIF indicates that if the beach fill is not properly matched to native materials, a decrease in the quality of nesting habitat for this species may result.

- West Indian manatee: A federally-listed endangered species which has been documented in the project area. The draft EA does not appear to evaluate possible impacts to this species.

- Roseate tern: This is a federally-listed endangered species that has been documented in the project area. However, DGIF does not think that this species nests in the project area. Therefore, impacts upon this species are not anticipated to result from the proposed work.

- Bald eagle: This state-listed threatened species is known to be located in the project area. However, the project site is located outside the management zone for known nesting sites; therefore, impacts upon this species are not anticipated to result from the proposed work.

***3(d) Recommendations.*** DGIF has the following recommendations:

- Address possible impacts upon the West Indian manatee in the final EA.
- Coordinate with the NMFS regarding the protection of loggerhead sea turtles, other sea turtles, and sea mammals known from the project area.
- Adhere to the requirements outlined in the incidental take statement and biological opinion previously issued by NMFS for this project.
- Coordinate with the FWS regarding possible impacts upon federally-listed species and for information about whether this project will result in adverse impacts upon Back Bay National Wildlife Refuge.
- Match all fill materials in color, grain size, and composition to native materials as closely as possible.
- Adhere to the requirements for sea turtle protection (such as time-of-year restrictions, matching of beach fill materials to native materials, hopper dredge retrofitting, use of observers, routine monitoring, etc.) outlined in the incidental take statement and biological opinion.

For additional information on these recommendations, contact DGIF.

***3(e) Conclusion.*** Assuming appropriate erosion and sediment controls are in place during beach nourishment, both the VMRC and DGIF find that the project consistent with the fisheries management enforceable policy of the VCP.

**4. Dunes Management.** The FCD (Enclosure 1) states that there will be no alteration or destruction of primary sand dunes related to this project.

***4(a) Agency Jurisdiction.*** 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) with the Virginia Institute of Marine Science serving in a technical advisory role during in the JPA process.

***4(b) Comments.*** VIMS states that the consistency determination should be revised to address impacts to beaches. The FCD references the dunes management enforceable policy, but based upon Virginia Code §28.2 1400 *et seq*., the enforceable policy also addresses beaches.

The VRMC did not provide comments on impacts to dune resources under its jurisdiction.

**5. Natural Heritage Resources.** The draft EA does not address natural heritage resources.

***5(a) Agency Jurisdiction.*** The mission of the Virginia Department of Conservation and Recreation (DCR) is to conserve Virginia's natural and recreational resources. DCR supports a variety of environmental programs organized within seven divisions including the Division of Natural Heritage (DNH). DCR's Natural Heritage Program's mission is conserving Virginia's biodiversity through inventory, protection, and stewardship. The Virginia Natural Area Preserves Act, 10.1-209 through 217 of the Code of Virginia, was passed in 1989 and codified DCR's powers and duties related to statewide biological inventory: maintaining a statewide database for conservation planning and project review, land protection for the conservation of biodiversity, and the protection and ecological management of natural heritage resources.

***5(b) Biotics Data System.*** DCR-DNH has searched its Biotics Data System for occurrences of natural heritage resources from the project area. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

***5(c) Findings.*** DCR states that the Biotics Data System documents the presence of natural heritage resources in the project area. However, as long as the beach nourishment does not include the dune field, DCR does not anticipate that this project will adversely impact these natural heritage resources. DCR concurs with the guidelines set by the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) (EA, Appendix A).

***5(d) Threatened and Endangered Plant and Insect Species.*** The Endangered Plant and Insect Species Act of 1979, Chapter 39, §3.1-102- through 1030 of the Code of Virginia, as amended, authorizes the Virginia Department of Agriculture and Consumer Services (VDACS) to conserve, protect and manage endangered species of plants and insects. VDACS Virginia Endangered Plant and Insect Species Program personnel cooperates with the U.S. Fish and Wildlife Service (FWS), DCR-DNH and other agencies and organizations on the recovery, protection or conservation of listed threatened or endangered species and designated plant and insect species that are rare throughout their worldwide ranges. In those instances where recovery plans, developed by FWS, are available, adherence to the order and tasks outlined in the plans should be followed to the extent possible.

VDACS has regulatory authority to conserve rare and endangered plant and insect species through the Virginia Endangered Plant and Insect Species Act. Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and DCR, DCR has the authority to report for VDACS on state-listed plant and insect species. DCR found that the current activity will not affect any documented state-listed plant and insect species. VDACS did not respond to our request for comments.

***5(e) Natural Area Preserves.*** DCR found that there are no State Natural Area Preserves under its jurisdiction in the project vicinity.

***5(f) Recommendations.*** The DCR-Division of Natural Heritage has the following recommendations:

- Follow the FWS and NMFS guidelines for beach nourishment found in the draft EA, Appendix A.
- Contact DCR-DNH (telephone, (804) 786-7951) if a significant amount of time passes before the project is implemented, since new and updated information is continually added to Biotics.

**6. Coastal Lands Management and Chesapeake Bay Preservation Areas.** Neither the draft EA nor the FCD addresses Chesapeake Bay Preservation Areas.

***6(a) Agency Jurisdiction.*** The Department of Conservation and Recreation's (DCR) Division of Chesapeake Bay Local Assistance (DCBLA) administers the coastal lands management enforceable policy of the Virginia Coastal Program which is governed by the Chesapeake Bay Preservation Act (Virginia Code §10.1-2100-10.1-2114) and Chesapeake Bay Preservation Area Designation and Management Regulations (9 VAC 10-20 *et seq.*).

***6(b) Findings.*** The DCR-DCBLA states that Sandbridge Beach is located outside of the Chesapeake Bay watershed and therefore, lies outside of the City of Virginia Beach's designated Chesapeake Bay Preservation Areas. Hence, there are no requirements under the Chesapeake Bay Preservation Act that must be met by the proposed project.

**7. Air Pollution Control.** Minor air pollution increases will occur due to the operation of construction equipment. The increases will be short-term and below *de minimis* threshold levels (FCD, Enclosure 1).

***7(a) Agency Jurisdiction.*** DEQ's Air Quality Division, on behalf of the State Air Pollution Control Board, is responsible for developing regulations that become Virginia's Air Pollution Control Law. The DEQ is charged with carrying out mandates of the state law and related regulations as well as Virginia's federal obligations under the Clean Air Act as amended in 1990. The objective is to protect and enhance public health and quality of life through control and mitigation of air pollution. The Division ensures the safety and quality of air in Virginia by monitoring and analyzing air quality data, regulating sources of air pollution, and working with local, state and federal agencies to plan and implement strategies to protect Virginia's air quality. The appropriate regional office is directly responsible for the issuance of necessary permits to construct and operate all stationary sources in the region as well as monitoring emissions from these sources for compliance. As a part of this mandate, Environmental Impact Reports of projects to be undertaken in the State are also reviewed. In the case of certain projects, additional evaluation and demonstration must be made under the general conformity provisions of state and federal law.

***7(b) Ozone Maintenance Area.*** According to the DEQ Air Division, the project site is located in an ozone ($O_3$) maintenance area and an emission control area for the volatile organic compounds (VOCs) and oxides of nitrogen ($NO_x$), which are contributors to ozone pollution. Therefore, the applicant should take all reasonable precautions to limit emissions of VOCs and $NO_x$ principally by controlling or limiting the burning of fossil fuels.

***7(c) Fugitive Dust.*** During project activities, fugitive dust must be kept to a minimum by using control methods outlined in 9 VAC 5-50-60 *et seq.* of the Regulations for the Control and Abatement of Air Pollution. These precautions include covering open equipment when conveying materials.

***7(d) Fuel Burning Equipment.*** An air permit may be required for any fuel-burning equipment. For more information, contact at DEQ's Tidewater Regional Office.

**8. Solid and Hazardous Wastes and Hazardous Materials.** The draft EA (page 9) states that no Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites are located within 4 miles of the project area, but one Resource Conservation and Recovery Information System (RCRIS) generator at False Cape State Park is located within four miles of the project area.

Also, during an archaeological remote sensing survey conducted in 2007, it was determined that Sandbridge Shoal had high potential for other materials, such as ordnance, because the shoal was within an area designated as a range for coastal ordnance training and military weapons experiments (Watts, 2007). Since small caliber unexploded ordnance (UXO) may be encountered in the borrow areas during dredging operations, the Corps requires that a screen be placed over the drag head to effectively prevent any UXO from entering the hopper and/or being subsequently placed on the beach.

