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FEB 10 2016

F/SER31:MET

MEMORANDUM FOR: F/HC3 – Mr. Christopher D. Doley

FROM: F/SE – Roy E. Crabtree, Ph.D.

SUBJECT: Framework Biological Opinion on *Deepwater Horizon* Oil Spill Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement (SER-2015-17459)

Enclosed is the National Marine Fisheries Service's (NMFS) framework programmatic Biological Opinion (Opinion) on the Preferred Alternative within the Deepwater Horizon Oil Spill Programmatic Damage Assessment and Restoration Plan and Programmatic Environmental Impact Statement (DWH PDARP). Our Opinion was prepared pursuant to section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 USC 1531 *et seq.)* and implementing regulations, 50 CFR Part 402.

The DWH PDARP is a framework for a comprehensive programmatic restoration plan that will guide the development of subsequent restoration plans and project-level actions. As such, it is a framework programmatic action as defined in 50 C.F.R. 402.02 and this is a framework programmatic consultation on the action. This Opinion does not include an incidental take statement. Any incidental take resulting from actions subsequently authorized, funded, or carried out under the DWH PDARP will be addressed in subsequent Section 7 consultations, as appropriate.

Species analyzed in this Opinion are sperm whales, humpback whales, fin whales, sei whales, sea turtles (loggerhead, leatherback, Kemp's ridley, hawksbill, and green), Gulf sturgeon, smalltooth sawfish, Nassau grouper (proposed for listing), and corals (elkhorn, staghorn, boulder star, mountainous star, and lobed star) and their respective designated critical habitats. Of these species, we conclude that the proposed action is not likely to adversely affect humpback whales, fin whales, sei whales, Nassau grouper, corals (elkhorn, staghorn, boulder star, mountainous star, and lobed star), or their respective designated critical habitats. We determined that the proposed action is likely to adversely affect sperm whales, sea turtles (loggerhead, leatherback, Kemp's ridley, hawksbill, and green), Gulf sturgeon, and smalltooth sawfish. Of these species, loggerhead sea turtles, smalltooth sawfish, and Gulf sturgeon have designated critical habitats within the action area which may also be adversely affected.

We reviewed and analyzed the current status of these listed species and their designated critical habitats (listed resources), including impacts from the *Deepwater Horizon* oil spill, the environmental baseline within the action area, the effects of the proposed action, including assumptions to address uncertainty, and any effects of interrelated and interdependent activities and cumulative effects. Our analysis of the effects of the DWH PDARP addresses program-level effects. It includes a risk assessment of the probable consequences of exposing listed resources under NMFS' jurisdiction to the potential effects of implementing the DWH PDARP. We also analyzed the ability of the DWH DPARP's governance and decision-making systems to ensure that the program as a whole will not result in jeopardy to listed species or destruction or adverse modification of their designated critical habitats. Our analyses include assumptions about implementation of best practices in project-level actions and about some areas of uncertainty associated with the governance and decision-making systems.

This Opinion also describes pathways for subsequent ESA section 7 consultations on project-level actions that are tiered from the DWH PDARP. Project-level consultations will be either informal, when NMFS concurs that the action is not likely to adversely affect listed resources, or formal, when adverse effects cannot be avoided. For formal consultations, NMFS will complete a Biological Opinion addressing adverse effects to listed resources and take of ESA-listed species. For informal consultations, we built on experience with the ESA section 7 process for *Deepwater Horizon* Early Restoration Projects, and created, in coordination with the U.S. Fish and Wildlife Service, a Biological Evaluation (BE) form (Appendix B of this Opinion) that can be used to help the Trustees provide the information necessary to allow NMFS to make a determination on the expected effects of proposed projects. For traditional informal consultations, the Trustees will submit this BE form and NMFS will respond with a Letter of Concurrence if we agree that the action is not likely to adversely affect listed resources. We also provide in Section 8 of this Opinion a pathway and detailed steps for streamlined informal consultations on actions for which NMFS' project design criteria (PDCs) are followed.

The streamlined informal consultation pathway using PDCs will be available for several common restoration activities proposed in the DWH PDARP. Appendix A of this Opinion provides the detailed PDCs and analyses of each, and explains how incorporation of these PDCs into project level actions is likely to avoid adverse effects on listed resources. The activities for which NMFS has developed PDCs (and are therefore eligible for streamlined informal consultation) are:

- Marsh creation and enhancement
- Construction of living shorelines
- Removal of derelict fishing gear and other marine debris
- Oyster reef creation and enhancement
- Construction of non-fishing piers

NMFS may update these PDCs or add new PDCs to cover additional restoration activities as new information becomes available through monitoring and evaluation of these and other restoration efforts.

Based on the review and analysis in the Opinion, we conclude that the DWH PDARP is not likely to jeopardize the continued existence of any ESA-listed endangered or threatened species under the jurisdiction of NMFS and is not likely to destroy or adversely modify any designated critical habitat.

This Opinion includes Conservation Recommendations that are discretionary measures the Trustees can implement to promote conservation of the ESA listed resources affected by the DWH PDARP. These recommendations include priority actions that would optimize benefits to listed species for which the DWH PDARP has set restoration goals, opportunities to reduce or eliminate potential adverse effects to listed resources, information needed to understand and report on the status and trends of listed species for which the DWH PDARP has restoration goals, and opportunities to enhance coordination of DWH PDARP restoration planning, monitoring, adaptive management and best available science. These conservation recommendations are directly linked to the restoration approaches proposed in the DWH PDARP and are designed to produce information that can help to guide restoration planning to achieve the ESA and DWH PDARP goals of restoring ESA listed resources.

As 50 CFR 402.16 provides, reinitiation of formal consultation is required if: (1) the amount or extent of incidental taking specified in the incidental take statement is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion, (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this Opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action. In the context of this Opinion, there is no incidental take authorized and the reinitiation trigger set out in (1) is not applicable.

We look forward to further cooperation with the Trustees through the implementation of the DWH PDARP to ensure the conservation and restoration of threatened and endangered species. If you have any questions regarding this consultation, please contact Mike Tucker at (727) 209-5981, or via email at michael.tucker@noaa.gov.

Enclosure

File:

Endangered Species Act - Section 7 Consultation
Biological Opinion

Agency: NOAA Restoration Center, on behalf of *Deepwater Horizon* Trustees

Activity: Endangered Species Act (ESA) Section 7 Programmatic Consultation on the Preferred Alternative within the *Deepwater Horizon* Oil Spill Programmatic Damage Assessment and Restoration Plan and Programmatic Environmental Impact Statement

Consultation No. SER-2015-17459

Consulting Agency: National Marine Fisheries Service
Southeast Regional Office
Protected Resources Division

Date Issued: Feb. 10, 2016

Approved By:

Roy E. Crabtree, Ph.D.
Regional Administrator

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Abbreviations and Acronyms

BA	Biological Assessment
BE	Biological Evaluation
BIRNM	Buck Island Reef National Monument
BRD	bycatch reduction device
BSEE	Bureau of Safety and Environmental Enforcement
CCL	Curved Carapace Length
CFR	Code of Federal Regulations
CHEU	Charlotte Harbor Estuary Unit
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
CPUE	catch per unit effort
CWPPRA	Coastal Wetlands Planning, Protection, and Restoration Program
dB	decibel
DDT	dichlorodiphenyltrichloroethane
DNA	deoxyribonucleic acid
DO	dissolved oxygen
DOI	Department of the Interior
DPS	distinct population segment
DTRU	Dry Tortugas Recovery Unit
DWH	*Deepwater Horizon*
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FDEP	Florida Department of Environmental Protection
FEMA	Federal Emergency Management Agency
FMP	Fishery Management Plan
FP	fibropapillomatosis
FWC	Florida Fish and Wildlife Conservation Commission
FWRI	Florida Fish and Wildlife Research Institute
GADNR	Georgia Department of Natural Resources
GCERTF	Gulf Coast Ecosystem Restoration Task Force
GCRU	Greater Caribbean Recovery Unit
GOM	Gulf of Mexico
GSCH	Gulf sturgeon critical habitat
HAB	harmful algal bloom
IPCC	Intergovernmental Panel on Climate Change
ISED	International Sawfish Encounter Database

ITS	Incidental Take Statement
LDWF	Louisiana Department of Wildlife and Fisheries
LOC	Letter of Concurrence
MHWL	mean high water line
MIT	Massachusetts Institute of Technology
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act
MMSN	Marine Mammal Stranding Network
MOA	Memoranda of Agreement
MOU	Memoranda of Understanding
mtDNA	mitochondrial deoxyribonucleic acid
NAWCA	North American Wetlands Conservation Council
NCWRC	North Carolina Wildlife Resources Commission
nDNA	nuclear deoxyribonucleic acid
NEPA	National Environmental Policy Act
NFWF GEBF	National Fish and Wildlife Foundation Gulf Environmental Benefit Fund
NGMRU	Northern Gulf of Mexico Recovery Unit
NLAA	not likely to adversely affect
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOAA RC	National Oceanic and Atmospheric Administration Restoration Center
NPS	National Park Service
NRC	Nuclear Regulatory Commission
NRDA	Natural Resource Damage Assessment
NRDAR	Natural Resources Damage Assessment and Restoration
NRU	Northern Recovery Unit
NWA DPS	Northwest Atlantic distinct population segment
OPA	Oil Pollution Act of 1990
PCB	polychlorinated biphenyl(s)
PDARP	Programmatic Damage Assessment and Restoration Plan
PDC	project design criteria
PFRU	Peninsular Florida Recovery Unit
PRDNER	Puerto Rico Department of Natural and Environmental Resources
QA/QC	quality assurance and quality control
RESTORE	Gulf Coast Ecosystem Restoration Council
rkm	river kilometers
RPAs	reasonable and prudent alternatives
SAV	Submerged Aquatic Vegetation
SCDNR	South Carolina Department of Natural Resources
SCL	straight carapace length

SOP	Standard Operating Procedures
STSSN	Sea Turtle Stranding and Salvage Network
TIG	Trustee Implementation Group
TL	total length
TTIU	Ten Thousand Islands/Everglades Unit
UME	unusual mortality event
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	United States Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
YOY	young-of-the-year

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1. Background and Consultation History

The National Marine Fisheries Service (NMFS) prepared this conference and Biological Opinion (Opinion) in accordance with Section 7(b) of the ESA of 1973, as amended (16 U.S.C. 1531, et seq.), and implementing regulations at 50 CFR 402.

1.1 Background

In 2010, the natural resources of the northern Gulf of Mexico were seriously impacted by the *Deepwater Horizon* oil spill. Since that time, the *Deepwater Horizon* Natural Resource Trustees (Trustees) have worked together to assess the injuries to natural resources in the northern Gulf of Mexico and to the services those resources provide, and to determine the restoration needed to compensate the public for these impacts. Many habitats, plants, and animals in the northern Gulf of Mexico were injured; indeed, the Trustees believe that the northern Gulf of Mexico ecosystem itself was injured. The Trustees include designated agencies from each of the 5 Gulf states (Alabama, Florida, Louisiana, Mississippi, Texas) and 4 federal agencies: National Oceanic and Atmospheric Administration (NOAA), Department of the Interior (DOI), Environmental Protection Agency (EPA), and United States Department of Agriculture (USDA).

The Trustees prepared the *Deepwater Horizon* Oil Spill Draft Programmatic Damage Assessment and Restoration Plan and Draft Programmatic Environmental Impact Statement (*henceforth referred to as* DWH PDARP) in accordance with the Oil Pollution Act (OPA) and the National Environmental Policy Act (NEPA). As required under OPA, the Trustees have conducted a natural resource damage assessment (NRDA) and prepared the DWH PDARP,[1] which describes the Trustees' injury assessment and proposed restoration plan, considering the environmental impacts of the proposed restoration and alternatives to that restoration. The Trustees propose to select a comprehensive, integrated ecosystem restoration plan for implementation that will result in restoration in the Gulf of Mexico over the next 15-20 years. The DWH PDARP is programmatic; it describes the framework by which subsequent project-specific restoration plans will be identified and developed during the coming decades. The following Opinion is in response to the request from the NOAA Restoration Center (NOAA RC), on behalf of the Trustees, to initiate ESA Section 7 consultation on the preferred alternative and governance structure presented in the DWH PDARP.

[1] In addition to the program outlined in the DWH PDARP, there are other restoration efforts related to the *Deepwater Horizon* oil spill including: the Resources and Ecosystems Sustainability, Tourist Opportunities and Revived Economies of the Gulf Coast States (RESTORE) Act of 2012, the Gulf Environmental Benefit Fund administered by the National Fish and Wildlife Foundation, and the North American Wetlands Conservation Fund designated for wetlands restoration and conservation in the Gulf or projects to benefit migratory bird species and other wildlife and habitat affected by the oil spill.

Prior to the development of the DWH PDARP, there were emergency and early restoration efforts which resulted in approximately $800 million in projects on the ground to offset injuries. These early restoration projects underwent separate OPA and NEPA processes, and Endangered Species Act (ESA) Section 7 consultations when a project may have affected ESA-listed species.

1.2 Consultation History

- In May and October 2012, NOAA RC began to inform NMFS of a future ESA Section 7 consultation request for expected DWH NRDA restoration projects in the Gulf of Mexico. Several follow-up coordination meetings were held.
- In May 2013, an internal NOAA work group including the NOAA RC, began meeting to discuss and refine a framework for ESA consultation and opportunities for streamlining consultation, while still avoiding and minimizing adverse effects to ESA-listed species and critical habitat and insuring against likely jeopardy and/or destruction or adverse modification.
- In March 2014, the work group produced a framework for ESA consultation. In June 2015, the work group updated the framework. During this time, the work group started writing project design criteria to guide future restoration project design to avoid or minimize adverse effects. The ESA consultation framework and project design criteria were further informed through Trustees' ongoing consultations with NMFS on DWH Early Restoration projects (2012 through to present).
- On October 6, 2015, the Trustees released the draft DWH PDARP for public comment and used this document as the basis for requesting ESA consultation under Section 7(a)(2) from NMFS on October 9, 2015.
- On October 9, 2015, the NOAA RC, on behalf of the Trustees, initiated formal consultation with NMFS Southeast Region, and the consultation was assigned tracking number SER-2015-17459.

2. Proposed Action

The Trustees' goals for DWH NRDA restoration planning are specific to addressing injury and align with the overarching goals previously identified by the Gulf Coast Ecosystem Restoration Task Force (GCERTF 2011). The Trustees' guiding principle, at the highest level, is to provide a comprehensive restoration plan that restores a range of habitats, natural resources, and environmental services that were injured by the spill by allocating restoration funds using an integrated restoration portfolio across restoration types and locations to meet the following goals:

- Restore and conserve habitat
- Restore water quality
- Replenish and protect living coastal and marine resources
- Provide and enhance recreational opportunities
- Provide for monitoring, adaptive management, and administrative oversight to support restoration implementation

To meet the purpose of restoring extensive and complex injuries, the Trustees' proposed an integrated restoration portfolio that emphasizes the broad ecosystem benefits realized through coastal habitat restoration in combination with resource specific restoration in the interconnected Gulf of Mexico ecosystem.

The proposed action considered in this Opinion is the preferred alternative and governance structure for implementing the DWH PDARP. This action is described in the preferred alternative in Chapter 5 of the DWH PDARP, environmental consequences and compliance in Chapter 6, and in the governance structure provided in Chapter 7. These parts of the proposed action are discussed in more detail below, with references to appropriate sections of the DWH PDARP. Most text is directly from the DWH PDARP except where summary suffices. For more explicit detail, refer to the DWH PDARP.

2.1 Preferred Alternative and Governance Structure

Ecosystem Approach to the Restoration Portfolio

The injuries caused by the *Deepwater Horizon* spill cannot be fully described at the level of a single species, a single habitat type, or even a single region. The ecological scope of this incident is unprecedented, with oiling occurring in the deep ocean a mile below the surface, in offshore habitats, as well as nearshore and shoreline habitats hundreds of miles from the wellhead. The injuries affected such a wide array of linked resources over such an enormous area that the effects of the *Deepwater Horizon* spill must be described as constituting an ecosystem-level injury. Just as the injuries cannot be understood in isolation, restoration efforts must also be considered and implemented from a broader perspective. These restoration types work both independently and together to achieve necessary benefits to injured resources and services at the ecosystem level (Figure 2-1). Consequently, the Trustees' preferred restoration alternative was similarly developed using an ecosystem-level approach, informed by reasonable scientific inferences based on the information collected for representative habitats and resources. This approach resulted in the comprehensive, integrated, ecosystem restoration portfolio identified as the preferred alternative and distributes restoration across a range of different restoration types and locations.

The integrated restoration portfolio presented in Chapter 5.5 of the DWH PDARP, Alternative A: Comprehensive Integrated Ecosystem Restoration (Preferred Alternative) addresses the diverse suite of injuries that occurred at both regional and local scales. The Trustees have considered key ecological factors such as linkages (interactions between the interdependent network of habitats and organisms [from microbes, to plants, to animals]), as well as factors such as resiliency and sustainability. The preferred alternative allocates restoration funds across restoration types, making investments regionwide, in the open ocean, and throughout all 5 Gulf states to restore coastal and nearshore habitats, improve water quality in priority watersheds, protect and restore living coastal and marine resources, and enhance recreational use opportunities. By making investments across resource groupings and supporting habitats, the Trustees will maximize the likelihood of appropriately compensating the public for all the resources and services injured by the spill.

Shoreline and nearshore habitats, including wetlands, dunes, submerged aquatic vegetation (SAV), and oyster beds, provide important nursery and foraging habitat for many species of injured birds, turtles, marine mammals, finfish, shellfish, and invertebrates (O'Connell et al. 2005; Wursig et al. 2000). These shoreline and nearshore habitats often have high rates of productivity. They are also important contributors to productivity in the shallow continental shelf water column through movement of detritus offshore, driven by tides and major currents, and through migration of animals to offshore locations to become a part of the offshore food web (EPA 1999). For example, many species of fish, invertebrates, and crustaceans inhabit marsh habitat as juveniles, but then migrate away from the marsh as they mature, ultimately becoming important food sources for other animals that live offshore (Boesch and Turner 1984). These are critical processes that influence the structure and function of the Gulf of Mexico ecosystem and the services provided to the human community. Because of these scientifically demonstrated physical and biological linkages between nearshore habitats and many of the resources injured by the spill, restoration of these nearshore habitats is a critical underpinning of the Trustees' preferred alternative.

As part of the ecosystem approach to the restoration portfolio, the Trustees also will conduct restoration to improve water quality in localized watersheds to provide further ecological benefits. For example, reductions of excessive nutrient inputs would likely reduce the extent and occurrence of low dissolved oxygen, harmful algal blooms, and large aquatic mortality events (commonly referred to as "fish kills") (EPA 1999). In addition, water quality improvements could benefit beach going, swimming, and recreational fishing experiences in localized watersheds.

Although it is important to dedicate restoration activities broadly across the habitats on which injured resources rely, it is equally important to develop species-specific restoration actions to directly support the recovery of fragile and unique resources. Targeted restoration for key species and resources, such as fish (e.g., bluefin tuna and Gulf sturgeon), birds, sea turtles, beach mice, marine mammals, and mesophotic and deep benthic communities, will ensure that species and life stages that have specific restoration needs or that have weaker linkages with nearshore habitats are also restored.

As part of this integrated restoration portfolio, loss of human use as a result of actual and perceived negative impacts on the Gulf region caused by this spill will also be addressed. Coastal communities of the Gulf of Mexico have a deep connection to the natural ecosystem and the benefits it provides (NOAA 2011). Considering this important link between healthy natural resources and recreational activities, restoring habitats and improving water quality will provide human use benefits. However, it is also important to include specific restoration actions that directly provide and enhance recreational opportunities through improved access or increased educational opportunities.

The Trustees conclude that this combination of efforts will work synergistically to restore for the full range of assessed injuries caused by this spill. By conducting restoration for both targeted species in the vast Gulf of Mexico food web and for the habitats on which they rely, ecological linkages such as habitat-community-species interactions, predator-prey relationships, nutrient transfer and cycling, and organism migration and behavior may also feasibly be restored. The ecosystem approach to the restoration portfolio also includes a commitment to monitoring and adaptive management that accommodates the dynamics of ecosystems and new knowledge on how they respond, as well as to continuous oversight and rigorous planning. Adaptive management will also be used to address currently unknown injuries that may be uncovered in the future. In this manner, the Trustees provide for a flexible, science-based approach to ensuring that the restoration portfolio provides long-term benefits to the resources and services injured by the spill in the manner envisioned in this programmatic plan.

System wide factors may influence uncertainties related to restoration implementation and adaptive management will be a critical component of successful restoration. The Trustees also recognize the Gulf of Mexico is a dynamic and changing environment, influenced by external factors and stressors such as pollution, climate change, sea level rise, hurricanes, and other events. Restoration will take place over many years, and restoration may have to be modified to adapt to changing environmental conditions (Bricker et al. 2008; Choi et al. 2008; Hobbs 2007; Nichols et al. 2011b). Details on monitoring and adaptive management can be found in Appendix 5.E of the DWH PDARP.

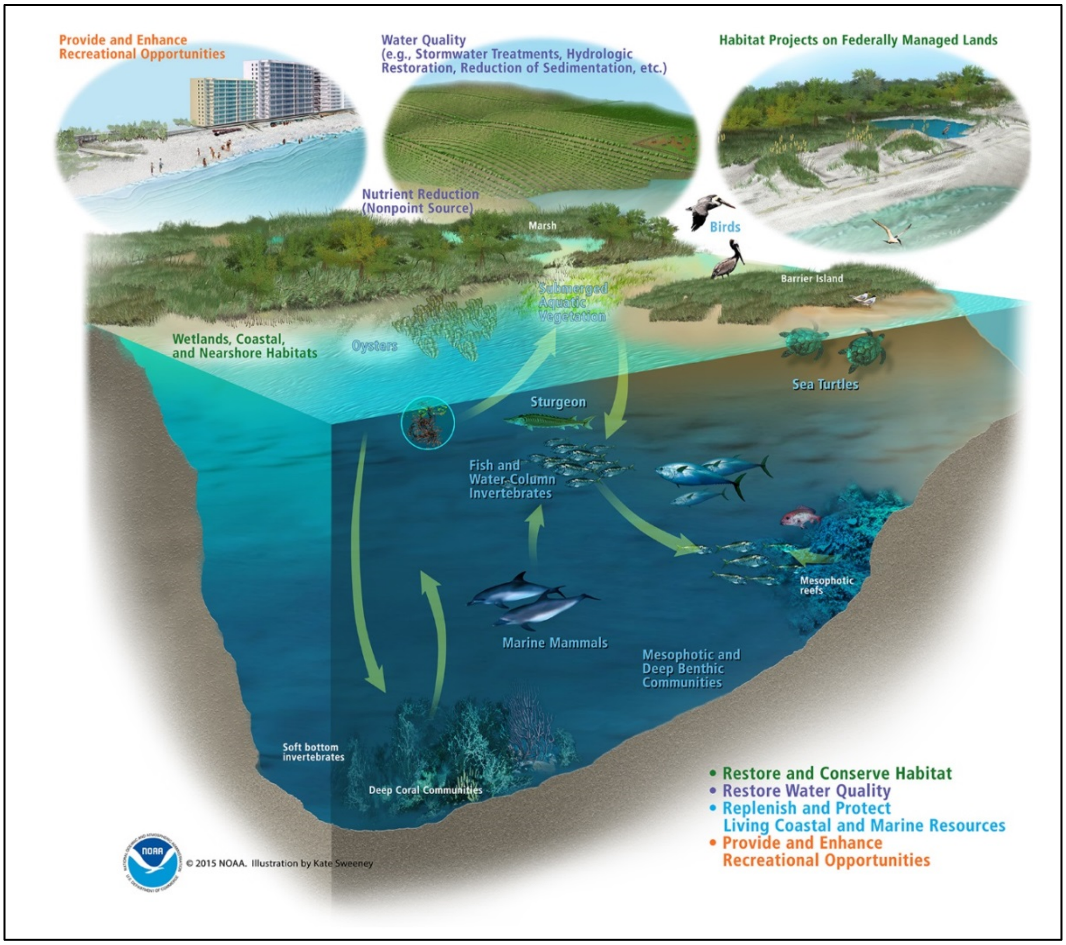

Figure 2-1. Restoration types that restore, protect, or enhance habitats, resources, and services within an integrated restoration portfolio. The restoration types work both independently and together to achieve necessary benefits to injured resources and services at the ecosystem level. (Source**:** Kate Sweeney for NOAA)

Funding Allocations by Restoration Type

The Trustees have determined that natural resource damage settlement funds in the amount of $8.1 billion (plus up to $700 million for adaptive management for unknown conditions) are appropriate and sufficient to address injuries caused by this spill. To address the diverse suite of injuries that occurred at both regional and local scales, the Trustees' preferred alternative allocates funds to restoration types based on the understanding of injury and the capacity of each programmatic goal. Figure 2-2 shows how the restoration types and approaches work together to meet the Trustees' restoration goals in the plan. Additionally, the Trustees allocate restoration funds geographically based on their understanding and evaluation of exposure and injury to natural resources and services, as well as their evaluation of where restoration spending for the various restoration types will be most beneficial within the ecosystem-level restoration portfolio. These geographic restoration areas include Regionwide, Open Ocean, and the 5 Gulf states (Alabama, Florida, Louisiana, Mississippi, and Texas). By allocating restoration funds across resources, supporting habitats, and geographic areas, the Trustees will maximize the likelihood of providing long-term benefits to those resources and services injured by the spill.

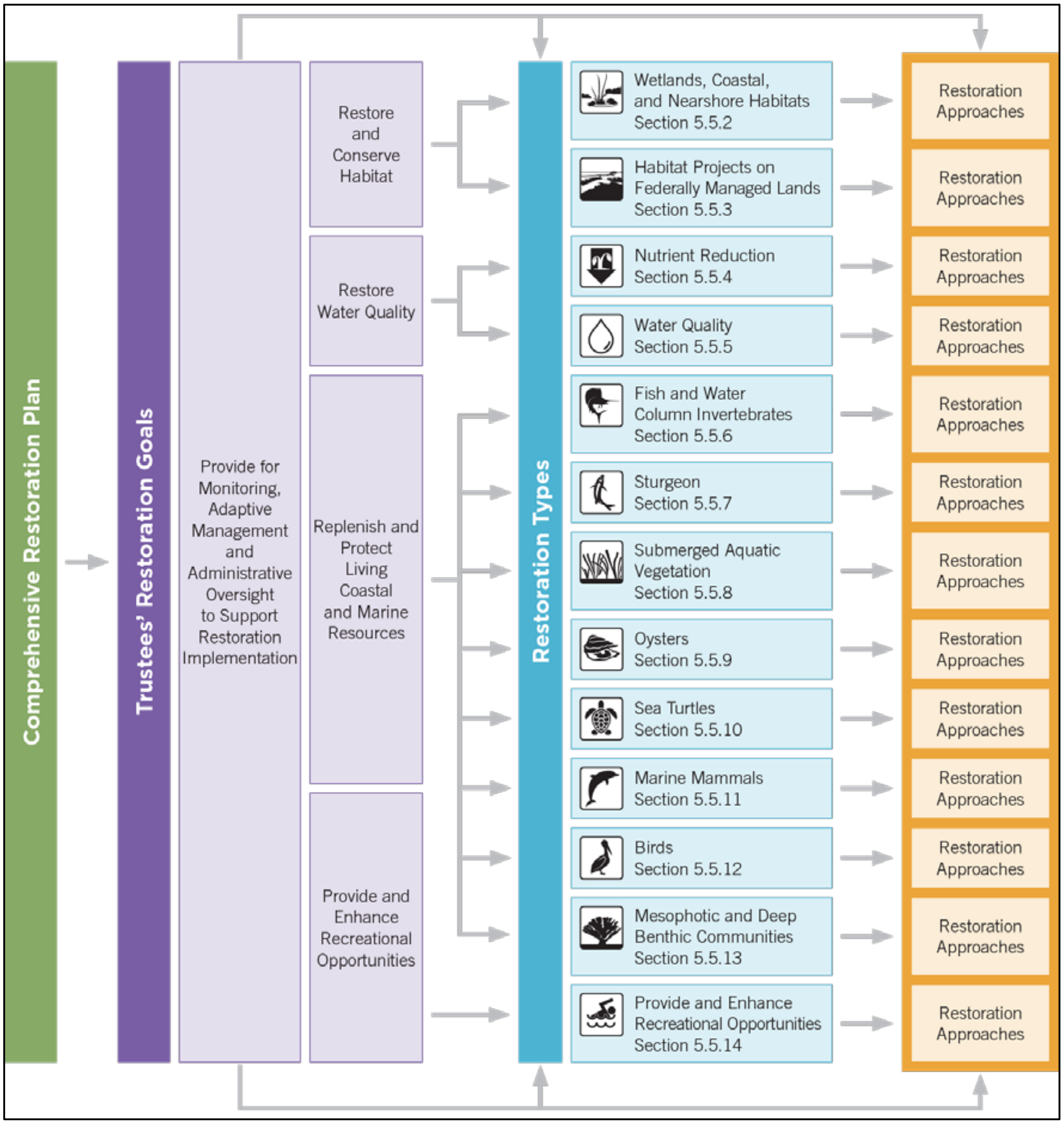

Figure 2-2. The Trustees' comprehensive restoration plan showing the goals and their related restoration type(s) connecting to restoration approaches, with monitoring, adaptive management, and administrative oversight planned throughout all restoration types.

The DWH PDARP describes each restoration type that makes up the preferred alternative. For each restoration type, it provides specific goals for the restoration type, the strategy for implementing the restoration type, including the restoration approaches and techniques that could be implemented, implementation considerations; and monitoring, including both project-level and resource-level monitoring considerations, as applicable. It also describes restoration approaches.

Table 2-1 shows the Trustees' funding allocations by goal and restoration type (rows) and restoration area (columns). This table also highlights where investments have already been made through the Trustees' Early Restoration efforts. The rationale for the remaining allocation of funds by programmatic goal and restoration type, after subtraction of Early Restoration investments, is outlined below.

- Goal 1: Restore and Conserve Habitat. The Trustees allocate the greatest amount of funds to the goal of Restore and Conserve Habitat, given the critical role that coastal and nearshore habitats play in the overall productivity of the Gulf of Mexico.
    - Restoration Type - Wetlands, Coastal, and Nearshore Habitats

      The Trustees allocate funds throughout all 5 Gulf state restoration areas to restore coastal and nearshore habitats - such as wetlands, oysters, SAV, beaches, dunes, islands, and barrier headlands - either individually or in combination with one another. The Trustees make this allocation as part of the strategy to develop a diversified portfolio that supports Gulf-wide recovery of injured resources that rely on habitats.

      Geographically, the wetland habitats of coastal Louisiana will be a primary area of focus. The Trustees focus on the wetland habitats in this area because the area experienced among the heaviest and most persistent oiling and also because these wetlands support very high primary and secondary production that contributes to the overall health of the northern Gulf of Mexico ecosystem. Coastal Louisiana contains a diversity of habitat types, including herbaceous marsh of different salinities, mangroves, chenier ridges, intertidal oysters, barrier islands, and barrier headlands. The habitats in eastern Louisiana are especially diverse because of the influence of the Mississippi River, which provides for the gradual elevation gain from coast to uplands. This topography results in a large, connected marsh zone across a range of salinities, from barrier islands and saline marsh at the coastal edge, to brackish and freshwater marsh away from the coast (Gosselink and Pendleton 1984). Restoration throughout this coastal habitat area provides the Trustees with an opportunity to provide benefits to the extensive and diverse resources that rely on the productivity of the diverse and vast marshes and other nearshore habitats connected to the Mississippi River delta.
    - Restoration Type - Habitat Projects on Federally Managed Lands. The Trustees allocate funds to the Florida, Alabama, Mississippi, and Louisiana restoration areas to address injuries that occurred on specific federally managed lands. Restoration in these diverse lands will include a portfolio of approaches that support a wide array of plants, fish, birds, beach mice, and other wildlife, including but not limited to coastal wetlands, marsh, SAV, sand beaches, and dunes.

- Goal 2: Restore Water Quality. The Trustees allocate funds to improve water quality in coastal watersheds as part of the strategy to address ecosystem-level injuries as well as specific aspects of lost recreational use.

- Restoration Type - Nutrient Reduction (nonpoint source). The Trustees allocate funds to this restoration type throughout all 5 Gulf state restoration areas to address excessive nutrient loading into coastal watersheds, which in turn will reduce threats such as hypoxia, harmful algal blooms, and habitat losses, thereby compensating for injuries to multiple resources and broken ecosystem-level linkages.
- Restoration Type - Water Quality (e.g., stormwater treatments, hydrologic restoration, reduction of sedimentation). The Trustees allocate additional funds to the Florida restoration area to address water quality degradation that will not only compensate for injured resources and broken ecosystem-level linkages, but also recreational losses caused by the spill. Focusing this effort within the state of Florida will address specific water quality issues that adversely affect the overall health and quality of this state's beaches, bays, and nearshore habitats that have high recreational value.

- Goal 3: Replenish and Protect Living Coastal and Marine Resources. The Trustees allocate funding to resource-specific restoration actions as part of the integrated restoration portfolio to ensure that species, life-stages, and/or services not fully addressed by coastal and nearshore restoration will be addressed.
  - Restoration Type - Fish and Water Column Invertebrates. The Trustees allocate funds to address direct sources of mortality to fish and water column invertebrates. The Trustees make all this allocation to the Open Ocean resource area because of the need to address specific species and life stages that may not sufficiently benefit from coastal and nearshore habitat restoration.
  - Restoration Type - Sturgeon. The Trustees allocate funds to address the specific recovery needs of this protected species. The funds are allocated to the Open Ocean restoration area and will target approaches focused on sturgeon recovery in priority rivers.
  - Restoration Type - Sea Turtles. The Trustees allocate funds across all 7 geographically defined restoration areas, with particular emphasis on the Open Ocean and Regionwide restoration areas, because of the diversity of species and life stages that were injured. The Trustees may use funds allocated to the Regionwide and Open Ocean restoration areas for restoration outside of the Gulf of Mexico as ecologically appropriate, and these funds may be used for resource-level planning, prioritization, implementation, and monitoring for resource recovery, among others.
  - Restoration Type - SAV. The Trustees allocate funds to the Louisiana restoration area for restoring the Chandeleur Islands SAV beds to ensure that restoration can be targeted to the unique SAV ecosystem that was affected in this area.
  - Restoration Type - Marine Mammals. The Trustees allocate funds across Florida, Alabama, Mississippi, Louisiana, Open Ocean, and Regionwide restoration areas,

with particular emphasis on the Louisiana, Open Ocean, and Regionwide restoration areas. The Trustees place the majority of funds for marine mammals in these 3 restoration areas to reflect the diversity of species injured and the geographic distribution of the injury. The Trustees may additionally use funds in the Regionwide and Open Ocean restoration areas for restoration outside of the Gulf of Mexico as ecologically appropriate, and these funds may be used for resource-level planning, prioritization, implementation, and monitoring for resource recovery, among others.

- Restoration Type - Birds. The Trustees allocate funds for birds across all 7 geographically defined restoration areas because of the diverse array of species and geographic areas that these species inhabit. The Trustees may additionally use funds in the Regionwide and Open Ocean restoration areas for restoration outside coastal Gulf of Mexico habitats, and these funds may be used for resource-level planning, prioritization, implementation, and monitoring for resource recovery, among others.
- Restoration Type - Mesophotic and Deep Benthic Communities. The Trustees allocate substantial funds for this restoration type, all allocated to the Open Ocean restoration area. This allocation reflects the Trustees' conclusions about the large injury to these rare and long-lived resources, as well as an understanding of the expense of working in these remote regions of the Gulf of Mexico.
- Restoration Type - Oysters. The Trustees allocate funds to specifically address unique aspects of injury to oysters that may not be fully addressed by restoration conducted within the goal of Restore and Conserve Habitat. Funds are distributed across all 5 state restoration areas, as well as the Regionwide restoration area, to address not only injuries to specific oyster beds, but also to address the broader recruitment failure and ecological functions that need to be restored. Region-wide restoration area funds also may be used for resource-level planning, prioritization, implementation, and monitoring for resource recovery, among others.

- Goal 4: Provide and Enhance Recreational Opportunities. The Trustees allocate funds to restore aspects of lost recreational opportunities not fully addressed by restoration conducted under the other 4 restoration goals.
  - Restoration Type - Provide and Enhance Recreational Opportunities. The Trustees allocate funds to the Florida, Alabama, Mississippi, and Louisiana restoration areas to address specific components of recreational use injuries. These funds are in addition to any recreational use benefits that may be derived from the ecological restoration projects being implemented within the other restoration types.

- Goal 5: Provide for Monitoring, Adaptive Management and Administrative Oversight. The Trustees allocate funds to provide for monitoring, adaptive management, and administrative oversight, recognizing that implementation of this restoration plan will occur over many years.

- Monitoring and Adaptive Management. The Trustees allocate funds to the broader monitoring and adaptive management activities of the restoration plan, which are in addition to funds allocated within each restoration type. Recognizing that the restoration plan outlined in the DWH PDARP is unprecedented in amount, type, and geographic scope, the Trustees allocate funds for monitoring and adaptive management to all restoration areas. However, the Trustees allocate the largest funds to the Open Ocean and Louisiana restoration areas, commensurate with the locations of the largest restoration fund allocations. The Trustees also allocate significant funds to the Regionwide restoration area to support such activities as the development and maintenance of a web-based public portal to access monitoring data and other important information related to restoration activities conducted under this restoration plan.
- Administrative Oversight and Comprehensive Planning. The Trustees allocate funds across all 7 geographically defined restoration areas, emphasizing the Regionwide, Open Ocean, and Louisiana restoration areas, commensurate with areas of greatest restoration fund allocations. The Trustees make this allocation because implementing this plan will require significant administrative oversight and will especially benefit from comprehensive planning to guide restoration project selection and adaptive management.
- Adaptive Management Natural Resource Damage Payment for Unknown Conditions. The Trustees also set aside funds to address currently unknown conditions that may be uncovered in the future. The Trustees make this allocation because conditions will change over the course of the decades it will take to fully implement the restoration outlined in this plan, and setting aside funds to address future unknown conditions reduces the risk of proceeding with restoration in the face of those uncertainties.

Table 2-1. Settlement of Natural Resources Damage (NRD) Claims (The NRD final allocation is in dollars)

Major Restoration Categories	Unknown Conditions	Regionwide	Open Ocean	Alabama	Florida	Louisiana	Mississippi	Texas	Total Restoration Funding*
1. Restore and Conserve Habitat									
Wetlands, Coastal, and Nearshore Habitats				**65,000,000**	**5,000,000**	**4,009,062,700**	**55,500,000**	**100,000,000**	**4,234,562,700**
Habitat Projects on Federally Managed Lands				**3,000,000**	**17,500,000**	**50,000,000**	**5,000,000**		**75,500,000**
Early Restoration (through Phase IV)				28,110,000	15,629,367	259,625,700	80,000,000		383,365,067
2. Restore Water Quality									
Nutrient Reduction (Nonpoint Source)				**5,000,000**	**35,000,000**	**20,000,000**	**27,500,000**	**22,500,000**	**110,000,000**
Water Quality (e.g., Stormwater Treatments, Hydrologic Restoration, Reduction of Sedimentation)					**300,000,000**				**300,000,000**
3. Replenish and Protect Living Coastal and Marine Resources									
Fish and Water Column Invertebrates			**380,000,000**						**380,000,000**
Early Restoration Fish and Water Column Invertebrates			20,000,000						20,000,000
Sturgeon			**15,000,000**						**15,000,000**
Sea Turtles		**60,000,000**	**55,000,000**	**5,500,000**	**20,000,000**	**10,000,000**	**5,000,000**	**7,500,000**	**163,000,000**
Early Restoration Turtles		29,256,165						19,965,000	49,221,165
Submerged Aquatic Vegetation						**22,000,000**			**22,000,000**
Marine Mammals		**19,000,000**	**55,000,000**	**5,000,000**	**5,000,000**	**50,000,000**	**10,000,000**		**144,000,000**
Birds		**70,400,000**	**70,000,000**	**30,000,000**	**40,000,000**	**148,500,000**	**25,000,000**	**20,000,000**	**403,900,000**
Early Restoration Birds		1,823,100		145,000	2,835,000	71,937,300		20,603,770	97,344,170
Mesophotic and Deep Benthic Communities			**273,300,000**						**273,300,000**
Oysters		**64,372,413**		**10,000,000**	**20,000,000**	**26,000,000**	**20,000,000**	**22,500,000**	**162,872,413**
Early Restoration Oysters				3,329,000	5,370,596	14,874,300	13,600,000		37,173,896
4. Provide and Enhance Recreational Opportunities									
Provide and Enhance Recreational Opportunities				**25,000,000**	**63,274,513**	**38,000,000**	**5,000,000**		**131,274,513**
Early Restoration Recreational Opportunities			22,397,916	85,505,305	120,543,167	22,000,000	18,957,000	18,582,688	287,986,076
5. Monitoring, Adaptive Management, Administrative Oversight									
Monitoring and Adaptive Management		**65,000,000**	**200,000,000**	**10,000,000**	**10,000,000**	**225,000,000**	**7,500,000**	**2,500,000**	**520,000,000**
Administrative Oversight and Comprehensive Planning		**40,000,000**	**150,000,000**	**20,000,000**	**20,000,000**	**33,000,000**	**22,500,000**	**4,000,000**	**289,500,000**
Adaptive Management NRD Payment for Unknown Conditions	**700,000,000**								**700,000,000**
Total NRD Funding	**$700,000,000**	**$349,851,678**	**$1,240,697,916**	**$295,589,305**	**$680,152,643**	**$5,000,000,000**	**$295,557,000**	**$238,151,458**	

*The total restoration funding allocation for the Early Restoration work; each restoration type; and monitoring, adaptive management, and administrative oversight is $8.1 billion (plus up to an additional $700 million for adaptive management and unknown conditions).

ESA Consultation and NEPA

As the DWH PDARP is a programmatic plan outlining restoration approaches available for future development of project specific restoration, the selection of the preferred alternative does not in itself result in environmental impacts. Rather, impacts would occur as a result of projects ultimately identified and selected in future project-specific restoration plans that tier from the DWH PDARP. A summary of restoration types and restoration approaches proposed in the preferred alternative are summarized in Table 2-2. More details on restoration types and approaches can be found in DWH PDARP Chapter 5.5 and Chapter 5, Appendix 5-D.

The Trustees are pursuing ESA consultation at the program level to evaluate the entire program as well as provide some efficiency. Program-level consultation, resulting in a programmatic Biological Opinion, examines the effects of a program on ESA-listed species and their habitat(s). It also provides an analysis that can be tiered from during future ESA consultations. Programmatic Biological Opinions can offer pathways for streamlining large numbers of projects that require ESA consultation by providing a consistent framework for submitting individual projects or groups of projects.

To comply with the ESA on future project-specific actions, the Trustees will initiate consultations and conferences with the United States Fish and Wildlife Services (USFWS) and/or NMFS on proposed projects or groups of projects that may affect ESA-listed and proposed species and their designated or proposed critical habitats. The Trustees, which include NMFS and USFWS, will develop a list of species and critical habitats that may be affected by each proposed project or group of projects, document the types of potential impacts from the proposed project to listed and proposed species and designated critical habitats, incorporate practices from Appendix 6.A, Chapter A.1 of the DWH PDARP, and where necessary, propose additional project-specific avoidance and minimization measures. Based on this information, projects or groups of projects will be analyzed to determine if they (1) would have no effect on listed species, species proposed for listing, or designated or proposed critical habitat (together, "listed resources"); (2) may affect, but are not likely to adversely affect, listed resources; or (3) are likely to adversely affect listed resources.

The DWH PDARP analysis assumes implementation of NMFS and USFWS guidance when there are potential impacts to protected resources and their habitats (see Appendix 6.A., Chapter A.1 of the DWH PDARP). Examples of best practices in the DWH PDARP that reduce adverse effects on ESA-listed resources under NMFS's jurisdiction are:

- NMFS Southeast Region Measures for Reducing Entrapment Risk to Protected Species, Revised: May 22, 2012
- Vessel Strike Avoidance Measures and Reporting for Mariners NOAA Fisheries Service, Southeast Region, Revised: February 2008
- Sea Turtle and Smalltooth Sawfish Construction Conditions, Revised: March 23, 2006

All projects implemented under subsequent restoration plans and tiered NEPA analyses will be consistent with the DWH PDARP. The Trustees will secure all necessary state and federal permits, authorizations, consultations, or other regulatory processes, including those related to sensitive habitats (e.g., wetlands or Essential Fish Habitat [EFH]) and protected species (e.g., marine mammals, such as dolphins, or federally listed species under the ESA, such as sea turtles) before the implementation of specific projects or groups of projects. Projects will also be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources.

Table 2-2. Summary of DWH PDARP Restoration Types and Restoration Approaches Proposed in the Preferred Alternative

Restoration Type	Restoration Approach
Wetlands, coastal, and nearshore habitats	Create, restore, and enhance coastal wetlands
	Restore and preserve Mississippi-Atchafalaya River processes
	Restore oyster reef habitat
	Create, restore, and enhance barrier and coastal islands and headlands
	Restore and enhance dunes and beaches
	Restore and enhance submerged aquatic vegetation
	Protect and conserve marine, coastal, estuarine, and riparian habitats
Habitat projects on federally managed lands	Create, restore, and enhance coastal wetlands
	Restore oyster reef habitat
	Create, restore, and enhance barrier and coastal islands and headlands
	Restore and enhance dunes and beaches
	Restore and enhance submerged aquatic vegetation
	Protect and conserve marine, coastal, estuarine, and riparian habitats
	Promote environmental stewardship, education, and outreach
Nutrient reduction (nonpoint source)	Reduce nutrient loads to coastal watersheds
	Reduce pollution and hydrologic degradation to coastal watersheds
	Create, restore, and enhance coastal wetlands
	Protect and conserve marine, coastal, estuarine, and riparian habitats
Water quality (e.g., stormwater treatments, hydrologic restoration, sedimentation reduction)	Reduce pollution and hydrologic degradation to coastal watersheds
	Reduce nutrient loads to coastal watersheds
	Create, restore, and enhance coastal wetlands
	Protect and conserve marine, coastal, estuarine, and riparian habitats
Fish and water column invertebrates	Reduce impacts of ghost fishing through gear conversion and/or removal of derelict fishing gear
	Reduce mortality among Highly Migratory Species and other oceanic fishes
	Voluntary reduction in Gulf menhaden harvest
	Incentivize Gulf of Mexico commercial shrimp fishers to increase gear selectivity and environmental stewardship
	Voluntary fisheries-related actions to increase fish biomass

Restoration Type	Restoration Approach
	Reduce post-release mortality of red snapper and other reef fishes in Gulf of Mexico recreational fishery using fish descender devices
	Restore sturgeon spawning habitat
	Reduce Gulf of Mexico commercial red snapper or other reef fish discards through individual fishing quota (IFQ) allocation subsidy program
Sturgeon	Restore sturgeon spawning habitat
	Reduce nutrient loads to coastal watersheds
	Protect and conserve marine, coastal, estuarine, and riparian habitats
Sea turtles	Reduce sea turtle bycatch in commercial fisheries through identification and implementation of conservation measures
	Reduce sea turtle bycatch in commercial fisheries through enhanced training and outreach to the fishing community
	Enhance sea turtle hatchling productivity and restore and conserve nesting beach habitat
	Reduce sea turtle bycatch in recreational fisheries through development and implementation of conservation measures
	Reduce sea turtle bycatch in commercial fisheries through enhanced state enforcement effort to improve compliance with existing requirements
	Increase sea turtle survival through enhanced mortality investigation and early detection of and response to anthropogenic threats and emergency events
	Reduce injury and mortality of sea turtles from vessel strikes
Submerged aquatic vegetation	Restore and enhance submerged aquatic vegetation
Marine mammals	Reduce commercial fishery bycatch through collaborative partnerships
	Reduce injury and mortality of bottlenose dolphins from hook and line fishing gear
	Increase marine mammal survival through better understanding of causes of illness and death as well as early detection and intervention for anthropogenic and natural threats
	Measure noise to improve knowledge and reduce impacts of anthropogenic noise on marine mammals
	Reduce injury, harm, and mortality to bottlenose dolphins by reducing illegal feeding and harassment activities
	Reduce marine mammal takes through enhanced state enforcement related to the Marine Mammal Protection Act
	Reduce injury and mortality of marine mammals from vessel collisions
	Protect and conserve marine, coastal, estuarine, and riparian habitats
Birds	Restore and conserve bird nesting and foraging habitat
	Create, restore, and enhance coastal wetlands
	Restore and enhance dunes and beaches
	Create, restore, and enhance barrier and coastal islands and headlands
	Restore and enhance submerged aquatic vegetation
	Protect and conserve marine, coastal, estuarine, and riparian habitats
	Establish or re-establish breeding colonies
	Prevent incidental bird mortality

Restoration Type	Restoration Approach
Mesophotic and deep benthic communities	Place hard ground substrate and transplant coral
	Protect and manage mesophotic and deep benthic coral communities
Oysters	Restore oyster reef habitat
Provide and enhance recreational opportunities	Enhance public access to natural resources for recreational use
	Enhance recreational experiences
	Promote environmental stewardship, education, and outreach
	Create, restore, and enhance coastal wetlands
	Restore oyster reef habitat
	Create, restore, and enhance barrier and coastal islands and headlands
	Restore and enhance dunes and beaches
	Restore and enhance submerged aquatic vegetation
	Protect and conserve marine, coastal, estuarine, and riparian habitats

Governance

As specified in the Oil Pollution Act of 1990 (OPA), natural resource trustees are designated to act on behalf of the public to:

- Assess and recover damages for the injury to, destruction of, and loss and lost use of natural resources caused by an oil spill and the services those resources provide.
- Develop and implement plans for the restoration, rehabilitation, replacement, or acquisition of the equivalent of the damaged natural resources under their trusteeship.
- Develop and implement these restoration plans after adequate public notice, opportunity for a hearing, and consideration of all public comment.
- Use recovered sums only to reimburse or pay the costs of assessing natural resource injuries and of developing and implementing these restoration plans.

In keeping with these responsibilities, and in the context of the comprehensive, integrated ecosystem restoration plan identified as the preferred alternative, the Trustees' governance structure to implement restoration under the DWH PDARP is summarized below. More detail can be found in Chapter 7 of the DWH PDARP.

Management Structure

The magnitude and geographic scale of the restoration in the DWH PDARP is far greater than in any other prior undertaking by natural resource trustees. Because of this, and because of the programmatic restoration determinations described in Chapter 5 of the DWH PDARP, the Trustees propose a governance structure to streamline restoration implementation and oversight. The Trustees will continue to function as a Trustee Council with overall responsibility for assuring that restoration is achieved with financial accountability and that obligations set forth in OPA, the Consent Decree, the PDARP, and future restoration plans are met. Trustee Council duties include restoration planning, restoration implementation, monitoring and adaptive management, financial management, public engagement, and restoration tracking. The Trustee Council will also assure that Trustees carry out their duties fully to achieve restoration.

As such, the Trustees have proposed a distributed governance structure that assigns a Trustee Implementation Group (TIG) for each of the 8 restoration areas: the 5 Gulf states, Open Ocean, Regionwide, and Unknown Conditions and Adaptive Management (see Table 2-1). The Trustees believe that restoration can be carried out most efficiently by directly vesting restoration decision-making to those Trustees who have the strongest collective trust interests in natural resources and their services within each restoration area. Because these are shared public trust resources, with overlap in federal and state jurisdiction, both state and federal Trustees serve on the Trustee Council and within respective TIGs. The composition of each TIG varies, depending on the geographic area and restoration types to be performed in each restoration area. All TIGs will have a representative from NOAA, USFWS or both. The general division of responsibilities between the TIGs and the Trustee Council is as follows:

- The TIGs' function will primarily be planning, deciding on, and implementing restoration, including monitoring and adaptive management. Each TIG will make all restoration decisions for the funding allocated to its restoration area on a consensus basis (decision-making described below).
- The Trustee Council's function will primarily be to ensure coordination and efficiency across the TIGs by establishing procedures and practices needed to standardize or provide for consistency of some TIG activities, such as: financial management, public information availability, and other activities identified in the sections below; aggregating information from and disseminating information to the TIGs; facilitating use of existing tracking tools; and facilitating the TIGs' ability to implement the ecosystem-wide restoration goals of the DWH PDARP.

Under this restoration planning structure, the Trustees recognize the need to establish agreements and procedures, such as:

- **Memoranda of Understanding (MOUs) (and/or Memoranda of Agreement [MOAs])**. The Trustees will revise their existing MOU for the Trustee Council that forms the basis of Trustee coordination and cooperation under the DWH PDARP. The Trustee Council MOU will be followed by each TIG and Trustee member. The TIGs, at their discretion, may develop additional MOUs for their respective restoration areas, provided TIG MOUs are consistent and compliant with the Trustee Council MOU.
- **Standard Operating Procedures (SOP).** Consistent with, and in support of, the Trustee Council MOU, the Trustee Council will develop SOP for administration, implementation, and long-term management of restoration under the DWH PDARP. The Trustee Council SOP will document the overall structure, roles, and decision-making responsibilities of the Trustee Council. The Trustee Council SOP will also provide the common procedures to be used by all TIGs. Each TIG may develop additional SOP for their respective restoration areas, provided they are consistent with the Trustee Council SOP. The Trustee

Council SOP will be in place prior to any TIG's withdrawal of funds from the U.S. Department of Interior (DOI) Natural Resources Damage Assessment and Restoration (NRDAR) Fund. The Trustee Council SOP will include, but will not necessarily be limited to, the following topics:

- Trustee Council structure and management (e.g., Lead Administrative Trustee responsibilities)
- Decision-making and delegation of authority
- Funding
- Administrative procedures
- Project reporting
- Conflict resolution
- Monitoring and adaptive management
- Consultation opportunities among the Trustees
- Public participation
- Administrative accounting and independent auditing procedures
- Administrative Record

These SOPs will be developed and approved by consensus of the Trustee Council, or TIGs for TIG-specific SOP, and may be amended as needed.

The division of responsibilities among the Trustee Council, TIGs, and Individual Trustee Agencies is summarized in Table 2-3. The configuration of TIGs is shown below in Figure 2-3. The TIGs develop plans for, choose, and implement specific restoration actions under the DWH PDARP. Each TIG ensures their actions are fully consistent with the DWH PDARP and SOP.

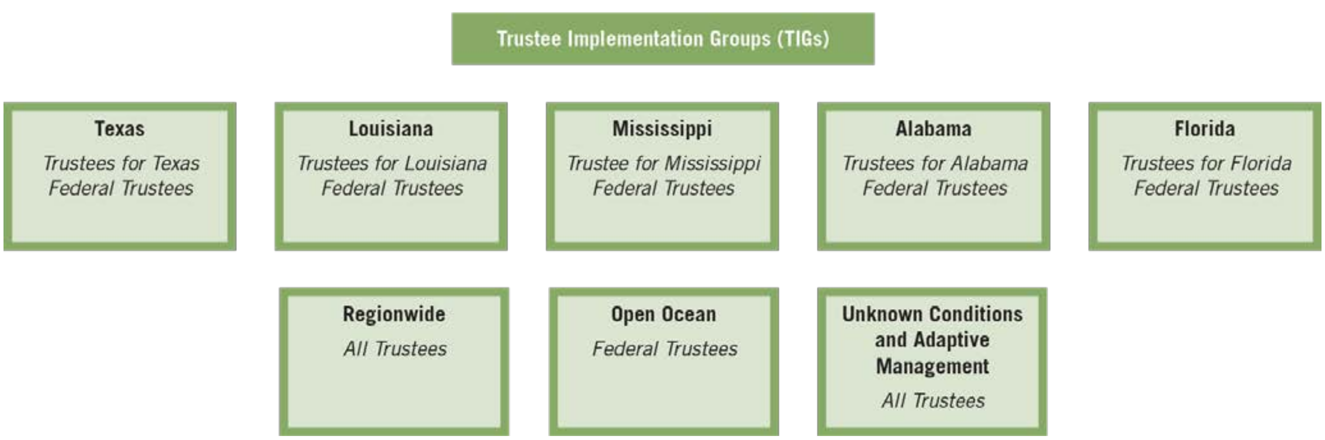

Figure 2-3. Composition of the TIGs

Depending on its needs, each TIG may establish subgroups to support and assist meeting its responsibilities (e.g., financial representatives to advise on issues related to financial administration and/or technical representatives to advise on issues related to restoration program implementation).

Each TIG will develop, select, and implement projects on a consensus basis. For each of the 5 Gulf state TIGs, consensus requires that a proposed action or decision be supported by both the United States (as decided by the federal Trustees as a group) and the state (as decided by the state Trustees as a group). The federal Trustees will develop an MOU setting forth an approach and procedures pursuant to which the federal Trustees speak with a single voice on decisions made within the TIGs for each of the 5 Gulf states; the state Trustees for each state will develop an MOU setting forth an approach and procedures pursuant to which their state Trustees speak with a single voice on decisions made by the 5 TIGs for each of the 5 Gulf states. For the Trustee Implementation Groups for the Regionwide and Adaptive Management and Unknown Conditions restoration areas, consensus requires that a proposed restoration action be supported by all non-abstaining federal Trustees and all non-abstaining Gulf states (as decided for each Gulf state by the state Trustees as a group). For the Open Ocean restoration area, consensus requires that a proposed restoration action be supported by all non-abstaining federal Trustees.

Any issues with respect to an established SOP that arise within a TIG will be resolved in that TIG and, if the TIG does not resolve the matter in a timely manner, a Trustee in that TIG may bring the matter to the full Trustee Council for discussion as provided through dispute resolution. If there is an unresolved dispute about a substantial matter in 1 of the 5 TIGs for the Gulf states, a Trustee in that TIG may seek guidance from the full Trustee Council through a nonbinding, nonvoting executive session discussion.

Restoration Planning

The Trustee Council retains and performs certain restoration planning administrative functions that serve to promote consistency in processes under the DWH PDARP, allow for appropriate aggregation of information across TIGs, and support program-wide reporting to the public.

The Trustee Council will continue using existing project reporting tools that enable tracking restoration planning progress. The Trustee Council will coordinate with the TIGs to aggregate both restoration planning and specific project information for regular public reporting, as determined in Trustee Council SOP. The Trustee Council may re-examine the restoration program approximately every 5 years to track its status towards meeting the established restoration goals, including the Monitoring, Adaptive Management, and Administrative Oversight goal, and to determine any updates needed based on newly emerged science and/or restoration procedures and Trustees’ experience managing and implementing this restoration program.

The Trustee Council and TIGs share responsibility to coordinate with other *Deepwater Horizon* restoration programs. As such, the Trustees will commit to formal coordination with NFWF and RESTORE at least annually and will coordinate with these other programs on specific topics (e.g. monitoring and data management) and specific restoration types, as needed. Coordination among programs will promote successful implementation of the DWH PDARP and optimize ecosystem recovery within the Gulf. The Trustee Council may consider the restoration actions of these other programs and facilitate the TIGs in identifying synergies, leveraging opportunities, and evaluating cumulative effects, as well as reducing potential redundancy when selecting projects under the DWH PDARP. Furthermore, these programs will each produce significant monitoring data that are critical to informing restoration decisions and improving adaptive management. Data sharing among programs is encouraged, and the Trustee Council will make information for projects selected under the DWH PDARP available to the public, as well as to the scientific community and other restoration programs.

Table 2-3. Trustee Council, TIG, and Individual Trustee Agency Responsibilities Matrix

		Trustees' Governance Structure		
		Trustee Council	**TIGs**	**Individual Trustee Agencies**
Responsibilities	**Restoration Planning**	Aggregates status of TIG restoration planning, maintain web portals, makes planning information publicly available, compiles the planning Administrative Record, and coordinates with other *Deepwater Horizon* Restoration Programs (i.e., RESTORE and Gulf Environmental Benefit Fund).	Develop draft and final restoration plans/environmental reviews (environmental assessments and environmental impact statements), coordinate environmental compliance, select projects, provide for public engagement within the restoration area, and maintain materials for the planning Administrative Record.	Prepare project-level conceptual designs, costs, plans, analyses, and environmental compliance documentation.
	Restoration Implementation	Aggregates restoration program status tracking, publicly reports overall DWH PDARP restoration implementation, and compiles the implementation Administrative Record.	Track restoration area project implementation progress and report by restoration type, and maintain materials for the implementation Administrative Record.	Carry out project implementation and contracting (all phases—planning, engineering and design, construction, monitoring, and long-term management); report implementation status to their TIG.

	Trustees' Governance Structure		
	Trustee Council	**TIGs**	**Individual Trustee Agencies**
Monitoring and Adaptive Management	Aggregates restoration program monitoring information and performance, makes information publicly available, compiles Administrative Record, and adaptively manages the overall DWH PDARP restoration program.	Track and aggregate restoration area monitoring data and reporting to the Trustee Council by restoration type, conduct environmental reviews, oversee corrective actions and development of adaptive management plans, and maintain materials for the Administrative Record.	Develop project-specific monitoring plans and conduct project-specific monitoring, data analysis, adaptive management, and reporting.
Financial Management	Aggregates restoration program financial tracking, publicly reports use of funds across the restoration program, and compiles the Administrative Record, as applicable.	Track financial information for the restoration area, provide summarized financial reporting to the Trustee Council, and maintain materials for the Administrative Record.	Conduct project-level financial tracking through project completion, track project receipts and expenditures, and report use of funds to their TIG.

The TIGs will develop project-specific restoration plans for their respective restoration areas consistent with the restoration type funding allocations. Over the full time period of restoration, each TIG ensures all restoration type goals are supported via the series of TIG restoration plans. TIGs identify, develop, and evaluate project alternatives; propose projects in draft restoration plans; engage the public for comment on restoration plans; and select projects in final restoration plans (15 CFR 990.55). Each TIG will develop projects in accordance with the OPA regulations and other applicable requirements, including consistency with the DWH PDARP. General restoration planning procedures are described below. Additionally, during project planning, TIGs will coordinate with other TIGs or individual Trustees for proposed projects that overlap TIG restoration areas. The Open Ocean TIG will coordinate with other TIGs when proposed projects overlap their jurisdictions.

The Council SOP will define the common restoration planning procedures to be followed by each TIG, and the Council SOP will include at least the following:

- Initial public engagement following settlement. The Council website will be updated and maintained to include information on activities underway in each restoration area, to be updated by each TIG as initial restoration planning comes into focus. In addition, while not necessary to describe in the Council SOP, several of the TIGs are proposing initial public listening sessions (e.g., in the Alabama, Mississippi, and Florida restoration areas) to discuss developing the restoration area NRDA vision, including the context with RESTORE and Gulf Environmental Benefit Fund restoration. TIG restoration planning procedures may be further refined and informed by these listening sessions.

- Initial project identification. TIGs develop project ideas and conduct project screening consistent with the restoration type and the restoration approaches described in Chapter 5, Restoring Natural Resources, and its appendices. TIGs will consider a reasonable range of restoration alternatives (15 CFR 990.53[(a])[(2)]) in restoration plans (see below for "Draft Restoration Plan").
- **Public involvement in project identification.** The TIGs will continue to provide opportunity for public input of project ideas and will maintain or update tools to collect project ideas. TIGs consider project ideas from the public and may hold public meetings and will or maintain or update tools to collect project ideas, such as the existing project submission database and other Trustee portals.
- **TIG meetings for public input.** Each TIG will hold at least one annual TIG meeting focused on public dialogue on the progress and future of PDARP/PEIS implementation in that restoration area. If a TIG planning cycle calls for a different frequency than an annual meeting, that TIG will ensure the public is informed via the Trustee Council website. These TIG meetings can be coordinated with other restoration meetings, provided those meetings have a formal role for all TIG Trustees and for all restoration types that are under the purview of the TIG (e.g., in the Louisiana restoration area, the TIG may consider how to coordinate TIG meetings with public meetings of the Coastal Protection and Restoration Authority Board; the TIG for Restoration in Mississippi is considering establishment of an annual restoration conference).
- **Notify the public at initiation of restoration plans.** The Council website will be updated to notify the public when a TIG is initiating restoration planning. For example, the notification would describe, to the extent known, the restoration types and approaches (or projects, if applicable) to be considered, the context for the restoration plan in relation to other Gulf restoration programs, and the intended years of funding to be included in the restoration planning for each restoration type. Where a restoration plan will rely on or incorporate portions of a regional restoration plan, the TIG can use this step as an opportunity to notify the public of projects to be considered from regional restoration plans.
- **Project development**. The identification and development of potential projects will be consistent with the NRDA regulations and this PDARP/PEIS; and with one or more of the restoration type goals described in Section 5, Section 5.5, Alternative A: Comprehensive Integrated Ecosystem Restoration (Preferred Alternative). TIGs may develop additional project selection criteria that further the goals established in this PDARP/PEIS. The TIGs will review cost estimates for each project so that the costs of the project and the consistency with programmatic goals can be considered and compared with other project alternatives. The Trustees may access their respective administrative funding for initial project identification, evaluation of alternatives, and development activities prior to including projects in a draft restoration plan. Funding for continued development of restoration projects (or for strategic frameworks discussed below) for inclusion in a restoration plan can be taken from allocations for the respective TIG

restoration type funds to which that project applies, upon consensus of the Trustees in that TIG, as determined by the decision-making process. Particularly for complex planning efforts, the TIGs will consider whether an interim status update on the Council website is useful to keep the public apprised of the projects and alternatives anticipated to be included in an upcoming draft restoration plan. Each TIG determines when their respective projects are ready to be proposed and released in a draft restoration plan.

- **Payment schedule and frequency of restoration plans**. The frequency of restoration plans may vary by TIG. Each TIG may specify a restoration plan frequency in its specific procedures or may choose a flexible planning schedule that brings forward proposed projects individually or in groups. A series of payments will be distributed to each TIG over the course of 15 years, proportional to the total amount allocated to each restoration area. As such, TIGs have differing amounts of total restoration dollars available annually. Considering its respective payment schedule, each TIG can determine a project planning and funding schedule that most appropriately benefits the restoration types under the TIGs purview. Generally, it is anticipated that each TIG will develop at least 1 restoration plan every 3 years, although this frequency is at the discretion of the TIGs. The restoration plans may include a varying number of specific restoration projects and may be developed jointly with other TIGs.
- **Project phases**. The Trustees may propose to phase restoration projects. For example, a TIG may propose to fund a project's initial engineering and design phase in order to develop the information necessary to fully consider the construction phase of that project in a future restoration plan. TIGs will encourage Individual Trustee Agencies to seek technical assistance from environmental regulatory agencies early in planning.
- **Draft restoration plans.** TIGs prepare draft restoration plans that document and provide sufficiently detailed information on the proposed project(s), or groups of projects, and alternatives to those projects. The draft plans also do the following:
    - Explain the consistency between the proposed plan and the DWH PDARP. For example, draft plans include information on the funding status by restoration type, the project screening process, the restoration type(s) goals to which each project contributes, and how the planning and implementation considerations identified in Section 5, Restoring Natural Resources, and Appendix 5.D, Restoration Approaches and OPA Evaluation were considered during project development.
    - Provide sufficient implementation detail for analysis under OPA, the National Environmental Policy Act (NEPA), and other environmental regulations, as appropriate to the project phase, including draft monitoring plans. TIGs strive to promote consistency in monitoring across similar project types by evaluating monitoring plans against a minimum standard of common performance criteria.
    - Provide context on how the draft plan relates to any longer-term vision of that TIG or strategic framework for particular resources, and describe the context of

the preferred project alternatives to other Gulf restoration programs (particularly RESTORE and Gulf Environment Benefit Fund).

  - Describe the federal environmental compliance required for proposed projects (e.g., Endangered Species Act [ESA] consultations and Clean Water Act permits; see Section 6, Environmental Consequences and Compliance with Other Laws, for more detail), how those requirements will be met, and the compliance status (e.g., initiated or completed) at the release of the draft (and final) restoration plan. State and local environmental compliance coordination may also be identified. Where feasible, the TIGs may initiate compliance coordination early in the planning process to inform restoration decisions. The TIGs will ensure there is no irreversible or irretrievable commitment of resources to a project that has the effect of foreclosing alternative measures to restore and/or protect trust resources. When proposing projects intended to restore ESA-listed species (e.g., sea turtles or sturgeon), the plans will describe consistency with ESA recovery plans and recovery goals for those species, if available, such that conservation programs are supported.

- **Corresponding NEPA analysis.** TIGs will integrate into restoration plans the appropriate level of NEPA analysis tiered from the DWH PDARP. NEPA analyses must clearly state whether they are tiered Environmental Assessments or tiered Environmental Impact Statements. For a tiered NEPA analysis, the Trustees must analyze the affected environment and environmental impacts with a focus on project-specific issues not addressed in the DWH PDARP, and identify how the best practices appended to Chapter 6 of the DWH PDARP were considered in developing projects. Lead and cooperating agencies must also be identified, including any cooperating agencies invited to participate. The details of the NEPA analysis will be commensurate with the project phase under consideration.
- **Public engagement and public comment on draft restoration plans.** TIGs will provide an opportunity for public review and comment on each draft restoration plan/NEPA analysis. Draft restoration plans are released and the public comment period noticed through the Federal Register, as well as by other means or public venues as deemed appropriate by the TIG (e.g., state registers). Generally, the intent of the TIGs is to engage in public dialogue at this planning public meetings held on draft restoration plans.
- **Final restoration plans and corresponding NEPA analyses**. Following the consideration of public comments, the TIGs revise restoration plans and corresponding NEPA analyses, as appropriate. Final restoration plans clearly identify the projects that a TIG selects for implementation after taking into consideration all public comments as well as the final environmental analyses under the NEPA process. Monitoring plans will be complete for final restoration plans and can be updated as appropriate during project implementation. Final restoration plans also identify the best practices applicable to the implementation of each selected project and any outstanding environmental compliance needs or other contingencies that must be resolved prior to project implementation. Final

restoration plans will be made available on the Trustee Council website and in the Administrative Record.

- **Modifications to funding within restoration areas.** Any change to funding that is significant enough to constitute a modification of the DWH PDARP, within its respective restoration area, will be communicated to the Trustee Council. By agreement of the TIG, changes to the amount of funding to be spent on a restoration type within a restoration area may be made after the TIG proposes a revised restoration plan, subject to public review and comment.
    - Changes of less than $50,000 to the amount of funding to be spent on a restoration type within a restoration area are not changes to the restoration plan and would not require public review, comment, or court approval before the change is put into effect; however, public notice of such a change is required.
    - Modifications to shift funding designated for one restoration goal to another restoration goal will be made only with the consensus of the Trustees in the TIGs affected and only with court approval, through a motion to the court with a description for the basis of the change.
- **Strategic restoration planning.** TIGs may prepare strategic frameworks to focus and sequence priorities within a restoration area or to provide additional vision of how to meet restoration type goals set forth in the PDARP. Strategic frameworks can provide context for Gulf-wide prioritization, sequencing, and selection of specific projects within project-specific restoration plans. Strategic frameworks help the Trustees consider resources at the ecosystem level, while implementing restoration at the local level. These frameworks would support the adaptive management framework described in the DWH PDARP (e.g., modification of restoration approaches in Appendix 5.D, Restoration Approaches and OPA Evaluation or update best practices in Appendix 6.A) to provide more protection for listed species and designated critical habitat). Strategic frameworks may be particularly relevant for resource-level planning led by the Regionwide TIG for living coastal and marine resources, sea turtles, marine mammals, birds, and oysters and may also be developed for other Restoration Types allocated to the Regionwide and Open Ocean TIGs. Strategic frameworks may be updated based on new knowledge obtained by Trustee efforts or the broader science community and updates to relevant species recovery or management plans prepared under other statutes. Where applicable, this planning would be coordinated with existing entities charged with managing protected and managed resources, such as ESA technical recovery teams and the appropriate NOAA or USFWS offices. Strategic restoration planning can also create streamlining efficiencies for regulatory compliance, such as ESA consultation.

Individual Trustee Agencies identify candidate restoration projects; develop project details, including costs and alternatives; describe implementation methodologies; evaluate expected resource benefits; and develop project-specific monitoring plans. These project-specific details will be provided to the TIG to support their restoration planning and project decision responsibilities.

Many of the Individual Trustee Agencies have conducted extensive regional restoration planning, and the OPA NRDA regulations allow for consideration of such plans in selecting projects, provided the OPA regulations are followed. The Individual Trustee Agencies can assist the TIG in drawing from these plans provided they are relevant and consistent with implementing the goals of the DWH PDARP.

Restoration Implementation

TIGs will ensure that implementation of projects for each restoration type is in accordance with Trustee Council and TIG MOUs and SOP. TIGs will identify Implementing Trustees for each selected restoration project and follow Trustee Council SOP to ensure that consistent project tracking and reporting approaches are used by Implementing Trustees. When multiple Individual Trustee Agencies are cooperatively implementing projects, or when complex projects are selected, the TIGs may request that project management plans and/or project-specific MOUs be completed by the Implementing Trustee(s). Project management plans may include items such as Trustee coordination, detailed project budgets and schedules, implementation approaches, project phasing (if applicable), risk assessment, and contingency planning. As requested by the TIG, these plans may be reviewed by the TIG and agreed upon prior to the release of project funds. Project-specific MOUs may be used to identify which Individual Trustee Agency is responsible for each project phase, including long-term management and oversight.

Throughout project implementation, TIGs review project information and monitoring data provided by the Implementing Trustee(s) to consider whether the project is performing as planned. In the event that project modifications are identified during implementation, TIGs must coordinate with Implementing Trustees to determine if those changes warrant any revised restoration planning or environmental evaluation and identify if a project needs to be terminated. Further, TIGs will develop procedures to select another project in the event of project termination. TIGs may also review corrective actions proposed by the Implementing Trustee(s) to promote consistency in actions applied to restoration approaches. TIG coordination across projects may be funded with administrative oversight and comprehensive planning funds allocated to each respective TIG.

TIGs summarize progress toward completing the engineering and design, construction, monitoring and adaptive management, and long-term maintenance project phases and provide this information to the Trustee Council in accordance with the Trustee Council SOP.

Project implementation is accomplished by Individual Trustee Agencies that are identified by each TIG as the Implementing Trustee or Trustees. Project-specific administration and oversight costs for project management will be included in project implementation budgets. Project implementation is generally completed and reported in the following phases, when applicable:

- **Engineering and design.** Engineering and design may be completed by the Implementing Trustee, when appropriate, or through the use of contractors. Where signed and sealed engineer or survey documentation is required, the Implementing Trustee(s) will ensure that the engineer or surveyor signing work products is licensed to practice in the state where the project is being implemented. Designs will not be finalized until the Implementing Trustee determines that the design is in compliance with all regulatory requirements (e.g., federal, state, and local permitting requirements) and consultations (e.g., ESA-listed and other protected species). On request, the Implementing Trustee(s) will furnish engineering and design materials to the TIG. When the engineering and design phase is complete, the Implementing Trustee(s) will notify the TIG that the project is moving into the construction phase.
- **Construction.** During construction, Implementing Trustees monitor construction activities as required by regulatory permits and consultations to avoid environmental impacts to habitats and species. When the construction phase is complete, the Implementing Trustee(s) notifies the TIG that the project is moving into the monitoring phase, reports on the outcomes of construction, and provides as-built materials, as requested by the TIG.
- **Monitoring**. Project-specific monitoring and associated adaptive management/corrective actions will be conducted by the Implementing Trustee(s), before, during and/or after construction and/or implementation. Monitoring will use project funds and be conducted in accordance with final project monitoring plans. Project monitoring will be conducted using methodologies established in the monitoring and adaptive management SOP developed by the Trustee Council. Monitoring data will be used by the Implementing Trustee(s) to track whether projects are trending towards the project's established performance criteria or whether adaptive management, maintenance, or corrective actions are needed. If these corrective actions require additional or modified environmental reviews, the Implementing Trustee(s) will notify the TIG, and a determination will be made on whether any public notification is required by law.
- **Long-term maintenance.** The Implementing Trustee(s) will ensure that appropriate long-term maintenance activities likely to be required for each project are identified and that appropriate budgets and agreements are established to maintain each project over its intended life span. Upon discretion of the Implementing Trustee(s), third-parties may be identified as long-term stewards of completed projects, and project funds may be allocated for their involvement.
- **Project modifications.** If a project modification is necessary during the engineering and design or construction phases of the project, the Implementing Trustee(s) will inform the TIG, document whether the project modification materially affects the project's selection, and determine, in coordination with the TIG, whether any updates to regulatory permits and/or consultations may be required. If changes to environmental compliance require additional public input, the TIG will give the public a reasonable opportunity to review

and comment on the proposed project change prior to final approval of the modification by the TIG.

- **Project termination.** If a project must be terminated during the engineering and design or construction phases, the remaining funds that would have been spent on that project will remain dedicated to the same restoration type and returned to the NRDAR TIG subaccount. Use of remaining funds for another project will require additional restoration planning.
- **Project completion/closeout.** A project is complete after all activities and expenditures have been accomplished for that project per the final restoration plan, including monitoring, long-term maintenance, and final reports. The Implementing Trustee(s) will notify the TIG when a project is complete and identify whether any project funds remain (excess funds[2]). Excess funds will be returned to the TIG's NRDAR subaccount and will remain dedicated to the same restoration type as that associated with the project that returned excess funds. A TIG must agree by consensus to apply excess funds to another project(s) in accordance with the project selection criteria.

Monitoring and Adaptive Management

The Trustee Council promotes consistency in monitoring and adaptive management activities across TIGs and restoration types through development of SOP. It also aggregates monitoring information across TIGs to track restoration progress of each restoration area. The Trustee Council will designate support staff to participate on a cross-TIG Monitoring and Adaptive Management working group to manage the Trustee Council's monitoring and adaptive management responsibilities. This working group may also be supported by a designated science coordinator. Trustee Council monitoring and adaptive management responsibilities include activities such as:

- **Develop and maintain a monitoring and adaptive management SOP**. Monitoring and adaptive management SOP will be a component of the Trustee Council SOP and will ensure monitoring data can be accessed and evaluated to track resource-level restoration progress. Consistent monitoring plans and data management procedures facilitate consistency in data collection and reporting, data aggregation for restoration types, reporting to the public, coordination with other restoration partners, and use of data by the scientific community.
- **Summarize and communicate monitoring information.** The Trustee Council aggregates both monitoring information and results of analyses provided by each TIG and communicates their collective progress towards meeting the programmatic and restoration type goals (see Chapter 5, Restoring Natural Resources) to the public.
- **Provide data management infrastructure.** The Trustee Council, working with the TIGs and Individual Trustee Agencies, supports the provision and/or development and

[2] Early Restoration excess funds are discussed below.

maintenance of data infrastructure (e.g., the DIVER Restoration Management Portal) for monitoring and adaptive management. This portal includes a central repository for aggregation of monitoring information.

- **Coordinate with other science and monitoring programs in the Gulf of Mexico**. The Trustee Council will coordinate with the RESTORE Council and National Fish and Wildlife Foundation Gulf Environmental Benefit Fund on the development of monitoring and data protocols. The Trustee Council will also identify and coordinate with other programs, as appropriate. Coordination on monitoring and adaptive management will include but is not limited to participation in the annual meeting between the 3 funding programs.
- **Detect emerging unknown conditions.** The Trustee Council identifies, with input from the TIGs, irregularities in restoration data and/or information from other restoration and science programs that may signal the existence of emerging unknown conditions that may need to be considered in future restoration decision-making. Decisions on utilizing funds under the Unknown Conditions TIG will be informed by monitoring data gathered across TIGs and by review of any available scientific and supporting information that documents unforeseen conditions. Specific procedures will be developed in the future to guide Trustees' decisions on use of the Unknown Conditions allocation, and will then be made part of the Trustee Council SOP. Unknown Conditions funds would not be accessed until such time as those procedures are developed.
- **Perform program review**. Trustee Council support staff may direct peer review, by restoration and/or academic professionals, of any monitoring, analysis, and/or other products developed by the Trustees and guide the subsequent flow of this information to and from the TIGs and Individual Trustee Agencies.

The Trustees identify specific funding for the monitoring and adaptive management component of the restoration goals. Monitoring and adaptive management supports all restoration activities under the DWH PDARP by tracking and evaluating restoration progress toward goals, determining the need for corrective actions, addressing key uncertainties, and ensuring compliance with appropriate regulations. Through monitoring and adaptive management, decisions are continuously informed by evolving restoration data and information. The adaptive management process incorporates monitoring of restoration progress, consideration of uncertainties, and opportunities for Trustees to adapt restoration activities to ensure restoration success (Pastorok et al. 1997; Thom et al. 2005; Williams 2011; Williams et al. 2007).

The Trustees recognize that the best available science to use for planning restoration activities evolves as the body of science originating from this program, as well as other science, monitoring, and restoration programs in the Gulf of Mexico, continues to grow. As a result, the adaptive management process for this restoration plan incorporates monitoring and other targeted scientific support (e.g., modeling and analysis of existing data and engagement of external scientific expertise) to address uncertainties and inform corrective actions.

- The TIGs provide several project- and resource-level monitoring and adaptive management functions, including monitoring data aggregation and tracking progress toward restoration objectives and goals. TIGs coordinate with Implementing Trustees to support consistency and compatibility of monitoring plans and data management, in accordance with the Trustee Council SOP (and respective TIG SOP, if applicable) and aggregate Implementing Trustee's monitoring data by restoration type for reporting to the Trustee Council. According to the OPA NRDA regulations (15 CFR § 990.55), a project-specific monitoring plan includes "a description of monitoring for documenting restoration effectiveness, including performance criteria that will be used to determine the success of restoration or need for interim corrective action." The Trustees are committed to this required level of project monitoring and may choose to conduct additional monitoring. TIG responsibilities will include the following:
    - **Review and provide feedback for monitoring and adaptive management plans and efforts.** TIGs review project monitoring and adaptive management plans for content, for compliance with regulatory requirements, and to determine their readiness for inclusion in restoration plans.
    - **Coordinate data management and reporting.** TIGs track project monitoring data to ensure that data, monitoring reports, and other monitoring information are consistent and compatible with the SOP and are linked to a central repository. They then report this monitoring information to the Trustee Council.
    - **Assist in identifying and developing corrective actions.** TIGs will coordinate and support the identification and development of corrective actions, particularly for projects with similar restoration objectives.

TIGs will coordinate with each other and with individual Trustees to identify resource level monitoring priorities. This coordination support consistency among restoration efforts, as well as with the Trustee Council SOP and TIG SOP. It will also promote efficiency of resource-level and/or cross-resource-level monitoring and adaptive management activities, as appropriate. Resource-level (i.e., for a restoration type) and/or cross-resource-level (i.e., applicable to multiple restoration types) monitoring and adaptive management includes tracking and enabling aggregation and evaluation of restoration progress, addressing key uncertainties about a resource and its responsiveness to restoration actions, and performing strategic planning for restoration of injured resources. Resource- and cross-resource-level adaptive management will be supported by targeted monitoring and scientific support, as appropriate. TIG responsibilities include the following:

- **Evaluate and aggregate progress of multiple projects.** TIGs evaluate and aggregate monitoring data from projects with similar objectives, as appropriate, to document progress toward meeting restoration type and Programmatic Goals (see Chapter 5, Restoring Natural Resources, for more details).

- **Identify needs and set priorities for targeted resource-level monitoring and scientific support.** TIGs identify the need and priorities to most efficiently conduct resource-level and/or cross-resource-level monitoring and scientific support. TIGs define the objectives and scope for resource-level and/or cross-resource-level monitoring and scientific support, identify the Implementing Trustee(s), authorize funding, and include monitoring and scientific support activities in restoration plans.
- **Consider strategic planning to guide restoration of injured resources.** Particularly within the Regionwide TIG, but not exclusively, TIGs may develop strategic plans to guide monitoring and adaptive management for an injured resource. TIGs may share monitoring data aggregation and analysis responsibilities with each other, especially when restoration types overlap geographic areas, to help assess the combined effects of restoration projects and to improve the efficiency and overall effectiveness of restoration evaluation.

Individual Trustee Agencies write monitoring and adaptive management plans and conduct monitoring activities, including project-specific maintenance, adaptive management, and corrective actions, consistent with the Trustee Council SOP and TIG SOPs. When designated as Implementing Trustees, Individual Trustee Agencies' project-level responsibilities include the following:

- **Write monitoring and adaptive management plans.** Implementing Trustees develop monitoring plans for inclusion in restoration plans for all selected projects. Monitoring and adaptive management plans include measurable objectives with associated performance standards to track progress toward restoration goals, methodologies and parameters for data collection, identification of key uncertainties, tracking of compliance with appropriate regulations, and potential corrective actions and adaptive management protocols.
- **Conduct (or contract) project-level monitoring and evaluation.** Implementing Trustees conduct project-specific monitoring (including data collection, data analysis, and synthesis), compare progress against project-specific performance standards, evaluate each project's performance toward restoration objectives, and identify the need for and propose corrective actions to the TIGs. Individual Trustee Agencies enter or upload project-specific monitoring information, including objectives, performance standards, and collected data into the central repository.

Resource-level monitoring and adaptive management responsibilities of Individual Trustee Agencies at the direction of the TIGs may include the following:

- **Identify and recommend resource-level monitoring needs.** Individual Trustee Agencies may identify and propose resource-level and/or cross-resource-level monitoring activities to the TIGs.
- **Conduct resource-level monitoring and scientific support**. Individual Trustee Agencies, when designated by the TIGs, conduct resource-level and/or cross-resource-level monitoring and scientific support activities (as defined in Appendix 5.E, Monitoring and Adaptive Management Framework) and link data, analyses, reports, and other scientific products to the central repository.

Financial Management

The Trustee Council will establish financial SOP as a component of the Trustee Council SOP, as well as other processes to guide financial documentation, tracking, and reporting of the Trustee Council, each TIG, and each Individual Trustee Agency. In doing so, the Trustee Council will promote public transparency in the expenditure of funds and consistency in financial reporting. All funds received and expended, including interest on received funds, will be subject to the financial SOP. The Trustee Council will coordinate with the TIGs to aggregate the financial status of the restoration program and report that status to the public on a regular basis.

TIGs review Individual Trustee Agency accounting policies and procedures for holding and tracking disbursed funds, review actual expenditures disbursed for restoration activities, and report to the Trustee Council on the use of funds throughout the TIG.

In selecting and implementing projects and using administrative and oversight funds, each TIG will conform, at a minimum, to the SOP set by the Trustee Council, and each TIG will establish a system for managing all funds deposited in its specific DOI NRDAR Fund subaccount. A general framework to develop an administrative accounting process will include the following:

- **Distribution of funds**. NRD monies will be deposited into the DOI NRDAR Fund. Subaccounts for each TIG will be established to fund the work in that restoration area and further subaccounts may be established by each TIG, as appropriate and in coordination with DOI. Disbursements from these subaccounts will be made by DOI on receipt of written request, in the form of formal resolution, from the TIG. The process for requesting funding from the DOI NRDAR Fund will be contained in the Trustee Council SOP.
- **Use of funds**. Funds will be used for restoration activities that are consistent with the DWH PDARP, Trustee Council SOP, and TIG SOP, when applicable. Funds can be used for direct project implementation costs and indirect costs to support TIG activities related to project planning and implementation, including monitoring/adaptive management and administrative oversight.
- **Administrative accounting process**. At a minimum, annual financial reports will be generated by each TIG. The reports will track all funds disbursed to and expended by the TIGs according to restoration types and will include all project and administrative

disbursements, interest earned, expenditures, and account balances. The reports will be submitted to the Trustee Council and made publicly available. The annual reporting period will be set according to the Trustee Council fiscal year (January-December). These annual reports will be compiled by each TIG and be self-certified (formal audits are discussed below).

- **Regular audits.** Financial audits will be conducted on a regular basis (e.g., at least every 2-3 years) to ensure public trust and accountability regarding the use of *Deepwater Horizon* NRDA funds. The Trustee Council SOP will specify the minimum internal controls and documentation measures required. Financial audits will be conducted by an independent financial auditor following the most recent Generally Accepted Government Auditing Standards available during the fiscal year in which the audit is conducted. All final financial audit reports will be provided to the Trustee Council.
- **Use of interest earned on restoration funds**. Interest earned on TIG NRDAR subaccounts may be used at the discretion of the TIGs for restoration within the jurisdiction of each TIG, including for TIG planning, operation, and administration, or for any other responsibilities described in Trustee Council and/or TIG SOP. Any use of such funds for projects requires restoration planning.

Individual Trustee agencies, acting as Implementing Trustees, are responsible for tracking project-level receipts and expenditures throughout project implementation, including long-term maintenance, until project completion/closeout. Individual Trustee agencies execute contracts to complete projects, enter into cooperative agreements (or other appropriate partnership arrangements) with local governments and other third parties, and ensure that project funds are expended by contractors and partners on appropriate project-related expenses. All contracting and/or partnering procedures that obligate TIG funds will be executed in accordance with applicable federal and/or state acquisition regulations where project implementation occurs, including internationally, when applicable.

Public Engagement

As stewards of public trust resources under OPA, the Trustees engage and inform the public and maintain an open and documented process for implementing restoration under the DWH PDARP. To effectively act on behalf of the public, the Trustees maintain transparency by establishing public engagement and reporting policies.

Opportunities for public engagement will be provided throughout the implementation of this restoration program. Public meetings will be held to provide information to, and to receive comment from, the public on restoration activities. The Trustees will publicly notice meetings at certain program milestones and encourage public participation as part of effective restoration planning and implementation, exchange restoration ideas or concerns, cultivate a broad understanding of restoration, and increase the public's awareness of the process. The Trustee Council will hold at least one meeting per year in which each TIG will provide an update on the status of its restoration planning, implementation, and monitoring/adaptive management, and where there will be opportunity for public input. Each TIG will hold at least one public meeting per year to discuss the status of its restoration planning, upcoming restoration planning (including the restoration type[s] that TIG will focus on for a specified timeframe), and where there will be an opportunity for public input. These meetings are in addition to the opportunity for public review and comment that is inherent through the requirements of OPA for every draft Restoration Plan.

Further, Trustees recognize the value that local communities, NGOs, citizen groups, etc. can provide when developing restoration projects and will, on a project-by-project basis, determine when focus groups with specific communities would be helpful to develop and/or refine project ideas prior to drafting a restoration plan.

In addition to public meetings, the Trustee Council will maintain its current public website containing information on restoration activities. The website will be updated to provide public access to restoration information and updates from the Trustee Council, TIGs, and Individual Trustee Agencies in a central location. Information also may be available on individual Trustee's websites. Information posted on the Trustee Council's website will include, but will not be limited to, the following:

- Draft and final restoration plans
- Project and resource monitoring information
- Informational fact sheets
- Project details, status reports, and other activity tracking information
- Restoration progress updates and reports
- A library of supporting documents
- Notices and information regarding upcoming outreach/public participation activities
- Trustee contact information
- Links to TIG and individual Trustee websites
- Link(s) to the Administrative Record(s)

Notices for public meetings, opportunities for public review of restoration plans, and other public participation events are provided in the Federal Register, when required, and by the Trustee Council's website.

Administrative Record

As provided in 15 CFR § 990.45 and § 990.61, Trustees will maintain the Administrative Record(s) for restoration planning and restoration implementation. Each TIG will develop and maintain Administrative Record material for its restoration area. The Trustee Council will establish Administrative Record consistency and aggregate the Administrative Record collected and maintained by the TIGs in a central location (e.g., via a web portal). The Administrative

Record for restoration planning generally includes (1) draft and final restoration plans, notices, public comments, and signed NEPA and environmental compliance documentation; (2) relevant information used to form the basis for Trustee decisions related to restoration; and (3) agreements, not otherwise privileged, among the participating Trustees, Trustee Council, and TIG, including resolutions and implementation decision documents. The Administrative Record for restoration implementation generally includes all restoration implementation decisions, actions, and expenditures, including any modifications made to the final restoration plan. The Administrative Record for the DWH PDARP can be found at http://www.doi.gov/ deepwaterhorizon/adminrecord/index.cfm.

Restoration Tracking and Reporting

The Trustee Council will share with the public regular reports of project progress, performance, and financial accounting of their actions. The basic reporting requirements for each TIG will be further defined within the Trustee Council SOPs, including procedures for reporting project status, financial information, environmental compliance, and project monitoring activities. Additional metrics and SOPs applicable to reporting requirements may be developed by the TIGs.

Given the complexity and volume of projects likely to be implemented under this PDARP/PEIS, the Trustee Council will use and adapt its existing central reporting platform, the DIVER Restoration Management Portal, to facilitate consistent and efficient aggregation of information and project reporting across the TIGs. This existing portal enables a cost-effective approach for the Trustee Council to provide aggregate restoration reporting to the public, because it supports consistent information collection and is designed to connect to a public web interface that publishes submitted data. This functionality reduces the administrative and financial burden of manually generating reports and converting them into publicly accessible and easily transferable information. The Restoration Management Portal is part of the broader DIVER platform, which is a data warehouse and query application that integrates datasets across data holdings. The DIVER platform also provides for ease in sharing project, financial, and scientific information with the other *Deepwater Horizon* restoration programs and other restoration partners. The DIVER Restoration Management Portal offers data management options for each Trustee; additionally, the Trustees may maintain records on other platforms.

The DIVER Restoration Management Portal facilitates consistent project progress reporting, as well as financial information, which is necessary for the Trustee Council to compile aggregate reports. These aggregate reports are essential both for reflecting the collective project outcomes of the full body of restoration work conducted by the Trustees to the public and for informing adaptive management of this program. Further, aggregate financial reports track the collective disbursements and expenditures of the TIGs and provide financial information material for conducting the independent financial audits. The DIVER Restoration Management Portal includes the following:

- Project idea submissions

- Administrative and financial disbursements and expenditures
- Restoration project tracking information
- Document and data storage
- Environmental compliance tracking information
- Adaptive management and monitoring data

2.2 Action Area

NMFS has determined that the appropriate action area for this programmatic framework Opinion is the United States Exclusive Economic Zone (EEZ) in the Gulf of Mexico and the adjacent marine, estuarine, and tidal state waters of the Gulf area (i.e., from the Texas-Mexico border to the Florida Keys at the Gulf-South Atlantic Fishery Management Council boundary; see Figure 2-4). All of the restoration techniques that are described in the DWH PDARP and have the potential to affect ESA-listed species or designated critical habitat under NMFS jurisdiction, are associated with coastal habitat restoration, fisheries practices, and wildlife rescue efforts that will occur and will have effects within the U.S. EEZ in the Gulf of Mexico and adjacent marine, estuarine, and riverine habitats.

While the DWH PDARP states that there is a possibility that some program activities may occur outside of the Gulf of Mexico, the program description does not provide any information on the types, extent or locations of potential activities that could occur outside of the Gulf of Mexico. If, in the future, the Trustees develop more detailed proposals to implement activities that may affect ESA-listed species under NMFS jurisdiction outside of the Gulf of Mexico EEZ, those activities would require individual ESA consultation and would not tier from this programmatic framework Opinion. Although unlikely, it is possible that such activities outside of the Gulf of Mexico EEZ could result in program-related effects that are not considered in this Opinion and may trigger the requirement to reinitiate formal consultation on the DWH PDARP.

Figure 2-4. The Gulf of Mexico action area for this Opinion. The boundary lines on this map follow the United States Exclusive Economic Zone (33 USC 2.30) and the Fishery Management Council boundary (50 CFR 600.105(c)). (Image source: NNMFS Southeast Region PRD)

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3. Approach to the Consultation

3.1 General Analytical Approach

Framework Programmatic Consultation
Section 7(a)(2) of the ESA requires federal agencies, in consultation and with the assistance of NMFS and the USFWS (Services), to insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of endangered species or threatened species, or result in destruction or adverse modification of critical habitat that has been designated for these species (16 U.S.C. 1536). The Section 7 regulatory definition of federal action includes federal agency programs (*see* 50 CFR 402.02). Such programs may include a collection of activities of a similar nature, a group of different actions proposed within a specified geographic area, or an action adopting a framework for the development of future actions.

As described in Section 2.0, Proposed Action, the DWH PDARP does not include specific projects at specific sites, rather, it is a framework for a comprehensive programmatic restoration plan that will guide the development of subsequent restoration plans and project-level actions. Thus, the DWH PDARP is a framework programmatic action as defined in 50 C.F.R. 402.02. Therefore, this Opinion does not include an incidental take statement (ITS), consistent with 50 C.F.R. 402.14(i)(6). Any incidental take resulting from any action subsequently authorized, funded, or carried out under the program will be addressed in subsequent Section 7 consultations, as appropriate.

NMFS and USFWS Shared Jurisdiction
Generally, NMFS has responsibilities under the ESA for marine and anadromous species, including whales, corals, and marine fish. The USFWS and NMFS share Federal jurisdiction for sea turtles and Gulf sturgeon under the ESA. The USFWS has responsibility for sea turtles on nesting beaches including nesting sea turtles, nests and eggs, and hatchlings as they emerge from the nest and crawl to the sea. NMFS has jurisdiction for sea turtles in the marine environment when they are foraging, rearing and migrating in the ocean. For Gulf sturgeon, the USFWS has consultation responsibility in fresh water and NMFS has consultation responsibility over Gulf sturgeon in estuarine and marine waters. This Opinion will analyze effects to sturgeon in estuarine and marine waters and to sea turtles in the marine environment.

Not Likely to Adversely Affect Determinations
Some of the species in the species list NOAA RC provided in its October 9, 2015 request for initiation of consultation are not likely to be adversely affected (NLAA) by the DWH PDARP. We identify those species and provide the analysis supporting the NLAA determinations in Section 4.1, Status of Species. For these species, we determined that all of the effects of the PDARP are expected to be either discountable, insignificant or completely beneficial. Those NLAA determinations conclude our analyses for those species. However, if a project causes effects to these species in a way not anticipated in this Opinion, or in a way that might result in

adverse effects, the Trustees would need to conduct an individual Section 7 consultation to evaluate the effects of that project, and to determine whether reinitiation of consultation on the DWH PDARP is triggered.

Approach for Species and Critical Habitat Likely to be Adversely Affected

For the species and critical habitat that the DWH PDARP is likely to adversely affect, this Opinion includes both a jeopardy analysis and an adverse modification of critical habitat analysis. The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of a listed species," which is "to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species. The adverse modification analysis considers the impacts of the federal action on the conservation value of designated critical habitat. This Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the analysis with respect to critical habitat.[3]

We use the following approach to determine whether this proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Identify the range-wide status of the species and critical habitat likely to be adversely affected by the proposed action (Section 4 of this Opinion).
- Describe the environmental baseline in the action area. The "environmental baseline" includes the past and present impacts of all federal, state, 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 which are concurrent with the consultation in process (50 CFR 402.02) (Section 5 of this Opinion).
- Analyze the effects of the proposed action. "Effects of the action" means the direct and indirect effects of the action on affected species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur. For this framework programmatic Opinion, we first provide risk analyses that assess the probable consequences of exposing listed resources to the physical, chemical, and biotic stressors that are known to be associated with the types of projects the program would authorize, fund, or carry out (Section 6 of this Opinion). Then, we analyze the

[3] Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS (Application of the "Destruction or Adverse Modification" Standard Under Section 7(a)(2) of the Endangered Species Act) (November 7, 2005).

program's decision-making processes to determine if they will enable the Trustees to eliminate, avoid, or reduce risks the program poses and ensure that actions that they authorize are not, individually or collectively, likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat that has been designated for those species (Section 7 of this Opinion).

- Describe the pathways for subsequent ESA Section 7(a)(2) consultations on project-level actions that are tiered from the DWH PDARP (Section 8 of this Opinion).
- Describe any cumulative effects in the action area. Cumulative effects are those effects of future state or private activities, not involving federal activities that are reasonably certain to occur within the action area of the federal action subject to consultation (Section 9 of this Opinion).
- Integrate and synthesize the above factors to assess the risk that the proposed action poses to listed species and their designated critical habitats. Specifically, we add our analysis of the effects of the program to the environmental baseline and cumulative effects, taking into account the status of the species and their designated critical habitats. Based on this integrated evaluation, we formulate our opinion as to whether the proposed action is likely to (1) appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species (Section 10 of this Opinion).
- Reach jeopardy and adverse modification of critical habitat conclusions (Section 11 of this Opinion).
- Confirm that this consultation does not authorize any incidental take associated with implementation of the DWH PDARP (Section 12 of this Opinion).
- Provide conservation recommendations that provide additional discretionary measures for furthering species conservation as part of implementing the DWH PDARP (Section 13 of this Opinion).

3.2 Analyzing Effects of This Programmatic Action

The DWH PDARP directs and confines the future development and evaluation of restoration projects such that specific project proposals are required to fully align with the parameters (i.e., restoration type, restoration approach, scale, and geography) established in the DWH PDARP. As described in the Proposed Action, (Section 2 of this Opinion), the DWH PDARP analyses follow a two-tiered approach with analyses completed at both the program-level and subsequent project level. This Opinion analyzes the program-level effects of the DWH PDARP. Subsequent project-level[4] analyses will tier from analyses in this programmatic consultation, thus eliminating or reducing duplication at the project level. This should create efficiencies that enable future project-level Section 7 consultations to focus on specific issues, rather than broad programmatic issues (Figure 3-1).

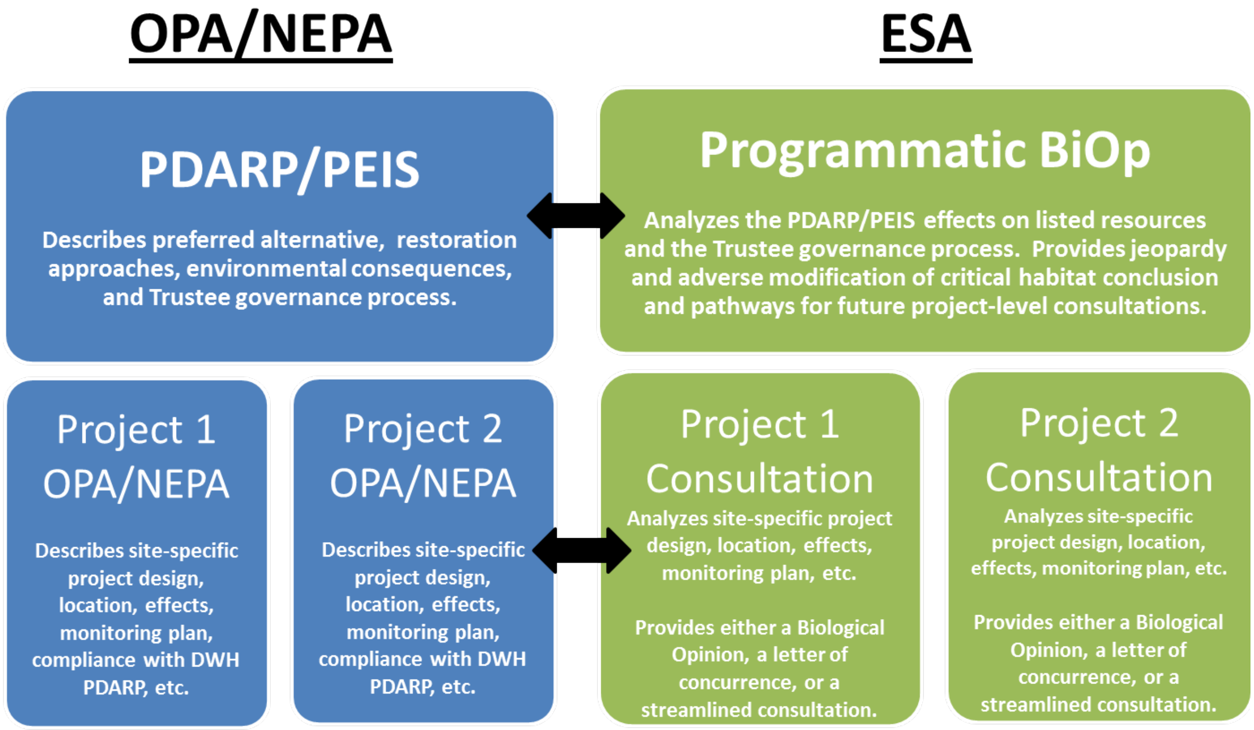

Figure 3-1. Equivalent OPA/NEPA and ESA documents for the DWH PDARP and ESA consultation. This figure shows how the program level DWH PDARP lines up with the ESA Programmatic Opinion on that program and the subsequent project-level requirements under each regulation.

3.2.1 Approach to Risk Analyses for Listed Resources

Species Risk Analyses for the Program-Level Consultation

Our risk analyses evaluates the potential consequences of exposing listed resources to the physical, chemical, and biotic stressors that are known to be associated with the types of actions the program would authorize, fund, or carry out. The types of actions the DWH PDARP would authorize are generally described in the Proposed Action, Section 2 of this Opinion.

Our consideration of how an action affects risks to listed species reflects ecological relationships between listed species, the populations that comprise them, and the individuals that comprise those populations. The continued existence of species is determined by the fate of the

[4] The DWH PDARP provides the 2 tiers of program-level and project-level processes. The PDARP also states that projects can be either individual projects of groups of projects. Thus, future project-level consultations may be programmatic in nature (i.e., on groups of multiple projects) or they may be on individual projects.

populations that comprise them and the continued existence of a population is determined by the fate of the individuals that comprise them. Populations grow or decline as the individuals that comprise them live, die, grow, mature, migrate, and reproduce, or fail to do so.

In typical project-level consultations, when we assess whether or to what degree an action is likely to create, avoid, or eliminate risks to individual members of listed species, we think in terms of the individual's fitness, i.e., its survival and current or expected future reproductive success. Specifically, we examine the scientific and commercial data available to determine if an individual's probable response to an action authorized by the program would reasonably be expected to increase the individual's likelihood of dying prematurely or otherwise reduce its reproductive success. If such responses by individuals are anticipated, the next question is whether those reductions are sufficient to reduce the abundance, reproduction rates, and growth rates of the populations those individuals represent. If these characteristics of population viability are reduced, then the action has fulfilled a condition for reductions in viability of the population(s). If a population (or affected populations) has reduced viability, there must be an analysis of whether that reduction results in reductions in viability of the species. For those species for which populations have not been identified through ESA listing regulations, the analysis must evaluate whether the reductions in individual fitness result in effects to the listed species.

For this framework programmatic consultation, the species risk analysis evaluates the potential response of individuals that could be exposed to the effects of potential future projects authorized by the DWH PDARP. The DWH PDARP does not provide detail about the specific location, magnitude, duration and techniques associated with future specific restoration projects. Thus, analyses of whether effects of specific projects or groups of projects on individuals are sufficient to reduce the viability of populations and species that those individuals represent will need to occur through project-level consultations. For this framework programmatic consultation, we evaluate whether the Trustees' decision-making processes are reasonably certain to ensure that the Trustees will not implement actions that are likely to reduce, the reproduction, numbers, or distribution of the affected species to such an extent to reduce appreciably the likelihood of survival and recovery in the wild.

Critical Habitat Risk Analyses at the Program Level

When determining the potential impacts to critical habitat for this framework programmatic Opinion, NMFS does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat (50 CFR 402.02). Instead, we have relied upon the statutory provisions of the ESA.

Ultimately, we seek to determine if, with the implementation of the proposed action, critical habitat would remain functional (or retain the current ability for the essential features to become functional) to serve the intended conservation role for the listed species affected by the DWH PDARP. This analysis takes into account the geographic and temporal scope of the DWH PDARP, recognizing that "functionality" of critical habitat necessarily means that it must now and must continue in the future to support the conservation of the species and its progress toward recovery.

As with the species risk analyses, the critical habitat analyses for this framework programmatic consultation evaluates the potential impacts of future actions to designated critical habitat. Analyses of whether effects of specific projects or groups of projects on critical habitat are sufficient to result in destruction or adverse modification of critical habitat will occur through project-level consultations. For this framework programmatic consultation, we evaluate whether the Trustees' governance system and decision-making processes are reasonably certain to ensure that the Trustees will not implement actions that are likely to reduce the functionality of critical habitat, impairing its ability to support the conservation of listed species and its progress toward recovery.

Risk Analyses for Subsequent Project-level Consultations

Risk analyses for subsequent project-level consultations projects or groups of projects will tier from the risk analyses in this programmatic Opinion. Projects that are likely to adversely affect listed resources will require additional risk analyses following the analysis steps described above. In addition, we will specifically evaluate whether incidental take is reasonably certain to occur and if so, the amount and extent of take. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect or to attempt to engage in such conduct. "Harm" is further defined by regulation to 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 (50 CFR 222.102). If incidental take is reasonably certain to occur, we will provide reasonable and prudent measures that are necessary and appropriate to minimize the impact of the incidental take and terms and conditions for implementing the reasonable and prudent measures. For subsequent project-level critical habitat analyses, we will use the analysis provided by this programmatic consultation and scale our project-level analysis to the affected critical habitat within the specific action area.

It is possible that during project-level formal consultation, we could determine that the adverse effects of a project, alone or in combination with other projects, are likely to jeopardize the continued existence of listed species or result in the adverse modification of critical habitat. In those cases, we would work with the Trustee action agency to develop reasonable and prudent alternatives, which are alternative actions identified during formal consultation that would avoid the likelihood of jeopardizing the continued existence of listed species or result in the adverse modification of critical habitat. In this case, we would conduct further risk analyses on those alternative actions to ensure that they meet Section 7(a)(2) standards.

3.2.2 Approach to Analysis of the Decision-making Processes

Program-level Analysis of Decision-making Processes

For this programmatic consultation, we evaluate the DWH PDARP decision-making processes that are part of its governance system to ensure that the Trustees' decisions to authorize, fund, or carry out specific actions are likely to fulfill the obligations under ESA Section 7(a)(2). The

DWH PDARP establishes requirements that the Trustees will use to guide the development and implementation of specific actions. Projects will be screened for consistency with the restoration types and goals and will be consistent with the OPA and NRDA regulations, which require the Trustees to prepare restoration plans of single or multiple projects. Restoration plans document and provide detailed information on proposed projects, and alternatives to those projects, and provide for public notice and comment during restoration plan development. Implementation is through a distributed governance structure, including a Trustee Council and Trustee Implementation Groups (TIGs), as described in the Proposed Action, Section 2 of this Opinion.

Our analysis of the DWH PDARP's decision-making processes will address the following issues:

1. What standards apply to the process of approving or rejecting project-level actions?

   1-1 Does the DWH PDARP provide sufficient standards to ensure that specific actions, alone or in combination with other specific actions, are not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of their critical habitats?

   1-2 Do Federal Trustees have sufficient authorities to adjust or amend actions in consultation with NMFS to avoid jeopardizing the continued existence of listed species or the destruction or adverse modification of critical habitat, minimize impacts on listed species, and implement terms and conditions to minimize incidental take of listed species?

2. What information forms the foundation for the Trustees' approval of restoration plans and actions undertaken in accordance with those plans?

   2-1 Does the DWH PDARP require the Trustees to assess the individual and collective impacts of specific projects or groups of projects contained in restoration plans in the aggregate throughout the action area?

   2-2 Does the DWH PDARP require the Trustees to actively identify, gather, and analyze data and other information that would be relevant to identifying the presence or absence of adverse consequences for listed resources?

   2-3 Does the DWH PDARP establish quality assurance and quality control procedures that would apply to restoration plans or project approval documents?

3. What provisions are there for monitoring and adaptive management during the execution of the DWH PDARP and individual projects?

   3-1 Are there transparent monitoring, feedback, and adjustment loops that require Trustees to collect empirical information that allows them to ensure that specific projects are undertaken as designed, including best practices, terms and conditions, and reasonable and prudent measures established during ESA consultation?

3-2 Are there transparent monitoring, feedback, and adjustment loops that require Trustees to assess the actual effects of their actions including the amount and extent of take of listed species caused by those actions, both individually and collectively?

3-3 Are there transparent monitoring, feedback, and adjustment loops that require Trustees to incorporate new information to improve subsequent decisions?

3-4 Are there transparent monitoring, feedback, and adjustment loops that require Trustees to adjust and modify actions, in coordination with NMFS, when new information reveals that particular projects (considered individually or collectively) have unanticipated effects, change in a way that results in effects not considered, or otherwise require additional consultation with NMFS to ensure continued compliance with Section 7(a)(2) of the ESA?

3.3 Project-level Consultations

Trustees will conduct ESA consultation whenever a project may affect listed species. Project-level consultations will be either informal, because we determine that the action alone, or in combination with others, may affect, but is not likely to adversely affect listed resources, or formal because adverse effects cannot be avoided. Traditional informal consultations require a process to do the following: determine what effect the action may have on listed or proposed resources in the action area; explore ways to modify the action to reduce or remove adverse effects to the listed resources; determine the need to enter into formal consultation; and explore the design or modification of an action to benefit the species. For traditional informal consultations the Trustees would submit a Biological Assessment or Biological Evaluation (BE) form and, if NMFS agrees that the action is not likely to adversely affect listed resources, we would respond with a Letter of Concurrence (LOC). If NMFS does not agree and there are no modifications that would avoid adverse effects, or if the Trustees conclude that there will be likely adverse effects, a project-specific formal consultation ending with a Biological Opinion is required. For formal consultations, the Trustees would also submit a Biological Assessment, and NMFS would do a project-level Biological Opinion on the proposed action.

NMFS has developed an option for streamlined informal consultations. In Appendix A of this Opinion, we provide project design criteria (PDCs) that provide technical guidance and best practices that apply to several of the restoration techniques that are part of the DWH PDARP. If Trustees implement applicable PDCs, then a project is not likely to adversely affect ESA-listed resources and would qualify for streamlined consultation. This process is discussed in more detail in Section 8, Project-level Pathways for ESA Consultation.

4. Status of Species and Critical Habitat

NMFS uses 2 criteria to identify those endangered or threatened species or critical habitats that are likely to be adversely affected by the various/projects that would be authorized by the DWH PDARP. The first criterion is exposure or some reasonable expectation of a co-occurrence between one or more potential stressors associated with the projects and a particular listed species or designated critical habitat. The second criterion is the probability of a response given exposure, which considers susceptibility. For example, species may be exposed to sound transmissions from pile driving, but they are likely to be unaffected by the pile driving (i.e., no response) because the sound pressure levels to which they might be exposed are too low to cause adverse effects.

For “not likely to adversely affect” determinations, all of the effects of the proposed action are expected to be completely beneficial, insignificant, or discountable. Completely beneficial effects are contemporaneous, positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and would never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Completely beneficial, insignificant, or discountable effects are the only effects expected to occur to the species in Section 4.1.

If an ESA-listed species or designated habitat has an adverse response to stressors resulting from a project, then the action is determined to be likely to adversely affect. These effects are not discountable, insignificant, or beneficial. NMFS expects the proposed action is likely to adversely affect ESA-listed species and critical habitats discussed in Section 4.2, below.

4.1 Status of Species and Critical Habitats Not Likely to be Adversely Affected

NMFS has determined that the proposed action is not likely to adversely affect the following species in the Gulf of Mexico that are listed under the ESA because they are not likely present in the action area and the potential effects are discountable, as described below: humpback whales, fin whales, and sei whales. Also, Nassau grouper, a species proposed for listing under the ESA, is not likely present in the action area. Therefore, it is not likely to be adversely affected by the proposed action, because any potential effects are discountable.

NMFS has determined that the proposed action is not likely to adversely affect the following ESA-listed corals that are within the action area because any effects of the actions proposed in the DWH PDARP would be discountable, insignificant, or completely beneficial, as described below: elkhorn, staghorn, lobed star, mountainous star, and boulder star.

The following discussion summarizes our rationale for these determinations. Effects to these species will not be analyzed further in this Opinion.

4.1.1 Humpback Whales (*Megaptera novaeangliae*)

Humpback whales were listed as endangered in 1970 under the Endangered Species Conservation Act of 1969, the precursor to the Endangered Species Act (ESA). When the ESA was enacted in 1973, humpback whales were included in the List of Endangered and Threatened Wildlife and Plants (the List) as endangered.[5]

In the western North Atlantic Ocean, humpback whales' feeding range in the spring, summer, and fall encompasses the eastern coast of the United States (including the Gulf of Maine), the Gulf of St. Lawrence, Newfoundland/Labrador, and western Greenland (Katona and Beard 1990). In the winter, most whales from the entire North Atlantic feeding grounds migrate south to mate and calf in the West Indies. In the West Indies, the majority of whales are found in the waters of the Dominican Republic, notably on Silver Bank and Navidad Bank, and in Samana Bay (Balcomb III and Nichols Jr. 1982; Mattila and Clapham 1989; Mattila et al. 1994; Whitehead and Moore 1982). While the breeding range is the entire Antillean archipelago, from Cuba to the Gulf of Paria, Venezuela (80 FR 22303 2015), humpback whales are found at much lower densities in these areas (Levenson and Leapley 1978; Mattila and Clapham 1989; Price 1985; Winn et al. 1975).

In the Gulf of Mexico, humpback whales are uncommon. Sighting and stranding records exist; however, many of the traditionally cited records of humpback whales in the Gulf of Mexico appear questionable. Although they are presumed to be reliable records, there are no further details regarding their reliability. It is important to distinguish between sighting and stranding records. There are only 6 records that provide sufficient documentation to correctly identify sightings as humpback whales during winter and spring seasons (Maze-Foley and Mullin 2006; Weller et al. 1996). These include a sighting 20 miles from Havana, Cuba in 1932 (Aguayo 1954), a whale off Egmont Key, Florida (Layne 1965), and 3 Florida sightings reported by the United States Marine Mammal Stranding Network, which include animals near Pensacola, Seahorse Key, and Clearwater in 1980, 1983, and 1989, respectively. Last, there was a sighting of an injured juvenile whale near Naples, Florida in 1994 (Weller et al. 1996).

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[5] NOAA Fisheries has proposed to revise the listing status of humpback whales 80 FR 22303. 2015. Endangered and Threatened Species; Identification of 14 Distinct Population Segments of the Humpback Whale (Megaptera novaeangliae) and Proposed Revision of Species-Wide Listing. Federal Register 80(76):22303-22356. The proposal suggests dividing the globally listed and endangered species into 14 distinct populations segments (DPSs), removing the current species-level listing, and in its place, listing 2 DPSs as endangered (Cape Verde Islands/Northwest Africa and Arabian Sea) and 2 DPSs as threatened (Central American and Western North Pacific). The remaining 10 DPSs are not proposed for listing based on their current statuses *(Hilterman, M., E. Goverse, M. Godfrey, M. Girondot, and C. Sakimin. 2003. Seasonal sand temperature profiles of four major leatherback nesting beaches in the Guyana Shield. Pages 189-190 in J. A. Seminoff, editor Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation.).* The West Indies DPS is one of the 10 DPSs not proposed for listing; it consists of whales whose range may come closest to the Gulf of Mexico.

Humpbacks are infrequent visitors to the Gulf of Mexico. A resident population of humpback whales does not occur in the Gulf of Mexico, and their presence in the Gulf of Mexico is likely rare (Maze-Foley and Mullin 2006; Weller et al. 1996). Observations during the winter are likely due to incomplete migration from some juvenile whales, and during the spring, inexperienced whales may become lost during their northern migration (Weller et al. 1996). Humpback whales were not considered in the injury assessment following the *Deepwater Horizon* oil spill (DWH Trustees 2015).

NMFS concludes that humpback whales are not likely to be adversely affected by the DWH PDARP because their occurrence in the action area is rare and the potential effects on the species are discountable.

4.1.2 Sei Whales (*Balaenoptera borealis*)

The sei whale is listed as endangered under the ESA (NMFS 2011b). Sei whales are highly migratory but are generally uncommon in most tropical regions (Ward et al. 2001). Sei whales do not tend to move to as high latitudes as do some other balaenopterids, and sei whales also do not tend to enter semi-enclosed water bodies, such as the Gulf of Mexico, the Gulf of St. Lawrence, Hudson Bay, the North Sea, and the Mediterranean Sea (NMFS 2011c). Throughout their range, sei whales occur predominantly in deep water; they are most common over the continental slope (Martin 1983; Mitchell 1975; Olsen et al. 2009), shelf breaks (COSEWIC 2003), and deep ocean basins situated between banks (Sutcliffe and Brodie 1977).

Sighting and stranding records of sei whales are often confused with the Bryde's whale (*Balaenoptera edeni*), a resident species to the Gulf of Mexico (Ward et al. 2001). The 2 species are similar in size and appearance, both with a falcate dorsal fin. By contrast, Bryde's whales have 3 ridges, compared to a single ridge on the dorsal surface of a sei whale's rostrum (Maze-Foley and Mullin 2006). There are few details regarding the 5 sei whale stranding records in the Gulf of Mexico (Maze-Foley and Mullin 2006; Ward et al. 2001). One of these records may be questionable; however, consensus exists that 3 out of the 4 reliable records are from Louisiana (Jefferson and Schiro 1997; Ward et al. 2001).

These accounts are the most readily available information regarding stranding records; however, due to the lack of specific details and true verification of a stranding versus a sighting, they must be assessed with caution. All sources concur that sei whales' presence in the Gulf of Mexico is most likely of rare occurrence (Jefferson and Schiro 1997; Maze-Foley and Mullin 2006; Ward et al. 2001). Sei whales were not considered in the injury assessment following the *Deepwater Horizon* oil spill (DWH Trustees 2015).

NMFS concludes that sei whales are not likely to be adversely affected by the DWH PDARP because their occurrence in the action area is rare, and the potential effects on the species are discountable.

4.1.3 Fin Whales (*Balaenoptera physalus*)

The fin whale is listed as endangered under the ESA (NMFS 2010c). In general, fin whales are most common north of approximately 30°N latitude, which touches the very northern portion of the Gulf of Mexico (NMFS 2010c). Primarily found in the U.S. Atlantic, fin whales range from Cape Hatteras, North Carolina to their major summer feeding grounds in New England (Ward et al. 2001). The summer feeding range of fin whales in the western North Atlantic is mainly between 41°20'N and 51°00'N, from shore seaward to the 1,000-fathom contour (Mitchell 1975).

As with other species, fin whales rarely occur outside of their typical ranges. Because of the difficulty of distinguishing fin whales from Bryde's whales, considerable confusion exists concerning fin whale occurrence south of 30°N latitude (Mead 1977). Some sighting or stranding records of fin whales may have actually been of Bryde's whales. Seven reliable records of fin whale strandings or sightings in the Gulf of Mexico exist from summer, fall, and winter marine mammal research surveys, although 4 of these records have questionable accuracy (Jefferson and Schiro 1997; Maze-Foley and Mullin 2006).

Without further details as to whether the records were sightings, strandings, or possible misidentification, fin whales' occurrence in the Gulf of Mexico may be rare. Fin whales were not considered in the injury report from the *Deepwater Horizon* oil spill (DWH Trustees 2015).

NMFS concludes that fin whales are not likely to be adversely affected by the DWH PDARP because their occurrence in the action area is rare, and the potential effects on the species are discountable.

4.1.4 Corals

Elkhorn (*Acropora palmata*) and staghorn (*Acropora cervicornis*) corals were listed as threatened under the ESA in May 2006 (71 FR 26852 2006). In December 2012, NMFS proposed changing their statuses from threatened to endangered (77 FR 73219 2012). On September 10, 2014, NMFS determined that elkhorn and staghorn coral should remain listed as threatened (79 FR 53851 2014). Lobed star coral (*Orbicella annularis*), mountainous star coral (*Orbicella faveolata*), and boulder star coral (*Orbicella franksi*) were listed as threatened under the ESA on September 10, 2014 (79 FR 53851 2014). These 5 listed coral species were not injured by the DWH oil spill; thus the DWH PDARP does not provide an injury assessment for them. Nonetheless, these 5 listed coral species are found within the DWH PDARP action area, and they may be affected by DWH PDARP restoration activities.

Within the action area, lobed star, boulder star, and mountainous star corals are only present at the Flower Garden Banks National Marine Sanctuary and the Dry Tortugas, off the southwest coast of Florida. Elkhorn and staghorn corals are present in the Dry Tortugas, and there is a single colony of elkhorn coral at the Flower Garden Banks National Marine Sanctuary.

The DWH PDARP includes restoration approaches for coral transplantation and placement of hard ground substrate to restore mesophotic and deepwater corals. Fragmentation and/or transplantation efforts will focus on injured coral species or appropriate proxies. The DWH PDARP provides that this restoration approach will avoid using the 5 ESA-listed coral species that occur in the action area.

Furthermore, it provides that substrate will not intentionally be placed on top of ESA-listed corals. Thus, the effects of those restoration approaches would be discountable and insignificant and not likely to adversely affect listed corals. In addition, there are potential wholly beneficial effects to listed corals, including the potential to expand existing or designate new marine protected areas at the Flower Garden Banks National Marine Sanctuary, as well as restoration approaches intended to improve water quality in the Gulf of Mexico.

4.1.5 Nassau Grouper (*Epinephelus striatus*) – Proposed for Listing

On September 2, 2014, NMFS published a proposed Rule to list Nassau grouper as a threatened species. While we have not yet published a final listing Rule, we will consider possible effects to this species resulting from the proposed action. The 2013 status review indicates the current geographic range of the species extends from Bermuda and Florida, throughout the Bahamas and Caribbean Sea, to the Yucatan Peninsula in Mexico (Hill and Sadovy de Mitcheson 2013). Nassau grouper is considered a rare or transient species in the northwestern Gulf of Mexico off Texas (Gunter and Knapp 1951; Hoese and Moore 1998) and is generally replaced ecologically in the eastern Gulf by red grouper (*Epinephelus morio*) (Smith 1971). Nassau grouper are rare in U.S. waters; most reports of the species are only along the reef tract of the Florida Keys (i.e., the Atlantic side). Within this geographic range, Nassau grouper are most abundant in clear waters on high-relief coral or rocky reefs.

The geographic range of Nassau grouper overlaps with a portion of the action area, though as discussed above, Nassau grouper are unlikely to be found in Gulf waters. Therefore, Nassau grouper are extremely unlikely to be exposed to any effects from the DWH PDARP. NMFS believes any potential effects would be discountable and would not be likely to adversely affect Nassau grouper.

4.2 Status of Species and Critical Habitats Likely to be Adversely Affected

4.2.1 Sperm Whales (*Physeter macrocephalus*)

Sperm whales are listed as endangered under the ESA (35 FR 18319 1970). They are also protected under the Marine Mammal Protection Act of 1972 (MMPA). The sperm whale is the only federally listed marine mammal species that is likely to be adversely affected by the proposed action. As required by the ESA, a periodic review of a species' status must be conducted to ensure the threatened or endangered listing classification is accurate. The sperm whale species has undergone 2 separate 5-year reviews (NMFS 2009d; NMFS 2015d), and a Final Recovery Plan for sperm whales was published (NMFS 2010b). NMFS has not designated critical habitat for sperm whales. In 2013, NMFS found that listing the Gulf of Mexico (GOM) population as a distinct population segment (DPS) was not warranted (78 FR 68032 2013). In order for a population to qualify as a DPS, the population must be determined to be both discrete and significant, in accordance with the 1996 Joint United States Fish and Wildlife Service-NMFS DPS Policy (78 FR 68032 2013). A population segment is considered discrete if it is markedly separate from the rest of the taxon based on physical, physiological, ecological, or behavioral factors (78 FR 68032 2013). On the basis of the best available information, the GOM population of sperm whales is not discrete from other sperm whale populations given information on genetics, size, behavior, and regulatory mechanisms, and therefore does not meet the DPS criteria. Because the GOM sperm whale is not discrete, there was no need to determine whether the GOM sperm whale is significant to the global taxon of sperm whale, per the DPS policy (78 FR 68032 2013).

For management under the ESA, the Final Recovery Plan for the sperm whale identifies recovery criteria geographically across 3 ocean basins: the Atlantic Ocean/Mediterranean Sea (including the Caribbean Sea and Gulf of Mexico), the Pacific Ocean, and the Indian Ocean (NMFS 2010b). This geographic division by basin is due to the wide distribution of sperm whales and presumably little movement of whales between ocean basins. For management purposes under the Marine Mammal Protection Act (MMPA), NMFS has identified the Northern Gulf of Mexico sperm whale population as a stock (Waring et al. 2013). However, a stock under the MMPA is not equivalent to a DPS under the ESA. Under the MMPA, a “population stock” or a “stock” is “a group of marine mammals of the same species or smaller taxa in a common spatial arrangement that interbreed when mature” (16 U.S.C. 1362 (11) 1972). To be determined a DPS for purposes of the ESA, demographic independence alone does not suffice. Therefore, the fact that the GOM population is considered a stock under the MMPA does not qualify the population as a DPS under the ESA.

4.2.1.1 Species Description and Distribution

The sperm whale is the largest toothed whale species. Adult females can reach 11-12 meters (m) in length, and adult males are much larger, measuring 16-18 m in length (Jefferson et al. 1993; Whitehead 2009). Researchers have reported that GOM sperm whales are smaller than those from other areas (Jochens et al. 2008). Measurements of the total length of GOM sperm whales indicate that they are 1.5-2.0 m smaller on average compared to whales measured in other areas (NMFS 2015d). However, whale size data has never been normalized to account for age, therefore no reliable comparison can be made to animals in other geographic areas. Similarly, average group size in the GOM is smaller than in other oceans, but again, size is variable and there is not sufficient data to demonstrate that the GOM population is “markedly separate” from other sperm whale populations (78 FR 68032 2013).

Sperm whales are brownish gray to black in color. The surface of the body behind the eye tends to be wrinkled. The flippers are relatively short, wide, and paddle-shaped. There is a low rounded dorsal hump and a series of bumps on the dorsal ridge of the tailstock (Whitehead 2009). Sperm whales have a disproportionately large head that is an adaptation to produce acoustic signals (Cranford 1992; Norris and Harvey 1972).

Sperm whales are one of the most widely distributed marine mammal species on Earth, ranging from the ice-edge at both poles to the equator (Whitehead 2009). They are typically composed of female philopatry and male dispersal. Mature females and immature sperm whales form groups that are generally found within tropical and temperate latitudes between 50°N and 50°S throughout the year, while solitary adult males will move extensively to higher latitudes between 75°N and 75°S, before returning to tropical and subtropical waters (Reeves and Whitehead 1997; Whitehead 2009). Sperm whales are the most common large cetacean in the northern Gulf of Mexico. They are found year-round along the continental slope and in oceanic waters, where their greatest density is along and seaward of the 1,000-m isobath (Davis et al. 1998; Mullin et al. 1991; Mullin and Fulling 2004; NMFS 2015d). There are several areas between Mississippi Canyon and De Soto Canyon where sperm whales congregate in high densities, likely because of localized, highly productive habitats (Biggs et al. 2005; Jochens et al. 2008).

Cephalopods (i.e., squid, octopi, cuttlefishes, and nautili) are the main component of sperm whale diets. Sperm whales can consume about 3.0-3.5% of their body weight per day (Lockyer 1981). Sperm whales forage during deep dives that routinely reach depths of 600 m and can last for about 45 minutes (min) (Whitehead 2009). The animals are capable of diving depths of over 3,200 m that can last for over 60 min (Wursig et al. 2000). After long, deep dives, individuals come to the surface to breathe and recover for approximately 9 min (Whitehead 2009).

Based on the best available genetic information, there is strong mitochondrial deoxyribonucleic acid (mtDNA) evidence of population structuring indicating differences between the GOM sperm whales and sperm whales in the northwest Atlantic, this is not coupled with nuclear deoxyribonucleic acid (nDNA) evidence that would indicate that males from the GOM are genetically different from males in the northwest Atlantic (78 FR 68032 2013). Engelhaupt et al. (2009) suggest that the discrepancy between the mtDNA and nDNA differentiation may reflect sex-biased dispersal. Because mtDNA is maternally inherited, it cannot stand alone is describing population structure. Differences in mtDNA haplotypes between populations do not necessarily mean that the populations are substantially reproductively isolated from each other because they do not provide any information on males. Considering that males move in and out of the GOM when mature and interbreed with females from other populations, as evidenced by the homogeneity of the nDNA, the GOM population is not markedly separate from other populations in the Atlantic Ocean (78 FR 68032 2013).

Sperm whales make vocalizations called “codas” that have distinct patterns and are used to communicate among stable social units of mixed-sex groups of females, calves, and immature whales (Rendell and Whitehead 2003). Whitehead (1998) documented a clear link between mtDNA and coda repertoire as groups with similar mtDNA tended to have similar coda usage dialects, due to cultural transmission through the matrilineal line. However, this link does not suggest population structuring considering it does not account for nDNA. During a 2008 sperm whale seismic study, variation in vocalization was found between the north central GOM and the northwest GOM (Jochens et al. 2008). Due to these communication differences, along with the fact that adult sperm whales travel outside the Gulf of Mexico, the GOM population of sperm whales are not "markedly" separate from other populations (78 FR 68032 2013).

4.2.1.2 Life History Information

Female sperm whales remain in the geographic area in which they were born, and adult males disperse more broadly, allowing them to mate with multiple female populations throughout a lifetime. Female sperm whales reach sexual maturity at about 8-9 years old, have a minimum inter-birth interval of about 3 years, and have a gestational period of 14.5-16.5 months (DWH MMIQT 2015; Lockyer 1981). Males begin maturation in the same age interval, however don't become fully mature and begin to breed until their late 20s (Whitehead 2009). A single calf is born at about 4 m, weighing nearly 1,000 kg (Lockyer 1991). Maturing males leave the female groups and form loose aggregations of bachelor schools. As the males age, they separate from the bachelor schools and remain solitary most of the year (Best 1979). In the Gulf of Mexico, large, solitary adult males enter the Gulf only for a short period to breed with females. Because females within a group often reach a reoccurring period of fertility simultaneously, males do not need to remain with the females for the entire breeding season, and typically move on to achieve maximal breeding success (Best and Butterworth 1980). In the northern hemisphere, peak breeding season for sperm whales occurs between March/April and June, while in the southern hemisphere, peak breeding season occurs between October and December (Best et al. 1984). Sperm whales mature slowly and can live to ages in excess of 60 years (Rice 1989).

4.2.1.3 Status and Population Dynamics

The best estimate for the current worldwide abundance of sperm whale is 300,000-450,000 individuals (Whitehead 2002). The abundance of sperm whales in the Atlantic Ocean is estimated at 90,000-134,000 individuals (NMFS 2010b). The best available abundance estimate for northern Gulf of Mexico sperm whales is 763 (CV = 0.38), derived from an oceanic survey of waters from the 200-m isobath to the seaward extent of the U.S. EEZ in June-August 2009 (NMFS 2015a). An earlier estimate of 1,665 was derived from June-August 2003 and April-June 2004 surveys. Between April-June 1996-2001 (excluding 1998), there was an estimated 1,349 individuals. Under the MMPA, the maximum number of animals that may be removed, not including natural mortalities, from a marine mammal stock annually while allowing that stock to reach or maintain its optimum sustainable population is called Potential Biological Removal (PBR). PBR for sperm whales in the Gulf of Mexico is 1.1 (NMFS 2015a). A trend analysis has not been conducted for the northern Gulf of Mexico stock of sperm whales.

4.2.1.4 Threats

Anthropogenic (Man-made) Noise

Humans introduce sound intentionally and unintentionally into the marine environment for many purposes including oil exploration, navigation, military operations, and research. Noise exposure can result in a multitude of impacts, ranging from those causing little or no impact, to those being potentially severe, depending on source level and other variables. Marine mammal response to noise varies due to numerous factors, including type and characteristics of the noise source, distance between the source and the receptor, receptor characteristics (e.g., sensitivity, behavioral context, age, sex, and previous experience with sound source) and time of the day or season (NMFS 2015d). Noise may be intermittent or continuous, steady or impulsive, and may be generated by stationary or transient sources. As one of the potential stressors to marine mammal populations, noise may disrupt marine mammal communication, navigational ability, and social behavior. Marine mammals use sound, both passively (i.e., listening) and actively (i.e., sound generation), to communicate, navigate, locate prey, and sense their environment (NMFS 2015d). Both anthropogenic and natural sounds may cause interference with these functions.

The effects of sonar on sperm whale behavior have not been studied extensively; however, sonar affects sperm whale diving and foraging behavior. Research suggests that during low frequency active sonar exposure (1-2 kHz), sperm whales continue a deep dive, but not to their normal depths. In addition, their vocal activity diminishes, indicating the whales are not foraging when exposed to sonar (Sivle et al. 2012). During mid-frequency active sonar exposure (6-7 kHz), whales retain their normal diving and foraging activity (Sivle et al. 2012). Whales exposed to sonar that rapidly changes their dive behavior may not be able to manage nitrogen loads during the dive and may be physiologically impaired when gas bubbles form in the blood and tissue (known as decompression sickness) (Hooker et al. 2009; Hooker et al. 2011).

The northern Gulf of Mexico has been increasingly subject to extensive seismic airgun sounds in search for hydrocarbon deposits. Visual tracking, passive acoustic monitoring, and movement recording tags were used to quantify behavior prior to, during, and following exposure to airgun arrays at received levels in the range 140-160 decibels (dB) at distances of 7-13 km, following a phase-in of sound intensity and full array exposures at 1-13 km (Miller et al. 2009). Sperm whales did not exhibit avoidance behavior at the surface. However, foraging behavior may have been affected. Data raise concerns that seismic surveys may affect foraging behavior in sperm whales, but more data are required to understand whether the differences were due to exposure to the seismic surveys or natural variation in sperm whale behavior (Miller et al. 2009).

Other sources of anthropogenic noise include surface shipping and aircraft noise. Background ocean noise has been estimated to increase as much as 1.5-3 dB per decade since the advent of propeller-driven ships (Andrew et al. 2002; McDonald et al. 2008; McDonald et al. 2006a; NRC 2003). Varying documentations exist of sperm whale behavioral disruption from aircraft; however, the species are likely sensitive to the associated noise (Au and Perryman 1982; Green et al. 1992; Richter et al. 2006; Richter et al. 2003; Wursig et al. 1998).

Fishery Interaction

Incidental entrapment and entanglement in fishing gear is a potential concern for sperm whales. The commercial fishery that interacts with sperm whales in the northern Gulf of Mexico is the Atlantic Ocean, Caribbean, and Gulf of Mexico large pelagic longline fishery that targets swordfish, tunas, and billfish (NMFS 2015a). This fishery has not killed or seriously injured sperm whales in recent years (2009-2013) or historically 1998-2008 (Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Fairfield Walsh and Garrison 2006; Garrison 2003; Garrison 2005; Garrison and Richards 2004; Garrison and Stokes 2010; Garrison and Stokes 2012a; Garrison and Stokes 2012b; Garrison and Stokes 2013; Garrison and Stokes 2014; Garrison et al. 2009; Yeung 1999; Yeung 2001). One incident of a sperm whale entanglement and live release without serious injury occurred in 2008 (Garrison et al. 2009). The whale was entangled in mainline and other fishing gear and was accompanied by a calf.

Research on sperm whale interactions with fisheries elsewhere has begun to focus on the phenomenon known as "depredation," when sperm whales remove fish from longline gear. Investigations were conducted to document rates of depredation, understand how sperm whales manage to find vessels and remove fish from the gear, quantify the amount of prey removed, and record the frequency of resulting mortality or serious injury due to entanglement (Hernandez-Milian et al. 2008). Depredation behavior may be transmitted socially between individuals (Schakner et al. 2014). Many negative outcomes to depredation include injury or entanglement of the whales in addition to the negative impacts on the fisheries (Hamer et al. 2012).

Vessel Strikes

Ship strikes to whales occur worldwide and are a source of injury and mortality. Sperm whales spend long periods, typically up to 10 min (Jaquet et al. 1998), "rafting" at the surface between deep dives. When in close proximity to vessels, this makes them vulnerable to ship strikes. No vessel strikes have been documented in recent years (2009-2014) for sperm whales in the Gulf of Mexico (NMFS 2015a). Historically, a single sperm whale mortality (possibly due to a vessel strike) has been documented for the Gulf of Mexico. The incident occurred in 1990 in the vicinity of Grande Isle, Louisiana. Deep cuts on the dorsal surface of the whale indicated the ship strike was probably pre-mortem (Jensen and Silber 2004).

Marine Debris

Marine debris may be ingested by sperm whales as is the case with many marine animals. Debris entrained in the deep scattering layer where sperm whales feed could be mistaken for prey and incidentally ingested. Marine debris has been found in the gastrointestinal track of stranded sperm whales in Spain and along the coast of California resulting in gastric ruptures (De Stephanis et al. 2013; Jacobsen et al. 2010) however, there have been no cases documented in the Gulf of Mexico.

Climate Change

This section discusses the potential effects of climate change on sperm whales. A general overview of climate change and its potential impacts on marine organisms is presented in Section 5.2.4 of this Opinion.

The effects of climate and oceanographic change on sperm whales are uncertain, but they have potential to greatly affect habitat and food availability. Evidence suggests that the productivity in the North Pacific Ocean (Doney et al. 2012; Gregg et al. 2003; Mackas et al. 1998; Quinn and Neibauer 1995) and other oceans is affected by changes in the environment. Site selection for whale migration, feeding, and breeding for sperm whales may be influenced by factors such as ocean currents and water temperature. Increases in global temperatures are expected to have profound impacts on arctic and sub-arctic ecosystems and these impacts are projected to accelerate during this century. There is some evidence from Pacific equatorial waters that sperm whale feeding success and, in turn, calf production rates are negatively affected by increases in sea surface temperature (Smith and Whitehead 1993; Whitehead 1997). Squid, being the primary prey of sperm whales, may be negatively impacted by rising ocean temperatures, especially in the Antarctic. However, squid are opportunistic feeders, and they may be able to adapt to changes in krill abundance by feeding on a variety of organisms (Rodhouse 2013). Habitat is also expected to be altered. As sea ice melts, areas will open to shipping lanes and increase the risk of vessel interactions with sperm whales (Alter et al. 2010). Any changes in these factors could lower habitat quality with possible long-term impacts to sperm whales or render currently used habitat areas unsuitable (NMFS 2015d). Further study is necessary to evaluate and understand the effects of changes to oceanographic conditions due to climate change on sperm whales and marine mammals in general. However, it is worth noting that the feeding range of sperm whales is likely the greatest of any species on earth, and, consequently, it's likely that sperm whales will be more resilient to climate change than species with a narrow range of habitat preferences (NMFS 2015d).

Oil Spills and Contaminants
In response to the DWH oil spill in April 2010, research has aimed to determine the effects of this catastrophic disaster on the 22 species of marine mammals that inhabit the pelagic, continental shelf, and coastal waters, as well as bays, sounds, and estuaries (BSEs) of the northern Gulf of Mexico (DWH Trustees 2015). In addition to the estimated 3.19 million barrels of oil released into the ocean (U.S. *v.* B.P. 2015) approximately 1.84 million gallons of chemical dispersant were also used during the spill (USCG 2011). Tens of thousands of marine mammals were exposed to the *Deepwater Horizon* surface slick, where they likely inhaled, aspirated, ingested, physically contacted, and absorbed oil components. The oil's physical, chemical, and toxic effects damaged tissues and organs, leading to a constellation of adverse health effects, including reproductive failure, adrenal disease, lung disease, and poor body condition. Animals that succumbed to these adverse health effects contributed to the largest and longest lasting marine mammal unusual mortality event (UME) on record in the northern Gulf of Mexico (DWH Trustees 2015).

Sperm whales were among one of the 22 marine mammal species in the Gulf of Mexico that were exposed to the oil. Little is known about the effects of oil spills, chemicals, or heavy metals on offshore cetacean populations because of logistical challenges and lack of baseline data. Immediately following the DWH oil spill, Wise Jr. et al. (2014) identified oil-associated metal concentrations in Bryde's whales and sperm whales, and compared these concentrations to levels measured in whales found in other parts of the world. The average nickel concentration in northern Gulf of Mexico sperm whales was 6.6 times higher than the global average, and 1.4

times higher for chromium concentrations (Wise Jr. et al. 2014). The most elevated concentrations of metals were found in whales near the center of the DWH spill (Wise Jr. et al. 2014).

Due to lack of information for offshore cetacean populations, a large majority of the injury quantification for oceanic marine mammals within the *Deepwater Horizon* oil spill footprint was modeled from the measured injuries to bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay and Mississippi Sound (DWH Trustees 2015). Health assessments on these animals in the aftermath of the spill are used as a proxy for a population modeling approach to quantify the entire scope of injury to populations (DWH MMIQT 2015).

The pre-spill abundance estimate for sperm whales in the Gulf of Mexico is 1,635 individuals (DWH Trustees 2015). While this estimate varies from the 2009 oceanic survey of 763 individuals, it is based upon sighting functions as well as a spatially explicit model of sperm whale density that was used for the injury quantification analysis (DWH MMIQT 2015). Applying the expected effects from bottlenose dolphins to sperm whales, it was determined that 16% of the Gulf of Mexico population, or about 262 whales, were exposed to DWH oil. In total, 6% of the Gulf of Mexico sperm whale population was killed (98 individuals) (DWH Trustees 2015). The initial exposure likely resulted in whale deaths later in time due to adrenal and lung disease, as was observed in bottlenose dolphins.

Similar to mortality rates, reproductive failure data are not available for other populations exposed to the *Deepwater Horizon* oil spill. Thus, based off the percentage of bottlenose dolphin females with reproductive failure in Barataria Bay and Mississippi Sound (46%), the best estimate for female sperm whales with reproductive failure is 7%, or 115 individuals (DWH MMIQT 2015). Overall adverse health effects resulting from oil exposure were determined by a veterinarian's prognosis of an animal's likely future outcome. For sperm whales, 6% of the population was predicted to suffer from adverse health effects (DWH Trustees 2015).

Based on population monitoring and taking into account the overlapping and synergistic relationships between mortality, reproductive failure, and adverse health effects, DWH oil exposure resulted in a maximum population reduction of 7% (about 115 animals) requiring 21 years to recover to the pre-spill population size. At a more subtle but still crucial level, the summed negative effects of the *Deepwater Horizon* oil spill on the Gulf of Mexico ecosystem across resources—up and down the food web, and among habitats—will continue to affect sperm whales due to the long life of marine mammals and their strong dependence on a healthy ecosystem (Bossart 2011; Moore 2008; Reddy et al. 2001; Ross 2000; Wells et al. 2004).

4.2.1.5 Summary of the Status of Sperm Whales and Recovery Objectives

NMFS's Final Recovery Plan for the Sperm Whale (NMFS 2010b) provides recovery goals for sperm whale populations to achieve levels at which it becomes appropriate to "downlist" them from endangered to threatened status and ultimately to "de-list" them from the list of threatened and endangered species. Sperm whales have not met the objectives and criteria for downlisting. Thus, NMFS has not yet analyzed and developed specific delisting objectives and criteria. However, the downlisting objectives and criteria are provided below.

Sperm Whale Recovery Plan lists 2 objectives for downlisting the species to threatened status: (1) achieve sufficient and viable populations in all ocean basins, and (2) ensure significant threats are addressed.

For Objective No. 1 (sufficient and viable populations in all ocean basins), the recovery plan provides the following recovery criterion:

> "Given current and projected threats and environmental conditions, the sperm whale population in each ocean basin in which it occurs (Atlantic Ocean/Mediterranean Sea, Pacific Ocean, and Indian Ocean) satisfies the risk analysis standard for threatened status (has no more than a 1% chance of extinction in 100 years) *and* the global population has at least 1,500 mature, reproductive individuals (consisting of at least 250 mature females and at least 250 mature males in each ocean basin). Mature is defined as the number of individuals known, estimated, or inferred to be capable of reproduction…"

For Objective No. 2 (ensure significant threats are addressed), the recovery plan provides the following criteria:

> Factors that may limit population growth have been identified and are being or have been addressed to the extent that they allow for continued growth of populations. Specifically, the factors in 4(a)(l) of the ESA are being or have been addressed as follows:

Factor A: The present or threatened destruction, modification, or curtailment of a species' habitat or range

- Effects of reduced prey abundance due to climate change have continued to be investigated and any necessary action being taken to address the issue are shown to be effective or this is no longer believed to be a threat.
- Effects of anthropogenic noise have continued to be investigated and actions being taken to address the issue are shown to be effective or this is no longer believed to be a threat. Competition with fisheries for resources continues to be addressed through fishery management plans and other measures or is no longer believed to be a threat.
- Effects of oil spills and contaminants are determined to not affect the potential for continued growth or maintenance of the sperm whale population and actions taken or having been taken to minimize potential effects have been proven effective.

Factor B: Overutilization for commercial, recreational, or educational purposes

- Management measures are in place that ensure that any direct harvest (commercial, subsistence, and scientific) is at a sustainable level.

Factor C: Disease or Predation. There are no criteria for this factor because there are no data to indicate that disease or predation are threats.

Factor D: The inadequacy of existing regulatory mechanisms

- Ship collisions have been investigated and action being taken to address the issue are shown to be effective or this is no longer believed to be a threat. Direct harvest is addressed under Factor B.

Factor E: Other natural or manmade factors affecting its continued existence. No other factors are known to be threats.

With regard to the first downlisting objective (sufficient and viable populations in all ocean basins), efforts to attain information on population sizes are ongoing, however, current data are insufficient to determine population abundance and trends in most ocean basins and to conduct a risk analysis. Viable population criteria are measured by the number of mature reproductive individuals in a population. The Mediterranean Sea is the only ocean basin for which this information is known (NMFS 2015d). For other ocean basins, continued research on age structure would provide that insight. In the Mediterranean Sea, the sperm whale population is estimated to be less than 2,500 mature individuals (Notarbartolo di Sciara et al. 2012). Based on photo-identification from 1990-2008, the average abundance estimate was approximately 400 mature individuals (Rendell et al. 2014). Elsewhere stock assessment reports provide best and minimum population estimates.

Based on the sperm whale 5-year review in 2015 (NMFS 2015d), the most recent worldwide estimate from 2002 indicates sperm whale abundance to be approximately 300,000-450,000 individuals (Whitehead 2002). In the western North Atlantic population, the best sperm whale population estimate is 2,288 with a minimum population estimate of 1,815 whales. Specifically, in the northern Gulf of Mexico population, the best estimate of abundance for sperm whales is 763 and a minimum estimate of 560 whales (NMFS 2015d). There is currently no reliable estimate about the minimum population size for the Northeast Pacific population or for the Indian Ocean.

A wide range of threats that may limit population growth have been identified and are being or have been addressed to the extent that they allow for continued growth of sperm whale populations. The most prevalent threats where efforts have been concentrated to continue research and further understand have been in regards to the effects of reduced prey due to climate change, anthropogenic noise, competition with fisheries, effects of oil spills and contaminants, direct harvest, and ship collisions.

Fortunately, sperm whales are one of the most widely distributed marine mammals on Earth, such that they may be more resilient to climate change than species with more narrow ranges. However, continued research is needed to provide quantitative data on possible changes to sperm whale distribution and their prey. Anthropogenic noise is believed to be increasing in the marine environment as a result of oil and gas exploration, shipping, construction, and naval exercises. Possible negative impacts to sperm whales include changes in foraging behavior. NMFS developed draft guidance in 2013 for assessing the effects of anthropogenic sound on marine mammal species, including the sperm whale (78 FR 78822 2013). Currently NMFS is reviewing updated information on acoustic impacts since 2013, and working to incorporate the new information into the draft guidance prior to finalization. With regards to competition with fisheries, currently, there are no management plans in place factoring in predation by sperm whales when setting catch limits for fisheries, however efforts are ongoing. The effects of oil spills and contaminants can impact population growth as discussed above in the results of the *Deepwater Horizon* spill. Efforts are ongoing to gain a better representation of direct mortality from spills and their long-term impacts. Direct harvest is unlikely for countries except Japan that continues to hunt sperm whales reportedly for the purposes of scientific research under Article VIII of the International Convention for the Regulation of Whaling. The number taken is unknown, but likely relatively small. Last, federal agencies continue to consult under the ESA with NMFS on federally funded or permitted actions and take measures to reduce the likelihood of shop strikes. Currently, observers are being placed on ships to monitor whale presence and avoid collisions.

4.2.2 Sea Turtles – General Threats

Five species of sea turtles (green [*Chelonia mydas*], hawksbill [*Eretmochelys imbricata*], Kemp's ridley [*Lepidochelys kempii*], leatherback [*Dermochelys coriacea*], and the Northwest Atlantic Ocean distinct population segment [DPS] of loggerhead [*Caretta caretta*]) travel widely throughout the South Atlantic, Gulf of Mexico, and the Caribbean. Section 4.2.2 describes the general threats that confront all sea turtle species. The remainder of Section 4.2.2 (Sections 4.2.3-4.2.7) describes information on the distribution, life history, population trends, and unique threats to each species of sea turtle and its designated critical habitat.

4.2.2.1 Fisheries

Incidental bycatch in commercial fisheries is a major contributor to past declines and a threat to future recovery for all sea turtle species (NMFS and USFWS 1991; NMFS and USFWS 1993; NMFS and USFWS 2008; NMFS et al. 2011). Domestic fisheries often capture, injure, and kill sea turtles at various life stages. Sea turtles in the pelagic environment are exposed to U.S. Atlantic pelagic longline fisheries. Sea turtles in the benthic environment in waters off the coastal United States are exposed to a suite of other fisheries in federal and state waters. These fishing methods include trawls, gillnets, purse seines, hook-and-line gear (including bottom longlines and vertical lines [e.g., bandit gear, handlines, and rod-reel]), pound nets, and trap fisheries. Refer to the environmental baseline section of this Opinion for more specific information regarding federal and state fisheries affecting sea turtles within the action area. The

Southeast U.S. shrimp fisheries have historically been the largest fishery threat to benthic sea turtles in the southeastern United States, and they continue to interact with and kill large numbers of sea turtles each year.

In addition to domestic fisheries, sea turtles are subject to direct and incidental captures in numerous foreign fisheries, further impeding the ability of sea turtles to survive and recover on a global scale. For example, pelagic stage sea turtles circumnavigating the Atlantic, especially loggerheads and leatherbacks, are susceptible to international longline fisheries including the Azorean, Spanish, and various other fleets (Aguilar et al. 1994; Bolten et al. 1998; Crouse 1999). Bottom longlines and gillnet fishing are known to occur in many foreign waters, including, but not limited to, the northwestern Atlantic, western Mediterranean, South America, West Africa, Central America, and the Caribbean. Shrimp trawl fisheries also occur off the shores of numerous foreign countries and pose a significant threat to sea turtles similar to the impacts seen in U.S. waters. Many unreported takes or incomplete records by foreign fleets make it difficult to characterize the total impact that international fishing pressure has on listed sea turtles. Nevertheless, international fisheries represent a continuing threat to sea turtle survival and recovery throughout their respective ranges.

4.2.2.2 Other In-Water Activities

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

4.2.2.3 Coastal Development and Erosion Control

Coastal development can deter or interfere with nesting, affect nesting success, and degrade nesting habitats for sea turtles. Structural impacts to nesting habitat include the construction of buildings and pilings, beach armoring and renourishment, and sand extraction (Bouchard et al. 1998; Lutcavage et al. 1997). These factors may decrease the amount of nesting area available to females and change the natural behaviors of both adults and hatchlings, directly or indirectly, through loss of beach habitat, increasing erosion, and changing thermal profiles in nests, which affects the sex ratio of hatchlings (Ackerman 1997; Witherington et al. 2003; Witherington et al. 2007). In addition, coastal development is usually accompanied by artificial lighting, which can alter the behavior of nesting adults (Witherington 1992) and is often fatal to emerging hatchlings that are drawn away from the water (Witherington and Bjorndal 1991). In-water erosion control structures such as breakwaters, groins, and jetties can affect nesting females and hatchlings as they approach and leave the surf zone or head out to sea by creating physical blockage, concentrating predators, creating longshore currents, and disrupting of wave patterns.

4.2.2.4 Environmental Contamination

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

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

4.2.2.5 Marine Debris

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

4.2.2.6 Climate Change

This section discusses the potential effects of climate change on ESA-listed sea turtles. A general overview of climate change and its potential impacts on marine organisms is presented in Section 5.2.4 of this Opinion.

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

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

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

4.2.2.7 Other Threats

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

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

4.2.3 Loggerhead Sea Turtle (*Caretta caretta*)-Northwest Atlantic Ocean DPS

The loggerhead sea turtle was listed as a threatened species throughout its global range on July 28, 1978 (43 FR 32800 1978). NMFS and USFWS published a Final Rule designating 9 DPSs for loggerhead sea turtles (76 FR 58868 2011), September 22, 2011, and effective October 24, 2011). The Rule listed the following DPSs: (1) Northwest Atlantic Ocean (threatened), (2) Northeast Atlantic Ocean (endangered), (3) South Atlantic Ocean (threatened), (4) Mediterranean Sea (endangered), (5) North Pacific Ocean (endangered), (6) South Pacific Ocean (endangered), (7) North Indian Ocean (endangered), (8) Southeast Indo-Pacific Ocean (threatened), and (9) Southwest Indian Ocean (threatened). The Northwest Atlantic Ocean

(NWA) DPS is the only one that occurs within the action area and, therefore, is the only one considered in this Opinion.

4.2.3.1 Species Description and Distribution

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

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

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

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

The recovery plan for the Northwest Atlantic population of loggerhead sea turtles concluded that there is no genetic distinction between loggerheads nesting on adjacent beaches along the Florida Peninsula (NMFS and USFWS 2008). It also concluded that specific boundaries for subpopulations could not be designated based on genetic differences alone. Thus, the recovery plan uses a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences, to identify recovery units. A recovery unit is a special unit of the listed entity, and defined subset of the recovery planning area, that is geographically or otherwise identifiable and is essential to the recovery of the entire listed entity (i.e., recovery units are individually necessary to conserve genetic robustness, demographic robustness, important life history stages, or some other feature necessary for long-term sustainability of the entire listed entity). The recovery units are as follows: (1) the Northern Recovery Unit (Florida/Georgia border north through southern Virginia), (2) the Peninsular Florida Recovery Unit (Florida/Georgia border through Pinellas County, Florida), (3) the Dry Tortugas Recovery Unit (islands located west of Key West, Florida), (4) the Northern Gulf of Mexico Recovery Unit (Franklin County, Florida, through Texas), and (5) the Greater Caribbean Recovery Unit (Mexico through French Guiana, the Bahamas, Lesser Antilles, and Greater Antilles) (NMFS and USFWS 2008). The recovery plan concluded that all recovery units are essential to the recovery of the species. Although the recovery plan was written prior to the listing of the NWA DPS, it was specific to the Northwest Atlantic population of loggerheads, which is the same population that was then listed as a DPS. Therefore, the recovery units in the 2008 recovery plan apply to the NWA DPS.

4.2.3.2 Life History Information

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

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

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

inshore waters of the continental shelf throughout the U.S. Atlantic and Gulf of Mexico (Witzell 2002).

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

Like juveniles, non-nesting adult loggerheads also use the neritic zone. However, these adult loggerheads do not use the relatively enclosed shallow-water estuarine habitats with limited ocean access as frequently as juveniles. Areas such as Pamlico Sound, North Carolina, and the Indian River Lagoon, Florida, are regularly used by juveniles but not by adult loggerheads. Adult loggerheads do tend to use estuarine areas with more open ocean access, such as the Chesapeake Bay in the U.S. mid-Atlantic. Shallow-water habitats with large expanses of open ocean access, such as Florida Bay, provide year-round resident foraging areas for significant numbers of male and female adult loggerheads (Conant et al. 2009).

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

4.2.3.3 Status and Population Dynamics

Although scientists conducted stock assessments and similar reviews, no reliable estimate exists for population size of the loggerhead in the northwestern Atlantic (Conant et al. 2009; Heppell et al. 2003a; NMFS-SEFSC 2009a; NMFS and USFWS 2008; TEWG 1998; TEWG 2000; TEWG 2009). The NMFS Southeast Fisheries Science Center developed a preliminary stage/age demographic model to help determine the estimated impacts of mortality reductions on loggerhead sea turtle population dynamics (NMFS-SEFSC 2009a). The model uses the range of published information for the various parameters including mortality by stage, stage duration (years in a stage), and fecundity parameters such as eggs per nest, nests per nesting female, hatchling emergence success, sex ratio, and remigration interval. Resulting trajectories of model runs for each individual recovery unit, and the western North Atlantic population as a whole, were found to be very similar. The model run estimates from the adult female population size for the western North Atlantic (from the 2004-2008 time frame), suggest the adult female population size is approximately 20,000- 40,000 individuals, with a low likelihood of being up to 70,000 (NMFS-SEFSC 2009a). A less robust estimate for total benthic females in the western North Atlantic was also obtained, yielding approximately 30,000-300,000 individuals, up to less than 1 million (NMFS-SEFSC 2009a). A preliminary regional abundance survey of loggerheads within the northwestern Atlantic continental shelf for positively identified loggerhead in all strata estimated about 588,000 loggerheads (interquartile range of 382,000-817,000). When correcting for unidentified turtles in proportion to the ratio of identified turtles, the estimate increased to about 801,000 loggerheads (interquartile range of 521,000-1,111,000) (NMFS-NEFSC 2011).

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

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

Peninsular Florida Recovery Unit

The Peninsular Florida Recovery Unit (PFRU) is the largest loggerhead nesting assemblage in the Northwest Atlantic. A near-complete nest census (all beaches including index nesting beaches) undertaken from 1989-2007 showed an average of 64,513 loggerhead nests per year, representing approximately 15,735 nesting females per year (NMFS and USFWS 2008). The statewide estimated total for 2014 was 86,870 nests (FWRI 2014).

In addition to the total nest count estimates, the Florida Fish and Wildlife Research Institute (FWRI) uses an index nesting beach survey method. The index survey uses standardized data-collection criteria to measure seasonal nesting and allow accurate comparisons between beaches and between years. This provides a better tool for understanding the nesting trends (Figure 4-1). FWRI performed a detailed analysis of the long-term loggerhead index nesting data (1989-2015) (FWRI 2014). Over that time period, 3 distinct trends were identified. From 1989-1998, there was a 24% increase that was then followed by a sharp decline over the subsequent 9 years. A large increase in loggerhead nesting has occurred since, as indicated by the 74% increase in nesting between 2008 and 2015. FWRI examined the trend from the 1998 nesting high through 2015 and found that the decade-long post-1998 decline was replaced with a slight, insignificant increasing trend. Looking at the data from 1989 through 2015 (an increase of over 38%), FWRI concluded an overall positive change in the nest counts (FWRI 2014).

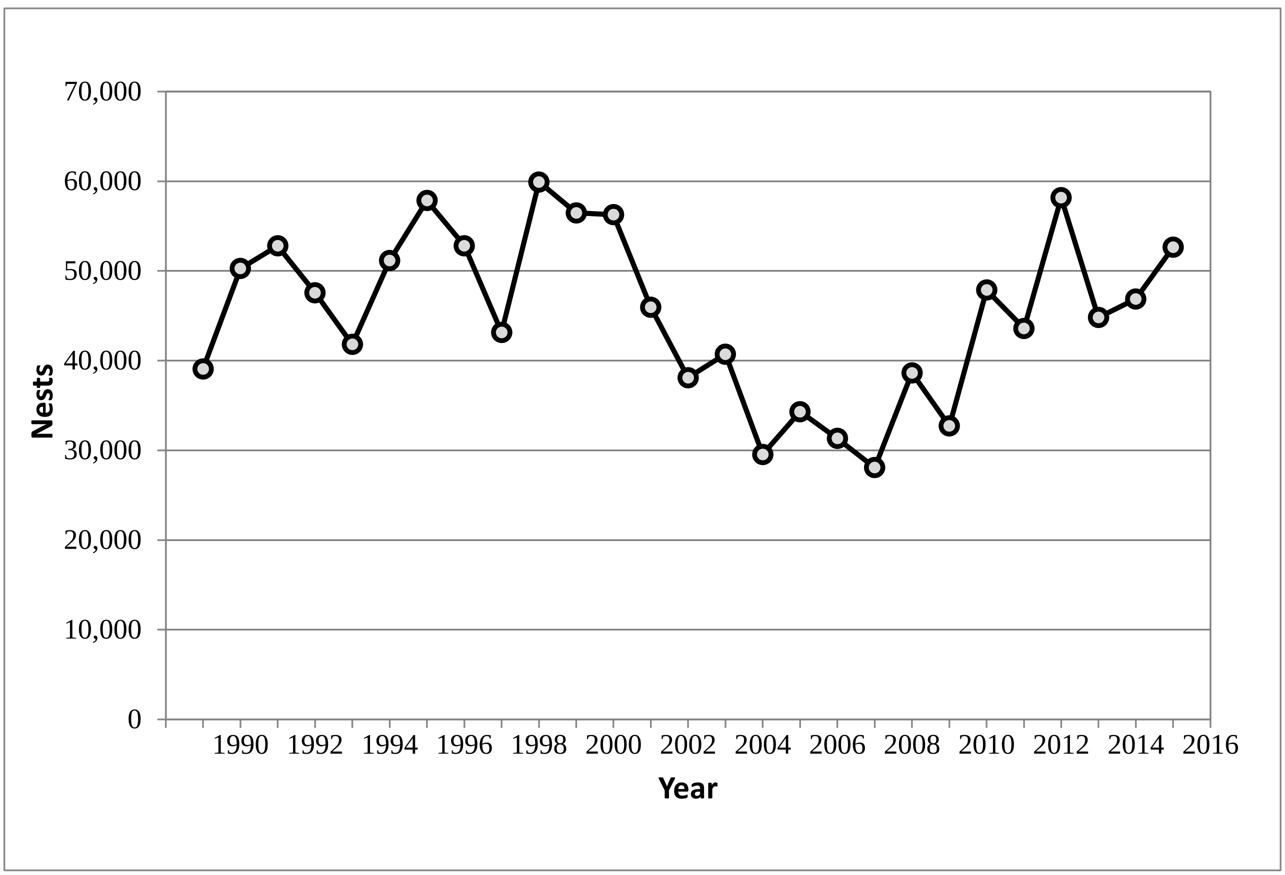


Figure 4-1. Loggerhead sea turtle nesting at Florida index beaches since 1989 (FWRI 2014)

Northern Recovery Unit

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

Data since that analysis (Table 4-1) show improved nesting numbers and a departure from the declining trend. Georgia nesting has rebounded to show the first statistically significant increasing trend since comprehensive nesting surveys began in 1989 (GDNR 2012). South Carolina and North Carolina nesting has also begun to show a shift away from the declining trend of the past.

Table 4-1. Total Number of NRU Loggerhead Nests

Nests Recorded	2008	2009	2010	2011	2012	2013	2014
Georgia	1,649	997	1,761	1,992	2,241	2,289	1,201
South Carolina	4,500	2,182	3,141	4,015	4,616	5,193	2,086
North Carolina	841	611	859	950	1,074	1,261	546
Total	**6,990**	**3,790**	**5,761**	**6,957**	**7,931**	**8,743**	**3,833**

(GADNR, SCDNR, and NCWRC nesting datasets: (GDNR 2015; Seaturtle.org 2015))

South Carolina also conducts an index beach nesting survey similar to the one described for Florida. Although the survey only includes a subset of nesting, the standardized effort and locations allow for a better representation of the nesting trend over time. Increases in nesting were seen for the period from 2009-2012, with 2012 showing the highest index nesting total since the start of the program (Figure 4-2).

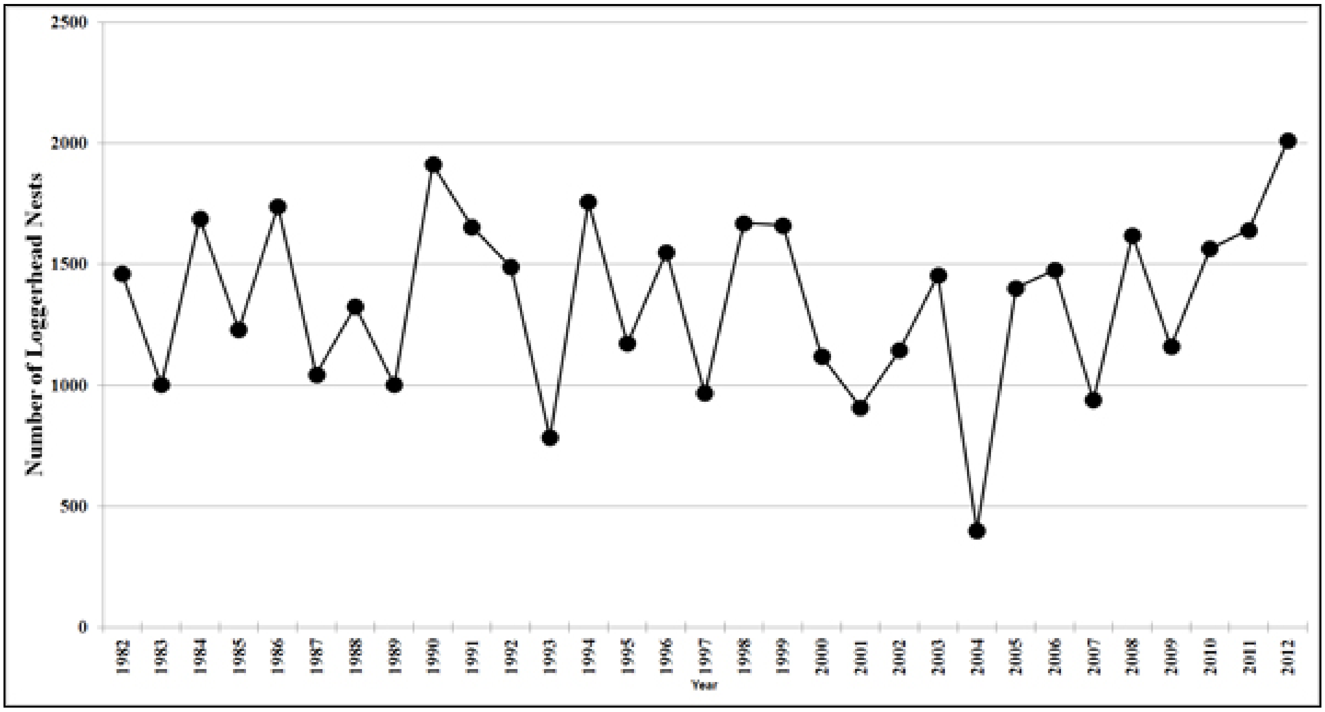


Figure 4-2. South Carolina index nesting beach counts for loggerhead sea turtles (from the SCDNR website, http://www.dnr.sc.gov/seaturtle/nest.htm)

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

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

4.2.3.4 Threats (Specific to Loggerhead Sea Turtles)

The threats faced by loggerhead sea turtles are well summarized in the general discussion of threats in Section 4.2.2. Yet, the impact of fishery interactions is a point of further emphasis for this species. The joint NMFS and USFWS Loggerhead Biological Review Team determined that the greatest threats to the NWA DPS of loggerheads result from cumulative fishery bycatch in neritic and oceanic habitats (Conant et al. 2009).

Regarding the impacts of pollution, loggerheads may be particularly affected by organochlorine contaminants and metals, which occur at higher concentrations in loggerheads than in other sea turtle species (Storelli et al. 2008; D'Ilio et al. 2011). Dietary preference is likely to be the main differentiating factor among sea turtle species. Mercury accumulates in loggerhead sea turtle livers, and cadmium accumulates in their kidneys, as has been reported for other marine organisms like dolphins, seals, and porpoises (Law et al. 1991).

While oil spill impacts are discussed generally for all species in Section 4.2.2, specific impacts of the DWH spill and response efforts on loggerhead sea turtles are considered here. Impacts to loggerhead sea turtles occurred to offshore small juveniles as well as large juveniles and adults. A total of 30,800 small juvenile loggerheads (7.3% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. Of those exposed, 10,700 small juvenile loggerheads are estimated to have died as a result of the exposure. In contrast to small juveniles, loggerheads represented a large proportion of the adults and large juveniles exposed to and killed by the oil, with 30,000 estimated exposures (almost 52% of all exposures for those age/size classes) and an estimated 3,600 mortalities. A total of 265 nests (27,618 eggs) were also translocated during response efforts, with 14,216 hatchlings released (the fate of which is unknown) (DWH Trustees 2015).

Additional unquantified impacts of the DWH oil spill on loggerhead sea turtles may have included inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources that could lead to compromised growth and/or reproductive potential. No information is available to determine the extent of those impacts, if they occurred. Unlike Kemp’s ridleys, the majority of nesting for the NWA loggerhead DPS occurs on the U.S. Atlantic coast and, thus, loggerheads were affected to a relatively lesser degree than Kemp’s ridleys. However, impacts to the NGMRU of the NWA loggerhead DPS would likely be proportionally greater than the impacts occurring to other recovery units. Based on the injury response evaluations for Florida Panhandle and Alabama nesting beaches (which fall under the NGMRU), the Trustees estimated that approximately 20,000 loggerhead hatchlings were lost due to DWH response activities on nesting beaches. These losses include transition of hatchlings to the Atlantic and disruption of nesting due to activity on the beach(es) or in the water (DWH 2015). Although the long-term effects remain unknown, the DWH impacts may result in some nesting declines in the future due to a reduction of oceanic age classes during DWH.

Specific information regarding potential climate change impacts on loggerheads is also available. Modeling suggests an increase of 2°C in air temperature would result in a sex ratio of over 80% female offspring (up from 58% female offspring) for loggerheads nesting near Southport, North Carolina. The same increase in air temperatures at nesting beaches in Cape Canaveral, Florida, would result in close to 100% female offspring. Such highly skewed sex ratios could undermine the reproductive capacity of the species. More ominously, an air temperature increase of 3°C is likely to exceed the thermal threshold of most nests, leading to egg mortality (Hawkes et al. 2007). Warmer sea surface temperatures have also been correlated with an earlier onset of loggerhead nesting in the spring (Hawkes et al. 2007; Weishampel et al. 2004), short inter-nesting intervals (Hays et al. 2002), and shorter nesting seasons (Pike et al. 2006).

4.2.3.5 Summary of the Status of NWA DPS of Loggerhead Sea Turtle and Recovery Objectives

The Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle (*Caretta caretta*) (NMFS and USFWS 2008) specifies recovery criteria that must be met in order to consider the delisting or downlisting of the species (now the NWA DPS). The information provided above, and what it means about the status of the species, should be viewed in light of the recovery criteria.

The Recovery Plan has specific demographic criteria for recovery, including nest and nesting female criteria for each recovery unit:

<u>Demographic Recovery Criteria</u>:

1. Number of Nests and Number of Nesting Females

    a. Northern Recovery Unit

        i. There is statistical confidence (95%) that the annual rate of increase over a generation time of 50 years is 2% or greater resulting in a total annual number of nests of 14,000 or greater for this recovery unit (approximate distribution of nests is NC=14% [2,000], SC=66% [9,200], and GA=20% [2,800]).

        ii. This increase in number of nests must be a result of corresponding increases in number of nesting females (estimated from nests, clutch frequency, and remigration interval).

    b. Peninsular Florida Recovery Unit

        i. There is statistical confidence (95%) that the annual rate of increase over a generation time of 50 years is statistically detectable (1%) resulting in a total annual number of nests of 106,100 or greater for this recovery unit.

        ii. This increase in number of nests must be a result of corresponding increases in number of nesting females (estimated from nests, clutch frequency, and remigration interval).

c. Dry Tortugas Recovery Unit

   i. There is statistical confidence (95%) that the annual rate of increase over a generation time of 50 years is 3% or greater resulting in a total annual number of nests of 1,100 or greater for this recovery unit.

   ii. This increase in number of nests must be a result of corresponding increases in number of nesting females (estimated from nests, clutch frequency, and remigration interval).

d. Northern Gulf of Mexico Recovery Unit

   i. There is statistical confidence (95%) that the annual rate of increase over a generation time of 50 years is 3% or greater resulting in a total annual number of nests of 4,000 or greater for this recovery unit (approximate distribution of nests (2002-2007) is FL= 92% [3,700] and AL=8% [300]).

   ii. This increase in number of nests must be a result of corresponding increases in number of nesting females (estimated from nests, clutch frequency, and remigration interval).

e. Greater Caribbean Recovery Unit

   i. The total annual number of nests at a minimum of 3 nesting assemblages, averaging greater than 100 nests annually (e.g., Yucatán, Mexico; Cay Sal Bank, The Bahamas) has increased over a generation time of 50 years.

   ii. This increase in number of nests must be a result of corresponding increases in number of nesting females (estimated from nests, clutch frequency, and remigration interval).

2. Trends in Abundance on Foraging Grounds

   A network of in-water sites, both oceanic and neritic, distributed across the foraging range is established and monitoring is implemented to measure abundance. There is statistical confidence (95%) that a composite estimate of relative abundance from these sites is increasing for at least one generation.

3. Trends in Neritic Strandings Relative to In-water Abundance

   Stranding trends are not increasing at a rate greater than the trends in in-water relative abundance for similar age classes for at least one generation.

Additionally, there are recovery criteria related to the listing factors that were used when determining the listing status of the species, including: Present or Threatened Destruction, Modification, or Curtailment of a Species' Habitat or Range; Overutilization for Commercial, Recreational, Scientific, or Educational Purposes; Disease or Predation; Inadequacy of Existing

Regulatory Mechanisms; and Other Natural or Manmade Factors Affecting Its Continued Existence. The listing factors recovery criteria address the threats described above. For the specific listing factors recovery criteria, see the Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle (*Caretta caretta*) (NMFS and USFWS 2008).

4.2.3.6 Critical Habitat for NWA DPS of Loggerhead Sea Turtle

NMFS and USFWS designated critical habitat for the threatened NWA DPS of loggerhead sea turtle on July 18, 2013, followed by the Final Rule on July 10, 2014 (79 FR 39855 2014). The designation includes 38 marine areas within portions of the northwestern Atlantic Ocean and the Gulf of Mexico (Figure 4-3). Each of these areas consists of one or a combination of the following habitat types: nearshore reproductive habitat (directly off high density nesting beaches out to 1 mi [1.6 km]), wintering habitat, breeding habitat, constricted migratory corridors, and *Sargassum* habitat. These habitat types support key life history phases of the loggerhead sea turtle and are essential to the conservation of the species. To further define critical habitat, we identified the physical and biological features (PBFs) of the habitat that are vital for the conservation of the species and the primary constituent elements (also referred to as "essential features") that support the PBFs (Table 4-2).

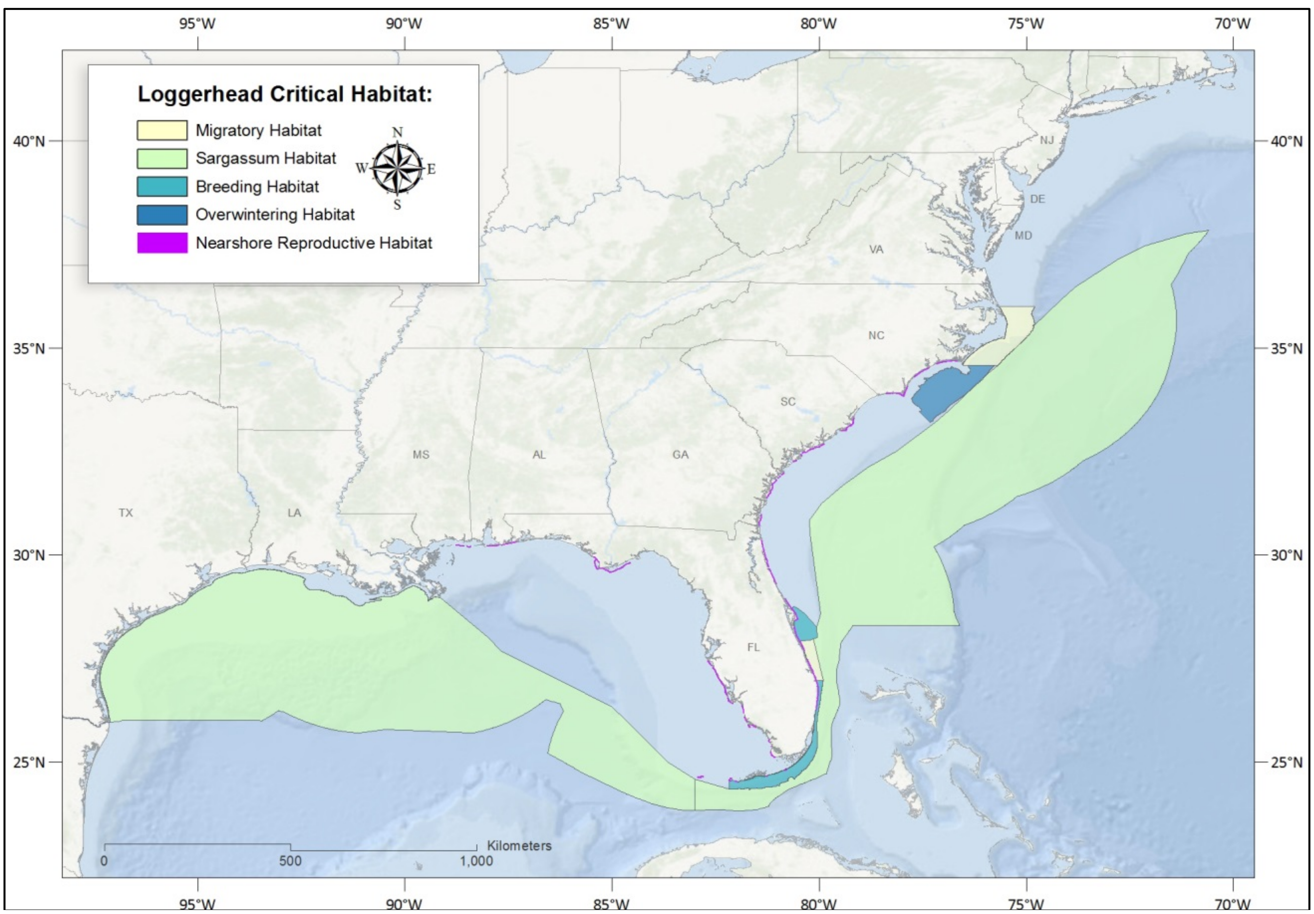


Figure 4-3. Distribution of critical habitat for the NWA DPS of loggerhead sea turtles (Image source: http://www.nmfs.noaa.gov/pr/species/turtles/images/loggerhead_critical_habitat_map.jpg)

Table 4-2. Description of Critical Habitat for the NWA DPS of Loggerhead Sea Turtles (79 FR 39855 2014)

Habitat Type	Physical and Biological Features	Primary Constituent Elements	Unit Numbers
Nearshore Reproductive	Portion of nearshore waters adjacent to nesting beaches that are used by hatchlings to egress to the open-water environment as well as by nesting females to transit between beach and open water during the nesting season	• Waters directly off the highest density nesting beaches to 1.6 km (1 mi) offshore • Waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water • Waters with minimal manmade structures that could promote predators (e.g., submerged offshore structures), disrupt wave patterns necessary for orientation, and/or create excessive longshore currents	LOGG-N-1 through LOGG-N-36
Winter	Warm water habitat south of Cape Hatteras near the western edge of the Gulf Stream used by concentration of juveniles and adults during the winter months	• Water temperatures above 10°C during colder months of November through April • Continental shelf waters in proximity to the western boundary of the Gulf Stream • Water depths between 20 and 100 m	LOGG-N-1 LOGG-N-2
Breeding	Areas with high concentrations of both male and female adult individuals during the breeding season	• Concentrations of reproductive males and females • Proximity to primary Florida migratory corridor • Proximity to Florida nesting grounds	LOGG-N-17 LOGG-N-19
Constricted Migratory	High-use migratory corridors that are constricted (limited in width) by land on one side and the edge of the continental shelf and Gulf Stream on the other side	• Constricted continental shelf area relative to nearby continental shelf waters that concentrate migratory pathways • Passage conditions to allow for migration to and from nesting, breeding, and/or foraging areas	LOGG-N-1, LOGG-N-17, LOGG-N-18, LOGG-N-19
Sargassum	Developmental and foraging habitat for	• Convergence zones, surface-water downwelling areas, and	LOGG-S-1

Habitat Type	Physical and Biological Features	Primary Constituent Elements	Unit Numbers
	young loggerheads where surface waters form accumulations of floating material, especially *Sargassum*	other locations where there are concentrated components of the *Sargassum* community in water temperatures suitable for the optimal growth of *Sargassum* and inhabitance of loggerheads • *Sargassum* in concentrations that support adequate prey abundance and cover • Available prey and other material associated with *Sargassum* habitat such as, but not limited to, plants and cyanobacteria and animals endemic to the *Sargassum* community such as hydroids and copepods	LOGG-S-2

4.2.3.6.1 Critical Habitat Unit(s) in the Action Area

The proposed action will occur within the Gulf of Mexico and encompass loggerhead critical habitat units, LOGG-N-31 through LOGG-N-36 and LOGG-S-02. Units LOGG-N-31 through LOGG-N-36 contain only nearshore reproductive habitat while LOGG-S-02 only contains *Sargassum* habitat. The location of each unit is described below while the primary constituent elements (PCEs) of these habitat types are detailed in Table 4-2.