***8(a) Agency Jurisdiction.*** Solid and hazardous wastes in Virginia are regulated by the Virginia Department of Environmental Quality, the Virginia Waste Management Board (VWMB) and the U.S. Environmental Protection Agency. They administer programs created by the federal Resource Conservation and Recovery Act, Comprehensive Environmental Response Compensation and Liability Act, commonly called Superfund, and the Virginia Waste Management Act. DEQ administers regulations established by the VWMB and reviews permit applications for completeness and conformance with facility standards and financial assurance requirements. All Virginia localities are required, under the Solid Waste Management Planning Regulations, to identify the strategies they will follow on the management of their solid wastes to include items such as facility siting, long-term (20-year) use, and alternative programs such as materials recycling and composting.

***8(b) Comments.*** The DEQ-Tidewater Regional Office, Waste Permit Program states that any UXO and other debris encountered during project activities must be managed in accordance with the Virginia Hazardous Waste Management Regulations and the Virginia Solid Waste Management Regulations.

Also, the DEQ-Waste Division states that the EA addresses hazardous waste issues and included a search of waste-related databases. The EA does not address solid waste issues. A GIS database search did not reveal any waste sites within a half mile radius that would impact or be impacted by the project site.

***8(c) Findings.*** Staff reviewed the Waste Division's data files and determined that several solid waste facilities are located within the same zip code as the installation; however their proximity to the subject site is unknown. These sites are as follows.

Solid waste

- SPSA - Landstown Transfer, PBR 191, Transfer Station
- SPSA - Landstown Transfer, SWP 537, Transfer Station
- Virginia Beach City - Mt Trashmore Landfill II, SWP 324, Closed Sanitary Landfill
- Virginia Beach City - Mt Trashmore Landfill II, SWP 367, Closed Sanitary Landfill
- Virginia Beach City - Mt Trashmore Landfill II, SWP 398, Sanitary Landfill
- Tidewater Recyclable Products Incorporated, SWP 596, CDD Landfill

***8(d) Recommendations.*** DEQ encourages all projects to implement pollution prevention principles, including:

- the reduction, reuse, and recycling of all solid wastes generated; and
- the minimization and proper handling of generated hazardous wastes.

For further information, contact Paul Kohler, DEQ-Waste Division, at (804) 698-4208.

**9. Historic Structures and Archaeological Resources.** The draft EA (page 23) states that within the study area, there are no known archaeological or historical sites eligible for or listed on the National Register of Historic Places. However, archaeological surveys (2007) of the offshore borrow areas near Sandbridge Beach resulted in the identification of numerous magnetic anomalies. The remote sensing survey recorded 51 unidentified magnetic anomalies and one side-scan sonar target in proposed Borrow Area A, and 37 unidentified magnetic anomalies and one side-scan sonar target within proposed Borrow Area B. The side-scan sonar target recorded in Borrow Area A has been identified as a small barge. Five of the magnetic anomalies were associated with this feature. The side-scan sonar target and five associated magnetic anomalies recorded in Borrow Area B have been tentatively identified as a potentially significant historic shipwreck site. Of the remaining 46 unidentified magnetic anomalies in Area A, 29 are considered to be potentially representative of historic shipwreck sites. The Corps will avoid the two side-scan targets by 500 feet, which will also result in the avoidance of all associated magnetic anomalies (EA, page 37).

***9(a) Agency Jurisdiction.*** The Department of Historic Resources (DHR) conducts reviews of projects to determine their effect on historic structures or cultural resources under its jurisdiction. DHR, as the designated State's Historic Preservation Office, ensures that federal actions comply with *Section 106 of the National Historic Preservation Act of 1966* (NHPA), as amended, and its implementing regulation at 36 CFR Part 800. The NHPA requires federal agencies to consider the effects of federal projects on properties that are listed or eligible for listing on the National Register of Historic Places. Section 106 also applies if there are any federal involvements, such as licenses, permits, approvals or funding. DHR also provides comments to DEQ through the state EIR review process.

***9(b) Finding.*** The DHR has been in direct consultation with the Corps and has determined that the project will not affect historic properties.

**10. Geologic Resources.** The draft EA (page 25) states that the proposed project would remove approximately 1.5 to 2.0 million cy of sand from Sandbridge Shoal. The sediments in the shoal are approximately 96 percent sand, 1.5 percent gravel, and about 2.5 percent fines. Mean grain size at the placement site ranges between 0.25 mm and 0.35 mm, medium grained sand. There would be no significant impacts to sediment quality at the borrow area or at the placement site.

***10(a) Agency Jurisdiction.*** The Virginia Department of Mines, Minerals and Energy (DMME), through its six divisions, regulates the mineral industry, provides mineral research and offers advice on the wise use of resources. The Department's mission is to enhance the development and conservation of energy and mineral resources in a safe and environmentally sound manner in order to support a more productive economy in Virginia. The DMME Division of Geology and Mineral Resources (DGMR), serving as Virginia's geological survey, generates, collects, compiles and evaluates geologic data, creates and publishes geologic maps and reports, works cooperatively with other state and federal agencies, and is the primary source of information on geology, mineral and energy resources, and geologic hazards for both the mineral and energy industries and the general public. DMME DGMR also provides the necessary geologic support for those divisions of DMME that regulate the permitting of new mineral and fuel extraction sites, miner safety and land reclamation.

***10(b) Agency Finding.*** DMME-DGMR states the project involves the beneficial use of a mineral resource. Therefore, DMME-DGMR does not anticipate negative impacts to mineral resources within the nourishment area.

**11. Waterworks Operation.**

***11(a) Findings.*** The Virginia Department of Health (VDH), Office of Drinking Water (ODW) states that there are no records of public groundwater sources within a 1-mile radius and there is no public surface water source within a 5-mile radius of the project site. Therefore, the VDH-ODW finds no apparent impacts to drinking water sources resulting for this project.

**12. Regional Planning Area.** The Hampton Roads Planning District Commission (PDC) and the City of Virginia Beach were invited to comment.

***12(a) Agency Jurisdiction.*** In accordance with the Code of Virginia, Section 15.2-4207, planning district commissions encourage and facilitate local government cooperation and state-local cooperation in addressing, on a regional basis, problems of greater than local significance. The cooperation resulting from this is intended to facilitate the recognition and analysis of regional opportunities and take account of regional influences in planning and implementing public policies and services. Planning district commissions promote the orderly and efficient development of the physical, social and economic elements of the districts by planning, and encouraging and assisting localities to plan, for the future.

***12(b) Regional Agency Comments.*** The Hampton Roads PDC states that the proposed project is generally consistent with local and regional plans and policies.

***12(c) Locality Comments.*** The City of Virginia Beach has no comment on the proposed project.

## FEDERAL CONSISTENCY UNDER THE COASTAL ZONE MANAGEMENT ACT

Pursuant to the Coastal Zone Management Act of 1972, as amended, federal activities located inside or outside of Virginia's designated coastal management area that can have reasonably foreseeable effects on coastal resources or coastal uses must, to the maximum extent practicable, be implemented in a manner consistent with the Virginia Coastal Resources Management Program (VCP) (also called the Virginia Coastal Zone Management Program). The VCP consists of a network of programs administered by several agencies. The DEQ coordinates the review of federal consistency determinations with agencies administering the Enforceable and Advisory Policies of the VCP.

The draft EA includes a federal consistency determination and accompanying analysis of the enforceable policies of the VCP (Enclosure 1). The FCD states that the implementation of the plan would have no effect on the wetlands management, dunes management, and shoreline sanitation management enforceable policies of the VCP. The reviewing agencies that are responsible for the administration of specific enforceable policies generally agree with the Corps's determination. However, in order to be consistent with the VCP, the Corps must obtain all applicable permits and approvals prior to commencing the project.

## PUBLIC PARTICIPATION

In accordance with 15 CFR §930.2, the public was invited to participate in the Commonwealth's review of the FCD. A public notice for this proposed action was published on the DEQ website from April 24, 2009 to May 20, 2009. No comments were received in response to the public notice.

## CONSISTENCY CONCURRENCE

Based on our review of the draft EA and the FCD and the comments submitted by agencies administering the enforceable policies of the VCP, DEQ concurs that the proposal is consistent to the maximum extent practicable with the VCP provided all applicable permits and approvals are obtained. However, other State approvals which may apply to this project are not included in this consistency concurrence. Therefore, the Corps must ensure that this project is implemented in accordance with all applicable Federal, State, and local laws and regulations.

## REGULATORY AND COORDINATION NEEDS

**1. Water Quality.** Authorization under a Virginia Water Protection (VWP) permit (9 VAC 25-210-50) is required. A completed Joint Permit Application (JPA) should be submitted and a VWP permit obtained prior to project commencement. For receive a JPA, contact VMRC at (757) 247-2200. The VMRC will distribute the application to the appropriate agencies and each agency will conduct its review and respond. For additional information on the VWP permit program, contact Bert Parolari of DEQ's Tidewater Regional Office (telephone, (757) 518-2166).

**2. Subaqueous Lands.** The Virginia Marine Resources Commission, pursuant to Virginia Code *§ 28.2-1200* through *1400*, regulates encroachments in, on or over any state-owned bays, rivers, streams or creeks throughout the Commonwealth. Contact VMRC at (757) 247-2200 for a JPA. In order to achieve consistency with the subaqueous lands management enforceable policy of the VCP, the Corps must submit a Joint Permit Application to the VMRC for review and approval. For information on permits issued by the VMRC, contact Justin Worrell at (757) 247-8063.

**3. Air Quality Regulations.** This project may be subject to air regulations administered by the Department of Environmental Quality. The following sections of Virginia Administrative Code are applicable:

- 9 VAC 5-50-60 *et seq.* governing fugitive dust emissions; and

For more information regarding air permits that may be required, contact Jane Workman, DEQ-TRO at (757) 518-2112.

**4. Protected Species Legislation.** Questions regarding biological resources can be addressed to Amy Ewing of DGIF (telephone, (804) 367-2211) or Rene Hypes of DCR (telephone, (804) 371-2708).

Thank you for the opportunity to review the draft Environmental Assessment and the federal consistency determination for this undertaking. Detailed comments of reviewing agencies are attached for your review. Please contact me at (804) 698-4325 or Anne Pinion at (804) 698-4488 for clarification of these comments.

Sincerely,

Ellie Irs

Ellie L. Irons, Manager
Office of Environmental Impact Review

Enclosures

cc: Michelle Hollis, DEQ-TRO
Amy Ewing, DGIF
Keith Tignor, VDACS
Justin Worrell, VMRC
Roger Kirchen, DHR
Dwight Farmer, Hampton Roads PDC
Clay Bernick, Virginia Beach

**Pinion,Anne**

**From:** Worrell, Justin (MRC)
**Sent:** Thursday, May 21, 2009 2:54 PM
**To:** Pinion,Anne
**Cc:** Watkinson, Tony (MRC)
**Subject:** FW: EIR Project Reminder

Anne,

Sorry for the delay in commenting. As we previously permitted a Sandbridge Beach nourishment project in the past, further proposed beach nourishment efforts along the Sandbridge Beach shoreline in Virginia Beach will require the submittal of a JPA and a permit from the Virginia Marine Resources Commission.

Feel free to call me if you have questions. The Corps is also aware of our permitting requirements.

Thanks

Justin D. Worrell
Environmental Engineer
Habitat Management Division
Virginia Marine Resources Commission
(757) 247-8063 telephone
(757) 247-8062 fax

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**From:** Pinion,Anne [mailto:Anne.Pinion@deq.virginia.gov]
**Sent:** Wednesday, May 20, 2009 8:08 AM
**To:** Ewing, Amy (DGIF); Tignor, Keith (VDACS); Watkinson, Tony (MRC); Heller, Matthew (DMME); Pam Mason; Claire JONES; cbernick@vbgov.com
**Subject:** EIR Project Reminder

Reviewers,

Comments for the following project are due today, May 20, 2009.

- 09-078F Corps-Sandbridge Beach Erosion Control and Hurricane Protection Project

If you have any questions, please contact me.

Thanks,
Anne

Anne N. Pinion
Department of Environmental Quality

**Pinion,Anne**

**From:** O'Reilly, Rob (MRC)
**Sent:** Monday, June 01, 2009 9:33 AM
**To:** Pinion,Anne
**Cc:** Travelstead, Jack (MRC)
**Subject:** FW: VA Policy on Beach Nourishment -DEQ-09078

Anne: please find Fr. McConnaugha's response, relative to the project impact on blue crab.

Thanks
Rob

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**From:** Mcconaugha, John [mailto:jmcconau@odu.edu]
**Sent:** Sunday, May 31, 2009 8:13 PM
**To:** O'Reilly, Rob (MRC)
**Subject:** RE: VA Policy on Beach Nourishment -DEQ-09078

Rob,

Sorry for the delay. I don't have a problem with the beach nourishment as long as there is no sediment in the offshore surface waters. Run off from the beach should not have an impact.

John

John McConaugha
Chief Departmental Advisor
Ocean Earth and Atmospheric Sciences
jmconau@odu.edu

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**From:** Pinion,Anne [mailto:Anne.Pinion@deq.virginia.gov]
**Sent:** Thursday, May 28, 2009 3:04 PM
**To:** Watkinson, Tony (MRC); Travelstead, Jack (MRC); O'Reilly, Rob (MRC)
**Cc:** Grabb, Bob (MRC); Worrell, Justin (MRC)
**Subject:** RE: VA Policy on Beach Nourishment -DEQ-09078

Tony,

Thanks for the response...I have forwarded it to Ellie, which might prompt some discussion. And yes, the dredging of Sandbridge Shoal is, according to the document, outside of Virginia's territorial sea.

Jack and or Rob,

Any comments on the fisheries aspects of this project? I have attached a brief project description below.

**PROJECT DESCRIPTION**

The U.S. Army Corps of Engineers (Corps) proposes beach nourishment at the Sandbridge oceanfront. The nourishment area is approximately 5 miles long and 125 feet wide and extends from the U.S. Naval Fleet Anti-Air Warfare Training Center at Dam Neck to the north to Back Bay National Wildlife Refuge to the south. Approximately 1.5 to 2.0 million cubic yards (cy) of beach quality sand would be placed on the beach approximately every 3 years depending upon weather conditions, availability of funding, and behavior of subsequently placed material at the project site.

Beach nourishment at Sandbridge began in 1998 and several beach nourishment maintenance projects have been completed since the original nourishment in 1998. This EA is an updated evaluation of the project to determine whether the proposed nourishment has the potential for creating significant impacts to the environment and to consider any changes to the environment that may have occurred since the original EA was prepared in 1992.

The designated borrow area is Sandbridge Shoal, located approximately 3 nautical miles from the shoreline, outside of Virginia's territorial sea. The two selected borrow areas within Sandbridge Shoal are Area B to the north and Area A to the south; depths range from 30 to 65 feet. Beach quality sand would most likely be removed by trailing suction hopper dredge. The hopper dredge is equipped with dragheads and a hopper which collects sand. When the hopper is full, material is transported to a pump-out buoy located offshore and then pumped through a discharge pipeline. The pipeline runs along the ocean floor and up onto the beach where bulldozers and graders will distribute the material.

---

**From:** Watkinson, Tony (MRC)
**Sent:** Thursday, May 28, 2009 2:58 PM
**To:** Pinion,Anne
**Cc:** Grabb, Bob (MRC); Travelstead, Jack (MRC); O'Reilly, Rob (MRC); Worrell, Justin (MRC)
**Subject:** RE: VA Policy on Beach Nourishment -DEQ-09078

Anne,
Agree that the reference to enforceable policies should also include beaches as well as dunes. Ellie's Summary looks good, but believe it more accurately reflects projects that would generate suitable sandy dredge material from navigation projects. Dredging in Virginia waters for the sole purpose of obtaining beach nourishment material would require permits and a public interest review. We would consider those factors identified in Section 28.2-1205 of the code of Virginia. That would include the dredge project's effect on the following:
1. Other reasonable and permissible uses of state waters and state-owned bottomlands;
2. Marine and fisheries resources of the Commonwealth;
3. Tidal wetlands, except when this has or will be determined under the provisions of Chapter 13 of this title;
4. Adjacent or nearby properties;
5. Water quality; and
6. Submerged aquatic vegetation (SAV).
It has been my understanding that the borrow area for the Sandbridge Nourishment project is outside Virginia's Territorial Sea (beyond 3 miles). As such, we have no direct permit authority over the dredging/borrow operation. However, I'm not sure if our Fisheries Mangement Division would want to provide any further comment. I am copying Jack Travelstead and Rob O'Reilly on this, but it may be best if you contacted them directly. I have also include the VIMS comment for their consideration.

Tony
<<vims comments.doc>>

---

**From:** Pinion,Anne [mailto:Anne.Pinion@deq.virginia.gov]
**Sent:** Thursday, May 28, 2009 1:57 PM
**To:** Worrell, Justin (MRC)
**Cc:** Watkinson, Tony (MRC)
**Subject:** FW: VA Policy on Beach Nourishment -DEQ-09078

Justin,
Ellie had the following questions (please see below) I need VMRC to respond by June 1?
I have attached VIMS' comments for reference.

<< File: vims comments.doc >>

Thanks,
Anne

---

**From:** Irons,Ellie
**Sent:** Thursday, May 28, 2009 1:52 PM
**To:** Pinion,Anne
**Subject:** VA Policy on Beach Nourishment -DEQ-09078

Anne:

Please include the summary below in our response to the EA. Virginia has been recommending beach nourishment over the years and I noticed that responses provided did not reflect this position. Also, please contact VMRC to see if they support VIMS statement on dunes enf pol as well as if they wish to comment on potential impacts to fisheries. If you already did, please reflect their response on the dunes and fisheries management enforceable policy. Depending on the response from VMRC, a conditional concurrence may be better. Thanks.