- LOGG-N-31 - St. Joseph Peninsula, Cape San Blas, St. Vincent, St. George and Dog Islands, Gulf and Franklin Counties, Florida. The boundaries of this unit are from St. Joseph Bay to St. George Sound (crossing Indian, West, and East Passes) from the MHW line seaward 1.6 km (Figure 4-4).
- LOGG-N-32 - Mexico Beach and St. Joe Beach, Bay and Gulf Counties, Florida. The boundaries of the unit are from the eastern boundary of Tyndall Air Force Base to Gulf County Canal in St. Joseph Bay from the MHW line seaward 1.6 km (Figure 4-4).
- LOGG-N-33 - Gulf State Park to Florida/Alabama state line, Baldwin County, Alabama; Florida/Alabama state line to Pensacola Pass, Escambia County, Florida. The boundaries of the unit are nearshore areas from the west boundary of Gulf State Park to the Pensacola Pass crossing Perido Pass and the Alabama-Florida border) from the MHW line and seaward to 1.6 km (Figure 4-5).
- LOGG-N-34 - Mobile Bay - Little Lagoon Pass, Baldwin County, Alabama. The boundaries of the unit are nearshore areas from Mobile Bay Inlet to Little Lagoon Pass from the MHW line and seaward to 1.6 km (Figure 4-5).

- LOGG-N-35 - Petit Bois Island, Jackson County, Mississippi. The boundaries of the unit are nearshore areas from Horn Island Pass to Petit Bois Pass from the MHW line and seaward to 1.6 km (Figure 4-5).
- LOGG-N-36 - Horn Island, Jackson County, Mississippi. The boundaries of the unit are nearshore areas from Dog Keys Pass to the eastern most point of the ocean facing island shore from the MHW line and seaward to 1.6 km (Figure 4-5).
- LOGG-S-2 - Gulf of Mexico *Sargassum* (Figure 4-6). The northern and western boundaries of the unit follow the 10-m depth contour starting at the mouth of South Pass of the Mississippi River proceeding west and south to the outer boundary of the U.S. EEZ. The southern boundary of the unit is the U.S. EEZ from the 10-m depth contour off of Texas to the Gulf of Mexico-Atlantic border (83°W longitude). The eastern boundary follows the 10-m depth contour from the mouth of South Pass of the Mississippi River at 28.97°N latitude, 89.15°W longitude, in a straight line to the northernmost boundary of the Loop Current (28°N latitude, 89°W longitude) and along the eastern edge of the Loop Current roughly following the velocity of 0.101-0.20 m/second as depicted by Love et al. (2013) using the Gulf of Mexico summer mean sea surface currents from 1993-2011, to the Gulf of Mexico-Atlantic border (24.58°N latitude, 83°W longitude).

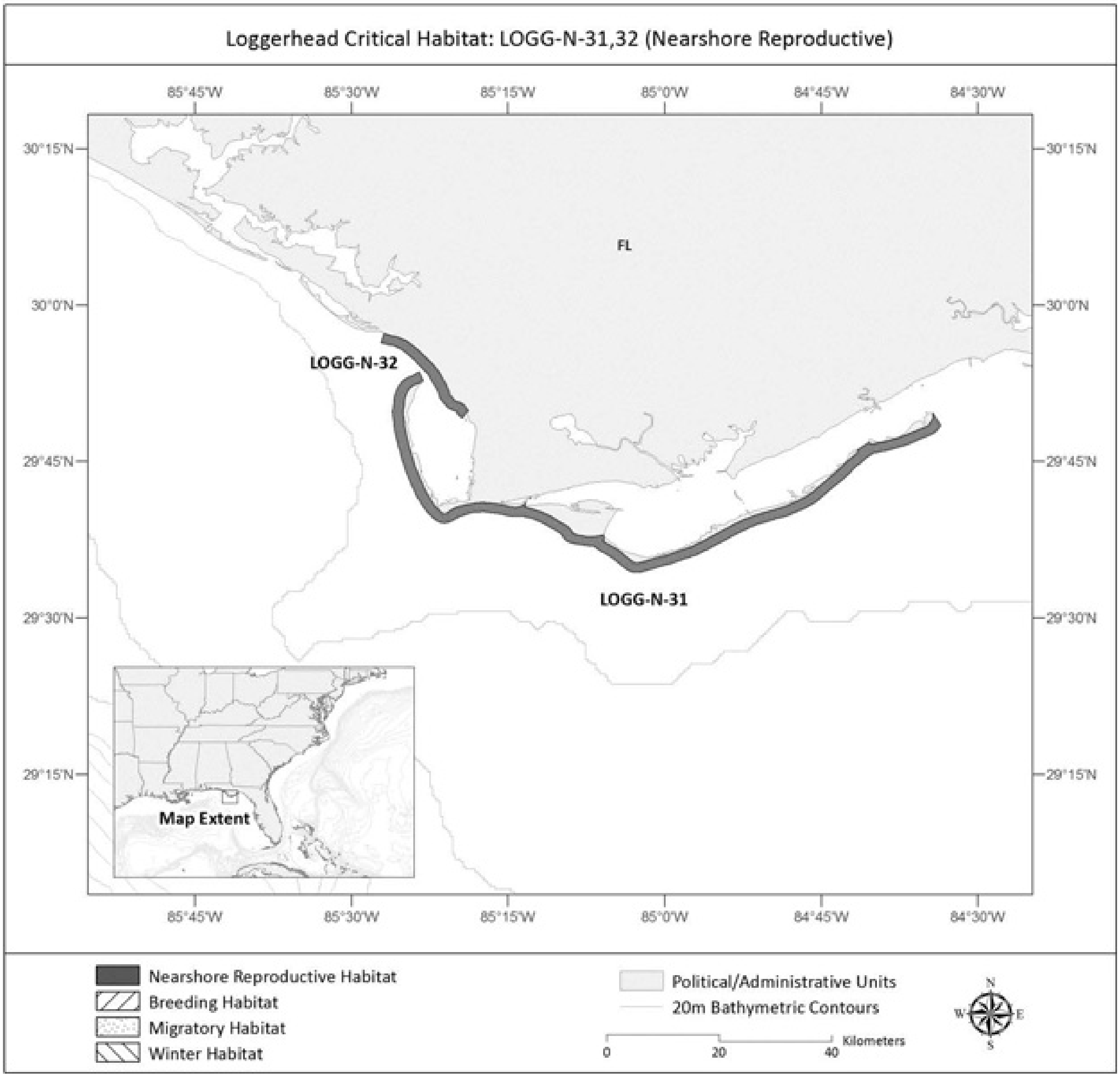


Figure 4-4. Nearshore reproductive habitat along the St. Joseph Peninsula, Florida (LOGG-N-31 and LOGG-N-32) (79 FR 39855 2014).

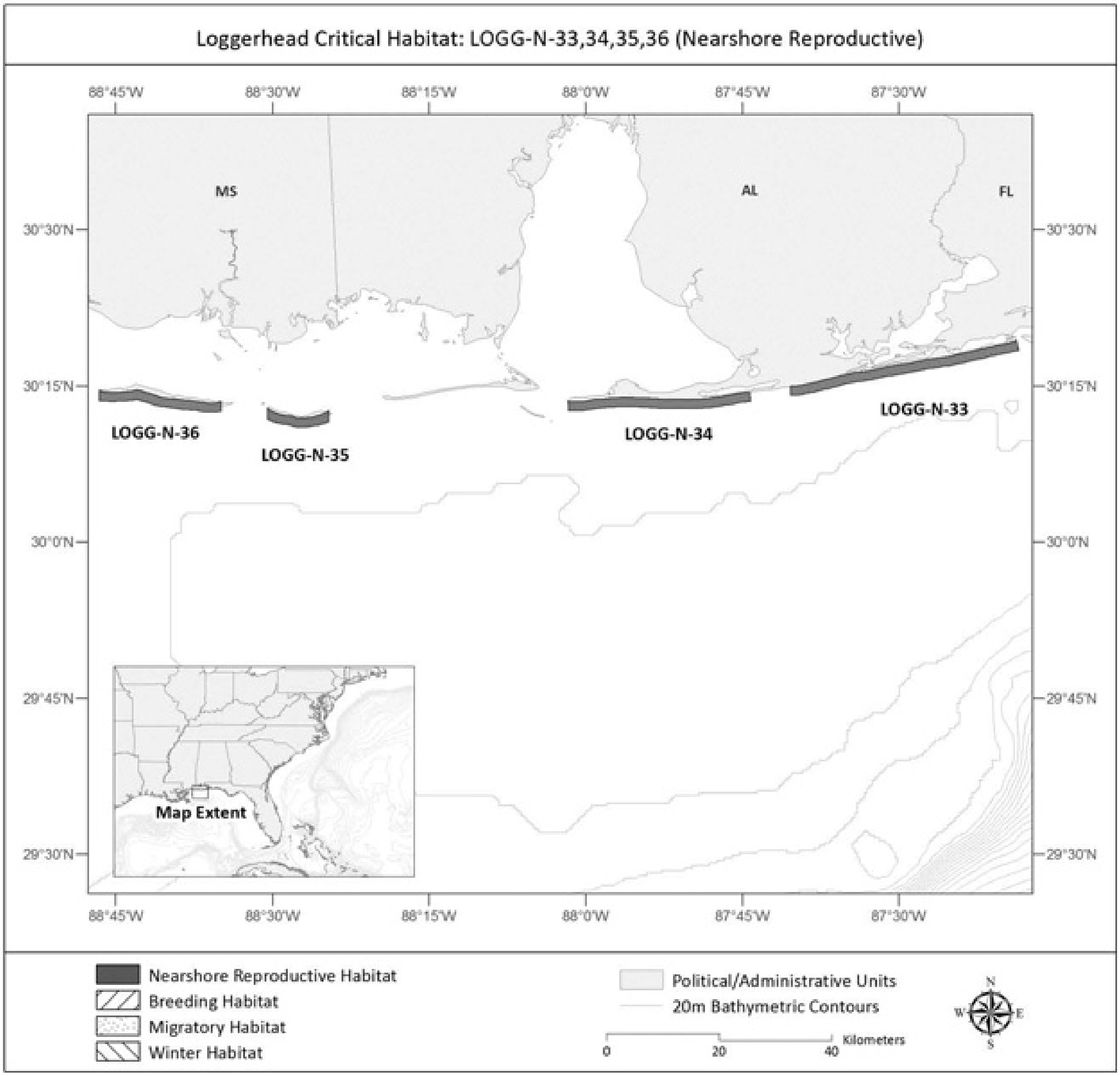


Figure 4-5. Nearshore reproductive habitat along the Northern Gulf Coast (LOGG-N-33 through LOGG-N-36) (79 FR 39855 2014).

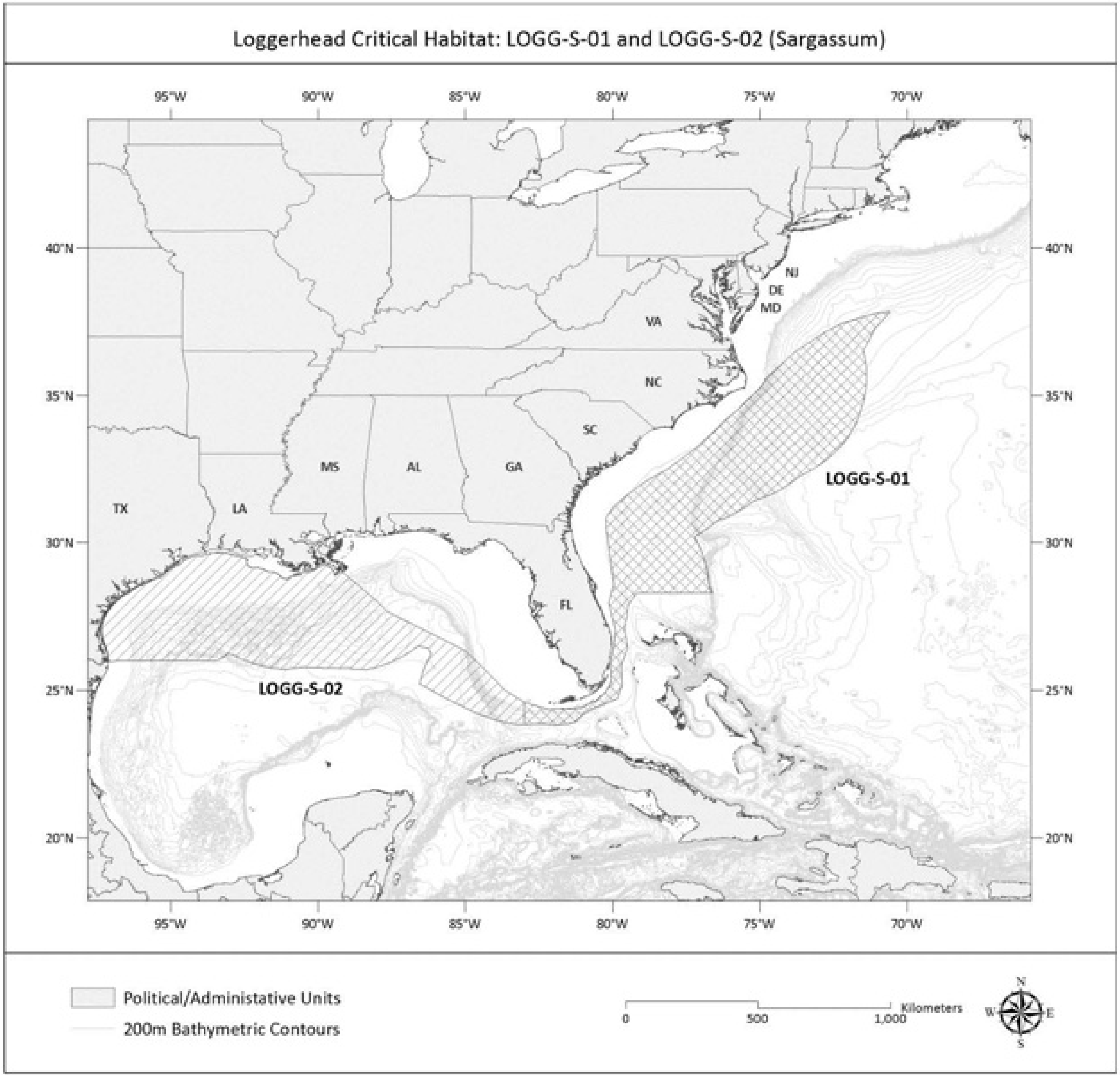


Figure 4-6. *Sargassum* critical habitat (79 FR 39855 2014).

4.2.3.6.2 Status of Critical Habitat

Due to the recent listing, NMFS is currently unaware of any adverse impacts to the essential features of the designated critical habitat units (LOGG-N-31-36 and LOGG-S-02) for loggerheads. No structures have been constructed within the nearshore reproductive habitat that (1) obstruct the free transit of nesting females and hatchlings through the surf zone and outward to open water, (2) promote notable increases in predatory species, (3) disrupt wave patterns necessary for hatchling orientation out to open waters, or (4) create excessive longshore currents that could sweep hatchling sea turtles off course as they attempt to reach open waters. Furthermore, the profile of the surf zone approach to the beach has not been altered to a degree that would preclude or deter nesting females from accessing the beach. Similarly, NMFS is not aware of any actions that have or are currently affecting *Sargassum* in critical habitat unit LOGG-S-02 since the listing. No projects have affected (1) convergence zones, downwelling areas, or other locations where concentrated components of the *Sargassum* community occur, (2) the density or concentration of *Sargassum*, or (3) the prey community associated with *Sargassum* habitat.

4.2.3.6.3 Threats to Critical Habitat in the Proposed Action Area

Potential threats to loggerhead critical habitat in the proposed action area would include any activities that adversely affect the essential features. Such potential threats include:

<u>Offshore structures</u>
The construction of large-scale offshore structures, such as breakwaters, groins, reefs, etc., has the potential to adversely affect the nearshore reproductive habitat of loggerhead critical habitat. Offshore structures have the potential to adversely affect the essential features of this critical habitat type and reduce the habitat's functionality. Orientation cues used by hatchlings as they crawl, swim through the surf, and migrate offshore (i.e. the hatchling swim frenzy) include visual cues on the beach, wave orientation in the nearshore, and later magnetic field orientation as they proceed further toward open water (Lohmann and Lohmann 2003). Any obstructions to swift egress from the beach and through the water to open ocean, whether via blockage or disorientation, and structures that aggregate potential predators to hatchlings can affect the successful movement of hatchlings through nearshore habitat. Additionally, disruption of wave angles used for orientation to open water and the formation of strong longshore currents resulting from artificial structures may adversely affect efficient movement offshore during the critical swim frenzy period. Offshore structures also have the potential to adversely affect habitat functionality for nesting female loggerheads. Habitat suitable for transit between the beach and open waters is necessary during approach to the nesting beach and return to the sea. Nesting females typically favor beach approaches with few obstructions or physical impediments that may make the entrance to nearshore waters more difficult or cause injury (Salmon 2006).

<u>Artificial lighting</u>
The impacts of artificial lighting are discussed in Section 4.2.2 as it relates to direct impacts to individual turtles. However, the consistent presence of artificial lighting at nesting beaches can also be considered habitat alteration as it adversely affects the essential habitat feature that allows safe and efficient transit through the surf zone to and from open water. While onshore lighting is a threat best addressed through consultation with the USFWS, lighting in nearshore waters is something that NMFS acknowledges as an ongoing threat to loggerhead critical habitat.

<u>Oil Spills</u>
Large-scale oil spills can adversely affect the *Sargassum* units of loggerhead critical habitat, thereby reducing their ability to provide developmental and foraging habitat for young

loggerheads. Surface oils can accumulate in mats of *Sargassum* and adversely affect the prey community that loggerhead turtles need. Additionally, oil-spill response activities, such as the use of dispersants, in-situ burning, containment booms, and skimmer operations, could further affect the essential features of this habitat by affecting prey and modifying the concentration of the algal mats.

The DWH oil spill in 2010 is known to have had a detrimental impact on *Sargassum* and the *Sargassum* community that provide essential habitat functions for loggerhead sea turtles. Heavy oil (greater than 5% coverage) affected 23% of the *Sargassum* (873 to 1,749 square kilometers [km^2]) in the northern Gulf of Mexico, resulting in a range of lost *Sargassum* area from forgone growth (loss of potential growth for that growing season from *Sargassum* killed by oil) between 4,524 and 9,392 km^2. The total combined loss of *Sargassum* from direct loss and foregone growth loss for that year's crop may have been as high as 11,100 km^2 (DWH Trustees 2015). Areas of *Sargassum* that experienced lighter oiling may still have been negatively affected, which could reduce the habitat function that would normally be provided. The indirect effects to *Sargassum*-dependent species, including sea turtles, resulting from the loss of habitat, were not determined. However, some level of detrimental impacts is expected to have occurred due to the loss of habitat functions (foraging and shelter) that would have been provided by the lost habitat.

4.2.4 Green Sea Turtle (*Chelonia mydas*)

The green sea turtle was listed as threatened under the ESA on July 28, 1978, except for the Florida and Pacific coast of Mexico breeding populations, which were listed as endangered (43 FR 32800 1978). On March 23, 2015, NMFS and USFWS published a proposed rule to remove the current species-wide ESA listing for green turtles and instead list 11 separate DPSs of green turtles (80 FR 15271 2015). Two of the proposed DPSs occur within the action area, the North Atlantic (NA) and South Atlantic (SA) DPSs, both of which are proposed to be listed as threatened. The separate endangered status of the Florida green turtle nesting assemblage would be removed and turtles from those nesting beaches would be part of the threatened NA DPS. Green turtles from the NA DPS are expected to comprise the vast majority of individuals in the action area, but SA DPS individuals may also enter the Gulf of Mexico and Atlantic waters off Florida to forage. While green turtles are currently listed globally, the analysis for green turtles presented in this Opinion is focused on green turtles in the western Atlantic Ocean, which is comprised of what would be listed as the NA and SA DPSs. Therefore, if the proposed DPS listing is finalized, the analysis in this Opinion would remain valid. Critical habitat was designated on September 2, 1998, in coastal waters surrounding Culebra Island in Puerto Rico (63 FR 46693 1998). Because the critical habitat occurs only beyond the action area, this Opinion has no further discussion of designated critical habitat for the green sea turtle.

4.2.4.1 Species Description and Distribution

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

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

Differences in mitochondrial DNA properties of green sea turtles from different nesting regions indicate there are genetic subpopulations (Bowen et al. 1992; FitzSimmons et al. 2006). Despite the genetic differences, sea turtles from separate nesting origins are commonly found mixed together on foraging grounds throughout the species' range. Such mixing occurs at extremely low levels in Hawaiian foraging areas, perhaps making this central Pacific population the most isolated of all green sea turtle populations occurring worldwide (Dutton et al. 2008).

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

The complete nesting range of green sea turtles within the southeastern United States includes sandy beaches between Texas and North Carolina, as well as the U.S. Virgin Islands and Puerto Rico (Dow et al. 2007; NMFS and USFWS 1991). The majority of green sea turtle nesting within the southeastern United States occurs in Florida (Johnson and Ehrhart 1994; Meylan et al. 1995). Principal U.S. nesting areas for green sea turtles are in eastern Florida, predominantly Brevard County south through Broward County. For more information on green sea turtle nesting in other ocean basins, refer to the 1991 publication, *Recovery Plan for the Atlantic Green Turtle* (NMFS and USFWS 1991) or the 2007 publication, *Green Sea Turtle 5-Year Status Review* (NMFS and USFWS 2007a).

4.2.4.2 Life History Information

Green sea turtles reproduce sexually, and mating occurs in the waters off nesting beaches and migratory corridors. Mature females return to their natal beaches (i.e., the same beaches where they were born) to lay eggs (Balazs 1982; Frazer and Ehrhart 1985) every 2-4 years. Males in Hawaii and the Pacific Islands are known to reproduce every year (Balazs 1983) but similar information is not available for the Atlantic and Gulf of Mexico. In the southeastern United States, females generally nest between June and September, and peak nesting occurs in June and July (Witherington and Ehrhart 1989b). During the nesting season, females nest at approximately 2-week intervals, laying an average of 3-4 clutches (Johnson and Ehrhart 1996). Clutch size often varies geographically, but mean clutch size is approximately 110-115 eggs. In Florida, clutch size averages 136 eggs (Witherington and Ehrhart 1989b). Eggs incubate for approximately 2 months before hatching. Hatchling green sea turtles are approximately 2 in (5 cm) in length and weigh approximately 0.9 ounces (25 grams). The level of anthropogenic stressors at any particular nesting site (e.g. predators, lights, and development) greatly influences survivorship. For example, more pristine and less disturbed nesting sites (e.g., along the Great Barrier Reef in Australia) show higher survivorship values than nesting sites known to be highly disturbed (e.g., Nicaragua) (Campell and Lagueux 2005; Chaloupka and Limpus 2005).

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

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

4.2.4.3 Status and Population Dynamics

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

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

By far, the largest known nesting assemblage in the western Atlantic region occurs at Tortuguero, Costa Rica. According to monitoring data on nest counts, as well as documented emergences (both nesting and non-nesting events), an increasing trend in this nesting assemblage exists since monitoring began in the early 1970s. For instance, from 1971-1975 approximately 41,250 average annual emergences were documented and this number increased to an average of 72,200 emergences from 1992-1996 (Bjorndal et al. 1999). Troëng and Rankin (2005) collected nest counts from 1999-2003 and also reported increasing trends in the population consistent with the earlier studies, with nest count data suggesting 17,402-37,290 nesting females per year (NMFS and USFWS 2007a). Modeling by Chaloupka et al. (2008) using data sets of 25 years or more resulted in an estimate of the Tortuguero, Costa Rica, population's growing at 4.9% annually.

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

In Florida, index beaches were established in 1989 to standardize data collection methods and effort on key nesting beaches. The pattern of green sea turtle nesting has generally shown biennial peaks in abundance with a positive trend during the 25 years of regular monitoring (Figure 4-7). According to data collected from Florida's index nesting beach survey from 1989-2015, green sea turtle nest counts across Florida have increased approximately ten-fold from a low of 267 in the early 1990s to a high of 27,975 in 2015. Two consecutive years of nesting declines in 2008 and 2009 were followed by increases in 2010 and 2011 and a return to the trend of biennial peaks in abundance thereafter (Figure 4-7). Modeling by Chaloupka et al. (2008) using data sets of 25 years or more has resulted in an estimate of the Florida nesting assemblage at the Archie Carr National Wildlife Refuge growing at an annual rate of 13.9%.

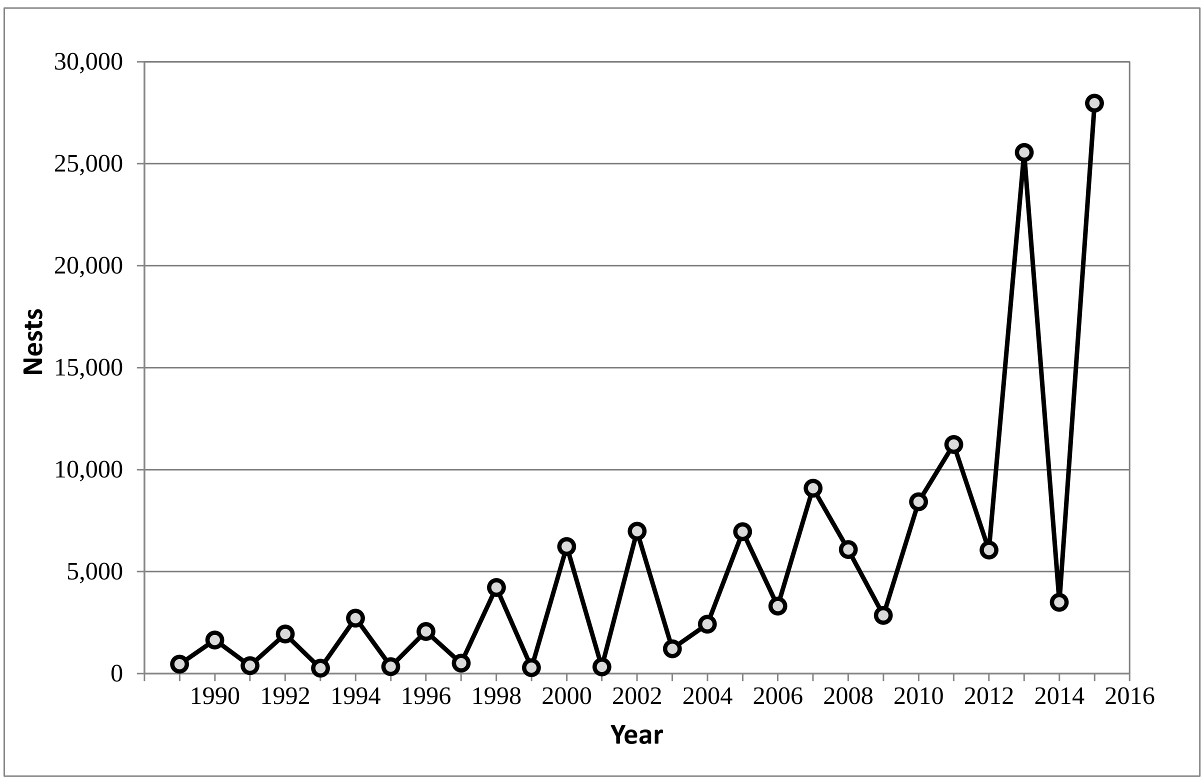


Figure 4-7. Green sea turtle nesting at Florida index beaches since 1989 (FWRI 2015)

4.2.4.4 Threats (Specific to Green Sea Turtles)

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

Green sea turtles are susceptible to natural mortality from Fibropapillomatosis (FP) disease. FP results in the growth of tumors on soft external tissues (flippers, neck, tail, etc.), the carapace, the eyes, the mouth, and internal organs (gastrointestinal tract, heart, lungs, etc.) (Aguirre et al. 2002; Herbst 1994; Jacobson et al. 1989). These tumors range in size from 0.04 in (0.1 cm) to greater than 11.81 in (30 cm) in diameter and may affect swimming, vision, feeding, and organ function (Aguirre et al. 2002; Herbst 1994; Jacobson et al. 1989). Presently, scientists are unsure of the exact mechanism causing this disease, but it is likely related to both an infectious agent, such as a virus (Herbst et al. 1995), and environmental conditions (e.g., habitat degradation, pollution, low wave energy, and shallow water) (Foley et al. 2005). FP is cosmopolitan, but it affects large numbers of animals in specific areas, including Hawaii and Florida (Herbst 1994; Jacobson 1990; Jacobson et al. 1991).

Although not a major source of mortality, cold stunning is another natural threat to green sea turtles. As temperatures fall below 46.4°F-50°F (8°-10°C), turtles may lose their ability to swim and dive, and they often float to the surface. The rate of cooling that precipitates cold stunning appears to be the primary threat (Milton and Lutz 2003). Sea turtles that overwinter in inshore waters are most susceptible to cold stunning because temperature changes are most rapid in shallow water and access to deeper, warmer water is restricted (Witherington and Ehrhart 1989a). During January 2010, an unusually large cold stunning event in the southeastern United States resulted in approximately 4,600 sea turtles, mostly greens, found cold-stunned, with hundreds found dead or dying (Roberts et al. 2014). A large cold-stunning event occurred in the western Gulf of Mexico in February 2011, resulting in approximately 1,650 green sea turtles found cold-stunned in Texas. Of these, approximately 620 were found dead or died after stranding, while approximately 1,030 turtles were rehabilitated and released. Additionally, during this same time frame, approximately 340 green sea turtles were found cold-stunned in Mexico, and approximately 300 of those were subsequently rehabilitated and released.

While oil spill impacts are discussed generally for all species in Section 4.2.1, specific impacts of the DWH oil spill on green sea turtles are considered here. While impacts to large benthic juveniles and adults were likely, those effects could not be adequately quantified. Quantifiable impacts to green sea turtles were limited to offshore small juveniles and nests/hatchlings. A total of 154,000 small juvenile greens (36.6% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. An estimated 57,300 small juveniles greens died as a result of the exposure. A total of 4 nests (580 eggs) were also translocated during response efforts, with 455 hatchlings released (the fate of which is unknown) (DWH Trustees 2015). Additional unquantified effects may have included inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources, which could lead to compromised growth and/or reproductive potential. No information is currently available to determine the extent of those impacts, if they occurred. While green turtles regularly use the northern Gulf of Mexico, they have a widespread distribution throughout the entire Gulf of Mexico, Caribbean, and Atlantic, and the proportion of the population using the northern Gulf of Mexico at any given time is relatively low. Recovery of green turtles has likely been affected by the loss of 57,300 small juveniles in the northern Gulf of Mexico as a result of the spill and will require sustained and enhanced efforts to reduce the existing threats and enhance survivorship of multiple life stages (DWH Trustees 2015).

4.2.4.5 Summary of the Status of Green Turtle and Recovery Objectives

The Recovery Plan for the U.S. Population of Atlantic Green Turtle (NMFS and USFWS 1991) specifies recovery criteria and 6 major actions needed in order to consider delisting of the species. Additional details in the Recovery Plan within the "Stepdown Outline and Narrative" provide specifics on actions that need to be taken, and goals that need to be met, to meet the broader recovery objectives and associated actions. The information provided above, and what it means about the status of the species, should be viewed in light of the following conditions as well as the detailed actions and goals provided in the Recovery Plan's "Stepdown Outline and Narrative":

Recovery Criteria

The U.S. populations of green turtles can be considered for delisting if, over a period of 25 years, the following conditions are met:

1. The level of nesting in Florida has increased to an average of 5,000 nests per year for at least 6 years. Nesting data must be based on standardized surveys.
2. At least 25% (105 km) of all available nesting beaches (420 km) is in public ownership and encompasses greater than 50% of the nesting activity.
3. A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.
4. All Priority 1 tasks have been successfully implemented.

Actions Needed

Six major actions are needed to achieve recovery:

1. Provide long-term protection to important nesting beaches.
2. Ensure at least 60% hatch success on major nesting beaches.
3. Implement effective lighting ordinances or lighting plans on nesting beaches.
4. Determine distribution and seasonal movements for all life stages in the marine environment.
5. Minimize mortality from commercial fisheries.
6. Reduce threat to population and foraging habitat from marine pollution.

4.2.5 Hawksbill Sea Turtle (*Eretmochelys imbricata*)

The hawksbill sea turtle was listed as endangered throughout its entire range on June 2, 1970 (35 FR 8491 1970) under the Endangered Species Conservation Act of 1969, a precursor to the ESA. Critical habitat was designated on September 2, 1998, in coastal waters surrounding Mona and Monito Islands in Puerto Rico (63 FR 46693 1998). Because the critical habitat occurs only beyond the action area, this Opinion has no further discussion of designated critical habitat for the hawksbill sea turtle.

4.2.5.1 Species Description and Distribution

Hawksbill sea turtles are small to medium turtles (99-150 lb on average [45 to 68 kg]), but females nesting in the Caribbean are known to weigh up to 176 lb (80 kg) (Pritchard et al. 1983). The carapace is usually serrated and has a "tortoise-shell" coloring, ranging from dark to golden brown, with streaks of orange, red, and/or black. The plastron of a hawksbill turtle is typically yellow. The head is elongated and tapers to a point, with a beak-like mouth that gives the species its name. The shape of the mouth allows the hawksbill turtle to reach into holes and crevices of coral reefs to find sponges, their primary adult food source, and other invertebrates. The shells of hatchlings are 1.7 in (42 mm) long, mostly brown, and somewhat heart-shaped (Eckert 1995; Hillis and Mackay 1989; van Dam and Sarti 1989).

Hawksbill sea turtles have a circumtropical distribution and usually occur between latitudes 30°N and 30°S in the Atlantic, Pacific, and Indian Oceans. In the western Atlantic, hawksbills are widely distributed throughout the Caribbean Sea, off the coasts of Florida and Texas in the continental United States, in the Greater and Lesser Antilles, and along the mainland of Central America south to Brazil (Amos 1989; Groombridge and Luxmoore 1989; Lund 1985; Meylan and Donnelly 1999; NMFS and USFWS 1998a; Plotkin and Amos 1990; Plotkin and Amos 1988). Hawksbills are highly migratory and use a wide range of habitats throughout their different life stages (Musick and Limpus 1997; Plotkin 2003). Adult hawksbill sea turtles are capable of migrating long distances between nesting beaches and foraging areas. For instance, a female hawksbill sea turtle tagged at Buck Island Reef National Monument (BIRNM) was later identified 1,160 miles (1,866 km) away in the Miskito Cays in Nicaragua (Spotila 2004).

Hawksbill sea turtles nest on sandy beaches throughout the tropics and subtropics. Nesting occurs in at least 70 countries, but nesting now only occurs at low densities at most rookeries compared to that of other sea turtle species (NMFS and USFWS 2007b). Meylan and Donnelly (1999) believe that the widely dispersed nesting areas and low nest densities are likely a result of overexploitation of previously large colonies that have since been depleted over time. The most significant nesting within the United States occurs on Mona Island, Puerto Rico and at BIRNM in the U.S. Virgin Islands. Although nesting within the continental United States is typically rare, it can occur along the southeastern coast of Florida and the Florida Keys. The largest hawksbill nesting population in the western Atlantic occurs in the Yucatán Peninsula of Mexico, where several thousand nests are recorded annually in the states of Campeche, Yucatán, and Quintana Roo (Garduño-Andrade et al. 1999; Spotila 2004). In the U.S. Pacific, hawksbills nest on main island beaches in Hawaii, primarily along the east coast of the island. Hawksbill nesting has also been documented in American Samoa and Guam. More information on nesting in other ocean basins may be found in the 5-year status review for the species (NMFS and USFWS 2007b).

Mitochondrial DNA studies show that reproductive populations are effectively isolated over ecological time scales (Bass et al. 1996). Substantial efforts have been made to determine the nesting population origins of hawksbill sea turtles assembled in foraging grounds, and genetic research has shown that hawksbills of multiple nesting origins commonly mix in foraging areas (Bowen and Witzell 1996). If a nesting population is decimated, it might not be replenished by sea turtles from other nesting rookeries because of the high fidelity to nesting beaches (Bass et al. 1996).

4.2.5.2 Life History Information

Growth rates of hawksbill sea turtles vary within and among populations from a low of 0.4-1.2 in (1-3 cm) per year, measured in the Indo-Pacific (Chaloupka and Limpus 1997; Mortimer et al. 2003; Mortimer et al. 2002; Whiting 2000), to a high of 2 in (5 cm) or more per year, measured at some sites in the Caribbean (Diez and Van Dam 2002; León and Diez 1999). Differences in growth rates are likely due to differences in diet and/or density of sea turtles at foraging sites and overall time spent foraging (Bjorndal and Bolten 2002; Chaloupka et al. 2004). Consistent with slow growth, age to maturity for the species is also long, taking between 20 and 40 years, depending on the region (Chaloupka and Musick 1997; Limpus and Miller 2000). Hawksbills in the western Atlantic are known to mature faster (i.e., 20 or more years) than sea turtles found in the Indo-Pacific (i.e., 30-40 years) (Boulan 1983; Boulon Jr. 1994; Diez and Van Dam 2002; Limpus and Miller 2000). Males are typically mature when their length reaches 27 in (69 cm), and females are typically mature at 30 in (75 cm) (Eckert et al. 1992; Limpus 1992).

Female hawksbills return to the beaches where they were born (natal beaches) every 2-3 years to nest (Van Dam et al. 1991; Witzell 1983) and generally lay 3-5 nests per season (Richardson et al. 1999). Clutch size for hawksbills is typically higher than that of other sea turtle species. The largest clutches recorded for any sea turtle belong to hawksbills (approximately 250 eggs per nest) (Hirth and Latif 1980) nests in the U.S. Caribbean and Florida more typically contain approximately 140 eggs that incubate for approximately 60 days before hatching (USFWS 2015b). Hatchling hawksbill sea turtles typically measure 1-2 in (2.5-5 cm) in length and weigh approximately 0.5 oz (15 g).

Hawksbills may undertake developmental migrations (migrations as immatures) and reproductive migrations that involve travel over many tens to thousands of miles (Meylan 1999a). Post-hatchlings (oceanic stage juveniles) likely live in the open ocean and take shelter in floating algal mats and drift lines of flotsam and jetsam in the Atlantic and Pacific Oceans (Musick and Limpus 1997) before returning to coastal foraging grounds. In the Caribbean, hawksbills are known to almost exclusively feed on sponges (Meylan 1988; Van Dam and Diez 1997) and occasionally on other food items, notably corallimorphs and zooanthids (León and Diez 2000; Mayor et al. 1998; Van Dam and Diez 1997).

Reproductive females undertake periodic (usually non-annual) migrations to their natal beaches to nest and exhibit a high degree of fidelity to their nest sites. Movements of reproductive males are less certain but are presumed to involve migrations to nesting beaches or to courtship stations along the migratory corridor. Hawksbills show a high fidelity to their foraging areas as well (Van Dam and Diez 1998). Foraging sites are typically areas associated with coral reefs, but hawksbills are also found around rocky outcrops and high energy shoals, which are optimum sites for sponge growth. They can also inhabit seagrass pastures in mangrove-fringed bays and estuaries, particularly along the eastern shore of continents where coral reefs are absent (Bjorndal 1997; Van Dam and Diez 1998).

4.2.5.3 Status and Population Dynamics

Nesting beach data are currently the primary information source for evaluating trends in global abundance for hawksbills. Most hawksbill populations are either declining, depleted, and/or remnants of larger aggregations (NMFS and USFWS 2007b). The largest nesting population of hawksbills occurs in Australia where approximately 2,000 hawksbills nest off the northwestern coast and about 6,000-8,000 nest off the Great Barrier Reef each year (Spotila 2004). Additionally, about 2,000 hawksbills nest each year in Indonesia, and 1,000 nest annually in the Republic of Seychelles (Spotila 2004). In the United States, hawksbills typically laid about 500-1,000 nests on Mona Island, Puerto Rico in the past (Diez and Van Dam 2007), but the numbers appear to be increasing. The Puerto Rico Department of Natural and Environmental Resources (PRDNER) counted nearly 1,600 nests in 2010 (greenantilles.com 2011). Another 56-150 nests are typically laid on Buck Island off St. Croix (Meylan 1999b; Mortimer and Donnelly 2008). Nesting also occurs to a lesser extent on beaches on Culebra Island and Vieques Island in Puerto Rico, the mainland of Puerto Rico, and additional beaches on St. Croix, St. John, and St. Thomas, U.S. Virgin Islands.

Meylan (1999b) and Mortimer and Donnelly (2008) reviewed nesting data for 83 nesting concentrations organized among 10 different ocean regions (i.e., Insular Caribbean, Western

Caribbean Mainland, Southwestern Atlantic Ocean, Eastern Atlantic Ocean, Southwestern Indian Ocean, Northwestern Indian Ocean, Central Indian Ocean, Eastern Indian Ocean, Western Pacific Ocean, Central Pacific Ocean, and Eastern Pacific Ocean). They determined historic trends (i.e., 20-100 years ago) for 58 of the 83 sites, and also determined recent abundance trends (i.e., within the past 20 years) for 42 of the 83 sites. Among the 58 sites where historic trends could be determined, all showed a declining trend during the long-term period. Among the 42 sites where recent (past 20 years) trend data were available, 10 appeared to be increasing, 3 appeared to be stable, and 29 appeared to be decreasing. With respect to regional trends, nesting populations in the Atlantic (especially in the Insular Caribbean and Western Caribbean Mainland) are generally doing better than those in the Indo-Pacific regions. For instance, 9 of the 10 sites that showed recent increases are located in the Caribbean. Buck Island and St. Croix's East End beaches support 2 remnant populations of between 17-30 nesting females per season (Hillis and Mackay 1989; Mackay 2006). While the proportion of hawksbills nesting on Buck Island represents a small proportion of the hawksbill nesting occurring in the greater Caribbean region, an increasing nesting trend occurred at that site from 2001-2006 (Mortimer and Donnelly 2008), The conservation measures implemented when BIRNM was expanded in 2001 most likely explains this increase.

Nesting concentrations in the Pacific Ocean appear to be the lowest of all regions despite the fact that the region currently supports more nesting hawksbills than either the Atlantic or Indian Oceans (Mortimer and Donnelly 2008). Even so, while still critically low in numbers, sightings of hawksbills in the eastern Pacific appear to have been increasing since 2007, though some of that increase may be attributable to better observations (Gaos et al. 2010). More information about site-specific trends can be found in the most recent 5-year status review for the species (NMFS and USFWS 2007b).

4.2.5.4 Threats (Specific to Hawksbill Sea Turtle)

Hawksbills are currently subjected to the same suite of threats on both nesting beaches and in the marine environment that affect other sea turtles (e.g., interaction with federal and state fisheries, coastal construction, oil spills, climate change affecting sex ratios) as discussed in Section 4.2.5. There are also specific threats that are of special emphasis, or are unique, for hawksbill sea turtles discussed in further detail below.

While oil spill impacts are discussed generally for all species in Section 4.2.5, specific impacts of the DWH spill on hawksbill turtles have been estimated. An estimated 8,850 small juvenile hawksbills exposures were linked to DWH oil in offshore areas, with an estimate of 615-3,090 individuals dying as a result of this exposure (DWH Trustees 2015). No quantification of large benthic juveniles or adults could be made. Additional unquantified effects may have included inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources, which could lead to compromised growth and/or reproductive potential. No information currently exists to determine the extent of those impacts, if they occurred. Although adverse impacts occurred to hawksbills, only a small percentage of the globally listed species was estimated to have been exposed to and directly affected by the DWH event because of the widespread distribution for this species.

The historical decline of the species is primarily attributed to centuries of exploitation for the beautifully patterned shell, which made it a highly attractive species to target (Parsons 1972). Hawksbills, like all sea turtles, are easy targets for capture and killing on nesting beaches. The shells from hundreds of thousands of sea turtles in the western Caribbean region were imported into the United Kingdom and France during the nineteenth and early twentieth centuries (Parsons 1972). Additionally, hundreds of thousands of sea turtles contributed to the region's trade with Japan prior to 1993 when a zero quota was imposed (Milliken and Tokunaga 1987), as cited in (Brautigam and Eckert 2006).

The continuing demand for the hawksbill shell as well as other products derived from the species (e.g., leather, oil, perfume, and cosmetics) represents an ongoing threat to its recovery. Various Caribbean nations still permit some form of legal take of hawksbill sea turtles. In the northern Caribbean, hawksbills continue to be harvested for their shells, which are often carved into hair clips, combs, jewelry, and other trinkets (Márquez M. 1990; Stapleton and Stapleton 2006). Additionally, hawksbills are harvested for their eggs and meat, while whole, stuffed sea turtles are sold as curios in the tourist trade. Hawksbill sea turtle products are openly available in the Dominican Republic and Jamaica, despite a prohibition on harvesting hawksbills and their eggs (Fleming 2001). Up to 500 hawksbills per year from 2 harvest sites within Cuba were legally captured each year until 2008 when the Cuban government placed a voluntary moratorium on the sea-turtle fishery (Carillo et al. 1999; Mortimer and Donnelly 2008). While current nesting trends are unknown, the number of nesting females is likely declining in some areas (Carillo et al. 1999; Moncada et al. 1999). International trade in the shell of this species is prohibited between countries that have signed the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), but illegal trade still occurs and remains an ongoing threat to hawksbill survival and recovery throughout its range.

Hawksbill sea turtles are particularly sensitive to losses of coral reef communities because of the strong foraging preference for sponges. Coral reefs are vulnerable to destruction and degradation caused by human activities (e.g., nutrient pollution, sedimentation, contaminant spills, vessel groundings and anchoring, recreational uses) and are also highly sensitive to the effects of climate change (e.g., higher incidences of disease and coral bleaching) (Crabbe 2008; Wilkinson 2004). Continued loss of coral reef communities (especially in the greater Caribbean region) is expected to affect hawksbill foraging and represents a major threat to the recovery of the species.

4.2.5.5 Summary of the Status of Hawksbill Sea Turtle and Recovery Objectives

The Recovery Plan for Hawksbill Turtles in the U.S. Caribbean Sea, Atlantic Ocean, and Gulf of Mexico (NMFS and USFWS 1993) specifies recovery objectives and 6 major actions needed that must be met in order to consider the delisting of the species. Additional details in the Recovery Plan within the "Stepdown Outline and Narrative" provides specifics on actions that need to be taken, and goals that need to be met, to meet the broader recovery objectives and associated actions. The information provided above, and what it means about the status of the species, should be viewed in light of the following conditions as well as the detailed actions and goals provided in the Recovery Plan's "Stepdown Outline and Narrative":

Recovery Objectives

The U.S. populations of hawksbill turtles can be considered for delisting if, over a period of 25 years, the following conditions are met:

1. The adult female population is increasing, as evidenced by a statistically significant trend in the annual number of nests on at least 5 index beaches, including Mona Island and BIRNM.
2. Habitat for at least 50% of the nesting activity that occurs in the USVI and Puerto Rico is protected in perpetuity.
3. Numbers of adults, subadults, and juveniles are increasing, as evidenced by a statistically significant trend on at least 5 key foraging areas within Puerto Rico, USVI, and Florida.
4. All Priority 1 tasks have been successfully implemented.

Actions Needed

Six major actions are needed to achieve recovery:

1. Provide long-term protection to important nesting beaches.
2. Ensure at least 75% hatching success rate on major nesting beaches.
3. Determine distribution and seasonal movements of turtles in all life stages in the marine environment.
4. Minimize threat from illegal exploitation.
5. End international trade in hawksbill products.
6. Ensure long-term protection of important foraging habitats.

4.2.6 Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)

The Kemp's ridley sea turtle was listed as endangered on December 2, 1970, under the Endangered Species Conservation Act of 1969 (35 FR 18319 1970), a precursor to the ESA. No critical habitat has been designated for Kemp's ridley sea turtle.

4.2.6.1 Species Description and Distribution

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

Kemp's ridley neritic habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 120 ft (37 m) deep. Smaller, younger juveniles occupy surface pelagic habitats in the oceanic zone. In neritic habitats, the primary prey species of the Kemp's ridley sea turtle, are swimming crabs, but may also include fish, jellyfish, and an array of mollusks.

The primary geographic range of Kemp's ridley sea turtles is the Gulf of Mexico basin through nearshore waters of the U.S. Atlantic Ocean. Juvenile Kemp's ridley sea turtles, possibly carried by oceanic currents, have been recorded as far north as Nova Scotia. The species primary nesting occurs in the Mexican state of Tamaulipas, with some nesting occurring in Texas (primarily southern Texas) and occasional nesting in the other Gulf states and the southeast U.S. The Following a precipitous decline in nest numbers during the second half of the twentieth century, nesting began slowly increasing in the late twentieth century and exponentially increasing over the past nearly 2 decades. The number of nests dropped significantly in 2010 and has been followed by fluctuating annual nest numbers. Continued monitoring is necessary to determine the longer-term trajectory.

4.2.6.2 Life History Information

Kemp's ridley sea turtles share a life history pattern similar to other sea turtles. Females lay their eggs on coastal beaches where the eggs incubate in sandy nests. After 45-58 days of embryonic development, the hatchlings emerge and swim offshore into deep water where they live a surface pelagic existence and feed and grow until recruiting to nearshore, shallower waters at a larger size. Hatchlings generally range from 1.65-1.89 in (42-48 mm) SCL, 1.26-1.73 in (32-44 mm) in width, and 0.3-0.4 lb (15-20 g) in weight. Their return to nearshore coastal habitats typically occurs around 2 years of age (Ogren 1989), but the time spent in the oceanic zone may vary from 1-4 years or perhaps more (TEWG 2000). In some areas, juvenile Kemp's ridley sea turtles migrate to deeper waters (or more southern waters along the Atlantic coast) as water temperature drops.

The average rates of growth may vary by location but generally fall within 2.2-2.9 ± 2.4 in per year (5.5-7.5 ± 6.2 cm/year) (Schmid and Barichivich 2006; Schmid and Woodhead 2000). Estimates of age to sexual maturity range from 5-16 years, with a point estimate of age to maturity of 12 years (NMFS et al. (2011). Adults likely do not grow very much after maturity. While some Kemp's ridley females nest annually, the weighted mean remigration rate for Kemp's ridley is approximately 2 years. Nesting generally occurs from April to July, and females lay approximately 2.5 nests per season with each nest containing approximately 100 eggs (Márquez M. 1994). The species primarily is in synchronized mass nesting events known as arribadas (Spanish for "arrival").

4.2.6.3 Population Dynamics

Kemp's ridley declined to a very low population level in the latter half of the twentieth century. Most of the population of adult females nest on the beaches of Rancho Nuevo, Mexico (Pritchard 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, the adult female population was estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the mid-1980s, however, nest numbers from Rancho Nuevo and adjacent Mexican beaches were below 1,000, with a low of 702 nests in 1985 (Gladys Porter Zoo 2013). Following intensive conservation efforts, nesting steadily increased through the 1990s and then accelerated during the first decade of the 21st century (Figure 4-8), which indicates the species is recovering. Following a significant decline in 2010, Kemp's ridley nests in Mexico reached a record high of 21,797 in 2012 (Gladys Porter Zoo 2013). The number of nests decreased in 2013 and 2014, with 16,385 and 11,279 nests recorded, respectively. In 2015, 14,006 nests were recorded (J. Pena, Gladys Porter Zoo, pers. comm. to M. Barnette, NMFS, October 19, 2015). Kemp's ridley nesting in the United States is concentrated primarily in south Texas, recorded nests ranged from 6 nests in 1996 to 42 in 2004, to a record high of 209 nests in 2012 (NPS 2015). Nesting in Texas has paralleled the trends observed in Mexico.

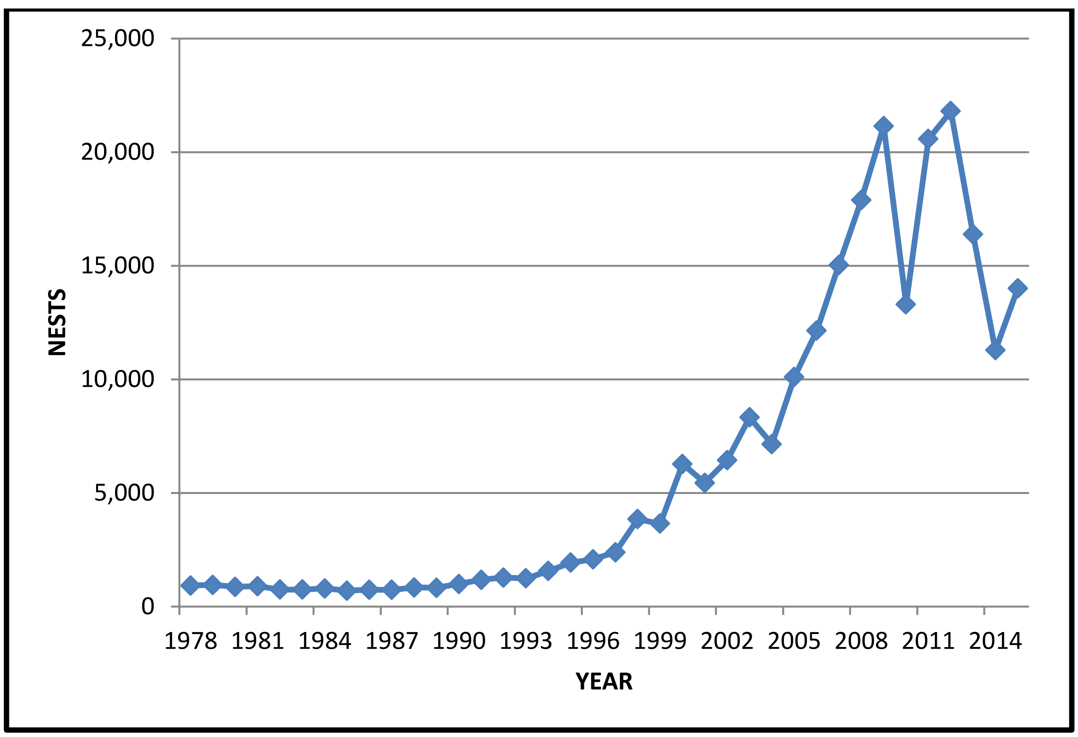


Figure 4-8. Kemp's ridley nest totals from Mexican beaches (Gladys Porter Zoo 2013)

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

4.2.6.4 Threats (Specific to Kemp's Ridley Sea Turtle)

Kemp's ridley sea turtles face many of the same threats as other sea turtle species including bycatch in fisheries, ecosystem alterations (nesting beach development, beach nourishment and shoreline stabilization, vegetation changes, etc.) pollution (plastics, petroleum products, petrochemicals, etc.), poaching, global climate change, cold-stunning, and predation. A discussion on general sea turtle threats can be found in Section 4.2.6; the remainder of this section will expand on a few of the aforementioned threats and how they may specifically impact Kemp's ridley sea turtles.

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

Nonetheless, considering that strandings typically represent only a small fraction of actual mortality, these strandings potentially represent a serious impact to local and/or regional sea turtle populations. While a definitive cause for the Spring/Summer spikes in strandings that have occurred over multiple years, both before and after the oil spill, has not been identified, necropsy results indicate a significant number of stranded turtles from these events likely perished due to forced submergence, which is commonly associated with bycatch in fisheries (B. Stacy, NMFS, pers. comm. to M. Barnette, NMFS, March 2012). Yet, available information indicates fishery effort was extremely limited during some of the Spring/Summer stranding events.

In response to these strandings and due to concerns regarding bycatch in the shrimp trawl fishery, fishery observer effort was partially shifted to the skimmer trawl fishery during the summer of 2012. During May-July of that year, observers reported 24 sea turtle interactions in the skimmer trawl fishery; all but one turtle were identified as Kemp's ridleys (1 sea turtle was an unidentified hardshell turtle). Encountered sea turtles were all very small, juvenile specimens ranging from 7.6-19.0 in (19.4-48.3 cm) curved carapace length (CCL), and all sea turtles were released alive. The small average size of encountered Kemp's ridleys introduces a potential conservation issue, as over 50% of these reported sea turtles could potentially pass through the maximum 4-in bar spacing of TEDs currently required in the otter trawl component of shrimp fishery. Due to this issue, a proposed 2012 Rule to require TEDs in the skimmer trawl fishery (77 FR 27411 2012) was not implemented. Bycatch in trawl fisheries, especially the skimmer trawl fishery that is not currently required to use TEDs continues to be a significant conservation concern for the species.

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

A total of 217,000 small juvenile Kemp's ridleys were estimated to have been exposed to oil. The Trustees estimated total abundance of oceanic juvenile Kemp's ridleys during 2010 as approximately 430,000 individuals and approximately half these were estimated to have been exposed to oil. Of these, up to 90,300 are estimated to have died as a result of the DWH. Based on estimated total abundance of oceanic juvenile Kemp's ridleys during 2010, approximately

20% were killed during that year. Impacts to large juveniles (3+ years old) and adults were also high. An estimated 21,990 of these turtles were exposed to oil (about 22% of the total estimated population for those age classes), with an estimated 3,110 mortalities (an estimated 3% of the population for those age classes). The loss of near-mature and mature females could have contributed to the documented post-2010 decline in the previously predicted nesting trajectory. The estimated number of unrealized Kemp's ridley nests is between 1,300 and 2,000, which translates to approximately 65,000 and 95,000 unrealized hatchlings (DWH Trustees 2015). However, this is a minimum estimate because of the overall potential effect of DWH oil on turtles, their prey, and their habitats might have delayed or reduced reproduction in subsequent years. These sublethal effects could have slowed growth and maturation rates, increased remigration intervals, and/or decreased clutch frequency (number of nests per female per nesting season). The nature of the DWH effect on Kemp's ridley nesting abundance and associated hatchling production after 2010 requires further evaluation. Additionally, 483 eggs from 5 nests were translocated, with 125 hatchlings ultimately released (DWH Trustees 2015).

Additional unquantified effects may have included inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources, which could lead to compromised growth and/or reproductive potential. No information is currently available to determine the extent of those impacts, if they occurred. The DWH spill event resulted in large losses to the Kemp's ridley population across various age classes and likely had an important population-level effect on the species. However, we do not, at this time, have a complete understanding of those impacts on the population trajectory for the species into the future.

4.2.6.5 Summary of the Status of the Kemp's Ridley Sea Turtle and Recovery Objectives

The Bi-National Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*), Second Revision (NMFS et al. 2011) (Bi-National Recovery Plan) specifies recovery criteria that must be met in order to consider the downlisting or delisting of the species. The information provided above, and what it means about the status of the species, should be viewed in light of the recovery criteria.

The Recovery Plan has specific demographic criteria for recovery, including nest and nesting female criteria for each recovery unit:

Downlisting Criteria

Demographic Criteria

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

2. Recruitment of at least 300,000[2] hatchlings to the marine environment per season at the 3 primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) in Mexico is attained to ensure a minimum level of known production through *in situ* incubation, incubation in corrals, or a combination of both.

Delisting Criteria

Demographic Criteria

1. An average population of at least 40,000 (Hildebrand 1963) nesting females per season (as measured by clutch frequency per female per season and annual nest counts) over a 6-year period distributed among nesting beaches in Mexico and the U.S. is attained. Methodology and capacity to ensure accurate nesting female counts have been developed and implemented.
2. Ensure average annual recruitment of hatchlings over a 6-year period from *in situ* nests and beach corrals is sufficient to maintain a population of at least 40,000 nesting females per nesting season distributed among nesting beaches in Mexico and the U.S into the future. This criterion may rely on massive synchronous nesting events (i.e., arribadas) that will swamp predators as well as rely on supplemental protection in corrals and facilities.

Additionally, there are recovery criteria related to the listing factors that were used when determining the listing status of the species, including: Present or Threatened Destruction, Modification, or Curtailment of a Species' Habitat or Range; Overutilization for Commercial, Recreational, Scientific, or Educational Purposes; Disease or Predation; Inadequacy of Existing Regulatory Mechanisms; and Other Natural or Manmade Factors Affecting Its Continued Existence. The listing factors' recovery criteria address the threats described above. For the specific listing factors' recovery criteria, see the Bi-National Recovery Plan for the Kemp's Ridley Sea Turtle.

4.2.7 Leatherback Sea Turtles (*Dermochelys coriacea*)

The leatherback sea turtle was listed as endangered throughout its range on June 2, 1970, (35 FR 8491 1970) under the Endangered Species Conservation Act of 1969. Critical habitat was designated on March 23, 1979, in coastal waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands (44 FR 17710 1979), and additional critical habitat was designated in the Pacific Ocean on January 26, 2012 (77 FR 4170 2012). Because the critical habitat occurs only beyond the action area, this Opinion has no further discussion of designated critical habitat for the leatherback sea turtle.

4.2.7.1 Species Description and Distribution

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

Unlike other sea turtles, leatherbacks have a unique physiology that enables them to inhabit a wider range of thermal habitats than other sea turtle species. These adaptations include a countercurrent circulatory system (Greer et al. 1973),[7] a thick layer of insulating fat (Davenport et al. 1990; Goff and Lien 1988), gigantothermy (Paladino et al. 1990),[8] and the ability to increase their body temperature through increased metabolic activity (Bostrom and Jones 2007; Southwood et al. 2005). These adaptations allow leatherbacks to inhabit a wide range of temperatures and thus a broad north to south geographic range, (NMFS and USFWS 1995). Leatherbacks can migrate more than 6,000 mi (10,000 km) in a single year (Benson et al. 2007a; Benson et al. 2011; Eckert 2006; Eckert et al. 2006). They search for food between latitudes 71°N and 47°S, in all oceans, and travel extensively to and from their tropical nesting beaches. In the Atlantic Ocean, leatherbacks have been recorded as far north as Newfoundland, Canada, and Norway, and as far south as Uruguay, Argentina, and South Africa (NMFS 2001c).

While leatherbacks also forage in shallower coastal waters, they appear to prefer the open ocean at all life stages (Heppell et al. 2003b). Leatherbacks have pointed tooth-like cusps and sharp-edged jaws that are adapted for a diet of soft-bodied prey such as jellyfish and salps. A leatherback's mouth and throat also have backward-pointing spines that help retain jelly-like prey. Primary prey items (e.g., medusae, siphonophores, and salps) occur commonly in temperate and northern or sub-arctic latitudes, and prey distribution likely has a strong influence on leatherback distribution in these areas (Plotkin 2003). Leatherbacks are known to be deep divers, with recorded depths in excess of 0.5 mi (Eckert et al. 1989).

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

4.2.7.2 Life History Information

[7] Countercurrent circulation is a highly efficient means of minimizing heat loss through the skin's surface because heat is recycled. For example, a countercurrent circulation system often has an artery containing warm blood from the heart surrounded by a bundle of veins containing cool blood from the body's surface. As the warm blood flows away from the heart, it passes much of its heat to the colder blood returning to the heart via the veins. This conserves heat by recirculating it back to the body's core.
[8] "Gigantothermy" refers to a condition when an animal has relatively high volume compared to its surface area, and as a result, it loses less heat.

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

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

Female leatherbacks typically nest on sandy, tropical beaches at intervals of 2-4 years (Garcia M. and Sarti 2000; McDonald and Dutton 1996; Spotila et al. 2000). Unlike other sea turtle species, female leatherbacks do not always nest at the same beach year after year; some females may even nest at different beaches during the same year (Dutton et al. 2005; Eckert 1989; Keinath and Musick 1993; Spotila et al. 1996). Individual female leatherbacks have been observed nesting across 25 nesting seasons (years) (Hughes 1996). Females usually lay up to 10 nests during the 3-6 month nesting season (March through July in the United States), typically 8-12 days apart, with 100 eggs or more per nest (Eckert et al. 2012; Eckert 1989; Maharaj 2004; Matos 1986; Stewart and Johnson 2006; Tucker 1988). Typically 30% of the eggs are infertile (Eckert 1989; Eckert et al. 1984; Maharaj 2004; Matos 1986; Stewart and Johnson 2006; Tucker 1988). Emergence success is approximately 50% worldwide (Eckert et al. 2012), which is lower than reported for hardshell species (Miller 1997). In the United States Virgin Islands, emergence success ranges from 54%-72% (Eckert and Eckert 1990; Stewart and Johnson 2006; Tucker 1988). Eggs hatch after 60-65 days, and the hatchlings have white striping along the ridges of their backs and on the edges of the flippers. Leatherback hatchlings weigh approximately 1.5-2 ounces (40-50 g), and are approximately 2-3 inches (51-76 mm) in length, with fore flippers as long as their bodies.

In the Atlantic, the sex ratio appears to be skewed toward females. Sixty percent of leatherbacks stranded along the U.S. Atlantic and Gulf of Mexico coasts were female (TEWG 2007). James et al. (2007) collected size and sex data from large subadult and adult leatherbacks off Nova Scotia and also concluded a bias toward females (1.86:1.FM).

The survival and mortality rates for leatherbacks are difficult to estimate and vary by location. For example, the annual mortality rate for Pacific leatherbacks that nested at Playa Grande, Costa

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

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

4.2.7.3 Status and Population Dynamics

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

The Southern Caribbean/Guianas stock is the largest known Atlantic leatherback nesting aggregation (TEWG 2007). This area includes the Guianas (Guyana, Suriname, and French Guiana), Trinidad, Dominica, and Venezuela, with most of the nesting occurring in the Guianas and Trinidad. The Southern Caribbean/Guianas stock of leatherbacks was identified after genetics studies indicated that animals from the Guianas (and possibly Trinidad) should be viewed as a single population. Using nesting females as a proxy for population, the TEWG (2007) determined that the Southern Caribbean/Guianas stock had demonstrated a long-term, positive population growth rate. TEWG observed positive population growth within major nesting areas for the stock, including Trinidad, Guyana, and the combined beaches of Suriname and French Guiana was estimated (TEWG 2007). More specifically, Wallace et al. (2014) report an estimated three-generation abundance change of +3%, +20,800%, +1,778%, and +6% in Trinidad, Guyana, Suriname, and French Guiana, respectively.

Researchers believe the cyclical pattern of beach erosion and then reformation has affected leatherback nesting patterns in the Guianas. For example, between 1979 and 1986, the number of leatherback nests in French Guiana had increased by about 15% annually (NMFS 2001c). The increase was followed by a 15% annual nesting decline, which corresponded with the erosion of beaches in French Guiana and increased nesting in Suriname. This pattern suggests that the declines observed since 1987 might actually be a part of a nesting cycle that coincides with cyclic beach erosion in Guiana (Schulz 1975). Researchers think that the cycle of erosion and reformation of beaches may have changed where leatherbacks nest throughout this region. The idea of shifting nesting beach locations was supported by increased nesting in Suriname,[9] while the number of nests was declining at beaches in Guiana (Hilterman et al. 2003) suggesting that the long-term trend for the overall Suriname and French Guiana population was increasing.

The Western Caribbean stock includes nesting beaches from Honduras to Colombia. Across the Western Caribbean, nesting is most prevalent in Costa Rica, Panama, and the Gulf of Uraba in Colombia (Duque et al. 2000). The Caribbean coastline of Costa Rica and extending through Chiriquí Beach, Panama, represents the fourth largest known leatherback rookery in the world (Troëng et al. 2004). Examination of data from index nesting beaches in Tortuguero, Gandoca, and Pacuaré in Costa Rica indicates that the nesting population likely was not growing over the 1995-2005 time series (TEWG 2007). Other modeling of the nesting data for Tortuguero indicates a possible 67.8% decline between 1995 and 2006 (Troëng et al. 2007). Wallace et al. (2014) report an estimated three-generation abundance change of -72%, -24%, and +6% for Tortuguero, Gandoca, and Pacuare, respectively.

Nesting data for the Northern Caribbean stock is available from Puerto Rico, St. Croix (U.S. Virgin Islands), and the British Virgin Islands (Tortola). In Puerto Rico, the primary nesting beaches are at Fajardo and on the island of Culebra. Nesting between 1978 and 2005 has ranged between 469-882 nests, and the population has been growing since 1978, with an overall annual growth rate of 1.1% (TEWG 2007). Wallace et al. (2014) report an estimated three-generation abundance change of -4% and +5,583% at Culebra and Fajardo, respectively. At the primary nesting beach on St. Croix, the Sandy Point National Wildlife Refuge, nesting has varied from a few hundred nests to a high of 1,008 in 2001, and the average annual growth rate has been approximately 1.1% from 1986-2004 (TEWG 2007). From 2006-2010, Wallace et al. (2014) report an annual growth rate of +7.5% in St. Croix and a three-generation abundance change of +1,058%. Nesting in Tortola is limited, but has been increasing from 0-6 nests per year in the late 1980s to 35-65 per year in the 2000s, with an annual growth rate of approximately 1.2% between 1994 and 2004 (TEWG 2007).

The Florida nesting assemblage nests primarily along the eastern coast of Florida, with total nests between 800-900 per year in the 2000s following nesting totals fewer than 100 nests per

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

year in the 1980s (Florida Fish and Wildlife Conservation Commission, unpublished data). Using data from the index nesting beach surveys, the TEWG (TEWG 2007) estimated a significant annual nesting growth rate of 1.17% between 1989 and 2005. The Florida Fish and Wildlife Conservation Commission (FWC) Index Nesting Beach Survey Data generally indicate biennial peaks in nesting abundance beginning in 2007 (Figure 4-9 and Table 4-3). A similar pattern was also observed statewide (Table 4-3). This up-and-down pattern is thought to be a result of the cyclical nature of leatherback nesting, similar to the biennial cycle of green turtle nesting. Overall, the trend shows growth on Florida's east coast beaches. Wallace et al. (2014) report an annual growth rate of 9.7% and a three-generation abundance change of +1,863%.

Table 4-3. Number of Leatherback Sea Turtle Nests in Florida from FWC Index Beach and Statewide Sea Turtle Nesting Databases

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

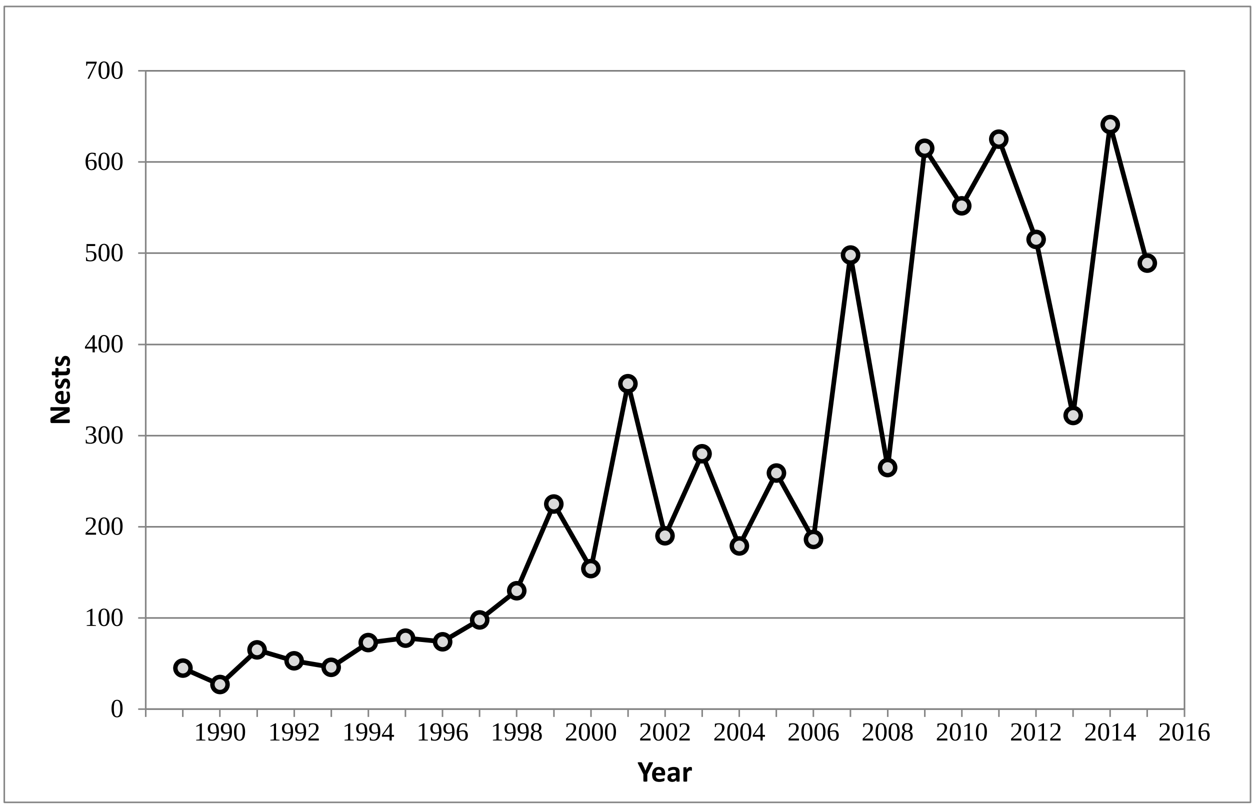


Figure 4-9. Leatherback sea turtle nesting at Florida index beaches since 1989 (FWRI 2014)

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

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

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

4.2.7.4 Threats (Specific to Leatherback Sea Turtles)

Of all sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear, especially gillnet and pot/trap lines. This may be because of their body type (large size, long pectoral flippers, and lack of a hard shell), their foraging behavior, attraction to gelatinous organisms and algae that may aggregate near buoys and buoy lines at or near the surface, their method of locomotion, and/or perhaps their attraction to the lightsticks used to attract target species in longline fisheries. Zug and Parham (1996) point out that a combination of the loss of long-lived adults in fishery-related mortalities and a lack of recruitment from intense egg harvesting in some areas has caused a sharp decline in leatherback sea turtle populations and represents a significant threat to survival and recovery of the species worldwide.

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

As discussed in Section 4.2.2.6, global climate change can be expected to have various impacts on all sea turtles, including leatherbacks. Global climate change is likely to also influence the distribution and abundance of jellyfish, the primary prey item of leatherbacks (NMFS and USFWS 2007d). Several studies have shown leatherback distribution is influenced by jellyfish abundance (e.g., Houghton et al. 2006; Witt et al. 2007; Witt et al. 2006), however, more studies need to be done to monitor how changes to prey items affect distribution and foraging success of leatherbacks so population-level effects can be determined.

While oil spill impacts are discussed generally for all species in Section 4.2.2, specific impacts of the DWH spill on leatherback sea turtles are considered here. Available information indicates leatherback sea turtles were affected by the spill to a lesser degree than other sea turtle species l, at least directly. Leatherbacks were documented in the spill area, but the number of affected leatherbacks was not able to be estimated. However, given that the northern Gulf of Mexico is important habitat for leatherback migration and foraging (TEWG 2007) and documentation of leatherbacks in the DWH oil spill zone during the spill period, the Trustees concluded that leatherbacks were exposed to DWH oil, and some portion of those exposed leatherbacks likely died. Potential DWH-related impacts to leatherback sea turtles include direct oiling or contact with dispersants from surface and subsurface oil and dispersants, inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources which could lead to compromised growth and/or reproductive potential. No current information is available to determine the extent of those impacts, if they occurred. Although adverse impacts likely occurred to leatherbacks, the relative proportion of the population that is expected to have been exposed to and directly affected by the DWH event may be relatively low.

4.2.7.5 Summary of the Status of the Leatherback Sea Turtle and Recovery Objectives

The Recovery Plan for Leatherback Turtles in the U.S. Caribbean, Atlantic, and Gulf of Mexico (NMFS and USFWS 1992) specifies recovery objectives that must be met in order to consider the delisting of the species. Additional details in the Recovery Plan within the “Stepdown Outline and Narrative” provide specifics on actions that need to be taken, and goals that need to be met, to meet the broad Recovery Objectives. The information provided above, and what it means about the status of the species, should be viewed in light of the Recovery Objectives below as well as the actions and goals provided in the Recovery Plan’s “Stepdown Outline and Narrative”:

<u>Recovery Objectives</u>

The U.S. population of leatherbacks can be considered for delisting if the following conditions are met:

1. The adult female population increases over the next 25 years, as evidenced by a statistically significant trend in the number of nests at Culebra, Puerto Rico, St. Croix, USVI, and along the east coast of Florida.
2. Nesting habitat encompassing at least 75% of nesting activity in USVI, Puerto Rico, and Florida is in public ownership.
3. All Priority 1 tasks have been successfully implemented.

4.2.8 Gulf Sturgeon (Acipenser oxyrinchus desotoi)

Gulf sturgeon (*Acipenser oxyrinchus desotoi*) were listed as threatened effective October 30, 1991 (56 FR 49653 1991). Three ESA factors were found to contribute to their threatened status: Present or threatened destruction, modification or curtailment of habitat or range; overutilization for commercial, recreational, scientific, or educational purposes; and other natural or manmade factors affecting its continued existence. Generally, the listing concluded that while Gulf sturgeon occurred, at least occasionally, throughout its range, the numbers were greatly reduced and they had been extirpated in some portions of the range. Specific habitat threats in the 1991 listing include the presence of dams preventing fish from reaching spawning areas, dredging, de-snagging, and spoil deposition. Other threats in the listing include historic overfishing, incidental take by commercial fishers, and slow rate of maturity that limit recolonization of extirpated populations.

NMFS and the U.S. Wildlife Service (USFWS) jointly manage Gulf sturgeon. Jurisdiction by the 2 agencies is separated generally at River Mile 0 with USFWS responsible for riverine areas and NMFS for marine areas. In estuarine habitats, responsibility is divided based on the action agency involved. USFWS consults with the Department of Transportation, the Environmental Protection Agency, the U.S. Coast Guard, and the Federal Emergency Management Agency; NMFS consults with the Department of Defense, U.S. Army Corps of Engineers, the Bureau of Ocean Energy Management, and any other federal agencies not specifically mentioned at 50 CFR 226.214. In 2009, NMFS and USFWS conducted a 5-year review and found Gulf sturgeon continued to meet the definition of a threatened species (USFWS and NMFS 2009). New information regarding threats to the Gulf sturgeon were included in the 5-year review (USFWS and NMFS 2009),and identified progress at relieving threats identified in the 1991 listing. Emerging threats to Gulf sturgeon identified in the 2009 5-year review include: point and non-point discharge; climate change; hurricanes; collisions with boats; and red tide (USFWS and NMFS 2009).

4.2.8.1 Species Description and Distribution

The Gulf sturgeon is a subspecies of the Atlantic sturgeon (*Acipenser oxyrinchus*). Gulf sturgeon are nearly cylindrical fish with an extended snout, vertical mouth, 5 rows of scutes (bony plates surrounding the body), 4 chin barbels (slender, whisker-like feelers extending from the head used for touch and taste), and a heterocercal (upper lobe is longer than lower) caudal fin (tail fin). Adults range from 6-8 ft in length and weigh up to 200 lb; females grow larger than males. Gulf sturgeon spawn in rivers in the spring and spend the summer months in the riverine habitat between the upstream spawning areas and the estuary. Subadults (90-135 cm Total Length [TL]) and adults (> 135 cm TL) do not forage while in the river (Mason Jr. and Clugston 1993). In the fall, both subadults and adults move into estuarine waters and forage extensively: adults will move into marine waters in the winter but younger size classes remain in the estuarine and freshwater habitats until about age 2 or 3. Large juveniles and adults feed primarily on benthic macroinvertebrates including lancelets, brachiopods, amphipods and other crustaceans, polychaetes, and gastropods. Smaller Gulf sturgeon feed on benthic infauna such as amphipods, grass shrimp, isopods, oligochaetes, polychaetes, and chironomid and ceratopogonid larvae, found in the intertidal zone.

Historically, Gulf sturgeon occurred from the Mississippi River east to Tampa Bay. Sporadic occurrences were recorded as far west as the Rio Grande River in Texas and Mexico, and to Florida Bay in the east (Reynolds 1993; Wooley and Crateau 1985). The subspecies' present range extends from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi respectively, east to the Suwannee River in Florida. Based on current data, reproducing populations continue to be evident in 7 river systems (USFWS and NMFS 2009): Pearl, Pascagoula, Escambia, Yellow/Blackwater, Choctawhatchee, Apalachicola, and Suwanee Rivers). With the goal of identifying and maintaining genetic diversity and integrity, these 7 reproducing riverine populations formed the basis of the critical habitat designation in 2003, where habitat essential for the conservation of the species was identified (68 FR 13370 2003). This designation included critical habitat units within the major river systems that support the 7 reproducing populations with the associated marine and estuarine habitats. In addition to the 7 spawning riverine populations, Gulf sturgeon are also known to inhabit the Mississippi, Mobile and Ochlocknee Rivers.

Because the Gulf sturgeon were listed prior to the 1996 joint USFWS-NMFS policy (61 FR 4722 1996) on determining and listing Distinct Population Segments (DPS), the 2009 5-Year Review (USFWS and NMFS 2009) evaluated that listing of the Gulf sturgeon as a species and determined the current listing is valid based on the best available information. The 5-Year Review noted: (1) there is a lack of information to separate the species into population segments in accordance with the DPS policy across various genetic/geographic subdivisions; (2) data from ongoing genetics analyses and tagging studies may allow us to determine whether Gulf sturgeon DPSs are identifiable; and (3) an analysis and review of the species should be conducted in the future to determine if the application of the DPS policy could be appropriate for the Gulf sturgeon. NMFS has been actively working to collect information to describe the population structure of Gulf sturgeon by: (1) providing funds to analyze Gulf sturgeon tissue samples, (2) requiring tissue samples be collected and sent to the laboratory through incidental take permits; and (3) recommending sampling in geographic areas/rivers to balance sample size. It is the intention of NMFS the subsequent analysis or review of the status of the Gulf sturgeon will update abundance metrics and population structure for each riverine unit in order to inform the status of the listed species, and further investigate the influence of riverine populations on overall genetic structure for the species.

4.2.8.2 Life History

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

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

Tagging studies confirm that Gulf sturgeon exhibit a high degree of river fidelity (Carr 1983) with each stock exchanging fewer than 1 mature female per generation (Waldman and Wirgin 1998). Of 4,100 fish tagged, 21% (860 of 4,100 fish) were later recaptured in the river of their initial collection, 8 fish (0.2%) moved between river systems, and the remaining fish (78.8%) have not yet been recaptured (USFWS and NMFS 2009). There is no information documenting the presence of spawning adults in non-natal rivers. However, there is some evidence of movements by both male and female Gulf sturgeon (n = 22) from natal rivers into non-natal rivers (Carr et al. 1996; Craft et al. 2001; Fox et al. 2002; Ross et al. 2001; Wooley and Crateau 1985). Tagging studies confirm that Gulf sturgeon exhibit a high degree of river fidelity (Carr 1983) with each stock exchanging less fewer than 1one mature female per generation (Waldman and Wirgin 1998). Of 4,100 fish tagged, 21% (860 of 4,100 fish) were later recaptured in the river of their initial collection, 8 fish (0.2%) moved between river systems, and the remaining fish (78.8%) have not yet been recaptured (USFWS and NMFS 2009). There is no information documenting the presence of spawning adults in non-natal rivers. However, there is some evidence of movements by both male and female Gulf sturgeon (n = 22) from natal rivers into non-natal rivers (Carr et al. 1996; Craft et al. 2001; Fox et al. 2002; Ross et al. 2001; Wooley and Crateau 1985). Genetic studies confirm that Gulf sturgeon exhibit river-specific fidelity. Stabile et al. (1996) analyzed tissue taken from Gulf sturgeon in 8 drainages along the Gulf of Mexico for genetic diversity and noted significant differences among Gulf sturgeon stocks, which suggests region-specific affinities and likely river-specific fidelity. Ongoing genetic analyses continue.

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

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

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

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

4.2.8.3 Status and Populations

Abundance of Gulf sturgeon is measured at the riverine scale. Given the variety of survey methods and gears utilized to estimate abundance both within and across rivers, coupled with surveys regularly targeting only particular geographic areas within a river (e.g., a summer holding area), it is difficult to quantitatively assess abundance of Gulf sturgeon both at a riverine and species scale. Some gears and surveys target specific age-classes and some estimates include only a portion of the population. Therefore, surveys over time within and across rivers are not easily comparable due to key differences in methods and assumptions. Effects of these sampling differences were discussed by Pine III and Martell (2009). Pine III and Martell (2009).The most recent peer-reviewed report on the status of the Gulf sturgeon was published in 2009 (NMFS and USFWS 2009) that included an extensive appendix that systematically reported mean abundance estimates, with confidence intervals, over time for each riverine population. The most recent abundance estimates reported in the 5-Year Review (NMFS and USFWS 2009) by river is presented in Table 4-4. For most of those abundance estimates, the large confidence intervals, indicating great uncertainty, around the mean estimates reflect the low capture probability in mark-recapture survey. Given the difficulty in comparing surveys over time, abundance trends were described qualitatively in the peer-reviewed 5-Year Status Review (NMFS and USFWS 2009). Since then, a draft report with updated abundance estimates for 3 rivers (Suwannee, Apalachicola, and Yellow) was written as part of the DWH injury assessment (USFWS 2015a) along with a novel abundance estimate for the Blackwater River; unfortunately, those data used to calculate each new estimate are cited as “unpublished.” NMFS and USFWS will continue to work together on data collection and incorporating new peer reviewed data in future status reviews of Gulf sturgeon.

Table 4-4. Gulf Sturgeon Abundance Estimates by River and Year
(Confidence intervals [CI] and source for the 7 known reproducing populations as presented in the 5-Year Review (USFWS and NMFS 2009))

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

Published estimates for Gulf sturgeon abundance generally range from several hundred individuals in the Pearl River to tens of thousands in the Suwanee River (USFWS and NMFS 2009). A population model was developed in 2009 to estimate current and historical abundance of Gulf sturgeon (Pine III and Martell 2009) in order to assess relative population status from a conservative perspective. Generally, Gulf sturgeon populations in the eastern part of the range (Suwannee, Apalachicola Choctawhatchee) appear to be larger in number and relatively stable or have a slightly increasing population trend when compared to the riverine populations in the western portion of the range (Pearl and Pascagoula Rivers).

Population size of the Pearl and Pascagoula are likely much lower than those in the eastern part of the range with unknown population trends given the paucity of surveys (USFWS and NMFS 2009). Based on the 5-year status review, NMFS believes the cumulative total number of adult Gulf sturgeon is between 5,000 and 10,000 with greater numbers in the east compared to the western part of the range.

The most recent stock assessment for Gulf sturgeon highlighted the need to standardize sampling methods utilized as estimated mortality rates from the tagging data estimated in population trajectories that could be increasing or decreasing (Pine III and Martell 2009). NMFS and USWS initiated a 5-year standardized acoustic telemetry program in 2010 in order to develop temporal and spatial consistency in Gulf sturgeon monitoring programs. Acoustic signatures received on remote receivers across the range provided information to determine fidelity and mortality of tagged Gulf sturgeon. A standardized, centralized database was established to coordinate tagging efforts and archive information with the intention to conduct future stock assessments on regular intervals. The first analysis of those telemetry data utilized the initial 25 months of data and found estimates of survival, fidelity, and detection were unbiased (Rudd et al. 2014). Similar to the abundance estimates presented in the 5-Year Review (USFWS and NMFS 2009), survival rates estimated from acoustic telemetry data (Rudd et al. 2014) found that Gulf sturgeon in the western part of the range (Pearl and Pascagoula Rivers) have higher mortality rates than those in the eastern part of the range. In addition, Gulf sturgeon in the western part of the range had limited mixing compared to those in the eastern part of the range with higher movement probabilities (Rudd et al. 2014). A stock assessment utilizing the data collected from all 5 years of the 2010-2015 Gulf sturgeon monitoring program is currently underway.

4.2.8.4 Threats

The 1991 listing Rule (56 FR 49653 1991) for Gulf sturgeon cited the following impacts and threats: (1) dams; (2) channel improvement and maintenance activities: dredging, de-snagging; and spoil deposition; (3) water quality degradation, (4) incidental take by commercial shrimpers; (5) late-maturation; and (6) historical overfishing.

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

1. Pollution from industrial, agricultural, and municipal activities is believed responsible for a suite of physical, behavioral, and physiological impacts to sturgeon worldwide. Specific impacts of pollution and contamination on sturgeon have been identified to include muscle atrophy; abnormality of gonad, sperm, and egg development; morphogenesis of organs, tumors; and disruption of hormone production.
2. Chemicals and metals such as chlordane, dichlorodiphenyldichloroethylene, dichlorodiphenyltrichloroethane, dieldrin, polychlorinated biphenyls, cadmium, mercury, and selenium settle to the river bottom and are later incorporated into the food web as they are consumed by benthic feeders, such as sturgeon or macroinvertebrates.
3. Bycatch from fisheries may continue although all directed fisheries of Gulf sturgeon have been closed since 1990 (NMFS and USFWS 1995). Although confirmed reports are rare, it is a common opinion among Gulf sturgeon researchers that bycatch mortality continues.
4. Dredging activities can pose significant impacts to aquatic ecosystems by: (1) direct removal/burial of organisms; (2) turbidity/siltation effects; (3) contaminant resuspension; (4) noise/disturbance; (5) alterations to hydrodynamic regime and physical habitat; and (6) loss of riparian habitat. Dredging operations may also destroy benthic feeding areas, disrupt spawning migrations, and re-suspend fine sediments causing siltation over required substrate in spawning habitat. Because Gulf sturgeon are benthic omnivores, the modification of the benthos affects the quality, quantity, and availability of prey.
5. Collisions between jumping Gulf sturgeon and fast-moving boats on the Suwannee River and elsewhere are a relatively recent and new source of sturgeon mortality and pose a serious public safety issue as well. The Florida Fish and Wildlife Commission documented 3 collisions in the Suwannee River in 2008, and 1 incident in 2009.

6. Dams represent a significant impact to Gulf sturgeon by blocking passage to historical spawning habitats, which reduces the amount of available spawning habitat or entirely impede access to it. The ongoing operations of these dams also affect downstream habitat.
7. Global climate change may affect Gulf sturgeon by leading to accelerated changes in habitats utilized by Gulf sturgeon through saltwater intrusion, changes in water temperature, and extreme weather periods that could increase both droughts and floods. For a general overview of climate change and its potential impacts on marine organisms, see Section 5.2.4 of this Opinion.
8. Hurricanes have resulted in mortality of Gulf sturgeon in both Escambia Bay after Hurricane Ivan in 2004 (USFWS 2005) and Hurricane Katrina in 2005.
9. Red tide is the common name for a harmful algal bloom (HAB) of marine algae (*Karenia brevis*) that produces a brevetoxin that is absorbed directly across the gill membranes of fish or through ingestion of algal cells. Fish mortalities associated with *Karenia brevis* events are very common and widespread. Blooms of red tides have been increasing in frequency in the Gulf of Mexico since the 1990s and have likely killed Gulf sturgeon at both the juvenile and adult life stages.
10. Aquaculture: Although the state of Florida has Best Management Practices to reduce the risk of hybridization and escapement, the threat of introduction of captive fishes into the wild continues.