SUMMARY

In general, the Commonwealth of Virginia supports the beneficial use of suitable dredged material for beach nourishment provided it is carried out in accordance with all applicable laws, regulations, and policies. This position is consistent with the Code of Virginia § 10.1-704 which state "the beaches of the Commonwealth shall be given priority consideration as sites for the disposal of that portion of dredged material determined to be suitable for beach nourishment." Pursuant to Virginia regulation governing the placement of sandy dredged material along beaches in Virginia ( 4 VAC-20-400-50), the project should be engineered in a manner which results in the least environmental impact while providing an efficient and cost effective construction plan. During the Virginia Marine Resources Commission's review of dredging applications, consideration will be given, but not limited to, the project's potential impacts on existing natural resources and habitats. These include, inter alia, existing finfish, shellfish, turtle and avian species and their critical time periods for spawning, nesting and nursery functions in areas of submerged aquatic vegetation, wetlands and submerged or intertidal and beach habitat.

Ellie Irons
Program Manager
Office of Environmental Impact Review
629 East Main Street, Room 631
Richmond, VA 23219
Telephone: (804) 698-4325
Fax: (804) 698-4319
email address: elirons@deq.virginia.gov
http://www.deq.virginia.gov

# DEPARTMENT OF ENVIRONMENTAL QUALITY
# TIDEWATER REGIONAL OFFICE
# ENVIRONMENTAL IMPACT REVIEW COMMENTS

**May 12, 2009**

**PROJECT NUMBER:** **09-078F**

**PROJECT TITLE:** Sandbridge Beach Erosion Control and Hurricane Protection

As Requested, TRO staff has reviewed the supplied information and has the following comments:

**Petroleum Storage Tank Cleanups:**
No comments.

**Petroleum Storage Tank Compliance/Inspections:**
No comments.

**Virginia Water Protection Permit Program (VWPP):**
A VWP permit will be required for this project. Once a Joint Permit Application is submitted, all pertinent VWP regulatory issues will be resolved satisfactorily during the permit issuance process.

**Air Permit Program :**
No comments.

**Water Permit Program :**
VPDES Permit Section – No Comment. Activities described in this document are not impacted by the VPDES permit program.

GW – No comments.

**Waste Permit Program :**
Any UXO and other debris encountered must be managed in accordance with the Virginia Hazardous Waste Management Regulations and the Virginia Solid Waste Management Regulations.

The staff from the Tidewater Regional Office thanks you for the opportunity to provide comments.

Sincerely,

Michelle R. Hollis
Environmental Specialist
5636 Southern Blvd.
VA Beach, VA 23462
(757) 518-2146
mrhollis@deq.virginia.gov

To: Interested Parties
From: Pam Mason
Re: 09-078F Corps-Sandbridge Beach Erosion Control and Hurricane Protection Project
Date: May 20, 2009

Based on the following 3 statements (pages 39 and 40), what is the current volume of Sandbridge shoal, (~30 x106 m3), or 20% less than (~30 x106 m3)?

1. To date, approximately ~6x106 m3 of OCS sand have been excavated from the shoal, representing approximately 20% of the estimated shoal volume (~30 x106 m3).
2. The 2 million cubic yards of sand potentially removed in this proposed action represents 6% of the estimated volume remaining in the main shoal body (~30 x106 m3).
3. Considered in combination with past dredging operations, the cumulative volume of sand removed through 2010 will represent less than 25% of fairly conservative volume estimates of Sandbridge Shoal. (pages 39 and 40).

We note the following comment from the EA (page 39)
"Given the likelihood of future dredging at Sandbridge Shoal, it is important to fully consider the potential impacts of continued dredging". Given competing interests (Virginia Beach, Navy, others) will the shoal continue to support proposed uses including those proposed in this project; every 3-5 years over the next 40 years?

Research of the direct effects on, and recovery of, the benthic community and cascading impacts on the pelagic and demersal fishes and crustaceans in the borrow area should continue in order to improve understanding of the impacts on ecosystem services.

Detailed comments:
In section **6.1.3 Terrestrial Environment** (page 5), bulrush (*Scirpus validus)* has been renamed *Schoenoplectus tabernaemontani*, and southern bayberry (*Myrica cerifera var. cerifera*), has been renamed *Morella cerifera.*

We also note the following on the second page of Enclosure 1, Consistency Determination, the reference in the table to the Dunes Management (based upon the enforceable policy found in VAC 28.2 1400 et seq. Coastal Primary Sand Dunes **and Beaches**) should address beaches.

Center for Coastal Resources Management
Virginia Institute of Marine Science

Center for Coastal Resources Management
P.O. Box 1346 | Route 1208 Greate Road
Gloucester Point, Virginia 23062-1346 USA
Phone: 804-684-7380 | FAX: 804-684-7179
www.ccrm.vims.edu

WILLIAM & MARY
VIMS
Virginia Institute of Marine Science
School of Marine Science

**Pinion,Anne**

**From:** Amy.Ewing@dgif.virginia.gov
**Sent:** Wednesday, May 20, 2009 2:53 PM
**To:** Pinion,Anne; brian.k.rheinhart@usace.army.mil
**Cc:** Ruth.Boettcher@dgif.virginia.gov; John.Kleopfer@dgif.virginia.gov
**Subject:** ESSLog# 26509_Sandbridge Beach Erosion Control and Hurricane Protection Project

We have reviewed the draft Environmental Assessment (EA) for the subject project that proposes to perform beach nourishment along an area approximately 5 miles long and 125 feet wide near Sandbridge in Virginia Beach. Materials for the nourishment will be collected from the borrow site at Sandbridge Shoal, located greater than three nautical miles of the coast of Virginia.

According to our records, federal Endangered roseate tern has been documented from the project area. However, to our knowledge, this species does not nest in this project area. Therefore, impacts upon this species are not anticipated to result from the proposed work.

State Threatened bald eagle has also been documented from the project area. However, the project site is located outside the management zone for the known nesting sites. Therefore, impacts upon this species are not anticipated to result from the proposed work.

Also documented from the proejct site is federal Threatened loggerhead sea turtle. This species is known to nest on the beaches in the project area. As stated in the draft EA, beach nourishment and associated dredging activities are likely to adversely impact this species. The addition of beach fill, if not properly matched to native materials, may result in a decrease in the quality of nesting habitat for this species. We recommend that all fill materials be matched in color, grain size, and composition to native materials as closely as possible. According to the information in the draft EA, the incidental take statement and biological opinion previously issued by NMFS for this project are still valid. We recommend adherence to the requirements for sea turtle protection (such as time of year restrictions, matching of beach fill materials to native materials, hopper dredge retrofitting, use of observers, routine monitoring, etc.) outlined in these documents.

We document federal Endangered West Indian manatee from the project area. It does not appear that possible impacts upon this species were evaluated in the draft EA. We recommend that possible impacts upon this species be addressed in the EA for this project.

We recommend continued coordination with NMFS regarding the protection of loggerhead sea turtles, other sea turtles, and sea mammals known from the project area and upon which adverse impacts resulting from the project are anticipated to occur. We recommend adherence to the requirements outlined in the incidental take statement and biological opinion previously issued by NMFS for this project.

We recommend coordination with the USFWS regarding possible impacts upon federally listed species and for information about whether this project will result in adverse impacts upon Back Bay NWR.

Assuming appropriate erosion and sediment controls are in place during beach nourishment, we find this project consistent with the parts of the Fisheries Management Section of the CZMA over which we have authority (inland fisheries). We defer to VMRC for concurrence that dredging and piping of materials are consistent with the aspects of the Fisheries Management section of the CZMA that addresses marine habitats.

Thank you. Amy

Amy M. Ewing
Environmental Services Biologist
Virginia Dept. of Game and Inland Fisheries
4010 West Broad Street
Richmond, VA 23230
804-367-2211
amy.ewing@dgif.virginia.gov

L. Preston Bryant. Jr.
Secretary of Natural Resources

Joseph H. Maroon
Director

# COMMONWEALTH of VIRGINIA

## DEPARTMENT OF CONSERVATION AND RECREATION

203 Governor Street
Richmond, Virginia 23219-2010
(804) 786-6124

**MEMORANDUM**

Date: May 19, 2009

TO: Anne Pinion, DEQ

From: Robert S. Munson, Planning Bureau Manager, DCR-DPRR *Robert S Munson*

Subject: DEQ 09-078F, Sandbridge Beach Erosion Control and Hurricane Protection Project

Division of Natural Heritage

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

Biotics documents the presence of natural heritage resources in the project area. However, as long as the nourishment does not include the dune field, we do not anticipate that this project will adversely impact these natural heritage resources. DCR concurs with the guidelines set by the United States Fish and Wildlife Service and National Marine Fisheries Service.