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

Moreover, large-scale acute and episodic events could affect multiple or all Gulf sturgeon populations at once. The *Deepwater Horizon* spill that began on April 20, 2010, continued for almost 3 months in the northern Gulf of Mexico. Researchers used remote sensing of surface oil to determine that large numbers of Gulf sturgeon were potentially exposed to oil pollution. Exposures occurred in Gulf sturgeon populations from the Pearl, Pascagoula, Escambia, Blackwater, Yellow, and Choctawhatchee Rivers; over 60% of fish from these 6 rivers were potentially exposed to oil from the *Deepwater Horizon* disaster (USFWS 2015a). Furthermore, blood test results indicate DNA damage at cellular and biochemical levels, adverse effects from the cell cycle assessment, and an increase in repair proteins (USFWS 2015a). Finally, higher levels of DNA fragmentation and of neutrophils were detected after oil exposure when compared to pre-exposure levels (USFWS 2015a). Additionally, laboratory studies on a surrogate, the shovelnose sturgeon (*Scaphirhynchus platorynchus*), confirmed above results and indicated additional effects to exposed individuals in the form of immune injury at molecular, biochemical, cellular, and organ levels (USFWS 2015a; Lavelle et al. 2015). The identified injuries reveal genotoxicity and immunosuppression in exposed fish during a strenuous time in their life history.

4.2.8.5 Summary of the Status of Gulf Sturgeon and Recovery Objectives

In summary, based on the 5-Year Review (USFWS and NMFS 2009), NMFS believes the number of adult Gulf sturgeon is believed to be less than 10,000 individuals. Recovery of depleted populations is an inherently slow process for a late-maturing species such as Gulf sturgeon. Their late age at maturity provides more opportunities for individuals to be removed from the population before reproducing. While a long life span also allows multiple opportunities to contribute to future generations, this is hampered within the species’ range by habitat alteration, pollution, and bycatch. It is also challenging to realize recovery goals for Gulf sturgeon in terms of abundance or spatial distribution given the intense period of commercial fishing during the late nineteenth and early twentieth centuries coupled with the subsequent habitat modification that occurred across the range (Ahrens and Pine 2014).

The long-term recovery objective for Gulf sturgeon is for self-sustaining populations, where the average rate of natural recruitment is at least equal to the average mortality rate in a 12-year period (USFWS and GSMFC 1995). The 2009 5-Year Review clarified the need for each of the 7 reproducing populations to be self-sustaining and determined that no population estimate had been made that would satisfy the recovery criteria to determine if the average rate of natural recruitment is at least equal to the average mortality rate over a 12-year period (USFWS and NMFS 2009). Recent publications support this productivity-based approach to Gulf sturgeon recovery. For example, Flowers and Pine III (2008) describes how the historic overexploitation of Gulf sturgeon led to a change in the age-structure of the populations that reduced annual reproductive output. Pine III and Allen (2001), working with data from the Suwannee River population, identified 3 parameters (i.e., egg-to-age-1 mortality, the percentage of females that spawn annually, and adult mortality) as those most sensitive in determining the trajectory of population size. The impact of slight increases in adult Gulf sturgeon mortality has found to shift the population trajectory from an increasing trend into a decline ((Pine III and Allen 2001; Pine III and Martell 2009). Therefore, the number of adult deaths greatly influences the population trajectory highlighting the need for balanced age classes within the population to ensure a constant population size. This supports the range-wide approach to Gulf sturgeon recovery that identifies self-sustaining populations.

A wide range of threats continue to dictate the status of Gulf sturgeon and their recovery, such as dams and dredging and spoil deposition during channel maintenance. The presence of dams reduces the amount of available spawning habitat or entirely impedes access to it and ongoing operation of these dams effects downstream water quality, such as depth, temperature, velocity, and dissolved oxygen. Similarly, dredging projects modify Gulf sturgeon spawning and nursery habitat through direct removal of habitat features or reduced water quality due to nutrient-loading, anoxia, potential resuspension of contaminate sediments, and modification of benthic community structure with spoil deposition. Water quality can be further influenced by point and non-point pollution, reduction of water through inter-basin water transfers, sea level rise, and climate change which may exacerbate existing water quality issues.

Small and large scale pollution can adversely affect Gulf sturgeon as exemplified, in part, in the above discussion of results from the *Deepwater Horizon* spill. Ingestion of polyaromatic hydrocarbons directly or indirectly through prey consumption results in various toxic effects, particularly, if they occur during physiologically strenuous times in the Gulf sturgeon life history. Toxic effects include DNA damage, immunosuppression, developmental toxicity, tumors, abnormal gene expression, and increased repair protein production. Such impacts would likely hinder recovery of the Gulf sturgeon.

Bycatch mortality is known to be rare, but continues. No Gulf sturgeon were observed in the Gulf of Mexico shrimp fishery between 1997 through June 2007 when observer coverage was typically less than 1% of total shrimp effort. Mandatory observer coverage was initiated in the Gulf of Mexico shrimp fishery in July 2007 and since then only 2 Gulf sturgeon have been observed captured: 1 in federal waters, and 1 in state waters (NMFS 2014a). Both of these captures were in main trawl nets in relatively shallow waters (NMFS 2014a).

4.2.8.6 Critical Habitat for Gulf Sturgeon

NMFS and USFWS jointly designated Gulf sturgeon critical habitat (GSCH) on April 18, 2003 (see, 50 CFR 226.214). The agencies designated 7 riverine areas (Units 1-7) and 7 estuarine/marine areas (Units 8-14) as critical habitat based on the physical and biological features that support the species. Critical habitat units encompass a total of 2,783 river kilometers (rkm) and 6,042 km^2 of estuarine and marine habitats (Figure 4-10). NMFS's jurisdiction encompasses the 7 units in marine and estuarine waters (Units 8-14), though NMFS's consultation responsibilities for projects in estuarine waters are limited to specific action agencies (Table 4-5).

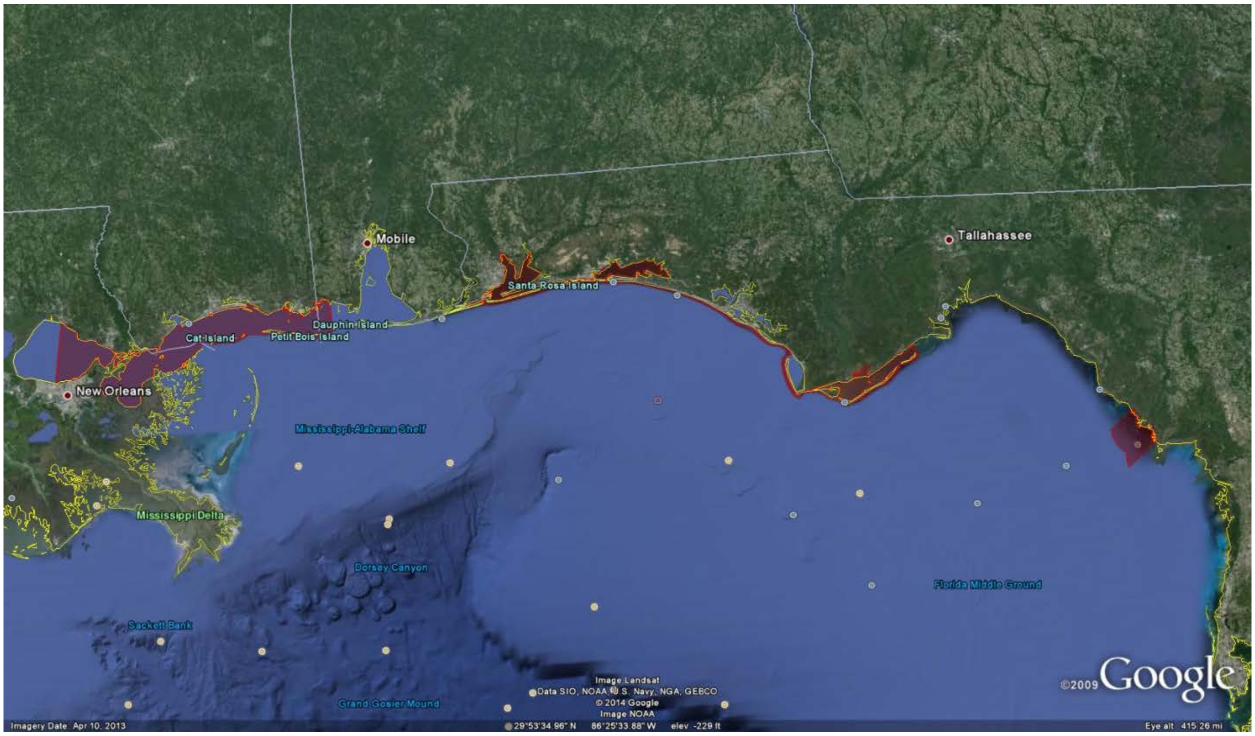


Figure 4-10. Gulf sturgeon critical habitat in estuarine and marine waters (Units 8-14) denoted by the red areas (©2014 Google)

Gulf sturgeon use rivers for spawning, larval and juvenile feeding, adult resting and staging, and to move between the areas that support these components. Gulf sturgeon use the lower riverine, estuarine, and marine environment during winter months primarily for feeding and for inter-river migrations. Within the estuarine environment, Gulf sturgeon are typically found in waters 2-4 m deep and use depths outside this range less than expected based on availability (Fox et al. 2002). Further, the 2-4-m deep habitats where Gulf sturgeon are typically found have sediments with a high percentage (>80%) of sand (Fox et al. 2002). Adult sturgeon appear to spend extended periods of time in specific areas of the estuary and then travel relatively quickly to other areas where they again spend extended amounts of time (Edwards et al. 2007; Edwards et al. 2003). Edwards et al. (2007) discussed the mixing of Gulf sturgeon from different populations and overlap of winter habitat utilization. Similarly, in a multi-year study Ross et al. (2009) found Gulf sturgeon from both the Pascagoula and Pearl Rivers broadly overlap and use the shallow water along the Gulf barrier islands as foraging grounds in the winter. These marine habitats utilized by the Gulf sturgeon were all less than 7 m deep, generally well oxygenated, and with relatively clear water; bottom substrates were mostly coarse sand and shell fragments or fine sand (Ross et al. 2009). Also, Gulf sturgeon tagged in 7 Florida panhandle river systems were monitored from Carrabelle, Florida to Mobile Bay, Alabama during the winter period in the coastal waters of the Gulf of Mexico. Gulf sturgeon from different river systems were located occupying the same area of marine habitat. USFWS discovered nearshore areas of concentrated feeding activity for adults from multiple riverine systems in the waters near Tyndall Air Force Base/Panama City Beach, Florida, and waters from Perdido, Florida to Gulf Shores, Alabama

(USFWS 2004; USFWS 2005; USFWS 2006; USFWS 2007). Sulak et al. (2012) believe Gulf sturgeon feed continuously during these periods which may last for 1-3 months. Additionally, Gulf sturgeon may concentrate in certain areas. Estuaries and bays adjacent to riverine areas provide unobstructed passage of sturgeon from feeding areas to spawning grounds.

4.2.8.6.1 Critical Habitat Units Affected by this Action

The programmatic nature of this action indicates that any estuarine and marine critical habitat unit could be affected, depending on details of the specific restoration activity proposed. Therefore, unit-specific effects to designated critical habitat should be assessed in the project-level consultation.

4.2.8.6.2 Essential Features of Critical Habitat

NMFS and USFWS identified 7 habitat features essential for the conservation of Gulf sturgeon (68 FR 13370 2003). Four of these features are found in the marine and estuarine units of critical habitat:

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

4.2.8.6.3 Status of Critical Habitat

Activities associated with coastal development have been and continue to be the primary threat to marine and estuarine units of Gulf sturgeon critical habitat. These activities generally include dredge, fill, or dredge-and-fill projects, freshwater withdrawals, and storm water drainage systems. Although many coastal development activities are currently regulated, some permitted direct and/or indirect damage to habitat from increased urbanization still occurs and is expected to continue in the future. The winter foraging areas were affected by oil from the 2010 *Deepwater Horizon* disaster, and the essential habitat features were harmed. The remotely sensed surface oil footprint from the 2010 spill covers 23% of the designated critical habitat for Gulf sturgeon (USFWS 2015a).

Critical Habitat Unit 8

Unit 8 encompasses 1,377 mi^2 (3,567 km^2; 881,425 acres) in Louisiana, Mississippi, and Alabama and includes Lake Pontchartrain east of the Lake Pontchartrain Causeway, all of Little Lake, The Rigolets, Lake St. Catherine, Lake Borgne, including Heron Bay, and the Mississippi Sound (Figure 4-11). Critical habitat follows the shorelines around the perimeters of each included lake. The Mississippi Sound includes adjacent open bays including Pascagoula Bay, Point aux Chenes Bay, Grand Bay, Sandy Bay, and barrier island passes, including Ship Island Pass, Dog Keys Pass, Horn Island Pass, and Petit Bois Pass. The northern boundary of the Mississippi Sound is the shoreline of the mainland between Heron Bay Point, Mississippi and Point aux Pins, Alabama. Critical habitat excludes St. Louis Bay, north of the railroad bridge across its mouth; Biloxi Bay, north of the U.S. Highway 90 bridge; and Back Bay of Biloxi. The southern boundary follows along the broken shoreline of Lake Borgne created by low swamp islands from Malheureux Point to Isleau Pitre. From the northeast point of Isleau Pitre, the boundary continues in a straight north-northeast line to the point 1 nautical mile (nmi) (1.9 km) seaward of the western most extremity of Cat Island (30°13′N, 89°10′W). The southern boundary continues 1 nmi (1.9 km) offshore of the barrier islands and offshore of the 72 COLREGS lines at barrier island passes (defined at 33 CFR80.815)), (d) and (e)) to the eastern boundary. Between Cat Island and Ship Island there is no 72 COLREGS line. We, therefore, defined that section of the unit's southern boundary as 1 nmi (1.9 km) offshore of a straight line drawn from the southern tip of Cat Island to the western tip of Ship Island. The eastern boundary is the line of longitude 88°18.8′W from its intersection with the shore (Point aux Pins) to its intersection with the southern boundary. The lateral extent of Unit 8 is the MHW line on each shoreline of the included water bodies or the entrance to rivers, bayous, and creeks.

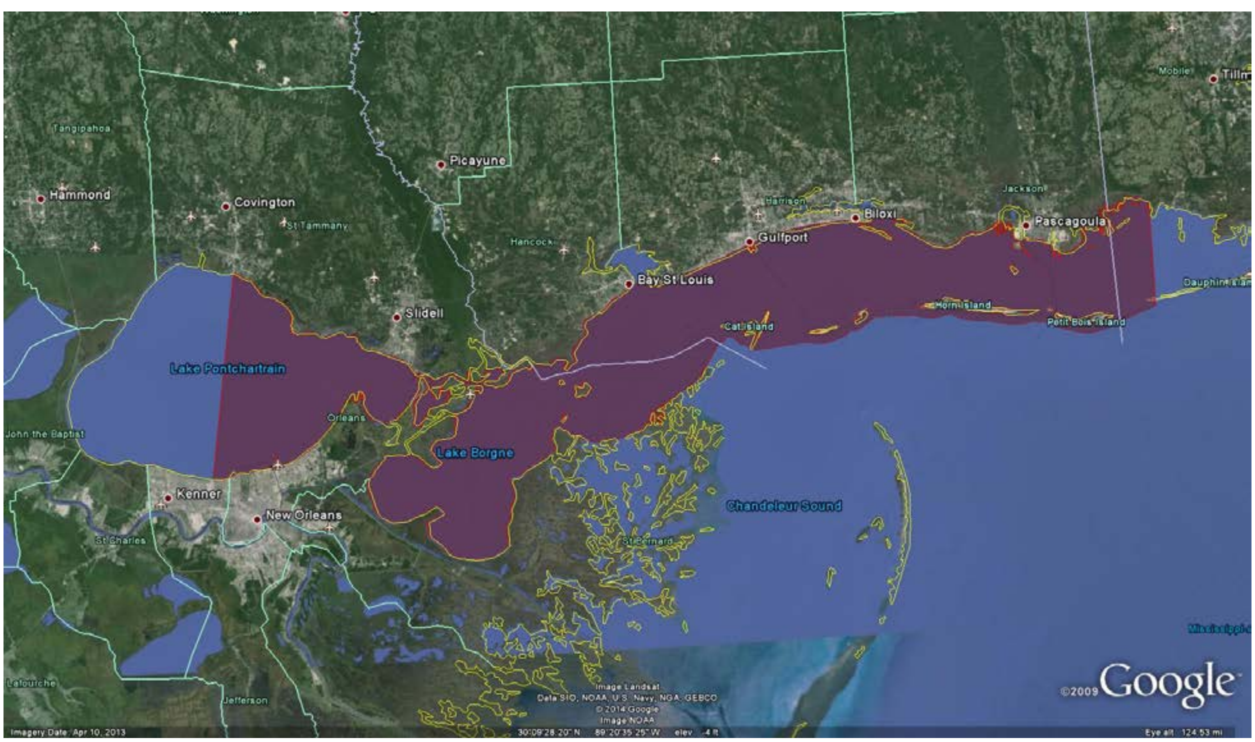


Figure 4-11. Gulf sturgeon critical habitat Unit 8 (©2014 Google, Data SIO, NOAA, U.S. Navy, NGA, GEBCO)

Status of Critical Habitat Unit 8

Unit 8 is impacted by a number of activities including dredging, shoreline armoring, installation of breakwaters, and construction of docks, piers, marinas, and artificial reefs. Since tracking began in 2003, Unit 8 has had 71,640 acres of critical habitat impacted. Most of these impacts were temporary, with effects lasting a few days to months, but generally less than a year. There has been a permanent loss of 655 acres of critical habitat during that time period, but much of this area lacked the essential features.

In 2014, there were 15 projects submitted for consultation in Unit 8: 8 pier/dock projects, 3 dredging projects, 2 restoration projects, 1 jetty, and 1 beach nourishment project. These projects are not expected to adversely affect the essential features of Unit 8, and any impacts from these projects should only be temporary or discountable. Currently, data are unavailable for 2015, but we are not aware of any projects in 2015 that were unusual in scope or scale in Unit 8.

Critical Habitat Unit 9

Unit 9 encompasses 147 mi^2 (381 km^2; 94,147 acres) in Florida and includes Pensacola Bay and its adjacent main bays and coves (Figure 4-12). These include Big Lagoon, Escambia Bay, East Bay, Blackwater Bay, Bayou Grande, Macky Bay, Saultsmar Cove, Bass Hole Cove, and Catfish Basin. All other bays, bayous, creeks, and rivers are excluded at their mouths. The western boundary is the Florida State Highway 292 Bridge crossing Big Lagoon to Perdido Key. The southern boundary is the 72 COLREGS line between Perdido Key and Santa Rosa Island (defined at 33 CFR 80.810 (g)). The eastern boundary is the Florida State Highway 399 Bridge at Gulf Breeze, Florida. The lateral extent of Unit 9 is the MHW line on each shoreline of the included waterbodies.

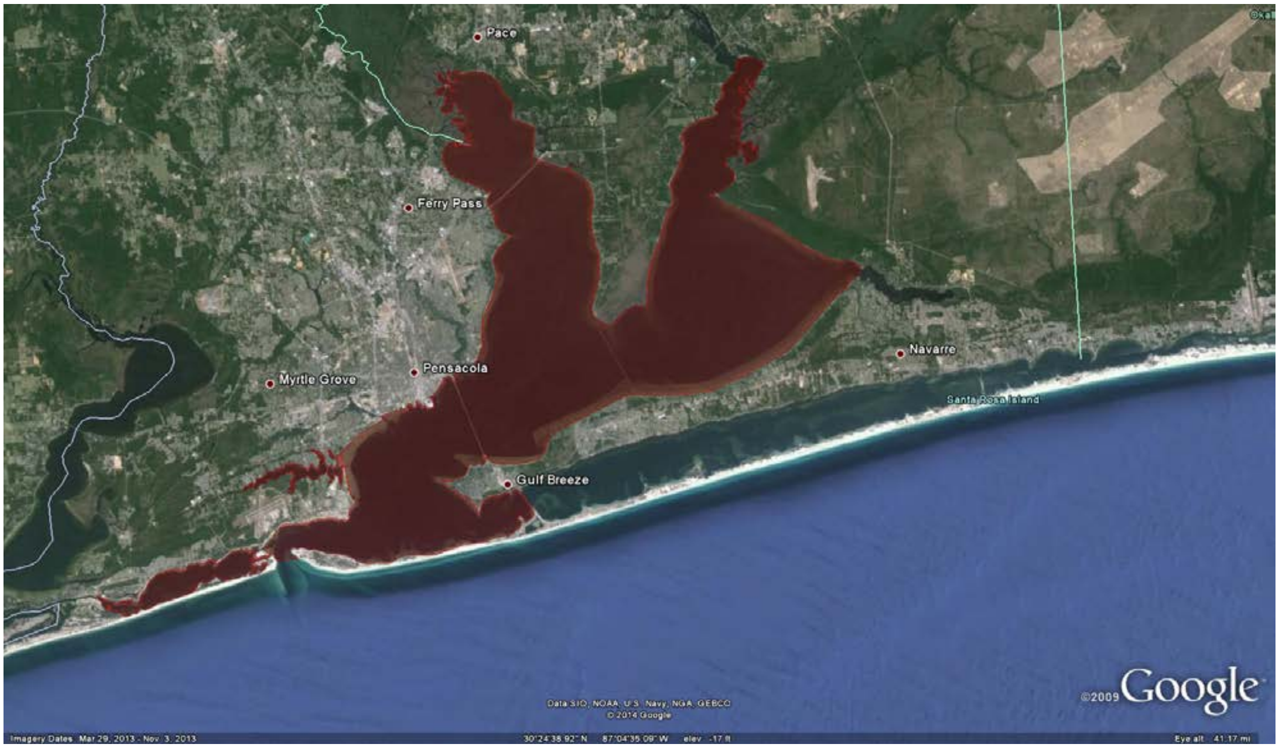


Figure 4-12. Gulf sturgeon critical habitat Unit 9 (©2014 Google, Data SIO, NOAA, U.S. Navy, NGA, GEBCO)

Status of Critical Habitat Unit 9

Unit 9 is impacted by a number of activities including dredging, shoreline armoring, installation of breakwaters, and construction of docks, piers, marinas, and artificial reefs. Since tracking began in 2003, Unit 9 has had 11,485 acres of critical habitat impacted. Most of these impacts were temporary, with effects lasting a few days to months, and generally less than a year. There had been a loss of 43 acres of critical habitat during that time period, but much of this area lacked the essential features.

In 2014, there were 7 projects submitted for consultation in Unit 9: 3 boat ramp/boathouse projects, 2 living shoreline projects, 1 seawall project, and 1 ferry project that included a boat ramp and creation of an oyster and artificial reef. These projects are not expected to adversely affect the essential features of Unit 9, and any impacts from these projects should only be temporary or discountable. Currently, data are unavailable for 2015, but we are not aware of any projects in 2015 that were unusual in scope or scale in Unit 9.

Critical Habitat Unit 10

Unit 10 encompasses 39 mi^2 (102 km^2; 25,205 acres) in Florida and includes the Santa Rosa Sound, bounded on the west by the Florida State Highway 399 bridge in Gulf Breeze, Florida and the east by U.S. Highway 98 bridge in Fort Walton Beach, Florida (Figure 4-13). The northern and southern boundaries of Unit 10 are formed by the shorelines to the MHW line or by the entrance to rivers, bayous, and creeks.

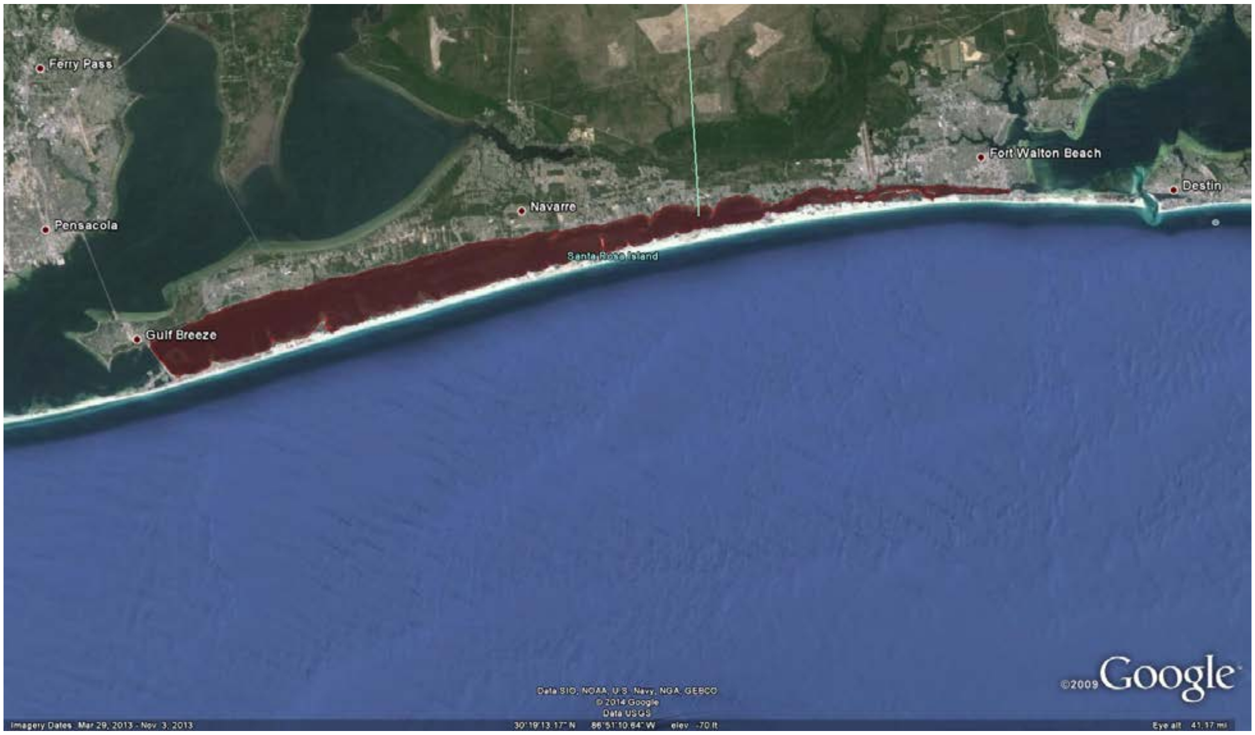


Figure 4-13. Gulf sturgeon critical habitat Unit 10 (©2014 Google, Data SIO, NOAA, U.S. Navy, NGA, GEBCO)

Status of Critical Habitat Unit 10

Unit 10 is impacted by a number of activities including dredging, shoreline armoring, installation of breakwaters, and construction of docks, piers, marinas, and artificial reefs. Since tracking began in 2003, Unit 10 has had 4.5 acres of critical habitat impacted. Most of these impacts were temporary, with effects lasting a few days to months, and generally less than a year. There has been a loss of 0.55 acres of critical habitat during that time period, but much of this area lacked the essential features or was poor quality.

In 2014, there were 4 projects submitted for consultation in Unit 10: 2 marinas and 2 restoration projects. These projects are not expected to adversely affect the essential features of Unit 10, and any impacts from these projects should only be temporary or discountable. Currently, data are unavailable for 2015, but we are not aware of any projects in 2015 that were unusual in scope or scale in Unit 10.

Critical Habitat Unit 11

Unit 11 encompasses 171 mi^2 (442 km^2; 109,221 acres) in Florida and includes a portion of the Gulf of Mexico along the shoreline of the Florida Panhandle (Figure 4-14). The western boundary is the line of longitude 87°20.0′W (approximately 1 nmi [1.9 km] west of Pensacola Pass) from its intersection with the shore to its intersection with the southern boundary. The northern boundary is the MHW of the mainland shoreline and the 72 COLREGS line at passes as defined at 30 CFR 80.810 (a–g). The southern boundary of the unit is 1 nmi (1.9 km) offshore of the northern boundary; the eastern boundary is the line of longitude 85°17.0′W from its intersection with the shore (near Money Bayou between Cape San Blas and Indian Peninsula) to its intersection with the southern boundary.

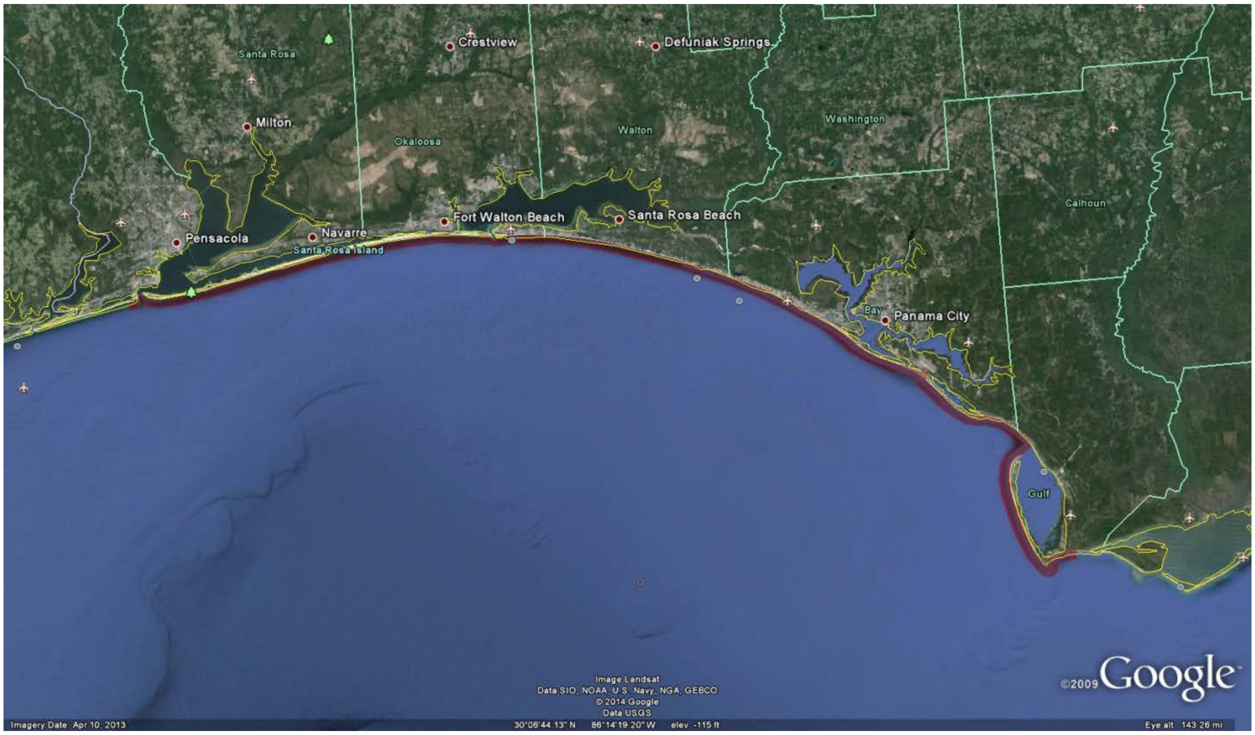


Figure 4-14. Gulf sturgeon critical habitat Unit 11 (©2014 Google, Data SIO, NOAA, U.S. Navy, NGA, GEBCO)

Status of Critical Habitat Unit 11

Unit 11 is impacted by a number of activities including dredging, shoreline armoring, installation of breakwaters, and construction of docks, piers, marinas, and artificial reefs. Since tracking began in 2003, Unit 11 has had 3,925 acres of critical habitat impacted. Most of these impacts were temporary, with effects lasting a few days to months, and generally less than a year. There has been a loss of 2,851 acres of critical habitat during that time period, but much of this area lacked the essential features or was poor quality habitat.

In 2014, there were 8 projects submitted for consultation in Unit 11: 5 artificial reef projects, 2 beach nourishments, and 1 water intake structure. These projects are not expected to adversely affect the essential features of Unit 11, and any impacts from these projects should only be temporary or discountable. Currently, data are unavailable for 2015, but we are not aware of any projects in 2015 that were unusual in scope or scale in Unit 11.

Critical Habitat Unit 12

Unit 12 encompasses 124 mi^2 (321 km^2; 79,321 acres) in Florida and includes the main body of Choctawhatchee Bay, Hogtown Bayou, Jolly Bay, Bunker Cove, and Grassy Cove (Figure 4-15).

All other bayous, creeks, and rivers are excluded at their mouths/entrances. The western unit boundary is the U.S. Highway 98 Bridge at Fort Walton Beach, Florida; the southern boundary is the 72 COLREGS line across East (Destin) Pass as defined at 33 CFR 80.810 (f). The lateral extent of Unit 12 is the MHW line on each shoreline of the included water bodies.

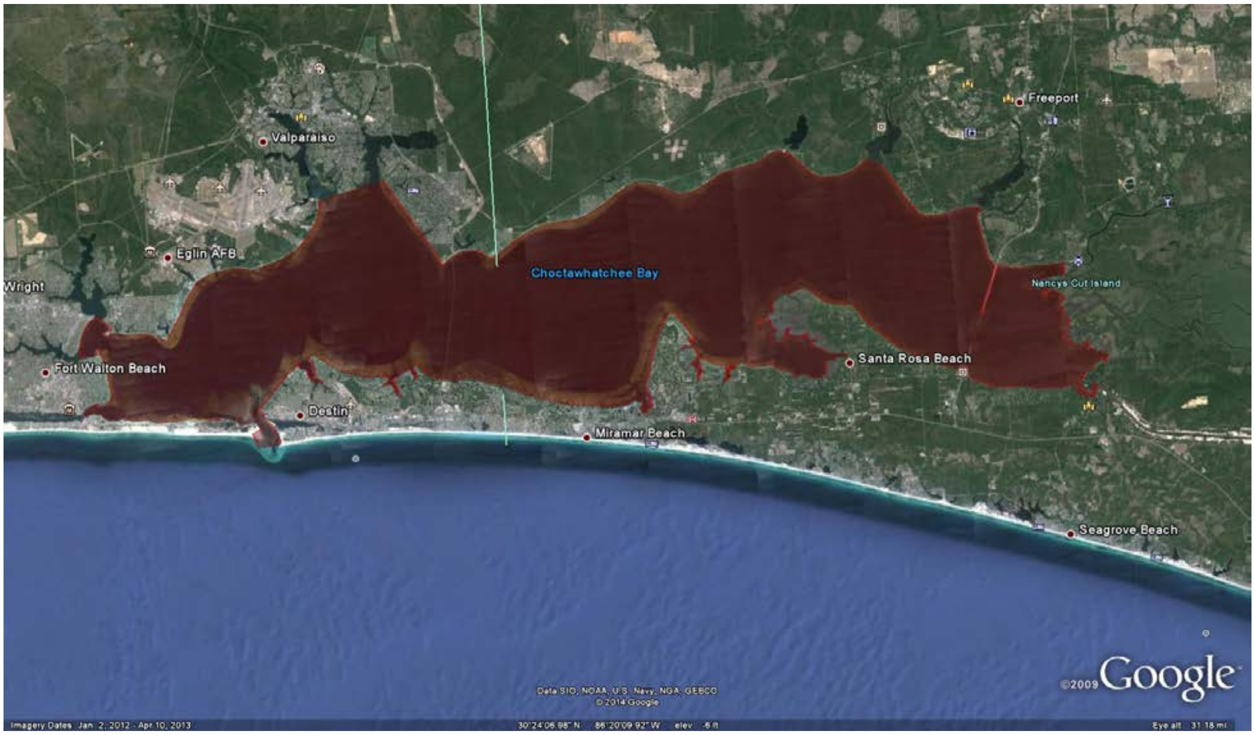


Figure 4-15. Gulf sturgeon critical habitat Unit 12 (©2014 Google, Data SIO, NOAA, U.S. Navy, NGA, GEBCO)

Status of Critical Habitat Unit 12

Unit 12 is impacted by a number of activities including dredging, shoreline armoring, installation of breakwaters, and construction of docks, piers, marinas, and artificial reefs. Since tracking began in 2003, Unit 12 has had 15 acres of critical habitat impacted. Most of these impacts were temporary, with effects lasting a few days to months, and generally less than a year. There has been a loss of 0.12 acres of critical habitat during that time period, but much of this area lacked the essential features or was poor quality habitat.

In 2014, there were 7 projects submitted for consultation in Unit 12: 3 bridge projects, 2 restoration projects, 1 marina project, and 1 dune and boardwalk project. These projects are not expected to adversely affect the essential features of Unit 12, and any impacts from these projects should only be temporary or discountable. Currently, data are unavailable for 2015, but we are not aware of any projects in 2015 that were unusual in scope or scale in Unit 12.

Critical Habitat Unit 13

Unit 13 encompasses 264 mi^2 (683 km^2; 168,773 acres) in Florida and includes the main body of Apalachicola Bay and its adjacent sounds, bays, and the nearshore waters of the Gulf of Mexico

(Figure 4-16). These consist of St. Vincent Sound, including Indian Lagoon; Apalachicola Bay including Horseshoe Cove and All Tides Cove; East Bay including Little Bay and Big Bay; and St George Sound, including Rattlesnake Cove and East Cove. Barrier Island passes (Indian Pass, West Pass, and East Pass) are also included. Sike’s Cut is excluded from the lighted buoys on the Gulf of Mexico side to the day boards on the bay side. The southern unit boundary includes water extending into the Gulf of Mexico 1 nmi (1.9 km) from the MHW line of the barrier islands and from 72 COLREGS lines between the barrier islands (defined at 33 CFR 80.805 (e–h)) the western boundary is the line of longitude 85°17.0′W from its intersection with the shore (near Money Bayou between Cape San Blas and Indian Peninsula) to its intersection with the southern boundary. The eastern boundary of the unit is formed by a straight line drawn from the shoreline of Lanark Village at 29°53.1′N, 84°35.0′W to a point that is 1 nmi (1.9 km) offshore from the northeastern extremity of Dog Island at 29°49.6’N, 84°33.2’W. The lateral extent of Unit 13 is the MHW line on each shoreline of the included water bodies or the entrance of excluded rivers, bayous, and creeks.

Figure 4-16. Gulf sturgeon critical habitat Unit 13 (©2014 Google, Data SIO, NOAA, U.S. Navy, NGA, GEBCO)

Status of Critical Habitat Unit 13

Unit 13 is impacted by a number of activities including dredging, shoreline armoring, installation of breakwaters, and construction of docks, piers, marinas, and artificial reefs. Since tracking began in 2003, Unit 13 has had 671 acres of critical habitat impacted. Most of these impacts were temporary, with effects lasting a few days to months, and generally less than a year. There has been a loss of 1.8 acres of critical habitat during that time period, but much of this area lacked the essential features or was poor quality habitat.

In 2014, there were 6 projects submitted for consultation in Unit 13: 3 dock projects, 2 living shoreline projects, and 1 dredging project. These projects are not expected to adversely affect the essential features of Unit 13, and any impacts from these projects should only be temporary or discountable. Currently, data are unavailable for 2015, but we are not aware of any projects in 2015 that were unusual in scope or scale in Unit 13.

Critical Habitat Unit 14

Unit 14 encompasses 211 mi^2 (546 km^2; 135,661 acres) in Florida and includes Suwannee Sound and a portion of adjacent Gulf of Mexico waters extending 9 nmi from shore (16.7 km) out to the Florida State territorial water boundary (Figure 4-17). Its northern boundary is formed by a straight line from the northern tip of Big Pine Island (at approximately 29°23′N, 83°12′W) to the federal-state boundary at 29°17′N, 83°21′W; the southern boundary is formed by a straight line from the southern tip of Richards Island (at approximately 29°11′N, 83°04′W) to the federal-state boundary at 29°04′N, 83°15′W. The lateral extent of Unit 14 is the MHW line along the shorelines and the mouths of the Suwannee River (East and West Pass), its distributaries and other rivers, creeks, or water bodies.

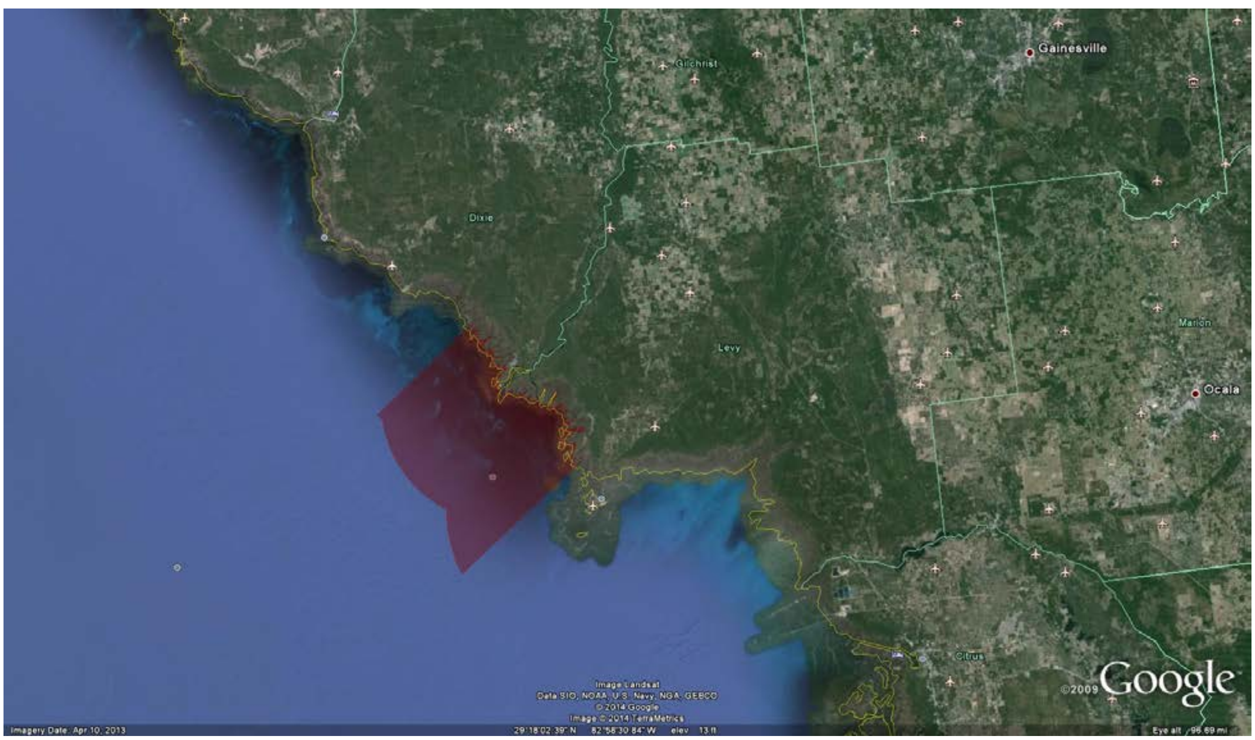


Figure 4-17. Gulf sturgeon critical habitat Unit 14 (©2014 Google, Data SIO, NOAA, U.S. Navy, NGA, GEBCO)

Status of Critical Habitat Unit 14

Unit 14 has had a single oyster restoration project that occurred in 2005. This project impacted 10 acres of critical habitat which were converted to oyster reefs. Still, the project was expected to improve Gulf sturgeon critical habitat through an increase in abundance of prey items as organisms associated with oyster reefs spillover into the surrounding substrate. Currently, data are unavailable for 2015, but we are not aware of any projects in 2015 that were unusual in scope or scale in Unit 14.

4.2.8.6.4 Threats to Critical Habitat

As stated in the 2003 Final Rule designating Gulf sturgeon critical habitat, the following activities, when authorized, funded or carried out by a federal agency, may destroy or adversely modify critical habitat:

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

Dredge, fill, and dredge-and-fill activities associated with the creation and maintenance of navigation channels as well as coastal development can result in the loss of Gulf sturgeon habitat (Wooley and Crateau 1985). Dredging activities can pose significant impacts to aquatic ecosystems by: (1) direct removal/burial of organisms, (2) turbidity/siltation effects, (3) contaminant resuspension, (4) noise/disturbance, (5) alterations to hydrodynamic regime and physical habitat, and (6) loss of the habitats and communities along the river margins and banks (Chytalo 1996; Winger et al. 2000). In regards to Gulf sturgeon and their critical habitat, dredging may alter reduce prey availability of benthic feeding areas, disrupt spawning migrations, modify substrate composition, resuspend toxins and contaminates, and impact benthic community structure. Deposition of dredge materials can change substrate composition, reduce prey availability, and result in changes in community sturgeon of benthic invertebrates. Dredge, fill, and dredge-and-fill activities continue to threaten Gulf sturgeon critical habitat. Creation of artificial reefs reduces access to foraging areas and can constrict migratory pathways. Beach re-nourishment can impact both the borrow areas and the deposition sites; removal of sand removes macroinvertebrates from foraging habitat and can modify substrate composition and resuspend contaminants, while deposition buries existing macrofauna, and can modify both sediment and water quality.

The primary constituent elements of Gulf sturgeon critical habitat that may be impacted from contaminants introduced by the *Deepwater Horizon* disaster are sediment quality and water quality. Sturgeon may be particularly susceptible to impacts from environmental contamination due to their benthic foraging behavior and long life span. Sturgeon using estuarine habitats near urbanized areas may be exposed to numerous suites of contaminants within the substrate. Contaminants, including toxic metals, polychlorinated aromatic hydrocarbons (PAHs), organophosphate and organochlorine pesticides, polychlorinated biphenyls (PCBs), and other chlorinated hydrocarbon compounds can have substantial deleterious effects on aquatic life (ASSRT 2007). Effects from these elements and compounds on fish include production of acute lesions, growth retardation and reproductive impairment (Cooper et al. 1989; Sindermann 1994). Chemicals and metals such as chlordane, DDE, DDT, dieldrin, PCBs, cadmium, mercury, and selenium settle to the river bottom and are later incorporated into the food web as they are consumed by benthic feeders, such as sturgeon or macroinvertebrates. In fish, exposure to PCBs reportedly causes a higher incidence of fin erosion, epidermal lesions, blood anemia, and an altered immune response (Kennish 1992). PCBs probably have the greatest effect on reproduction where PCB residues have been related to mortality and reproductive failure in Baltic flounder – *Platichthys flesus* (Von Westernhagen et al. 1981), charr – *Salvelinus* sp. (Monod 1985), fathead minnows (Post 1987), lake trout – *S. namaycush* (Mac and Schwartz 1992), rainbow and westslope cutthroat (*Oncorhynchus clarki lewisi*) trout (Matta et al. 1997), and zebrafish – *Danio rerio* (Billsson et al. 1998). Some of these compounds may affect physiological processes and impede the ability of a fish to withstand stress.

Moser and Ross (1995) suggested that certain deformities and ulcerations found in Atlantic sturgeon in North Carolina’s Brunswick River might be due to poor water quality in addition to possible boat propeller inflicted injuries. Although little is known about contaminant effects on Gulf sturgeon, pollution from industrial, agricultural, and municipal activities is believed to be responsible for a suite of physical, behavioral, and physiological impacts to sturgeon species worldwide (Agusa et al. 2004; Barannikova 1995; Barannikova et al. 1995; Bickham et al. 1998; Billard and Lecointre 2000; Kajiwara 2003; Khodorevskaya et al. 1997; Khodorevskaya and Krasikov 1999). Oil pollution greatly affects Gulf sturgeon and their critical habitat as demonstrated by pre- and post-exposure studies related to the *Deepwater Horizon* disaster (USFWS 2015a).

4.2.9 Smalltooth Sawfish (*Pristis pectinata*)

The U.S. DPS of smalltooth sawfish was listed as endangered under the ESA effective May 1, 2003 (68 FR 15674 2003). Critical habitat was designated on September 2, 2009 (effective October 2, 2009), in portions off the Gulf Coast of Florida (63 FR 46693 1998); the critical habitat is discussed further in Section 4.2.9.6. There was no evidence of injury from the DWH oil spill and the DWH Trustees did not conduct an injury assessment for smalltooth sawfish or their critical habitat as part of the DWH PDARP.

4.2.9.1 Species Description and Distribution

The smalltooth sawfish is a tropical marine and estuarine elasmobranch with an extended snout with a long, narrow, flattened, rostral blade (rostrum) with a series of transverse teeth along either edge. In general, smalltooth sawfish inhabit shallow coastal waters of warm seas throughout the world and feed on a variety of small fish (e.g., mullet, jacks, and ladyfish) (Simpfendorfer 2001), and crustaceans (e.g., shrimp and crabs) (Bigelow and Schroeder 1953; Norman and Fraser 1937).

Although this species is reported to have a circumtropical distribution, NMFS identified smalltooth sawfish from the southeastern United States as a DPS, due to the physical isolation of this population from others, the differences in international management of the species, and the significance of the U.S. population in relation to the global range of the species (see 68 FR 15674 2003). Within the United States, smalltooth sawfish have been captured in estuarine and coastal waters from New York southward through Texas, although peninsular Florida has historically been the region of the United States with the largest number of recorded captures (NMFS 2000). Recent records indicate there is a resident reproducing population of smalltooth sawfish in south and southwest Florida from Charlotte Harbor through the Dry Tortugas, which is also the last U.S. stronghold for the species (Poulakis and Seitz 2004; Seitz and Poulakis 2002; Simpfendorfer and Wiley 2005). Water temperatures (no lower than 16-18°C) and the availability of appropriate coastal habitat (shallow, euryhaline waters and red mangroves) are the major environmental constraints limiting the northern movements of smalltooth sawfish in the western North Atlantic. Most specimens captured along the Atlantic coast north of Florida are large adults (over 10 ft) that likely represent seasonal migrants, wanderers, or colonizers from a historic Florida core population(s) to the south, rather than being members of a continuous, even-density population (Bigelow and Schroeder 1953).

4.2.9.2 Life History Information

Smalltooth sawfish fertilization is internal, and females give birth to live young. The brood size, gestation period, and frequency of reproduction are unknown for smalltooth sawfish. Therefore, data from the closely related (in terms of size and body morphology) largetooth sawfish (*Pristis pristis*) represent our best estimates of these parameters. The largetooth sawfish likely reproduces every other year, has a gestation period of approximately 5 months, and produces a mean of 7.3 offspring per brood, with a range of 1-13 offspring (Thorson 1976). Smalltooth sawfish are approximately 31 in (80 cm) at birth and may grow to a length of 18 ft (548 cm) or greater during their lifetime (Bigelow and Schroeder 1953; Simpfendorfer 2002). Simpfendorfer et al. (2008) reported rapid juvenile growth for smalltooth sawfish for the first 2 years after birth, with stretched total length increasing by an average of 25-33 in (65-85 cm) in the first year and an average of 19-27 in (48-68 cm) in the second year.

By contrast, very little information exists on size classes other than juveniles, which make up the majority of sawfish encounters; therefore, much uncertainty remains in estimating life history parameters for smalltooth sawfish, especially as they relate to age at maturity and post-juvenile growth rates. Based on age and growth studies of the largetooth sawfish (Thorson 1982) and research by (Simpfendorfer 2000), the smalltooth sawfish is likely a slow-growing (with the exception of early juveniles), late-maturing (10-20 years) species with a long life span (30-60 years). Juvenile growth rates presented by Simpfendorfer et al. (2008) suggest smalltooth sawfish are growing faster than previously thought and may reach sexual maturity at an earlier age.

Each life history stage uses different habitats. Juvenile smalltooth sawfish, those up to 3 years of age or approximately 8 ft in length (Simpfendorfer et al. 2008) inhabit the shallow waters of estuaries and can be found in sheltered bays, dredged canals, along banks and sandbars, and in rivers (NMFS 2000). Juvenile smalltooth sawfish occur in euryhaline waters (i.e., waters with a wide range of salinities) and are often closely associated with muddy or sandy substrates, and shorelines containing red mangroves (*Rhizophora mangle*) (Simpfendorfer 2001; Simpfendorfer 2003). Tracking data from the Caloosahatchee River in Florida indicate very shallow depths and salinity are important abiotic factors influencing juvenile smalltooth sawfish movement patterns, habitat use, and distribution (Simpfendorfer et al. 2011). Another recent acoustic tagging study in a developed region of Charlotte Harbor, Florida, identified the importance of mangroves in close proximity to shallow water habitat for juvenile smalltooth sawfish, stating that juveniles generally occur in shallow water within 328 ft (100 m) of mangrove shorelines, generally red mangroves (Simpfendorfer et al. 2010). Juvenile smalltooth sawfish spend the majority of their time in waters less than 13 ft (4 m) in depth (Simpfendorfer et al. 2010) and are seldom found in depths greater than 32 ft (10 m) (Poulakis and Seitz 2004).

(Simpfendorfer et al. 2010) also indicated developmental differences in habitat use: the smallest juveniles (young-of-the-year juveniles measuring < 100 cm in length) generally used water depths less than 0.5 m (1.64 ft), had small home ranges (4,264-4,557 m^2), and exhibited high levels of site fidelity. Although small juveniles exhibit high levels of site fidelity for specific nursery habitats for periods of time lasting up to 3 months (Wiley and Simpfendorfer 2007), they do undergo small movements coinciding with changing tidal stages. These movements often involve moving from shallow sandbars at low tide to within red mangrove prop roots at higher tides (Simpfendorfer et al. 2010), which is a behavior that likely reduces the risk of predation (Simpfendorfer 2006). As juveniles increase in size, they begin to expand their home ranges (Simpfendorfer et al. 2010; Simpfendorfer et al. 2011) also indicated developmental differences in habitat use: the smallest juveniles (young-of-the-year juveniles measuring < 100 cm in length) generally used water depths less than 0.5 m (1.64 ft), had small home ranges (4,264-4,557 m^2), and exhibited high levels of site fidelity. Although small juveniles exhibit high levels of site fidelity for specific nursery habitats for periods of time lasting up to 3 months (Wiley and Simpfendorfer 2007), they do undergo small movements coinciding with changing tidal stages. These movements often involve moving from shallow sandbars at low tide to within red mangrove prop roots at higher tides (Simpfendorfer et al. 2010), which is a behavior that likely reduces the risk of predation (Simpfendorfer 2006). As juveniles increase in size, they begin to expand their home ranges (Simpfendorfer et al. 2010; Simpfendorfer et al. 2011) and eventually move to offshore habitats where they likely feed on larger prey and eventually reach sexual maturity.

Researchers have identified several areas within the Charlotte Harbor Estuary that are disproportionately more important to juvenile smalltooth sawfish, based on intra- or inter-annual (within or between year) capture rates during random sampling events within the estuary (Poulakis 2012; Poulakis et al. 2011). These areas, termed “hotspots,” also correspond with areas where public encounters are most frequently reported. Use of these “hotspots” can vary within and among years based on the amount and timing of freshwater inflow. Smalltooth sawfish use hotspots further upriver during high salinity conditions (drought) and areas closer to the mouth of the Caloosahatchee River during times of high freshwater inflow (Poulakis et al. 2011). At this time, researchers are unsure what specific biotic or abiotic factors influence this habitat use, but they believe a variety of conditions in addition to salinity, such as temperature, dissolved oxygen, water depth, shoreline vegetation, and food availability, may influence habitat selection (Poulakis et al. 2011).

While adult smalltooth sawfish may also use the estuarine habitats used by juveniles, they are commonly observed in deeper waters along the coasts. Poulakis and Seitz (2004) noted that nearly half of the encounters with adult-sized smalltooth sawfish in Florida Bay and the Florida Keys occurred in depths from 200-400 ft (70-122 m) of water. Similarly, Simpfendorfer and Wiley (2005) reported encounters in deeper waters off the Florida Keys, and observations from both commercial longline fishing vessels and fishery-independent sampling in the Florida Straits report large smalltooth sawfish in depths up to 130 ft (~ 40 m) (ISED 2014). Even so, NMFS believes adult smalltooth sawfish use shallow estuarine habitats during parturition (when adult females return to shallow estuaries to pup) because very young juveniles still containing rostral sheaths are captured in these areas. Since very young juveniles have high site fidelities, we hypothesize that they are birthed nearby or in their nursery habitats.

The smalltooth sawfish is also limited by its life history characteristics as a slow-growing, relatively late-maturing, and long-lived species. Animals using this life history strategy are usually successful in maintaining small, persistent population sizes in constant environments, but are particularly vulnerable to increases in mortality or rapid environmental change (NMFS 2000). The combined characteristics of this life history strategy result in a very low intrinsic rate of population increase (Musick 1999) that make it slow to recover from any significant population decline (Simpfendorfer 2000). More recent data suggest smalltooth sawfish may mature earlier than previously thought, meaning rates of population increase could be higher and recovery times shorter than those currently reported (Simpfendorfer et al. 2008).

4.2.9.3 Status and Population Dynamics

Few long-term abundance data exist for the smalltooth sawfish, which hinders estimation of the current population size. Simpfendorfer (2001) estimated that the U.S. population may number less than 5% of historic levels, based on anecdotal data and the fact that the species' range has contracted by nearly 90%. Southern and southwestern Florida are the only areas known to support a reproducing population. Since actual abundance data are limited, researchers have begun to compile capture and sightings data (collectively referred to as encounter data) in the International Sawfish Encounter Database (ISED) that was developed in 2000. Although these data cannot be used to assess the population because of the opportunistic nature in which they are collected (i.e., encounter data are a series of random occurrences rather than an evenly distributed search over a defined period of time), researchers can use this database to assess the spatial and temporal distribution of smalltooth sawfish. We expect that as the population grows, the geographic range of encounters would also increase. Since the conception of the ISED, over 3,000 smalltooth sawfish encounters have been reported and compiled in the encounter database (ISED 2014).

Despite the lack of scientific data on abundance, recent encounters with young-of-the-year, older juveniles, and sexually mature smalltooth sawfish indicate that the U.S. population is currently reproducing (Seitz and Poulakis 2002; Simpfendorfer 2003). Data analyzed from Everglades National Park as part of an established fisheries-dependent monitoring program (angler interviews) indicate a slightly increasing trend in abundance within the park over the past decade (Carlson and Osborne 2012; Carlson et al. 2007). Using a demographic approach and life history data for smalltooth sawfish and similar species from the literature, Simpfendorfer (2000) estimated intrinsic rates of natural population increase for the species at 0.08-0.13 per year and population doubling times at 5.4-8.5 years. These low intrinsic rates of population increase[10] suggest that the species is particularly vulnerable to excessive mortality and rapid population declines, after which recovery may take decades.

4.2.9.4 Threats

Past literature indicates smalltooth sawfish were once abundant along both coasts of Florida and quite common along the shores of Texas and the northern Gulf Coast (NMFS 2010d). Based on recent comparisons with these historical reports, the U.S. DPS of smalltooth sawfish has declined over the past century (Simpfendorfer 2001; Simpfendorfer 2002). The decline in smalltooth sawfish abundance has been attributed to several factors including bycatch mortality in fisheries, habitat loss, and life history limitations of the species (NMFS 2010d). Other threats such as the illegal commercial trade of smalltooth sawfish or their body parts, predation, and marine pollution and debris may also affect the population and recovery of smalltooth sawfish on

[10] The rate at which a population increases in size if there are no density-dependent forces regulating the population

smaller scales (NMFS 2010d). We anticipate that all of these threats will continue to affect the rate of recovery for the U.S. DPS of smalltooth sawfish.

Bycatch Mortality

Bycatch mortality is cited as the primary cause for the decline in smalltooth sawfish in the United States (NMFS 2010d). While there has never been a large-scale directed fishery, smalltooth sawfish easily become entangled in fishing gears (gill nets, otter trawls, trammel nets, and seines) directed at other commercial species, and entanglement often results in serious injury or death (NMFS 2009c). This has historically been reported in Florida (Snelson and Williams 1981), Louisiana (Simpfendorfer 2002), and Texas (Baughman 1943). For instance, a fisherman interviewed by Evermann and Bean (1898) reported taking an estimated 300 smalltooth sawfish in just a single netting season in the Indian River Lagoon, Florida. In another example, smalltooth sawfish landings data gathered by Louisiana shrimp trawlers from 1945-1978, which contained both landings data and crude information on effort (number of vessels, vessel tonnage, number of gear units), indicated declines in smalltooth sawfish landings from a high of 34,900 lb in 1949 to less than 1,500 lb in most years after 1967. The Florida net ban passed in 1995 has led to a reduction in the number of smalltooth sawfish incidentally captured, "…by prohibiting the use of gill and other entangling nets in all Florida waters, and prohibiting the use of other nets larger than 500 sq ft in mesh area in nearshore and inshore Florida waters"[11] (Fla. Const. art. X, § 16). However, the threat of bycatch currently remains in commercial fisheries (e.g., South Atlantic shrimp fishery, Gulf of Mexico shrimp fishery, federal shark fisheries of the South Atlantic, and the Gulf of Mexico reef fish fishery), but anecdotal information collected by NMFS port agents suggest smalltooth sawfish captures are now rare.

In addition to incidental bycatch in commercial fisheries, smalltooth sawfish have historically been and continue to be captured by recreational fishers. Encounter data (ISED 2014) and past research (Caldwell 1990) document that rostrums are sometimes removed from smalltooth sawfish caught by recreational fishers, which greatly reduces chances of survival for the sawfish. While the current threat of mortality associated with recreational fisheries is expected to be low given that possession of the species in Florida has been prohibited since 1992, bycatch in recreational fisheries remains a potential threat to the species.

Habitat Loss

Modification and loss of smalltooth sawfish habitat, especially nursery habitat, is another contributing factor in the decline of the species. Activities such as agricultural and urban development, commercial activities, dredge-and-fill operations, boating, erosion, and diversions of freshwater runoff contribute to these losses (SAFMC 1998). Large areas of coastal habitat were modified or lost between the mid-1970s and mid-1980s within the United States (Dahl and Johnson 1991). Since then, rates of loss have decreased, but habitat loss continues. From 1998-2004, approximately 64,560 ac of coastal wetlands were lost along the Atlantic and Gulf coasts

[11] "nearshore and inshore Florida waters" means all Florida waters inside a line 3 miles seaward of the coastline along the Gulf of Mexico and inside a line 1 mi seaward of the coastline along the Atlantic Ocean.

of the United States, of which approximately 2,450 ac were intertidal wetlands consisting of mangroves or other estuarine shrubs (Steadman and Dahl 2008). Further, (Orlando et al. 1994) analyzed 18 major southeastern estuaries and recorded over 703 mi of navigation channels and 9,844 mi of shoreline with modifications. In Florida, coastal development often involves the removal of mangroves and the armoring of shorelines through seawall construction. Changes to the natural freshwater flows into estuarine and marine waters through construction of canals and other water control devices have had other impacts: altered the temperature, salinity, and nutrient regimes; reduced wetlands and submerged aquatic vegetation; and degraded vast areas of coastal habitat utilized by smalltooth sawfish (Gilmore 1995; Reddering 1988; Whitfield and Bruton 1989). While these modifications of habitat are not the primary reason for the decline of smalltooth sawfish abundance, they likely a contributing factor and almost certainly hampers the recovery of the species. Juvenile sawfish have an affinity for shallow, estuarine habitats, and their nursery habitats are particularly likely to be affected by habitat losses or alternations. Although many forms of habitat modification are currently regulated, some permitted direct and/or indirect damage to habitat from increased urbanization still occurs and is expected to continue to threaten survival and recovery of the species in the future.

Climate Change

This section discusses the potential effects of climate change on smalltooth sawfish. A general overview of climate change and its potential impacts on marine organisms is presented in Section 5.2.4 of this Opinion.

In addition to the anthropogenic effects mentioned above, changes to the global climate are likely to be a threat to smalltooth sawfish and their habitats. The impacts to smalltooth sawfish cannot, for the most part, currently be predicted with any degree of certainty, but we can project some effects to the coastal habitats where they reside. We know that the coastal habitats that contain red mangroves and shallow, euryhaline waters will be directly affected by climate change through sea level rise, which is expected to exceed 1 meter globally by 2100 according to Meehl et al. (2007), Pfeffer et al. (2008), and Vermeer and Rahmstorf (2009). Sea level rise will affect mangrove resources because mangroves will not keep pace with conservative projected rates of elevation in sea level (Gilman et al. 2008). Sea level increases will also affect the amount of shallow water available for juvenile smalltooth sawfish nursery habitat, especially in areas where there is shoreline armoring (e.g., seawalls). Furthermore, the changes in precipitation coupled with sea level rise may alter salinities of coastal habitats, reducing the amount of available smalltooth sawfish nursery habitat.

4.2.9.5 Summary of the Status of Smalltooth Sawfish and Recovery Objectives

Though data indicate the population of smalltooth sawfish has been reduced by approximately 95% over the last century, there is not enough abundance data to make an assessment of the current status of this species. Recovery of depleted populations is an inherently slow process for a slow growing, late-maturing species such as the smalltooth sawfish. Its late age at maturity provides more opportunities for individuals to be removed from the population before reproducing, yet a long life span also allows multiple opportunities to contribute to future generations. Recovery is hampered by a number of threats including habitat alteration and mortality as bycatch in other fisheries.

NMFS has developed a goal to rebuild and assure the long-term viability of the U.S. DPS of smalltooth sawfish in the wild, so that it may ultimately recover and be removed from the List of Endangered and Threatened Wildlife. The 2009 Recovery Plan laid out 3 main objectives for recovery: (1) minimize human interactions and associated injury and mortality; (2) protect and/or restore smalltooth sawfish habitats; and (3) ensure smalltooth sawfish abundance increases substantially and the species reoccupies areas from which it had been previously extirpated (NMFS 2009c). It also provides more specific sub-objectives, downlisting criteria (for changing the species' listing status from endangered to threatened), and delisting criteria for each objective. The information provided above, and what it means about the status of the species, should be viewed in light of the recovery criteria. The recovery criteria for Objectives 1 and 2 address ameliorating the threats described above. For specific listing factors recovery criteria, see the 2009 Recovery Plan. The recovery criteria for Objective 3 provide demographic parameters for evaluating whether the species is viable.

Demographic criteria associated with Objective 3:

Downlisting criteria

1. The relative abundance of juvenile smalltooth in peninsular Florida (recovery Regions G-K and at least 1 additional) has increased at an average annual rate of at least 5% over a 27-year period with greater than 95% certainty or is at greater than 80% of carrying capacity.
2. The relative abundance of adult smalltooth sawfish along Florida's east coast (Regions J-L) and west coast (Regions F-H) has increased to a level at least 15 times higher than the level at the time of listing with greater than 95% certainty that abundance at this level has been sustained for a period of at least 14 years.
3. Verified records of adult smalltooth sawfish are observed in 12 out of 14 years, with consecutive records occurring in the last 3 years in recovery regions north of Florida (Regions M and N) and at least 1 region west of Florida (Regions A-D).

Delisting criteria

1. The relative abundance of small juvenile smalltooth sawfish (< 200 cm) is stable or increasing in peninsular Florida and at least 4 other recovery regions.
2. The relative abundance of adult smalltooth sawfish along Florida's east coast (Regions J-L) and west coast (Regions F-H) has increased to a level at least 20 times higher than the level at the time of listing with greater than 95% certainty that abundance at this level has been sustained for a period of at least 14 years.
3. Verified records of adult smalltooth sawfish are observed in 12 out of 14 years, with consecutive records occurring in the last 3 years in recovery regions north of Florida (regions M and N) and at least one region west of Florida (Regions A-D).

4. The relative abundance of small juvenile smalltooth sawfish (< 200 cm) in peninsular Florida (recovery Regions G-K and at least 1 additional) and at least 3 other recovery regions (one of which must be west of Florida) is either increasing at an average annual rate of at least 5% over a 27-year period with greater than 95% certainty or at greater than 80% carrying capacity.

Actions associated with each of the recovery objectives are underway. Many of these actions deal with sampling and tracking both adult and juvenile smalltooth sawfish to gain a baseline understanding of the current status of this species and the habitats it relies upon at each life stage. Once we have a strong baseline of abundance data and trends over a few decades, we will be able to better evaluate whether our efforts have been successful in recovering the species. Other actions are focused on recovery through habitat protections and public education. Because sawfish use estuarine areas that are bordered by human development, concerted efforts are needed to (1) identify and protect the most important habitats from future development and (2) to educate the public about the species to minimize injury or mortality from human interactions. Public education to date has included the development of safe release guidelines and a variety of outreach materials to distribute to those groups that are most likely to interact with the species (i.e., fishers, boaters, and divers).

4.2.9.6 Critical Habitat for Smalltooth Sawfish

NMFS designated critical habitat for the U.S. DPS of smalltooth sawfish on September 2, 2009 ((74 FR 45353 2009); see also, 50 CFR § 226.218). The critical habitat, which is along the southwestern coast of Florida, consists of 2 units: the Charlotte Harbor Estuary Unit (CHEU), which is comprised of approximately 221,459 ac (346 square miles [mi^2]) of coastal habitat, and the Ten Thousand Islands/Everglades Unit (TTIU), which is comprised of approximately 619,013 ac (967 mi^2) of coastal habitat.

The CHEU encompasses portions of Charlotte and Lee Counties (Figure 4-11). The CHEU is comprised of Charlotte Harbor, Gasparilla Sound, Matlacha Pass, Pine Island Sound, San Carlos Bay, and Estero Bay. The unit is fed by the Myakka and Peace Rivers to the north and the Caloosahatchee River to the east. A series of passes between barrier islands connect the CHEU with the Gulf of Mexico. The CHEU is a relatively shallow estuary with large areas of submerged aquatic vegetation, oyster bars, saltwater marsh, freshwater wetlands, and mangroves. Freshwater flows from the Caloosahatchee River are controlled by the Franklin Lock and Dam, which periodically releases water, which thereby affects downstream salinity regimes.

The TTIU is located within Collier, Monroe, and Miami-Dade Counties (Figure 4-12). The unit includes the waters of Everglades National Park, Florida Bay, Everglades City, Cape Romano-Ten Thousand Islands Aquatic Preserve, and the portion of Rookery Bay Aquatic Preserve south of state road 92. The few developed regions of the unit include the areas of Goodland, Everglades City, Plantation, Chokoloskee, and Flamingo. The unit receives freshwater from a number of creeks and rivers found along the coast, including those associated with the Shark

River Slough which originates in and drains central Florida. The TTIU is a relatively shallow nearshore environment with a diversity of habitats including submerged aquatic vegetation, oyster bars, mud banks, beaches, and mangrove communities.

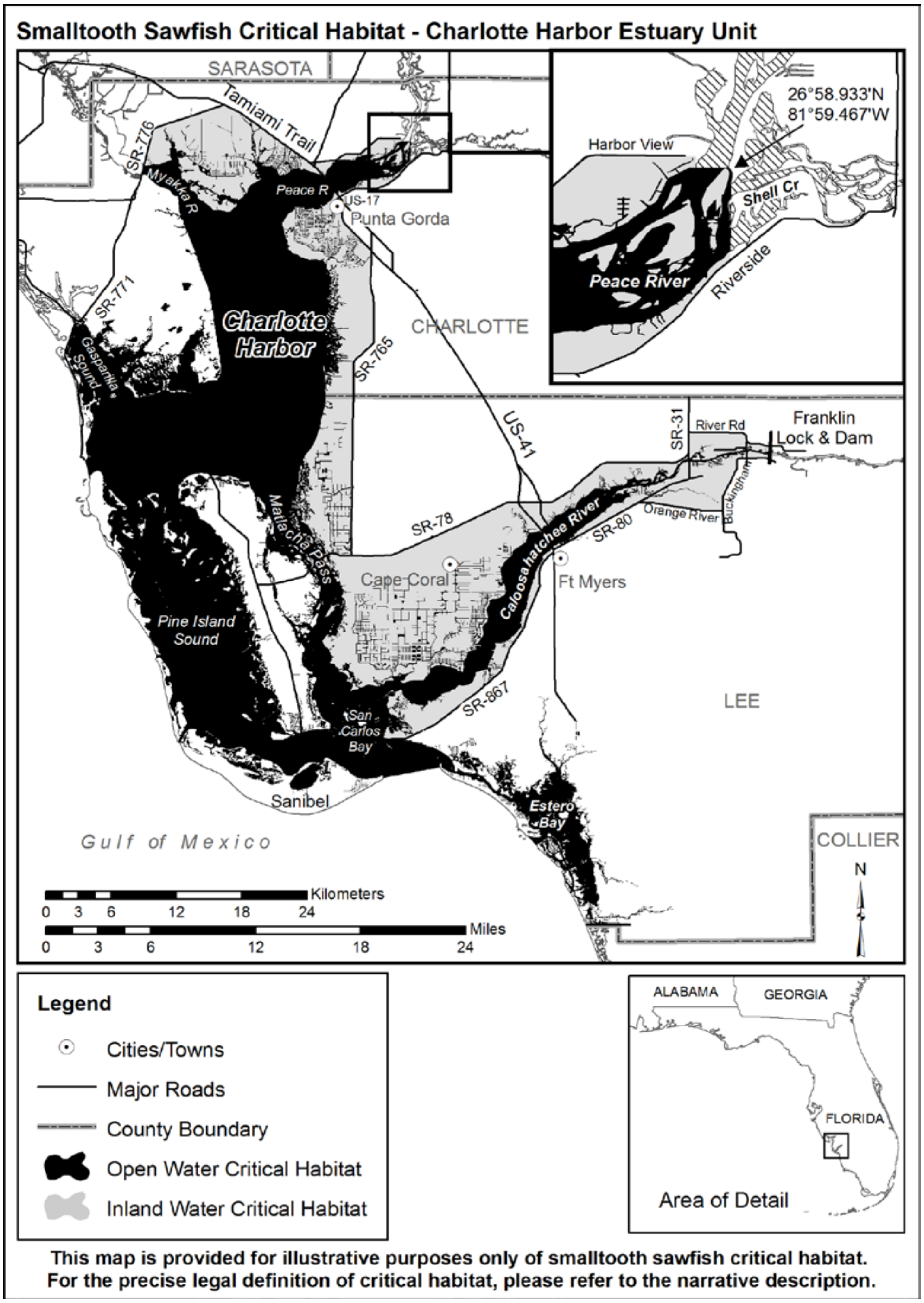


Figure 4-18. Map of smalltooth sawfish critical habitat – Charlotte Harbor Estuary Unit (CHEU).

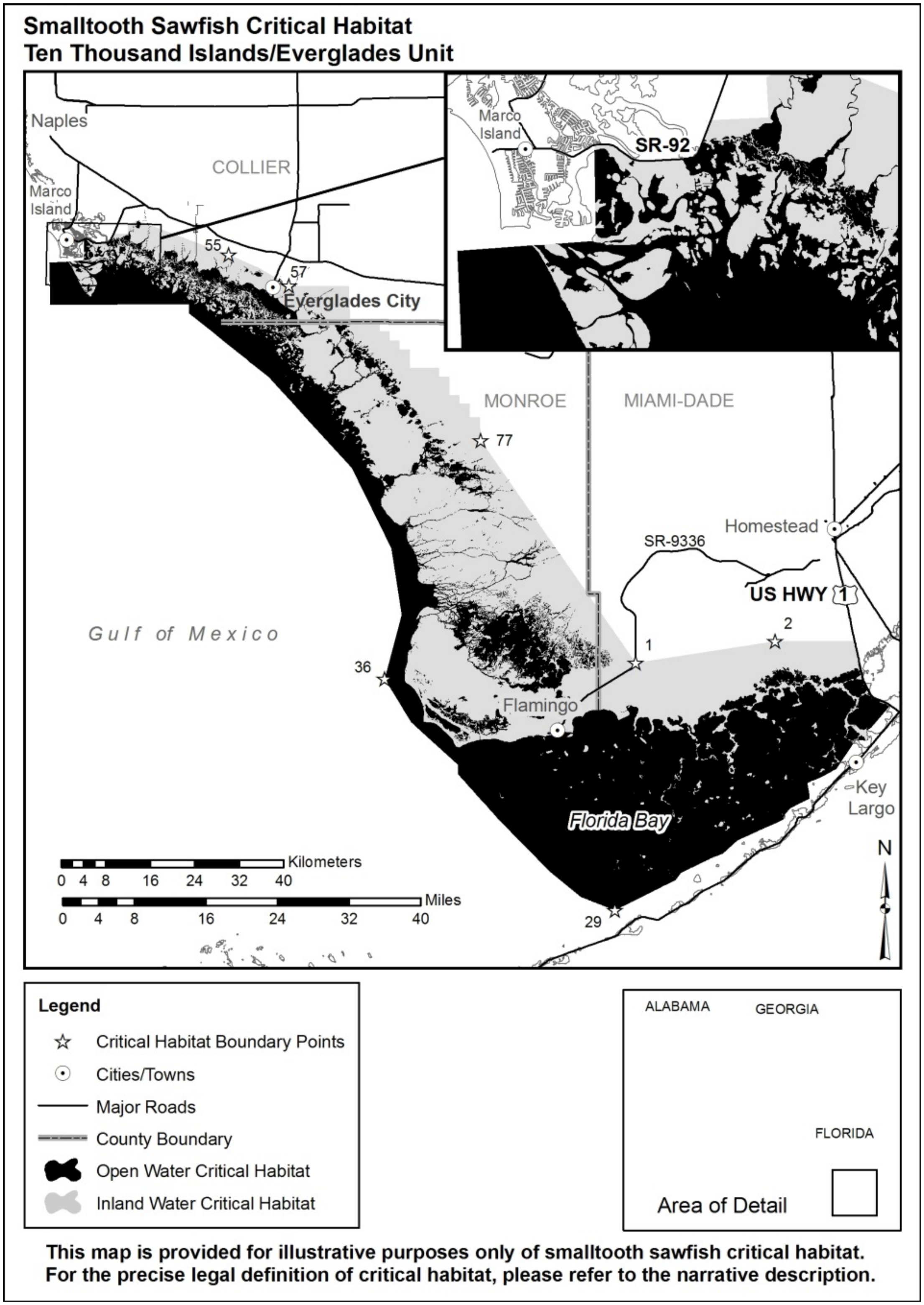


Figure 4-19. Map of smalltooth sawfish critical habitat – Ten Thousand Islands Unit (TTIU)

4.2.9.6.1 Essential Features of Critical Habitat

The recovery plan, developed for the smalltooth sawfish, which represents NMFS's best judgment about the objectives and actions necessary for the species' recovery, identified a need to increase the number of juvenile smalltooth sawfish developing into adulthood by protecting or restoring nursery habitat. NMFS determined that without sufficient habitat, the population was unlikely to increase to a level associated with low extinction risk and de-listing. Therefore, NMFS identified 2 habitat features essential for the conservation of this species: (1) red mangroves, and (2) shallow, euryhaline habitats characterized by water depths between the mean high water line (MHWL) and -3 ft (-0.9 m) measured at mean lower low water (MLLW). These essential features of critical habitat provide juveniles refuge from predation and forage opportunities within their nursery habitat. One or both of these essential features must be present in an action area for it to function as critical habitat for smalltooth sawfish.

4.2.9.6.2 Status of Critical Habitat

As mentioned previously, there are 2 essential features of smalltooth sawfish critical habitat: (1) red mangroves; and (2) shallow, euryhaline habitats characterized by water depths between the MHWL and -3 ft (-0.9 m) measured at MLLW. The U.S. Army Corps of Engineers (USACE) oversees the permitting process for residential and commercial marine development in each critical habitat unit. The Florida Department of Environmental Protection (FDEP) and their designated authorities also regulate mangrove removal in Florida. All red mangrove removal permit requests within smalltooth sawfish critical habitat necessitate ESA Section 7 consultation. NMFS Protected Resources Division tracks the loss of these essential features of smalltooth sawfish critical habitat.

<u>Status of the Charlotte Harbor Estuary Unit</u>

The CHEU is bordered by urban development and is impacted by a number of activities including dredging, shoreline armoring, and construction of docks, piers, and marinas. Since tracking began following the designation of critical habitat in 2009, NMFS has received requests for consultation on approximately 150 projects within the CHEU. NMFS completed consultation on approximately 140 of these projects—about half of them resulted in no adverse effects to critical habitat. Seventy-five projects resulted in a modest loss of at least 1 of the essential features. To date, approximately 17,352 linear ft of red mangroves and 703,075 ft^2 (16.1 acres) of shallow, euryhaline waters have been adversely affected by project activities in the CHEU. These losses represent a very small percentage of the overall critical habitat within the CHEU (< 1%) and thus the status has changed little since designation.

<u>Status of the Ten Thousand Islands/Everglades Unit</u>

The TTIU is located in a more remote part of Florida that is largely protected from development by Everglades National Park and the Ten Thousand Islands National Wildlife Refuge. As a result the status of this unit has changed little since critical habitat designation. NMFS has completed consultation on 10 projects located within this unit and only 2 have resulted in the loss of essential features. The first project involved the replacement of 2 existing dam structures which resulted in the temporary loss of 4,359 linear ft of red mangroves. The second project involved the restoration of a marina destroyed by Hurricane Wilma which resulted in the loss of 10,767 ft^2 of shallow, euryhaline waters and 1,900 linear ft of red mangroves. There are several other projects underway, well inland of the critical habitat unit, that are focused on restoring the natural hydrology of the Everglades. Though NMFS has not specifically consulted on these projects there is a chance that these restoration projects benefit the critical habitat unit and the species in the future.

4.2.9.6.3 Threats to Critical Habitat

Modification and loss of smalltooth sawfish critical habitat is an ongoing threat contributing to the current status of the species as described in the Habitat Loss section above within Section 4.2.9.4. In Florida, coastal development often involves the removal of mangroves, the armoring of shorelines through seawall construction, and the dredging of canals. This is especially apparent in master plan communities such as Cape Coral and Punta Gorda which are located within the Charlotte Harbor Estuary. These communities were created through dredge-and-fill projects to increase the amount of waterfront property available for development, but in doing so, developers removed the majority of red mangrove habitat from the area. The canals created by these communities require periodic dredging for boat access, further affecting the shallow, euryhaline habitat essential feature of critical habitat (see Figure 3, Diagrams A and B). Development continues along the shorelines of southwest Florida in the form of docks, boat ramps, shoreline armoring, utility projects, and navigation channel dredging.

<u>Construction of Infrastructure</u>
The USACE encourages applicants to construct docks in accordance with the NMFS-USACE Dock Construction Guidelines in Florida for Docks or Other Minor Structures Constructed in or over Submerged Aquatic Vegetation (SAV), Marsh, or Mangrove Habitat (NMFS 2001a) when possible. The current dock construction guidelines allow for some mangrove removal; however, it is typically restricted to either (1) trimming to facilitate a dock, or (2) complete removal up to the width of the dock walkway extending toward open water, which the guidelines define as a width of 4 ft.

Installation or replacement of boat ramps is often part of larger projects such as marinas, bridge approaches, and causeways where natural and previously created deep-water habitat access channels already exist. Boat ramps can result in the permanent loss of both the red mangrove and the shallow, euryhaline habitat features of critical habitat for smalltooth sawfish.

Marinas have the potential to adversely affect aquatic habitats. Marinas are typically designed to be deeper than -3 ft MLLW to accommodate vessel traffic; therefore, most existing marinas lacking essential features are unlikely to function as critical habitat for smalltooth sawfish. The expansion of existing marinas and creation of new marinas can result in the permanent loss of large areas of this nursery habitat.

Bulkheads and other shoreline stabilization structures are used to protect adjacent shorelines from wave and current action and to enhance water access. These projects may adversely affect critical habitat for smalltooth sawfish by removal of the essential features through direct filling and dredging to construct vertical or riprap seawalls. Generally, vegetation plantings, sloping riprap, or gabions are environmentally preferred shoreline stabilization methods over vertical seawalls because they provide better quality fish and wildlife habitat. Nevertheless, placement of riprap material removes more of the shallow euryhaline habitat essential feature than a vertical seawall.

While not as common as other activities, excavation of submerged lands is sometimes required for installing cables, pipelines, and transmission lines. Construction may also require temporary or permanent filling of submerged habitats. Open-cut trenching and installation of aerial transmission line footers are activities that have the ability to temporarily or permanently affect critical habitat for smalltooth sawfish.

Potential adverse effects from federal transportation projects in the action area include operations of the Federal Highway Administration, USACE, and the Federal Emergency Management Agency. Construction of road improvement projects typically follow the existing alignments and expand to compensate for the increase in public use. Transportation projects may affect critical habitat for smalltooth sawfish through installation of bridge footers, fenders, piles, and abutment armoring, or through removal of existing bridge materials by blasting or mechanical efforts.

Dredging

Riverine, nearshore, and offshore areas are dredged for navigation, construction of infrastructure, and marine mining. An analysis of 18 major southeastern estuaries conducted in 1993-94 demonstrated that over 7,000 km of navigation channels have already been dredged (Orlando et al. 1994). Habitat effects of dredging include the loss of submerged habitats by disposal of excavated materials, turbidity and siltation effects, contaminant release, alteration of hydrodynamic regimes, and fragmentation of physical habitats (GMFMC 1998; GMFMC 2005; SAFMC 1998). In the CHEU, dredging to maintain canals and channels constructed prior to the critical habitat designation limits the amount of available shallow, euryhaline habitat to the edges of waterways, and these dredging activities can disturb juveniles. At the time of critical habitat designation, many previously dredged channels and canals existed within the boundaries of the critical habitat units; however, we are unsure which of those contained the shallow-water essential feature at that time. Many of these channels and canals were likely originally dredged deeper than -3 ft MLLW, but they have since shoaled in and now contain the essential feature of shallow, euryhaline habitat. Therefore, maintenance dredging impacts are counted as a loss to this essential feature, even though the areas may or may not have contained the essential feature at time of designation (see Figure 3, Diagrams A and B).

Construction, Operations and Maintenance of Impoundments and Other Water Level Controls

Federal agencies such as the USACE have historically been involved in large water control projects in Florida. Agencies sometimes propose impounding rivers and tributaries for such purposes as flood control, saltwater intrusion prevention, or creation of industrial, municipal, and agricultural water supplies. Projects to repair or replace water control structures may affect smalltooth sawfish critical habitat by limiting sufficient freshwater discharge, which could alter the salinity of estuaries. The ability of an estuary to function as a nursery depends upon the quantity, timing, and input location of freshwater inflows (Garmestani and Percival 2005; Norton et al. 2012; USEPA 1994). Estuarine ecosystems are vulnerable to the following anthropogenic disturbances: (1) decreases in seasonal inflow caused by the removal of freshwater upstream for agricultural, industrial, and domestic purposes; (2) contamination by industrial and sewage discharges; (3) agricultural runoff carrying pesticides, herbicides, and other toxic pollutants; and (4) eutrophication (e.g., influx of nutrients such as nitrates and phosphates most often from fertilizer runoff and sewage) caused by excessive nutrient inputs from a variety of nonpoint and point sources. Additionally, rivers and their tributaries are susceptible to natural disturbances, such as floods and droughts, whose effects can be exacerbated by these anthropogenic disturbances.

As stated above, smalltooth sawfish show an affinity for a particular salinity range, moving downriver during wetter months and upriver during drier months to remain within that range (Simpfendorfer et al. 2011). Therefore, water management decisions that affect salinity regimes may affect the functionality of critical habitat. This may result in smalltooth sawfish following specific salinity gradients into less advantageous habitats (e.g., areas with less shallow-water or red mangrove habitat). Furthermore, large changes in water flow over short durations would likely escalate movement patterns for smalltooth sawfish, thereby increasing predation risk and energy output. Researchers are currently looking into the effects of large-scale freshwater discharges on smalltooth sawfish and their designated critical habitat. The most vulnerable portion of the juvenile sawfish population to water-management outfall projects appears to be smalltooth sawfish in their first year of life. Newborn smalltooth sawfish remain in smaller areas irrespective of salinity, which potentially exposes them to greater osmotic stress (a sudden change in the solute concentration around a cell, causing a rapid change in the movement of water across its cell membrane), and affects the nursery functions of sawfish critical habitat (Poulakis et al. 2013; Simpfendorfer et al. 2011).

Climate Change

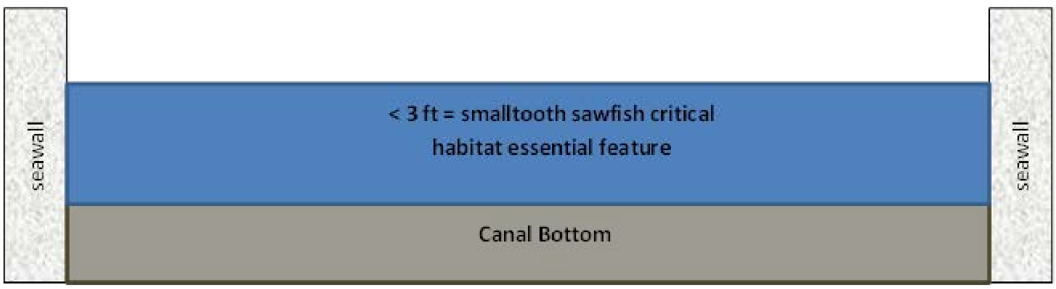
This section discusses the potential effects of climate change on smalltooth sawfish critical habitat. A general overview of climate change and its potential impacts on marine organisms is presented in Section 5.2.4 of this opinion.

Though the impacts on smalltooth sawfish cannot, for the most part, be predicted with any degree of certainty, we can project some effects to sawfish critical habitat. We know that both essential features (red mangroves and shallow, euryhaline waters less than 3 ft deep at MLLW) will be affected by climate change. As discussed in Section 5.2.4, the world’s oceans are projected to rise from 0.26 to 0.98 meters by the end of the century, depending on the level of greenhouse gas emissions (IPCC 2013).

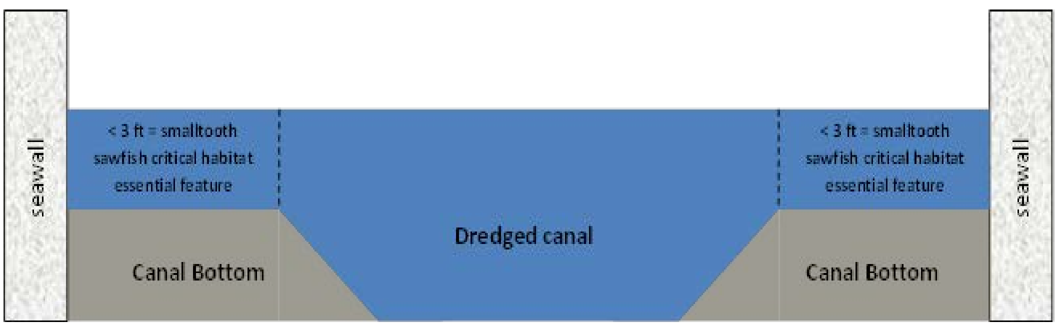
Sea level increases would affect the shallow-water essential feature of smalltooth sawfish critical habitat within the CHEU. A 2010 climate change study by the Massachusetts Institute of

Technology (MIT) forecasted sea level rise in a study area with significant overlap with the CHEU (Vargas-Moreno and Flaxman 2010). The study investigated possible trajectories of future transformation in Florida's Greater Everglades landscape relative to 4 main drivers: climate change, shifts in planning approaches and regulations, population change, and variations in financial resources. MIT used (IPCC 2007) sea level modeling data to forecast a range of sea level rise trajectories from low to moderate to high predictions (Figure 4-13). The effects of sea level rise on available shallow-water habitat for smalltooth sawfish would be exacerbated in areas where there is shoreline armoring (e.g., seawalls). This is especially true in canals where the centerlines are maintenance-dredged deeper than -3 ft (0.9 m) for boat accessibility. In these areas, the areas that currently contain the essential feature depth (less than -3 ft at MLLW) would be reduced along the edges of the canals as sea level rises (see Figure 4-20 below).

A.



B.



C.

Figure 4-20. Diagram A depicts a cross section of a historically dredged channel/canal within the boundaries of the critical habitat units that has not been maintained. Diagram B depicts the typical cross section of a maintenance dredged channel/canal. Diagram C depicts a cross section of a maintained dredged channel/canal after sea level rise of > 1 ft.

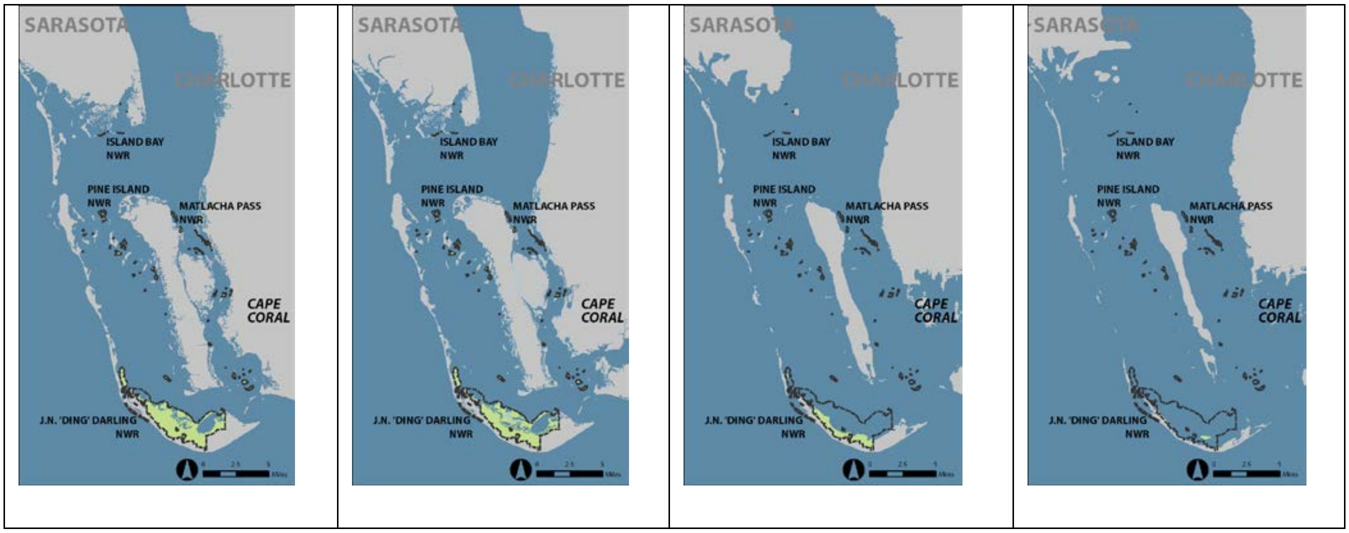


Figure 4-21. Adapted from (Vargas-Moreno and Flaxman), M. Addressing the Challenges of Climate Change in the Greater Everglades Landscape. Project Sheet. November, 2010. Department of Urban Planning, MIT. From left to right: current shoreline, + 3.5 in (+ 9 cm); + 18.5 in (+ 47 cm); and + 38.97 in (+ 99 cm) sea level rise by 2060.

Along the Gulf Coast of Florida and south Florida in particular, rises in sea level will affect mangrove resources. As sea levels rise, mangroves will be forced landward in order to remain at a preferred water inundation level and sediment surface elevation, which is necessary for successful growth. This retreat landward will not keep pace with conservative projected rates of elevation in sea level (Gilman et al. 2008). Forced landward progression poses the greatest threat to mangroves in areas where there is limited or no room for landward or lateral migration (Semeniuk 1994). Such is the case in areas of the CHEU where landward mangrove growth is restricted by shoreline armoring and coastal development. This man-made barrier will prohibit mangroves from moving landward and will result in the loss of the mangrove essential feature.

Other threats to mangroves result from climate change: fluctuations in precipitation amounts and distribution, seawater temperature, CO_2 levels, and damage to mangroves from increasingly severe storms and hurricanes (McLeod and Salm 2006). A 25% increase in precipitation globally is predicted by 2050 (McLeod and Salm 2006), but the specific geographic distribution will vary, leading to increases and decreases in precipitation at the regional level. Changes in precipitation patterns caused by climate change may adversely affect the growth of mangroves and their distribution (Field 1995; Snedaker 1995). Decreases in precipitation will increase salinity and inhibit mangrove productivity, growth, seedling survival, and spatial coverage (Burchett et al. 1984). Decreases in precipitation may also change mangrove species composition, favoring more salt-tolerant types (Ellison 2010). Increases in precipitation may benefit some species of mangroves, increasing spatial coverage and allowing them to out-compete other salt marsh vegetation (Harty 2004). Even so, potential mangrove expansion requires suitable habitat for mangroves to increase their range, which depends to a great extent on patterns and intensity of coastal development (i.e., bulkhead and seawall construction).

Seawater temperature changes will have potential adverse effects on mangroves as well. Many species of mangroves show an optimal shoot density in sediment temperatures between 59°-77°F (15°-25°C) (Hutchings and Saenger 1987). Yet, at temperatures between 77°-95°F (25°-35°C), many species begin to show a decline in leaf structure and root and leaf formation rates (Saenger and Moverley 1985). Temperatures above 95°F lead to adverse effects on root structure and survivability of seedlings (UNESCO 1992), and temperatures above 100.4°F (38°C) lead to a cessation of photosynthesis and mangrove mortality (Andrews et al. 1984). Although impossible to forecast precisely, sea surface ocean temperatures are predicted to increase 1.8°-3.6°F (1°-2°C) by 2060 (Section 11 (IPCC 2013)), which will in turn affect underlying sediment temperatures along the coast. If mangroves shift pole-ward in response to temperature increases, they will at some point be limited by temperatures at the lower end of their optimal range and available recruitment area. This is especially true when considering already armored shorelines in residential communities such as those within and surrounding the CHEU of critical habitat for smalltooth sawfish.

As atmospheric CO_2 levels increase, the world's oceans will absorb much of this CO_2, causing potential increases in photosynthesis and mangrove growth rates. This increase in growth rate, however, would be limited by lower salinities expected from CO_2 absorption in the oceans (Ball et al. 1997), and by the availability of undeveloped coastline for mangroves to expand their range. A secondary effect of increased CO_2 concentrations in the oceans is the deleterious effect on coral reefs' ability to absorb calcium carbonate (Hoegh-Guldberg et al. 2007), and subsequent reef erosion. Eroded reefs may not be able to buffer mangrove habitats from waves, especially during storm/hurricane events, causing additional physical effects.

Finally, the anticipated increase in the severity of storms and hurricanes may also affect mangroves. Tropical storms are expected to increase in intensity and/or frequency, which will directly affect existing mangroves that are already adversely affected by increased seawater temperatures, CO_2, and changes in precipitation (Cahoon et al. 2003; Trenberth 2005). The combination these factors may lead to reduced mangrove height (Ning et al. 2003). Furthermore, intense storms could result in more severe storm surges and lead to potential changes in mangrove community composition, mortality, and recruitment (Gilman et al. 2006). Increased storms surges and flooding events could also affect mangroves' ability to photosynthesize (Gilman et al. 2006) and the oxygen concentrations in the mangrove lenticels (Ellison 2010).

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5. Environmental Baseline

By regulation, environmental baselines for Biological Opinions include the past and present impacts of all state, federal, or private actions and other human activities in the action area, 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).

5.1 Status of Listed Resources in the action area

5.1.1 Whales

Sperm whales occur within the action area. The status of and threats to this species in the action area are best reflected in their range-wide status and supported by the species account in Section 4.2.1.

5.1.2 Sea Turtles

The sea turtle species that occur in the action area are all migratory. Therefore, the status of these species (or DPS where applicable) in the action area, as well as the threats to these species, are best reflected in their range-wide statuses and supported by the species accounts in Section 4.2.2.

Currently, only loggerhead sea turtles have designated critical habitat in the action area. The status of this habitat is best reflected in the description of the critical habitat and threats to critical habitat discussed in Section 4.2.3.6.

5.1.3 Fish

The range of Gulf sturgeon extends from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi respectively, east to the Suwannee River in Florida. Smalltooth sawfish are found in the action area off of Florida particularly off Southwest Florida. The statuses of these species and their critical habitat in the action area, as well as the threats to these species, are best reflected in their range-wide statuses described in Sections 4.2.3 and 4.2.4.

5.2 Factors Affecting Listed Resources in the Action Area

As stated in Section 2.2, the action area is the Gulf of Mexico. The following analysis examines the impacts of past and on-going actions that may affect ESA-listed species and designated critical habitat specifically within the action area. The Environmental Baseline for this Opinion includes the effects of several activities affecting the survival and recovery of ESA-listed species in the action area. The activities that shape the environmental baseline in the action area of this consultation include, but are not limited to, fisheries, oil and gas activities, vessel operations, military activities, dredging, research permits allowing take under the ESA, and marine pollution. Increased shoreline and coastal development is expected to exacerbate and increase the magnitude and effect of many of these factors (e.g., marine pollution). Additionally, certain regulatory, conservation, and recovery actions aimed at benefiting ESA-listed resources help shape the environmental baseline.

5.2.1 Federal Actions

NMFS conducts Section 7 consultations to address the effects of federally permitted fisheries and other federal actions on threatened and endangered species, and when appropriate, has authorized the incidental taking of these species. Each of those consultations sought to minimize the adverse impacts of the action on sea turtles, sperm whales, Gulf sturgeon, and any designated critical habitat in the Biological Opinion's action area, when applicable. The summary below includes federal actions in the action area that have concluded or are currently in consultation under Section 7 of the ESA as well as the effects these actions have had on these ESA-listed species and critical habitat in the action area.

5.2.1.1 Fisheries

Recreational and commercial fisheries operating in federal waters of the Gulf of Mexico have interacted with (e.g., caught as bycatch, entangled) sea turtles throughout the past. Threatened and endangered sea turtles are adversely affected by several types of fishing gear in the action area. Gillnet, hook-and-line (i.e., longline and vertical line), and trawl gear have all been documented interacting with sea turtles.

Interactions between federal fisheries and sperm whales are very rare. The commercial fishery which potentially could interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (69 FR 40734 2004). While this species is less susceptible to threats posed by fishing gear than other more coastal species, there is at least one confirmed report of a sperm whale entanglement within the Gulf of Mexico. This incident occurred in 2008 in the pelagic longline fishery that operates in the northern Gulf of Mexico and the animal was released alive with no serious injury (NMFS 2010e).

Interactions between federal fisheries and Gulf sturgeon are also rare. Gulf sturgeon are susceptible to capture in trawls and gillnet gear via entanglement. However, because Gulf sturgeon occur in the Gulf of Mexico only during winter months and during that time most migrate alongshore and to barrier island habitats within shallower state waters, we believe federal fisheries have only a minor impact on the species.

Interactions between smalltooth sawfish and federal fisheries can also occur. Interactions have been documented in shrimp trawls, gillnets, and hook and line gear (NMFS 2010d).

For all fisheries for which there is a fishery management plan (FMP) or for which any federal action is taken to manage that fishery, the impacts have been evaluated via Section 7 consultation. Formal Section 7 consultations have been conducted on the following fisheries: Coastal Migratory Pelagics, Gulf of Mexico Reef Fish, Spiny Lobster, Southeastern Shrimp Trawl, Atlantic HMS Pelagic Longline, and HMS Atlantic Shark and Smoothhound fisheries. NMFS issued an incidental take statement (ITS) for the take of ESA-listed species in each of the fisheries. A summary of each consultation is provided below, but more detailed information can be found in the respective Biological Opinions (NMFS 2007; NMFS 2011a; NMFS 2012b).

5.2.1.1.1 Coastal Migratory Pelagics Fishery

In 2015, NMFS completed a Section 7 consultation on the continued authorization of the coastal migratory pelagics fishery in the Gulf of Mexico and South Atlantic (NMFS 2015c). In the Gulf of Mexico, hook-and-line, gillnet, and cast net gears are used, while the recreational sector uses hook-and-line gear. The hook-and-line effort is primarily trolling. The Biological Opinion concluded that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles, as well as smalltooth sawfish and Gulf sturgeon, may be adversely affected by operation of the fishery. However, the proposed action was not expected to jeopardize the continued existence of any of these species and an ITS was provided.

5.2.1.1.2 Gulf of Mexico Reef Fish Fishery

The Gulf of Mexico reef fish fishery uses 2 basic types of gear: spear or powerhead, and hook-and-line gear. Hook-and-line gear used in the fishery includes both commercial bottom longline and commercial and recreational vertical line (e.g., handline, bandit gear, rod-and-reel). The hook-and-line components of the fishery interact with both sea turtles and sawfish. Trap gear was phased-out completely by February 2007, but prior to that likely resulted in a few smalltooth sawfish entanglements.

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

In response, NMFS published an Emergency Rule prohibiting the use of bottom longline gear in the reef fish fishery shoreward of a line approximating the 50-fathom depth contour in the eastern Gulf of Mexico, essentially closing the bottom longline sector of the reef fish fishery in the eastern Gulf of Mexico for 6 months pending the implementation of a long-term management strategy. The Gulf of Mexico Fishery Management Council (GMFMC) developed a long-term management strategy via a new amendment (Amendment 31 to the Reef Fish FMP). The amendment included: (1) a prohibition on the use of bottom longline gear in the Gulf of Mexico reef fish fishery, shoreward of a line approximating the 35-fathom contour east of Cape San Blas, Florida, from June through August; and (2) a reduction in the number of bottom longline vessels operating in the fishery via an endorsement program and a restriction on the total number of hooks that may be possessed onboard each Gulf of Mexico reef fish bottom longline vessel to 1,000, only 750 of which may be rigged for fishing.

On October 13, 2009, SERO completed an Opinion that analyzed the expected effects of the continued operation of the Gulf of Mexico reef fish fishery under the changes proposed in Amendment 31 (NMFS-SEFSC 2009b). The Opinion concluded that sea turtle takes would be substantially reduced compared to the fishery as it was previously prosecuted, and that operation of the fishery is not likely to jeopardize the continued existence of any sea turtle species. Amendment 31 was implemented on May 26, 2010. In August 2011, consultation was reinitiated to address the DWH oil release event and potential changes to the environmental baseline. Reinitiation of consultation was not related to any material change in the fishery itself, violations of any terms and conditions of the 2009 Opinion, or an exceedance of the incidental take statement. The resulting September 30, 2011, Opinion concluded the continued operation of the Gulf of Mexico reef fish fishery is not likely to jeopardize the continued existence of any listed sea turtles (NMFS 2011a).

Additionally, the hook-and-line components of the fishery have likely always had the most adverse effects on smalltooth sawfish. However, all consultations to date have concluded the fishery is not likely to jeopardize the continued existence of the smalltooth sawfish. An ITS was provided authorizing nonlethal takes in the commercial and recreational hook-and-line components of the fishery.

5.2.1.1.3 Spiny Lobster Fishery

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

5.2.1.1.4 Southeast Shrimp Trawl Fisheries

NMFS has prepared Opinions on the Southeastern shrimp trawling numerous times over the years (most recently 2012 and 2014). The consultation history is closely tied to the lengthy regulatory history governing the use of TEDs and a series of regulations aimed at reducing potential for incidental mortality of sea turtles in commercial shrimp trawl fisheries.

Shrimp trawling increased dramatically in the action area between the 1940s and the 1960s. By the late 1970s, there was evidence thousands of sea turtles were being killed annually in the Southeast (NRC 1990). In 1990, the NRC concluded the Southeast shrimp trawl fishery affected more sea turtles than all other activities combined and was the most significant anthropogenic source of sea turtle mortality in the U.S. waters (NRC 1990) .

The level of annual mortality described in (NRC 1990) is believed to have continued until 1992-1994, when U.S. law required all shrimp trawlers in the Atlantic and Gulf of Mexico to use TEDs, allowing at least some sea turtles to escape nets before drowning (NMFS 2002).[12] TEDs approved for use have had to demonstrate 97% effectiveness in excluding sea turtles from trawls in controlled testing. These regulations have been refined over the years to ensure that TED effectiveness is maximized through proper placement and installation, configuration (e.g., width of bar spacing), flotation, and more widespread use.

Despite the apparent success of TEDs for some species of sea turtles (e.g., Kemp's ridleys), it was later discovered that TEDs were not adequately protecting all species and size classes of sea turtles. Analyses by Epperly and Teas (2002) indicated that the minimum requirements for the escape opening dimension in TEDs in use at that time were too small for some sea turtles and that as many as 47% of the loggerheads stranding annually along the Atlantic and Gulf of Mexico were too large to fit the existing openings. On December 2, 2002, NMFS completed an opinion on shrimp trawling in the southeastern United States (NMFS 2002) under proposed revisions to the TED regulations requiring larger escape openings (68 FR 8456 2003). This Opinion determined that the shrimp trawl fishery under the revised TED regulations would not jeopardize the continued existence of any sea turtle species. The determination was based in part on the Opinion's analysis that shows the revised TED regulations are expected to reduce shrimp trawl related mortality by 94% for loggerheads and 97% for leatherbacks. In February 2003, NMFS implemented the revisions to the TED regulations.

On May 9, 2012, NMFS completed a Biological Opinion that analyzed the continued implementation of the sea turtle conservation regulations and the continued authorization of the Southeast U.S. shrimp fisheries in federal waters under the Magnuson-Stevens Act (NMFS 2012c). The Opinion also considered a proposed amendment to the sea turtle conservation regulations to withdraw the alternative tow-time restriction (at 50 CFR 223.206(d)(2)(ii)(A)(3)) for skimmer trawls, pusher-head trawls, and wing nets (butterfly trawls) and instead require all of those vessels to use TEDs. The Opinion concluded that the proposed action was not likely to jeopardize the continued existence of any sea turtle species. An ITS was provided that used anticipated trawl effort and fleet TED compliance (i.e., compliance resulting in overall average sea turtle catch rates in the shrimp otter trawl fleet at or below 12%) as surrogates for sea turtle takes. On November 21, 2012, NMFS determined that a Final Rule requiring TEDs in skimmer

[12] TEDs were mandatory on all shrimping vessels. However, certain shrimpers (e.g., fishers using skimmer trawls or targeting bait shrimp) could operate without TEDs if they agreed to follow specific tow-time restrictions**.**

trawls, pusher-head trawls, and wing nets was not warranted and withdrew the proposal. The decision to not implement the Final Rule created a change to the proposed action analyzed in the 2012 Opinion and triggered the need to reinitiate consultation. Consequently, NMFS reinitiated consultation on November 26, 2012. Consultation was completed in April 2014. It was determined the continued implementation of the sea turtle conservation regulations and the continued authorization of the Southeast U.S. shrimp fisheries in federal waters under the Magnuson-Stevens Act was not likely jeopardize the continued existence of any sea turtle species. The ITS maintained the use of anticipated trawl effort and fleet TED compliance as surrogates for numerical sea turtle takes.

This opinion also considered impacts to Gulf sturgeon and smalltooth sawfish. On December 15, 2009, an observer documented a Gulf sturgeon captured in a shrimp trawl operating in federal waters; the animal was released alive. This observation was the first and only record of a Gulf sturgeon incidentally caught by a federal shrimp trawl. Previous Section 7 consultations on federal fisheries have always discounted effects on Gulf sturgeon because of their rarity in federal waters. The opinion determined that while capture of Gulf sturgeon in shrimp trawls remains an unlikely event, trawling could adversely affect the species but is not likely to jeopardize its continued existence (NMFS 2014c). The opinion provided an ITS for smalltooth sawfish, but concluded that the shrimp trawl fishery would not jeopardize the continued existence of the species.

5.2.1.1.5 Atlantic HMS Pelagic Longline Fisheries

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

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

NMFS reinitiated consultation in 2003 on the pelagic longline component of this fishery as a result of exceeded incidental take levels for loggerheads and leatherbacks (NMFS 2004c). The resulting 2004 Opinion stated the long-term continued operation of this sector of the fishery was likely to jeopardize the continued existence of leatherback sea turtles, but RPAs were implemented allowing for the continued authorization of pelagic longline fishing that would avoid jeopardizing the continued existence of leatherback sea turtles.

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

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

5.2.1.1.6 HMS Atlantic shark and smoothhound fisheries

These fisheries include commercial shark bottom longline and gillnet fisheries and recreational shark fisheries under the FMP for Atlantic Tunas, Swordfish, and Sharks (HMS FMP). NMFS has formally consulted 3 times on the effects of HMS shark fisheries on sea turtles (i.e., (NMFS 2003; NMFS 2008a; NMFS 2012b). NMFS has also authorized a federal smoothhound fishery that will be managed as part of the HMS shark fisheries. NMFS (2012b) analyzed the potential adverse effects from the smoothhound fishery on sea turtles for the first time. Both bottom longline and gillnet are known to adversely affect sea turtles and smalltooth sawfish. From 2007-2011, the sandbar shark research fishery had 100% observer coverage, with 4-6% observer coverage in the remaining shark fisheries. During that period, 10 sea turtle takes (all loggerheads) were observed on bottom longline gear in the sandbar shark research fishery and 5 were taken outside the research fishery. The 5 non-research fishery takes were extrapolated to the entire fishery, providing an estimate of 45.6 sea turtle takes (all loggerheads) for non-sandbar shark research fishery from 2007-2010 (Carlson and Richards 2011). No sea turtle takes were observed in the non-research fishery in 2011 (NMFS unpublished data). Since the research fishery has a 100% observer coverage requirement, those observed takes were not extrapolated

(Carlson and Richards 2011). Because few smoothhound trips were observed, no sea turtle captures were documented in the smoothhound fishery.

The most recent ESA Section 7 consultation was completed on December 12, 2012, on the continued operation of those fisheries and Amendments 3 and 4 to the Consolidated HMS FMP (NMFS 2012b). The consultation concluded the proposed action was not likely to jeopardize the continued existence of sea turtles or smalltooth sawfish and an ITS was provided authorizing take. ESA consultation was reinitiated on this fishery in 2015.

5.2.1.2 Vessel activity

Watercraft have the potential to affect sea turtles and sperm whales through collisions and the production of noise. Vessels are the greatest contributors to increases in low-frequency ambient noise in the sea (Andrew et al. 2011). It is predicted that ambient ocean noise will continue to increase at a rate of ½ dB per year (Ross 2005). Sound levels and tones produced are generally related to vessel size and speed. Larger vessels generally emit more sound than smaller vessels, and vessels underway with a full load, or those pushing or towing a load, are noisier than unladen vessels. The use of sonar aboard vessels presents another source of noise which can affect sperm whales. Vessels operating at high speeds have the potential to strike sea turtles or marine mammals with their hulls or propellers. Vessel activity can also result in death of coral larvae from cavitation in propellers. Potential sources of adverse effects from federal vessel operations in the action area include operations of the U.S. Department of Defense (DoD), Bureau of Ocean Energy Management/Bureau of Safety and Environmental Enforcement (BOEM/BSEE), Federal Energy Regulatory Commission (FERC), United States Coast Guard (USCG), NOAA, and USACE.

5.2.1.3 Military

The air space over the Gulf of Mexico is used extensively by the DoD for conducting various air-to-air and air-to-surface operations. Nine military warning areas and 5 water test areas are located within the Gulf of Mexico. The western Gulf of Mexico has 4 warning areas that are used for military operations. The areas total approximately 21 million ac or 58% of the area. In addition, 6 blocks in the western Gulf of Mexico are used by the Navy for mine warfare testing and training. The central Gulf of Mexico has 5 designated military warning areas that are used for military operations. These areas total approximately 11.3 million ac. Portions of the Eglin Water Test Areas (EWTA) comprise an additional 0.5 million ac in the Central Planning Area (CPA). The total 11.8 million ac is about 25% of the area of the CPA.

Formal consultations on overall U.S. Navy (USN) activities in the Atlantic (including the Gulf of Mexico) have been completed, including the USN Activities in East Coast Training Ranges (June 1, 2011); USN Atlantic Fleet Sonar Training Activities (AFAST) (January 20, 2011); USN AFAST LOA 2012-2014: USN active sonar training along the Atlantic Coast and Gulf of Mexico (December 19, 2011); activities in GOMEX Range Complex from November 2010 to November 2015 (March 17 2011); the USN East Coast Training Ranges (Virginia Capes, Cherry Point, and Jacksonville) (June 2010); and U.S. Navy's Atlantic Fleet Training and Testing

Activities (November 14, 2013). These Opinions concluded that although there is a potential for some USN activities to affect ESA-listed species, those effects were not expected to impact any species on a population level. Therefore, the activities were determined to be not likely to jeopardize the continued existence of any ESA-listed species.

A consultation evaluating the impacts from United States Air Force (USAF) search-and-rescue training operations in the Gulf of Mexico was completed in 1999 (NMFS 1999). NMFS more recently completed 5 consultations on Eglin Air Force Base testing and training activities in the Gulf of Mexico. These consultations concluded that the incidental take of sea turtles is likely to occur. These Opinions have issued incidental take for these actions: Eglin Gulf Test and Training Range (NMFS 2004b), the Precision Strike Weapons Tests (NMFS 2005b), the Santa Rosa Island Mission Utilization Plan (NMFS 2005c), Naval Explosive Ordnance Disposal School (NMFS 2004a), Eglin Maritime Strike Operations Tactics Development and Evaluation (NMFS 2013). These consultations determined the training operations would adversely affect sea turtles, but not jeopardize their continued existence. They further determined that because the activities were to be completed over shelf waters, they were not likely to adversely affect sperm whales.

5.2.1.4 Oil and gas operations

Oil and gas operations involve a variety of activities that adversely affect sea turtles, sperm whales, and/or Gulf sturgeon in the action area. These activities include vessels making supply deliveries, drilling operations, seismic surveys, and oil rig removals.

5.2.1.4.1 Oil and Gas Vessel Operations

Offshore supply boats running from shore bases to offshore Outer Continental Shelf oil and gas structures, is one of the industry activities considered in previous Section 7 consultations. The most recent Biological Opinion on BOEM lease sales and operations determined that vessels would adversely affect sea turtles, but not jeopardize their continued existence. Further, the opinion determined that vessels were not likely to adversely affect sperm whales as the potential for direct strikes or harassment was unlikely to occur. In response to terms and conditions of previous Opinions, and in an effort to minimize the potential for vessel strikes to marine mammals and sea turtles, BOEM and BSEE issued Joint NTL (2012-G01), “Vessel Strike Avoidance and Injured/Dead Protected Species Reporting.” Industry-related vessel traffic is a part of the current Environmental Baseline in the Gulf of Mexico and is expected to continue over the foreseeable future.

5.2.1.4.2 Lease Sales and Drilling Operations

The sale of OCS leases in the Gulf of Mexico and the resulting exploration and development of these leases for oil and natural gas resources is another activity affecting the status of ESA-listed species in the action area. BOEM administers the Outer Continental Shelf Lands Act and authorizes the exploration and development of wells in Gulf leases. As technology has advanced over the past several decades, oil exploration and development has moved further offshore into deeper waters of the Gulf. The development of wells often involves additional activities such as the installation of platforms, pipelines, and other infrastructure. Once operational, a platform will generate a variety of wastes including a variety of effluents and emissions. Each of these wastes can contribute to the baseline. Additionally, although the release of oil is prohibited, accidental oil spills can occur from loss of well control and thus adversely affect sea turtles, sperm whales, and Gulf sturgeon in the Gulf of Mexico. Previous Biological Opinions have considered the effects resulting from the variety of actions associated lease sales and development. These Opinions determined that sea turtles, sperm whales, and Gulf sturgeon, would be adversely affected though these effects are not likely to jeopardize their continued existences.

5.2.1.4.3 Seismic Surveys

Seismic exploration is an integral part of oil and gas discovery, development, and production in the Gulf of Mexico. Seismic surveys are routinely conducted in virtually all water depths, including the deep habitat of the sperm whales. NMFS considered the effects of seismic operations in a Biological Opinion issued to BOEM on its 2007–2012 OCS Gulf of Mexico program. This Opinion concluded that seismic surveys, with BOEM-required mitigation, were not likely to adversely affect sperm whales or sea turtles. Required mitigations can be found in the BOEM and BSEE Joint NTL 2012-G-02, “Implementation of Seismic Survey Mitigation Measures and Protected Species Observer Program.” Oil and gas activities are not permitted in the FGBNMS, except for occasional G&G surveys that require approval to occur. G&G surveys can result in some mortality of coral larvae, but the occurrence of surveys is rare.

5.2.1.4.4 Oil Rig Removals

Both the USACE and BSEE permit the removal of oil rigs in the Gulf of Mexico. These removals often use explosives to sever associated pile structures which can impact a variety of species, including any ESA-listed species, in the action area. The USACE oversees rig removals in state waters while BSEE permits those platforms in federal waters of the OCS. The USACE consults with NMFS on a project-by-project basis for decommissioning activities that use explosives in state waters. In regard to rig removals in federal waters, BSEE consults with NMFS on possible adverse effects. A formal ESA Section 7 consultation was completed in 2006 and in 2008 the ITS was amended following completion of the MMPA rule. This Opinion found that the permitting of structure removals in the Gulf of Mexico is likely to adversely affect, but not result in jeopardy for sperm whales and loggerhead, Kemp’s ridley, green, hawksbill, or leatherback sea turtles. Incidental take, by injury or mortality, of 3 sea turtles per year or 18 sea turtles during the 6 year period of the Opinion is anticipated during detonations. Most of these are predicted to be loggerhead sea turtles. In addition to the Reasonable and Prudent Measures within the ITS, BOEM has also issued “Decommissioning Guidance for Wells and Platforms” (NTL 2010-G05) to inform lessees about mitigation and reporting requirements. The removal of non-operating oil platforms is expected to continue to affect protected sea turtles over the foreseeable future.

5.2.1.5 Dredging

Coastal navigation channels are often dredged to support commercial shipping and recreational boating. Dredging activities can pose significant impacts to aquatic ecosystems by: (1) direct removal/burial of organisms; (2) turbidity/siltation effects; (3) contaminant resuspension; (4)

noise/disturbance; (5) alterations to hydrodynamic regime and physical habitat; and (6) loss of riparian habitat (Chytalo 1996; Winger et al. 2000). Additionally, beach nourishment projects typically require dredging to source sand, often from nearshore sandy bottom habitats. Increasing coastal development and ongoing beach erosion is expected to result in increased demands by coastal communities, especially beach resort towns, for periodic privately funded or federally sponsored beach renourishment projects.

Marine dredging vessels are common within U.S. coastal waters. Although the underwater noises from dredge vessels are typically continuous in duration (for periods of days or weeks at a time) and strongest at low frequencies, they are not believed to have any long-term effect on sea turtles, sperm whales, or Gulf sturgeon. However, the construction and maintenance of federal navigation channels and dredging in sand mining sites ("borrow areas") have been identified as sources of sea turtle and Gulf sturgeon mortality. Hopper dredges can lethally harm sea turtles and sturgeons by entraining them in dredge drag arms and impeller pumps. Hopper dredges in the dredging mode are capable of moving relatively quickly and can thus overtake, entrain, and kill sea turtles and Gulf sturgeon as the suction draghead(s) of the advancing dredge overtakes a resting or swimming organism.

To reduce take of listed species, relocation trawling may be utilized to capture and move sea turtles and sturgeon. In relocation trawling, a boat equipped with nets precedes the dredge to capture sturgeon and sea turtles and then releases the animals out of the dredge pathway, thus avoiding lethal take. Relocation trawling has been successful and routinely moves sea turtles and sturgeon in the Gulf of Mexico. Between January 2005 and April 2006 relocation trawling captured and successfully moved 2 Gulf sturgeon near Mobile Bay, Alabama: 5 near Gulf Shores, Alabama, 1 near Destin, Florida, and 8 near Panama City Beach, Florida. Seasonal in-water work periods, when Gulf sturgeon are absent from coastal waters, also assists in reducing incidental take.

In 2003, NMFS completed a regional opinion in the Gulf of Mexico that includes impacts to sea turtles, Gulf sturgeon, and Gulf sturgeon critical habitat from hopper dredging for maintenance. NMFS determined that (1) Gulf of Mexico hopper dredging would adversely affect Gulf sturgeon and 4 sea turtle species (i.e., green, hawksbill, Kemp's ridley, and loggerheads) but is not likely to jeopardize their continued existence, and (2) dredging in the Gulf of Mexico is not likely to adversely affect leatherback sea turtles, smalltooth sawfish, or ESA-listed whales. An ITS for those species adversely affected was issued. This Opinion also concluded that when existing navigation channels within designated critical habitat are dredged to only their current depth (i.e., maintenance-dredged), without improvements (e.g., deepening or widening), the project will not destroy or adversely modify Gulf sturgeon critical habitat. This ESA consultation was reinitiated in 2015.

Numerous other opinions have been produced that analyzed hopper dredging projects that did not fall under the scope of actions contemplated by the regional Opinion, including: the dredging of Ship Shoal in the Gulf of Mexico Central Planning Area for coastal restoration projects in

2005, the Gulfport Harbor Navigation Project in 2007, the East Pass dredging in Destin, Florida in 2009, the Mississippi Coastal Improvements Program in 2010, and the dredging of City of Mexico beach canal inlet in 2012. Each of the above free-standing Opinions had its own ITS and determined that hopper dredging during the proposed actions is not likely to jeopardize the continued existence of any ESA-listed species or adversely modify critical habitat of any listed species.

NMFS has previously determined in dredging Biological Opinions that non-hopper type dredging methods (e.g., clamshell or bucket dredging, cutterhead dredging, pipeline dredging, sidecast dredging) are slower and not likely to adversely affect ESA-listed species. NMFS has no new information that would alter that finding.

5.2.1.6 Construction and operation of public fishing piers

Since the active hurricane seasons of 2004 and 2005 a number of fishing piers have either been built or rebuilt along the Gulf Coast, particularly in Mississippi. The USACE permits the building of these structures and in some cases, FEMA provides funding. NMFS concluded that the fishing likely to occur following the completion of each pier project was likely to adversely affect certain species of sea turtles, but was not likely to jeopardize their continued existence. Incidental capture of sea turtles does not generally result in immediate mortality, though some captures result in severe injuries which may later lead to death. Incidental capture of smalltooth sawfish and Gulf sturgeon is also possible from public fishing piers. We expect fishing effort to continue at Gulf piers in the foreseeable future.

5.2.1.7 Aquaculture

On June 24, 2015, NMFS completed a Section 7 consultation on the final rule for the FMP for Regulating Offshore Marine Aquaculture in the Gulf of Mexico (Aquaculture FMP). The consultation considered, among other things, risk of entanglement and potential impacts to water quality from the permitting of up to 20 offshore aquaculture operations in federal waters of the Gulf of Mexico over a 10 year period. The consultation concluded that the Aquaculture FMP was not likely to adversely affect listed species or designated critical habitat under NMFS's purview. With respect to entanglement risks, entanglement can be greatly reduced through the use of rigid, durable materials and by keeping lines taut, and that in practice, most offshore marine aquaculture facilities are constructed under these specifications. The Aquaculture FMP requires applicants to provide documentation sufficient to evaluate a system's ability to withstand physical stresses and that there is anecdotal evidence that supports the conclusion that interactions are rare. On January 11, 2016, NOAA published the final rule implementing the Aquaculture FMP, the nation's first regional regulatory program for offshore aquaculture in federal waters.

5.2.1.8 Scientific research permits under Section 10 of the ESA

Regulations developed under the ESA allow for the issuance of permits allowing take of certain ESA-listed species for the purposes of scientific research under Section 10(a)(1)(a) of the ESA. Since issuance of the scientific research permits is a federal activity, issuance of the permit by

NMFS must also be reviewed for compliance with Section 7(a)(2) of the ESA to ensure that issuance of the permit does not result in jeopardy to the species or adverse modification of its critical habitat.

Sea turtles are the focus of research activities authorized by Section 10 permits under the ESA. Authorized activities range from photographing, weighing, and tagging sea turtles incidentally taken in fisheries, to blood sampling, tissue sampling, and performing laparoscopy on intentionally captured sea turtles. Most takes authorized under these permits are nonlethal. Before any research permit is issued, the proposal must be reviewed under the permit regulations.

NMFS also issues research permits for directed research on smalltooth sawfish. The permits allow researchers to capture, handle, collect tissue samples, and tag smalltooth sawfish in Florida waters. All take authorized under these permits is nonlethal. Additionally, NMFS has authorized incidental take (nonlethal) of smalltooth sawfish associated with scientific research for sea turtles.

A Section 10 permit is currently not required for scientific research on ESA-listed corals in the action area, with the exception of elkhorn coral. For this species, a permit is required per the ESA Section 4(d) Rule (73 FR 64264 2008). Research activities include, but are not limited to, collecting basic population data such as the numbers and sizes of individual colonies, collecting information on recruitment and mortality, and documenting disease, predation, and other factors that may inhibit recovery.

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

5.2.2 State or Private Actions

As discussed below, numerous state and private activities also affect the ESA-listed resources considered in this Opinion. State actions to conserve and recover listed resources are discussed in Section 5.2.5.

5.2.2.1 State Fisheries

Several coastal state fisheries are known to incidentally take listed species, but information on these fisheries is sparse (NMFS 2001b). Various fishing methods used in these commercial and recreational fisheries, including trawling, pot fisheries, gillnets, and vertical line are known to incidentally take sea turtles and/or Gulf sturgeon (NMFS 2001b). The past and current effects of state fisheries on listed species are currently not determinable. Most state data are based on extremely low observer coverage or sea turtles were not part of data collection; however, available data provide insight into gear interactions that could occur but are not indicative of the magnitude of the overall problem. The 2001 Highly Migratory Species Fishery Management

Plan Biological Opinion has an excellent summary of turtles taken in state fisheries throughout the action area (NMFS 2001b).

In addition to commercial state fisheries, protected sea turtles can also be incidentally captured by hook and line recreational fishers. Observations of state recreational fisheries have shown that loggerhead, leatherback, Kemp's ridley, and green sea turtles are known to bite baited hooks. Further, observations show that loggerheads and Kemp's ridleys frequently ingest the hooks. Hooked turtles have been reported by the public fishing from boats, piers, beaches, banks, and jetties. A detailed summary of the known impacts of hook-and-line incidental captures to loggerhead sea turtles can be found in the Turtle Expert Working Group reports (TEWG 1998; TEWG 2000).

Though not as commonly as sea turtles, Gulf sturgeon also likely interact with state fisheries. The Gulf sturgeon recovery plan (USFWS and GSMFC 1995) documents that Gulf sturgeon are occasionally incidentally captured in state shrimp fisheries in bays and sounds along the northern Gulf of Mexico. There is 1 recorded interaction (NMFS 2014c) of a Gulf sturgeon in state waters (December 15, 2009). State licensed commercial and recreational shrimp trawling also has the potential to affect Gulf sturgeon critical habitat through increased turbidity and the disruption of sediment surface dwelling invertebrates at trawling locations, though these disturbances are temporary and small in spatial scale.

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

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

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

5.2.2.2 Vessel traffic

Commercial traffic and recreational boating pursuits can have adverse effects on sea turtles via propeller and boat strike damage. The Sea Turtle Stranding and Salvage Network (STSSN) includes many records of vessel interactions (propeller injury) with sea turtles off Gulf of Mexico coastal states such as Florida, where there are high levels of vessel traffic. There are similar vessel interactions risks for sperm whales. After deep foraging dives, sperm whales spend up to 10 minutes "rafting" at the surface of the water, increasing their vulnerability to ship strikes when vessels are in close proximity (Jaquet et al. 1998). There has been one documented case of a possible sperm whale vessel strike in the Gulf of Mexico. The incident occurred in 1990 off the coast of Louisiana where it was determined that deep cuts on the dorsal surface probably occurred pre-mortem (Jensen and Silber 2004; NMFS 2012d). Looking at vessel interactions from stranding data, not all records indicate where a potential vessel strike occurred, as a turtle or sperm whale could have been injured/killed at one location and then drifted with currents for a considerable distance before coming ashore. Sperm whales, in many cases, might not even make it to shore, but rather sink at sea and be undetected.

Given these variables, it is difficult to definitively evaluate potential risk to sea turtles and whales stemming from specific vessel traffic. This difficulty is compounded by a general lack of information on vessel use trends, particularly in regard to offshore vessel traffic. Due to the benthic nature of sturgeon and sawfish and their mobility, we would not expect vessel traffic to be a significant threat to these species. Vessel traffic can also impact ESA-listed corals. For example, poor boating and anchoring practices (as well as associated poor snorkeling or diving techniques) can cause physical damage to corals.

5.2.2.2.1 Commercial and private marine mammal watching

Vessels (both commercial and private) engaged in marine mammal watching have the potential to impact ESA-listed species in the action area. A recent study of whale watch activities worldwide has found that the business of viewing whales and dolphins in their natural habitat has grown rapidly over the past decade into a billion dollar ($US) industry involving over 80 countries and territories and over 9 million participants (Hoyt 2001). In a more recent economic evaluation of the whale watching industry, (O'Connor 2009) estimated that by 2008 the market grew to comprise 13 million participants across 119 countries and generated a total expenditure of $2.1 billion. In 1988, the Center for Marine Conservation and the NMFS sponsored a workshop to review and evaluate whale watching programs and management needs (CMC and NMFS 1988). That workshop produced several recommendations for addressing potential harassment of marine mammals during wildlife viewing activities that include developing regulations to restrict operating thrill craft near cetaceans, swimming and diving with the animals, and feeding cetaceans in the wild.

Since then, NMFS has promulgated regulations at 50 CFR §224.103 that specifically prohibit the negligent or intentional operation of an aircraft or vessel, or the doing of any other negligent or intentional act which results in disturbing or molesting a marine mammal and feeding or attempting to feed a marine mammal in the wild. In addition, NMFS launched an education and outreach campaign to provide commercial operators and the general public with responsible marine mammal viewing guidelines which in part state that viewers should: (1) remain at least 50 yards from dolphins, porpoise, seals, sea lions and sea turtles and 100 yards from large whales; (2) limit observation time to 30 minutes; (3) never encircle, chase or entrap animals with boats; (4) place boat engine in neutral if approached by a wild marine mammal; (5) leave the water if approached while swimming; and (6) never feed wild marine mammals.

Although considered by many to be a non-consumptive use of marine mammals with economic, recreational, educational and scientific benefits, marine mammal watching is not without potential negative impacts. One concern is that animals may become more vulnerable to vessel strikes once they habituate to vessel traffic. Another concern is that preferred habitats may be abandoned if disturbance levels are too high.

Several investigators have studied the effects of whale watch vessels on marine mammals (Amaral and Carlson 2005; Au and Green 2000; Christiansen et al. 2013; Christiansen et al. 2011; Corkeron 1995; Erbe 2002; Felix 2001; Magalhaes et al. 2002; May-Collado and Quinones-Lebron 2014; Richter et al. 2006; Scheidat et al. 2004; Simmonds 2005; Watkins 1986; Williams et al. 2002). The whale’s behavioral responses to whale watching vessels depended on the distance of the vessel from the whale, vessel speed, vessel direction, vessel noise, and the number of vessels. Responses changed with these different variables and, in some circumstances, the whales or dolphins did not respond to the vessels, but in other circumstances, whales changed their vocalizations, surface time, swimming speed, swimming angle or direction, respiration rates, dive times, feeding behavior, and social interactions.

5.2.2.3 Oil and gas activities

Each Gulf state participates in the oil and gas industry, with Texas and Louisiana among the nation’s leading states in terms of crude oil and natural gas production. State oil and gas exploration, production, and development are expected to result in similar effects to protected species as reported in the analysis of federal activities for oil and gas lease sale Biological Opinions, including impacts associated with the explosive removal of offshore structures, seismic exploration, marine debris, oil spills, and vessel operation. Oil refineries, processing facilities, and pipelines along the Gulf Coast also may impact ESA-listed species through construction activities or pollution.

Florida has minor oil and gas reserves and few other energy resources. Legislation currently does not allow energy development within 100-125 miles of Florida until 2022. Most of Florida’s minor crude oil production comes from onshore fields in the northwestern Panhandle and from smaller fields in the south. Florida has no oil refineries and relies on petroleum products delivered by tanker and barge to marine terminals near the state's major coastal cities. Florida receives most of its natural gas supply from the Gulf Coast Region via 2 major interstate pipelines: (1) the Florida Gas Transmission line, which runs from Texas through the Florida Panhandle to Miami, and (2) the Gulfstream pipeline, an underwater link from Mississippi and Alabama to central Florida. With the completion of the Cypress Pipeline in May 2007, the Jacksonville area has also begun receiving supplies from the liquefied natural gas (LNG) import terminal at Elba Island, Georgia. To help meet Florida's growing demand for natural gas, companies have proposed building a new LNG import terminals in the federal waters off Florida's Gulf Coast that would be connected via underwater pipeline to Florida's existing natural gas pipeline system.

Alabama is rich in onshore energy resources, but not offshore waters. Alabama produces a small amount of crude oil from reserves located in the Black Warrior Basin in the north and the Gulf Coast in the south. One petroleum refinery is located near the Port of Mobile, a second is located in Tuscaloosa on the Black Warrior River, and a third is located in Atmore in the southern part of the state. Most offshore energy is in the form of natural gas. In 2005, gas production flowed through 47 fixed structures Alabama's state waters. Alabama receives additional supplies of natural gas transported by pipeline mainly from the Gulf of Mexico, Louisiana, and Texas. The Southeast Supply Header pipeline, transporting natural gas from the Perryville Hub in Texas to southern Alabama, came online in September 2008. This pipeline is intended to give Alabama consumers an alternative to the offshore supply.

Although Mississippi is not rich in energy, the State has substantial oil and gas fields are found primarily in the southern half of the State. In recent years, new deposits have been discovered onshore and offshore along the Gulf Coast. Mississippi currently produces a small amount of crude oil, and has 3 oil refineries, which together account for about 2% of total U.S. refining capacity. Mississippi's largest refinery, located along the Gulf Coast in Pascagoula, processes crude oil imported by marine tanker from Central and South America. In January 2007, the U.S. Department of Energy (DOE) chose a group of salt domes in Richton, Mississippi, as a new storage site for the Strategic Petroleum Reserve. Mississippi's natural gas production is minimal, but recent regulations published in 2011 that now allow leasing in offshore state waters may result in increased development in gas reserves found there. Mississippi's natural gas processing industry has expanded in recent years to serve growing offshore supplies brought in via pipelines from the outer continental shelf (OCS). Mississippi will soon begin importing international supplies from LNG import terminals have been approved near Pascagoula.

Louisiana is rich in crude oil and natural gas. Oil and gas deposits are found in abundance both onshore and offshore in state-owned waters. Although Louisiana State's offshore oil production peaked in 1970, Louisiana's production in the federal OCS continues to expand as new offshore technologies allowed companies to access reserves in deeper areas of the Gulf of Mexico. Oil production in Louisiana state waters is a fraction of that produced in adjacent deeper offshore federal waters. For example, according to the Louisiana Department of Natural Resources, over 5 million barrels of crude oil and condensate were produced in state waters in 2015, but 271 million barrels were produced in adjacent federal waters of the Gulf of Mexico.

Louisiana is also a major importer of crude oil from around the world, typically bringing in about one-fifth of all foreign crude oil processed in the United States. The state receives petroleum supplies at several ports, including the Louisiana Offshore Oil Port (LOOP)—the only port in the United States capable of accommodating deep-draft tankers. The LOOP, which began receiving foreign crude oil in 1981 after domestic U.S. production peaked in the 1970s, can import up to 1.2 million barrels per day and is connected through a network of crude oil pipelines to about one-half of U.S. refining capacity. Associated with LOOP are Clovelly Dome, a 40-million-barrel salt cavern storage facility, and the Capline pipeline, which is the largest pipeline system delivering crude oil from the Gulf Coast to the Midwest. Because Louisiana's infrastructure provides multiple connections to the nation's commercial oil transport network, the U.S. Department of Energy chose the state as a site for 2 of the Strategic Petroleum Reserve's 4 storage facilities. State crude oil production and imports that are not sent to other states are processed at Louisiana's 16 operating refineries, clustered mostly along the Lower Mississippi River and in the Lake Charles area. With a refining capacity of more than 2.5 million barrels per day, Louisiana produces more petroleum products than any state but Texas.

Substantial natural gas production takes place offshore in Louisiana state waters. Louisiana plays an essential role in the movement of natural gas from the U.S. Gulf Coast region to markets throughout the country. Despite high demand from state consumers, Louisiana delivers most of its natural gas production to other states via a vast network of interstate pipelines. Over half of the natural gas that is supplied to Louisiana enters the state via pipelines from Texas. The state also receives, stores, and re-ships natural gas supplies from numerous international sources. To offset recent declines in Louisiana's natural gas supply and to meet the nation's demand, the state began to supplement production with foreign imports of LNG.

Texas leads the nation in fossil fuel reserves, crude oil production, and refining capacity. Texas oil production increased until 1972, when it peaked at more than 3.4 million barrels per day. Production declined rapidly, and in recent years, Texas crude oil output has fallen to less than one-third of its 1972 peak. Although Texas oil production is in decline, the state's signature type of crude oil, known as West Texas Intermediate (WTI), remains the major benchmark of crude oil in the Americas. Because of its light consistency and low-sulfur content, the quality of WTI is considered to be high, and it yields a large fraction of gasoline when refined. Texas's 27 petroleum refineries can process more than 4.7 million barrels of crude oil per day, and they account for more than one-fourth of total U.S. refining capacity. Most of the state's refineries are clustered near major ports along the Gulf Coast, including Houston, Port Arthur, and Corpus Christi. These coastal refineries have access to local Texas production, foreign imports, and oil produced offshore in the Gulf of Mexico, as well as the U.S. Government's Strategic Petroleum Reserve. Refineries in the Houston area, including the Nation's largest refinery in Baytown, make up the largest refining center in the United States.

Texas is the Nation's leading natural gas producer, accounting for approximately three-tenths of total U.S. natural gas production. Texas also consumes more natural gas than any other state and accounts for nearly one-fifth of total U.S. natural gas consumption. Texas natural gas demand is dominated by the industrial and electric power sectors, which together account for more than four-fifths of state use. Because Texas demand is high, and because the state's natural gas infrastructure is well connected to consumption markets throughout the country, several LNG import terminals have been proposed along the Gulf Coast in Texas.

5.2.2.4 Aquaculture

NOAA estimates that commercial marine aquaculture in waters of the Gulf of Mexico was a $61m industry in 2013 (NMFS 2015b). Commercial marine aquaculture in the Gulf of Mexico mainly consists of oysters and clam culture in coastal areas; shrimp and red drum are also cultured in tanks and ponds. There are currently no net pen aquaculture operations in Gulf of Mexico state waters, although Florida has developed specific best management practices (BMPs) for net pen culture in their state waters (Services 2007). Other states such as Louisiana, have instituted BMPs for aquaculture operations to help reduce and mitigate any potential environmental impacts.

Stock enhancement is the practice of releasing cultured fish into the wild to supplement natural populations. Several Gulf of Mexico states (Texas, Florida, and Mississippi) have active stock enhancement programs for red drum, spotted sea trout, southern flounder, snook, and bay scallops. In addition, aquaculture-based restoration activities to rebuild oyster reefs also occur throughout the Gulf of Mexico.

Aquaculture has the potential to impact protected species via entanglement and/ or other interaction with aquaculture gear (i.e., buoys, nets, lines), introduction or transfer of pathogens, increased vessel traffic, impacts to habitat and benthic organisms, and water quality. In most cases, aquaculture operations will need to obtain a permit authorized by the USACE under Section 10 of the Rivers and Harbors Act (Section 10) (DWH Trustees 2015). Additionally, finfish operations which produce 100,000 pounds or more annually are also required to obtain a National Pollutant Discharge Elimination System (NPDES) from the Environmental Protection Agency. Issuance of such permits is a federal action, and would be subject to ESA Section 7 consultation.

5.2.3 Other Potential Sources of Impacts in the Environmental Baseline

As discussed below, several other stressors that cannot always be traced back to specific federal, state, or private sources are also known to impact ESA-listed resources in the action area.

5.2.3.1 *Deepwater Horizon* Oil Spill and Response

On April 20, 2010, while working on an exploratory well approximately 50 miles offshore Louisiana, the semi-submersible drilling rig *Deepwater Horizon* (DWH) experienced an explosion and fire. The rig subsequently sank and oil and natural gas began leaking into the Gulf of Mexico. Oil flowed for 86 days, until the well was finally capped on July 15, 2010. Millions of barrels of oil were released into the Gulf of Mexico. Oil spread from the deep ocean to the surface and nearshore environment, from Texas to Florida. In response to this uncontrolled oil discharge, approximately 1.84 million gallons of chemical dispersant was applied both subsurface and on the surface to attempt to break down the oil. Further response activities included hundreds of oil patches burned at the sea surface, synthetic-based drilling muds released on the sea floor, deployment of boom and construction of berms to prevent oil from reaching the shore, and disruptive mechanical collection and removal of oil that reached the shore. Each of these activities resulted in additional environmental consequences (DWH Trustees 2015).

The investigation conducted under the National Resource Damage Assessment regulations under the Oil Pollution Act (33 U.S.C. 2701 *et seq.*) assessed natural resource damages stemming from the DWH oil spill. The investigation evaluated whether a pathway could be established from the discharge to the exposed resource (e.g., the ESA-listed species), whether the resource had been exposed to the oil or chemical dispersants, and the injury caused by that exposure. The oil released into the environment was found to be toxic to a wide range of organisms, including fish, invertebrates, plankton, birds, and mammals, causing a wide array of toxic effects including death, disease, reduced growth, impaired reproduction, and physiological impairments that reduce the fitness of organisms (their ability to survive and reproduce). In addition to direct injuries to individual organisms, the *Deepwater Horizon* incident resulted in injuries to habitats used by ESA-listed species including marsh habitats, shoreline beaches, floating *Sargassum* habitats offshore, and submerged aquatic vegetation. Further details on the findings of this assessment for each ESA-listed species injured by the spill are discussed in Section 4 and in the DWH PDARP. Information about DWH early restoration can be found below, in Section 5.2.5.6.

5.2.3.2 Marine Debris

The discharge of debris into the marine environment is a continuing threat to the status of ESA-listed resources in the action area, regardless of whether the debris is discharged intentionally or accidentally. Marine debris may originate from a variety of sources, though specific origins of debris are difficult to identify. Debris can originate from land-based sources, but can also originate from a variety of marine industries including fishing, oil and gas, and shipping. A worldwide review of marine debris identifies plastic as the primary form of marine debris (Derraik 2002). Many of the plastics discharged to the sea can withstand years of saltwater exposure without disintegrating or dissolving. Further, floating materials have been shown to concentrate in ocean gyres and convergence zones where *Sargassum* and consequently juvenile sea turtles are known to occur (Carr 1987). In the Gulf of Mexico, marine debris ranges from large concentrations of litter (i.e., cigarette butts and plastic bottles) that find their way through storm drains to beaches and coastal habitats to large derelict vessels that disturb marshes and seagrass habitats.

Marine debris has the potential to impact protected species through ingestion or entanglement (Gregory 2009). Both of these effects could result in reduced feeding, reduced reproductive success, and potential injury, infection, or death. Sperm whale ingestion of marine debris is a concern, particularly because their suspected feeding behavior includes cruising along the bottom with their mouths open (Walker and Coe 1990). Stranded sperm whales have been found with an assortment of fishing related debris (e.g., net scraps, rope) and other plastics inside their stomachs, leading researchers to conclude that gastric impaction from the debris can cause mortality (Jacobsen et al. 2010). All sea turtles are susceptible to ingesting marine debris, though leatherbacks show a marked tendency to ingest plastic which they misidentify as jellyfish – a primary food source (Balazs 1985). Ingested debris may block the digestive tract or remain in the stomach for extended periods, thereby reducing the feeding drive, causing ulcerations and injury to the stomach lining, or perhaps even providing a source of toxic chemicals (Laist 1987; Laist 1997). Weakened animals are then more susceptible to predators and disease and are also less fit to migrate, breed, or, in the case of turtles, nest successfully (McCauley and Bjorndal 1999; Katsanevakis 2008).

In 2014, the NOAA Marine Debris Program compiled a report summarizing information on the entanglement of marine species in marine debris in the United States (Balazs 1985; Program 2014). Information cited in that report relvant to ESA-listed species in the action area is described below. The report noted that sea turtles are particularly vulnerable to entanglement and ingestion of marine debris because they tend to align themselves with oceanic fronts, convergences, rip, and driftlines where marine debris often occurs (Balazs 1985; Carr 1987). Balazs (1985) listed 52 cases of sea turtle entanglement between 1973 and 1984. While most of these reports were from Hawaii, reports from Florida and Texas also occurred. Combining data from the Gulf of Mexico, southeast U.S., northeast U.S., and U.S. Caribbean, Teas and Witzell (1995) reported 52 sea turtle entanglements per year from stranding network beach observations from 1980 to 1992. More recently, the Florida Entanglement Working Group reported 1,217 sea turtles that were entangled or had ingested marine debris from 1997-2009 (Bassos-Hull and Powell 2012). Seitz and Poulakis (2006) reported on a study conducted from 1998-2005 on entanglement of smalltooth sawfish. Individuals were found entangled in a variety of marine debris including PVC pipe, monofilament line, elastic bands, and netting in Florida. The authors suspected that the long snout of the species with exposed teeth could make it vulnerable to any debris that could easily attach to the teeth. Chiappone et al. (2002) conducted surveys of the Florida Keys and documented marine debris entanglement in reef areas. The authors documented damage from marine debris on coral reef habitat, including damage to scleractinian corals (likely inclusive of ESA-listed corals such as elkhorn and staghorn coral). While there are several documented cases of ESA-listed species entangled with marine debris in the action area, the report also noted that estimates of entanglement in marine debris in the United States are likely underestimated (Program 2014).

5.2.3.3 Pollution

Pollution from a variety of sources including atmospheric loading of pollutants such as PCBs, stormwater from coastal or river communities, and discharges from ships and industries affect ESA-listed species in the action area. Sources of marine pollution are often difficult to attribute to specific federal, state, local, or private actions.

There are studies on organic contaminants and trace metal accumulation in green, leatherback, and loggerhead sea turtles (Aguirre et al. 1994; Caurant et al. 1999; Corsolini et al. 2000). McKenzie et al. (1999) measured concentrations of chlorobiphenyls and organochlorine pesticides in sea turtles tissues collected from the Mediterranean (Cyprus, Greece) and European Atlantic waters (Scotland) between 1994 and 1996. Omnivorous loggerhead turtles had the highest organochlorine contaminant concentrations in all the tissues sampled, including those from green and leatherback turtles (Storelli et al. 2008). It is thought that dietary preferences were likely to be the main differentiating factor among species. Decreasing lipid contaminant burdens with sea turtle size were observed in green turtles, most likely attributable to a change in diet with age. Sakai et al. (1995) documented the presence of metal residues occurring in loggerhead sea turtle organs and eggs. Storelli et al. (1998) analyzed tissues from 12 loggerhead sea turtles stranded along the Adriatic Sea (Italy) and found that characteristically, mercury accumulates in sea turtle livers while cadmium accumulates in their kidneys, as has been reported for other marine organisms like dolphins, seals, and porpoises (Law et al. 1991). No information on detrimental threshold concentrations is available and little is known about the consequences of exposure of organochlorine compounds to sea turtles. Research is needed on the short- and long-term health and fecundity effects of chlorobiphenyl, organochlorine, and heavy metal accumulation in sea turtles.

Like sea turtles, sperm whales may be adversely affected by marine pollution originating from federal, state, or private activities, though little is known regarding the specific pollutants or the effects pollutants may have on individuals. Further, we are unaware of the possible long-term and trans-generational effects of exposure to pollutants. It is not known if high levels of heavy metals, PCBs, and organochlorines found in prey species accumulate with age and are transferred through nursing. Nevertheless, the accumulation of stable pollutants such as heavy metals, polycholorobiphenyls [PCBs], chlorinated pesticides [DDT, DDE, etc.], and polycyclic aromatic hydrocarbons [PAHs]) is of concern.

Pollution from industrial, agricultural, and municipal activities is believed responsible for a suite of physical, behavioral, and physiological impacts to sturgeon worldwide (Agusa et al. 2004; Barannikova 1995; Barannikova et al. 1995; Bickham et al. 1998; Billard and Lecointre 2000; Kajiwara 2003; Karpinsky 1992; Khodorevskaya et al. 1997; Khodorevskaya and Krasikov 1999). Pharmaceuticals and other endocrinologically active chemicals may also be affecting Gulf sturgeon. Several characteristics of the Gulf sturgeon (i.e., long life span, extended residence in riverine and estuarine habitats, benthic predator) predispose the species to long-term and repeated exposure to environmental contamination and potential bioaccumulation of heavy metals and other toxicants. Some of these compounds may affect physiological processes and impede the ability of a fish to withstand stress, while simultaneously increasing the stress of the surrounding environment by reducing DO, altering pH, and altering other water quality properties.

Natural seeps provide a large petroleum input to the offshore Gulf of Mexico. The total amount of natural oil seepage per year, from thousands of natural seeps over the entire 600,000 square miles of the Gulf of Mexico, is estimated to be between 220,000 and 550,000 barrels (MacDonald 2012). This volume of oil slowly enters the deep sea from thousands of locations over a huge area annually and is expected to continue into the reasonably foreseeable future. In contrast, the *Deepwater Horizon* spill released about 6 to 15 times the volume of oil from a single location in just 87 days. As it is a natural occurrence, the rate of natural oil seepage is expected to continue into the reasonably foreseeable future.

The development of marinas and docks in inshore waters can negatively impact nearshore habitats. Fueling facilities at marinas can sometimes discharge oil, gas, and sewage into sensitive estuarine and coastal habitats. Although these contaminant concentrations do not likely affect the more pelagic waters of the action area, the species of turtles analyzed in this Opinion travel between nearshore and offshore habitats and may be exposed to and accumulate these contaminants during their life cycles. Further, Gulf sturgeon use coastal areas during a portion of the year and may also be affected by pollution originating from marina facilities. Fuel oil spills could affect animals directly or indirectly through the food chain. Fuel spills involving fishing vessels are common events. However, these spills typically involve small amounts of material. Larger oil spills may result from accidents, although these events would be rare. No direct adverse effects on listed species resulting from fishing vessel fuel spills have been documented.

5.2.3.4 Nutrient loading and hypoxia

Nutrient loading from land-based sources, such as coastal communities and agricultural operations stimulate plankton blooms in closed or semi-closed estuarine systems. The effects on larger embayments are unknown. An example is the large area of the Louisiana continental shelf where seasonally depleted oxygen levels (< 2 mg/liter) are caused by eutrophication from both point and non-point sources. This definition of hypoxia is based on the oxygen levels that cause a behavioral response in most demersal fish, crabs, and shrimp to move away from these water (Rabalais et al. 2010). The oxygen depletion, referred to as hypoxia, begins in late spring, reaches a maximum in mid-summer, and disappears in the fall. The hypoxic zone in the Gulf of Mexico reaches up to 22,000 km^2 and averaged 13,500 km^2 from 1985 to 2005. It is the second largest human-caused hypoxic zone in the coastal ocean (Rabalais et al. 2010). The hypoxic zone negatively impacts sea turtle and Gulf sturgeon habitats and prey availability which in turn can affect survival and reproductive fitness.

5.2.3.5 Anthropogenic sound

Noise generated by human activity may adversely affect ESA-listed species in the action area. Several investigators have argued that anthropogenic sources of noise have increased ambient noise levels in the ocean over the last 50 years (Jasny et al. 2005; NRC 2003; Richardson and Wursig 1995). Anthropogenic noise is generated by commercial and recreational vessels, aircraft, commercial sonar, military activities, seismic exploration, in-water construction activities, and other human activities. These activities occur within the action area to varying degrees throughout the year. The effects of noise on ESA-listed species can range from behavioral disturbance to physical damage (Richardson et al. 1995). For example, sperm whales generate and rely on sound to navigate, hunt, and communicate with other individuals.

Anthropogenic noise can interfere with these important activities. Noise, particularly at higher intensities, can also impact fish and sea turtles potentially resulting in death, hearing impairment, damage to anatomical structures, or changes in behavior (Popper and coauthors 2014). The severity of these impacts can vary greatly between minor impacts that have no real cost to the animal, to more severe impacts that may have lasting consequences.

Many researchers have described behavioral responses of marine mammals to the sounds produced by helicopters and fixed-wing aircraft, boats and ships, as well as dredging and construction (Richardson et al. 1995). Most observations have been limited to short term behavioral responses, which included temporary cessation of feeding, resting, or social interactions, however, habitat abandonment can lead to more long-term effects which may have implications at the population level. Masking may also occur, in which an animal may not be able to detect, interpret, and/or respond to biologically relevant sounds. Masking can reduce the range of communication, particularly long-range communication, such as that for blue and fin whales. This could have a variety of implications for an animal's fitness including, but not limited to, predator avoidance and the ability to reproduce successfully (NRC 2003). Recent scientific evidence suggests that marine mammals (NRC 2003) compensate for masking by changing the frequency, source level, redundancy, or timing of their signals, but the long-term implications of these adjustments are currently unknown (McDonald et al. 2006b; Parks 2003; Parks 2009).

Commercial shipping traffic is a major source of low frequency anthropogenic noise in the oceans (NRC 2003). Although large vessels emit predominantly low frequency sound, studies report broadband noise from large cargo ships above 2 kHz, which may interfere with important biological functions of cetaceans (Holt 2008). Commercial sonar systems are used on recreational and commercial vessels and may affect marine mammals (NRC 2003). Although little information is available on potential effects of multiple commercial sonars to marine mammals, the distribution of these sounds would be small because of their short durations and the fact that the high frequencies of the signals attenuate quickly in seawater (Richardson et al. 1995). Hildebrand (2009) discussed the various factors contributing to ocean noise (both natural and anthropogenic) and determined that low frequency ambient noise is dominated by commercial shipping. He estimated that over the past few decades, shipping has increased ambient noise levels by 12 dB, coinciding with a significant increase in the number and size of commercial shipping vessels in the world's oceans (Hildebrand 2009). NOAA is working cooperatively with the ship-building industry to find technologically-based solutions to reduce the amount of noise produced by commercial vessels.

Seismic surveys using towed airguns also occur within the action area and are the primary exploration technique to locate oil and gas deposits, fault structure, and other geological hazards. Airguns generate intense low-frequency sound pressure waves capable of penetrating the seafloor and are fired repetitively at intervals of 10-20 seconds for extended periods (NRC 2003). Most of the energy from the guns is directed vertically downward, but significant sound emission also extends horizontally. Peak sound pressure levels from airguns usually reach 235-

240 dB at dominant frequencies of 5-300 Hz (NRC 2003). Most of the sound energy is at frequencies below 500 Hz. As documented previously, NMFS considered the effects of seismic operations in a Biological Opinion issued to BOEM on its 2007–2012 OCS Gulf of Mexico program. This Opinion concluded that seismic surveys, with BOEM-required mitigation, were not likely to adversely affect sperm whales or sea turtles.

Through ESA consultation with NMFS, BOEM has implemented Gulf of Mexico-wide measures to reduce the risk of harassment to sperm whales from noise produced by geological and geophysical surveying activities and the explosive removal of offshore structures. The U.S. Navy has also implemented mitigation measures to reduce the potential effects of underwater sound from military training and testing activities on ESA-listed resources in the Gulf of Mexico. Mitigation measures include employing lookouts and implementing mitigation zones when training and testing using active sonar or explosives. For example, as documented in the 2013 Biological Opinion on U.S. Navy's Atlantic Fleet Training and Testing Activities, the Navy ensures that low-frequency and hull-mounted mid-frequency active sonar transmissions are ceased, for sources that can be turned off during the activity, if any visually detected marine mammals are within 200 yd of the sonar dome. Transmissions are not permitted to resume until one of the following conditions is met: the animal is observed exiting the mitigation zone, the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, the mitigation zone has been clear from any additional sightings for a period of 30 minutes, the ship has transited more than 2,000 yards beyond the location of the last sighting, or the ship concludes that dolphins are deliberately closing in on the ship to ride the ship's bow wave (and there are no other marine mammal sightings within the mitigation zone).

Noise from pile driving or other activities during in-water construction may also cause injury or behavioral responses in sea turtles and fish. For example, Popper and coauthors (2014) in their "Sound Exposure Guidelines for Sea Turtles and Fishes," a technical report developed and approved by Accredited Standards Committee S3/SC 1 Animal Bioacoustics, determined that mortality and potential mortal injury could occur if a sea turtle is subject to cumulative sound exposure levels from pile driving of 210 decibels or peak levels of greater than 207 decibels. The authors further determined that recoverable injury, temporary threshold shift, masking, or behavioral reactions all could occur from exposure to sound from pile driving, depending on how close the sea turtle was to the sound source. In-water construction projects in the Gulf of Mexico, including those involving pile driving, are permitted by the USACE and are subject to Section 7 consultation. Many construction projects in the Gulf of Mexico include measures as part of the proposed action on order to reduce the potential for high levels of sound exposure to ESA-listed resources from construction activities including using a vibratory hammer, operating according to seasonal work windows, and the use of noise abatement measures (e.g., bubble curtains, TNAP[13]).

[13] Temporary Noise Attenuation Pile (TNAP) are sleeves placed over the pile during installation consisting of a casing lined with noise-insulating foam.

It is clear that impacts may result from increased levels of anthropogenic-induced background noise or high intensity, short-term anthropogenic sounds. The majority of impacts will likely be short-term behavioral responses, although more serious impacts are possible. Despite the potential for these impacts to affect individual animals, information is not currently available to determine the potential population level effect of anthropogenic sound levels in the marine environment (MMC 2007) on ESA-listed marine mammals and sea turtles. More information would be required including, but not limited to, empirical data on how sound impacts an individual's growth and vital rates, how these changes impact that individual's ability to reproduce successfully, and then the relative influence of that individual's reproductive success on the population being considered. As a result, the consequences of anthropogenic sound on threatened and endangered marine mammal and sea turtles at the population or species scale remain uncertain.

5.2.3.6 Invasive species

Invasive species have been referred to as 1 of the top 4 threats to the world's oceans (Pughiuc 2010; Raaymakers 2003; Raaymakers and Hilliard 2002; Terdalkar et al. 2005; Wambiji et al. 2007). A variety of vectors are thought to have introduced non-native species to the Gulf of Mexico including, but not limited to, aquarium and pet trades, recreation, and ballast water discharges from ocean-going vessels. Common impacts of invasive species are alteration of habitat and nutrient availability, as well as altering species composition and diversity within an ecosystem (Strayer 2010).

Shifts in the base of food webs, a common result of the introduction of invasive species, can fundamentally alter predator-prey dynamics up and across food chains (Moncheva and Kamburska 2002), potentially affecting prey availability and habitat suitability for ESA-listed species. For example, the Asian tiger prawn was introduced to the Gulf of Mexico and poses a significant threat to native shrimp, crabs, and mollusks as a predator. It also is known to carry diseases not native to certain areas of the Gulf (e.g., the Texas coast) that could infect and devastate native shrimp and blue crab populations. Since loggerhead sea turtles in coastal waters are omnivorous and known to feed on crabs and mollusks (Graham et al. 2003; NMFS 2010a), the invasion of Asian tiger prawn could affect food availability for loggerheads in coastal areas of the Gulf of Mexico. The Australian jellyfish predates on larval fishes and invertebrates and can negatively impact the recruitment of fish species such as red drum and spotted seatrout (Graham et al. 2003; Chilton et al. 2011), potentially resulting in impacts throughout the food web. The orange cup coral has been established in the Gulf of Mexico and the Flower Garden Banks National Marine Sanctuary (FGBNMS) (Fenner and Banks 2004). The species is known to displace native coral species as it takes up space that could otherwise be used by native species. In the FGBNMS, this includes the potential displacement of ESA-listed corals. Lionfish is another invasive species that has been found in the Gulf of Mexico (Schofield 2010). The species is known to predate on coral and more than 70 species of native fish, potentially leading to food web changes that could affect ESA-listed species (NMFS 2014b). Red tide dinoflagellates have been introduced into the Gulf of Mexico via ballast water discharges and have the potential to undergo extreme seasonal population fluctuations. During bloom conditions, high levels of neurotoxins are released into local and regional surface water and air that can cause illness and death in fishes, sea turtles, marine mammals, and invertebrates (as well as their larvae) (Hallegraeff and Bolch 1992; Hallegraeff 1998; Hamer et al. 2001; Hamer et al. 2000; Lilly et al. 2002; McMinn et al. 1997). The brown alga, Aureococcus anophagefferens, causes brown tide when it blooms, causing diebacks of eelgrass habitat due to blooms decreasing light availability and failure of scallops and mussels to recruit (Doblin et al. 2004).

In the Gulf of Mexico, several states including Texas and Louisiana have Aquatic Nuisance Species management plans in place describing efforts to detect and monitor aquatic nuisance species, prevention efforts to stop their introduction and spread, and control efforts to reduce their impacts. Under these plans, invasive species management efforts include educating the public about harmful exotic species, controlling existing invasive species populations, and supporting research that yields new biological controls and control mechanisms for invasive aquatic animals (Chilton et al. 2011). The federal government (e.g., NOAA, United States Geological Survey) is also leading efforts to prevent and control the spread of invasive species in the Gulf of Mexico. For example, NOAA's Office of National Marine Sanctuaries has developed a lionfish management plan to guide the prevention, early detection, control, management, and research at the Florida Keys and the Flower Garden Banks.

5.2.4 Climate Change

This section provides a general overview of climate change and its potential impacts on marine organisms. For discussion on the potential effects of climate change on the ESA-listed resources considered in this Opinion, see Section 4.2.

The Fifth Assessment Synthesis Reports from the Working Groups on the Intergovernmental Panel on Climate Change (IPCC) conclude that climate change is unequivocal (IPCC 2014). The Report concludes oceans have warmed, with ocean warming the greatest near the surface (e.g., the upper 75 m have warmed by 0.11^{o}C per decade over the period 1971 to 2010) (IPCC 2014). Global mean sea level rose by 0.19 m between 1901 and 2010, and the rate of sea level rise since the mid-nineteenth century has been greater than the mean rate during the previous 2 millennia (IPCC 2014). The IPCC projects a rise of the world's oceans from 0.26 to 0.98 meters by the end of the century, depending on the level of greenhouse gas emissions. Additional consequences of climate change include increased ocean stratification, decreased sea-ice extent, altered patterns of ocean circulation, and decreased ocean oxygen levels (Doney et al. 2012). Further, ocean acidity has increased by 26% since the beginning of the industrial era (IPCC 2014) and this rise has been linked to climate change. Climate change is also expected to increase the frequency of extreme weather and climate events including, but not limited to, cyclones, heat waves, and droughts (IPCC 2014).

Specific to the southeastern United States, climate change is projected to lead to a number of impacts including increases in air and water temperatures, decreased water availability, an increase in the frequency of severe weather events, and ecosystem change. Average annual temperatures are predicted to increase 4-9 degrees Fahrenheit (USGCRP 2009). It is suggested that heavier rainfall is expected, separated by increased dry periods, which would result in increased risk of flooding and drought (IPCC 2014). Biasutti et al. (2012) noted that sea level rise is likely the greatest threat to coastal areas of the Gulf of Mexico, as even small amounts of sea level rise could inundate significant areas of the region. Figure 5-1 illustrates sea level projections for the continental United States. Areas experiencing little to no change in mean sea level are illustrated in green. Areas illustrated with positive sea level trends (yellow-to-red) are experiencing both global sea level rise and lowering or sinking of the local land, causing an apparently exaggerated rate of relative sea level rise. For example, some areas in Texas and Louisiana are experiencing subsiding land elevations, which are further exacerbating effects of sea level rise (NOAA 2013).

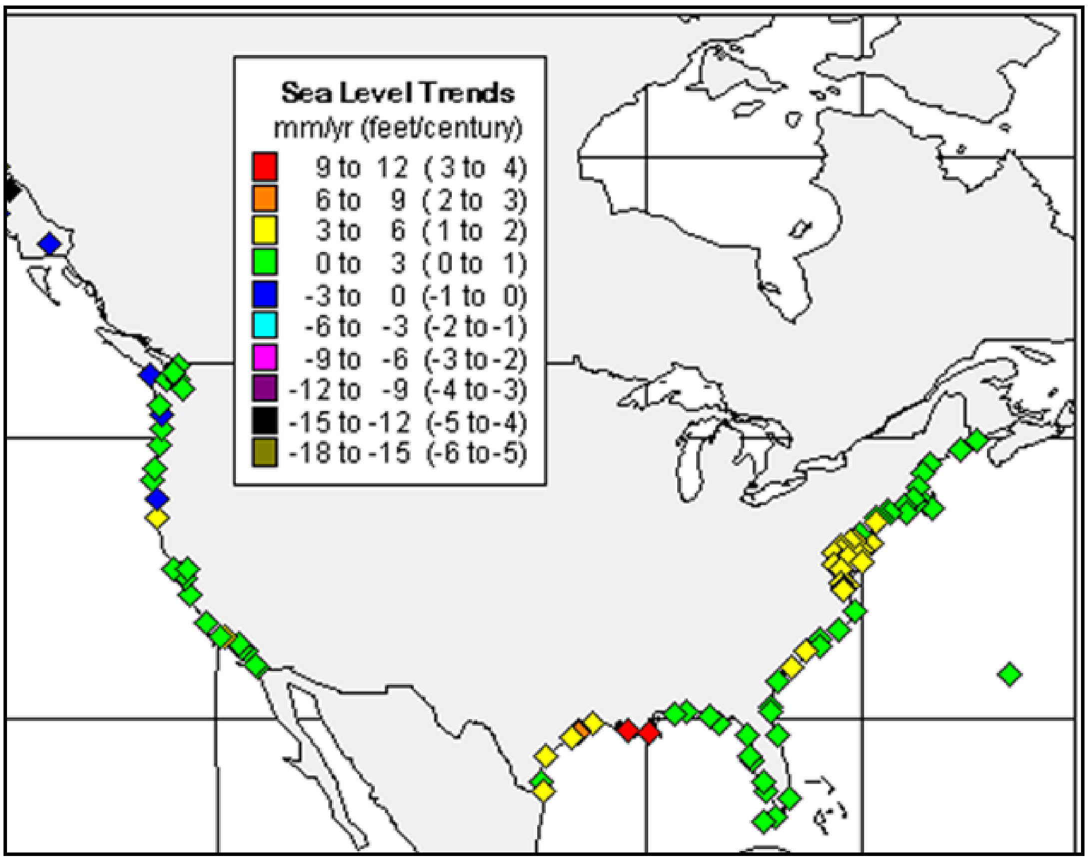

Figure 5-1. Regional mean sea level trends. Source: (IPCC 2014)

Climate change is expected to have a number of impacts on the aquatic ecosystem of the northern Gulf of Mexico (IPCC 2014), likely resulting in impacts to marine species abundance, geographic distribution, migration patterns, timing of seasonal activities (IPCC 2014), and species viability into the future. Sea level rise and increasingly frequent coastal storms and hurricanes and associated storm surges will affect shorelines, altering coastal wetland hydrology, geomorphology, biotic structure, and nutrient cycling (Michener et al. 1997). Furthermore, an increase in atmospheric carbon dioxide concentrations is projected to increase freshwater discharge from the Mississippi River to the coastal ocean, decrease aquatic oxygen content, and expand the hypoxic zone in the northern Gulf of Mexico (Justic et al. 1997). Sea level rise could result in more frequent flooding of low-lying areas, which would permanently alter some ecological communities (Simmonds and Isaac 2007; USGCRP 2009).

Though predicting the precise consequences of climate change on highly mobile marine species, such as many of those considered in this Opinion is difficult, Simmonds and Isaac (2007) recent research has indicated a range of consequences already occurring. Marine species ranges are expected to shift as they align their distributions to match their physiological tolerances under changing environmental conditions (Doney et al. 2012). Hazen et al. (2012) examined top predator distribution and diversity and predicted that some species would experience gains in available core habitat (e.g., leatherback sea turtle) and some would to experience losses (e.g., loggerhead sea turtles, blue whales). MacLeod (2009) estimated, based upon expected shifts in water temperature, 88% of cetaceans would be affected by climate change, with 47% likely to be negatively affected. Higher ocean temperatures are also expected to increase coral bleaching (Raymundo et al. 2008b). Bleaching episodes result in substantial loss of coral cover, and result in the loss of important habitat for associated reef fishes and other biota (e.g., sea turtles). Reef building organisms are also predicted to decrease the rate at which they deposit calcium carbonate in response to increased ocean acidity and warmer water temperatures (Raymundo et al. 2008a).

Similarly, climate-mediated changes in important prey species populations are likely to affect predator populations. For example, Pecl and Jackson (2008) predicted climate change will likely result in squid that hatch out smaller and earlier, undergo faster growth over shorter life-spans, and mature younger at a smaller size. This could have significant negative consequences for species such as sperm whales, whose diets can be dominated by cephalopods. For ESA-listed species that undergo long migrations, if either prey availability or habitat suitability is disrupted by changing ocean temperature regimes, the timing of migration can change or negatively impact population sustainability (Simmonds and Eliott. 2009). Specific to the Gulf of Mexico, (Fodrie et al. 2009) observed measurable changes in nearshore fish assemblages in the northern Gulf of Mexico. Such changes in community structure have the potential to affect ESA-listed species that occupy these nearshore habitats (e.g., smalltooth sawfish, sea turtles).

Changes in global climatic patterns are expected to have profound effects on coastlines worldwide, potentially having significant consequences for the species considered in this Opinion that are partially dependent on terrestrial habitat areas (i.e., sea turtles). For example, rising sea levels are projected to inundate some sea turtle nesting beaches (Caut et al. 2009; Fodrie et al. 2009; Wilkinson and Souter 2008), change patterns of coastal erosion and sand accretion that are necessary to maintain those beaches, and increase the number of turtle nests destroyed by tropical storms and hurricanes (Wilkinson and Souter 2008). The loss of nesting beaches may have catastrophic effects on global sea turtle populations if they are unable to colonize new beaches, or if new beaches do not provide the habitat attributes (e.g., sand depth, temperature regimes, refuge) necessary for egg survival. Additionally, as discussed in Section 4.2.2, increasing temperatures in sea turtle nests, as is expected with climate change, alters sex ratios, reduces incubation times (producing smaller hatchlings), and reduces nesting success due to exceeded thermal tolerances (Fuentes et al. 2009a; Fuentes et al. 2010; Fuentes et al. 2009b; Glen et al. 2003).

In the NMFS's Final Rule to list 20 coral species as threatened (79 FR 53851 2014), ocean warming and acidification, associated with climate change, were identified as two of the most important threats to the current or expected future extinction risk of reef building corals. Corals can typically withstand mild to moderate bleaching, but severe or prolonged bleaching events can lead to coral colony death. While the susceptibility to ocean warming and acidification associated with climate change is expected to vary by species and specific coral colony (based on latitude, depth, bathymetry, etc.), climate change is expected to have major impacts on corals.

This is not an exhaustive review of all available literature regarding the potential impacts of climate change to marine organisms and the species considered in this Opinion. However, this review provides some examples of impacts that may occur. Additionally, Section 4.2 includes discussion on the potential effects of climate change on the ESA-listed resources considered in this Opinion. While it is difficult to accurately predict the consequences of climate change to the species considered in this Opinion, a range of consequences are expected, ranging from beneficial to catastrophic.

5.2.5 Regulatory, Conservation, and Recovery Actions Benefiting Listed Resources

Appendix 6.B of the DWH PDARP provides a discussion of a number of federal, state, and local habitat conservation and protection programs in the Gulf Coast region. For example, there are 36 National Wildlife Refuges located within the coastal areas of the Gulf of Mexico. Additionally, private and non-governmental conservation easements total almost 1.5 million acres in the Gulf states. A number of regulatory and voluntary programs are also in place in the Gulf Coast region to improve water quality. For example, as described in Appendix 6.B of DWH PDARP, Florida is implementing nutrient reduction strategies through its total maximum daily load program and setting numerical nutrient limits on the amount of allowable nutrients that can be discharged in state waters. The Mississippi Department of Environmental Quality is co-leading an effort with a farming industry group to develop a nutrient reduction strategy for the Delta region of Mississippi. These actions are expected to benefit the Gulf of Mexico ecosystem, thereby benefiting ESA-listed resources in the action area. In addition, a number of regulatory, conservation, and recovery actions have occurred or are ongoing to specifically benefit the ESA-listed species considered in this Opinion.

5.2.5.1 Sea turtles

Federal Actions to Conserve Sea Turtles

Reducing Threats from Pelagic Longline and Other Hook-and-Line Fisheries
On July 6, 2004, NMFS published a Final Rule to implement management measures to reduce bycatch and bycatch mortality of Atlantic sea turtles in the Atlantic pelagic longline fishery (69 FR 40734 2004). The management measures include mandatory circle hook and bait requirements, and mandatory possession and use of sea turtle release equipment to reduce bycatch mortality.

NMFS published the Final Rules to implement sea turtle release gear requirements and sea turtle careful release protocols in the Gulf of Mexico reef fish (71 FR 45428 2006). These measures require owners and operators of vessels with federal commercial or charter vessel/headboat permits for Gulf reef fish and South Atlantic snapper-grouper to comply with sea turtle (and smalltooth sawfish) release protocols and have on board specific sea turtle release gear.

Revised Use of Turtle Excluder Devices in Trawl Fisheries
NMFS has also implemented a series of regulations aimed at reducing potential for incidental mortality of sea turtles in commercial shrimp trawl fisheries. NMFS has required the use of TEDs in southeast United States shrimp trawls since 1989. TEDs when installed and maintained exclude 97% of the sea turtles caught in such trawls. These regulations have been refined over the years to ensure that TED effectiveness is maximized through more widespread use, and proper placement, installation, configuration (e.g., width of bar spacing), and floatation.

Placement of Fisheries Observers to Monitor Sea Turtle Captures
On August 3, 2007, NMFS published a Final Rule that required selected fishing vessels to carry observers on board to implement the prohibitions on unauthorized take. Observers collect data on sea turtle interactions with fishing operations, evaluate existing measures to reduce sea turtle captures, and determine whether additional measures to address prohibited sea turtle captures may be necessary (72 FR 43176 2007). This rule also extended the number of days NMFS observers could be placed aboard vessels, for 30-180 days, in response to a determination by the Assistant Administrator that the unauthorized take of sea turtles may be likely to jeopardize their continued existence under existing regulations.

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

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

The NMFS Protected Resources Division has also developed educational signage to provide the public guidance on how to avoid harmful interactions with sea turtles. These signs are often posted near boat ramps, piers, docks, marinas, and waterfront parks along the Gulf Coast. Signs may be posted voluntarily or as a requirement of a Section 7 consultation. These signs include information on how to avoid interactions with sea turtles, the proper procedure to follow should a fisher hook a sea turtle, and a 24-hour hotline that fishers can call for instructions on how to avoid further harm to the hooked individual. Signs can be found at: http://sero.nmfs.noaa.gov/protected_resources/section_7/protected_species_educational_signs/index.html.

Recovery planning

The second revision to the recovery plan for the loggerhead sea turtle was completed January 11, 2009 (NMFS and USFWS 2009). The recovery plan for the Kemp's ridley sea turtle was published 2011 (USFWS 2011). Recovery teams comprised of sea turtle experts have been convened and are currently working towards revising these plans based upon the latest and best available information. Five-year status reviews were completed in 2007 for green, hawksbill, Kemp's ridley, and leatherback sea turtles. A review of the loggerhead sea turtle's status was conducted in 2009 (Conant et al. 2009). These reviews were conducted to comply with the ESA mandate for periodic status evaluation of listed species to ensure that their threatened or endangered listing status remains accurate. The reviews for green, hawksbill, Kemp's ridley, and leatherback sea turtles determined that no delisting or reclassification of a species status (i.e., threatened or endangered) was warranted at this time. However, further review of species data for the green, hawksbill, and leatherback sea turtles was recommended, to evaluate whether DPS should be established for these species (NMFS and USFWS 2007a; NMFS and USFWS 2007b; NMFS and USFWS 2007d).

Outreach and education, sea turtle entanglement, and rehabilitation

NMFS has also been active in public outreach efforts to educate fishers regarding sea turtle handling and resuscitation techniques. As well as making this information widely available to all fishers, NMFS recently conducted a number of workshops with Atlantic HMS pelagic longline fishers to discuss bycatch issues including protected species, and to educate them regarding handling and release guidelines. NMFS intends to continue these outreach efforts and hopes to reach all fishers participating in the Atlantic HMS pelagic longline fishery over the next 1-2 years. There is also an extensive network of STSSN participants along the Atlantic and Gulf of

Mexico coasts who not only collect data on dead sea turtles, but also rescue and rehabilitate any live stranded sea turtles.

State Actions to Conserve Sea Turtles

Under Section 6 of the ESA, state agencies may voluntarily enter into cooperative research and conservation agreements with NMFS to assist in recovery actions of listed species. NMFS currently has an agreement with all states along the Gulf of Mexico including Florida, Alabama, Mississippi, Louisiana, and Texas. Prior to issuance of these agreements, the proposals were reviewed for compliance with Section 7 of the ESA.

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

5.2.5.2 Gulf sturgeon

Critical habitat for Gulf sturgeon was jointly designated by NMFS and USFWS on April 18, 2003 (50 CFR 226.214). Additionally, a Gulf sturgeon recovery/management plan was prepared in 1995 (USFWS and GSMFC 1995). An updated recovery plan is currently under development by USFWS and NMFS.

A 5-year review of the Gulf sturgeon, completed in 2009, stated that abundance numbers indicate an essentially stable or slightly increasing population trend over the last decade in the eastern river systems (Florida), with a much stronger increasing trend in the Suwannee River and a possible decline in the Escambia. Populations in the western portion of the range (Mississippi and Louisiana) have never been nearly as abundant, and their current status is unknown as comprehensive surveys have not occurred in the past 5 years (USFWS and NMFS 2009).

The 5-year review also stated that data are not yet available to determine if population recovery is limited by factors affecting recruitment (e.g., spawning habitat quantity or quality), adult survival (e.g., incidental catch in fisheries directed at other species), or the late-maturing, intermittent reproductive characteristics of the species. It seems probable that riverine populations are being affected by various factors operating in concert and synergistically on a river-specific scale (USFWS and NMFS 2009).

Gulf sturgeon benefit from the use of devices inserted into trawl nets designed to exclude other species, such as sea turtles. Anecdotal reports and scientific research indicate that Atlantic sturgeon escape through TEDs installed in trawls. Flexible Flatbar Flynet TED testing was conducted in North Carolina from 2008 through 2009 by the NMFS SEFSC Pascagoula Laboratory to evaluate catch loss aboard contracted commercial vessels utilizing the trouser trawl technique (NMFS-SEFSC 2012). A standard 85-ft flynet trawl was modified to accommodate 2 separate cod ends with a divider panel originating at the cod end split and extending into the body of the trawl. This technique was chosen because of the high between-tow catch variability associated with flynet trawls. The TED was installed in one cod end, while no

TED was installed in the other net to serve as a control. Atlantic sturgeon were incidentally encountered during testing. Video obtained from a camera mounted behind the TED opening revealed several sturgeon escaping through the TED opening. In the course of 4 tows, the control net (with no TED) captured a total of 15 sturgeon, while the net with the TED captured only 2 Atlantic sturgeon. Based on Flexible Flatbar Flynet TED testing conducted in North Carolina from 2008 through 2009 by the NMFS SEFSC Pascagoula Laboratory, the TED resulted in an 87% reduction in Atlantic sturgeon bycatch by number of individuals (i.e., 2 Atlantic sturgeon were captured and 13 are assumed to have escaped capture through the TED out of an estimated 15 Atlantic sturgeon encountering the trawl gear).

Evidence of exclusion from a shrimp trawl net was documented when an Atlantic sturgeon caught off South Carolina by a shrimp trawler in December 2011 exited through the TED alive. NMFS has required the use of TEDs in some Gulf of Mexico shrimp trawls since 1989. The regulations have been refined over the years to ensure effectiveness is maximized doe sea turtle escapement through more widespread use, and proper placement, installation, configuration (e.g., width of bar spacing), and floatation.

State Actions

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

Gulf sturgeon is protected in Alabama and Mississippi. It is illegal to take, capture, kill, or attempt to take, capture or kill; possess, sell, trade for anything of monetary value, or offer to sell or trade for anything of monetary value, for Gulf sturgeon. Collection of Gulf sturgeon is only allowed with a scientific collection permit (AL ADC 220-2-92, MS ADC 40-1-28). In 1992, the State of Louisiana listed Gulf sturgeon as a state threatened species (76 LA ADC pt I, §317). Currently, the harvest of Gulf sturgeon in state waters is prohibited (76 LA ADC pt XIX, §111), and any modifications to habitat must consider the potential effects on sturgeon. Studies are underway to determine the status, distribution, and movements of this species in Louisiana.

Other Conservation Actions Benefiting Gulf Sturgeon

In 1998, Gulf sturgeon were listed under Appendix II of CITES. Appendix II species are threatened with extinction if their trade is not regulated and monitored. Appendix II species require an export permit, which may be issued for any purpose as long as the specimens were legally acquired and export is not detrimental to the species. The listing of sturgeon in CITES provides managers with a mechanism for regulating the import and export of sturgeon and their products, thereby curtailing the illegal caviar trade and the harm it causes to the wild populations. The USFWS, Division of Law Enforcement, is responsible for the enforcement of CITES and is the permit and enforcement authority responsible for regulating the importation of sturgeon from foreign countries.