In addition, our files do not indicate the presence of any State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the Virginia Department of Conservation and Recreation (DCR), DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

New and updated information is continually added to Biotics. Please contact DCR for an update on this natural heritage information if a significant amount of time passes before it is utilized.

The Virginia Department of Game and Inland Fisheries maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters that may contain information not documented in this letter. Their database may be accessed from http://vafwis.org/fwis/ or contact Shirl Dressler at (804) 367-6913.

Division of Chesapeake Bay Local Assistance

The proposed activity lies outside of the City of Virginia Beach's designated Chesapeake Bay Preservation Areas, as Sandbridge Beach is located along the shoreline of the Atlantic Ocean and therefore outside of the Chesapeake Bay watershed. As such, there are no requirements under the Chesapeake Bay Preservation Act.

The remaining DCR divisions have no comments regarding the scope of this project. Thank you for the opportunity to comment.

**Pinion,Anne**

**From:** Heller, Matthew (DMME)
**Sent:** Friday, May 22, 2009 2:38 PM
**To:** Pinion,Anne
**Subject:** RE: New EA and Consistency-Sandbridge Beach Erosion Control and Hurricane Protection Project (DEQ# 09-078F)

Anne,

I have reviewed the information that you provided for this project. Based on my review, this project involves the beneficial use of a mineral resource. I do not anticipate a negative impact to mineral resource potential in the nourishment area.

Sincerely,

Matt Heller

Matthew J. Heller, P.G.
Manager, Geologic Mapping
Virginia Department of Mines, Minerals and Energy
Division of Geology and Mineral Resources
900 Natural Resources Drive, Suite 500
Charlottesville, Virginia, 22903
Phone: (434) 951-6351
Fax: (434) 951-6366

<http://www.dmme.virginia.gov/divisionmineralresources.shtml>

Please fill out our customer survey at:
<http://www.dmme.virginia.gov/DmrQualitySurvey>

---

**From:** Pinion, Anne (DEQ)
**Sent:** Friday, May 22, 2009 1:27 PM
**To:** Heller, Matthew
**Subject:** FW: New EA and Consistency-Sandbridge Beach Erosion Control and Hurricane Protection Project (DEQ# 09-078F)

---

**From:** Pinion,Anne
**Sent:** Thursday, April 23, 2009 9:50 AM
**To:** Ewing, Amy (DGIF); Tignor, Keith (VDACS); Rhur, Robbie (DCR); Matthews, Barry (VDH); Kohler,Paul; Narasimhan,Kotur; Hollis,Michelle; Watkinson, Tony (MRC); Kirchen, Roger; Holma, Marc; Heller, Matthew (DMME); Pam Mason; 'Claire JONES'; 'cbernick@vbgov.com'
**Subject:** New EA and Consistency-Sandbridge Beach Erosion Control and Hurricane Protection Project (DEQ# 09-078F)

Reviewers,

Attached is a new project from the U.S. Army Corps of Engineers. The comments are due May 20, 2009.

Here is a link to the project document.

http://www.deq.virginia.gov/eir/documents/09-078F-ProjectDocument.pdf

You can respond to the project by email or use the form attached. However, send me an electronic version of your comments if possible.

**Pinion,Anne**

**From:** Matthews, Barry (VDH)
**Sent:** Tuesday, April 28, 2009 1:04 PM
**To:** Pinion,Anne
**Subject:** RE: New EA and Consistency-Sandbridge Beach Erosion Control and Hurricane Protection Project (DEQ# 09-078F)

VDH - Office of Drinking Water has reviewed Federal Project 09 - 078F - Sandbridge Beach Erosion. Potential impacts to public water distribution systems or sanitary sewage collection systems must be verified by the local utility. Below are our comments as they relate to proximity to public drinking water sources (groundwater wells, springs and surface water intakes).

- There are no records of active public drinking water wells within a mile radius of the project site.
- There are no records of active Public Surface Water intakes within 5 miles of the project site.
- NO IMPACT

**Barry E. Matthews, P.G.**
Department of Health
James Madison Building
Office of Drinking Water, Room 621
Construction Assistance, Planning and Policy
109 Governor Street
Richmond, VA 23219
804 864-7515 (w)
804 864-7520 (fax)
barry.matthews@vdh.virginia.gov

---

**From:** Pinion,Anne [mailto:Anne.Pinion@deq.virginia.gov]
**Sent:** Thursday, April 23, 2009 9:50 AM
**To:** Ewing, Amy (DGIF); Tignor, Keith (VDACS); Rhur, Robbie (DCR); Matthews, Barry (VDH); Kohler, Paul (DEQ); Narasimhan, Kotur (DEQ); Hollis, Michelle (DEQ); Watkinson, Tony (MRC); Kirchen, Roger; Holma, Marc; Heller, Matthew (DMME); Pam Mason; Claire JONES; cbernick@vbgov.com
**Subject:** New EA and Consistency-Sandbridge Beach Erosion Control and Hurricane Protection Project (DEQ# 09-078F)

Reviewers,

Attached is a new project from the U.S. Army Corps of Engineers. The comments are due May 20, 2009.

Here is a link to the project document.

http://www.deq.virginia.gov/eir/documents/09-078F-ProjectDocument.pdf

You can respond to the project by email or use the form attached. However, send me an electronic version of your comments if possible.

Please let me know if you have any questions.

Thanks,

Anne

<<EIR review form.pdf>>

Anne N. Pinion

**If you cannot meet the deadline, please notify ANNE N. PINION at 804/698-4488 prior to the date given. Arrangements will be made to extend the date for your review if possible. An agency will not be considered to have reviewed a document if no comments are received (or contact is made) within the period specified.**

REVIEW INSTRUCTIONS:

A. Please review the document carefully. If the proposal has been reviewed earlier (i.e. if the document is a federal Final EIS or a state supplement), please consider whether your earlier comments have been adequately addressed.

B. Prepare your agency's comments in a form which would be acceptable for responding directly to a project proponent agency.

C. Use your agency stationery or the space below for your comments. **IF YOU USE THE SPACE BELOW, THE FORM MUST BE SIGNED AND DATED.**

Please return your comments to:

**MS. ANNE N. PINION**
**DEPARTMENT OF ENVIRONMENTAL QUALITY**
**OFFICE OF ENVIRONMENTAL IMPACT REVIEW**
**629 EAST MAIN STREET, SIXTH FLOOR**
**RICHMOND, VA 23219**
**FAX #804/698-4319**
**anpinion@deq.virginia.gov**

**ANNE N. PINION**
**ENVIRONMENTAL PROGRAM PLANNER**

COMMENTS

**DHR has been in direct consultation with the Corps of Engineers regarding this project and reached consensus that the Sandbridge Beach Erosion Control Project will result in no adverse effect to historic properties. DHR has no further comment at this time.**

(signed) ______ (date) 4/24/09

(title) ARCHAEOLOGIST

(agency) DHR (FILE #2007-0458)

**PROJECT #09-078F** **2/09**

VIRGINIA DEPARTMENT OF
ENVIRONMENTAL QUALITY

**MEMORANDUM**

**TO:** Anne Pinion, Environmental Program Planner

**FROM:** Paul Kohler, Waste Division Environmental Review Coordinator PWK

**DATE:** May 17, 2009

**COPIES:** Sanjay Thirunagari, Waste Division Environmental Review Manager; file

**SUBJECT:** Environmental Impact Report: Sandbridge Beach Erosion Control and Hurricane Protection Project; 09-078F

The Waste Division has completed its review of the Environmental Impact report for the Sandbridge Beach Erosion Control and Hurricane Protection Project in Virginia Beach, Virginia. We have the following comments concerning the waste issues associated with this project:

Hazardous waste, but not solid waste, issues were addressed in the report. The report did include a search of waste-related data bases. A GIS database search did not reveal any waste sites within a half mile radius that would impact or be impacted by the subject site. The Waste Division staff performed a cursory review of its data files and determined that a number of solid waste sites are located within the same zip code, however their proximity to the subject site are unknown. These are as follows.