5.2.5.3 Smalltooth sawfish

Federal Actions

On January 21, 2009, NMFS published the Final Recovery Plan for the U.S. DPS of smalltooth sawfish. NMFS is implementing recovery actions identified in the plan based on the recovery action's priority and available funding. Additionally, a 5-year review of the species status was published in October of 2010. The 5-year review concluded that the U.S. DPS of smalltooth sawfish remains vulnerable to extinction, and the species still meets the definition of endangered under the ESA, in that the species is in danger of extinction throughout its range (NMFS 2010d).

The NMFS Protected Resources Division has also developed educational signage to provide the public guidance on how to avoid harmful interactions with smalltooth sawfish. These signs are often posted near boat ramps, piers, docks, marinas, and waterfront parks along the Gulf Coast in areas where this species may occur. Signs may be posted voluntarily or as a requirement of a Section 7 consultation. These signs include information on how to avoid interactions with smalltooth sawfish, the proper procedure to follow should a fisher hook a smalltooth sawfish, and a 24-hour hotline that fishers can call for instructions on how to avoid further harm to the hooked individual.

State Actions

Regulations restricting the use of fishing gears known to incidentally catch smalltooth sawfish, benefits the species by reducing their capture and/or mortality in these gear types. In 1994, entangling nets (including gillnets, trammel nets, and purse seines) were banned in Florida state waters. Although intended to restore the populations of inshore gamefish, this action removed possibly the greatest source of fishing mortality on smalltooth sawfish (Simpfendorfer 2002).

Research, monitoring, and outreach efforts on smalltooth sawfish are providing valuable information on which to base effective conservation management measures. For example, the Florida Fish and Wildlife Conservation Commission (FWC) Fish and Wildlife Research Institute is responsible for collecting a wide variety of estuarine and marine fisheries data for the State of Florida (e.g., stock assessments, life history, fisheries-dependent monitoring, and fisheries-independent monitoring). The fisheries sampling conducted statewide by the State of Florida has the potential to provide a significant amount of data on smalltooth sawfish, especially as recovery of the species progresses and sawfish move beyond their current south Florida range. Additionally, the FWC's Fisheries-Dependent Monitoring Program, in cooperation with NMFS, collects and compiles data on recreational landings, commercial landings, and processed fishery products in Florida. The recreational landings are collected as part of the Marine Recreational Information Program. Data collected from this program can be used to monitor the recovery of the smalltooth sawfish throughout Florida.

Public outreach and education
Public outreach efforts are also helping to educate the public on smalltooth sawfish status and proper handling techniques and helping to minimize interaction, injury, and mortality of encountered smalltooth sawfish. Information regarding the status of smalltooth sawfish and what the public can do to help the species is available on the Florida Museum of Natural History and NMFS websites. These organizations also educate the public about sawfish status and conservation through regular presentations at various public meetings and during interviews with the media.

5.2.5.4 Sperm whales

Federal Actions
In December 2010, NMFS published the final recovery plan for sperm whales (NMFS 2010e). NMFS is implementing recovery actions identified in the plan based on the recovery action's priority and available funding. Additionally, a 5-year review of the species status was published in June of 2015. The 5-year review concluded that sperm whales remains vulnerable to extinction, and the status of the sperm whale should remain as endangered (NMFS 2015d). The 2015 status review discussed a variety of recommendations for the future so that we meet the downlisting criteria outlined in the final recovery plan (NMFS 2010e) including the need to accurately estimate current sperm whale abundance, continue research on population structures of the species, and continue research on the variety of threats the species faces (e.g., anthropogenic noise, entanglement in fishing gear, climate change).

Some of these research priorities are already being pursued. For example, in cooperation with NMFS, the Bureau of Ocean Energy Management is developing a long-term monitoring plan for marine mammals in the Gulf of Mexico. The monitoring plan will focus on the potential impacts to marine mammals from geological and geophysical data acquisition activities. This is being completed as a requirement for rulemaking under the Marine Mammal Protection Act. The federal agencies hope this monitoring plan will contribute to our knowledge of sperm whale presence, abundance, distribution, density, and behavior within the Gulf of Mexico. The agencies also seek to determine how individual marine mammals respond to acute or chronic stressors associated with geological and geophysical activities. Data collected from the long-term monitoring plan may then be used for making future management decisions.

5.2.5.5 DWH Early Restoration

On April 20, 2011, the *Deepwater Horizon* Natural Resource Damage Assessment Trustee Council reached an agreement with BP to start restoration planning and implementation before the damage assessment was completed. Up to $1 billion was approved for restoration projects. A number of projects have been approved that will rebuild coastal marshes, wetland and barrier islands, replenish damaged beaches, reduce bycatch and enhance the marine mammal stranding network. Additionally, in Phase II Early Restoration, a project was approved that would improve the quality of loggerhead sea turtle nesting beach habitat by replacing harmful artificial lighting. These projects are expected to address natural resource injury from the *Deepwater Horizon* oil spill, some of which was injury to ESA-listed resources.

Table 5-1. Summary of early restoration projects funded through DWH early restoration funds that were determined to be not likely to adversely affect (NLAA) or likely to adversely affect (LAA) ESA-listed resources. The table shows the NMFS consultation status and determination for complete consultations as of the time of this Opinion. This table does not include DWH early restoration projects determined to have no effect on ESA-listed resources.

DWH Early Restoration Phases I and II			
NMFS Number	Project	Consultation Status	NMFS Determination
SER-2012-889	Louisiana Oyster Cultch Project	Complete	NLAA
SER-2012-889	Mississippi Oyster Cultch Restoration Project	Complete	NLAA
SER-2012-889	Mississippi Artificial Reef Habitat Project	Complete	NLAA
SER-2012-889	Marsh Island (Portersville Bay) Restoration Project	Complete	NLAA
SER-2012-889	Florida Boat Ramp Enhancement Project (Navy Point, Mahogany Mill, Galvez Landing, Perdido)	Complete	NLAA
DWH Early Restoration Phase III			
NMFS Number	Project	Consultation Status	NMFS Determination
SER-2014-12910	Texas Parks & Wildlife - Corpus Christi Artificial Reef Project	Complete	NLAA
SER-2014-12916	Texas Parks & Wildlife - Freeport Artificial Reef Project	Complete	NLAA
SER-2014-12920	Texas Parks & Wildlife - Matagorda Artificial Reef Project	Complete	NLAA
SER-2014-12923	TX Ship Reef Project	Complete	NLAA
SER-2014-12924	Alabama Department of Conservation & Natural Resources - Alabama Oyster Enhancement Project	Complete	NLAA
SER-2014-12925	MS Dept. of Environmental Quality - Hancock County Marsh Living Shoreline	Complete	NLAA
SER-2014-12926	Swift Tract Living Shoreline	Complete	NLAA
SER-2014-13016	NOAA & FDEP - Florida Pensacola Bay Living Shoreline Project	Complete	NLAA
SER-2014-13017	NOAA Fisheries Restoration Center - Beach Enhancement Project at Gulf Islands National Seashore	Complete	NLAA
SER-2014-13018	NOAA Fisheries Restoration Center - North Breton Island Restoration by cutterhead pipeline dredge	Complete	NLAA
SER-2014-13026	DWH ERP3 - MS Dept. of Environmental Quality - Popp's Ferry Causeway Park	Complete	NLAA
SER-2014-13077	Florida Gulf Coast Marine Fisheries Hatchery/Enhancement Center	Complete	NLAA
SER-2014-13079	Florida Gulf Oyster Reef Restoration - Florida Oyster Cultch	Complete	NLAA
SER-2014-13080	Scallop Enhancement for Increased Recreational Fishing Opportunity in the Florida Panhandle	Complete	NLAA
SER-2014-13081	Florida Artificial Reef Creation and Restoration	Complete	NLAA
SER-2014-13083	Cat Point Living Shoreline - Apalachicola Bay, Florida	Complete	NLAA
SER-2014-13084	Bald Point State Park Recreation Area	Complete	NLAA

SER-2014-13085	Florida Wakulla County Mashes Sands Park Improvements	Complete	NLAA
SER-2014-13086	Norriego Point Restoration and Recreational Project	Complete	NLAA
DWH Early Restoration Phase III			
NMFS Number	Project	Consultation Status	NMFS Determination
SER-2014-13101	Florida Apalachicola River Wildlife and Environmental Area Viewing Access Improvements - Cash Bayou	Complete	NLAA
SER-2014-13119	Florida FWC Strategic Boat Access - Port St. Joe Frank Pate Boat Ramp Improvements	Complete	NLAA
SER-2014-13124	Big Lagoon State Park Boat Ramp Improvements	Complete	NLAA
SER-2014-13127	Enhancement of Franklin County Parks and Boat Ramps - Waterfront park	Complete	NLAA
SER-2014-13131	Gulf Breeze Wayside Park Boat Ramp - Gulf Breeze	Complete	NLAA
SER-2014-13135	Enhancement of Franklin County Parks and Boat Ramps: Indian Creek Park	Complete	NLAA
SER-2014-13140	FWC Strategic Boating Access - Walton County Lafayette Creek Boat Dock	Complete	NLAA
SER-2014-13144	FWC Strategic Boating Access - Mexico Beach Marina	Complete	NLAA
SER-2014-13270	Florida Walton County Boardwalks and Dune Crossovers: Bayside Ranchettes Park Improvements	Complete	NLAA
SER-2014-13272	FWC Strategic Boat Access: City of Parker, Earl Gilbert Dock and Boat Ramp Improvements	Complete	NLAA
SER-2014-13275	FWC - Florida Navarre Beach Park Access and Dune Restoration	Complete	NLAA
SER-2014-13276	Northwest Florida Estuarine Habitat Restoration, Protection and Education - Fort Walton Beach	Complete	NLAA
SER-2014-13277	FWC Strategic Boat Access: City of Panama City, St. Andrews Marina Docking Facility Expansions	Complete	NLAA
SER-2014-13278	FWC Strategic Boat Access: City of St. Marks Boat Ramp Improvements	Complete	NLAA
SER-2014-13886	Franklin County Parks and Boat Ramps - St. George Island Fishing Pier Improvements (St. George Improvements)	Complete	NLAA
SER-2014-15032	Gulf Island National Seashore Ferry Project	Complete	NLAA
SER-2014-15033	Louisiana Outer Coast Restoration - Chenier Ronquille Barrier Island Project	Complete	NLAA
SER-2014-15034	Louisiana Outer Coast Restoration - Caillou Lake Headlands/Shell Island Project	Complete	NLAA
SER-2014-15075	Reinitiation Army Permit No. SWG-2010-1407 - Texas Parks & Wildlife - Corpus Christi Artificial Reef Project	Complete	NLAA
SER-2014-15077	Reinitiation Army Permit No. SWG-2010-264 - Texas Parks & Wildlife - Freeport Artificial Reef Project	Complete	NLAA
SER-2014-15079	Reinitiation of Army Permit No. SWG-2009-2239 - Texas Parks & Wildlife - Matagorda Artificial Reef Project	Complete	NLAA
SER-2015-17048	Reinitiation of MS Dept. of Environmental Quality - Hancock County Marsh Living Shoreline Project	In Process	
SER-2014-13881	Gulf County - Windmark Beach Fishing Pier Improvements	In Process	
SER-2014-13883	City of Parker - Oak Shore Drive Pier Project	In Process	
SER-2014-13884	City of Panama - City Marina Fishing Pier, Boat Ramp and Staging Docks	In Process	

DWH Early Restoration Phase IV			
NMFS Number	Project	Consultation Status	NMFS Determination
SER-2015-16919	Pelagic Longline Bycatch Reduction Project	In Process	
SER-2015-16817	AL DCNR - Point aux Pins Living Shoreline Project	In Process	
SER-2015-16818	AL DCNR - Shell Belt Road Living Shoreline Project	In Process	
SER-2015-16819	AL DCNR- Coden Belt Road Living Shoreline Project	In Process	
SER-2015-16945	Texas Rookery Islands Project (Dickinson Bay Island II) - Texas Parks and Wildlife Department (TPWD)	In Process	
SER-2015-16946	Texas Rookery Islands Project (Rollover Bay Island) - Texas Parks and Wildlife Department (TPWD)	In Process	
SER-2015-16947	Texas Rookery Islands Project (Smith Point Island) - Texas Parks and Wildlife Department (TPWD)	In Process	
SER-2015-16948	Texas Rookery Islands Project (Dressing Point Island) - Texas Parks and Wildlife Department (TPWD)	In Process	
SER-2015-16954	Mississippi Dept of Environmental Quality - Grand Bay Intertidal Artificial Reef Creation/Enhancement Project	In Process	
SER-2015-16955	Mississippi Dept of Environmental Quality - Grand Bay Subtidal Artificial Reef Creation/Enhancement Project	In Process	
SER-2015-16956	Mississippi Dept of Environmental Quality - St. Louis Bay Living Shoreline Project	In Process	
SER-2015-16957	Mississippi Dept of Environmental Quality - Wolf River Living Shoreline and Subtidal Reef Project	In Process	
SER-2015-16958	Mississippi Dept of Environmental Quality - Little Island Living Shoreline Project	In Process	
SER-2015-16959	Mississippi Dept of Environmental Quality - Graveline Bay Intertidal Reefs Project	In Process	
SER-2015-16960	Mississippi Dept of Environmental Quality - Graveline Bay Subtidal Reefs Project	In Process	
SER-2015-16961	Mississippi Dept of Environmental Quality - Big Island Living Shoreline Project	In Process	
SER-2015-16962	Mississippi Dept of Environmental Quality - Channel Island Living Shoreline and Subtidal Reef Project	In Process	
SER-2015-16963	Mississippi Dept of Environmental Quality - Deer Island Subtidal Reef Project	In Process	
SER-2015-16990	Mississippi Dept of Environmental Quality - Grand Bay Intertidal Artificial Reef Creation/Enhancement Project	In Process	
SER-2015-17050	Sea Turtle Early Restoration Project	In Process	
DWH Early Restoration Phase V			
NMFS Number	Project	Consultation Status	NMFS Determination
SER-2015-17523	Florida Coastal Access Project (Innerarity Point Park) - Florida Dept of Environmental Protection	In Process	
SER-2015-17526	Florida Coastal Access Project (Leonard Destin Park) - Florida Dept of Environmental Protection	In Process	
SER-2015-17525	Florida Coastal Access Project (Island View Park) - Florida Dept of Environmental Protection	In Process	
SER-2015-17527	Florida Coastal Access Project (Lynn Haven Preserve and Park) - Florida Dept of Environmental Protection	In Process	

5.3 Summary and Synthesis of Environmental Baseline

In summary, several factors are presently adversely affecting ESA-listed species and critical habitat in the action area. These factors include, but are not limited to, fisheries, oil and gas activities, military activities, dredging, research permits allowing take under the ESA, climate change, and pollution. These factors are ongoing and are expected to occur contemporaneously with the proposed action. Increased shoreline and coastal development is expected to exacerbate and increase the magnitude and effect of many of these factors (e.g., pollution). Also of note, the *Deepwater Horizon* oil spill and response resulted in a wide range of adverse impacts to several of the ESA-listed species considered in this Opinion. Additionally, certain regulatory, conservation, and recovery actions aimed at benefiting ESA-listed resources help shape the environmental baseline.

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6. Effects of the Action – Species and Critical Habitat Analysis

Approach to Species and Critical Habitat Risk Analyses

This section assesses the potential direct and indirect effects of implementing the DWH PDARP on ESA-listed species and designated critical habitat. For this framework programmatic consultation, our analysis of risk to the species evaluates the potential response of individuals that could be exposed to the effects of future projects authorized under the DWH PDARP. The DWH PDARP does not provide detail about the specific location, magnitude, or duration of future project-specific actions. Thus, analyses of whether effects of specific projects or groups of projects are sufficient to reduce the viability of populations and species that those individuals represent will need to occur through project-level consultations.

Our analyses of risks to designated critical habitats evaluate the potential impacts of future actions on these habitats. Analyses of whether effects of specific projects or groups of projects on critical habitat are sufficient to result in destruction or adverse modification of critical habitat will occur through project-level consultations. The analyses in this section are based upon the best available commercial and scientific data on species' biology and the effects of the proposed program as described in the DWH PDARP.

The DWH PDARP (Appendix 6.A.) provides a list of "best practices" which are commonly incorporated into project designs to avoid or minimize impacts to natural resources during project implementation. The Trustees acknowledge in Appendix 6.A. that "projects generally would not be able to move forward through agency review without incorporation of best practices." We concur with this statement and have included throughout this analysis the assumption that all projects will include the appropriate best practices identified in the DWH PDARP Appendix 6.A.

Approach to Assessing the DWH PDARP Framework

The DWH PDARP lays out a framework of programmatic goals, restoration types, and 39 restoration approaches that will guide and direct subsequent project-level activities. Many of the restoration approaches are further broken down into restoration techniques, which are specific "on the ground" activities that would be employed to implement the restoration approaches. To avoid confusion as to which activities are labeled as approaches or techniques (or a combination of both) in the DWH PDARP, we have adopted the term "restoration activities" to describe all project-level activities that may be authorized and implemented under the DWH PDARP. A full description of all the proposed restoration activities can be found in Appendix 5.D. of the DWH PDARP.

There are many restoration activities included in the DWH PDARP that are expected to have no adverse effects on listed resources or are entirely beneficial to listed resources. Activities that result in beneficial activities are analyzed in Section 6.12. Activities that are expected to have no effect on listed resources under NMFS's jurisdiction are not analyzed in this Opinion. Table 6-1 lists the restoration activities that have the potential to cause adverse effects to listed resources and indicates the potential routes of those effects for each restoration activity. Those routes of effects are evaluated throughout the remainder of this section to show how the proposed restoration activities may affect each of the listed resource evaluated in this Opinion.

Table 6-1. Potential Routes of Adverse Effects for Restoration Activities

This table shows the relationship between potential routes of effects to ESA-listed species and critical habitat (horizontal axis) and the restoration activities in the DWH PDARP (vertical axis). The section numbers (6.X) noted in the potential routes of effects refer to the detailed analysis that follows this table.

	Potential Routes of Effect														
Restoration Activities	General In-water Construction Activities (6.1)	Construction of Living Shorelines, Rock Groins, and Breakwaters (6.2)	Dredging, including Placement of Dredged Material (6.3)	Placement of Oyster Shells/Cultch Material (6.4)	Construction of Artificial Reefs (6.5)	Revegetation, Propagation and Placement of Material for Restoration or Enhancement of SAV (6.6)	Controlled River Diversions (6.7)	Land-Based Runoff Sediments and Contaminants (6.8)	Pile Driving (6.8)	Shading and Permanent Displacement of SAV (6.6,6.8)	Permanent Anchored Buoys and Navigational Aids (6.8)	Increased Recreational Fishing and Boating (6.8)	Indirect Effects of Aquaculture (6.8)	Indirect/unintended Effects of Reducing Bycatch (6.9)	Increased Capture/Handling of Listed Species (6.10 , 6.11)
Create, restore, and enhance coastal wetlands	X	X	X	X											
Restore and preserve Mississippi-Atchafalaya River processes	X						X								
Restore oyster reef habitat	X			X											
Create, restore, and enhance barrier and coastal islands and headlands	X	X	X	X											
Restore and enhance dunes and beaches	X	X	X												
Restore and enhance submerged aquatic vegetation	X	X	X			X				X					
Gear conversion and/or removal of derelict fishing gear to reduce impacts of ghost fishing	X														
Voluntary reduction in Gulf menhaden harvest														X	
Reduce Gulf of Mexico commercial red snapper or other reef fish discards through individual														X	

	Potential Routes of Effect														
Restoration Activities	General In-water Construction Activities (6.1)	Construction of Living Shorelines, Rock Groins, and Breakwaters (6.2)	Dredging, including Placement of Dredged Material (6.3)	Placement of Oyster Shells/Cultch Material (6.4)	Construction of Artificial Reefs (6.5)	Revegetation, Propagation and Placement of Material for Restoration or Enhancement of SAV (6.6)	Controlled River Diversions (6.7)	Land-Based Runoff Sediments and Contaminants (6.8)	Pile Driving (6.8)	Shading and Permanent Displacement of SAV (6.6,6.8)	Permanent Anchored Buoys and Navigational Aids (6.8)	Increased Recreational Fishing and Boating (6.8)	Indirect Effects of Aquaculture (6.8)	Indirect/unintended Effects of Reducing Bycatch (6.9)	Increased Capture/Handling of Listed Species (6.10 , 6.11)
fishing quota (IFQ) allocation subsidy program															
Reduce sea turtle bycatch in commercial fisheries through identification and implementation of conservation measures														X	X
Reduce sea turtle bycatch in recreational fisheries through development and implementation of conservation measures												X			
Increase sea turtle and marine mammal survival through enhanced mortality investigation and early detection of and response to anthropogenic threats and emergency events															X
Coral transplantation and placement of hard ground substrate	X				X							X			
Enhance public access for recreational use by enhancing or constructing boat ramps, piers, boardwalks, etc.	X							X	X	X		X			
Enhance public access for recreational use by enhancing or constructing navigational channel improvements, safe harbors, and navigational aids	X		X						X		X	X			
Enhance recreational experiences by creating artificial reef structures	X				X							X			
Enhance recreational fishing opportunities through aquaculture													X		
Program-wide monitoring and adaptive management															X

Activities Likely to Adversely Affect Listed Species and Critical Habitat

Many of the restoration activities analyzed below are frequently designed and implemented in a manner that completely avoids adverse effects on ESA-listed species. We assume that action agencies will implement the best practices[14] described in the DWH PDARP, which will help to reduce adverse effects to listed species. However, even with implementation of these best practices, all of these activities still have the *potential* to result in adverse effects (as described below), and given that details on where, when, and how these activities will be implemented are not yet available, we are unable to make definitive ESA effects determinations on individual restoration activities at this time. NMFS has developed detailed project design criteria (PDCs) that are specific to certain restoration activities proposed in the DWH PDARP which, when fully implemented, are expected to result in projects that are not likely to adversely affect listed species or associated designated critical habitat for ESA-listed resources under NMFS's jurisdiction. More details on these PDCs and the process for ensuring that projects will be not likely to adversely affect listed species or their critical habitat can be found in Section 8 and Appendix A of this document.

6.1 General In-Water Construction Activities

Effects on Sea Turtles, Smalltooth Sawfish, and Gulf Sturgeon

Most of the habitat restoration activities analyzed in this section involve the use of heavy construction equipment, barges, and support vessels that can cause localized adverse impacts from vessel strikes, sediment disturbance, increased turbidity, and noise. These impacts can result in physical injury to listed species (e.g., vessel strikes), and/or cause them to avoid the construction area, which could disrupt foraging, sheltering, and other essential activities. Deployment of marker buoys related to construction activities can pose a risk of entanglement to listed species. Construction activities that involve deployment of turbidity curtains or other structures that enclose areas of aquatic habitat have the potential to result in entrapment of listed species within those areas or structures. Artificial lighting in the construction zone could disorient sea turtles as they approach and/or depart from nesting beaches. Fuel or chemical leaks from heavy equipment could enter the aquatic environment and impact listed species and their critical habitats. Best practices described in the DWH PDARP Appendix 6.A, include spill prevention and response procedures as well as measures to manage construction related lighting, turbidity and noise. Best practices also include NMFS's *Measures for Reducing Entrapment Risk to Protected Species (NMFS 2012a), Sea Turtle and Smalltooth Sawfish Construction Conditions* (NMFS 2006), and *Vessel Strike Avoidance Measures and Reporting for Mariners* (NMFS 2008b). Implementation of these practices is expected to reduce or avoid adverse effects from general construction activities.

[14] As defined in Chapter 6 and Appendix 6A in the DWH PDARP, best practices generally include design criteria, best management practices, lessons learned, expert advice, tips from the field, and more.

Effects on Smalltooth Sawfish Critical Habitat
The essential features for the conservation of smalltooth sawfish that provide nursery area functions are red mangroves and shallow, euryhaline habitats.

Red mangroves
While the DWH PDARP does not specifically state that impacts to red mangroves will be avoided, it does state (in Appendix 6.A) that the Trustees are expected to "Design projects to avoid known locations and associated habitat (of sensitive plants) to the extent possible." Given the sensitivity of these habitats, it is unlikely that construction activities would be proposed in smalltooth sawfish critical habitat, and if such activities were proposed they would likely be designed to avoid adverse impacts to red mangroves. However, the DWH PDARP does not expressly prohibit construction in this critical habitat, and implementation of actions that destroy red mangroves or impede access to red mangrove habitats within smalltooth sawfish critical habitat would constitute an adverse effect to this essential feature of critical habitat.

Shallow, euryhaline habitats
This habitat type is characterized by fluctuating salinity and water depths between MHW and -3 ft at MLLW. If in-water construction activities were to significantly alter or otherwise impact or interrupt access to shallow, euryhaline areas within smalltooth sawfish critical habitat, this would likely constitute an adverse effect to this essential feature of smalltooth sawfish critical habitat.

Effects on Gulf Sturgeon Critical Habitat
The essential features necessary for the conservation of Gulf sturgeon are abundant prey items, water quality, sediment quality, and safe and unobstructed pathways.

Abundant prey items
Gulf sturgeon are suction feeders that tend to forage in calmer marine and estuarine waters that support their macroinvertebrate prey including brachiopods, mollusks, worms, and crustaceans (Mason and Clugston 1993). If construction activities in Gulf sturgeon critical habitat were to cause sediment disturbance or compaction, it could reduce habitat suitability for these forage species and reduce prey abundance and availability. Similarly, if fuel or chemical leaks from construction equipment were to contaminate the aquatic environment, prey species could be killed or forced out of the affected area.

Water quality
Key factors related to water quality include temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages. Some of these factors may be temporarily impacted during in-water construction activities. For example, turbidity may be increased or fuel or chemical leaks could impact water quality during construction activities. The level of impacts would depend on several factors including size and location of the construction zone, the type of substrate in the project area, background turbidity levels, time of year when the construction occurs, and the use

of mitigation measures such as turbidity curtains and spill prevention measures during construction.

Sediment quality
Texture and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages were identified as components of this essential feature. Sediment compaction could affect the quality of sediments for supporting Gulf sturgeon foraging needs and fuel or chemical leaks from construction equipment could impact the chemical characteristics of the sediments rendering them unsuitable for sturgeon or their forage species.

Safe and unobstructed migratory pathways
Unrestricted corridors necessary for passage within and between riverine, estuarine, and marine habitats were identified as essential to the species. Large-scale construction activities in Gulf sturgeon critical habitat, particularly near the mouths of spawning rivers, could cause Gulf sturgeon to avoid these areas and hinder access and migration of sturgeon between freshwater spawning habitat and marine/estuarine foraging habitat, potentially resulting in short-term adverse effect on this essential feature of critical habitat.

Effects on Loggerhead Sea Turtle Critical Habitat
The nearshore reproductive habitat category of critical habitat for loggerhead sea turtles, specifically Loggerhead Critical Habitat Areas LOGG-N-19 through LOGG-N-36, has the potential to be adversely affected by proposed construction activities. The primary constituent element (PCE) of this habitat category that may be affected by proposed construction activities is "waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water." If any of the proposed construction activities were to occur at night, the use of artificial lighting within designated nearshore reproductive habitat during the loggerhead nesting and hatching season (April 24 - October 31) could affect the quality of this loggerhead sea turtle critical habitat feature. Additionally, if construction activities were to be conducted in a manner that obstructs the free movement of sea turtles within designated nearshore reproductive habitat, it would constitute an adverse effect on loggerhead sea turtle critical habitat.

6.2 Construction of Living Shorelines, Rock Groins, and Breakwaters

Some of the proposed habitat restoration activities involve the construction of hardened structures for the purpose of wave attenuation, erosion control, and/or habitat creation/protection. Nearshore construction of hardened structures has the potential to adversely affect sea turtles, Gulf sturgeon, smalltooth sawfish and their designated critical habitats. Potential routes of effects to sea turtles, smalltooth sawfish, and Gulf sturgeon, as well as their designated critical habitat are discussed below.

Effects on Sea Turtles, Smalltooth Sawfish, and Gulf Sturgeon

Direct physical injury

We do not believe that the proposed construction of living shorelines, rock groins, and breakwaters is likely to result in death or injury to these listed species from direct physical contact with construction materials. It is likely that these mobile species will move away from the noise and disturbance created by construction equipment and avoid being hit by materials dropped into the water during the construction process.

Foraging and Sheltering

Sea turtles, smalltooth sawfish, and Gulf sturgeon may be affected by being temporarily unable to use a site for foraging or sheltering habitat due to their potential avoidance of construction related noise and/or physical exclusion from areas bounded by turbidity curtains (see Section 6.1, above). Disruption of foraging and sheltering activities can adversely affect the growth and survival of individuals, and effects could be significant if large numbers of these projects were to be built in important habitat such as submerged aquatic vegetation for turtles, or mangroves and shallow, euryhaline areas for sawfish. Additionally, foraging and sheltering habitat may be permanently altered (i.e., covered or modified) by the proposed structures. Gulf sturgeon are opportunistic feeders and forage over large areas. During marine/estuarine foraging periods, Gulf sturgeon generally occupy shoreline areas between 6.5-13 ft (2-4 m) of depth characterized by low-relief sand substrate (Fox et al. 2002). Therefore, foraging Gulf sturgeon are unlikely to be directly affected by the construction of living shorelines, rock groins, and breakwaters in shallow water (< 6 ft). Creation of submerged and emergent structures near turtle nesting beaches could also result in an increase in nearshore predator concentrations resulting in increased predation on juvenile sea turtles.

Migration

If placed on or adjacent to turtle nesting beaches living shorelines, rock groins, and breakwaters could result in long-term adverse impacts to access by nesting females and navigation/survival of hatchlings that are leaving the beaches by obstructing hatchlings or altering long-shore currents in ways that adversely impact hatchlings attempting to return to the sea. Construction of living shorelines, rock groins, and breakwaters in Gulf sturgeon critical habitat, particularly near the mouths of spawning rivers could result in long-term adverse impacts to access and migration of sturgeon between freshwater spawning habitat and marine/estuarine foraging habitat. Construction of living shorelines, rock groins, and breakwaters in smalltooth sawfish habitat could similarly result in long-term adverse impacts to movement and migration of sawfish between essential habitat areas for pupping, rearing, foraging, and mating.

Effects on Smalltooth Sawfish Critical Habitat

Red mangroves

While the DWH PDARP does not specifically state that impacts to red mangroves will be avoided, it does state (in Appendix 6.A) that the Trustees are expected to “Design projects to avoid known locations and associated habitat (of sensitive plants) to the extent possible.” Given the sensitivity of these habitats, it is unlikely that living shorelines, rock groins, or breakwaters would be proposed in smalltooth sawfish critical habitat, and if such activities were proposed they would likely be designed to avoid adverse impacts to red mangroves. However, the DWH PDARP does not expressly prohibit construction in this critical habitat, and implementation of actions that destroy red mangrove or impede access to red mangrove habitats within smalltooth sawfish critical habitat would constitute an adverse effect to this essential feature of critical habitat.

Shallow, euryhaline habitats

While best practices described in the DWH PDARP are expected to avoid or minimize impacts to listed species and their habitats, there is still the possibility that projects could be proposed that would destroy, cover, fill-in or otherwise adversely affect or interrupt access to shallow, euryhaline areas within smalltooth sawfish critical habitat. If such activities were to occur, this would constitute an adverse effect to this essential feature of smalltooth sawfish critical habitat.

Effects on Gulf Sturgeon Critical Habitat

Abundant prey items

Gulf sturgeon are suction feeders that tend to forage in calmer marine and estuarine waters that support their macroinvertebrate prey including brachiopods, mollusks, worms, and crustaceans (Mason and Clugston 1993). Construction of hardened structures in these areas would kill or permanently displace prey within the structure's footprint. Long, contiguous structures (e.g., breakwaters) could obstruct Gulf sturgeon from accessing areas supporting abundant food sources.

Water quality

Key factors related to water quality include temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages. Some of these factors may be temporarily impacted during the construction of living shorelines, rock groins, and breakwaters. For example, turbidity may be increased during the placement of riprap on soft sediments. The level of impacts will depend on several factors including size and location of the structures, the type of substrate in the project area, background turbidity levels, time of year when the construction occurs, and the use of mitigation measures such as turbidity curtains during construction. Additional long-term effects could occur if the breakwater or structure alters hydrologic conditions, circulation, or flow in a manner affecting salinity levels, oxygen content, or temperature.

Sediment quality

Texture and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages were identified as components of this essential feature. Construction of hardened structures is expected to cover and/or enclose the sediments in the footprint of the activity and these sediments would no longer be accessible to Gulf sturgeon. Placement of hardened structures can also affect tidal flow and longshore currents. If flow energy is increased in areas that have high quality sediments, those sediments can be scoured away leaving coarser or more consolidated sediments behind. Conversely, if flow energy is decreased by the placement of a structure, high quality sediments can be covered up by softer, siltier/muddier sediments.

<u>Safe and unobstructed migratory pathways</u>
Unrestricted corridors necessary for passage within and between riverine, estuarine, and marine habitats were identified as essential to the species. Breakwaters constructed in Gulf sturgeon critical habitat, particularly near the mouths of spawning rivers could hinder access and migration of sturgeon between freshwater spawning habitat and marine/estuarine foraging habitat, potentially resulting in an adverse effect on critical habitat.

Effects on Loggerhead Sea Turtle Critical Habitat
The nearshore reproductive habitat category of critical habitat for loggerhead sea turtles, specifically Loggerhead Critical Habitat Areas LOGG-N-19 through LOGG-N-36, has the potential to be adversely affected by the construction of living shorelines, rock groins, and breakwaters. Potentially affected PCEs of this habitat category are "waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water" and "waters with minimal manmade structures that could promote predators (i.e., nearshore predator concentration caused by submerged and emergent offshore structures), disrupt wave patterns necessary for orientation, and/or create excessive longshore currents." If any of the proposed construction activities were to occur at night, the use of artificial lighting within designated nearshore reproductive habitat during the loggerhead nesting and hatching season (April 24 - October 31) could affect the quality of this loggerhead sea turtle critical habitat feature. Additionally, if any of these structures were to be constructed in a manner that obstructs the free movement of sea turtles within designated nearshore reproductive habitat, it would constitute an adverse effect on loggerhead sea turtle critical habitat. For example, structures located on or adjacent to nesting beaches could disrupt wave patterns necessary for orientation, and/or create excessive longshore currents, thereby resulting in a potentially adverse effect on critical habitat.

6.3 Dredging, Including Placement of Dredged Material

A common element of many habitat restoration activities, such as wetland restoration and beach nourishment, is the dredging of sediments from one area and its placement in another area. The proposed dredging and placement of dredged sediments has the potential to adversely affect sea turtles, Gulf sturgeon, smalltooth sawfish and their designated critical habitats.

Effects on Sea Turtles, Smalltooth Sawfish, and Gulf Sturgeon
Sea turtles, smalltooth sawfish, and Gulf sturgeon in project areas where dredging activity occurs could be adversely affected by direct interaction with dredging equipment as well as impacts from temporary placement and removal of dredge discharge pipelines (for transport of sediments), temporary storage of dredged sediments in nearshore habitats, and final placement of

sediment over existing habitats. These activities can cause temporary increases in noise and turbidity, water quality changes, alteration or loss of habitats, entrapment, and direct entrainment into dredging equipment that could result in injury or death. The DWH PDARP does not specify which types of dredging equipment and methodologies may be used for restoration projects so we will analyze each of the most common types: mechanical, such as clamshell and bucket dredging; hydraulic (suction) cutterhead/pipeline dredging; and hopper dredging.

All types of dredging cause impacts to the biological and physical conditions in the dredged area. Dredging removes the top layer of material from an area, including vegetation, sediment, topographic features and any sessile or slow moving benthic organisms. Removal of these elements, particularly repeated dredging of the same area can result in a reduction in the number of benthic species (both species diversity and species abundance) and a reduction of primary productivity (Lewis et al. 2001). Best practices described in the DWH PDARP include measures to only use suitable areas as borrow sites (i.e., those that do not contain *Sargassum*, SAV, or oysters) and to obtain sediments by beneficially using dredged material from navigation channels or by accessing material from approved offshore borrow areas. Therefore the most likely impacts to habitat features from the proposed dredging would be disruption of the benthic food chain in soft bottom (sand, clay, silt, etc.) borrow areas. Dredging can also contribute to the formation of localized anoxic or hypoxic conditions depending on the depth and location of the borrow sites. Dredged borrow areas have the potential to increase or alter wave climates by altering the direction and magnitude of waves. These impacts are discussed further as they relate to essential features of critical habitat below.

<u>Direct physical take of listed species</u>

Both mechanical and pipeline dredging techniques deploy slow moving apparatus under water. With implementation of basic safety measures and practices in the DWH PDARP (e.g., disengage pumps when the cutter head is not in the substrate; avoid pumping water from the bottom of the water column), these techniques are unlikely to result in direct physical take of listed species. No Gulf sturgeon or smalltooth sawfish have been documented to have been taken by these types of dredges. There have been a few reports of other species of sturgeon being taken, and a report of cold-stunned turtles being taken by cutterhead dredges in Laguna Madre, Texas. However, in the context of the massive volume of this type of dredging going on in the Gulf every year, these isolated incidents represent a very low risk of adverse impacts from these techniques.

Conversely, hopper dredges move relatively rapidly (compared to sea turtle swimming speeds) and can entrain and kill sea turtles as the drag arm of the moving dredge overtakes the slower-moving or stationary sea turtle. There have been numerous documented incidents of hopper dredges taking sea turtles and even Gulf sturgeon in the Gulf of Mexico (Dickerson 2013). Due to the well-documented impacts of hopper dredges, it is a common practice to conduct concurrent “relocation trawling” in the path of a hopper dredge. This involves limited duration and observed trawling through the target area in an attempt to capture, remove, and relocate any listed species before dredging commences. While much less dangerous for listed species than entrainment by a hopper dredge, capture of listed species during relocation trawling is a form of take under the ESA. In addition to the direct effects from capture and handling of ESA-listed species, relocation trawling can remove individuals from preferred habitat and disrupt foraging, sheltering, and mating activities. Hopper dredging is likely to adversely affect ESA-listed species by directly entraining or capturing them in the dredge itself, or during relocation trawling in preparation for dredging.

Placement of dredged material may also impact listed species. Direct adverse impacts to benthic habitats resulting from placement of dredged sediments may occur due to temporary placement and removal of dredge discharge pipelines (for transport of sediments), temporary storage of dredged sediments in nearshore habitats, and final placement of sediment in the footprint where existing habitats would be covered by the sediment. Sediment placed on beaches can also move off into the nearshore area resulting in smothering of benthic organisms and other important habitat features. These activities could cause adverse impacts to shallow intertidal or subtidal habitat such as that for SAV or oysters, if fill is placed in (or moves into) these areas. Increased turbidity in the areas surrounding sediment discharge sites could also affect sensitive benthic habitats such as oyster reefs, coral reefs, and seagrasses (Michel et al. 2013). Nevertheless, practices such as turbidity curtains, buffer zones, and water quality monitoring would be used to minimize such effects.

The first stage of marsh creation is often the placement of a berm or low-level earthen dike around the area to be restored; this structure serves to contain the dredge effluent, allowing the sediment to settle and dewater. If this berm fully encloses an area of aquatic habitat, there is the potential for listed species to become entrapped inside the enclosed area. Adherence to NMFS's *Measures for Reducing Entrapment Risk to Protected Species* (NMFS 2012a) is expected to make the possibility of listed species becoming entrapped within enclosed areas highly unlikely.

Effects on Smalltooth Sawfish Critical Habitat

The essential features of smalltooth sawfish critical habitat are red mangroves and shallow, euryhaline habitats. Shallow, euryhaline habitats are characterized by fluctuating salinity and water depths between MHW and -3 ft at MLLW. If dredging were to occur in these habitat types and cause impacts to red mangroves or changes in water depths, it would constitute an adverse effect on smalltooth sawfish critical habitat. Likewise, if dredged material were to be discharged into red mangroves or shallow, euryhaline habitats, it would also result in an adverse effect to critical habitat.

Effects on Gulf Sturgeon Critical Habitat

Dredging removes vegetation, sediment, topographic features, and sessile or slow-moving benthic organisms from the dredged area. Destruction of these elements (either from dredging or burial from material placement), particularly by repeated dredging of the same area, can result in a reduction in the number of benthic species (both species diversity and species abundance) and a reduction of primary productivity (Lewis et al. 2001).

Abundant prey items

Numerous reports have been published describing the i*n situ* effects of dredging on fish, aquatic plants, benthic communities, and primary productivity (Lewis et al. 2001). Of particular concern are the potential impacts of dredging on Gulf sturgeon prey availability; because Gulf sturgeon are benthic omnivores, the modification of the benthos affects the quality, quantity, and availability of prey. Adults forage sparingly in freshwater and depend almost entirely on estuarine and marine prey for their growth (Gu et al. 2001). Therefore, once Gulf sturgeon leave the rivers having spent at least 6 months in the river fasting, it is presumed they immediately begin feeding. Upon exiting the rivers, Gulf sturgeon initially concentrate around the mouths of their natal rivers in lakes and bays; they then disperse into nearshore areas (including nearshore passes) and continue to forage. Therefore, the nearshore foraging and migratory areas are very important for the Gulf sturgeon as they offer not only the first foraging opportunity for the Gulf sturgeon exiting the rivers, but also migratory pathways to winter habitat and, more rarely, to other rivers. In summary, impacts to populations of benthic prey species resulting from dredging activities (including smothering by dredged material placement), particularly in key nearshore foraging areas and near the mouths of rivers, may constitute an adverse effect on Gulf sturgeon critical habitat.

Water quality

Dredging and material placement in Gulf sturgeon critical habitat would likely cause increased turbidity in and around the area of activity. Effects from turbidity would be temporary and localized as disturbed sediments would settle out (likely within 1-2 days upon cessation of dredging operations), and may also be contained by turbidity curtains. Dredging can also contribute to the formation of localized anoxic or hypoxic conditions in areas where dredging produces deep holes that do not experience sufficient water circulation. Stagnant water at the bottom of these dredged holes can become anoxic or hypoxic, producing unsuitable habitat conditions for Gulf sturgeon and their forage species.

Sediment quality

Dredging could alter the composition and characteristics of sediments in the dredged area in several ways. Soft, unconsolidated sediments could be removed, leaving coarser, more compacted under-layers, or even solid rock exposed. Conversely, if dredging were to create deep depressions in an area that was normally swept by currents, the lack of water movement at the bottom of those depressions could allow soft sediments to accumulate, reducing the quality of that sediment for supporting Gulf sturgeon forage species.

Safe and unobstructed migratory pathways

Unrestricted corridors necessary for passage within and between riverine, estuarine, and marine habitats were identified as essential to the species. If placement of dredged material were to result in blockage of primary migratory pathways such as passes between barrier islands or channels leading to spawning rivers this would result in an adverse effect to this essential feature of critical habitat.

Effects on Loggerhead Sea Turtle Critical Habitat
The nearshore reproductive habitat category of critical habitat for loggerhead sea turtles has the potential to be adversely affected by dredging activities. As discussed in Section 6.1, if any of the proposed dredging activities were to occur at night, using artificial lighting within designated nearshore reproductive habitat and during the loggerhead nesting and hatching season (April 24 - October 31), those activities could cause an adverse effect on loggerhead critical habitat.

Similarly, if dredging activities and/or equipment were to obstruct or deter free movement of loggerhead sea turtles within nearshore reproductive habitat, and during the loggerhead nesting and hatching season, those activities could cause an adverse effect on loggerhead critical habitat. Finally, significant changes in water depth due to dredging activities can change wave conditions by altering wave direction or magnitude. Such changes could result in disorientation of nesting turtles or hatchlings.

6.4 Placement of Oyster Shells/Cultch Material

An important technique for restoring shallow-water ecosystem functions along the Gulf Coast is the creation or enhancement of living oyster reefs through the placement of oyster shells and other cultch materials in appropriate areas. While beneficial on many levels, these activities also have the potential to cause some adverse effects to listed species and critical habitat.

Effects on Sea Turtles, Smalltooth Sawfish, and Gulf Sturgeon
Many of the effects from oyster reef creation are identical to those described above in Sections 6.1- 6.3. The creation of oyster reefs frequently results in the same general construction impacts analyzed in Section 6.1. The use of heavy construction equipment, barges, and support vessels can cause temporary localized adverse impacts from vessel strikes, sediment disturbance, increased turbidity, noise. These effects can result in physical injury to listed species (e.g., vessel strikes), and/or cause them to avoid the construction area, which could disrupt foraging, sheltering, and other essential activities. Deployment of marker buoys related to construction activities can pose a risk of entanglement to listed species. Deployment of turbidity could potentially result in entrapment of listed species within the enclosed area. Artificial lighting zone could disorient sea turtles as they approach and/or depart from nesting beaches. Fuel or chemical leaks from heavy equipment could enter the aquatic environment and impact listed species and their critical habitats.

The effects on listed species from using cultch material for restoring living shorelines by creating long-shore breakwaters out of oyster shell or other cultch material is analyzed in Section 6.2.

The potential adverse effects to listed species from placing cultch material into tidal and subtidal waters are very similar to the analysis of placing dredged material for tidal marsh creation discussed in Section 6.3. Adverse impacts to benthic habitats from placement of oyster cultch material may occur in the footprint of the project areas where existing habitats would be permanently covered by the oyster reef. These activities could cause adverse impacts to shallow intertidal or subtidal habitat such as SAV if cultch is placed in these areas. Constructed oyster reefs could impede movement of listed species between shoreline and open water, and between marine habitat and freshwater spawning and rearing habitats.

There are a few potential effects from placement of oyster shells/cultch material that are relatively unique. Some past oyster shell deployment projects have used synthetic mesh coverings to consolidate the shells and hold them in place after deployment. These synthetic mesh materials have the potential to break away from the oyster reef and pose an entanglement risk to listed species. Another common method for oyster shell deployment is the use of water jets to spray the shells off of the deck of a barge. This method can cause significant disturbance and high levels of turbidity over a broad area where the shells are jetted. Use of a clamshell or power shovel for shell deployment results in less disturbance and turbidity, and the use of turbidity curtains and other practices can further reduce the potential impacts of oyster reef creation.

Effects on Smalltooth Sawfish Critical Habitat

The essential features of smalltooth sawfish critical habitat are red mangroves and shallow, euryhaline habitats. Shallow, euryhaline habitats are characterized by fluctuating salinity and water depths between MHW and -3 ft at MLLW. If cultch material were to be discharged into red mangroves or shallow, euryhaline habitats, the disruption of these essential features would result in an adverse effect on smalltooth sawfish critical habitat.

Effects on Gulf Sturgeon Critical Habitat

<u>Abundant prey items</u>

Adverse impacts to benthic habitats from placement of oyster cultch material may occur in the footprint of the project areas where benthic prey species would be smothered or displaced by the oyster reef. Impacts to benthic prey species resulting from smothering by cultch material placement, particularly in key nearshore foraging areas and near the mouths of rivers, may constitute an adverse effect on Gulf sturgeon critical habitat.

<u>Water quality</u>

Placement of cultch material in Gulf sturgeon critical habitat would likely cause increased turbidity in and around the area of activity. Effects from turbidity would be temporary and localized as disturbed sediments would settle out (likely within 1-2 days upon cessation of cultch placement activities), and may also be contained by turbidity curtains.

<u>Sediment quality</u>

Creation of oyster reefs is expected to cover the sediments in the footprint of the activity and these sediments would no longer be accessible to Gulf sturgeon. Placement of oyster reefs can also affect tidal flow and long-shore currents. If flow energy is increased in areas that have high quality sediments, those sediments can be scoured away leaving coarser or more consolidated sediments behind. Conversely, if flow energy is decreased by the placement of an oyster reef, high quality sediments can be covered up by softer, siltier/muddier sediments.

Safe and unobstructed migratory pathways
Unrestricted corridors necessary for passage within and between riverine, estuarine, and marine habitats were identified as essential to the species. Oyster reefs constructed in Gulf sturgeon critical habitat, particularly near the mouths of spawning rivers could hinder access and migration of sturgeon between freshwater spawning habitat and marine/estuarine foraging habitat, potentially resulting in an adverse effect on critical habitat.

Effects on Loggerhead Sea Turtle Critical Habitat
The nearshore reproductive habitat category of critical habitat for loggerhead sea turtles has the potential to be adversely affected by oyster reef creation. If oyster reef construction activities were to occur at night and were to use artificial lighting within designated nearshore reproductive habitat during the loggerhead nesting and hatching season (April 24 - October 31), those activities could cause an adverse effect on loggerhead critical habitat.

If construction activities, equipment or the oyster reef itself were to obstruct or deter free movement of loggerhead sea turtles within nearshore reproductive habitat, those activities could cause an adverse effect on loggerhead critical habitat. Finally, oyster reef creation within nearshore reproductive habitat for loggerhead sea turtles could promote nearshore predator concentration caused by submerged and emergent offshore structures, disrupt wave patterns necessary for orientation, and/or create excessive longshore currents.

6.5 Construction of Artificial Reefs

An artificial reef is defined as a submerged structure that is constructed or placed on the existing substrate in coastal or marine waters. Artificial reefs can be constructed from a variety of different materials including, but not limited to, quarried rock, concrete blocks or rubble, decontaminated vessels, or engineered reef unit structures.

Effects on Sea Turtles, Sperm Whales, Smalltooth Sawfish, and Gulf Sturgeon

Foraging and sheltering
Similar to the effects described for each species above related to the placement of hardened structures in marine environments, the placement of materials for the creation of artificial reefs could cover or otherwise impact important foraging habitat for listed species such as SAV, live bottom, or soft or hard corals. Even when initially placed to avoid impacts to these sensitive habitat types, there is the potential for the reefs (or dislodged pieces of reefs) to shift and move into sensitive areas, especially during storm events.

Movement and migration

Depending on their size and location, artificial reefs could impede ingress, egress, and migration of listed species between shoreline and open water and between marine habitat and freshwater spawning and rearing habitats.

Entrapment/entanglement

Artificial reefs have the potential to entrap or entangle sea turtles in particular. Sea turtles commonly wedge themselves under structure to rest. Artificial reefs consisting of large vessels with abundant access to extensive interior spaces could allow a sea turtle to enter and become entrapped, resulting in mortality. Likewise, open-bottom artificial reef modules (e.g., tetrahedrons, pyramids) have allowed sea turtles to push under and up into the interior of the module, resulting in mortality. As artificial reefs are designed largely to enhance habitat and present additional fishing opportunities, additional reefs may result in take from commercial and recreational fishing activities. Additionally, over time, monofilament fishing line and anchor lines accumulate on artificial reef structure. The more complex the artificial reef, the more likely lines will become snagged on reef components. Sea turtles can become entangled and "anchored" to the structure, leading to drowning. Likewise, artificial reefs with mooring buoys can accumulate monofilament line and become a hazard to sea turtles.

Noise/explosives

Explosives are often used in sinking of vessels to create artificial reefs. Use of explosives could result in injury or mortality to any listed species in the immediate area, including sperm whales. Injury or mortality could result from excessive noise, high-frequency energy, or concussive force from the explosive charges.

Best practices described in Appendix 6.A of the DWH PDARP including the Gulf States Marine Fisheries Council and Atlantic State Marine Fisheries Council's *Guidelines for Marine Artificial Reef Material* and the *National Artificial Reef Plan (as Amended): Guidelines for siting, construction, development, and assessment of artificial reefs* are expected to help avoid or minimize some of the potential adverse effects to listed species from creation of artificial reefs.

Effects on Smalltooth Sawfish Critical Habitat

Artificial reefs are proposed to be placed in areas where the water is deep enough to provide enhanced recreational opportunities for fishing and diving. Best practices are also expected to be implemented that would ensure that reefs are built in water sufficiently deep to avoid creating a hazard to navigation. Therefore, we do not expect that artificial reefs would be placed in areas that would adversely affect the essential features of smalltooth sawfish critical habitat (red mangroves and shallow, euryhaline habitats).

Effects on Gulf Sturgeon Critical Habitat

Abundant prey items

Gulf sturgeon are opportunistic benthic foragers that cruise sandy substrates that support their macroinvertebrate prey including brachiopods, mollusks, worms, and crustaceans (Mason and Clugston 1993). Construction of artificial reefs in these areas would likely smother prey under the immediate footprint of deployed artificial reef material. Given the abundance of foraging habitat and the relatively small size of artificial reefs, it is likely that the effects on prey abundance and availability would be minor.

<u>Water quality</u>
Turbidity levels could be temporarily elevated by the placement of reef materials. The level of impacts from increased turbidity will depend on several factors including the type of materials deposited and the type of sediment receiving those materials, background turbidity levels, time of year construction occurs, and the use of minimization measures such as turbidity curtains during placement.

<u>Sediment quality</u>
Construction of artificial reefs would cover-up the sediments in the footprint of the reef, rendering those sediments inaccessible to Gulf sturgeon. These covered areas would no longer provide the essential functions related to sediment quality for Gulf sturgeon critical habitat.

<u>Safe and unobstructed migratory pathways</u>
If artificial reefs were to be placed within Gulf sturgeon critical habitat in a location and in a manner that obstructed passage within and between riverine, estuarine, and marine habitats, this would constitute an adverse effect on Gulf sturgeon critical habitat.

Effects on Loggerhead Sea Turtle Critical Habitat
The nearshore reproductive habitat category of critical habitat for loggerhead sea turtles has the potential to be adversely affected by artificial reef creation. One of the PCEs of this habitat category is waters with minimal manmade structures that could promote predators (i.e., nearshore predator concentration caused by submerged and emergent offshore structures), disrupt wave patterns necessary for orientation, and/or create excessive longshore currents. Construction of artificial reefs within designated nearshore reproductive habitat could promote predator concentrations and result in increased predation of hatchling and juvenile loggerhead sea turtles. Any such impacts would constitute an adverse effect on critical habitat for loggerhead sea turtles.

6.6 Restoration and Enhancement of Submerged Aquatic Vegetation

This restoration activity focuses on restoring and protecting SAV habitat. The activity could include backfilling scars with sediment; revegetating SAV beds via propagation and/or transplanting; enhancing SAV beds through nutrient addition; protecting SAV beds with buoys, signage, and/or other protective measures; or protecting and enhancing SAV through wave attenuation structures.

Effects on Sea Turtles, Smalltooth Sawfish, and Gulf Sturgeon
SAV restoration and enhancement projects that involve dredging or placement of dredged materials to backfill scars or other degraded areas could have adverse effects on listed species, benthic organisms, substrate and water quality due to interactions with dredging equipment and

sediment disturbance at both the borrow site and the placement site. These effects would be similar to those described in Section 6.3, above, though on a significantly smaller scale than would be expected for marsh restoration or beach nourishment projects.

Revegetating SAV beds via propagation and/or transplanting can cause minor disturbance of sediments and avoidance of work areas by listed species in both the restoration area and the donor site. These activities are generally conducted by hand, without the use of heavy equipment so any disturbance is expected to be minimal and of short duration. There is also the potential for overharvesting of donor sites, causing damage to otherwise healthy SAV beds. Implementation of modern guidelines and criteria for selection and treatment of donor sites is expected to minimize any such impacts.

The placement of “bird stakes” to encourage natural fertilization of restored SAV areas is another technique proposed in the DWH PDARP. This technique involves driving small-diameter stakes into the ground to attract roosting sea birds whose feces provide natural fertilization for the surrounding area. Like SAV revegetation, this technique is generally conducted by hand without the use of heavy equipment, so any effects to the substrate or disturbance of listed species are expected to be minimal and of short duration.

Establishing boater restrictions or buffer zones around restored SAV beds may be implemented using buoys or signs marking SAV bed boundaries. Installation of floating buoys or pile supported signs may involve the use of barges, support boats and other in-water construction activities analyzed in Section 6.1, above. Installation of anchoring devices or support piles may impact small areas within the footprint of the anchors/piles. These impacts could increase if anchors were to break free from the bottom and be dragged through sensitive habitat areas. Sea turtles may be at risk of becoming entangled by accidently encountering in-water lines such as buoy lines. However, marker buoy anchor lines are generally made of thick, heavy, and taut lines that do not loop or entangle. Noise generated during pile driving of sign posts could affect listed species in the immediate area through behavioral changes or through direct physical injury from high pressure energy generated by impact hammer pile driving. Noise impacts are expected to be minimized through best practices described in the DWH PDARP which include measures to minimize construction noise to the maximum extent practicable when working near protected species and their habitats. These practices include pushing, auguring, or vibrating piles into substrate whenever possible and the use of sound attenuation devices to reduce peak sound pressure levels when the use of impact hammer pile driving is unavoidable.

The DWH PDARP calls for the creation of segmented living shorelines or permeable barriers (e.g., oyster reefs) to dissipate wave energy and protect restored SAV areas and allow regeneration. This technique could also include maintaining the integrity of existing living barriers, such as barrier islands. The effects of creating/restoring these types of structures (living shorelines, oyster reefs and barrier islands) are described above in Sections 6.2, 6.4, and 6.3 respectively.

Effects on Smalltooth Sawfish Critical Habitat

Red mangroves
As is described in previous sections, it is unlikely that activities that could adversely affect red mangroves would be proposed in smalltooth sawfish critical habitat. However, the DWH PDARP does not expressly prohibit construction in these areas, and implementation of activities related to SAV restoration that impact red mangroves or impede access to red mangrove habitats within smalltooth sawfish critical habitat (dredging, placement of fill, construction of wave attenuation structures, etc.) could result in adverse effects on this essential feature of critical habitat.

Shallow, euryhaline habitats
While best practices described in the DWH PDARP are expected to avoid or minimize impacts to listed species and their habitats, there is still the possibility that projects could be proposed that would destroy, cover, fill-in or otherwise adversely affect or interrupt access to shallow, euryhaline areas within smalltooth sawfish critical habitat. If such activities were to occur, this would constitute an adverse effect to this essential feature of smalltooth sawfish critical habitat.

Effects on Gulf Sturgeon Critical Habitat

Abundant prey items
Gulf sturgeon are suction feeders that tend to forage in calmer marine and estuarine waters that support their macroinvertebrate prey including brachiopods, mollusks, worms, and crustaceans (Mason and Clugston 1993). Implementation of activities related to SAV restoration such as dredging, placement of fill or construction of wave attenuation structures in these areas could kill or displace prey within the activity's footprint. Long, contiguous structures (i.e., wave attenuation structures) could obstruct Gulf sturgeon from accessing areas supporting abundant food sources.

Water quality
Water quality may be temporarily impacted during implementation of activities related to SAV restoration such as dredging, placement of fill or construction of wave attenuation structures. For example, turbidity may be increased during dredging or the placement of wave attenuation materials on soft sediments. The level of impacts will depend on several factors including size and location of the activities, the type of substrate in the project area, background turbidity levels, time of year when the construction occurs, and the use of mitigation measures such as turbidity curtains during construction. Additional long-term effects could occur if a wave attenuation structure alters hydrologic conditions, circulation, or flow in a manner affecting salinity levels, oxygen content, or temperature.

Sediment quality
Texture and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages were identified as components of this essential feature. Construction of hardened structures would cover the sediments in the footprint of the structure and these sediments would no longer be accessible to Gulf sturgeon. Placement of hardened structures can also affect tidal

flow and long-shore currents. If flow energy is increased in areas that have high quality sediments, those sediments can be scoured away leaving coarser or more consolidated sediments behind. Conversely, if flow energy is decreased by the placement of a structure, high quality sediments can be covered up by softer, siltier/muddier sediments.

Dredging could alter the composition and characteristics of sediments in the dredged area in several ways. Soft, unconsolidated sediments could be removed, leaving coarser, more compacted under-layers, or even solid rock, exposed. Conversely, if dredging were to create deep depressions in an area that was normally swept by currents, the lack of water movement at the bottom of those depressions could allow soft sediments to accumulate, reducing the quality of that sediment for supporting Gulf sturgeon forage species.

<u>Safe and unobstructed migratory pathways</u>
Unrestricted corridors necessary for passage within and between riverine, estuarine, and marine habitats were identified as essential to the species. Wave attenuation structures constructed in Gulf sturgeon critical habitat, particularly near the mouths of spawning rivers could hinder access and migration of sturgeon between freshwater spawning habitat and marine/estuarine foraging habitat, potentially resulting in an adverse effect on critical habitat.

Effects on Loggerhead Sea Turtle Critical Habitat
The nearshore reproductive habitat category of critical habitat for loggerhead sea turtles, specifically Loggerhead Critical Habitat Areas LOGG-N-19 through LOGG-N-36, has the potential to be adversely affected by the construction of wave attenuation structures. Potentially affected PCEs of this habitat category are "waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water" and "waters with minimal manmade structures that could promote predators (i.e., nearshore predator concentration caused by submerged and emergent offshore structures), disrupt wave patterns necessary for orientation, and/or create excessive longshore currents." If any of the proposed construction activities were to occur at night, the use of artificial lighting within designated nearshore reproductive habitat during the loggerhead nesting and hatching season (April 24 - October 31) could affect the quality of this loggerhead sea turtle critical habitat feature. Additionally, if any of these structures were to be constructed in a manner that obstructs the free movement of sea turtles within designated nearshore reproductive habitat, it would constitute an adverse effect on loggerhead sea turtle critical habitat. For example, structures located on or adjacent to nesting beaches could disrupt wave patterns necessary for orientation, and/or create excessive longshore currents, thereby resulting in a potentially adverse effect on critical habitat.

6.7 Controlled River Diversions

Under this restoration activity, controlled river diversions may be implemented within the Mississippi-Atchafalaya River system at a variety of different scales (from less than 10,000 cubic feet per second to greater than 50,000 cubic feet per second, depending on the intended goals of the project) to create, restore, and enhance coastal wetlands in the Mississippi River Delta region. River diversions would be designed to convey both freshwater and sediment to deltaic wetlands and the shallow nearshore environment. A detailed description of this restoration activity is provided in Appendix 5-D of the DWH PDARP.

River diversions could have both beneficial and adverse impacts on the species and habitats that have adapted over the past 100 years to river levees and the current environmental dynamics in the area. River diversions would result in changes to salinity patterns and gradients at least for the duration of the operation of the diversion and for some period of time after the diversion is closed. Additional impacts to water quality are possible, including altered oxygen concentrations and increased turbidity and sedimentation. These water quality impacts could change the distribution and reproductive patterns of estuarine-dependent fish species (Nyman et al. 2013) and disrupt the nursery functions of an estuary by affecting food and habitat availability (Rozas et al. 2005).

Effects on Sea Turtles and Gulf Sturgeon

Smalltooth sawfish and their designated critical habitat would not be affected by proposed river diversions as neither occurs in the areas that would be affected by this restoration activity.

The amount and extent of effects from river diversions on sea turtles and Gulf sturgeon will depend on many factors, including but not limited to location, volume and velocity of discharge, sediment load, river stage, outfall design and management, physical and ecological characteristics of the discharge area, and operational management of the diversion. River diversions constructed in the Atchafalaya River Delta or anywhere on the west side of the Mississippi River Delta would likely have minimal effects to Gulf sturgeon or their critical habitat as these areas are outside the primary range of Gulf sturgeon and no critical habitat is designated in these areas. River diversions built on the east side of the Mississippi River Delta would likely have more pronounced effects on Gulf sturgeon, and diversions that discharge into the Lake Pontchartrain/Lake Borgne area could affect Gulf sturgeon critical habitat (potential effects to critical habitat are discussed below in the Gulf sturgeon critical habitat section).

Gulf sturgeon could be affected by river diversions through changes in salinity, dissolved oxygen, and prey availability. Changes in salinity could affect migration and survival. During the fall migration from fresh to saltwater, Gulf sturgeon require a period of physiological acclimation to changing salinity levels, referred to as osmoregulation or staging (Wooley and Crateau 1985). Large pulses of freshwater into these staging areas could disrupt the osmoregulatory process. Further, sturgeon do not develop this active mechanism for osmoregulation and ionic balance until age one (Altinok 1997). Fish younger than this that are swept into estuaries or the marine environment by large pulses of freshwater would perish because of their inability to adapt to the higher saline waters. On some river systems, timing of the fall migration appears to be associated with pulses of higher river discharge (Heise et al. 1999). Large discharges that occur outside of this fall migration timing could change Gulf sturgeon migration patterns and put them into unfavorable environmental conditions.

Changes in dissolved oxygen caused by river diversions could affect survival of Gulf sturgeon. In comparison to other fish species, sturgeon have a limited behavioral and physiological capacity to respond to hypoxia (insufficient oxygen levels) (Secor and Niklitschek 2001). Basal metabolism, growth, consumption, and survival are sensitive to changes in oxygen levels (Secor and Niklitschek 2001). Temperatures greater than 20°C (68°F) amplify the effect of hypoxia on sturgeon and other fishes (Coutant 1987).

River diversions could also affect prey availability. Gulf sturgeon rely almost entirely on estuarine and marine food for their growth (Gu et al. 2001). Gulf sturgeon must be able to consume sufficient quantities of prey while in estuarine and marine waters to regain the weight they lose while in the river system and to maintain positive growth on a yearly basis. Large-scale, rapid reductions in salinity levels and/or dissolved oxygen levels could significantly alter or destroy microbenthic communities adapted to high salinity/dissolved oxygen conditions. Should significant reductions in prey availability and abundance occur in important Gulf Sturgeon foraging areas this would result in significant adverse effects on Gulf sturgeon.

Sea turtles cannot survive for extended periods in fresh water and would likely be forced to evacuate areas that experience significant reductions in salinity levels as a result of fresh water inputs from river diversions. Loggerhead sea turtles depend on similar prey species as Gulf sturgeon and could be adversely affected if significant reductions in prey distribution and availability were to result from large-scale, rapid reductions in salinity levels and/or dissolved oxygen levels caused by operation of river diversions.

Effects on Gulf Sturgeon Critical Habitat

The essential features of Gulf sturgeon critical habitat that could be affected by river diversions are prey abundance, water quality, and sediment quality. As discussed above, prey abundance is crucial for sturgeon, particularly after spending many months in their natal rivers. River diversions could alter or destroy the macrobenthic prey assemblages Gulf sturgeon rely on. Water quality could be degraded through reductions in salinity and dissolved oxygen. River diversions have the potential to change salinities dramatically and to reduce available oxygen. Sediment quality necessary for normal behavior and growth could also be affected by river diversions. River diversions carry large sediment loads and the fallout and distribution of those sediments could alter the texture and other chemical characteristics of Gulf sturgeon critical habitat.

Effects on Loggerhead Sea Turtle Critical Habitat

There is no loggerhead sea turtle nearshore reproductive critical habitat in the areas that could be affected by river diversions proposed in the DWH PDARP. Notably, the *Sargassum* habitat category of loggerhead critical habitat follows the 10-m (33-ft) contour along the west side of the Mississippi River Delta. If fresh water inflows from a west-side river diversion were to be large enough to cause a significant reduction in salinity or dissolved oxygen levels out beyond the 10-m contour, this could impact juvenile turtles and their prey species within the *Sargassum* critical habitat area and render that area of critical habitat uninhabitable until salinity and/or dissolved oxygen concentrations returned to tolerable levels.

6.8 Enhancing Recreational Public Access

This activity focuses on restoring, improving, or creating new access to natural resources for recreational purposes. Access to recreational areas may be improved by enhancing or constructing in-water or over-water infrastructure (e.g., boat ramps, fishing piers, boardwalks, navigational channels and navigational aids). Improved public access could also be accomplished by providing or improving water access in publicly owned areas (e.g., parks and marinas).

Effects on Sea Turtles, Smalltooth Sawfish, and Gulf Sturgeon
The following section discusses the variety of effects that may result from the various construction activities that would restore, improve, or create new facilities, structures, or services for public access.

<u>General construction activities</u>
The construction of boat ramps, piers, and other in-water structures could incorporate water-based construction including the use of heavy equipment, barges, and support vessels, as well as mitigation measures such as the use of turbidity curtains. The potential effects of these types of activities, and the best practices expected to minimize those effects are described in Section 6.1.

In addition to water-based construction activities, enhancing recreational public access will include construction activities on land and along the shoreline (boat ramps and associated parking lots, access roads, trails, etc.). Land-based run-off/sedimentation can occur when construction activities result in disturbance of vegetation and soils adjacent to aquatic habitats. Erosion and run-off from these disturbed areas can result in high turbidity levels in receiving waters. Action agencies are expected to develop and implement erosion control plans to minimize erosion during and after construction and, where possible, use vegetative buffers (100 ft or greater), revegetate with native species or annual grasses, and conduct work during dry seasons.

<u>Impervious surfaces</u>
Permanent adverse effects can also result from creating impervious surfaces (parking lots, access roads, etc.) adjacent to estuarine waters. The addition of impervious surfaces, especially coupled with urban drainage systems (i.e. curbs, gutters, and storm drain pipes), alters the natural hydrology in a watershed by increasing the volume of stormwater runoff and reducing groundwater recharge. Impervious surfaces add to the volume of stormwater during rain events and causes erosion that can result in increased sediment smothering habitat and stressing aquatic organisms. Impervious surfaces accelerate the delivery of pollutants such as fecal coliform bacteria, fertilizers, and oil and other toxic fluids leaked from automobiles, directly into the estuaries. The Center for Watershed Protection reports that hydrologic alteration, habitat loss,

and decreased water quality resulting from increased impervious surfaces "stresses aquatic species and collectively diminishes the quality and quantity of habitat" (CWP 2003).

Pile driving

Noise generated during pile driving for piers, docks, or navigational aids could affect listed species in the immediate area through behavioral changes or through direct physical injury from high pressure energy generated by impact hammer pile driving. Noise impacts are expected to be minimized through best practices described in the DWH PDARP, which include measures to minimize construction noise to the maximum extent practicable when working near protected species and their habitats. These practices include pushing, auguring, or vibrating piles into substrate whenever possible and the use of sound attenuation devices to reduce peak sound pressure levels when the use of impact hammer pile driving is unavoidable.

Aquatic vegetation

Piers, bridges and other similar structures constructed over SAV or marsh habitat can cause permanent displacement of these habitat types in the footprint of the piles supporting the structure and loss or thinning of the vegetation under the structure from shading of sunlight. Wide spread and persistent impacts to these keystone habitat features can eventually disrupt the functions of the ecosystems upon which listed species rely. Best practices described in the DWH PDARP include the following established guidelines: *Construction Guidelines in Florida for Minor Piling-Supported Structures Constructed in or over Submerged Aquatic Vegetation (SAV), Marsh or Mangrove Habitat* U.S. Army Corps of Engineers/National Marine Fisheries Service August 2001*;* and *Key for Construction Conditions for Docks or Other Minor Structures Constructed in or Over Johnson's Seagrass (Halophila johnsonii)* National Marine Fisheries Service/U.S. Army Corps of Engineers October 2002*.* Adherence to these guidelines is expected to minimize potential impacts to sensitive habitat features from the construction/operation of these types of structures.

Navigational channel improvements and dredging

The DWH PDARP does not provide any details or analysis on this activity, except to state that action agencies may conduct navigational channel improvements and dredging in order to create new or improved access to natural resources for recreational purposes. NMFS assumes that the effects from any such dredging activities would be similar to those analyzed in Section 6.3, above.

Navigational aids

Again, the DWH PDARP does not provide any details or analysis on this activity, except to include it in a list of activities that may be implemented in order to create new or improved access to natural resources for recreational purposes. Navigational aids generally take 1 of 2 forms. They are either floating buoys anchored to the bottom or solid structures supported by piles driven into the sea floor.

Installation of floating navigational buoys often involves the use of barges, support boats and other in-water construction activities analyzed in Section 6.1, above. Installation of anchoring devices may impact small areas of sensitive habitats such as SAV or live bottom. These impacts could increase if the anchors were to break free from the bottom and be dragged through these sensitive habitat areas. Sea turtles may be at risk of becoming entangled by accidentally encountering in-water lines such as buoy lines. However, navigational buoy anchor lines are generally made of thick, heavy, and taut lines that do not loop or entangle.

Installation of pile-supported navigational aids is also likely to involve the use of barges, support boats and other in-water construction activities analyzed in Section 6.1, above. The impacts of any noise generated during pile installation are the same as those discussed above.

Increased fishing interactions

Creating new or improved fishing access through construction of boat ramps and fishing piers can create or increase several fishing-related stressors for listed species. Fishing activities have the potential to adversely affect listed species via incidental hooking and entanglement in actively-fished lines, as well as in lost and discarded line. Heavily used fishing areas such as fishing piers are known to attract sea turtles that learn to forage there for discarded bait and fish carcasses, increasing their vulnerability to hooking and entanglement. These potential impacts are expected to be somewhat mitigated through best practices described in Appendix 6.A of the DWH PDARP such as the posting of signs at kiosks, ramps, and piers to provide visitors with information on how to avoid and minimize interactions with protected species while fishing, as well as what to do when a sea turtle is hooked (e.g., contact information for stranding coordinator or rehabilitation centers). These educational materials will be developed in coordination with NMFS, USFWS, and the local state Trustee resource agencies. Action agencies are also expected to supply and maintain containers for waste fishing gear to avoid fish and wildlife entanglement.

Increased boating activity

Creating new or improved boating access through construction of boat ramps and piers can create or increase several boating-related stressors for listed species. Increased recreational boating can result in increased vessel strikes of listed species and increased impacts to sensitive habitat features such as prop-scarring in SAV beds or damage to corals or other live bottom features through vessel groundings and anchoring. These potential impacts are expected to be mitigated through best practices described in Appendix 6.A of the DWH PDARP such as the posting of signs at kiosks, ramps, and piers to provide visitors with information on how to avoid and minimize impacts to protected species and their habitats while recreating. These educational materials will be developed in coordination with NMFS, USFWS, and the local state trust resource agencies.

Enhanced recreational fishing opportunities through aquaculture

The use of aquaculture to supplement and enhance wild stocks of marine game fish has the potential to negatively affect the genetic diversity of the wild stock and/or affect the balance of the fish community. Additionally, adverse impacts could occur through introduction of diseases or competition with wild species, along with potential effects on habitat or protected and sensitive marine areas (NOAA 2015). There is the possibility that one or more of these issues could result in direct effects (e.g., disease transmitted directly to listed populations) or indirect effects (e.g., reduction in key forage species due to increased predation from stocked fish) to listed species. The PDARP states that any such programs would follow the "Responsible Approach to Marine Stock Enhancement" developed by Blankenship and Leber (Symposium et al. 1995), in order to minimize the potential for aquaculture programs to adversely affect protected species and the marine ecosystem.

Effects on Smalltooth Sawfish Critical Habitat

Red mangroves

Activities related to enhancing recreational public access that have the potential to affect red mangroves include the construction of boat ramps, fishing piers and boardwalks and navigational channel dredging. If any of these activities were to occur in smalltooth sawfish critical habitat in a manner that would destroy red mangroves or impede access to red mangrove habitats this would constitute an adverse effect to this essential feature of critical habitat.

Shallow, euryhaline habitats

This habitat type is characterized by fluctuating salinity and water depths between MHW and -3 ft at MLLW. Activities related to enhancing recreational public access that have the potential to affect shallow, euryhaline habitats include the construction of boat ramps, fishing piers and boardwalks and navigational channel dredging. If any of these activities were to occur in smalltooth sawfish critical habitat in a manner that would impact shallow, euryhaline habitats or impede access to these habitats, this would constitute an adverse effect to this essential feature of critical habitat.

Effects on Gulf Sturgeon Critical Habitat

The essential features necessary for the conservation of Gulf sturgeon are abundant prey items, water quality, sediment quality, and safe and unobstructed pathways.

Abundant prey items

There are several potential routes of effects on Gulf sturgeon prey species that could result from activities related to enhancing recreational public access. If construction activities or dredging were to cause sediment disturbance or compaction, it could reduce habitat suitability for these forage species and reduce prey abundance and availability. Similarly, if fuel or chemical leaks from construction equipment were to contaminate the aquatic environment, prey species could be killed or forced out of the affected area. If populations of game fish populations were to significantly increase due to stocking programs, predation by these species could also impact abundance and availability Gulf sturgeon prey species.

Water quality

Water quality may be temporarily impacted during in-water construction activities related to enhancing recreational public access. For example, turbidity may be increased or fuel or chemical leaks could impact water quality during construction of piers, boat ramps or navigational aids. The level of impacts would depend on several factors including size and location of the construction zone, the type of substrate in the project area, background turbidity levels, time of year when the construction occurs, and the use of mitigation measures such as turbidity curtains and spill prevention measures during construction.

Sediment quality

Texture and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages were identified as components of this essential feature. Sediment compaction could affect the quality of sediments for supporting Gulf sturgeon foraging needs and fuel or chemical leaks from construction equipment could impact the chemical characteristics of the sediments rendering them unsuitable for sturgeon or their forage species. Dredging could alter the composition and characteristics of sediments in the dredged area in several ways. Soft, unconsolidated sediments could be removed, leaving coarser, more compacted under-layers, or even solid rock exposed. Conversely, if dredging were to create deep depressions in an area that was normally swept by currents, the lack of water movement at the bottom of those depressions could allow soft sediments to accumulate. This would reduce the quality of that sediment for supporting Gulf sturgeon forage species.

Safe and unobstructed migratory pathways

Unrestricted corridors necessary for passage within and between riverine, estuarine, and marine habitats were identified as essential to the species. The activities related to enhancing recreational public access would not be expected to affect this essential feature of Gulf sturgeon critical habitat.

Effects on Loggerhead Sea Turtle Critical Habitat

The nearshore reproductive habitat category of critical habitat for loggerhead sea turtles, specifically Loggerhead Critical Habitat Areas LOGG-N-19 through LOGG-N-36, has the potential to be adversely affected by proposed activities related to enhancing recreational public access. The PCE of this habitat category that may be affected by proposed construction activities is “waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water”. If any of the proposed construction activities were to occur at night, the use of artificial lighting within designated nearshore reproductive habitat during the loggerhead nesting and hatching season (April 24 - October 31) could affect the quality of this loggerhead sea turtle critical habitat feature. Additionally, many recreational structures such as fishing piers and boat ramps include permanent lighting elements. Any such permanent lighting created in designated nearshore reproductive habitat would constitute an adverse effect on loggerhead sea turtle critical habitat.

6.9 Reducing Bycatch

The majority of DWH PDARP proposed restoration activities related to voluntarily improving fishing gear and practices would result in little or no adverse effects on listed species, and many of the proposed activities are expected to result in significant benefits for these species, especially sea turtles and marine mammals. However, there is the potential for implementation of new fishing practices that are intended to reduce impacts on one species to inadvertently create/increase adverse effects on other species. Close coordination between the Trustees and NMFS during the planning and implementation of these measures is expected to avoid many of the potential conflicts and minimize the likelihood of unintended adverse effects on listed species.

Effects on Sea Turtles, Smalltooth Sawfish, and Gulf Sturgeon

<u>Voluntary reduction in menhaden harvest</u>
In response to the proposed reduction in the Gulf menhaden fishery catch, demand for reduction products (i.e., fish meal, fish oil, and fish solubles) may be met through increases in other fisheries or by menhaden fisheries in other countries. The increased demand for these alternative sources of reduction products may result in adverse impacts on biological resources through increased harvest of these replacement sources. Increased bycatch (e.g., sea turtles and marine mammals) may also occur in areas outside the United States.

<u>Reef fish fishery</u>
The proposal to reduce Gulf of Mexico commercial red snapper and other reef fish discards through an individual fishing quota allocation subsidy program could result in localized adverse impacts to biological resources, including some additional bycatch of other species (potentially listed sea turtles) during fishing operations in areas where quotas are increased.

<u>Other gear conversion and fishery practices</u>
The DWH PDARP includes restoration activities designed to reduce sea turtle bycatch in commercial and recreational fisheries through identification and implementation of conservation measures such as gear modifications (e.g., hook size and type), changes in fishing practices (e.g., reduced soak times), and/or temporal and spatial fishery management to reduce sea turtle bycatch in Gulf commercial fisheries. While these measures are expected to ultimately result in beneficial effects on sea turtles, some of the measures will be untested and could potentially cause short-term increases in impacts during experimentation with new gears and techniques.

<u>Removal of derelict fishing gear and other marine debris</u>
This activity is expected to result in long-term benefits to listed species through a reduction in entrapment and entanglement in derelict fishing gear and other marine debris. There is, however, potential for short-term, adverse impacts to listed species as a result of debris removal activities, such as noise, disturbance of sediments, and increased boating interactions.

Large-scale marine debris removal projects involving multiple vessels concentrated in major ingress or egress points in channels, rivers, passes, and bays could impede listed species' movement and migration.

Increased vessel traffic related to marine debris removal operations could increase the likelihood of adverse interactions between program vessels and listed species (vessel strikes, harassment, etc.). If low altitude aerial surveys are used to locate marine debris, those surveys could result in startling/harassment of listed species on the water surface by survey aircraft.

Removal of partially or entirely buried marine debris may cause disturbance of sediments and other habitat features such as submerged aquatic vegetation. In-water activities could also result in temporary displacement of listed species from preferred habitats and/or disruption of essential behaviors.

Depending on the location and magnitude of these impacts, sea turtles, Gulf sturgeon, and smalltooth sawfish could be temporarily displaced from their preferred habitats and/or have foraging, sheltering, nesting or migration behaviors interrupted. Implementation of best practices described in the DWH PDARP is expected to minimize any such impacts.

Effects on Critical Habitat

The removal of derelict fishing gear and other marine debris may result in minor, short-term impacts to Gulf sturgeon critical habitat. Removal of partially or entirely buried marine debris may impact the water quality essential feature by causing temporary, localized spikes in turbidity levels. If large-scale debris removal projects involving multiple vessels were to be concentrated in major Gulf sturgeon ingress or egress points in channels, rivers, passes, and bays, the boating activity could impact the safe and unobstructed migratory pathways essential feature of Gulf sturgeon critical habitat.

None of the PCEs or essential features of sea turtle or smalltooth sawfish critical habitat are likely to be adversely affected by removal of derelict fishing gear and other marine debris.

6.10 Increasing Rescue and Rehabilitation Efforts

Effects on sea turtles and sperm whales

While increasing the resources available for turtle and marine mammal rescue and rehabilitation programs is expected to produce important benefits for these species, it will (by design) increase the number of listed individuals encountered, captured and/or handled by program participants, which constitutes an increase in the level of take for these programs. It is also possible that individuals will be injured or killed during rescue and rehabilitation efforts. Overall, the number of individuals rescued, rehabilitated, and returned to the Gulf is expected to greatly exceed the number that are injured or killed as a result of rescue operations. It is unlikely that any essential features of critical habitat for any listed species would be affected by the proposed increase in rescue and rehabilitation efforts.

6.11 Monitoring and Adaptive Management

The DWH PDARP proposes large scale monitoring and adaptive management programs designed to inform the Trustees on the progress and effectiveness of restoration activities, and to help guide implementation of the program to achieve the overarching program goals. There is a potential for some of these monitoring and associated research activities to result in the take of listed species, either through intentional capture and examination of these species or through incidental interactions during monitoring activities focused on other species. It is highly likely that any activities that have the potential to take listed species would be designed to ensure that adverse effects on these species would be minimized and that any individuals collected during these activities would be carefully handled and released alive and in good condition. Unfortunately, the nature of field work makes it impossible to completely control all aspects of the collection and examination processes, and there is the possibility that some individuals will be injured or killed as a result of the monitoring program. For those individuals that are released in good condition, there is still a potential for minor, short-term harm due to interruption of essential behaviors such as foraging, sheltering and mating. It is unlikely that any essential features of critical habitat for any listed species would be affected by the proposed monitoring activities.

We assume that the Trustees will comply with ESA Section 10 requirements and apply with NMFS for permits for any potential take of listed species for scientific purposes to ensure that these activities are not likely to jeopardize listed species.

6.12 Analysis of Beneficial Effects of PDARP Implementation

The proposed action for this consultation is a large scale restoration program that is designed to create significant benefits to natural resources and improve ecosystem functions throughout the northern Gulf of Mexico. Under OPA, the baseline for this program is defined as the environmental conditions that would exist if not for the DWH oil spill. The restoration program is designed to offset the impacts of the spill and return the affected ecosystem back to the conditions that would exist if not for the DWH oil spill. However, under the ESA, the environmental baseline condition is now the current, post-spill environment. All effects of the spill are included in the baseline condition and all of the beneficial effects of implementation of the program are included as part of the effects of the action.

Previous sections of this Opinion examine elements of the program that have the potential to cause some level of adverse effects to listed species and their critical habitats. There are also several proposed restoration activities that are expected to have entirely beneficial effects on listed species, with no incidental adverse effects. The beneficial effects of all proposed activities, including those that may also have some incidental adverse effects, as well as those that are expected to have wholly beneficial effects, are analyzed in this section.

Similar to the previous analysis of potential adverse effects, the available information on exactly where, when and how these beneficial activities will occur is limited. Because specific projects have not yet been proposed and selected, it is not possible to definitively forecast what on-the-ground restoration will be implemented over time. We are therefore unable to provide a detailed quantitative analysis of the beneficial effects of the program at this time. Instead we provide a more qualitative summary of the benefits that are likely to result from program implementation, over time, throughout the action area. There is a significant amount of restoration targeted specifically at listed species in the DWH PDARP, and there will likely be additional ancillary benefits to listed species from other restoration approaches (e.g. wetland, coastal and nearshore habitat restoration).

Beneficial effects of habitat restoration

Some of the habitat restoration activities proposed in the DWH PDARP are expected to result in direct, identifiable benefits to listed species and their critical habitats (e.g., restored nesting habitat for sea turtles). Other activities are more likely to produce broad ecosystem level benefits that could indirectly benefit listed species and critical habitats (e.g., improved water quality, improved forage base). A summary of the benefits expected to result from implementation of the habitat restoration activities is provided below.

<u>Create, Restore, and Enhance Coastal Wetlands</u>

Creating new marsh and mangrove habitat or reconnecting available coastal wetlands to freshwater sources and/or tidal flooding will restore the natural hydrology and ecological functions of these habitats. This would re-establish natural estuarine salinity gradients and could maintain and improve coastal water quality, benefiting other coastal habitats and resources. This approach could provide long-term benefits for listed species and the essential features of their critical habitats in the form of food, shelter, breeding, and nursery habitat. Many of the species that directly utilize coastal marshes and mangroves as juveniles later migrate throughout nearshore and offshore habitats, where they serve as prey items for listed species. Thus, these highly productive habitats support ecological connectivity both within the coastal ecosystem and between the coastal, nearshore, and open ocean ecosystems through the movement of animals that use wetlands during their life cycle to grow and reproduce.

<u>Restore and Enhance SAV</u>

Long-term beneficial impacts to listed species would be expected as a result of restoration or enhancement of the SAV community. SAV beds support the growth of healthy sea grass and algal communities fed upon by green sea turtles. SAV beds also provide important habitat for invertebrates and other prey species utilized by other sea turtles, Gulf sturgeon, and smalltooth sawfish.

<u>Restore Oyster Reef Habitat</u>

Creation and restoration of oyster reef habitat could produce long-term benefits to listed species and their critical habitats due to the oyster's role as "ecosystem engineer." Oyster reefs and living shorelines provide protection, foraging, and propagation habitat for many of the forage species utilized by sea turtles, Gulf sturgeon and Smalltooth Sawfish. Oyster reefs and living shorelines also dissipate wave energy and improve water clarity, in turn, benefiting SAV and marshes.

Create, Restore and Enhance Barrier and Coastal Islands and Headlands and Restore and Enhance Dunes and Beaches

Restoration efforts that increase stability and resilience of barrier and coastal islands and their beaches may result in long-term habitat benefits, including increased areal extent and improvement of beach habitat for sea turtle nesting. Restored barrier and coastal islands and headlands could also help to protect back-bay areas that support SAV, oyster reefs, mangroves and sand flats utilized by Gulf sturgeon, sea turtles and smalltooth sawfish for foraging and sheltering, by reducing erosion, scouring, and subsequent water quality impacts of storm surge events.

Reduce Nutrient Loads to Coastal Watersheds and Reduce Pollution and Hydrologic Degradation to Coastal Watersheds

While these restoration activities do not involve direct creation/restoration of aquatic habitats, they are expected to indirectly benefit these habitats and enhance the functions they provide for listed species. Actions to improve water quality in coastal areas are expected to produce long-term benefits to surface water entering estuaries by reducing total suspended solids, nutrients, and other contaminant loads in stormwater runoff. Benefits to listed species and their forage base, such as benthic invertebrates, shellfish and finfish, could result from improved water quality in the estuaries receiving that runoff.

Protect and Conserve Marine, Coastal, Estuarine, and Riparian Habitats

Conservation of habitat through establishment or expansion of marine protected areas (or similar protective measures) could have a long-term benefit to listed species through the protection of coastal, riparian and offshore habitats. These protections can directly benefit listed species by preventing adverse interactions with humans (fishing, mineral extraction, etc.) and can also protect the essential features of their habitats such as forage species, vegetation, and bottom structure/substrate.

Resource Specific Restoration

In addition to habitat restoration, the proposed action includes restoration activities that address specific injuries or aspects of injuries not fully addressed by coastal habitat restoration. Many of these resource-specific restoration activities are expected to result in direct, identifiable benefits to listed species and their critical habitats. In particular, there are restoration activities that are specifically for sea turtles, sturgeon, and marine mammals (including sperm whales). There are other resource-specific approaches for fish and water column invertebrates that could also provide ancillary benefits to listed species. A summary of the benefits expected to result from implementation of the resource-specific restoration activities is provided below.

Enhance Sea Turtle Hatchling Productivity and Restore and Conserve Nesting Beach Habitat

Proposed activities include, but are not limited to:

- Reducing beachfront lighting on nesting beaches
- Enhancing protection of nests
- Acquiring lands for conservation of nesting beach habitat
- Promoting beach user outreach and education

Nesting habitat improvement via conservation of nesting beach habitat, turtle-friendly lighting, predation control, and nest detection, monitoring, and protection could provide a long-term benefit to sea turtles by increasing nesting success and hatchling survivorship, resulting in a higher number of sea turtles surviving to adulthood and reproductive life stages.

Restoring Gulf Sturgeon spawning habitat

A variety of restoration activities are proposed for implementation, including but not limited to:

- Erosion and sediment control or abatement.
- In-stream barrier removal or construction of fish passages.

Improved access to Gulf sturgeon spawning habitat, along with restoration and protection of that habitat are anticipated to result in numerous long-term benefits to Gulf sturgeon, including restored access between coastal waters and spawning grounds and subsequent increases in spawning success and population size. Barrier removal and restored river flows could scour the river channel and expose hard, limestone and/or gravel bottoms or ledges, which is preferred spawning habitat for Gulf sturgeon. Targeted acquisition of land, gravel rights, or management easements would benefit Gulf sturgeon by protecting areas, including spawning areas, from future disturbances or degradation.

The DWH PDARP proposes to implement or promote several strategies to reduce impacts to biological resources related to current fishing practices. These strategies include:

- Promotion of long-line gear conversion to circle hooks and weak hooks
- Promotion of gear conversion to greenstick and buoy gear
- Implementation of incentive-based annual time closure (repose period)
- Promotion of shrimping gear conversion to more efficient bycatch reduction devices (BRD)
- Promotion of shrimping gear conversion to a hopper post-catch sorting systems

Listed sea turtles and whales are expected to benefit from proposed long-line gear conversions. Sea turtles can ingest the hooks of longline fishing gear, can become entangled in the lines, or can be hooked externally. Whales have also been known to become entangled in the lines, or be hooked externally. Conversion to circle hooks and weak hooks is expected to reduce hooking and related mortality rates. If implementation of incentive-based annual time closure results in reduced fishing activities, listed species interactions with longline gear should also decrease.

Improved bycatch reduction techniques in the commercial shrimp fishery could have long-term beneficial effects on sea turtle populations by reducing the number of sea turtles incidentally caught as bycatch and improving the survival of those that are caught. Increased training and education intended to increase compliance with existing sea turtle bycatch reduction requirements is also proposed in the DWH PDARP. Increased compliance with these requirements should provide benefits to sea turtles by reducing sea turtle bycatch and mortality.