SW:
SPSA - Landstown Transfer, PBR 191, Transfer Station
SPSA - Landstown Transfer, SWP 537, Transfer Station
Virginia Beach City - Mt Trashmore Landfill II, SWP 324, Closed Sanitary Landfill
Virginia Beach City - Mt Trashmore Landfill II, SWP 367, Closed Sanitary Landfill
Virginia Beach City - Mt Trashmore Landfill II, SWP 398, Sanitary Landfill
Tidewater Recyclable Products Incorporated, SWP 596, CDD Landfill

Any soil that is suspected of contamination or wastes that are generated during construction-related activities must be tested and disposed of in accordance with applicable Federal, State, and local laws and regulations. Some of the applicable state laws and regulations are: Virginia Waste Management Act, Code of Virginia Section 10.1-1400 *et seq.*; Virginia Hazardous Waste Management Regulations (VHWMR) (9VAC 20-60); Virginia Solid Waste Management Regulations (VSWMR) (9VAC 20-80); Virginia Regulations for the Transportation of Hazardous Materials (9VAC 20-110). Some of the applicable Federal laws and regulations are: the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. Section 6901 *et seq.*, and the applicable regulations contained in Title 40 of the Code of Federal

Regulations; and the U.S. Department of Transportation Rules for Transportation of Hazardous materials, 49 CFR Part 107.

Also, all structures being demolished/renovated/ removed should be checked for asbestos-containing materials (ACM) and lead-based paint prior to demolition. If ACM or LBP are found, in addition to the federal waste-related regulations mentioned above, State regulations 9VAC 20-80-640 for ACM and 9VAC 20-60-261 for LBP must be followed.

Please note that DEQ encourages all construction projects and facilities to implement pollution prevention principles, including the reduction, reuse, and recycling of all solid wastes generated. All generation of hazardous wastes should be minimized and handled appropriately.

If you have any questions or need further information, please contact Paul Kohler at (804) 698-4208.

# DEPARTMENT OF ENVIRONMENTAL QUALITY
## DIVISION OF AIR PROGRAM COORDINATION

**ENVIRONMENTAL REVIEW COMMENTS APPLICABLE TO AIR QUALITY**

**TO: Anne N. Pinion** **DEQ - OEIA PROJECT NUMBER: 09 – 078F**

**PROJECT TYPE:** ☐ STATE EA / EIR **X FEDERAL EA / EIS** ☐ SCC

**X CONSISTENCY DETERMINATION**

RECEIVED

APR 2 4 2009

DEQ-Office of Environmental Impact Review

**PROJECT TITLE: SANDBBRIDGE BEACH EROSION CONTROL AND HURRICANE PROTECTION PROJECT**

**PROJECT SPONSOR: DOD / ARMY / U. S. ARMY CORPS OF ENGINEERS**

**PROJECT LOCATION:** ☒ **OZONE MAINTENANCE AREA**

**REGULATORY REQUIREMENTS MAY BE APPLICABLE TO:** **X** **CONSTRUCTION**
☐ OPERATION

**STATE AIR POLLUTION CONTROL BOARD REGULATIONS THAT MAY APPLY:**

1. ☐ 9 VAC 5-40-5200 C & 9 VAC 5-40-5220 E – STAGE I
2. ☐ 9 VAC 5-40-5200 C & 9 VAC 5-40-5220 F – STAGE II Vapor Recovery
3. ☐ 9 VAC 5-40-5490 et seq. – Asphalt Paving operations
4. **X 9 VAC 5-40-5600 et seq. – Open Burning**
5. **X 9 VAC 5-50-60 et seq. Fugitive Dust Emissions**
6. ☐ 9 VAC 5-50-130 et seq. - Odorous Emissions; Applicable to__________________
7. ☐ 9 VAC 5-50-160 et seq. – Standards of Performance for Toxic Pollutants
8. ☐ 9 VAC 5-50-400 Subpart_____, Standards of Performance for New Stationary Sources, designates standards of performance for the__________________________
9. ☐ 9 VAC 5-80-10 et seq. of the regulations – Permits for Stationary Sources
10. ☐ 9 VAC 5-80-1700 et seq. Of the regulations – Major or Modified Sources located in PSD areas. This rule may be applicable to the __________________________
11. ☐ 9 VAC 5-80-2000 et seq. of the regulations – New and modified sources located in non-attainment areas
12. ☐ 9 VAC 5-80-800 et seq. Of the regulations – Operating Permits and exemptions. This rule may be applicable to _________________________________________

**COMMENTS SPECIFIC TO THE PROJECT:**

**Being in an ozone maintenance area, all precautions are to be taken to restrict the emissions of volatile organic compounds (VOC) and oxides of nitrogen ($NO_X$) during construction.**

K. S. Smail

**(Kotur S. Narasimhan)**
**Office of Air Data Analysis**

**DATE: April 24, 2009**

HAMPTON ROADS
PLANNING DISTRICT COMMISSION

BRUCE C. GOODSON, CHAIRMAN • STAN D. CLARK, VICE CHAIRMAN • JAMES O. McREYNOLDS, TREASURER
DWIGHT L. FARMER, EXECUTIVE DIRECTOR/SECRETARY

RECEIVED

MAY 26 2009

DEQ-Office of Environmental Impact Review

May 20, 2009

Ms. Anne N. Pinion
Department of Environmental Quality
Office of Environmental Impact Review
629 East Main Street, Sixth Floor
Richmond, Virginia 23219

Re: Sandbridge Beach Erosion Control and Hurricane Protection Project
DEQ #09-078F (ENV:GEN)

Dear Ms. Pinion:

Pursuant to your request, the staff of the Hampton Roads Planning District Commission (HRPDC) has reviewed the Draft Environmental Assessment for the proposed erosion control and hurricane protection project at Sandbridge Beach. We have contacted the City of Virginia Beach concerning this project.

Based on this review, the proposal is generally consistent with local and regional plans and policies.

We appreciate the opportunity to review this project. If you have any questions, please do not hesitate to call.

Sincerely,

Dwight L. Farmer

Dwight L. Farmer
Executive Director/Secretary

MLJ/fh

Copy: Mr. H. Clayton Bernick III

**Pinion,Anne**

**From:** Clay Bernick [CBernick@vbgov.com]
**Sent:** Thursday, May 28, 2009 11:25 AM
**To:** Pinion,Anne
**Subject:** RE: Corps EA - Sandbridge Beach Nourishment

Anne-

Sorry for the delay; the City decided not to comment on the project.

Clay

**Clay Bernick**
Administrator
City of Virginia Beach Department of Planning
Environmental Management Center
2405 Courthouse Drive
Building 2, Room 115
Municipal Center
Virginia Beach, VA 23456-9040
(757) 385-4621 MAIN
(757) 385-5667 FAX
(757) 385-4899 DIRECT
(757) 377-3120 MOBILE

Reduce, Reuse, Recycle - please print only when necessary!

**From:** Pinion,Anne [mailto:Anne.Pinion@deq.virginia.gov]
**Sent:** Wednesday, May 27, 2009 9:17 AM
**To:** Clay Bernick
**Subject:** Corps EA - Sandbridge Beach Nourishment

Clay,

If Virginia Beach wants to comment on the project, I need to comments today.

Thanks,

Anne

Anne N. Pinion

Department of Environmental Quality

629 East Main Street

Richmond, Virginia 23219

(804) 698-4488

NEW EMAIL: anne.pinion@deq.virginia.gov

# APPENDIX F: PROPOSED MITIGATION MEASURES (where this differs from the lease, the lease governs)

## 1. Plans and Performance Requirements

The USACE will include this MOA as a reference document in the advertised "Construction Solicitation and Specifications Plan" (hereinafter referred to as the "Plan"). The USACE will ensure that all operations at SSBA are conducted in accordance with the final approved Plan and all terms and conditions in this MOA, as well as all applicable statutes, regulations, orders and any guidelines or directives specified or referenced herein. The USACE will send BOEM a copy of the plans and its modification when publically available.

The dredging method for removing sand from SSBA will be consistent with those evaluated in all applicable NEPA documents and approved in the authorizing documents, as well as project permits. The USACE will allow BOEM to review and comment on modifications to the Plan that may affect the borrow area or pipeline corridors on the OCS, including the use of submerged or floated pipelines to directly convey sediment from the borrow area to the placement site. Said comments will be delivered in a timely fashion so as to not unnecessarily delay the USACE's construction contract or schedule.

If dredging and/or conveyance methods are not wholly consistent with those evaluated in relevant NEPA documents prepared by BOEM for this Project, and environmental and cultural resource consultations, and those authorized by relevant project permits, additional environmental review may be necessary. If the additional NEPA, consultations, or permit modifications would impact or otherwise supplement the provisions of the MOA, an amendment may be required.

Prior to the commencement of construction, the USACE must electronically provide BOEM with a summary of the construction schedule consistent with Paragraph 15. The USACE, at the reasonable request of BOEM or the Bureau of Safety and Environmental Enforcement (BSEE), must allow any authorized Federal inspector to access the site of any operation, when permitted by safety regulations, and must provide BOEM or BSEE any documents and records that are pertinent to occupational or public health, safety, environmental protection, conservation of natural resources, or other use of the OCS as may be requested.

## 2. Environmental Responsibilities and Environmental Compliance

The USACE is the lead agency on behalf of the Federal Government to ensure the Project complies with applicable environmental laws, including but not limited to the ESA, MSA, NHPA, and CZMA, and any consultations or limitations imposed thereunder. The USACE or the City, as designated, is responsible for compliance with the specific conditions of state permits, such as those administered by the Virginia Marine Resources Commission (VMRC) and Virginia Department of Environmental Quality (VDEQ).

The USACE will serve as the lead Federal agency for ESA Section 7 consultation concerning protected species under the purview of the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). The USACE will instruct its contractor(s) to implement the mitigation terms, conditions, and measures required by the USFWS, NMFS, VMRC, and BOEM pursuant to applicable Federal and State laws and regulations prior to commencement of activities authorized under this MOA, including extraction, transportation and placement of sand resources from SSBA. The required mitigation terms, conditions, and measures are reflected in the relevant Biological Opinions, Conservation Recommendations, Consistency Determinations, and state permits issued to the USACE and/or City. Stipulations and mitigations associated with consultations are provided in Attachment 2, with full details, context, and correspondence provided as appendices to BOEM's Environmental Assessment. Electronic copies of all relevant correspondence, monitoring data, and reports related to the activities covered by this MOA, will be provided electronically to BOEM within 14 days of issuance (including, but not limited to, observer and dredging reports, and reports required by relevant project permits). Construction may not commence until the pre-construction requirements have been completed.

### 3. Pre-Construction Notification of Activity in or near the Borrow Area

The USACE will invite BOEM to attend a pre-construction meeting that describes the USACE's and/or its contractor's or agent's plan and schedule to construct the Project.

The USACE will notify BOEM electronically at least 72 hours prior to the commencement, and within 24 hours after termination, of operations at SSBA. BOEM will electronically notify the USACE in a timely manner of any OCS activity within the jurisdiction of the DOI that may adversely affect the USACE's ability to use OCS sand for the Project.

### 4. Dredge Positioning

During all phases of the Project, the USACE will ensure that the dredge and any bottom-disturbing equipment is outfitted with an onboard global positioning system (GPS) capable of maintaining and recording location within an accuracy range of no more than plus or minus 3 meters. The GPS must be installed as close to the hydraulic dredge as is practicable or must use appropriate instrumentation to accurately represent the position of the hydraulic dredge. During dredging operations, the USACE will immediately notify BOEM electronically if dredging occurs outside of the approved borrow area. Such notification will be made as soon as possible after the time USACE becomes aware of dredging outside of the approved borrow area.

Anchoring, spudding, or other bottom disturbing activities are not authorized outside of the approved borrow area on the OCS, except for immediate concerns of safety, navigation risks or emergency situations.

The USACE will provide BOEM, electronically, with all appropriate Dredging Quality Management (DQM) data acquired during the Project using procedures jointly developed by the USACE's National Dredging Quality Management (DQM) Data Program Support Center and BOEM. The USACE will submit the DQM data, including draghead, cutterhead, or other hydraulic or mechanical dredging device depth every two weeks. A summary DQM dataset will be submitted within 90 days of completion of the Project. If available, the USACE will also submit Automatic Identification System (AIS) data for vessels qualifying under the International Maritime Organization's (IMO) International Convention for the Safety of Life at Sea.

### 5. Dredge Operation

Dredging will occur preferentially in naturally accreting areas of the shoal complex, avoiding erosional areas of the shoal to the extent possible, and will avoid creating deep depressions or pits.

### 6. Submittal of Production and Volume Information

The USACE, in cooperation with the dredge operator, must submit to BOEM a summary of the dredge track lines, outlining any deviations from the original Plan every two weeks. A color-coded plot of the draghead, cutterhead, or other hydraulic or mechanical dredging device will be submitted, showing any horizontal or vertical dredge violations. The dredge track lines must show dredge status: hoteling, dredging, transiting, or unloading. This map will be provided in PDF format.

At least every two weeks, the USACE will electronically provide a report of the construction progress including estimated volumetric production rates to BOEM. The project completion report, as described below, will also include production and volume information, including Daily Operational Reports.

### 7. Local Notice to Mariners

The USACE will require its contractor(s) for the Project to place a notice in the U.S. Coast Guard Local Notice to Mariners regarding the timeframe and location of dredging and construction operations in advance of commencement of dredging.

### 8. Marine Pollution Control and Contingency Plan

The USACE will require its contractor(s) and subcontractor(s) to prepare for and take all necessary precautions to prevent discharges of oil and releases of waste or hazardous materials that may impair water quality. In the event of such an occurrence, notification and response will be in accordance with applicable requirements of 40 C.F.R. Part 300. All dredging and support operations must be compliant with U.S. Coast Guard regulations and the U.S. Environmental Protection Agency's Vessel General Permit, as applicable. The USACE will notify BOEM of any noncompliant discharges and remedial actions taken, and will provide copies of reports of the incident and resultant actions electronically.

### 9. Encounter of Ordnance

If any ordnance is encountered while conducting dredging activities at SSBA, the USACE will report the discovery within 24 hours to Dr. Jeff Reidenauer, Chief, BOEM Marine Minerals Division, at (703) 787-1851 and dredgeinfo@boem.gov.

### 10. Bathymetric Surveys

The Corps will provide BOEM with pre- and post-dredging bathymetric surveys of the Borrow Area. The pre-dredging survey of the Borrow Area will be conducted within 60 days prior to the commencement of dredging and the data will be provided to BOEM for review via dredgeinfo@boem.gov, allowing for a minimum of 7 working days for BOEM to provide concurrence prior to the commencement of dredging. A qualified hydrographic surveyor, independent from the dredging/construction contractor, must conduct and oversee the survey, and must approve the survey results before transmitting them to BOEM. The post-dredging survey of the Borrow Area will be conducted within 60 days after the completion of dredging. Given available funding, BOEM recommends that the Corps conduct additional bathymetric surveys of the Borrow Area one (1) and three (3) years after the completion of dredging to document borrow area evolution and provide information to inform future decisions and consultations regarding use of OCS sand resources. Surveys, error analysis, and reporting will be performed in accordance with the most recent edition of the National Oceanic and Atmospheric Administration's (NOAA's) Office of Coast Survey Hydrographic Survey Field Procedure Manual. Survey standards and requirements are specified and can be found on the Coast Survey Document Library (https://www.nauticalcharts.noaa.gov/publications/docs/standards-and-requirements/specs/hssd-2017.pdf).

For bathymetric surveys, one hundred percent coverage using multi-beam bathymetric survey methods is required. All bathymetric data will be roll, pitch, heave, and tide corrected using best practices. Sound velocity corrections will be applied based on measurements made during and throughout the duration of the survey using a profiling sound velocity meter to obtain water column sound velocities with casts that log the entire water column to the seafloor. Survey lines of the specific dredge area will be established at intervals necessary to provide 100 percent coverage. All survey lines will extend at least 100 meters (328 feet) beyond the edge of the Borrow Area limits as defined in this MOA.

All data will be collected in such a manner that post-dredging bathymetric surveys are compatible with the pre-dredging bathymetric survey data to enable the latter to be subtracted from the former to calculate the volume of sand removed, the shape of the excavation, and the nature of post-dredging bathymetric change. Pre-dredge bathymetric survey transects will be reoccupied during the post-dredging surveys. Surveys will be conducted using kinematic GPS referenced to a GPS base station occupying an established (NAVD 88 vertical control) monument within 15 kilometers (9 miles) of the survey area, a National Geodetic Survey real-time network, or a water-level gauge deployed within the vicinity of the Borrow Area and referenced to an established monument (NAVD 88 vertical control), unless alternative methods are approved by BOEM. Pre- and post-dredging surveys will be referenced to the same water-level gauge, tide gauge, real-time network, benchmark, or BOEM-approved method. An uncertainty or error analysis will be conducted on the bathymetric dataset based on calculated differences of measured elevations (depths) at all transect crossings (also note that other best practices typically employed to identify potential error or quantify uncertainty, such as daily bar-checks, will be conducted and documented). A methods section and results of the uncertainty analysis, field notes, and metadata must be submitted to BOEM with the processed bathymetric data products.

If data accuracy, coverage, quality, or other parameters for either pre- or post-dredging surveys are not sufficient to provide for accurate comparisons between the pre-dredge and post-dredge surveys (e.g., do not meet specifications and standards discussed or referenced above), BOEM may require that a new survey (at the pre-dredge and/or post-dredge phase) be conducted.