<u>Reduce Sea Turtle Bycatch in Recreational Fisheries</u>
This restoration approach focuses on reducing and minimizing the bycatch of sea turtles in recreational fisheries in the Gulf of Mexico. Restoration techniques for this approach include:

- A comprehensive inventory and characterization of recreational fisheries initially focused on piers and similar fixed structures in the Gulf of Mexico where bycatch of sea turtles has been reported or is likely to occur.
- The identification of factors that may contribute to sea turtle bycatch (e.g., bait type and hook type) and studies to test bycatch reduction measures.
- Implementation of conservation measures as appropriate.

Once developed, successful implementation resulting in reductions in injury/mortality of sea turtles caught in recreational fisheries could have benefits for adult and juvenile sea turtles. Cleaning up recreational fishing debris around piers and other known fishing locations could also reduce impacts from entanglement in or ingesting of fishing related debris.

<u>Gear conversion and/or removal of derelict fishing gear to reduce impacts of ghost fishing</u>
Beneficial effects for listed species and critical habitat are expected to result from removal and reduction of derelict fishing gear. Removal of derelict fishing gear will reduce direct injury and mortality of listed species due to entanglement in nets, monofilament line and buoy lines (Gilardi et al. 2010). Long-term benefits to benthic habitats may accrue due to reduced crab trap movement across benthic sediments (Uhrin et al. 2014). Finally, decreases in ghost fishing impacts should enhanced crab and finfish resources that serve as forage for listed species.

<u>Enhanced State Enforcement</u>
Increased enforcement and education is intended to increase compliance with existing sea turtle bycatch reduction requirements for fisheries conducted in state waters. Increased compliance with these requirements could provide benefits to sea turtles by reducing sea turtle bycatch and mortality.

Expand and Enhance Sea Turtle Stranding and Salvage Network (STSSN) and the Marine Mammal Stranding Network (MMSN)

Benefits of an improved STSSN and MMSN include a likely increase in the success of rescue, rehabilitation, and release of live sea turtles and marine mammals. Mortality investigations, as well as other data collected by enhanced stranding networks would better guide NOAA and other natural resource managers. This could provide long-term benefits to survival and reproduction of listed sea turtles and whales.

Reduce injury and mortality of sea turtles from vessel strikes and reduce injury and mortality of marine mammals from vessel collisions

These restoration activities focus on reducing vessel collisions with sea turtles and marine mammals in the Gulf of Mexico by developing and implementing techniques such as time/area-sensitive changes to vessel routes and speeds, mariner training, and mariner and recreational boater outreach and education. Long-term beneficial effects to listed sea turtles and whales may be achieved with reductions in injury and mortality from vessel strikes. Additional benefits could include increased knowledge regarding the frequency of vessel strikes and factors contributing to those events.

Measurement of Noise to Improve Knowledge and Reduce Impacts of Anthropogenic Noise on Marine Mammals

This restoration activity focuses on utilizing passive acoustics and other technologies to characterize the spatial overlap between noise and marine mammal stocks and to implement noise reduction measures in appropriate areas. Specific activities could include, but are not limited to: conducting research regarding noise reduction techniques; developing, testing, and implementing quieting technologies; developing best practices; and/or implementing outreach programs to promote strategies. Long-term benefits to marine mammals would include reduction of anthropogenic ocean noise, which could help reduce adverse physical and behavioral effects including death, hearing loss, stress, behavioral changes, reduced foraging success, reduced reproductive success, masking of communication and environmental cues, and habitat displacement (Francis and Barber 2013).

Promote Environmental Stewardship, Education, and Outreach

Programs developed at education centers and museums that provide education on environmental issues could benefit listed species by encouraging conservation, understanding, and environmental stewardship of these species and their critical habitats. Overall, if these educational programs increase appreciation for, and awareness of, the status of vulnerable ecological resources in the Gulf region, implementing this technique has the potential for long-term, beneficial impacts on listed resources.

Summary of Beneficial Effects

The restoration activities described above were carefully developed over many years and are designed to produce tangible benefits to the biological resources of the Gulf of Mexico. Successful implementation of these restoration activities is expected to result in wide ranging beneficial effects on listed species and their designated critical habitats. Because this is a long-term program to be implemented over many years, it is likely that beneficial effects resulting from early actions would mitigate or off-set any adverse effects that may be caused by subsequent actions (as described in Sections 6.1 – 6.8). Section 10 (Integration and Synthesis of Effects) will examine all of the information developed throughout this opinion and use the full sum of that information to reach a conclusion on the overall effect of implementing the proposed program.

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7. Effects of the Action - Decision-Making Analysis

This section evaluates the DWH PDARP's governance system and whether it leads to decision-making that eliminates, avoids, or reduces risks the program poses. Section 6 of this Opinion described potential effects of the DWH PDARP actions on individuals of the listed species and on designated critical habitats. This section evaluates whether the governance system ensures that the Trustees will not implement actions that adversely affect individuals or designated critical habitats to the degree that jeopardizes any species' continued existence or results in destruction or adverse modification of designated critical habitat. In summary, we evaluate whether the DWH PDARP's program, in particular its decision-making processes to select individual projects, is reasonably certain to comply with the requirements of Section 7(a)(2).

This section is structured to specifically evaluate the following: (1) the standards that apply to the Trustees' process of approving or rejecting project-level actions; (2) the information that forms the foundation for the Trustees' approval of restoration plans and project-level actions undertaken in accordance with those restoration plans; and (3) whether there are transparent monitoring, feedback, and adjustment loops that ensure corrective actions and adjustments that will protect listed resources.

7.1 Standards for the Process of Approving or Rejecting Project-Level Actions

We evaluate this over-arching concern through the following 2 questions, 1-1 through 1-2.

1-1 *Does the DWH PDARP provide sufficient standards to ensure that specific actions, alone or in combination with other specific actions, are not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of their critical habitats?*

The following DWH PDARP provisions are pertinent to evaluate this question:

- The DWH PDARP provides that,

  "Once the reasonable range of restoration alternatives is developed, the OPA regulations (15 CFR § 990.54) provide minimum criteria to be used by trustees to evaluate those alternatives. The trustees must evaluate and select the proposed restoration alternatives, and eventually actual restoration projects, based on these OPA evaluation standards:

- o The cost to carry out the alternative.
- o The extent to which each alternative is expected to meet the Trustees' goals and objectives in returning the injured natural resources and services to baseline and/or compensating for interim losses.
- o The likelihood of success of each alternative.
- o The extent to which each alternative will prevent future injury as a result of the incident and avoid collateral injury as a result of implementing the alternative.
- o The extent to which each alternative benefits more than one natural resource and/or service.
- o The effect of each alternative on public health and safety.

Additionally, the OPA regulations (15 CFR § 990.54) allow the Trustees to establish additional incident-specific evaluation and selection criteria for alternatives and restoration projects." [15]

- The DWH PDARP provides that subsequent restoration plans and projects must also be consistent with the programmatic goals and restoration types provided in the DWH PDARP.
- The Trustees will, "accomplish an incremental series of restoration decisions that flow from this Final PDARP/PEIS. Subsequent restoration plans shape the restoration that is ultimately implemented under this Final PDARP/PEIS..."
- The Trustees, via TIGs for each restoration area, will prepare a series of subsequent restoration plans to propose and select specific projects for implementation. The TIGs will also continue the implementation and monitoring of Early Restoration projects. The restoration plans will propose specific projects that will be consistent with the DWH PDARP and will be presented for public review and comment. Individual projects will contribute to one or more of the goals established for the relevant restoration type(s), and will be based on one or more of the restoration approaches analyzed for the relevant restoration type.
- The Trustees will have a MOU - the Trustee Council MOU - that forms the basis of Trustee coordination and cooperation under the DWH PDARP. The Trustee Council MOU will be followed by each TIG and Trustee member. The TIGs, at their discretion, may develop additional MOUs for their respective restoration areas, provided TIG MOUs are consistent and compliant with the Trustee Council MOU.

[15] The OPA definition of "baseline" is different from the ESA "environmental baseline" provided in this Opinion. The OPA regulations at 15 CFR 990.30 define baseline as, "… the condition of the natural resources and services that would have existed had the incident not occurred."

- The Trustee Council is required to develop Standard Operating Procedures (SOPs): "The SOPs will be developed and approved by consensus of the Trustee Council and may be amended as needed."
- The Trustee Council's SOP "… will be in place prior to any TIG's withdrawal of funds from the U.S. Department of Interior Natural Resources Damage Assessment and Restoration Fund."
- The Trustee Council's SOP "…includes, but is not limited to:
    - Trustee Council structure and management
    - Decision-making and delegation of authority
    - Funding
    - Administrative procedures
    - Project reporting
    - Conflict resolution
    - Monitoring and adaptive management
    - Consultation opportunities among the Trustees
    - Public participation
    - Administrative accounting and independent auditing procedures
    - Administrative record"
- Each TIG "… may develop additional SOP for their respective restoration areas, provided they are consistent with the Trustee Council SOP. Any TIG SOPs will be developed and approved by consensus."
- "Each TIG will develop, select, and implement projects on a consensus basis. For the 5 TIGs for each of the 5 Gulf states, consensus requires that a proposed action or decision be supported by both the United States (as decided by the federal Trustees as a group) and the state (as decided by the state Trustees as a group). The federal Trustees will develop an MOU setting forth an approach and procedures pursuant to which the federal Trustees speak with a single voice on decisions made within the TIGs for each of the 5 Gulf states; the state Trustees for each state will develop an MOU setting forth an approach and procedures pursuant to which their state Trustees speak with a single voice on decisions made by the 5 TIGs for each of the 5 Gulf states. For the TIGs for the Regionwide and Unknown Conditions and Adaptive Management restoration areas, consensus requires that a proposed restoration action be supported by all nonabstaining federal Trustees and all non-abstaining Gulf states (as decided for each Gulf state by the state Trustees as a group). For the Open Ocean restoration area, consensus requires that a proposed restoration action be supported by all nonabstaining federal Trustees."

- The DWH PDARP requires all projects to be developed through restoration plans in accordance with the OPA, NEPA, other environmental laws and the DWH PDARP. It requires that the Trustees (through the TIGs) "… identify, develop, and evaluate project alternatives; propose projects in draft restoration plans; engage the public for comment on restoration plans; and select projects in final restoration plans."
- The DWH PDARP requires each TIG to ensure that all restoration-type goals are supported via the series of TIG restoration plans over the full time period of restoration (15 years).
- Draft restoration plans are required to describe federal environmental compliance, including ESA consultations required for proposed projects, how those requirements will be met, and the compliance status (e.g., initiated or completed) at the release of the draft (and final) restoration plan.
- Draft restoration plans provide context on how the draft plan relates to any longer-term vision of that TIG or strategic framework for particular resources, and describe the context of the preferred project alternatives to other Gulf restoration programs (particularly RESTORE and Gulf Environment Benefit Fund). The DWH PDARP requires compliance with ESA Section 7(a)(2) for all project-level consultations. It provides:

    > "To comply with the ESA on future project-specific actions, a Federal Trustee, on behalf of the Implementing Trustee(s) when necessary, will serve as the action agency to initiate ESA consultations and conferences with USFWS and/or NMFS on proposed projects or groups of projects that may affect listed and proposed species and their designated or proposed critical habitats. The Trustees will develop a list of species and critical habitats that may be affected by each proposed project or group of projects, document the types of potential impacts from the proposed project to listed and proposed species and designated critical habitats, incorporate applicable practices from Appendix 6.A (Best Practices), of this Final PDARP/PEIS, and where necessary, propose additional project-specific avoidance and minimization measures. Based on this information, projects or groups of projects will be analyzed to determine if they (1) would have no effect on listed species, species proposed for listing, or designated or proposed critical habitat (together, "listed resources"); (2) may affect, but are not likely to adversely affect, listed resources; or (3) are likely to adversely affect listed resources."
    >
    > "The Trustees must comply with the procedural obligations of Section 7 of the ESA. If the Trustees determine a project has No Effect on ESA-listed species and their critical habitat, this determination should be documented and retained in project records. If a Federal action agency determines that the action is not likely to adversely affect listed species or designated critical habitat, initiates consultation, and NMFS or USFWS concurs, Section 7 consultation is complete.

If NMFS or USFWS does not concur, then the Federal action agency (representing the implementing trustee(s) when necessary) will initiate formal consultation for actions likely to adversely affect a listed species or designated critical habitat. NMFS or USFWS will provide a Biological Opinion that includes an ITS. This ITS provides an exemption to take, and requires the action agency to implement nondiscretionary terms and conditions. The Federal action agency ensures these terms and conditions are met, coordinating with the implementing Trustee as appropriate. If NMFS or USFWS determines that the project is likely to jeopardize listed species or destroy or adversely modify critical habitat, NMFS or USFWS will provide reasonable and prudent alternatives (RPAs) that will allow the project to proceed without likely jeopardy or adverse modification. It is possible that an individual project may result in jeopardy or adverse modification of critical habitat and would thus need to be modified through an RPA that avoids jeopardy and adverse modification or would need to be abandoned altogether."

- The federal regulatory agencies will provide guidance, including best practices, to project proponents as part of the environmental compliance process. Best practices generally include design criteria, lessons learned, expert advice, tips from the field, and more.
- Specific best practices are included in the DWH PDARP's NEPA analysis of impacts to protected biological resources and their habitats, the DWH PDARP states:

"For these resources, analysis of restoration types were specifically analyzed, assuming the incorporation of best practices that would typically be required by regulating agencies because these projects generally would not be able to move forward through agency review without incorporation of best practices. Such best practices include, but are not limited to, steps taken through site selection, engineering and design, use of proven restoration techniques, and other conditions or activities required for project-specific regulatory compliance. All projects implemented under subsequent restoration plans and tiered NEPA analyses consistent with this Final PDARP/PEIS would secure all necessary state and federal permits, authorizations, consultations, or other regulatory processes, including those related to sensitive habitats (e.g., wetlands or Essential Fish Habitat [EFH]) and protected species (e.g., marine mammals, such as dolphins, or federally listed species, such as sea turtles). Projects will also be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources. Note that consideration of best practices will be specifically included in the tiered analysis." as described in the DWH PDARP. Future projects tiered from this programmatic document will include the best practices below or best practices identified during project consultation, as appropriate. If changes to the best practices below are warranted for specific future projects, those changes will be analyzed in the future NRDA analysis and associated tiered Environmental Assessments (EAs) and Environmental Impact Statements (EISs) as well as other required reviews. Once best practices have been accepted, the project will be implemented using those best practices."

- Final restoration plans are required to identify the best practices applicable to the implementation of each selected project and any outstanding environmental compliance needs or other contingencies that must be resolved prior to project implementation. The DWH PDARP states that, "NOAA and USFWS have established best practices, which include guidance documents, lessons learned, and project design criteria, for many restoration actions. Project proponents are expected to consider these, and any additional relevant best practices, in the development of restoration projects and associated regulatory compliance..." and "the final set of project-specific best practices and mitigation measures would be determined prior to implementation by the implementing trustees and regulating agencies."

Evaluation for Question 1-1

We believe that the governance system and environmental compliance requirements provided by the DWH PDARP and overviewed above provide standards that are reasonably certain to ensure that specific actions, alone or in combination with other specific actions, are not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of their critical habitats with the following assumptions. If these assumptions prove incorrect, then reinitiation of this consultation may be required. We assume that:

- The Trustee Council's SOP will be in place prior to the TIGs' decisions on final restoration plans. This is important because the SOP will set standards and procedures that help the TIGs take consistent approaches to project-level restoration planning.
- NMFS and/or the U.S. Fish and Wildlife Service would participate on each TIG.
- The Trustee Council's SOP component of "decision making and delegation of authority" would address decision-making for project selection processes, including the minimum criteria provided by OPA regulations for evaluating and selecting restoration projects, and would address delegation of authority to TIGs or individual Trustees to select and implement projects.
- The federal MOUs for the 5 statewide TIGs would address dispute resolution processes among the federal Trustees.
- The MOUs/MOAs and SOP would clarify what circumstances are appropriate for a Trustee to abstain where the DWH PDARP states: "For the TIGs for the Regionwide and Unknown Conditions and Adaptive Management restoration areas, consensus requires that a proposed restoration action be supported by all nonabstaining federal Trustees and all non-abstaining Gulf states (as decided for each Gulf state by the state Trustees as a group). For the Open Ocean restoration area, consensus requires that a proposed restoration action be supported by all nonabstaining federal Trustees."
- The SOP will provide minimum monitoring standards and guidance to operationalize the DWH PDARP Monitoring and Adaptive Management Framework, Appendix 5E.

- Future projects tiered from the DWH PDARP will include the best practices identified in the DWH PDARP or best practices identified during project-level consultation. Such best practices include, but are not limited to, steps taken through site selection, engineering and design, use of proven restoration techniques, and other conditions or activities required for project-specific ESA regulatory compliance.

1-2. Do federal Trustees have sufficient authorities to adjust or amend actions in consultation with NMFS to avoid jeopardizing the continued existence of listed species or the destruction or adverse modification of critical habitat, minimize impacts on listed species, and implement terms and conditions to minimize incidental take of listed species?

The following DWH PDARP provisions, summarized directly from the DWH PDARP, are pertinent to evaluate this question:

- The DWH PDARP requires the Trustees to comply with the procedural obligations of Section 7, which includes adjusting and amending actions as part of ESA consultation as described above in Question 1-1.
- The DWH PDARP provides that federal environmental compliance includes developing a project proposal, requesting technical assistance if needed, and then entering into consultation or coordination under the relevant regulatory act (e.g., ESA). It states that, "During any consultation process, additional project-specific measures may be recommended or required as applicable to a project type in different locations (e.g., dune walkovers in Florida and Texas) due to differences in relevant conditions, such as species presence or absence or other factors."
- Specific best practices are included in the DWH PDARP's NEPA analysis of impacts to protected biological resources and their habitats as described above in Question 1-1..
- The DWH PDARP anticipates that future best practices will be developed and used. It provides that, "practices developed in the future are intended to provide essential technical assistance to avoid and minimize effects to ESA-listed species and their designated critical habitat and Essential Fish Habitat. Incorporating this guidance into future restoration plans can lead to effective and efficient consultation under the ESA and MSFCMA.[16] As projects in the Gulf of Mexico are implemented, additional practices may be developed." The DWH PDARP provides websites for the most recent guidance available.
- The DWH PDARP explicitly anticipates NMFS's project design criteria for ESA-listed species and provides that, "Project Design Criteria (PDCs) are being developed by NMFS to provide technical assistance and avoid or reduce adverse impacts to ESA-listed and

[16] MSFCMA is the acronym for the Magnuson-Stevens Fishery Conservation and Management Act.

protected species. PDCs may be developed for the following and/or additional restoration actions:

- Marine debris removal
- Living shorelines
- Marsh creation and enhancement
- Non-fishing piers
- Oyster reef creation or enhancement"

Evaluation for Question 1-2

We believe that the federal Trustees have sufficient authorities to adjust or amend actions in consultation with us to avoid jeopardizing the continued existence of listed species or the destruction or adverse modification of critical habitat; minimize impacts on listed species and implement terms and conditions to minimize incidental take of listed species.

7.2 Information that Forms the Foundation for the Trustees' Approval of Restoration Plans and the Actions Undertaken in accordance with Those Plans

The DWH PDARP requires TIGs to prepare draft restoration plans that document and provide detailed information on the proposed project(s), or groups of projects, and alternatives to those projects. Each draft plan is required to explain the consistency between the restoration plan and the DWH PDARP. For example, draft plans are to include information on the funding status by restoration type, the project scoping and screening process, the restoration type(s) goals each project contributes to, and how the planning and implementation considerations identified in the DWH PDARP sections on approaches to restoring natural resources are considered during project development.

We evaluate this over-arching concern through the following 3 more specific questions, 2-1 through 2-3.

2-1. Does the DWH PDARP require the Trustees to assess the individual and collective impacts of specific projects or groups of projects contained in restoration plans or in the aggregate across restoration plans throughout the action area?

The following DWH PDARP provisions summarized directly from the DWH PDARP are pertinent to evaluating this question.

For individual restoration plans and projects:

- Each restoration plan is required to provide sufficient implementation detail for analysis under OPA, the National Environmental Policy Act (NEPA), and other environmental regulations, including the ESA.
- The DWH PDARP requires that when proposing projects to restore for ESA-listed species (e.g., sea turtles or sturgeon), the restoration plans will describe consistency with ESA recovery plans and recovery goals for those species, if available, such that conservation programs are supported.
- Individual trustee agencies are required to evaluate expected resource benefits and develop project-specific monitoring plans. These project-specific details will be provided to the TIG to support their restoration planning and project decision responsibilities.

For collective/aggregate impacts of projects:

- The DWH PDARP states that, “TIGs coordinate with Implementing Trustees to support consistency and compatibility of monitoring plans and data management in accordance with the Trustee Council SOP (and respective TIG SOP, if applicable), and aggregate Implementing Trustees’ monitoring data by restoration type for reporting to the Trustee Council.”
- TIGS are to promote consistency in monitoring across similar project types by evaluating projects’ performance against a minimum standard of common performance criteria.
- The DWH PDARP states that “TIGs will coordinate with other TIGs or individual Trustees for proposed projects that overlap TIG restoration areas. The Open Ocean TIG will coordinate with other TIGs when proposed projects overlap their jurisdictions.”
- The Trustee Council is responsible for aggregating the status of restoration planning, implementation and monitoring across TIGs. The Trustee Council is to perform restoration planning functions that serve to promote consistency in processes under the DWH PDARP and allow for appropriate aggregation of information across TIGs and support program-wide reporting to the public.
- The Trustee Council will coordinate with the TIGs to aggregate project information for regular public reporting, as determined in Trustee Council SOPs. The Trustee Council may re-examine the restoration program approximately every 5 years to track its status towards meeting the established restoration goals, including the Monitoring, Adaptive Management and Administrative Oversight goal and to determine any updates needed based on newly emerged science and/or restoration procedures and Trustees’ experience managing and implementing this restoration program.
- The Trustee Council and TIGs share responsibility to coordinate with other *Deepwater Horizon* restoration programs.[17] The DWH PDARP states that,

[17] See footnote 1 in Section 2 of this Opinion.

> "The Trustee Council and TIGs share responsibility to coordinate with other *Deepwater Horizon* restoration programs. As such, the Trustees will commit to formal coordination with NFWF and RESTORE at least annually and will coordinate with these other programs on specific topics (e.g. monitoring and data management) and specific restoration types, as needed. Coordination among programs will promote successful implementation of this PDARP/PEIS and optimize ecosystem recovery within the Gulf. The Trustee Council may consider the restoration actions of these other programs and facilitate the TIGs identifying synergies, leveraging opportunities, and evaluating cumulative effects, as well as reducing potential redundancy when selecting projects under this PDARP/PEIS. Furthermore, these programs will each produce significant monitoring data that are critical to informing restoration decisions and improving adaptive management. Data sharing among programs is encouraged, and the Trustee Council will make information for projects selected under this PDARP/PEIS available to the public, as well as to the scientific community and other restoration programs."

- The DWH PDARP provides an option for the Trustees to prepare strategic restoration frameworks to focus and sequence restoration priorities or provide additional guidance to further the restoration program. Strategic frameworks are a good opportunity to review collective or aggregate impacts at a scale that is meaningful for listed resources. It provides that:

  > "TIGs may prepare strategic frameworks to focus and sequence priorities within a restoration area or to provide additional vision of how to meet restoration type goals set forth in the PDARP. Strategic frameworks may provide context prioritization, sequencing, and selection of specific projects within project-specific restoration plans. Strategic frameworks help the Trustees consider resources at the ecosystem level, while implementing restoration at the local level."

  > "Strategic frameworks may be particularly relevant for Gulf-wide resource-level planning led by the Regionwide TIG for living coastal and marine resources, sea turtles, marine mammals, birds, and oysters and may also be developed for other Restoration Types allocated to the Regionwide and Open Ocean TIGs."

- The Monitoring and Adaptive Framework appendix states that,

  > "Even for restoration approaches and/or techniques that are relatively well-established (e.g., coastal habitat restoration), uncertainties about the aggregate benefits and/or impacts of restoration projects will be higher as the total number of projects implemented, size of individual projects, and extent to which projects are concentrated in particular geographic areas increases. As restoration scale (i.e., number and size of restoration projects, both independently and within a particular geographic area) increases, it will be more important to ensure that the information about aggregate restoration benefits and potential unintended consequences are

incorporated into the monitoring and adaptive management framework (e.g., LoSchiavo et al. 2013; Steyer and Llewellyn 2000)."

Evaluation for Question 2-1

Based on the DWH PDARP provisions above, we believe that the DWH PDARP requires the Trustees to assess the individual and collective impacts of specific projects or groups of projects contained in restoration plans, or collectively across restoration plans throughout the action area, with the following assumptions. If these assumptions prove incorrect, then reinitiation of this consultation may be required. We assume the following:

Assessing individual adverse impacts. We assume that DWH PDARP provisions requiring the Trustees to assess the individual impacts of specific projects or groups of projects contained in restoration plans apply to adverse impacts. We rely on this assumption because, while the DWH PDARP provides ample direction for Trustees to monitor and assess individual project impacts that are beneficial, it is not clear that it also provides direction to monitor and assess individual project impacts that could be adverse to listed resources. We assume that individual adverse impacts and associated monitoring requirements will be identified during project-level ESA consultation, and that the Trustees will comply with the applicable monitoring requirements.

Assessing aggregate adverse impacts. We assume that the Trustees will track potential aggregate adverse impacts of projects within and across TIGs and within the DWH PDARP action area. We also assume that the Trustees will consider this information, as well as project implementation information available from other Gulf programs, as they develop restoration plans and projects over the life of the DWH PDARP. We rely on these assumptions because, while the DWH PDARP has ample direction for the Trustees to assess the potential aggregate impacts that are beneficial, it is not clear that it provides direction for the Trustees to also consider the potential aggregate impacts that could be adverse to listed resources.

The types of potential aggregate impacts that could adversely impact listed resources and that the TIGS should consider in restoration plans include:

- Time-crowded perturbations (i.e., repeated occurrence of a single type of impact in the same area) that are so close in time that the effects of one perturbation do not dissipate before a subsequent perturbation occurs
- Space-crowded perturbations (i.e., a concentration of a number of different impacts in the same area) or perturbations that are so close in space that their effects overlap
- Interactions or perturbations that have qualitatively and quantitatively different consequences for the ecosystems, ecological communities, populations, or individuals exposed to them because of synergism (when stressors produce fundamentally different effects in combination than they do individually), additivity, magnification (when a

combination of stressors have effects that are more than additive), or antagonism (when 2 or more stressors have less effect in combination than they do individually)

- Gradual disturbance and loss of land and habitat, or incremental and decremental effects are often, but not always, involved in each of the preceding 3 categories (known as "nibbling") (NRC 1986).

Monitoring parameters for tracking aggregate adverse impacts. We assume that the Trustees will coordinate with NMFS as they establish the DWH PDARP's Monitoring and Adaptive Management program to identify the kinds of adverse impacts that should be tracked and aggregated for purposes of tracking impacts to listed resources. Examples of the types of parameters for tracking aggregate adverse impacts could include, total number of acres of Gulf sturgeon critical habitat converted to marsh, total number (and size) of artificial reefs created, or total area of impervious surfaces constructed on previously unpaved lands.

Relationship of aggregate impacts to listed species recovery. Although we did not rely on this in our evaluation and conclusion and thus it is not an assumption that may trigger reinitiation if not met, we would like to note an important consideration. The DWH PDARP requires that when proposing projects to restore habitat for ESA-listed species (e.g., sea turtles or sturgeon), restoration plans will describe consistency with ESA recovery plans and recovery goals for those species, if available, such that conservation programs are supported. ESA recovery plans and related documents, including NMFS 5-Year Review Status Assessments, provide information about the nature and location of activities that would most benefit listed species, as well as the nature and location of listed species' most significant threats. This information is relevant for evaluating the potential effects of aggregate impacts on listed resources, and NMFS will consider this information as part of future project-level ESA consultations.

2-2. Does the DWH PDARP require the Trustees to actively identify, gather, and analyze data and other information that would be relevant to identifying the presence or absence of adverse consequences for listed resources?

The DWH PDARP provisions that require the Trustees' to actively identify, gather, and analyze information relevant to the presence or absence of adverse consequences during restoration plan and project development are overviewed and evaluated for Question 2-1, above. The requirements to do so during and after project implementation are overviewed and evaluated through Questions 3-1 and 3-2, below. Furthermore, the DWH PDARP specifically provides that designs will not be finalized until the Implementing Trustee determines that the design is in compliance with all regulatory requirements (e.g., federal, state, and local permitting requirements) and consultations (e.g., ESA-listed and other protected species). Through ESA compliance on project-level ESA consultations, NMFS would ensure that the information necessary for evaluating the potential adverse consequences of restoration plans and project development on listed resources is identified, gathered, and analyzed.

Evaluation for Question 2-2

Based on the DWH PDARP provisions above, we believe that the DWH PDARP requires the Trustees to actively identify, gather, and analyze data and other information that would be relevant to identifying the presence or absence of adverse consequences for listed resources.

2-3. Does the DWH PDARP establish quality assurance and quality control procedures that would apply to restoration plans or project approval documents*?*

In general terms, quality assurance and quality control is the combination of the process or set of processes used to measure and assure the quality of a product (quality assurance) and the process for ensuring that the product meets expectations (quality control). For natural resources restoration projects, quality assurance depends on the quality of the best available science that informs project planning and the level of assurance (which is a synonym for certainty or confidence) that decision-makers have in the consequences of project implementation. Quality control is the process for ensuring that restoration projects meet their stated goals and that implementation does not result in unanticipated adverse consequences or adverse consequences which go undetected.

Quality Assurance –Best available science and assurance
The Trustees' injury assessment approach used a variety of assessment procedures, including field and laboratory studies, and model- and literature- based approaches, included existing data sets and sources external to the DWH PDARP process, as well as the newly acquired assessment data.

During future implementation, the DWH PDARP will use the best available science from all sources for restoration planning, design, siting, implementation, evaluation, and adaptive management. The DWH PDARP acknowledges that data sources will include the project-scale, restoration-type, resource-level, region-scale information generated by the DWH PDARP activities, as well as coordination with and leveraging external science sources (for example, the RESTORE Council's monitoring and assessment program and the RESTORE Science Program).

a) <u>Assurance in Best Available Science</u>

The DWH PDARP identifies restoration approaches for future project-level actions based on extensive data from the injury assessment. The injury assessment established the nature, degree, and extent of injuries from the *Deepwater Horizon* incident to both natural resources and the services they provide, including listed resources.

Based on the vast scale of the incident and potentially affected resources, the Trustees employed an ecosystem approach to the assessment. This involved evaluating injuries to a suite of representative habitats, communities, and species, rather than evaluating injuries to all potentially affected individual species and habitats. The Trustees also evaluated injuries to representative ecological processes and linkages. The Trustees conducted their assessment at multiple scales of biological organization, including the cellular, individual, species, community, and habitat levels.

The Trustees used a variety of assessment procedures, including field and laboratory studies, and model- and literature-based approaches. They used scientific inference to make informed conclusions about injuries not directly studied. Field data collection by the Trustees involved roughly 20,000 trips, which generated over 100,000 samples of water, tissue, oil, and sediment and over 1 million field data forms and related electronic files. Testing of samples generated millions of additional records. The Trustees developed rigorous protocols and systems to manage sample collection, handling, and data management. To store data, the Trustees developed a "data warehouse," referred to as the Data Integration, Visualization, and Reporting system (DIVER), which is publicly accessible at https://dwhdiver.orr.noaa.gov/.

The injuries affected such a wide array of linked resources over such an enormous area that the Trustees describe the effects of the DWH spill as constituting an ecosystem-level injury. Just as the injuries cannot be understood in isolation, restoration efforts must also be considered and implemented from a broader perspective. Consequently, the Trustees developed the DWH PDARP using an ecosystem-level approach, informed by reasonable scientific inferences based on the information collected for representative habitats and resources. This approach resulted in DWH PDARP's integrated restoration portfolio. The integrated restoration portfolio addresses the diverse suite of injuries that occurred at both regional and local scales.

The DWH PDARP further provides that "…the best available science to use for planning restoration activities evolves as the body of science originating from this program, as well as other science, monitoring, and restoration programs in the Gulf of Mexico, continues to grow. As a result, the adaptive management process for this restoration plan incorporates monitoring and other targeted scientific support (e.g., modeling and analysis of existing data and engagement of external scientific expertise) to address uncertainties and inform corrective actions…" The DWH PDARP provides distribution of monitoring and adaptive management responsibilities across the Trustee Council, the TIGs, and the individual trustees. It provides that as restoration implementation and science in the Gulf of Mexico evolve, the Trustees may also update restoration approaches to ensure that they remain the best available to the Trustees over the life of the Final PDARP/PEIS implementation.

Furthermore, the DWH PDARP states that it envisions that science supporting restoration decision making will be enhanced by coordinating and collaborating with other research, observations, and monitoring efforts in the Gulf of Mexico.

The DWH PDARP states:

> "This restoration plan exists within a matrix of restoration and science efforts and programs across the Gulf of Mexico, both originating from and unrelated to the *Deepwater Horizon* incident. There are already many relevant science and other technical data sets, research results, models, and decision support tools available. These data and tools cover Gulf resources, habitats, and human use patterns, as well as existing data management systems that may support monitoring and adaptive management. Trustees will leverage existing work, when possible, to address priority uncertainties and conduct monitoring and scientific support activities efficiently. Throughout the restoration process, the Trustee Council will maintain coordination with the RESTORE Council, and other appropriate restoration programs and/or partners in the Gulf of Mexico in order to identify synergies across programs and ensure efficiencies are realized where applicable.
>
> Minimum monitoring standards, including monitoring parameters, methods, metadata, and data reporting standards, may be developed in coordination with other restoration and science programs. In addition, consistent monitoring plans, data aggregation, and reporting for this restoration plan may be coordinated with other restoration partners. These standards are important for enhancing transparency to the public, coordinating with other restoration partners, and ensuring accessibility to and utility of data for the scientific community.
>
> The Trustees are responsible for detecting irregularities that may signal the existence of emerging unknown conditions that could influence restoration outcomes. Currently unknown conditions may be detected by analyzing aggregated monitoring information provided by the Trustees, but detection may also require an awareness of other ongoing scientific and restoration efforts in the Gulf of Mexico."

See also this Opinion's overview of the DWH PDARP's monitoring and adaptive management provisions provided for Questions 3-1 through 3-4 below.

b) <u>Assurance in Environmental Consequences</u>

A decision-maker's assurance in the environmental consequences depends in part on whether there are uncertainties and the nature and degree of the uncertainties associated with the decision. As our evaluations for Questions 1 and 2 above indicate, the Trustees are required to provide assurances through the standards that apply to their processes of approving or rejecting project-level actions and that apply to the information they use to make those decisions.

The Trustees recognize that there are uncertainties to factor into their decision-making as described in the DWH PDARP's Monitoring and Adaptive Management Framework. The Monitoring and Adaptive Management Framework describes uncertainties related to system-wide factors, restoration elements, and project-level issues as follows.

Uncertainty Related to System-wide Factors

The DWH PDARP states:

> "System-wide factors may influence uncertainties related to restoration implemented in this plan. During the restoration plan development, the Trustees provided the following in the Monitoring and Adaptive Management Section:
>
> - The Gulf of Mexico is a complex, interconnected ecosystem, with interactions between and among resources and habitats and important ecological functions and services (Gosselink and Pendleton 1984; Lamberti et al. 2010; O'Connell et al. 2005). Restoration conducted to address a specific resource or habitat may have direct or indirect impacts on other resources, habitats, or functions.
> - The Gulf of Mexico is a dynamic and changing environment, influenced by external factors and stressors such as pollution, climate change, sea level rise, hurricanes, and other events. Restoration will take place over many years, and restoration may have to be modified to adapt to changing environmental conditions (Bricker et al. 2008; Choi et al. 2008; Hobbs 2007; Nichols et al. 2011a).
> - A matrix of restoration efforts are being conducted in the Gulf of Mexico (e.g., Gulf Coast Ecosystem Restoration Council [RESTORE], National Fish and Wildlife Foundation Gulf Environmental Benefit Fund [NFWF GEBF], North American Wetlands Conservation Council [NAWCA], and Coastal Wetlands Planning, Protection and Restoration Program [CWPPRA]). This restoration plan is one of several concurrent Gulf of Mexico restoration efforts. Each of these efforts are at different stages of planning and implementation, with different restoration goals and mandates.
> - There is potential that currently unknown conditions may influence restoration outcomes."

Uncertainty Related to Restoration Elements

The DWH PDARP Monitoring and Adaptive Management Appendix states:

> "The amount of monitoring and science support needed for restoration varies with the degree of uncertainty associated with the restoration elements identified in this plan. The Trustees expect higher uncertainty for some restoration elements. For instance, a limited scientific understanding of target resources, the use of novel approaches and/or techniques, restoration at large spatial scales and/or long time scales, and strong socioeconomic influence, among other factors, may lead to higher uncertainty. Higher uncertainty could drive a greater need to utilize the adaptive management feedback loop for some elements of the restoration plan (Gregory et al. 2006).

- *Scientific understanding of target resources***.** Some restoration will focus on organisms, habitats, or ecosystems that have not been well studied. In these cases, important information about populations and trophic dynamics (and other issues) needed to inform restoration planning may not be available. Robust monitoring and adaptive management will be particularly important where current scientific understanding of the resource is limited, e.g., deep benthic communities (Van Dover et al. 2013; White et al. 2012).
- *Approach or technique novelty***.** Although many of the restoration elements described in this restoration plan are well established, some elements are relatively novel (see Appendix 5.D, Restoration Approaches and OPA Evaluation, for more details on restoration approaches). Because of the higher uncertainty regarding optimal design and effectiveness, these elements could require scientific support during project design, implementation, and/or evaluation. It will be critical for the Trustees to learn as implementation proceeds to increase effectiveness in meeting goals and objectives.
- *Restoration scale***.** Even for restoration approaches and/or techniques that are relatively well established (e.g., coastal habitat restoration), uncertainties about the aggregate benefits and/or impacts of restoration projects will be higher as the total number of projects implemented, size of individual projects, and extent to which projects are concentrated in particular geographic areas increases. As restoration scale (i.e., number and size of restoration projects, both independently and within a particular geographic area) increases, it will be more important to ensure that the information about aggregate restoration benefits and potential unintended consequences are incorporated into the monitoring and adaptive management framework (e.g., LoSchiavo et al. 2013; Steyer and Llewellyn 2000).
- *Socioeconomic influence***.** Socioeconomic factors may also influence restoration effectiveness, particularly when restoration depends on voluntary participation or commercial activities. For example, socioeconomic factors influence fishery-based restoration approaches (Grafton and Kompas 2005). The adoption rate of fishing gear exchanges or practice changes may be influenced by receptivity of the community to changes in fishing practices or by market conditions that affect the profitability of a new practice. Each of these factors, among others, may influence the rate at which targeted audiences volunteer to participate in restoration.
- *Time scale*. It will take many years to implement all the restoration necessary to compensate the public for the injuries that occurred as a result of the *Deepwater Horizon* incident. The likelihood that external factors could affect restoration outcomes could increase with the duration over which implementation occurs. It will be increasingly important to incorporate an adaptive management approach as the time scale of implementation increases (Simenstad et al. 2006; Williams and Brown 2012).

Uncertainty Related to Project-level Consequences

With regard to monitoring to support project planning, the DWH PDARP states that,

> "The optimal design and expected benefits for many restoration projects are well understood. However, critical uncertainties may remain regarding the relative effectiveness, proper design, and appropriate geographic location for some restoration projects. In such cases, monitoring and scientific support for project planning is intended to resolve key uncertainties during the planning of restoration projects. Monitoring and targeted scientific support for project planning may use existing or newly collected data and will likely be most relevant for restoration projects that are highly novel or particularly complex."

Quality Control - Processes to ensure that restoration projects meet their stated goals

a) Quality Control through Project Development Processes

The DWH PDARP requires each TIG to develop projects in accordance with the OPA regulations and other applicable requirements, including consistency with the DWH PDARP. OPA regulations, 15 CFR 990.55 require that,

> "(1) When developing the Draft Restoration Plan, trustees must establish restoration objectives that are specific to the injuries. These objectives should clearly specify the desired outcome, and the performance criteria by which successful restoration will be judged. Performance criteria may include structural, functional, temporal, and/or other demonstrable factors. Trustees must, at a minimum, determine what criteria will:
>
> > (i) Constitute success, such that responsible parties are relieved of responsibility for further restoration actions; or
> >
> > (ii) Necessitate corrective actions in order to comply with the terms of a restoration plan or settlement agreement.
>
> (2) The monitoring component to the Draft Restoration Plan should address such factors as duration and frequency of monitoring needed to gauge progress and success, level of sampling needed to detect success or the need for corrective action, and whether monitoring of a reference or control site is needed to determine progress and success. Reasonable monitoring and oversight costs cover those activities necessary to gauge the progress, performance, and success of the restoration actions developed under the plan."

b) Quality Control through Implementing Monitoring, Reporting, and Corrective Actions

The DWH PDARP requires implementing Trustees to:

- "Conduct (or contract) project-level monitoring and evaluation**.** Implementing Trustees conduct project-specific monitoring (including data collection, data analysis, and synthesis), compare progress against project-specific performance standards, evaluate each project's performance toward restoration objectives, and identify the need for and propose corrective actions to the TIGs. Individual Trustee agencies enter or upload project-specific monitoring information, including objectives, performance standards, and collected data into a central repository…"
- "Identify and recommend resource-level monitoring needs**.** Individual Trustee Agencies may identify and propose resource-level and/or cross-resource-level monitoring activities to the TIGs."
- "Conduct resource-level monitoring and scientific support**.** Individual Trustee Agencies, when designated by the TIGs, conduct resource-level and/or cross-resource-level monitoring and scientific support activities (as defined in Appendix 5.E, Monitoring and Adaptive Management Framework) and link data, analyses, reports, and other scientific products to the central repository."

The DWH PDARP requires TIGs to:

- "Coordinate with Implementing Trustees to support consistency and compatibility of monitoring plans and data management in accordance with the Trustee Council SOP, and respective TIG SOP, if applicable and aggregate Implementing Trustee's monitoring data by restoration type for reporting to the Trustee Council. According to the OPA NRDA regulations (15 CFR § 990.55), a project specific monitoring plan includes a description of monitoring for documenting restoration effectiveness, including performance criteria that will be used to determine the success of restoration or need for interim corrective action. The Trustees are committed to this required level of project monitoring and may choose to conduct additional monitoring. TIG responsibilities will include the following:
    - Review and provide feedback for monitoring and adaptive management plans and efforts. TIGs review project monitoring and adaptive management plans for content, for compliance with regulatory requirements, and to determine their readiness for inclusion in restoration plans.
    - Coordinate data management and reporting**.** TIGs track project monitoring data to ensure that data, monitoring reports, and other monitoring information are consistent and compatible with the SOP and are linked to a central repository. They then report this monitoring information to the Trustee Council.

- Assist in identifying and developing corrective actions**.** TIGs will coordinate and support the identification and development of corrective actions, particularly for projects with similar restoration objectives."

Evaluation for Question 2-3

Based on the DWH PDARP provisions above, we believe that the DWH PDARP establishes quality assurance and quality control procedures that would apply to restoration plans or project approval documents with the following assumptions. If these assumptions prove incorrect, then reinitiation of this consultation may be required. We assume the following.

Incorporating uncertainty into restoration plans and project decisions. We assume that the types of uncertainties described in the DWH PDARP's Monitoring and Adaptive Management Framework and summarized above will be factored into all project-level decision-making and considered before the Trustees make decisions. We also assume that the Trustee Council will provide guidance to the TIGs to explicitly address these types of uncertainties in their decision-making on restoration plans.

We also assume that when restoration is focusing on organisms, habitats, or ecosystems that have not been well studied, and if there is the potential for that restoration to adversely impact listed resources, that the Trustees would do a risk analysis before they make a decision of whether to proceed with the restoration project. One of the DWH PDARP provisions above regarding *Scientific understanding of target resources* recognizes that in cases of this scientific uncertainty, important information about populations and trophic dynamics and other issues needed to inform restoration planning may not be available. This provision recognizes that robust monitoring and adaptive management will be particularly important in these circumstances. We rely on this assumption because it is not clear that the Trustees would analyze the potential risk to listed resources before making decisions to proceed in the face of uncertainty in their scientific understanding.

Corrective actions. We assume that the Trustees' OPA NRDA regulatory obligation to take corrective actions in order to comply with the terms of a restoration plan or settlement agreement includes corrective actions for purposes of ESA compliance. ESA compliance is part of the DWH PDARP restoration plan. There is sufficient emphasis throughout the DWH PDARP for corrective actions in order to ensure that DWH PDARP goals are met. We assume that the Trustees will also require corrective actions, in coordination with us, through additional consultation or re-initiated consultation when monitoring indicates that there are adverse effects to ESA-listed resources that exceed those anticipated or that were not anticipated during ESA consultation.

7.3 Provisions for Monitoring and Adaptive Management during the Execution of the DWH PDARP and Individual Projects

We evaluate this overarching concern through the following 4 specific questions: 3-1 through 3-4.

3-1. Are there transparent monitoring, feedback, and adjustment loops that require Trustees to collect empirical information that allows them to ensure that specific projects are undertaken as designed, including best practices, terms and conditions, and reasonable and prudent measures established during ESA consultation?

The following DWH PDARP provisions are pertinent to evaluate this question.

- The DWH PDARP requires consistency with OPA NRDA regulations. OPA NRDA regulations require restoration plans to describe monitoring for every restoration plan (15 CFR § 990.55). The regulations provide that a draft restoration plan should include a description of monitoring for documenting restoration effectiveness, including performance criteria that will be used to determine the success of restoration or need for interim corrective action.
- The DWH PDARP addresses performance monitoring, compliance monitoring and project-specific monitoring by stating the following:
  - "Performance monitoring will be conducted for all restoration projects developed under the DWH PDARP. The intent of performance monitoring is to document whether the projects have met their established performance criteria and determine the need for corrective actions (15 CFR § 990.55(b)(1)(vii))." OPA NRDA regulations require corrective actions in order to comply with the terms of a restoration plan or settlement agreement."
  - "Compliance monitoring will be conducted and is intended to collect information needed to demonstrate compliance with regulatory requirements, including the Endangered Species Act (ESA) and Marine Mammal Protection Act (MMPA), among other applicable statutes. Compliance monitoring may include proper implementation of project design criteria (PDCs) and other terms and conditions provided through ESA Section 7 consultations. Compliance monitoring will be required for many projects and will be incorporated as appropriate."
  - "Project-specific monitoring and associated adaptive management/corrective actions will be conducted by the Implementing Trustee(s), using project funds and in accordance with final project monitoring plans. Project monitoring will be conducted using methodologies established in the monitoring and adaptive management SOP developed by the Trustee Council. Monitoring data will be used by the Implementing Trustee(s) to track whether projects are trending towards the project's established performance criteria or whether adaptive management,

maintenance, or corrective actions are needed. If these corrective actions require additional or modified environmental reviews, the Implementing Trustee(s) will notify the TIG and a determination will be made on whether any public notification is required by law."

- The DWH PDARP recognizes, "Not only is monitoring necessary for tracking restoration and recovery, it is also required under several statutes. As per Natural Resource Damage Assessment (NRDA) regulations under the Oil Pollution Act (OPA), monitoring will be included for all projects and will be used to evaluate project success and determine the need for corrective actions. Restoration projects must also meet requirements within the Record of Decision in the NEPA regulations and demonstrate regulatory compliance with other pertinent statues (such as the Magnuson-Stevens Act, Endangered Species Act, and Marine Mammal Protection Act)."

Evaluation for Question 3-1

Based on the DWH PDARP provisions above, we believe that the DWH PDARP requires the Trustees to collect empirical information that allows them to ensure that specific projects are undertaken as designed, including best practices, terms or conditions, and reasonable and prudent measures established during ESA consultation with the following assumption. If this assumption proves incorrect, then reinitiation of this consultation may be required. We assume the following:

We assume that the Trustees' empirical information collection will include pre-project monitoring that will allow the performance monitoring and compliance monitoring to be assessed against pre-project baselines, for example documenting the presence/absence of listed species, essential features of designated critical habitats, and SAV.

3-2. Are there transparent monitoring, feedback, and adjustment loops that require Trustees to assess the actual effects of their actions, including the amount and extent of take of listed species caused by those actions, both individually and collectively?

Evaluation for Question 3-2

We believe that the DWH PDARP requires the Trustees to assess the actual effects of their actions, including amount and extent of take, by requiring them to comply with ESA Section 7(a)(2). During Section 7(a)(2) consultation on future projects, if we determine that the action will result in incidental take of listed species, we will document the amount or extent of take anticipated and provide reasonable and prudent measures necessary and appropriate to minimize the impact of the incidental take. We will also provide terms and conditions that set the specific methods by which the reasonable and prudent measures are to be accomplished. Terms and conditions of an incidental take statement must include reporting and monitoring requirements that assure the Trustees' oversight of any incidental take [50 CFR 402.14(i)]. Also, the monitoring must be sufficient to determine if the amount or extent of take is approached or exceeded, and the reporting must assure that the Trustees and NMFS will know when that happens.

3-3. Are there transparent monitoring, feedback, and adjustment loops that require Trustees to incorporate new information to improve subsequent decisions?

The following DWH PDARP provisions are pertinent to evaluate this question.

- The DWH PDARP provides that, "Through monitoring and adaptive management, decisions are continuously informed by evolving restoration data and information. The adaptive management process incorporates monitoring of restoration progress, consideration of uncertainties, and opportunities for Trustees to adapt restoration activities to ensure restoration success (Pastorok et al. 1997; Thom et al. 2005; Williams 2011; Williams et al. 2007)."

  The Trustees recognize that the best available science to use for planning restoration activities evolves as the body of science originating from this program, as well as other science, monitoring, and restoration programs in the Gulf of Mexico, continues to grow. As a result, the adaptive management process for this restoration plan incorporates monitoring and other targeted scientific support (e.g., modeling and analysis of existing data and engagement of external scientific experts) to address uncertainties and inform corrective actions."

  The Trustees also recognize that "The Gulf of Mexico is a dynamic and changing environment, influenced by external factors and stressors such as pollution, climate change, sea level rise, hurricanes, and other events. Restoration will take place over many years, and restoration may have to be modified to adapt to changing environmental conditions (Bricker et al. 2008; Choi et al. 2008; Hobbs 2007; Nichols et al. 2011)."In addition to the Project-level monitoring described above under Question 3-2, the DWH PDARP has sections that provide for Resource Level Monitoring and Adaptive Management and Cross Resource-level Monitoring and Adaptive management. It states that:
    - "Targeted resource-level monitoring and scientific support activities may be needed where substantial gaps exist in scientific understanding that limit restoration planning and implementation for individual restoration types. Gaps in scientific understanding exist for certain aspects of many of the Gulf of Mexico living coastal and marine resources targeted by this restoration plan (fish, oysters, sea turtles, marine mammals, birds, and mesophotic and deep benthic communities). This monitoring and targeted scientific support for restoration type planning and implementation is intended to support restoration planning across a suite of projects that benefit the same resource. Scientific activities to address these uncertainties could include targeted data collection, modeling, and/or other

analyses to better characterize status, trends, and spatiotemporal distributions of injured resources and/or habitats to be restored."

- "Monitoring and scientific support for evaluation of resource restoration progress may include, but is not limited to, aggregation of project level monitoring data across multiple projects within a restoration type, compilation of existing resource data, identification of critical data gaps and targeted collection of new monitoring data, and development of models to estimate population- or stock-level effects of restoration actions.
- For example, an improved understanding of status and trends in focal sea turtle stocks (e.g., Kemp's ridley) could support the Trustees' evaluation of the aggregate benefits of sea turtle restoration projects and whether the implemented projects have accelerated the recovery of the species."
- The DWH PDARP provides the Trustees the opportunity to "…adjust restoration actions, as needed, based on monitoring and evaluation of restoration outcomes (IPCC 2013). This feedback loop will not necessarily be needed in all instances. Projects that meet their success criteria, as determined during the evaluation step, may not need to utilize the adaptive management feedback loop. In other cases, multiple iterations of the feedback loop may be intentionally incorporated into project implementation. For example, a new restoration approach may be implemented first on a small scale to test design options and resolve any uncertainties through multiple iterations of the feedback loop prior to implementing the project on a larger scale."

- In addition, the DWH PDARP has sections that provide for Monitoring to Support Restoration Planning and Implementation across Restoration Types. It states that "Some key knowledge gaps in the selection, design, and optimization of restoration will affect planning and implementation for multiple resources. Potential cross-resource monitoring and adaptive management needs could include predicting and/or measuring the influence of external factors (e.g., sea level rise or large-scale disturbance events) on restoration outcomes, characterizing interactions among restoration actions that benefit different resources, and/or collecting additional data needed to support regional-scale restoration (Hijuelos and Hemmerling 2015; Steyer et al. 2003). Monitoring and scientific support activities for planning and implementation across restoration types is intended to fill key information gaps to support restoration for multiple resources. Monitoring and science support for this may include the compilation of existing relevant data, identification of key data gaps, targeted data collection, modeling, and/or analyses."

Evaluation for Question 3-3

Based on the DWH PDARP provisions provided above, NMFS finds that the DWH PDARP requires the Trustees to incorporate new information, including the best available science from all sources, to improve subsequent decisions.

3-4. Are there transparent monitoring, feedback, and adjustment loops that require Trustees to adjust and modify actions, in coordination with NMFS, when new information reveals that particular projects (considered individually or collectively) have unanticipated effects, change in a way that results in effects not considered, or otherwise require additional consultation with NMFS to ensure continued compliance with Section 7(a)(2) of the ESA?

The following PDARP provisions are pertinent to evaluate this question.

- "Project-specific monitoring and associated adaptive management/corrective actions will be conducted by the Implementing Trustee(s) before, during, and/or after construction and/or implementation. Monitoring will use project funds and in accordance with final project monitoring plans. Project monitoring will be conducted using methodologies established in the monitoring and adaptive management SOP developed by the Trustee Council. Monitoring data will be used by the Implementing Trustee(s) to track whether projects are trending towards the project's established performance criteria or whether adaptive management, maintenance, or corrective actions are needed. If these corrective actions require additional or modified environmental reviews, the Implementing Trustee(s) will notify the TIG and a determination will be made on whether any public notification is required by law."
- "Throughout project implementation, TIGs review project information and monitoring data provided by the Implementing Trustee(s) to consider whether the project is performing as planned. In the event that project modifications are identified during implementation, TIGs must coordinate with Implementing Trustees to determine if those changes warrant any revised restoration planning or environmental evaluation and identify if a project needs to be terminated. Further, TIGs will develop procedures to select another project in the event of project termination. TIGs may also review corrective actions proposed by the Implementing Trustee(s) to promote consistency in actions applied to restoration approaches. TIG coordination across projects may be funded with administrative oversight and comprehensive planning funds allocated to each respective TIG."

Evaluation for Question 3-4

Based on the DWH PDARP provisions provided above, we believe that the Trustees will adjust and modify actions, in coordination with us, when new information reveals that particular projects (considered individually and collectively) have unanticipated effects, change in a way that results in effects not considered, or otherwise require additional consultation with NMFS to ensure continued compliance with Section 7(a)(2) of the ESA.

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8. Project-Level Pathways for ESA Consultation

8.1 Informal and Formal Consultation

Subsequent project-level actions which tier from the DWH PDARP that may affect ESA-listed resources will require ESA Section 7(a)(2) consultation. Project-level consultations will be either informal, when NMFS concurs that the action is not likely to adversely affect listed resources, or formal, when adverse effects cannot be avoided. For traditional informal consultations, the Trustees will submit a Biological Evaluation (BE) form and NMFS will respond with a Letter of Concurrence (LOC), if we agree that the action is not likely to adversely affect listed resources. When proposed actions are likely to adversely affect ESA-listed resources, the Trustees enter into formal consultation and NMFS completes a Biological Opinion addressing adverse effects to listed resources and take of ESA-listed species. For phased projects, NMFS may evaluate the effects of all steps of the project at the time of consideration of the first phase. Consultation pathways, including streamlined consultations for actions for which project design criteria (PDCs) are presently available in Appendix A of this Opinion, are depicted in Figure 8-1.

8.2 Streamlined Consultation and NMFS Project Design Criteria

As part of this Opinion, we have developed an option for informal consultation that requires the use of PDCs for specific restoration actions. These PDCs were developed for types of project-level actions that can be readily categorized and evaluated to determine effects to ESA-listed resources. These types of restoration action are also likely to be implemented through the DWH PDARP:

- Marine Debris Removal
- Living Shorelines
- Marsh Creation and Enhancement
- Non-Fishing Piers
- Oyster Reef Creation or Enhancement

The PDCs and ESA analysis of these actions are in Appendix A of this Opinion. We conclude in that analysis that if the Trustees implement all applicable PDCs for the types of restoration actions listed above, then the project is not likely to adversely affect ESA-listed species or their designated critical habitats and the project qualifies for a streamlined ESA consultation. The Trustees used a BE form for ESA consultation on DWH Early Restoration projects. In Appendix B of this Opinion, we provide an updated BE form to be used for future informal and streamlined ESA consultations authorized under the DWH PDARP. For streamlined consultations, the PDC checklist portion of the BE form must also be completed to demonstrate compliance with PDCs and confirm that adverse effects to listed resources will be avoided. Formal consultations with

NMFS require a Biological Assessment to be submitted with a request for ESA consultation.

8.3 Consultation Pathways

Trustees are encouraged to request technical assistance from NMFS prior to initiating consultation. It may be possible through pre-consultation technical assistance to determine ways to reduce adverse effects and resolve issues. This will help make the consultation more efficient and insure that potential adverse effects are addressed. Project-level consultations will be conducted through one of the following pathways (see also Figure 8-1):

- **Traditional formal**. Trustees with projects in which the action is likely to adversely affect listed resources will submit a Biological Assessment to NMFS via email[18] and request to initiate consultation. We will review these consultation requests for completeness within 30 days and complete the traditional consultation procedures specified in 50 CFR 402. Our issuance of a Biological Opinion concludes consultation requirements for that project or group of projects. In all cases, project proponents should try to work with NMFS early in the project planning and development phases; *or*
- **Traditional informal.** Trustees with projects for which PDCs have not been developed, or the PDCs are not followed, and the action is not likely to adversely affect listed resources, will submit a BE form to NMFS via email and request to initiate consultation. NMFS will review these consultation requests for completeness within 30 days and complete the traditional consultation procedures. Our letter of concurrence with the conclusion of not likely to adversely affect concludes consultation requirements for that project or group of projects. In all cases, project proponents should try to work with NMFS early in the project planning and development phases; *or*
- **Streamlined informal.** Trustees with projects that meet the PDCs evaluated in this Opinion (Appendix A) will submit a BE Form with completed PDC checklist[19] (Appendix B) and any relevant maps and drawings to NMFS via email. If sufficient information is provided, NMFS will make a final determination as to whether the proposed action (1) falls within the appropriate category of activities covered by the relevant set of PDCs, and (2) whether all of those PDCs are fully incorporated into the project design. If these 2 requirements are met, then NMFS will respond via return email within 60 days confirming that (a) the project is consistent with the PDCs and this framework programmatic Biological Opinion, (b) it is not likely to adversely affect listed species or their critical habitat, and (c) consultation is concluded.

[18] See instructions for how to submit an ESA consultation request to NMFS Southeast Regional Office at: http://sero.nmfs.noaa.gov/protected_resources/section_7/consultation_submittal/index.html
[19] Endangered Species Act Biological Evaluation Form, *Deepwater Horizon* Oil Spill Restoration, Fish and Wildlife Service & National Marine Fisheries Service, January 2015 or most recent version available from NMFS

8.4 Batching Projects and Future Project-Level Consultations

The Trustees can facilitate efficient ESA authorizations by being strategic in their development of future restoration plans for specific projects. For example, Trustees could develop restoration plans that batch multiple projects by restoration type and/or by TIG geographic area for a period of multiple years. Restoration plans and projects could also be batched as a network across multiple TIG geographic areas for similar activities. When multiple projects are subject to ESA consultation, NMFS and the Trustees could conduct project-level batched consultations that are tiered to this framework Opinion. Project-level batched consultations allow NMFS to evaluate the aggregate impacts of such batched projects, and would create efficiencies for ESA analyses and for processing ESA consultations, leading to more timeliness and certainty for restoration project implementation.

8.5 Future Project Design Criteria and Best Practices

The PDCs evaluated in Appendix A of this Opinion represent the current best available science, reiterate many of the DWH PDARP examples of best practices, and also provide additional protections for listed resources. As the Trustees implement the program and learn through monitoring and evaluation, program-wide best practices may be adjusted, improved, and added to what is in the present DWH PDARP.

Likewise, NMFS may update and improve the set of PDCs presented and evaluated in Appendix A of this Opinion in the future. Also, it is possible that NMFS will develop new sets of PDCs for additional types of restoration activities to avoid adverse effects to listed species and critical habitat. New or updated PDCs designed to prevent activities from having adverse effects to listed resources will undergo an ESA analysis by NMFS, and the Opinion may be amended, as appropriate. Future PDCs are not likely to trigger reinitiation of formal consultation on the DWH PDARP, since PDCs are designed to avoid effects already considered in this Opinion.

Additionally, for activities with unavoidable adverse effects, NMFS may develop PDCs to reduce adverse effects; these PDCs will be analyzed by NMFS through formal consultation before they are available for use. Eligibility for streamlined consultation would be described in future individual or programmatic Opinions.

The Trustees are responsible for confirming that they are using the most current PDCs and Best Practices at the time of project implementation. NMFS will inform the Trustees when future PDCs become available. NMFS will post the current PDCs at: http://sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/index.html.

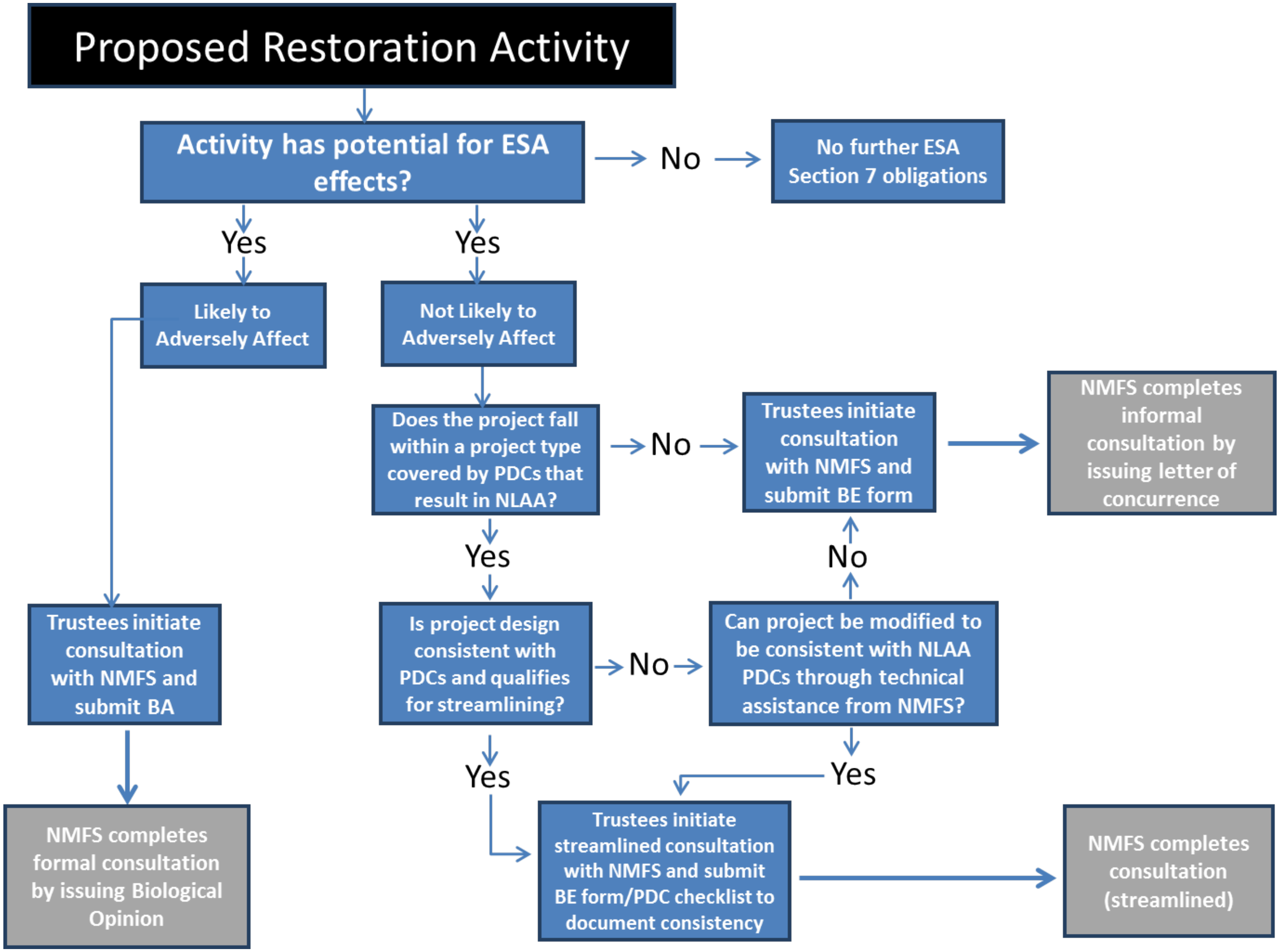

Figure 8-1. Pathways for ESA Consultation Process. This diagram shows through the ESA consultation process for any proposed project based on the ESA effect determination and whether the project can incorporate PDCs. The gray boxes indicate the conclusion of consultation with NMFS.

9. Cumulative Effects

"Cumulative effects" are those effects of future state, tribal, local, or private activities, not involving federal activities, that are reasonably certain to occur within the Action Area of the federal action subject to consultation (50 CFR 402.02). Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA. Because many activities that have the potential to affect the ESA-listed resources considered in this Opinion involve some degree of federal authorization, NMFS expects that ESA Section 7 will apply to most future actions that could affect ESA-listed resources.

The federal Trustees determined that the proposed programmatic structure, processes and principles for conducting future restoration planning as presented in the DWH PDARP is consistent with the federally approved coastal management programs in Texas, Louisiana, Alabama, Mississippi and Florida. All 5 states responded in agreement. Additionally, NMFS expects state and local habitat conservation and protection programs to continue into the future. See Appendix 6.B of the DWH PDARP for examples of these programs.

We expect the future state, tribal, local, or private actions that are reasonably certain to occur in the action area to be similar to those described in the environmental baseline section of this Opinion. The actions include, but are not limited to, fisheries, vessel traffic, oil and gas activities, pollution, and coastal development. With human population expansion in the action area, these actions are expected to intensify over time, though the degree to which this may affect the ESA-listed species considered in this Opinion cannot be quantified. Future changes in state and local government and private actions may include variation in land and water-use patterns, including ownership and intensity, any of which could affect listed species or their habitat. It is difficult, and perhaps speculative, to analyze the effects of such actions, considering the broad geographic landscape covered by this Opinion, the geographic and political variation in the action area, extensive private land holdings, the uncertainties associated with state and local government and private actions, and ongoing changes in the region's economy. Adverse effects to riverine and coastal habitat from continued urbanization are reasonably certain to occur. However, state and local governments have regulations in place to minimize these effects to listed species, including regulations regarding construction best management practices, storm water control, and treatment of wastewater.

Based on the best available information, NMFS is not aware of any proposed or anticipated changes in other human-related actions or natural conditions (e.g., over-abundance of land or sea predators, changes in oceanic conditions) that would substantially change the impacts that ESA-listed species covered by this Opinion may experience. NMFS will continue to work with states to develop ESA Section 6 agreements and with researchers working under Section 10 permits to enhance programs to quantify and mitigate these takes. Although quantifying an incremental change in survival for the species considered in this consultation due to the cumulative effects is not possible, it is reasonably likely that any resultant effects within the action area will have a small, long-term, negative effect on the likelihood of their survival and recovery.

10. Integration and Synthesis

The Integration and Synthesis is the final step in our assessment of the risk posed to listed resources by the DWH PDARP. In this section, we add our analyses of the effects of the action to the environmental baseline and the cumulative effects, taking into account the status of the species and critical habitat. Based on our integrated evaluation of these components, we formulate our opinion as to whether the DWH PDARP is likely to: (1) appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated critical habitat for the conservation of the species.

The DWH PDARP establishes requirements that the Trustees will use to guide the development and implementation of future individual restoration projects such that those projects fully align with the parameters established in the DWH PDARP. This Opinion analyzes the program-level effects of the DWH PDARP on listed species and critical habitats under NMFS's jurisdiction. As contemplated by the DWH PDARP, specific activities that it authorizes will be addressed in subsequent ESA Section 7(a)(2) consultations. The DWH PDARP's 5 overarching restoration goals are to: (1) restore and conserve habitat, (2) restore water quality, (3) replenish and protect living coastal and marine resources, (4) provide and enhance recreational opportunities, and (5) provide for monitoring, adaptive management and administrative oversight. While the Trustees intend the outcome of this program to achieve those goals and benefit listed species, adverse effects to listed resources are likely to occur.

This Opinion provides detailed discussions in Section 4 of the current status of each listed species and designated critical habitat that is likely to be adversely affected by the DWH PDARP. These species are: sperm whales, loggerhead sea turtle-Northwest Atlantic Ocean DPS, the green sea turtle, the hawksbill sea turtle, the Kemp's ridley sea turtle, the leatherback sea turtle, Gulf sturgeon, and smalltooth sawfish. Of these, critical habitat has been designated within the action area for the loggerhead sea turtle, Gulf sturgeon, and smalltooth sawfish. The status of each species varies based on the unique condition of that species and its critical habitat. For most of these species, their status reviews reflect that the species continue to be threatened by, or at risk of extinction, due to the particular stressors that have contributed to their at-risk state. Some of those stressors are, or have the potential to be, produced by activities authorized, funded, or carried out by the DWH PDARP.

As we describe in the Environmental Baseline, Section 5 of this Opinion, the ESA-listed species considered in this Opinion are affected by a number of federal, state, local, and private activities in the action area that have the potential to impact their survival and recovery. These actions include, but are not limited to, fisheries, vessel activity, oil and gas operations, dredging, pollution, and coastal development. The ESA-listed species considered in this Opinion have been, and continue to be, negatively affected both directly (e.g., mortality from vessel strike or fisheries interactions) and indirectly (e.g., through habitat degradation and effects on prey base) by these activities. Of note, the 2010 *Deepwater Horizon* oil spill adversely affected several of the ESA-listed species considered in this Opinion, resulting in instances of mortality, injury, and/or sublethal effects, many of which are expected to have fitness implications into the future. Also of note is climate change, though is it is difficult to accurately predict the consequences of climate change to the species considered in this Opinion. As described in the Status and Environmental Baseline sections of this Opinion, a range of consequences are expected, varying from beneficial to catastrophic. In the Gulf of Mexico there are also a number of ongoing federal, state, and local habitat conservation and protection programs. Many of these actions are specifically targeted at reducing threats to ESA-listed species and restoring their habitats. In addition, the program proposed by the DWH PDARP Trustees aims to restore habitats and provide benefits to ESA-listed species.

Additionally, as described in the Cumulative Effects, section 9 of this Opinion, with human population growth in the action area, the adverse effects of some state, local, and private actions are expected to intensify over time, though the degree to which this may affect the ESA-listed species considered in this Opinion cannot be quantified. A wide variety of programs undertaken by federal, state, and local governments, non-governmental organizations, and private individuals have been established to protect or restore the Gulf of Mexico region’s watersheds, coastal ecosystems, and the ESA-listed species considered in this Opinion. Those programs have helped slow and, for some areas, reverse the declining trends that began in the past. However, despite the efforts of agencies at every level of government, non-governmental organizations, and private individuals, the Gulf of Mexico ecosystem remains degraded and populations of the ESA-listed species considered in this Opinion have not recovered.

In the Effects of the Action - Species and Critical Habitat Analysis, Section 6 of this Opinion, we present the evidence that leads us to conclude that the listed species under NMFS’s jurisdiction are likely to be exposed to the activities proposed by the DWH PDARP. Many, but not all, of the activities proposed by the DWH PDARP have the potential to adversely affect listed species and their designated critical habitats and we described those potential effects. There may also be indirect effects likely to result from the activities proposed by the DWH PDARP- those effects that are caused by the projects but are later in time and reasonably certain to occur. Since the DWH PDARP presents a framework program, it does not provide detail about the specific location, magnitude, and duration of future specific restoration projects. Analyses of whether adverse effects of specific projects on individuals are sufficient to jeopardize the continued existence of the listed species by reducing the reproduction, numbers, or distribution of the affected species to such an extent as to reduce appreciably the likelihood of both survival and recovery in the wild will occur through project-level consultations. Likewise, analyses of whether adverse effects of specific projects are sufficient to result in destruction or adverse modification of designated critical habitats will also occur through project-level consultations.

Thus, Section 7 of this Opinion, Effects of the Action - Governance and Decision-making, evaluates whether the Trustees would implement project-level actions that are likely to jeopardize listed species or result in destruction or adverse modification of critical habitat. Our evaluation found that the DWH PDARP's governance and environmental compliance requirements provide standards that are reasonably certain to ensure that specific actions, alone or in combination with other specific actions, are not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of their critical habitats. Also, the Trustees have sufficient authorities to adjust or amend project-level actions, in consultation with NMFS, to minimize impacts on listed species and to implement terms and conditions to minimize incidental take of listed species. In the unlikely event that there is a jeopardy action on a specific project, the Trustees have sufficient authorities to work with NMFS to develop a reasonable and prudent alternative to that action.

The information that forms the foundation of the Trustees' approval of restoration plans and actions is based on the best available science and will continue to be updated based on monitoring and adaptive management and other future updates to best available science. We found that the DWH PDARP requires the Trustees to assess the individual and collective impacts of specific projects or groups of projects contained in restoration plans or in the aggregate across restoration plans throughout the action area. The DWH PDARP requires the Trustees to actively identify, gather, and analyze data and other information that would be relevant to identifying the presence or absence of adverse consequences for listed resources. It also establishes quality assurance and quality control procedures that will apply to restoration plans or project approval documents.

The DWH PDARP establishes transparent monitoring, feedback, and adjustment loops that require Trustees to collect information on project effects during planning and implementation and to adjust and modify actions, if necessary, when information reveals that the projects are not in compliance to comply with ESA Section 7(a)(2). The DWH PDARP requires the Trustees to collect empirical information that allows them to ensure that specific projects are undertaken as designed, including best practices, terms or conditions, and reasonable and prudent measures established during ESA consultation. They are also required to assess the actual effects of their actions, including the amount and extent of take of listed species being caused by the actions, both individually and collectively. The Trustees are required to implement monitoring and adaptive management and incorporate new information to improve subsequent decisions and to adjust and modify ongoing actions, in coordination with NMFS, when new information reveals that particular projects have unanticipated effects, change in a way that results in effects not considered, or otherwise require additional consultation with NMFS to ensure continued compliance with Section 7(a)(2) of the ESA.

In summary, the DWH PDARP's decision-making processes enable the Trustees to eliminate, avoid, or reduce risks the program poses and ensure that actions that they authorize under the program are not likely to jeopardize the continued existence of the listed species or result in the destruction or adverse modification of critical habitat that has been designated for those species.

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11. Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, and any effects of interrelated and interdependent activities and cumulative effects, and relying on identified assumptions in the case of uncertainty, it is NMFS's Biological Opinion that the Trustees' DWH PDARP **is not likely to jeopardize the continued existence** of any listed endangered or threatened species under the jurisdiction of NMFS and **is not likely to destroy or adversely modify any designated critical habitat**.

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12. Incidental Take Statement

This consultation does not authorize any incidental take associated with implementation of the DWH PDARP. In accordance with 50 CFR 402.14, for a framework programmatic action, an incidental take statement is not required at the programmatic level. Any incidental take resulting from any action subsequently authorized, funded, or carried out under the program will be addressed in subsequent Section 7 consultation, as appropriate.

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13. Conservation Recommendations

This section provides our conservation recommendations for implementing the DWH PDARP. Conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

The DWH PDARP evaluated impacts to a wide range of Gulf resources, included several ESA-listed species managed by NMFS. The DWH PDARP proposes a suite of actions to restore affected resources, including ESA-listed species, to baseline conditions, as defined by the OPA. As described in Section 5.2.3 of the DWH PDARP, restoration of injured resources will involve both primary and compensatory restoration. Primary restoration actions work to directly restore injured natural resources and services to baseline on an accelerated time frame. Compensatory restoration can include benefitting natural resources by addressing existing stressors to resources.

The Trustees have the opportunity to implement actions that support both OPA goals, as described in the DWH PDARP, and ESA goals for conserving listed species. The conservation recommendations included below are focused on providing information to support both primary and compensatory restoration. The OPA and ESA share some common elements, including focus on restoration and recovery through direct protection and conservation of managed resources and also through improving status of those resources through management of stressors.

The ESA's purpose is to conserve the ecosystems upon which listed species depend. Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of threatened and endangered species. ESA section 4(f) requires NMFS and the USFWS to develop and implement recovery plans for the conservation and survival of listed species. Recovery plans provide criteria that describe the characteristics of recovered species and describe the actions necessary to meet those criteria and achieve ESA goals. Recovery plan actions are not mandatory. However, they provide a roadmap, based on best available science, of how best to improve the species' status. As such, they provide relevant guidance for how to benefit ESA-listed species potentially impacted by DWH PDARP implementation.

In formulating these conservation recommendations, NMFS used recovery plans and the best available science to identify:

1) Priority actions that would benefit listed species and make progress toward achieving DWH PDARP goals;
2) Opportunities to reduce or eliminate potential adverse effects to listed resources that may be associated with implementation of DWH PDARP restoration activities through better

understanding of the potential effects of those activities and optimization of restoration techniques;

3) Information needed to understand the status and trends of listed species and their habitats and that would support monitoring, evaluation, and reporting of the aggregate benefits of the DWH PDARP's restoration projects; and,

4) Restoration planning, monitoring, adaptive management, and science coordination that would help optimize the Trustees' opportunities to meet DWH PDARP goals and contribute to conserving listed species affected by the proposed action.

13.1 Sea Turtles

Sea turtles are among the species injured by the DWH oil spill, and also potentially adversely affected by the DWH PDARP, as summarized in this Opinion's Status of Species Section 4 and Analysis of Effects, Section 6. The DWH oil spill affected sea turtles through direct mortality, reproductive failure, habitat degradation and a range of adverse health effects. The DWH PDARP's sea turtle restoration type provides a range of restoration approaches and techniques that are intended to restore sea turtle populations. There are also several habitat-related restoration approaches that are expected to directly benefit sea turtles (e.g., restore and enhance dunes and beaches). In addition to the expected beneficial effects to sea turtles from DWH PDARP implementation, there are also some proposed restoration approaches and techniques that may result in adverse effects on sea turtles (e.g., increased recreational fishing interactions resulting from the "enhance public access to natural resources for recreational use" approach, See section 6 of this Opinion for more detail).

The DWH PDARP determined that sea turtle monitoring and scientific support are critical to better understanding where and when restoration approaches are most likely to be successful and may inform restoration planning, implementation, and evaluation. Section 5.5.10.4 the DWH PDARP states that, "Information on sea turtle spatiotemporal distribution, migration patterns, life history parameters, and habitat use is critical for interpreting population trends, improving sea turtle population models, and helping assess progress toward recovery goals. Furthermore, monitoring and scientific support will be important for evaluating the effects of restoration actions on sea turtle recovery from injuries associated with the spill."

The following conservation recommendations are designed to help inform successful DWH PDARP restoration planning and implementation, and to monitor how anthropogenic activities related to the DWH PDARP restoration approaches may affect sea turtles. These conservation recommendations are informed directly by sea turtle recovery plans. For each conservation recommendation, we provide an explanation of how it links to and supports DWH PDARP restoration goals and potential restoration approaches.

Sea Turtle Conservation Recommendations

CR 1.1: Support in-water abundance and distribution estimates of sea turtles (all listed species and life stages addressed in this Opinion) to achieve more accurate status assessments for these species and to help inform the temporal and spatial implementation of future restoration projects.

DWH PDARP Restoration Approach:

- Reduce sea turtle bycatch in commercial and recreational fisheries through identification and implementation of conservation measures

Link: Understanding turtle distribution and abundance will help maximize the benefits of bycatch reduction projects by identifying areas and fisheries of greatest bycatch concern. In addition, this knowledge will help minimize and avoid adverse effects from restoration approach identified in CRs 1.2 through 1.4.

CR 1.2**:** Work to develop procedures to protect sea turtles and other species during in-situ burn operations.

DWH PDARP Restoration Approach:

- Increase sea turtle survival through enhanced mortality investigation and early detection of and response to anthropogenic threats and emergency events

Link: Supports returning sea turtles to baseline by preventing future injury. Additionally, information regarding in-water abundance and distribution estimates from CR 1.1 would further support increased sea turtle survival during activities that respond to anthropogenic threats and emergency events.

CR 1.3: Conduct monitoring to analyze the effects of artificial reef deployment on sea turtles.

DWH PDARP Restoration Approaches:

- Enhance recreational experiences
- Reduce sea turtle bycatch in commercial and recreational fisheries through identification and implementation of conservation measures

Link: Understanding rates of turtle entrapment, entanglement, and bycatch at artificial reefs will help inform location and design criteria for new artificial reef projects, which will support enhancement of recreational fishing opportunities while preventing future injuries to sea turtles. Additionally, information regarding in-water abundance and distribution estimates identified in CR 1.1 will further support efforts to reduce both commercial and recreational sea turtle bycatch associated with these restoration approaches.

CR 1.4: Support assessment of recreational fishing's effects on sea turtles.

DWH PDARP Restoration Approaches:

- o Reduce sea turtle bycatch in recreational fisheries through identification and implementation of conservation measures
- o Enhance public access to natural resources for recreational use

Link: Understanding recreational fishing's effects on sea turtles will help identification and implementation of conservation measures as well as improve project design and decision making for projects with fishing enhancement components. Efforts to reduce recreational bycatch of sea turtles and to improve public access to recreational fishing will be improved by information regarding in-water abundance and sea turtle distribution identified in CR 1.1.

CR 1.5: As many of the potential restoration activities aim to restore lost recreational fishing opportunities, we encourage the Trustee states to apply for ESA Section 10(a)1(B) permits for state-authorized recreational fishing.

DWH PDARP Restoration Approach:

- o Provide and enhance recreational opportunities/Enhance public access to natural resources for recreational use

Link: Securing ESA Section 10(a)1(B) permits will provide ESA take coverage for fishing activities and implementation of required conservation plans will improve analyses of effects of projects with fishing enhancement components.

13.2 Gulf Sturgeon

Gulf sturgeon are among the species adversely affected by the DWH oil spill and likely to be adversely affected by the DWH PDARP, as summarized in this Opinion's Status of Species, Section 4 and Analysis of Effects, Section 6. Sampling of Gulf sturgeon following the spill found evidence of physiological injury, including exposure biomarkers for DNA damage and immunosuppression.

The DWH PDARP's restoration approaches for Gulf sturgeon include:

- Restore sturgeon spawning habitat
- Reduce nutrient loads to coastal watersheds

- Protect and conserve marine, coastal, estuarine, and riparian habitats

Improving access to, and quality of, spawning habitat, and reducing water quality and habitat degradation threats in marine, coastal, estuarine, and freshwater ecosystems will contribute to the restoration of Gulf sturgeon to baseline conditions by improving the status of populations throughout the species' range. The DWH PDARP also includes other restoration approaches that will affect Gulf sturgeon:

- Create, restore, and enhance barrier and coastal islands and headlands
- Create, restore, and enhance coastal wetlands
- Enhance public access to natural resources for recreational use
- Enhance recreational experiences
- Promote environmental stewardship, education, and outreach

Habitat restoration approaches have the potential to directly affect critical Gulf sturgeon forage resources. Conservation, protection and restoration of coastal and marine foraging habitats are necessary because adult sturgeon forage sparingly in freshwater and depend almost entirely on estuarine and marine prey for their growth. Habitat-related restoration approaches are expected to benefit Gulf sturgeon by improving basic ecosystem functions and food production. These and other restoration approaches also have the potential to cause adverse effects to Gulf sturgeon by converting, covering, or impeding access to Gulf sturgeon foraging habitats or migratory pathways.

Additionally, approaches associated with increasing recreational opportunities and reducing fisheries bycatch may also affect Gulf sturgeon. Commercial bycatch of Gulf sturgeon is thought to be minor, and recreational bycatch appears to be low; however it is believed that both may be under-reported.

The DWH PDARP identifies gaps in knowledge as contributing to recovery uncertainty, noting "To maximize project efficiency and success, the Trustees may incrementally address key information needs through monitoring and adaptive management." The DWH PDARP also states that “restoration will focus on approaches that are consistent with those identified in the federal Gulf Sturgeon Recovery Plan” and that their “approach is consistent with the Gulf sturgeon recovery plan to ensure that restoration aligns with existing conservation priorities.” The following conservation recommendations are informed directly by the Gulf sturgeon recovery plan, and are designed to help inform successful restoration planning and implementation and to monitor how DWH PDARP restoration activities may affect Gulf sturgeon. For each conservation recommendation, we provide an explanation of how it links to and supports DWH PDARP restoration goals and potential restoration approaches.

Gulf Sturgeon Conservation Recommendations

CR 2.1: Integrate consideration of Gulf sturgeon foraging habitat in design of barrier island, coastal headlands, and coastal wetland restoration projects.

DWH PDARP Restoration Approaches:

- Protect and conserve marine, coastal, estuarine, and riparian habitats
- Create, restore, and enhance barrier and coastal islands and headlands
- Create, restore, and enhance coastal wetlands

Link: Estuarine, coastal, and marine habitats are critical components of sturgeon life history. Optimizing creation and restoration of Gulf sturgeon foraging habitats through incorporating creation of shallow, sandy habitats and other features will provide direct benefits to Gulf sturgeon recovery. Additionally, avoidance and minimization of potential impacts to existing Gulf sturgeon forage resources will further support restoration of injured gulf sturgeon resources.

CR 2.2: Consider targeting Gulf sturgeon recovery in the Pearl and Pascagoula Rivers.

DWH PDARP Restoration Approaches:

- Restore sturgeon spawning habitat
- Reduce nutrient loads to coastal watersheds
- Protect and conserve marine, coastal, estuarine, and riparian habitats

Link: Restoring Gulf sturgeon populations in the western portion of its range will contribute to the recovery of the species throughout its range. Generally, Gulf sturgeon populations in the eastern part of the range (Suwannee, Apalachicola Choctawhatchee) appear to be larger in number and relatively stable or have a slightly increasing population trend when compared to the riverine populations in the western portion of the range (Pearl and Pascagoula Rivers).

CR 2.3: Enhance efforts to minimize recreational bycatch of Gulf sturgeon.

DWH PDARP Restoration Approaches:

- Enhance Public Access to Natural Resources for Recreational Use
- Enhance Recreational Experiences
- Promote Environmental Stewardship, Education, and Outreach

Link: Although current information suggests that injury or death of Gulf sturgeon through bycatch may not be a major threat, it is also believed that bycatch is underreported. Integrating consideration of Gulf sturgeon in planning projects to increase fisher awareness and improve post-release survivorship as well as reporting can provide benefits to Gulf sturgeon recovery and understanding of potential threats.

CR 2.4: Track adult, juvenile, and young-of-year (YOY) Gulf sturgeon seasonal movements in the estuarine and marine environments. Particular focus should be on movements made from the nearshore estuarine environment to the marine environment and back for adults and juveniles and within-estuary movements of YOY.

DWH PDARP Restoration Approaches:

- Create, restore, and enhance coastal wetlands
- Restore and preserve Mississippi-Atchafalaya River processes
- Restore oyster reef habitat
- Create, restore, and enhance barrier and coastal islands and headlands

Link: Understanding the spatiotemporal distribution and migration patterns of Gulf sturgeon will provide restoration planners with information to maximize benefits for, and minimize adverse effects on, Gulf sturgeon. One example from the DWH PDARP states "monitoring for Mississippi River diversions should include modeling and monitoring at a scale appropriate to evaluate… the distribution of estuarine fauna."

CR 2.5: Support maintenance of the Gulf sturgeon telemetry database.

DWH PDARP Restoration Approaches:

- Create, restore, and enhance coastal wetlands
- Restore and preserve Mississippi-Atchafalaya River processes
- Restore oyster reef habitat
- Create, restore, and enhance barrier and coastal islands and headlands

Link: Maintaining a comprehensive, long-term database of the spatiotemporal distribution and migration patterns of Gulf sturgeon will help reveal patterns in Gulf sturgeon habitat use. The telemetry database can also support estimates of mortality and population assessments necessary for tracking gulf sturgeon recovery. This information will support planning and implementation for activities that may affect Gulf sturgeon, as well as helping evaluate any changes in these patterns resulting from DWH PDARP restoration projects.

<u>CR 2.6</u>: Conduct estuarine and marine foraging habitat area mapping and characterization for adult, juvenile, and YOY Gulf sturgeon. Target areas should include restoration project areas located in Gulf sturgeon critical habitat and ideally broader range areas (outside of Gulf sturgeon critical habitat) as well, to establish context for project evaluation. Mapped information should include, but not be limited to sediment type, prey availability and community composition, and water quality parameters (i.e., depth, temperature, DO, and salinity).

<u>DWH PDARP Restoration Approaches:</u>

- Create, restore, and enhance coastal wetlands
- Restore and preserve Mississippi-Atchafalaya River processes
- Restore oyster reef habitat
- Create, restore, and enhance barrier and coastal islands and headlands

<u>Link:</u> Understanding foraging habitat locations, conditions and characteristics preferred by Gulf sturgeon will be essential for planning restoration activities that could cause adverse effects to Gulf sturgeon by converting, covering, or impeding access to their potential foraging habitat. A strong understanding of habitat conditions will be necessary for restoration planners to ensure that project designs maximize benefits for, and minimize adverse effects on, Gulf sturgeon.

<u>CR 2.7</u>: Develop and deploy water quality monitoring stations that would complement existing sonic tagging arrays.

<u>DWH PDARP Restoration Approaches:</u>

- Reduce pollution and hydrologic degradation to coastal watersheds
- Create, restore, and enhance coastal wetlands
- Restore and preserve Mississippi-Atchafalaya River processes

<u>Link:</u> Improved monitoring of water quality in nearshore habitats will help in determining the effectiveness of water quality improvement measures in achieving the DWH PDARP goal to "Reduce nutrient loadings to Gulf Coast estuaries, habitats, and resources that are threatened by chronic eutrophication, hypoxia, or harmful algal blooms or that suffer habitat losses associated with water quality degradation." Improved water quality monitoring would also help in determining the far-field effects of large scale marsh restoration projects and river diversions.

13.3 Smalltooth Sawfish

There are several proposed restoration approaches that have the potential to affect (both positively and negatively) smalltooth sawfish and their designated critical habitat. The following conservation recommendations are informed directly by the smalltooth sawfish recovery plan. For each conservation recommendation, we provide an explanation of how it links to and supports DWH PDARP restoration goals and potential restoration approaches.

Smalltooth Sawfish Conservation Recommendations

CR 3.1: Enhance efforts to minimize recreational bycatch of smalltooth sawfish.

DWH PDARP Restoration Approaches:

- Voluntary Fisheries-related Actions to Increase Fish Biomass
- Enhance Public Access to Natural Resources for Recreational Use
- Enhance Recreational Experiences
- Promote Environmental Stewardship, Education, and Outreach

Link: Bycatch mortality is the primary cause for the decline in smalltooth sawfish in the United States. Bycatch in commercial fisheries appears to have been reduced substantially in the last 20 years; however, bycatch in recreational fisheries remains a significant threat. Increasing fisher awareness and improving post-release survivorship and catch reporting can reduce the primary threat to smalltooth sawfish recovery and also promote DWH PDARP goals for improving fish biomass.