The delivery format for bathymetry data submission is an ASCII file containing x, y, z data and a digital elevation model in a format agreed upon between BOEM and USACE in writing. The horizontal data will be provided in the NAD83 Virginia State Plane South, U.S. survey feet. Vertical data will be provided in the NAVD 88, U.S. survey feet unless otherwise specified. An 8.5 x 11 inch plan view plot of the pre- and post-construction data will be provided showing the survey vessel navigation tracks, as well as contour lines at appropriate elevation intervals. A plot of the digital elevation model will also be provided. These plots will be provided in Adobe PDF format. Images and descriptions of side scan sonar or bathymetric anomaly targets will be included and identified on an index map.

### 11. Archaeological Resources

*Onshore Prehistoric or Historic Resources*

If the USACE discovers any previously unknown historic or archeological resources while accomplishing the activity on Sandbridge Beach, the USACE will notify BOEM of any finding. The USACE will initiate the Federal and State coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

*Offshore Prehistoric or Historic Resources*

The following anomalies (listed in **Table 2**) must be avoided during dredging operations by a radius of at least 200 feet around the target coordinates and 500 feet around two side-scan (S1*) sonar targets:

**Table 2. Anomalies to be avoided During Dredging Operations**

| Acoustic Target | Magnetic Anomaly | Amplitude (gammas) | Duration (feet) | Coordinates (Virginia State Plane South [feet]) | | Avoidance Radius (min.) |
|---|---|---|---|---|---|---|
| | | | | X | Y | |
| **BORROW AREA A** | | | | | | |
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| **BORROW AREA B** | | | | | | |
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In the event that the Parties and/or dredge operators discover any archaeological resources prior to dredging operations in SSBA or in the vicinity of pump-out operations, the USACE will report the discovery to the Marine Minerals Division Chief at BOEM, electronically, in a timely manner. The USACE Water Resources Division (WRD) will coordinate with BOEM on the measures needed to evaluate, avoid, protect, and, if needed, mitigate adverse impacts from an unanticipated discovery. If investigations determine that the resource is significant, the Parties will together determine how best to protect it.

If the Parties and/or dredge operators discover any archaeological resources while conducting dredging operations, the USACE will require that dredge and/or pump-out operations be halted immediately and avoid the resource per the requirements of the USACE specifications for unanticipated finds. The USACE will then immediately report the discovery electronically to the Marine Minerals Division Chief at BOEM. The USACE will coordinate with BOEM on the measures needed to evaluate, avoid, protect, and, if needed, mitigate adverse impacts from an unanticipated discovery. If investigations determine that the resource is significant, the Parties will together determine the necessary further action required and how to best protect the resource.

### 12. Responsibilities

BOEM does not warrant that the OCS sand resources used in this Project are suitable for the purpose for which they are intended by the USACE and the City. BOEM's responsibility under this Project is limited to the authorization of access to OCS sand resources from SSBA, as described in this MOA, and therefore BOEM disclaims any and all responsibility for the physical and financial activities undertaken by the other Parties in pursuit of the Project.

### 13. Project Completion Report

Consistent with Paragraph 15, a project completion report will be submitted by the USACE to BOEM within 120 days following completion of the activities authorized under this MOA. This report and supporting materials should be sent electronically. The report will contain, at a minimum, the following information:

- the names and titles of the project managers overseeing the effort (for the USACE, the engineering firm (if applicable), and the contractor), including contact information (phone numbers, mailing addresses, and email addresses);
- the location and description of the Project, including the final total volume of material extracted from the borrow area and the volume of material actually placed on the beach or shoreline (including a description of the volume calculation method used to determine these volumes);
- DQM data, in ASCII files, containing the x, y, z coordinates and time stamp of the cutterhead or drag arm locations;
- a narrative describing the final, as-built features, boundaries, and acreage, including the restored beach width and length;
- a narrative discussing the construction sequences and activities, and, if applicable, any problems encountered and solutions;
- a list and description of any construction change orders issued, if applicable;
- a list and description of any safety-related issues or accidents reported during the life of the project;
- a narrative and any appropriate tables describing any environmental surveys or efforts associated with the Project and costs associated with these surveys or efforts;
- a table listing significant construction dates beginning with bid opening and ending with final acceptance of the Project by the USACE;
- a table showing the various phases of the Project construction, the types of construction equipment used, the nature of their use;
- digital appendices containing the as-built surveys, beach-fill cross-sections, and survey data; and
- metadata appropriate to electronic deliverables; and
- any additional pertinent comments.

**14. Reporting Compliance**

The USACE will designate in advance of construction a single point of contact (and preferably a back-up contact) responsible for facilitation of compliance with all MOA requirements. The contact information will be provided to BOEM, electronically, at least 30 days in advance of dredging and construction operations.

The Parties will attempt to reasonably comply with the provisions of this MOA. Should there be an allegation of a failure to comply, the alleged failure will be corrected as soon as possible and/or resolved jointly among BOEM, USACE and the City, including through the dispute resolution process identified in Paragraph 16.

**15. Sharing of Information**

Consistent with the purpose stipulated by the Parties in Title II, and to the extent allowed by law, policy and regulation, the USACE, the City, and BOEM agree to: (1) share all information needed for or generated from the Project, including the sharing of implementation and other applicable schedules; (2) provide such information to the requesting agency as expeditiously as possible; and (3) work to ensure that all required completion report information is received.

The Parties to this MOA acknowledge that information and reports required by and/or exchanged pursuant to the Project that is the subject of this MOA may include confidential business information, proprietary information, or other sensitive information that should be protected from disclosure.

Any Party, contractor or agent of one of the Parties requesting that information or reports provided pursuant to this MOA be treated as confidential, will prominently mark the information and report as "Confidential" along with the bases for the claim of confidentiality. Any covering correspondence submitted with the information or report will likewise note the claim of confidentiality being asserted. To the extent practicable, a Party to this MOA may only request information that has been marked as "Confidential" and is in the possession of another Party to this MOA if the information is needed by the requesting Party to carry out their obligations under this MOA or if the information is necessary for the requesting Party to fulfill their obligations under the law. The Party in possession of the information requested may work with the requesting party to determine if the information can be shared without waiving the confidential nature of the material.

The Parties further agree that they will notify the other Parties as soon as possible, in writing, of any request by any person seeking the release or disclosure of information marked "Confidential" in whole or in part, including, but not limited to, requests pursuant to Court orders, discovery, subpoenas, or other compulsory process, or public access request under applicable Federal or State law. Notification will be considered timely if it provides the Parties or individuals claiming the information or report is confidential a reasonable opportunity to seek a Court order to prevent release or disclosure. Any disputes regarding requests for information or the confidential nature of the information requested will be resolved according to applicable law and through the dispute resolution process identified in Paragraph 16. If the Party or individual claiming the information or report is confidential fails to obtain a timely Court order preventing the release or disclosure of the information, the Party in possession of the information will release it to the extent required by applicable law.

**16. Resolution of Disputes**

The Parties agree to make every attempt to settle any disputes regarding this MOA at the lowest operational level. In the case of a (1) substantial disagreement between BOEM and USACE or between BOEM and the City with respect to any aspect of BOEM's authorization of the use of OCS sand resources in accordance with the terms and conditions as specified or (2) any alleged breach by a Party of the terms and conditions as specified herein, the undersigned will designate a senior management official in their respective agencies to state the area(s) of disagreement or alleged breach in writing and present such statement to the other Parties for consideration. If resolution is not reached within 60 days, the undersigned may request the active participation of the District Commander, Norfolk District of the USACE, the Chief of the Office of Strategic Resources of BOEM, and the City Manager for the City of Virginia Beach.

**17. Miscellaneous**

This MOA will not affect any pre-existing or independent relationships or obligations among DOI, USACE, and the City, including any other relationships or obligations between BOEM and USACE, or any other units of such Departments.

All rights in the SSBA not expressly granted to USACE and the City are hereby reserved to BOEM. BOEM reserves the right to authorize other uses in the SSBA that will not unreasonably interfere with activities authorized under this MOA. BOEM will allow USACE and the City to review and comment on any proposed authorizations for the use of OCS sand resources in the SSBA while this MOA is in effect.

Nothing herein is intended to conflict with current USACE, City, or BOEM statutes or regulations. If the terms of this MOA are inconsistent with existing statues or regulations of any of the Parties entering into this MOA, then those portions of this agreement which are determined to be inconsistent will be invalid, but the remaining terms and conditions not affected by the inconsistency will remain in full force and effect. At the first opportunity for review of the MOA once such inconsistency is identified, all necessary changes will be accomplished either by an amendment to this MOA or by entering into a new MOA, whichever is deemed expedient to the interest of the Parties.

This agreement may be executed in two (2) or more counterparts, each of which will be deemed an original. The signatures to this agreement may be executed on separate pages, and when attached to this agreement will constitute one complete document.