CR 3.2: Conduct additional sampling and tracking of sawfish (especially adults) in the PDARP's action area to:

- Identify aggregation areas/mating grounds
- Identify pupping habitats
- Monitor the general population status/trends
- Analyze trends in annual relative abundance for juvenile sawfish

DWH PDARP Restoration Approaches:

- Enhance development of bycatch reducing technologies
- Create, restore, and enhance coastal wetlands
- Restore oyster reef habitat
- Create, restore, and enhance barrier and coastal islands and headlands

Link: Understanding the spatiotemporal distribution, migration patterns and key habitat areas of smalltooth sawfish will support the planning of these restoration approaches. Restoration planners should use these types of species specific ecological data to ensure that project designs maximize benefits for, and minimize adverse effects on, smalltooth sawfish.

CR 3.3: Conduct habitat mapping and characterization, including:

- Assessments of current red mangrove coverage and shallow, euryhaline waters to discern gains or losses since the time of critical habitat designation
- Development and deployment of water quality monitoring stations that would complement existing sonic tagging arrays or characterize crucial habitats for adults
- Development of a functional assessment to identify the most important habitats located within designated critical habitat

  DWH PDARP Restoration Approaches:

  - Reduce pollution and hydrologic degradation to coastal watersheds
  - Create, restore, and enhance coastal wetlands
  - Restore oyster reef habitat

  Link: Understanding habitat conditions and characteristics preferred by smalltooth sawfish will support the planning of restoration approaches that have the potential to convert, cover, or impede access to smalltooth sawfish habitats. A strong understanding of habitat conditions is necessary for restoration planners to ensure that project designs maximize benefits for, and minimize adverse effects on, smalltooth sawfish. Monitoring of water quality at array sites or known high density areas in nearshore habitats will help in determining the range of physiochemical variables that affect sawfish distribution and habitat use. Restoration planners can then use these data as guidance criteria when restoring habitats within the range of smalltooth sawfish. Further, improved water quality monitoring within estuarine waters will aid in identifying the effectiveness of water quality improvement measures in achieving the DWH PDARP goal to "Reduce nutrient loadings to Gulf Coast estuaries, habitats, and resources that are threatened by chronic eutrophication, hypoxia, or harmful algal blooms or that suffer habitat losses associated with water quality degradation."

13.4 Sperm Whales

Sperm whales are among the marine mammals injured by the DWH oil spill and also potentially adversely affected by the DWH PDARP, as summarized in this Opinion's status of species Section 4 and Effects of the Action, Section 6. The DWH oil spill affected sperm whales through direct mortality, reproductive failure, and a range of adverse health effects. The DWH PDARP's marine mammal restoration type provides a range of restoration approaches and techniques to identify and implement restoration activities that mitigate key stressors, support resilient populations, and address direct human-caused threats. Examples of DWH PDARP restoration approaches that are potentially applicable to sperm whales include:

- Reduce commercial fishery bycatch through collaborative partnerships;
- Increase marine mammal survival through better understanding of causes of illness and death and early detection and intervention of anthropogenic and natural threats;
- Measurement of noise to improve knowledge and reduce impacts of anthropogenic noise on marine mammals;
- Reduce injury and mortality of marine mammals from vessel collisions and industrial activities.

The DWH PDARP identifies gaps in knowledge as contributing to sperm whale recovery uncertainty, noting "The ability of the stocks to recover, and the length of time required for that recovery, are tied to the carrying capacity of the habitat, and to the degree of other population pressures. The fact that not enough is known about the pressures or stressors such as human impacts and natural events that may adversely affect these animals makes understanding the time frame required for stocks to recover even more challenging." According to the sperm whale recovery plan (NMFS 2010b) there are vital gaps in understanding of sperm whale biology which hinders planning and implementation of optimal recovery actions. The following conservation recommendations are informed directly by the sperm whale recovery plan. For each conservation recommendation, we provide an explanation of how it links to and supports DWH PDARP restoration goals and potential restoration approaches.

Sperm Whale Conservation Recommendations

CR 4.1: Support assessment of the distribution, density, abundance, movements and habitat use of sperm whales, particularly in the Mississippi Canyon and De Soto Canyon areas during winter and summer months. Aerial surveys, ship based surveys and year round deployment of passive acoustic buoys at sites along the shelf break and in important sperm whale habitats are established monitoring methods that can be used for these assessments and would support restoration decision making and effectiveness monitoring.

PDARP Restoration Approaches:

- Increase marine mammal survival through better understanding of causes of illness and death and early detection and intervention of anthropogenic and natural threats
- Measurement of noise to improve knowledge and reduce impacts of anthropogenic noise on marine mammals
- Reduce injury and mortality of marine mammals from vessel collisions

Link: Information regarding the spatial characteristics of sperm whale populations is pivotal to identifying habitat use, exposure to anthropogenic threats (*e.g.* shipping, oil and gas operations, military exercises*)*, and identifying restoration opportunities that address stressors.

CR 4.2: Collect information that improves understanding of diurnal and/or seasonal feeding pattern and ranges by sperm whales, and how prey distribution may influence whale distribution. Methodology would include additional tagging to understand dive profiles along with conducting fish sampling studies of deep benthic environment (e.g., > 1000m).

DWH PDARP Restoration Approaches:

- Increase marine mammal survival through better understanding of causes of illness and death and early detection and intervention of anthropogenic and natural threats
- Measurement of noise to improve knowledge and reduce impacts of anthropogenic noise on marine mammals
- Reduce injury and mortality of marine mammals from vessel collisions

Link: Understanding sperm whale foraging patterns and the benthic and acoustic environments in primary foraging ground, will improve the effectiveness of restoration and conservation measures in foraging areas.

CR 4.3: Collect and analyze data to better understand population demography including age and sex structure, reproductive rates, birth rates, and health status. These data will create more reliable population models that would support restoration decision making and effectiveness monitoring.

DWH PDARP Restoration Approaches:

- Increase marine mammal survival through better understanding of causes of illness and death and early detection and intervention of anthropogenic and natural threats
- Measurement of noise to improve knowledge and reduce impacts of anthropogenic noise on marine mammals

- Reduce injury and mortality of marine mammals from vessel collisions

Link: Accurate and precise models of spatial distribution, habitat use, and sperm whale abundance will provide information to assist the Trustees in determining whether the status of sperm whales is improving and also in ensuring project designs will maximize benefits and minimize any adverse effects associated with restoration implementation.

CR 4.4: Support the development of spatial planning tools for sperm whales that inform and facilitate decision-making and reduce cumulative impacts to sperm whales.

DWH PDARP Restoration Approach:

- Increase marine mammal survival through better understanding of causes of illness and death and early detection and intervention of anthropogenic and natural threats
- Measurement of noise to improve knowledge and reduce impacts of anthropogenic noise on marine mammals
- Reduce injury and mortality of marine mammals from vessel collisions

Link: Information from empirical modeling and spatial planning tools can be used for environmental assessments, operational planning, permitting by Federal agencies, and can improve detection of sperm whale co-occurrence with anthropogenic threats.

CR 4.5: Support collection of survey data including southern portions of the Gulf of Mexico to improve understanding of distribution, density, movements and population structure of sperm whales throughout the entire Gulf of Mexico.

DWH PDARP Restoration Approaches:

- Reduce commercial fishery bycatch through collaborative partnerships
- Increase marine mammal survival through better understanding of causes of illness and death and early detection and intervention of anthropogenic and natural threats
- Measurement of noise to improve knowledge and reduce impacts of anthropogenic noise on marine mammals
- Reduce injury and mortality of marine mammals from vessel collisions

Link: A gulf-wide understanding of sperm whale spatial distribution, habitat use, and abundance will help support determining whether the status of sperm whales is improving and will provide information to ensure project designs maximize benefits and reduce and eliminate adverse effects.

13.5 Restoration Planning, Monitoring, and Adaptive Management Processes

The PDARP identified numerous activities and initiatives that the Trustees may use to support planning, monitoring and adaptive management, as well as further scientific understanding of the effects, results, and outcomes of various restoration initiatives in the Gulf of Mexico. The following conservation recommendations are included to highlight important opportunities to enhance DWH PDARP implementation in a manner that significantly advances restoration efforts that affect listed resources in the Gulf of Mexico. Additionally, we suggest coordination with other restoration partners to ensure effectiveness and efficiency of management decision-making processes, and ensure accessibility to, and utility of data for the scientific community to provide the best available science.

Conservation Recommendations for Restoration Planning, Monitoring, and Adaptive Management Processes

CR 5.1: The Trustee Council should initiate strategic frameworks early in DWH PDARP implementation. Strategic frameworks, as described in the DWH PDARP, could demonstrate how to optimize progress toward both the DWH PDARP goals and recovery of the listed species impacted by the DWH PDARP. They would provide context for Gulf-wide prioritization, sequencing, and selection of specific projects within project-specific restoration plans. Strategic frameworks would help the Trustees consider resources at the ecosystem level, while implementing restoration at the local level. Consider expanding and coordinating strategic frameworks to include other Gulf programs, like RESTORE for planning, monitoring, and adaptive management. This would enhance the overall effectiveness and efficiency of Gulf restoration.

CR 5.2: The Trustee Council should re-examine the Restoration Program approximately every 5 years to track its status towards meeting the established restoration goals, including the Monitoring, Adaptive Management, and Administrative Oversight goal, and to determine any updates needed based on newly emerged science and/or restoration procedures as well as Trustees' experience managing and implementing this restoration program.

CR 5.3: The Trustee Council should consider the restoration actions of other programs (e.g., RESTORE, NFWF) and facilitate the TIGs in identifying synergies, leveraging opportunities for collaboration reducing potential redundancy when selecting projects under this PDARP/PEIS, and evaluating cumulative effects.

CR 5.4: Data should be shared in a timely manner among Gulf restoration programs. Additionally, the Trustee Council should make information for projects selected under this PDARP/PEIS available to the public, as well as to the scientific community and other restoration programs.

CR 5.5: The Trustee Council should incorporate climate change into restoration plans and project designs. This is particularly important to ensure that the anticipated benefits of projects endure through changing climate conditions. Also as NMFS' recent memorandum on climate change notes, construction designs that do not anticipate future climate conditions may fail, with adverse effects on listed species (NMFS 2016).

CR 5.6: To respond effectively to climate change, the adaptive management approach implemented by the Trustee Council should include: (1) adequate monitoring of climate and biological variables to identify actions whose adverse effects may be exacerbated by climate change; and (2) protective measures that can be implemented by the Trustee Council to ensure climate change does not result in adverse effects from the proposed action beyond those analyzed in this Opinion (NMFS 2016).

CR 5.7: Develop consistent and comparable minimum monitoring standards, including monitoring parameters, methods, metadata, and data management standards in coordination with other restoration and science programs.

CR 5.8: Coordinate the development of monitoring and data management plans, data acquisition activities, and reporting for the DWH PDARP with all internal and external partners (e.g., RESTORE Council, RESTORE Science Program, National Academies of Sciences Gulf Program, NFWF GEBF).

CR 5.9: When performing data analyses, synthesis, and evaluation that could guide restoration decision-making, analyze aggregated monitoring information provided by the Trustees, in combination with available information from other ongoing scientific and restoration efforts in the Gulf of Mexico.

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14. Reinitiation of Consutation

This concludes formal consultation for the ESA Section 7 Programmatic Consultation on the Preferred Alternative within the *Deepwater Horizon* Oil Spill Programmatic Damage Assessment and Restoration Plan and Programmatic Environmental Impact Statement.

As 50 CFR 402.16 states, 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 incidental taking specified in the incidental take statement is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion, (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this Opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

In the context of this Opinion, there is no incidental take anticipated or authorized and the reinitiation trigger set out the first scenario listed above is not applicable.

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Appendix A

Avoidance of Effects of Select Restoration Activities Eligible for Streamlined Project-Level Consultation through Implementation of Specified Project Design Criteria

1. Background

As described in the Section 2 of the Biological Opinion (“Opinion”), the DWH PDARP is a comprehensive, integrated, ecosystem restoration portfolio which distributes restoration across a range of different restoration types and locations. The DWH PDARP does not include specific projects at specific sites; rather, it is a framework for a comprehensive programmatic restoration plan that will guide the development of subsequent restoration plans and project-level actions.

Section 8 of the Opinion describes how Endangered Species Act (ESA) consultations for future project-level actions that tier from the DWH PDARP will be accomplished. Those future consultations will be either informal, because NMFS determines that the action is not likely to adversely affect listed resources, or formal because adverse effects cannot be avoided. Sections 8.2 and 8.3 of the Opinion also describe an option for streamlined informal consultation that requires the use of project design criteria (PDCs) for specific restoration activities.

This appendix evaluates potential effects of several well-established restoration activities. These activities have been repeatedly and widely implemented throughout the Gulf of Mexico, and have been repeatedly analyzed in previous ESA consultations with NMFS. When PDCs which are described below are implemented fully, these restoration activities result in projects that are not likely to adversely affect listed species or associated designated critical habitat for ESA-listed resources under NMFS’s jurisdiction. Additionally, this analysis assumes that action agencies will implement the best practices[20] described in Appendix 6.A. of the DWH PDARP, which help to reduce adverse effects to listed species.

The PDCs evaluated in this Appendix represent the current best available science. As the Trustees implement the program and learn through monitoring and evaluation, program-wide best practices may be adjusted, improved, and added to what is in the present DWH PDARP. Likewise, NMFS may update and improve this set of PDCs through a similar process in the future.

[20] As defined in Chapter 6 and Appendix 6A in the PDARP, best practices generally include design criteria, best management practices, lessons learned, expert advice, tips from the field, and more. Trustees will use appropriate best practices to avoid or minimize impacts to natural resources, including protected and listed species and their habitats.

PDCs were developed for 5 specific restoration activities that can be readily categorized and evaluated by NMFS to determine effects to ESA-listed resources:

- Marsh creation and enhancement
- Construction of living shorelines
- Removal of derelict fishing gear and other marine debris
- Oyster reef creation and enhancement
- Construction of non-fishing piers

Trustees with projects that fall within one of these activity types and meet the PDCs evaluated in this consultation will submit a BE Form with completed PDC checklist[21] (Appendix B) and any relevant maps and drawings to NMFS via email at nmfs.ser.esa.consultations@noaa.gov. If sufficient information is provided, NMFS will make a final determination as to whether the proposed action falls within the appropriate category of activities covered by the relevant set of PDCs, and whether all of those PDCs are fully incorporated into the project design. If these 2 requirements are met, then NMFS will respond via return email within 60 days confirming that (a) the project is consistent with the PDCs and this framework programmatic Opinion, (b) it is not likely to adversely affect ESA-listed species or their critical habitat, and (c) consultation is concluded.

Trustees are encouraged to request technical assistance from PRD prior to initiating consultation. This will help make the consultation more efficient and insure that potential adverse effects are addressed.

Section 4.1 of the Opinion identified several ESA-listed and proposed species that are not likely to be adversely affected (NLAA) by the DWH PDARP and provided an analysis supporting the NLAA determinations. For those species, we determined that all of the effects of the DWH PDARP are expected to be either discountable, insignificant, or completely beneficial. Those species are not re-evaluated or re-considered in this appendix, and will not be further analyzed in this appendix or in consultations carried out using the process described in this appendix.

[21] Endangered Species Act Biological Evaluation Form, Deepwater Horizon Oil Spill Restoration, Fish and Wildlife Service & National Marine Fisheries Service, January 2016 or most recent version available from NMFS

2. Effects of the Action

In the following sections, we assess the direct and indirect effects of implementing a defined suite of restoration activities on ESA-listed species and designated critical habitat managed by NMFS. We assess potential effects to the following ESA-listed species and associated designated critical habitat:

- Sperm whales
- 5 species of sea turtles (green, hawksbill, Kemp's ridley, leatherback, and the Northwest Atlantic Ocean distinct population segment of loggerhead)
- Gulf sturgeon
- U.S. distinct population segment (DPS) of smalltooth sawfish
- Gulf sturgeon critical habitat Units 8-14 (Units 1-7 riverine units are under the purview of USFWS)
- Loggerhead critical habitat units, LOGG-N-31 through LOGG-N-36 and LOGG-S-02
- Smalltooth sawfish U.S. DPS, Charlotte Harbor Estuary and Thousand Islands/Everglades critical habitat units

Each restoration activity eligible for streamlined ESA consultation is subject to one of the following sets of non-discretionary PDCs that avoid adverse effects to listed species and critical habitat.

3. PDCs for Marsh Creation and Enhancement

The following PDCs must be met for marsh creation and enhancement activities to qualify for streamlined consultation. The PDCs avoid adverse effects to ESA-listed threatened and endangered species and their designated critical habitats under NOAA Fisheries' jurisdiction. These PDCs apply to activities that occur in or impact marine and estuarine waters.[22] Additional criteria may be required under other statutes (e.g., the Marine Mammal Protection Act, Clean Water Act, and Magnuson Stevens Fishery and Conservation Management Act) and by the U.S. Fish and Wildlife Service for ESA-listed species under their jurisdiction.

Marsh creation/enhancement often involves dredging and disposal of dredged material. These dredged materials are frequently contained by earthen containment dikes or other sediment containment structures. Dredged material is placed within the containment structures to an elevation conducive to the establishment of emergent marsh. Supplemental planting of native marsh vegetation is often utilized to accelerate the establishment of ecological functions provided by marsh habitats.

Marsh creation or enhancement through hydrologic restoration or freshwater or sediment diversions are not evaluated in this analysis and not covered by this PDC.

1. Activities that must be avoided:
   a. Marshes shall not be created or enhanced in smalltooth sawfish critical habitat.
   b. Marshes shall not be created or enhanced in Gulf sturgeon critical habitat.
   c. Marshes shall not be created or enhanced on live bottom.[23]
   d. Mangroves shall not be trimmed or removed.
   e. Material used for construction shall not contain trash, debris, or toxic pollutants.
   f. Completed projects shall not impede ingress, egress, or migration of ESA-listed species between shoreline and open water and between marine habitat and freshwater spawning and rearing habitats.

2. General Conditions:
   a. Follow NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*.[24]

[22] NOAA Fisheries and the U.S Fish and Wildlife Service share jurisdiction for Gulf Sturgeon and listed sea turtles. 1977 Memorandum of Understanding regarding the Roles of the U.S. Fish and Wildlife Service and the National Marine Fisheries Service in Joint Administration of the Endangered Species Act of 1973 as to Marine Turtles.

[23] Live bottom means low to moderate relief naturally occurring hard or rocky formations with rough, broken, or smooth topography that contain biological assemblages consisting of sessile invertebrates living upon and attached to the hard substrate and may favor the accumulation of turtles, fishes, or other fauna. Definition modified from DOI MMS's *Notice to Lessees and Operators of Federal Oil, Gas, and Sulphur Leases and Pipeline Right-Of-Way Holders Outer Continental Shelf, Gulf of Mexico OCS Region*, dated January 27, 2010 http://www.boem.gov/Regulations/Notices-To-Lessees/2009/09-G39.aspx

[24] NMFS. Sea Turtle and Smalltooth Sawfish Construction Conditions. 2006. Available: sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/documents/sea_turtle_and_smalltooth_sawfish_construction_conditions_3-23-06.pdf

b. Follow NMFS's *Vessel Strike Avoidance Measures and Reporting for Mariners*.[25]

c. Conduct all in-water work activities during daylight hours.

d. Develop and implement a spill prevention and response plan, including cleaning and sealing all equipment that would be used in the water to rid it of chemical residue and conducting daily inspections of all construction and related equipment to ensure there are no leaks of fuel, antifreeze, hydraulic fluid, or other harmful substances. If a spill occurs, report response and outcome in Monitoring Report No. 3, below.

e. For projects that include sediment placement and/or dredging, fill material shall not be sourced using hopper dredge techniques (including relocation trolling) and shall not be sourced from Gulf sturgeon- or smalltooth sawfish designated critical habitat[26, 27] or from nearshore reproductive habitat areas of critical habitat for loggerhead sea turtles.[28]

    i. In-water sediment borrow sites shall not, either directly or indirectly, impact turtle nesting beaches.

f. Design or materials used shall not create an entanglement or entrapment risk to protected species or block migration.

    i. Follow *Measures for Reducing Entrapment Risk to Protected Species*.[29]

    ii. Any turbidity curtains or other such equipment/materials shall be installed in a manner that avoids entanglement or entrapment of protected species.

    iii. For projects that include installation of marker buoys or other floating objects tethered to the sea floor, all in-water lines shall be made of materials and in a manner to minimize the risk of entanglement by using thick, heavy, and taut lines that do not loop or entangle.

g. In-water construction activities shall not impede sea turtle access to or from sea turtle nesting sites, and no artificial lighting shall be visible at night in these areas during nesting season.

Location	**Species**	**Nesting Season**
Mississippi, Louisiana, Alabama, and Northern Florida (Escambia to	Loggerhead sea turtles	May 1 – October 31
	Green sea turtles	May 15 – October 31
	Leatherback sea turtles	May 1 – September 30

[25] NMFS. Vessel Strike Avoidance Measures and Reporting for Mariners. 2008. Available: sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/documents/copy_of_vessel_strike_avoidance_february_2008.pdf

[26] Federal Register Vol. 68, No. 53. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Gulf Sturgeon. 2003. Available: http://www.nmfs.noaa.gov/pr/pdfs/fr/fr68-13370.pdf

[27] Federal Register Vol. 74, No. 169. Endangered and Threatened Species; Critical Habitat for the Endangered Distinct Population Segment of Smalltooth Sawfish. 2009. Available: http://www.nmfs.noaa.gov/pr/pdfs/fr/fr74-45353.pdf

[28] Federal Register Vol. 79 (39855 -39912). Endangered and Threatened Wildlife and Plants; Designation of critical habitat; North Atlantic Ocean loggerhead sea turtle DPS, Final Rule. Available: http://www.nmfs.noaa.gov/pr/species/turtles/criticalhabitat_loggerhead.htm

[29] NMFS. Measures for Reducing Entrapment Risk to Protected Species. 2012. Available: sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/documents/entrapment_bmps_final.pdf

Location	Species	Nesting Season
Pasco Counties)		
Southern Florida (Pinellas to Monroe Counties)	Loggerhead sea turtles	April 24 – October 31
	Green sea turtles	May 15 – October 31
	Hawksbill sea turtles (Monroe County only)	June 1 – December 31
Texas	Kemp's ridley sea turtles	May 1 – September 30

h. To avoid turbidity impacts to ESA-listed species:
   i. Heavy equipment working in wetlands or mudflats shall be placed on mats, or other measures shall be taken to minimize soil disturbance.
   ii. Appropriate soil erosion and sediment controls shall be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, shall be permanently stabilized at the earliest practicable date.
   iii. Use floating turbidity curtains around all in-water construction areas, as appropriate.

3. Monitoring:
   a. Monitoring reports shall include:
      i. Project construction monitoring from PDC No. 2, above
      ii. As-built project completion drawings and photos
      iii. Any interactions with protected species listed in PDC No. 4, below
   b. Final reports from project monitoring shall be submitted with the report in PDC No. 4, below.

4. Reporting:
   a. Report all interactions with, or sightings of stranded, entangled, dead or injured sea turtles, Gulf sturgeon, sawfish, or marine mammals, immediately to:
      i. Sea turtles and marine mammals:
         Telephone: 1-877-WHALE HELP (1-877-942-5343)
      ii. Gulf sturgeon - NMFS's Protected Resources Division:
         Telephone: 1-844-788-7491 (1-844-STURG 911)
         Email: nmfs.ser.sturgeonnetwork@noaa.gov
         When possible provide:
         1) the location where the fish was found or caught
         2) the condition of the fish
         3) the presence of any research tags

4) the length of the fish
5) a photograph

iii. Smalltooth sawfish - Fish and Wildlife Research Institute:

Telephone: 1-941-255-7403
Email: Sawfish@MyFWC.com

b. Final reports from project monitoring shall be submitted to:

NOAA Fisheries Service – Protected Resources Division
DWH Restoration Program Monitoring Reports
263 13th Avenue South
Saint Petersburg, Florida 33701

3.1 Effects Analysis for Marsh Creation and Enhancement

Sections 6.1 of the Opinion (General In-Water Construction Activities) and 6.3 of the Opinion (Dredging, Including Placement of Dredged Material) provide detailed descriptions of the potential effects to listed species and critical habitats from marsh creation and enhancement projects related to general construction activities, dredging, and placement of dredged materials in the areas to be restored. The PDCs developed for marsh creation and enhancement include measures to ensure that these potential adverse effects are avoided. A summary of the potential adverse effects and an analysis showing how the PDCs ensure avoidance of those effects follows:

- Marsh creation and enhancement frequently involves the use of heavy construction equipment, barges, and support vessels that can cause temporary, localized adverse impacts from vessel strikes, sediment disturbance, increased turbidity, and noise. These effects can result in physical injury to listed species (e.g., vessel strikes), and/or cause them to avoid the construction area, which could disrupt foraging, sheltering, and other essential activities.

  PDC 2.a. requires action agencies to adhere to NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*. These criteria require that all vessels associated with construction projects operate at "no wake/idle" speeds at all times while in the construction area or other shallow water areas, and that operation of any mechanical construction equipment shall cease immediately if a sea turtle is seen within a 50-foot (ft) radius of the equipment. Due to the species' mobility and natural avoidance behaviors, and the action agency's compliance with NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*, the risk of injury directly related to construction activities is discountable.

  PDC 2.b. requires action agencies to adhere to NMFS's *Vessel Strike Avoidance Measures and Reporting for Mariners*. These criteria require that all vessel operators and crews maintain a vigilant watch for marine mammals and sea turtles and maintain appropriate speeds and distances from protected species to avoid striking or otherwise harming these species. Marsh creation activities generally occur in shallow-water areas far from the deepwater habitats occupied by sperm whales. However, if vessels involved in marsh creation do operate in these deepwater areas, adherence to NMFS's *Vessel Strike Avoidance Measures and Reporting for Mariners* will prevent striking or otherwise harming sperm whales. Due to the species' mobility and natural avoidance behaviors, and the action agency's compliance with these measures, the risk of adverse effects directly related to vessel interactions is discountable.

  PDC 2.h. includes several measures to avoid turbidity impacts to water quality. Listed species may be temporarily unable to use the sites for foraging or shelter habitat due to avoidance of construction activities and related noise. However, NMFS has consulted on numerous marsh creation and enhancement projects, which generally have relatively small footprints and short construction durations. In addition, the areas adjacent to these types of projects generally provide similar foraging and sheltering habitat. Therefore, NMFS expects any effects resulting from temporary avoidance of the area due to construction activities to be insignificant.

- Fuel or chemical leaks from heavy equipment could enter the aquatic environment and impact listed species and their critical habitats.

  PDC 2.d. requires action agencies to develop and implement a spill prevention and response plan, including cleaning and sealing all equipment (used in the water to rid it of chemical residue) and conducting daily inspections of all construction and related equipment to ensure there are no leaks of fuel, antifreeze, hydraulic fluid, or other harmful substances. When these measures are implemented fully, the possibility of adverse effects' resulting from fuel or chemical leaks and spills is discountable.

- Deployment of turbidity curtains or other devices that enclose areas of aquatic habitat have the potential to entrap listed species within the enclosed areas. Construction of berms or low-level earthen dikes around areas to be restored can also result in entrapment of listed species inside the diked area.

  PDC 2.f.i. requires that action agencies follow NMFS's *Measures for Reducing Entrapment Risk to Protected Species*. When these measures are implemented fully, the possibility of listed species' becoming entrapped within enclosed areas is discountable.

- Marsh creation may involve temporary deployment of turbidity curtains or other materials that have the potential to result in entanglement of listed species within those materials. Deployment of marker buoys related to construction activities can also pose a risk of entanglement in the anchor lines.

  PDC 2.f. ii. requires that any turbidity curtains or other such equipment/materials will be installed in a manner that avoids entanglement or entrapment of protected species.

  PDC 2.f. iii. requires projects that include installation of marker buoys or other floating objects tethered to the sea floor ensure that all in-water lines be made of materials and in a manner to minimize the risk of entanglement by using thick, heavy, and taut lines that do not loop or entangle. When these measures are implemented fully, the possibility of listed species' becoming entangled in construction related materials/equipment is discountable.

- Artificial lighting in construction zones could disorient sea turtles as they approach and/or depart from nesting beaches.

    Effects from artificial lighting during nesting season will be avoided by PDC 2.c., which requires action agencies to conduct all in-water work activities during daylight hours as well as PDC 2.g., which ensures that no artificial lighting shall be visible at night in sea turtle nesting areas during nesting season.

- Dredging removes the top layer of material from an area, including vegetation, sediment, topographic features, and any sessile or slow moving benthic organisms. Removal of these elements, particularly repeated dredging of the same area, can result in a reduction in the number of benthic species (both species diversity and species abundance) and a reduction of primary productivity (Lewis et al. 2001). Dredging can also contribute to the formation of localized anoxic or hypoxic conditions depending on the depth and location of the borrow sites. Dredged borrow areas have the potential to increase or alter wave climates by altering the direction and magnitude of waves.

    Best practices described in the DWH PDARP include measures to only use suitable areas as borrow sites (i.e., those that do not contain *Sargassum*, SAV, or oysters) and to obtain sediments by beneficially using dredged material from navigation channels or by accessing material from approved offshore borrow areas. Implementation of these best practices along with adherence to PDC 2.e., which prohibits borrow material from being sourced from Gulf sturgeon or smalltooth sawfish critical habitat or from nearshore reproductive habitat areas of critical habitat for loggerhead sea turtles, is expected to ensure that dredging effects on listed species and critical habitat will be insignificant.

- Hopper dredging and associated relocation trawling can capture, entrain, and kill sea turtles and Gulf sturgeon.

    Effects from hopper dredging will be avoided by PDC 2.e., which prohibits use of hopper dredging (and associated relocation trawling) to source material for use in marsh creation and enhancement projects.

- Adverse impacts to benthic habitats from placement of dredged sediments may occur from temporary storage of dredged sediments in nearshore habitats, and final placement of sediment in the footprint of marsh creation areas where existing habitats would be permanently covered by the sediment.

PDCs 1.a. and 1.b. prevent these potential adverse effects from occurring in designated critical habitat for smalltooth sawfish and Gulf sturgeon. Marsh creation/enhancement areas outside of these critical habitat designations may be permanently converted. However, NMFS has consulted on numerous marsh creation and enhancement projects, which generally have relatively small footprints and occur in shallow waters that do not provide ideal foraging/sheltering habitat for listed species. In addition, the areas adjacent to these types of projects generally provide similar foraging and sheltering habitat. Therefore, NMFS expects any impacts resulting from conversion of aquatic habitat into marsh habitat to be insignificant.

- The placement of fill for marsh creation could impede movement of listed species between shoreline and open water, and between marine habitat and freshwater spawning and rearing habitats.

PDC 1.f. requires that completed projects do not impede movement of listed species between shoreline and open water, and between marine habitat and freshwater spawning and rearing habitats. Therefore, any potential effects on the movement of listed species from marsh creation and enhancement projects will be insignificant.

4. PDCs for Construction of Living Shorelines

The following PDCs must be met for activities to qualify for streamlined consultation. The PDCs avoid adverse effects to ESA-listed threatened and endangered species and their designated critical habitats under NOAA Fisheries' jurisdiction. These PDCs apply to activities that occur in or impact marine and estuarine waters.[30] Additional criteria may be required under other statutes (e.g., the Marine Mammal Protection Act, Clean Water Act, and Magnuson Stevens Fishery and Conservation Management Act) and by the U.S. Fish and Wildlife Service for ESA-listed species under their jurisdiction.

The PDCs below apply to constructing living shorelines. These PDCs do not cover construction of breakwaters, shoreline armoring projects, seawalls, or other hardened features intended for the primary purpose of infrastructure protection. Living shoreline projects involve a variety of shoreline stabilization and habitat restoration techniques that span several habitat zones and utilize a variety of structural and organic materials. Living shorelines include features such as the incorporation of oyster shell to protect shorelines and prevent erosion. The primary features of a living shoreline are that it does not introduce a fixed interruption of a natural water/land continuum, and that it is designed to protect or restore natural shoreline ecosystem services. Projects using these techniques may also include the creation/enhancement of tidal marsh and/or oyster reefs. Such projects must also incorporate the PDCs specified for those techniques.

1. Activities that must be avoided:
    a. Projects shall not result in removal of red mangroves or filling of shallow euryhaline habitats[31] within smalltooth sawfish critical habitat.[32]
    b. Living shorelines shall not be constructed in nearshore reproductive habitat of loggerhead sea turtle designated critical habitat.[33]
    c. Within Gulf sturgeon critical habitat,[34] living shorelines shall not be constructed in areas deeper than -6 ft (2 meters [m]) at mean high water line (MHWL).
    d. Projects shall not be built on live bottom,[35] seagrass, or coral habitats.

[30] NOAA Fisheries and the U.S Fish and Wildlife Service share jurisdiction for Gulf Sturgeon and listed sea turtles. 1977 Memorandum of Understanding regarding the Roles of the U.S. Fish and Wildlife Service and the National Marine Fisheries Service in Joint Administration of the Endangered Species Act of 1973 as to Marine Turtles.
[31] Shallow euryhaline habitats are characterized by water depths between the Mean High Water line and 3 ft. measured at Mean Lower Low Water (MLLW). See Critical Habitat for the Endangered Distinct Population Segment of Smalltooth Sawfish available at: http://www.nmfs.noaa.gov/pr/pdfs/fr/fr74-45353.pdf
[32] Federal Register Vol. 74, No. 169. Endangered and Threatened Species; Critical Habitat for the Endangered Distinct Population Segment of Smalltooth Sawfish. 2009. Available: http://www.nmfs.noaa.gov/pr/pdfs/fr/fr74-45353.pdf
[33] Federal Register Vol. 79 (39855 -39912). Endangered and Threatened Wildlife and Plants; Designation of critical habitat; North Atlantic Ocean loggerhead sea turtle DPS, Final Rule. Available: http://www.nmfs.noaa.gov/pr/species/turtles/criticalhabitat_loggerhead.htm
[34] Federal Register Vol. 68, No. 53. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Gulf Sturgeon. 2003. Available: http://www.nmfs.noaa.gov/pr/pdfs/fr/fr68-13370.pdf
[35] Live bottom means low to moderate relief naturally occurring hard or rocky formations with rough, broken, or smooth topography that contain biological assemblages consisting of sessile invertebrates living upon and attached to the hard substrate and may favor the accumulation of turtles, fishes, or other fauna. Definition modified from

e. Mangroves shall not be trimmed or removed.

f. Material used for construction shall not contain trash, debris, and/or toxic pollutants.

g. Completed projects shall not impede movement of species protected under the ESA between shoreline and open water (e.g., adult sea turtle movement to and from nesting beaches or hatchlings going to the ocean) and between marine habitat and freshwater spawning and rearing habitats (e.g., Gulf sturgeon's moving between estuarine and riverine habitats).

h. Projects shall not include pile driving, unless piles are required for navigation or public safety (see 2.b.).

2. General conditions:

a. Follow NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*.[36]

b. Conduct all in-water work activities during daylight hours.

c. Piles required for navigation or public safety shall be less than 24 inches in diameter and non-metal if driven by impact hammer.

d. Develop and implement a spill prevention and response plan, including cleaning and sealing all equipment that would be used in or the water to rid it of chemical residue and conducting daily inspections of all construction and related equipment to ensure there are no leaks of fuel, antifreeze, hydraulic fluid, or other harmful substances. If a spill occurs, report response and outcome in Monitoring Report No. 3, below.

e. For projects that include sediment placement and/or dredging component, fill material shall not be sourced using hopper dredge techniques (including relocation trolling) and shall not be sourced from Gulf sturgeon, or smalltooth sawfish designated critical habitat[37,38] or from nearshore reproductive habitat areas of critical habitat for loggerhead sea turtles.[39]

f. Design or materials used shall not create an entanglement or entrapment risk to ESA-listed species or block migration.

DOI MMS's *Notice to Lessees and Operators of Federal Oil, Gas, and Sulphur Leases and Pipeline Right-Of-Way Holders Outer Continental Shelf, Gulf of Mexico OCS Region*, dated January 27, 2010 http://www.boem.gov/Regulations/Notices-To-Lessees/2009/09-G39.aspx.

[36] NMFS. Sea Turtle and Smalltooth Sawfish Construction Conditions. 2006. Available: sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/documents/sea_turtle_and_smalltooth_sawfish_construction_conditions_3-23-06.pdf.

[37] Federal Register Vol. 74, No. 169. Endangered and Threatened Species; Critical Habitat for the Endangered Distinct Population Segment of Smalltooth Sawfish. 2009. Available: http://www.nmfs.noaa.gov/pr/pdfs/fr/fr74-45353.pdf

[38] Federal Register Vol. 68, No. 53. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Gulf Sturgeon. 2003. Available: http://www.nmfs.noaa.gov/pr/pdfs/fr/fr68-13370.pdf

[39] Federal Register Vol. 79 (39855 -39912). Endangered and Threatened Wildlife and Plants; Designation of critical habitat; North Atlantic Ocean loggerhead sea turtle DPS, Final Rule. Available: http://www.nmfs.noaa.gov/pr/species/turtles/criticalhabitat_loggerhead.htm

i. Follow NMFS's *Measures for Reducing Entrapment Risk to Protected Species,*[40] where applicable.

ii. Any turbidity curtains or other such construction equipment/materials shall be installed in a manner that avoids entanglement or entrapment of protected species.

iii. Projects that include installation of marker buoys or other floating objects tethered to the sea floor, shall ensure that all in-water lines be made of materials and in a manner to minimize the risk of entanglement by using thick, heavy, and taut lines that do not loop or entangle.

g. In-water construction activities shall not impede sea turtle access to or from sea turtle nesting sites during nesting season.

Location	Species	Nesting Season
Mississippi, Louisiana, Alabama and Northern Florida (Escambia to Pasco Counties)	Loggerhead sea turtles	May 1 – October 31
	Green sea turtles	May 15 – October 31
	Leatherback sea turtles	May 1 – September 30
Southern Florida (Pinellas to Monroe Counties)	Loggerhead sea turtles	April 24 – October 31
	Green sea turtles	May 15 – October 31
	Hawksbill sea turtles (Monroe County only)	June 1 – December 31
Texas	Kemp's ridley sea turtles	May 1 – September 30

h. To avoid turbidity impacts to listed species:

i. Heavy equipment working in wetlands or mudflats shall be placed on mats, or other measures shall be taken to minimize soil disturbance.

ii. Appropriate soil erosion and sediment controls shall be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, shall be permanently stabilized at the earliest practicable date.

iii. Use floating turbidity curtains around all in-water construction areas as appropriate.

i. Follow NMFS's *Vessel Strike Avoidance Measures and Reporting for Mariners*. [41]

[40] NMFS. Measures for Reducing Entrapment Risk to Protected Species. 2012. Available: sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/documents/entrapment_bmps_final.pdf.

j. In addition to criteria described above, PDCs for marsh creation and oyster restoration shall be followed, where appropriate.

3. Monitoring:
   a. Monitoring reports shall include:
      i. Project construction monitoring from PDC No.2, above
      ii. As-built project completion drawings and photos
      iii. Any interactions with protected species listed in PDC No.4, below

4. Reporting:
   a. Report all interactions with, or sightings of stranded, entangled, dead or injured sea turtles, Gulf sturgeon, sawfish, or marine mammals, immediately to:
      i. Sea turtles, dolphins and marine mammals - Marine Mammal Stranding: Telephone: 1-877-WHALE HELP (1-877-942-5343)
      ii. Gulf sturgeon - NMFS's Protected Resources Division:

         Telephone: 1-844-788-7491 (1-844-STURG 911)
         Email: nmfs.ser.sturgeonnetwork@noaa.gov

         When possible provide:
         1) the location where the fish was found or caught
         2) the condition of the fish
         3) the presence of any research tags
         4) the length of the fish
         5) a photograph
      iii. Smalltooth sawfish - Fish and Wildlife Research Institute:

         Email: Sawfish@MyFWC.com
         Telephone: 1-941-255-7403
   b. Final reports from project monitoring shall be submitted to:

      NOAA Fisheries Southeast Region - Protected Resources Division
      Restoration Project Monitoring Reports
      263 13th Avenue South
      Saint Petersburg, Florida 33701

[41] NMFS. Vessel Strike Avoidance Measures and Reporting for Mariners. 2008. Available: sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/documents/copy_of_vessel_strike_avoidance_february_2008.pdf

4.1 Effects Analysis for Construction of Living Shorelines

Sections 6.1 of the Opinion (General In-Water Construction Activities) and Section 6.2 of the Opinion (Construction of Living Shorelines, Rock Groins, and Breakwaters) describe the potential routes of effects through which living shoreline creation projects could adversely affect listed species and critical habitats. Some living shoreline projects may include the placement of dredged sediments on the shoreward side of the living shoreline structure to increase the bottom elevation of those areas. Effects related to dredging and placement of dredged material are described in Section 6.3 of the Opinion (Dredging, Including Placement of Dredged Material). The PDCs developed for living shorelines include measures to ensure that any such effects are avoided. A summary of the potential adverse effects and an analysis showing how the PDCs ensure avoidance of those effects follows:

- Living shoreline creation frequently involves the use of heavy construction equipment, barges, and support vessels that can cause temporary localized adverse impacts from vessel strikes, sediment disturbance, increased turbidity, and noise. These effects can result in physical injury to listed species (e.g., vessel strikes), and/or cause them to avoid the construction area, which could disrupt foraging, sheltering, and other essential activities.

  PDC 2.a. requires action agencies to adhere to NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*. These criteria require that all vessels associated with construction projects operate at "no wake/idle" speeds at all times while in the construction area or other shallow water areas, and that operation of any mechanical construction equipment shall cease immediately if a sea turtle is seen within a 50-ft radius of the equipment. Due to the species' mobility and natural avoidance behaviors, and the action agency's compliance with NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*, the risk of injury directly related to construction activities is discountable.

  PDC 2.g. includes several measures to avoid turbidity impacts to water quality. Listed species may be temporarily unable to use the sites for foraging or shelter habitat due to avoidance of construction activities and related noise. However, NMFS has consulted on numerous living shoreline creation projects, which generally have relatively small footprints and short construction durations. In addition, the areas adjacent to these types of projects generally provide similar foraging and shelter habitat. Therefore, NMFS expects any impacts resulting from temporary avoidance of the area due to construction activities to be insignificant.

  PDC 2.h. requires action agencies to adhere to NMFS's *Vessel Strike Avoidance Measures and Reporting for Mariners.* These criteria require that all vessel operators and crews maintain a vigilant watch for marine mammals and sea turtles and maintain appropriate speeds and distances from protected species to avoid striking or otherwise harming these species. Living shoreline construction activities generally occur in shallow-water areas far from the deepwater habitats occupied by sperm whales. However, if vessels involved in living shoreline construction do end up in these deepwater areas, adherence to NMFS's *Vessel Strike Avoidance Measures and Reporting for Mariners* will prevent striking or otherwise harming sperm whales. Due to the species' mobility and natural avoidance behaviors, and the action agency's compliance with these measures, the risk of adverse effects directly related to vessel interactions is discountable.

- Fuel or chemical leaks from heavy equipment could enter the aquatic environment and impact listed species and their critical habitats.

  PDC 2.d. requires action agencies to develop and implement a spill prevention and response plan, including cleaning and sealing all equipment that would be used in the water to rid it of chemical residue and conducting daily inspections of all construction and related equipment to ensure there are no leaks of fuel, antifreeze, hydraulic fluid, or other harmful substances. When these measures are implemented fully, the possibility of adverse effects resulting from fuel or chemical leaks and spills is discountable.

- Deployment of turbidity curtains or other devices that enclose areas of aquatic habitat have the potential to entrap listed species within the enclosed areas. Construction of berms or low-level dikes to protect shorelines can also result in entrapment of listed species inside the diked area.

  PDC 2.f.i. requires that action agencies follow NMFS's *Measures for Reducing Entrapment Risk to Protected Species*. When these measures are implemented fully, the possibility of listed species' becoming entrapped within enclosed areas is discountable.

- Living shoreline creation may involve temporary deployment of turbidity curtains or other materials that have the potential to result in entanglement of listed species within those materials. Deployment of marker buoys related to construction activities can also pose a risk of entanglement in the anchor lines.

  PDC 2.f. ii. requires that any turbidity curtains or other such equipment/materials be installed in a manner that avoids entanglement or entrapment of protected species.

  PDC 2.f. iii. requires projects that include installation of marker buoys or other floating objects tethered to the sea floor, to ensure that all in-water lines be made of materials and in a manner to minimize the risk of entanglement by using thick, heavy, and taut lines that do not loop or entangle. When these measures are implemented fully, the possibility of listed species becoming entangled in construction related materials/equipment is discountable.

- Dredging removes the top layer of material from an area, including vegetation, sediment, topographic features, and any sessile or slow moving benthic organisms. Removal of these elements, particularly repeated dredging of the same area can result in a reduction in the number of benthic species (both species diversity and species abundance) and a reduction of primary productivity (Lewis et al. 2001). Dredging can also contribute to the formation of localized anoxic or hypoxic conditions depending on the depth and location of the borrow sites. Dredged borrow areas have the potential to increase or alter wave climates by altering the direction and magnitude of waves.

    Best practices described in the DWH PDARP include measure to only use suitable areas as borrow sites (i.e., those that do not contain *Sargassum*, SAV, or oysters) and to obtain sediments by beneficially using dredged material from navigation channels or by accessing material from approved offshore borrow areas. Implementation of these best practices along with adherence to PDC 2.e., which prohibits borrow material from being sourced from Gulf sturgeon or smalltooth sawfish critical habitat or from nearshore reproductive habitat areas of critical habitat for loggerhead sea turtles, is expected to ensure that dredging effects on listed species and critical habitat will be insignificant.

- Hopper dredging and associated relocation trawling can capture, entrain, and kill sea turtles and Gulf sturgeon.

    Effects from hopper dredging will be avoided by PDC 2.e., which prohibits use of hopper dredging (and associated relocation trawling) in marsh creation and enhancement projects.

- Adverse impacts to benthic habitats from placement of living shorelines (and potentially from placement of dredged sediments in areas landward of the living shoreline structure) may occur in the footprint of the project areas where existing habitats would be permanently covered, removed, or modified by the living shoreline (and associated sediment fill).

    PDC 1.a. prohibits adverse effects to red mangroves and shallow euryhaline habitats within smalltooth sawfish critical habitat, PDC 1.b. prohibits adverse effects in nearshore reproductive habitat of loggerhead sea turtle designated critical habitat, and PDC 1.c. requires living shoreline projects within Gulf sturgeon critical habitat to be built in shallow water (< 6 ft) to avoid the preferred foraging habitat for Gulf sturgeon (Gulf sturgeon generally occupy shoreline areas between 6.5-13 ft [2-4 m] of depth characterized by low-relief sand substrate (Fox et al. 2002). This PDC will help to minimize impacts to essential features of Gulf sturgeon critical habitat such as abundant prey items, sediment quality and water quality by preventing effects on these essential features in the areas preferred by Gulf sturgeon. In addition to these explicit protections, living shoreline creation projects consulted on in the past generally have relatively small footprints and occur in shallow waters that do not provide ideal foraging/sheltering habitat for listed species. Also, the areas adjacent to these types of projects generally provide similar foraging and sheltering habitat. Therefore, NMFS expects any impacts resulting from alteration of existing habitats by the proposed living shoreline projects to be insignificant.

- Construction of living shorelines could impede movement of listed species between shoreline and open water, and between marine habitat and freshwater spawning and rearing habitats.

The definition of living shorelines in the PDCs excludes breakwaters and sea walls that could impede the free movement of listed species, and PDC 1.g. requires that completed projects not impede movement of listed species between shoreline and open water, and between marine habitat and freshwater spawning and rearing habitats. Therefore, any potential effects on the movement of listed species or the essential features of Gulf sturgeon critical habitat (i.e., safe and unobstructed migratory pathways) from living shoreline projects will be insignificant.

- Living shorelines constructed within nearshore reproductive habitat of critical habitat for loggerhead sea turtles could create obstructions or artificial lighting (during construction activities) that adversely affect hatchlings as they transit through the surf zone and outward toward open water. Living shorelines could also promote nearshore predator concentration caused by submerged and emergent offshore structures, disrupt wave patterns necessary for orientation, and/or create excessive longshore currents.

Any effects to nearshore reproductive habitat for loggerhead sea turtles from living shorelines will be avoided by PDC 1.b., which prohibits living shorelines from being constructed in these areas.

5. PDCs for Removal of Derelict Fishing Gear and Other Marine Debris

The following PDCs must be met for activities to be qualified for streamlined consultation. The PDCs avoid adverse effects to ESA-listed threatened and endangered species and their designated critical habitats under NOAA Fisheries' jurisdiction. These PDCs apply to activities that occur in or impact marine and estuarine waters.[42] Additional criteria may be required under other statutes (e.g., the Marine Mammal Protection Act, Clean Water Act, and Magnuson Stevens Fishery and Conservation Management Act) and by the U.S. Fish and Wildlife Service for ESA-listed species under their jurisdiction.

The PDCs described below pertain to derelict fishing gear and other marine debris removal[43] operations.

1. Activities that must be avoided:

   a. Vessels and other equipment involved in marine debris removal activities shall not block or impede the movement of listed species at major ingress or egress points in channels, rivers, passes, and bays.
   b. To avoid harassment of listed species, aerial debris surveys shall not be conducted below 1,000 ft (305 m) altitude (for any type of piloted aircraft).
   c. Debris removal activities shall not affect access by sea turtles to or from nesting sites, thus, they shall not occur adjacent to sea turtle nesting sites during nesting season.

Location	Species	Nesting Season
Mississippi, Louisiana, Alabama and Northern Florida (Escambia to Pasco Counties)	Loggerhead sea turtles	May 1 – October 31
	Green sea turtles	May 15 – October 31
	Leatherback sea turtles	May 1 – September 30
Southern Florida (Pinellas to Monroe Counties)	Loggerhead sea turtles	April 24 – October 31
	Green sea turtles	May 15 – October 31
	Hawksbill sea turtles (Monroe County only)	June 1 – December 31
Texas	Kemp's ridley sea turtles	May 1 – September 30

[42] NOAA Fisheries and the U.S Fish and Wildlife Service share jurisdiction for Gulf Sturgeon and listed sea turtles. 1977 Memorandum of Understanding regarding the Roles of the U.S. Fish and Wildlife Service and the National Marine Fisheries Service in Joint Administration of the Endangered Species Act of 1973 as to Marine Turtles.
[43] Best Management Practices obtained in part from the NOAA Marine Debris Program (MDP) NEPA compliance and marine debris removal efforts in the aftermath of Super Storm Sandy Protocols.

2. General conditions:
    d. All on-water operations shall take place during daylight hours.
    e. Follow NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*.[44]
    f. Follow NMFS's *Vessel Strike Avoidance Measures and Reporting for Mariners*.[45]
    g. If approached by a marine mammal or sea turtle, cease activity and allow the animal to pass or move your vessel away slowly.
    h. Trash and other debris materials should be disposed of at an appropriate upland location.

3. Monitoring:
    a. Monitoring reports shall include:
        i. Total amount of materials removed
        ii. Type of materials removed
        iii. Any interactions with protected species listed in PDC No. 4 below.

4. Reporting:
    a. Report all interactions with, or sightings of stranded, entangled, dead or injured sea turtles, Gulf sturgeon, sawfish, or marine mammals, immediately to:
        i. Sea Turtles, dolphins and marine mammals - Marine Mammal Stranding Network: 1-877-WHALE HELP (1-877-942-5343)
        ii. Gulf sturgeon - NMFS's Protected Resources Division:
        Telephone: 1-844-788-7491 (1-844-STURG 911)
        Email: nmfs.ser.sturgeonnetwork@noaa.gov

        When possible provide:
            1) the location where the fish was found or caught
            2) the condition of the fish
            3) the presence of any research tags
            4) the length of the fish
            5) a photograph
        iii. Smalltooth sawfish - Fish and Wildlife Research Institute:
            Email: Sawfish@MyFWC.com

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[44] NMFS. Sea Turtle and Smalltooth Sawfish Construction Conditions. 2006. Available: sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/documents/sea_turtle_and_smalltooth_sawfish_construction_conditions_3-23-06.pdf

[45] NMFS. Vessel Strike Avoidance Measures and Reporting for Mariners. 2008. Available: sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/documents/copy_of_vessel_strike_avoidance_february_2008.pdf

Telephone: 1-941-255-7403

b. Final reports from project monitoring shall be submitted to:

NOAA Fisheries Southeast Region - Protected Resources Division
Restoration Project Monitoring Reports
263 13th Avenue South
Saint Petersburg, Florida 33701

5.1 Effects Analysis for Removal of Derelict Fishing Gear and Other Marine Debris

Section 6.9 describes the potential routes of effects through which marine debris removal projects could adversely affect listed species and critical habitats. In summary, potential effects include increased boating interactions and vessel strikes; harassment/startling of individuals on the water surface by debris survey aircraft; disturbance of sediments and other habitat features; and displacement of listed species from preferred habitats and/or disruption of essential behaviors due to noise and disturbance resulting from marine debris removal activities. The PDCs developed for this technique include measures to ensure that adverse effects are avoided. A summary of the potential adverse effects and an analysis showing how the PDCs ensure avoidance of those effects follows:

- Large-scale marine debris removal projects involving multiple vessels concentrated in major ingress or egress points in channels, rivers, passes, and bays could impede listed species' movement between shoreline and open water (e.g., adult sea turtle movement to and from nesting beaches or hatchlings going to the ocean) and between marine habitat and freshwater spawning and rearing habitats (e.g., Gulf sturgeon moving between estuarine and riverine habitats).

    PDC 1.a. requires action agencies to avoid blocking major ingress or egress points in channels, rivers, passes, and bays, and PDC 1.c. requires action agencies to avoid blocking access by sea turtles to or from nesting sites by ensuring activities do not occur adjacent to sea turtle nesting sites during nesting season. Adherence to these criteria will ensure that the potential for marine debris removal activities to impede or block the movement of listed species is discountable.

- Increased vessel traffic related to marine debris removal operations could increase the likelihood of adverse interactions between program vessels and listed species (vessel strikes, harassment, etc.).

    PDC 2.b. requires action agencies to adhere to NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*. These criteria require that all vessels associated with marine debris removal projects operate at "no wake/idle" speeds while in the debris removal area or other shallow water areas, and that operation of any mechanical equipment shall cease immediately if a sea turtle is seen within a 50-ft radius of the equipment. Due to the species' mobility and natural avoidance behaviors and the action agency's compliance with NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*, the risk of injury directly related to marine debris removal activities is discountable.

    PDC 2.c. requires action agencies to adhere to NMFS's *Vessel Strike Avoidance Measures and Reporting for Mariners*. These criteria require that all vessel operators and crews maintain a vigilant watch for marine mammals and sea turtles and maintain appropriate speeds and distances from protected species to avoid striking or otherwise harming these species. Marine debris removal activities generally occur in shallow-water areas far from the deepwater habitats occupied by sperm whales. However, if vessels involved in marine debris removal do end up in these deepwater areas, adherence to NMFS's *Vessel Strike Avoidance Measures and Reporting for Mariners* will prevent striking or otherwise harming sperm whales. Due to the species' mobility and natural avoidance behaviors, and the action agency's compliance with these measures, the risk of adverse effects directly related to vessel interactions is discountable.

- Low altitude aerial marine debris surveys could result in startling/harassment of listed species on the water surface by debris survey aircraft.

PDC 1.b. prohibits aerial surveys from being conducted at altitudes below 1,000 ft (305 m) for any type of piloted aircraft. Maintaining altitude above 1,000 ft for piloted survey aircraft will avoid startling/harassment of listed species on the water surface and ensure that effects on listed species from survey aircraft will be insignificant.

- Removal of partially or entirely buried marine debris may cause disturbance of sediments and other habitat features such as submerged aquatic vegetation. In-water activities could also result in temporary displacement of listed species from preferred habitats and/or disruption of essential behaviors.

Many of the PDCs are designed to minimize disruption of benthic habitats or harassment of listed species and marine debris removal activities generally have relatively small footprints and short operational durations. In addition, the areas adjacent to the disturbed areas generally provide similar foraging and sheltering habitat. Therefore, NMFS expects any effects resulting from temporary disturbance of essential features of critical habitat or avoidance of the area due to debris removal activities to be insignificant.

6. PDCs for Oyster Reef Creation and Enhancement

The following PDCs must be met for activities to be qualified for streamlined consultation. The PDCs avoid adverse effects to ESA-listed threatened and endangered species and their designated critical habitats under NOAA Fisheries' jurisdiction. These PDCs apply to activities that occur in or impact marine and estuarine waters.[46] Additional criteria may be required under other statutes (e.g., the Marine Mammal Protection Act, Clean Water Act, and Magnuson Stevens Fishery and Conservation Management Act) and by the U.S. Fish and Wildlife Service for ESA-listed species under their jurisdiction.

The following PDCs apply to Oyster Reef Creation or Enhancement. Cultch material generally consists of limestone rock, crushed concrete, oyster shell, or other similar material that, when placed in oyster spawning areas, provides a substrate on which free swimming oyster larvae can attach and grow into oysters. The goal of these projects is to restore and enhance the ecological functions provided by healthy oyster reef habitat.

1. Activities that must be avoided:
    a. Oyster reefs shall not be constructed in smalltooth sawfish critical habitat.
    b. Oyster reefs shall not be constructed in nearshore reproductive habitat of loggerhead sea turtle designated critical habitat.[47]
    c. Oyster reefs shall not be built on submerged aquatic vegetation, live bottom,[48] and hard or soft coral.
    d. Mangroves shall not be trimmed or removed.
    e. Oyster reefs shall not be built with materials that may create an entanglement risk to ESA-listed species.

2. General Conditions:
    a. Follow NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*, [49] where applicable.
    b. Follow NMFS's *Vessel Strike Avoidance Measures and Reporting for Mariners.*

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[46] NOAA Fisheries and the U.S Fish and Wildlife Service share jurisdiction for Gulf Sturgeon and listed sea turtles. 1977 Memorandum of Understanding regarding the Roles of the U.S. Fish and Wildlife Service and the National Marine Fisheries Service in Joint Administration of the Endangered Species Act of 1973 as to Marine Turtles.

[47] Federal Register Vol. 79 (39855 -39912). Endangered and Threatened Wildlife and Plants; Designation of critical habitat; North Atlantic Ocean loggerhead sea turtle DPS, Final Rule. Available: http://www.nmfs.noaa.gov/pr/species/turtles/criticalhabitat_loggerhead.htm

[48] Live bottom means low to moderate relief naturally occurring hard or rocky formations with rough, broken, or smooth topography that contain biological assemblages consisting of sessile invertebrates living upon and attached to the hard substrate and may favor the accumulation of turtles, fishes, or other fauna. Definition modified from DOI MMS's *Notice to Lessees and Operators of Federal Oil, Gas, and Sulphur Leases and Pipeline Right-Of-Way Holders Outer Continental Shelf, Gulf of Mexico OCS Region*, dated January 27, 2010 http://www.boem.gov/Regulations/Notices-To-Lessees/2009/09-G39.aspx

[49] NMFS. Sea Turtle and Smalltooth Sawfish Construction Conditions. 2006. Available: http://sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/documents/sea_turtle_and_smalltooth_sawfish_construction_conditions_3-23-06.pdf

c. In-water construction activities shall not impede sea turtle access to or from sea turtle nesting sites during nesting season.

Location	Species	Nesting Season
Mississippi, Louisiana, Alabama and Northern Florida (Escambia to Pasco Counties)	Loggerhead sea turtles	May 1 – October 31
	Green sea turtles	May 15 – October 31
	Leatherback sea turtles	May 1 – September 30
Southern Florida (Pinellas to Monroe Counties)	Loggerhead sea turtles	April 24 – October 31
	Green sea turtles	May 15 – October 31
	Hawksbill sea turtles (Monroe County only)	June 1 – December 31
Texas	Kemp's ridley sea turtles	May 1 – September 30

d. Within Gulf sturgeon critical habitat, oyster reef creation and enhancement shall occur only on existing shell substrata or relic reef locations.

e. Cultch material shall be free of debris and contaminants.

f. Fresh shell shall be aged or quarantined for not less than 6 months before deployment.

g. During deployment, cultch material shall be placed in a manner minimizing the disturbance of surrounding sediments. Use a clamshell or similar apparatus as the preferred method and only employ high-pressure water spray to distribute cultch materials if absolutely necessary.

h. To avoid turbidity impacts to listed species:

   i. Heavy equipment working in wetlands or mudflats shall be placed on mats, or other measures shall be taken to minimize soil disturbance.

   ii. Appropriate soil erosion and sediment controls shall be used and maintained in effective operating condition during construction and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, shall be permanently stabilized at the earliest practicable date.

   iii. Use floating turbidity curtains around all in-water construction areas.

i. Provide a plan for intermittent breaks between oyster reef segments to avoid impeding movement of ESA-listed species between marine habitat and shoreline/freshwater spawning and rearing habitats and prevent entrapment of ESA-listed species.

j. Develop and implement a spill prevention and response plan, including cleaning and sealing all equipment that would be used in or the water to rid it of chemical residue and conducting daily inspections of all construction and related equipment to ensure there are no leaks of fuel, antifreeze, hydraulic fluid, or other harmful substances. If a spill occurs, report response and outcome in Monitoring Report No. 3, below.

k. Design or materials used shall not create an entanglement or entrapment risk to ESA-listed species or block migration.
   i. Follow NMFS's *Measures for Reducing Entrapment Risk to Protected Species,*[50] where applicable.
   ii. Any turbidity curtains or other such construction equipment/materials shall be installed in a manner that avoids entanglement or entrapment of protected species.
   iii. Projects that include installation of marker buoys or other floating objects tethered to the sea floor, shall ensure that all in-water lines be made of materials and in a manner to minimize the risk of entanglement by using thick, heavy, and taut lines that do not loop or entangle.

3. Monitoring:
   a. Monitoring reports shall include:
      i. Project construction monitoring from PDC No. 2, above
      ii. As-built project completion drawings and photos
      iii. Any interactions with protected species listed in PDC No. 4, below

4. Reporting:
   a. Report all interactions with, or sightings of stranded, entangled, dead or injured sea turtles, Gulf sturgeon, sawfish, or marine mammals, immediately to:
      i. Sea turtles and marine mammals:

         Telephone: 1-877-WHALE HELP (1-877-942-5343)
      ii. Gulf sturgeon - NMFS's Protected Resources Division:

         Telephone: 1-844-788-7491 (1-844-STURG 911)
         Email: nmfs.ser.sturgeonnetwork@noaa.gov

         When possible provide:
         1) the location where the fish was found or caught
         2) the condition of the fish
         3) the presence of any research tags
         4) the length of the fish
         5) a photograph

[50] NMFS. Measures for Reducing Entrapment Risk to Protected Species. 2012. Available: sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/documents/entrapment_bmps_final.pdf.

iii. Smalltooth sawfish - Fish and Wildlife Research Institute:

Telephone: 1-941-255-7403
Email: Sawfish@MyFWC.com

c. Final reports from project monitoring shall be submitted to:

NOAA Fisheries Service - Protected Resources Division
Restoration Project Monitoring Reports
263 13th Avenue South
Saint Petersburg, Florida 33701

6.1 Effects Analysis for Oyster Reef Creation and Enhancement

Sections 6.1 of the Opinion (General In-Water Construction Activities) and Section 6.4 of the Opinion (Placement of Oyster Shells/Cultch Material) describe the potential routes of effects through which oyster reef creation/enhancement projects could adversely affect listed species and critical habitats. The PDCs developed for oyster reef creation include measures to ensure that any such effects are avoided. A summary of the potential adverse effects and an analysis showing how the PDCs ensure avoidance of those effects follows:

- Oyster reef creation/enhancement frequently involves the use of heavy construction equipment, barges, and support vessels that can cause temporary localized adverse impacts from vessel strikes, sediment disturbance, increased turbidity, and noise. These effects can result in physical injury to listed species (e.g., vessel strikes), and/or cause them to avoid the construction area, which could disrupt foraging, sheltering, and other essential activities.

PDC 2.a. requires action agencies to adhere to NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*. These criteria require that all vessels associated with construction projects operate at "no wake/idle" speeds at all times while in the construction area or other shallow water areas, and that operation of any mechanical construction equipment shall cease immediately if a sea turtle is seen within a 50-ft radius of the equipment. Due to the species' mobility and natural avoidance behaviors, and the action agency's compliance with NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*, the risk of injury directly related to construction activities is discountable.

PDC 2.h. includes several measures to avoid turbidity impacts to water quality. Listed species may be temporarily unable to use the sites for foraging or shelter habitat due to avoidance of construction activities and related noise. However, NMFS has consulted on numerous oyster reef creation/enhancement projects, which generally have relatively small footprints and short construction durations. In addition, the areas adjacent to these types of projects generally provide similar foraging and shelter habitat. Therefore, NMFS expects any impacts resulting from temporary avoidance of the area due to construction activities to be insignificant.

PDC 2.b. requires action agencies to adhere to NMFS's *Vessel Strike Avoidance Measures and Reporting for Mariners*. These criteria require that all vessel operators and crews maintain a vigilant watch for marine mammals and sea turtles and maintain appropriate speeds and distances from protected species to avoid striking or otherwise harming these species. Oyster reef creation/enhancement construction activities generally occur in shallow-water areas far from the deepwater habitats occupied by sperm whales. However, if vessels involved in oyster reef creation/enhancement do end up in these deepwater areas, adherence to NMFS's *Vessel Strike Avoidance Measures and Reporting for Mariners* will prevent striking or otherwise harming sperm whales. Due to the species' mobility and natural avoidance behaviors, and the action agency's compliance with these measures, the risk of adverse effects directly related to vessel interactions is discountable.

- Fuel or chemical leaks from heavy equipment could enter the aquatic environment and impact listed species and their critical habitats.

  PDC 2.j. requires action agencies to develop and implement a spill prevention and response plan, including cleaning and sealing all equipment that would be used in the water to rid it of chemical residue and conducting daily inspections of all construction and related equipment to ensure there are no leaks of fuel, antifreeze, hydraulic fluid, or other harmful substances. When these measures are implemented fully, the possibility of adverse effects' resulting from fuel or chemical leaks and spills is discountable.

- Deployment of turbidity curtains or other devices that enclose areas of aquatic habitat have the potential to entrap listed species within the enclosed areas.

  PDC 2.l.i. requires that action agencies follow NMFS's *Measures for Reducing Entrapment Risk to Protected Species*. When these measures are implemented fully, the possibility of listed species' becoming entrapped within enclosed areas is discountable.

- Oyster reef creation/enhancement may involve temporary deployment of turbidity curtains or other materials that have the potential to result in entanglement of listed species within those materials. Deployment of marker buoys related to construction activities can also pose a risk of entanglement in the anchor lines.

  PDC 2.l. ii. requires that any turbidity curtains or other such equipment/materials be installed in a manner that avoids entanglement or entrapment of protected species.

  PDC 2.l. iii. requires projects that include installation of marker buoys or other floating objects tethered to the sea floor, to ensure that all in-water lines be made of materials and in a manner to minimize the risk of entanglement by using thick, heavy, and taut lines that do not loop or entangle. When all of these measures are implemented fully, the possibility of listed species' becoming entangled in materials/equipment is discountable.

- Adverse impacts to benthic habitats from placement of oyster cultch material may occur in the footprint of the project areas where existing habitats would be permanently covered by the oyster reef.

  PDC 1.a. prohibits oyster reef creation/enhancement within smalltooth sawfish critical habitat, PDC 1.c. prohibits oyster reef creation/enhancement on submerged aquatic vegetation, live bottom, and hard or soft coral, PDC 2.g. requires that cultch material be placed in a manner minimizing the disturbance of surrounding sediments, and PDC 2.d. requires that oyster reef creation/enhancement within Gulf sturgeon critical habitat must occur only on existing shell substrata or relic reef locations. When all of these criteria are followed, NMFS expects any impacts to listed species or their designated critical habits by the restoration/enhancement of oyster reefs to be insignificant.

- Constructed oyster reefs could impede movement of listed species between shoreline and open water and between marine habitat and freshwater spawning and rearing habitats.

  PDC 1.b. prohibits oyster reef construction in nearshore reproductive habitat of loggerhead sea turtle designated critical habitat, PDC 2.b. prohibits construction activities that could impede sea turtle access to or from sea turtle nesting sites during nesting season, and PDC 2.i. requires that all oyster reef designs include intermittent breaks between oyster reef segments to avoid impeding movement of ESA-listed species. Implementation of these criteria will ensure that any potential effects from oyster reef creation/enhancement on the movement of listed species or the essential features/PCEs of critical habitat related to free movement will be insignificant or discountable.

- Oyster reef creation/enhancement within nearshore reproductive habitat of critical habitat for loggerhead sea turtles could promote nearshore predator concentration caused by submerged and emergent offshore structures, disrupt wave patterns necessary for orientation, and/or create excessive longshore currents.

  Any effects to nearshore reproductive habitat for loggerhead sea turtles from oyster reef creation/enhancement will be avoided by PDC 1.b., which prohibits oyster reef creation/enhancement in these areas.

7. PDCs for Construction of Non-Fishing Piers

The following PDCs must be met for activities to be qualified for streamlined consultation. The PDCs avoid adverse effects to ESA-listed threatened and endangered species and their designated critical habitats under NOAA Fisheries' jurisdiction. These PDCs apply to activities that occur in or impact marine and estuarine waters.[51] Additional criteria may be required under other statutes (e.g., the Marine Mammal Protection Act, Clean Water Act, and Magnuson Stevens Fishery and Conservation Management Act) and by the U.S. Fish and Wildlife Service for ESA-listed species under their jurisdiction.

These PDCs cover piers built for access to the water such as boating, bird and wildlife viewing, or walking. These PDCs do not cover piers built to provide fishing from the structure or fish-cleaning stations, as those types of projects have a potential for unavoidable adverse effects (e.g., hooking ESA-listed sea turtles or attracting protected species to improperly disposed fish parts) that need to be evaluated individually by NMFS.

1. Activities that must be avoided:
    a. Piers shall not be constructed within smalltooth sawfish critical habitat.

2. General conditions:
    a. Develop and implement a spill prevention and response plan, including cleaning and sealing all equipment that would be used in the water to rid it of chemical residue and conducting daily inspections of all construction and related equipment to ensure there are no leaks of fuel, antifreeze, hydraulic fluid, or other harmful substances. If a spill occurs, report response and outcome in Monitoring Report No. 3 below.
    b. Design or materials used shall not create an entanglement or entrapment risk to ESA-listed species or block migration.
        i. Follow NMFS's *Measures for Reducing Entrapment Risk to Protected Species*,[52] where applicable.
        ii. Any turbidity curtains or other such construction equipment/materials shall be installed in a manner that avoids entanglement or entrapment of protected species.
        iii. Projects that include installation of marker buoys or other floating objects tethered to the sea floor, shall ensure that all in-water lines be made of materials and in a manner to minimize the risk of entanglement by using thick, heavy, and taut lines that do not loop or entangle.
    c. Follow NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*,[53]

[51] NOAA Fisheries and the U.S Fish and Wildlife Service share jurisdiction for Gulf Sturgeon and listed sea turtles. 1977 Memorandum of Understanding regarding the Roles of the U.S. Fish and Wildlife Service and the National Marine Fisheries Service in Joint Administration of the Endangered Species Act of 1973 as to Marine Turtles.
[52] NMFS. Measures for Reducing Entrapment Risk to Protected Species. 2012. Available: sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/documents/entrapment_bmps_final.pdf.

d. Follow NMFS's *Vessel Strike Avoidance Measures and Reporting for Mariners*. [54]

e. Follow *Construction Guidelines in Florida for Minor Piling-Supported Structures Constructed in or over Submerged Aquatic Vegetation (SAV), Marsh or Mangrove Habitat. U.S. Army Corps of Engineers/National Marine Fisheries Service August 2001*.[55]

f. In-water construction activities shall not impede sea turtle access to or from sea turtle nesting sites during nesting season.

Location	Species	Nesting Season
Mississippi, Louisiana, Alabama and Northern Florida (Escambia to Pasco Counties)	Loggerhead sea turtles	May 1 – October 31
	Green sea turtles	May 15 – October 31
	Leatherback sea turtles	May 1 – September 30
Southern Florida (Pinellas to Monroe Counties)	Loggerhead sea turtles	April 24 – October 31
	Green sea turtles	May 15 – October 31
	Hawksbill sea turtles (Monroe County only)	June 1 – December 31
Texas	Kemp's ridley sea turtles	May 1 – September 30

g. Pile driving:
   i. Jetting, augering, or vibratory hammer methods are preferred.
   ii. Use of impact hammers in Gulf sturgeon critical habitat shall be limited to May 1 - September 30.
   iii. No steel piles shall be driven by impact hammer.
   iv. Noise abatement measures shall be required (e.g., bubble curtains, TNAP[56]) if 6 or more concrete piles are installed within any single day by impact hammer in a confined space.[57]

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[53] NMFS. Sea Turtle and Smalltooth Sawfish Construction Conditions. 2006. Available: sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/documents/sea_turtle_and_smalltooth_sawfish_construction_conditions_3-23-06.pdf

[54] NMFS. Vessel Strike Avoidance Measures and Reporting for Mariners. 2008. Available: sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/documents/copy_of_vessel_strike_avoidance_february_2008.pdf

[55] RS – on NMFS website at: http://sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/documents/dockguidelines2001.pdf

[56] Temporary Noise Attenuation Piles (TNAP) are sleeves placed over the pile during installation consisting of a casing lined with noise-insulating foam.

h. When possible, build the pier out from land using the pier itself as a work platform (e.g., "end-on" construction method). Terminal structures shall be located in sufficiently deep waters to avoid prop-washing of bottom sediments. If it is necessary to work from barges or small boats, use small outboard motors and exercise extreme care to assure that no prop-washing occurs.

i. Water depths shall not be altered through dredging or filling activities in association with pier construction.

j. Any piers constructed on or adjacent to sea turtle nesting beaches shall implement the following lighting specifications:

    i. Lighting of pier structures projecting over the beach or water shall be:

        1) Long wavelength and fully shielded, and

        2) Mounted as low to the deck as possible to prevent light pollution or spillage beyond the walking surface, and shall consist of:

            a. Recessed railing down-light fixtures, equipped with downward-directed louvers and interior dark-colored, non-reflective baffles, or

            b. Bollard-type fixtures, which do not extend more than 42 inches above the adjacent floor or deck, measured from the bottom of fixture, equipped with downward-directed louvers that completely hide the point source of light, and externally shielded on the side facing the beach, or

            c. Embedded lighting systems.

k. Post and maintain "No Fishing Allowed" signs on the pier. NMFS-approved, educational signage shall be posted and maintained in highly-frequented areas at the pier that provides the appropriate contact information in the event of a dolphin, sea turtle, Gulf sturgeon, or smalltooth sawfish stranding. Signage templates for NMFS species can be found here: http://sero.nmfs.noaa.gov/protected_resources/section_7/protected_species_educational_signs/index.html

l. To avoid turbidity impacts to listed species:

    i. Heavy equipment working in wetlands or mudflats shall be placed on mats, or other measures shall be taken to minimize soil disturbance.

    ii. Appropriate soil erosion and sediment controls shall be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, shall be permanently stabilized at the earliest practicable date.

    iii. Use floating turbidity curtains around all in-water construction areas.

3. Monitoring:

[57] A confined space is defined as any area that has another solid object (e.g., a shoreline) that creates a constricted passage area such that species attempting to move through the area would be forced to pass within 150 ft of the pile installation site.

a. Monitoring reports shall include

  i. Project construction monitoring from PDC No. 2, above

  ii. As-built project completion drawings and photos

  iii. Any interactions with protected species listed in PDC No. 4, below.

4. Reporting:

a. Report all interactions with, or sightings of stranded, entangled, dead or injured sea turtles, Gulf sturgeon, sawfish, or marine mammals, immediately to:

  i. Sea turtles and marine mammals:

  Telephone: 1-877-WHALE HELP (1-877-942-5343)

  ii. Gulf sturgeon - NMFS's Protected Resources Division:

  Telephone: 1-844-788-7491 (1-844-STURG 911)
  Email: nmfs.ser.sturgeonnetwork@noaa.gov

  When possible provide:

    1) the location where the fish was found or caught

    2) the condition of the fish

    3) the presence of any research tags

    4) the length of the fish

    5) a photograph

  iii. Smalltooth sawfish - Fish and Wildlife Research Institute:

    Telephone: 1-941-255-7403
    Email: Sawfish@MyFWC.com

c. Final reports from project monitoring shall be submitted to:

NOAA Fisheries Service - Protected Resources Division
Restoration Project Monitoring Reports
263 13th Avenue South
Saint Petersburg, Florida 33701

7.1 Effects Analysis for Construction of Non-fishing Piers

Section 6.8 (Enhancing Recreational Public Access) describes several potential routes of effects through which construction of piers could adversely affect listed species and critical habitats. The PDCs developed for construction of non-fishing piers include measures to ensure that any such effects are avoided or minimized to the point of insignificance. A summary of the potential adverse effects and the PDCs that ensure avoidance or minimization of those effects follows:

- Pier construction may involve the use of heavy construction equipment, barges, and support vessels that can cause temporary localized adverse impacts from vessel strikes, sediment disturbance, increased turbidity, and noise. These effects can result in physical injury to listed species (e.g., vessel strikes), and/or cause them to avoid the construction area, which could disrupt foraging, sheltering, and other essential activities.

    PDC 2.c. requires action agencies to adhere to NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*. These criteria require that all vessels associated with construction projects operate at "no wake/idle" speeds at all times while in the construction area or other shallow water areas, and that operation of any mechanical construction equipment shall cease immediately if a sea turtle is seen within a 50-ft radius of the equipment. Due to the species' mobility and natural avoidance behaviors and the action agency's compliance with NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*, the risk of injury directly related to construction activities is discountable.

    PDC 2.d. requires action agencies to adhere to NMFS's *Vessel Strike Avoidance Measures and Reporting for Mariners*. These criteria require that all vessel operators and crews maintain a vigilant watch for marine mammals and sea turtles and maintain appropriate speeds and distances from protected species to avoid striking or otherwise harming these species. Pier construction activities generally occur in shallow-water areas far from the deepwater habitats occupied by sperm whales. However, if vessels involved in pier construction do end up in these deepwater areas, adherence to NMFS's *Vessel Strike Avoidance Measures and Reporting for Mariners* will prevent striking or otherwise harming sperm whales. Due to the species' mobility and natural avoidance behaviors, and the action agency's compliance with these measures, the risk of adverse effects directly related to vessel interactions is discountable.

    PDC 2.l. includes several measures to avoid turbidity impacts to water quality. Listed species may be temporarily unable to use the sites for foraging or shelter habitat due to avoidance of construction activities and related noise. However, NMFS has consulted on numerous living shoreline creation projects which generally have relatively small footprints and short construction durations. In addition, the areas adjacent to these types of projects generally provide similar foraging and shelter habitat. Therefore, NMFS expects any impacts resulting from temporary avoidance of the area due to construction activities to be insignificant.

- Fuel or chemical leaks from construction equipment could enter the aquatic environment and impact listed species and their critical habitats.

  PDC 2.a. requires action agencies to develop and implement a spill prevention and response plan, including cleaning and sealing all equipment that would be used in the water to rid it of chemical residue and conducting daily inspections of all construction and related equipment to ensure there are no leaks of fuel, antifreeze, hydraulic fluid, or other harmful substances. When these measures are implemented fully, the possibility of adverse effects resulting from fuel or chemical leaks and spills is discountable.

- Deployment of turbidity curtains or other devices that enclose areas of aquatic habitat have the potential to entrap listed species within the enclosed areas.

  PDC 2.b.i. requires that action agencies follow NMFS's *Measures for Reducing Entrapment Risk to Protected Species*. When these measures are implemented fully, the possibility of listed species becoming entrapped within enclosed areas is discountable.

- Pier construction may involve temporary deployment of turbidity curtains or other materials that have the potential to result in entanglement of listed species within those materials. Deployment of marker buoys related to construction activities can also pose a risk of entanglement in the anchor lines.

  PDC 2.b. ii. requires that any turbidity curtains or other such equipment/materials be installed in a manner that avoids entanglement or entrapment of protected species.

  PDC 2.b. iii. requires projects that include installation of marker buoys or other floating objects tethered to the sea floor, to ensure that all in-water lines be made of materials and in a manner to minimize the risk of entanglement by using thick, heavy, and taut lines that do not loop or entangle. When these measures are implemented fully, the possibility of listed species becoming entangled in construction related materials/equipment is discountable.

- Noise generated during pile driving for piers could affect listed species in the immediate area through behavioral changes or direct physical injury from high pressure energy generated by impact hammer pile driving.

PDC 2.g. includes several measures designed to avoid or minimize impacts of pile driving to listed species and critical habitat. With implementation of these criteria, any effects of pile driving are expected to be insignificant.

- Piers constructed over sensitive habitat features such as SAV can cause permanent displacement of these habitat types in the footprint of the piles supporting the structure and loss or thinning of the vegetation under the structure from shading of sunlight. Pier construction activities can also result in impacts to sensitive habitat features from prop-washing by work vessel motors and removal or covering of surface layers through dredging activities. Widespread and persistent impacts to these keystone habitat features can eventually disrupt the functions of the ecosystems upon which listed species rely.

  PDC 1.a. prohibits construction of piers within smalltooth sawfish critical habitat, and PDC 2.c. requires adherence to guidelines developed by NMFS and the U.S. Army Corps of Engineers: *Construction Guidelines in Florida for Minor Piling-Supported Structures Constructed in or over Submerged Aquatic Vegetation (SAV), Marsh or Mangrove Habitat.* PDC 2.h requires vessel operators to exercise extreme care to assure that no prop-washing occurs, and PDC 2.i prohibits dredging or filling activities in association with pier construction. Adherence to these criteria will ensure any effects to sensitive habitats and the essential features of Gulf sturgeon critical habitat (i.e., sediment quality and abundant food items) from the construction of piers will be insignificant.

- If fishing were to be allowed on piers, fishing activities could adversely affect listed species via incidental hooking and entanglement in actively-fished lines, as well as in lost and discarded line. Heavily used fishing areas such as fishing piers are known to attract sea turtles that learn to forage there for discarded bait and fish carcasses, increasing their vulnerability to hooking and entanglement.

  PDC 2.k. requires action agencies to post and maintain “No Fishing Allowed” signs on piers. Adherence to these criteria will ensure that the potential for adverse effects from fishing-related interactions with listed species will be discountable.

- If pier designs were to include permanent lighting, and those piers were to be constructed on or adjacent to sea turtle nesting beaches, the lighting on those piers could alter the behavior of nesting adults (Witherington 1992) and could disorient emerging hatchlings causing them to be drawn away from, instead of toward, the water (Witherington and Bjorndal 1991).

  PDC 2.j. requires several measures designed to minimize any potential effects to sea turtles from pier lighting. Implementation of these criteria is expected to ensure that any such effects would be insignificant.

Appendix B: Endangered Species Act Biological Evaluation Form *Deepwater Horizon* Oil Spill Restoration

Endangered Species Act Biological Evaluation Form
Deepwater Horizon Oil Spill Restoration
U.S. Fish and Wildlife Service & National Marine Fisheries Service

This form will be used to provide information for the initiation of informal Section 7 consultations under the Endangered Species Act, if required, or to document a No Effect determination. In addition, information provided in this form may be used to inform other regulatory compliance processes such as Essential Fish Habitat (EFH), Marine Mammal Protection Act (MMPA), Section 106 of the National Historic Preservation Act (NHPA), Migratory Bird Treaty Act (MBTA), and Bald and Golden Eagle Protection Act (BGEPA). Further information may be required beyond what is captured in this form. Note: if you need additional space for writing, please attach pages as needed.

A. Project Identification

Lead Agency U.S. Fish and Wildlife Service and/or National Marine Fisheries Service

Agency Contact Person(s)

FWS: Ashley Mills at 812-756-2712 and Ashley_Mills@fws.gov
NMFS: Christy Fellas at 727-551-5714 and Christina.Fellas@noaa.gov or Laurel Jennings at 206-526-4601and Laurel.Jennings@noaa.gov

I. *Applicant Agency or Business Name*

II. *Applicant Contact Person* III. *Phone* *Email*

IV. *Project Name and ID# (Official name of project and ID number assigned by action agency)*

V. *NMFS Office (Choose appropriate office based on project location)*

Select Most Appropriate

FWS Office (Choose or write in appropriate office based on project location)

Write in or Select Most Appropriate

VI. *Project Type #1*

Select Most Appropriate

VII. *Project Type #2, if helpful*

Select Most Appropriate

B. Project Location

I. Physical Address of action area (If applicable)

II. *State & County/Parish of action area*

III. *Latitude & Longitude for action area (Decimal degrees and datum [e.g., 27.71622°N, 80.25174°W NAD83] [online conversion: https://www.fcc.gov/encyclopedia/degrees-minutes-seconds-tofrom-decimal-degrees])*

IV. Township, range and section of the action area

C. Description of Action Area

1. Attach a separate map delineating where the action will occur. 2. Describe ALL areas that may be affected directly or indirectly by the action and not merely the immediate action area involved in the action, or just where species or critical habitat may be present. Provide a description of the existing environmental conditions and characteristics (e.g., topography, vegetation type, soil type, substrate type, water quality, water depth, tidal/riverine/estuarine, hydrology and drainage patterns, current flow and direction), and land uses (e.g., public, residential, commercial, industrial, agricultural). 3. If habitat for species is present in the action area, provide a general description of the current state of the habitat. 4. Identify any management or other activities already occurring in the area. 5. Provide or attach a detailed map of the area of potential effect for ground disturbing activities if the area is different from the action area.

a. *Waterbody*

(If applicable. Name the body of water, including wetlands (freshwater or estuarine), on which the project is located. If the location is in a river or estuary, please approximate the navigable distance from the project location to the marine environment.)

b. *Existing Structures*

(If applicable. Describe the current and historical structures found in the action area (e.g., buildings, parking lots, docks, seawalls, groynes, jetties, marina.)). If known, please provide the years of construction.

c. *Seagrasses & Other Marine Vegetation*

(If applicable. Describe seagrasses found in action area. If a benthic survey was done, provide the date it was completed and a copy of the report. Estimate the species area of coverage and density. Attach a separate map showing the location of the seagrasses in the action area.)

d. *Mangroves*

(If applicable. Describe the mangroves found in action area. Indicate the species found (red, black, white), the species area of coverage in square footage and linear footage along project shoreline. Attach a separate map showing the location of the mangroves in the action area.)

e. *Corals*

(If applicable. Describe the corals found in action area. If a benthic survey was done, provide the date it was completed and a copy of the report. Estimate the species area of coverage and density. Attach a separate map showing the location of the corals in the action area.)

f. *Uplands*

(If applicable. Describe the current terrestrial habitat in which the project is located (e.g. pasture, forest, meadows, beach and dune habitats, etc.).

g. *Marine Mammals*

(If applicable. Indicate and describe the species found in the action area. Use Stock Assessment Reports (SARs) for more information, see http://www.nmfs.noaa.gov/pr/sars/species.htm)

D. Project Description

I. *Construction Schedule (What is the anticipated schedule for major phases of work? Include duration of in-water work.)*

II. *Describe the Proposed Action: 1. What is the purpose and need of the proposed action? 2. How do you plan to accomplish it? Describe in detail the construction equipment and methods** needed; permanent vs. temporary impacts; duration of temporary impacts; dust, erosion, and sedimentation controls; restoration areas; if the project is growth-inducing or facilitates growth; whether the project is part of a larger project or plan; and what permits will need to be obtained. 3. Attach a separate map showing project footprint, avoidance areas, construction accesses, staging/ laydown areas.* *****If construction involves overwater structures, pilings and sheetpiles, boat slips, boat ramps, shoreline armoring, dredging, blasting, artificial reefs or fishery activities, list the method here, but complete the next section(s) in detail.***

III. Specific In-Water and/or Terrestrial Construction Methods (Provide a detailed account of construction methods. It is important to include step-by-step descriptions of how demolition or removal of structures is conducted and if any debris will be moved and how. Describe how construction will be implemented, what type and size of materials will be used and if machines will be used, manual labor, or both. Indicate if work will be done from upland, barge, or both.)

a. Overwater Structures (Place your answers to the following questions in the box below.)

i. *Is the proposed use of this structure for a docking facility or an observation platform?*
ii. *If no, is this a fishing pier? Public or Private? How many people are expected to fish per day? How do you plan to address hook and line captures?*
iii. *Use of "Dock Construction Guidelines"?* http://sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/documents/dockkey2002.pdf
iv. *Type of decking: Grated – 43% open space; Wooden planks or composite planks – proposed spacing?*
v. *Height above Mean High Water (MHW) elevation?*
vi. *Directional orientation of main axis of dock?*
vii. *Overwater area (sqft)?*
viii. *Use of "Sea Turtle and Smalltooth Sawfish Construction Conditions, March 2006"?*

http://sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/documents/sea_turtle_and_smalltooth_sawfish_construction_conditions_3-23-06.pdf

b. Pilings & Sheetpiles (What type of material is the piling or sheetpiles? What size and how many will be used? Method used to install: impact hammer, vibratory hammer, jetting, etc.?)

c. Marinas and Boat Slips (Describe the number and size of slips and if the number of new slips changes from what is currently available at the project. Indicate how many are wet slips and how many are dry slips. Estimate the shadow effect of the boats - the area (sqft) beneath the boats that will be shaded.)

d. Boat Ramp (Describe the number and size of boat ramps, the number of vessels that can be moored at the site (e.g., staging area) and if this is a public or private ramp. Indicate the boat trailer parking lot capacity, and if this number changes from what is currently available at the project.)

e. Shoreline Armoring (This includes all manner of shoreline armoring (e.g., riprap, seawalls, jetties, groins, breakwaters, etc.). Provide specific information on material and construction methodology used to install the shoreline armoring materials. Include linear footage and square footage. Attach a separate map showing the location of the shoreline armoring in the action area. Follow the NOAA guidelines to avoid entrapment, http://sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/documents/entrapment_bmps_final.pdf)

f. Dredging or digging (Provide details about dredge type (hopper, cutterhead, clamshell, etc.), maximum depth of dredging, area (ft^2) to be dredged, volume of material (yd^3) to be produced, grain size of material, sediment testing for contamination, spoil disposition plans, and hydrodynamic description (average current speed/direction)). If digging in the terrestrial environment, please describe fully with details about possible water jetting, vibration methods to install pilings for dune walk-over structure, or other methods. If using devices/methods to relocate sea turtles then describe the methods here.

g. Blasting (Projects that use blasting might not qualify as "minor projects," and a Biological Assessment (BA) may need to be prepared for the project. Arrange a technical consultation meeting with NMFS Protected Resources Division to determine if a BA is necessary. Please include explosive weights and blasting plan.)

h. Artificial Reefs (Provide a detailed account of the artificial reef site selection and reef establishment decisions (i.e., management and siting considerations, stakeholder considerations, environmental considerations), deployment schedule, materials used, deployment methods, as well as final depth profile and overhead clearance for vessel traffic. For additional information and detailed guidance on artificial reefs, please refer to the artificial reef program websites for the particular state the project will occur in.

i. Fishery Activites (Projects that use gear that could entangle marine mammals needs to be described. This includes activites that may enhance fishing opportunities or be fishery/gear research related. For example, activites such as trawl lines, gill nets, hook and line work, and trap/pots all have the potential to entagle a marine mammal and therefore needs to be further described.)

E. NOAA Species & Critical Habitat and Effects Determination Requested

1. *List all species, critical habitat, proposed species and proposed critical habitat that may be found in the action area.*
2. *Attach a separate map identifying species/critical habitat locations within the action area.*

For information on species and critical habitat under under NMFS jurisdiction, visit: http://sero.nmfs.noaa.gov/protected_resources/section_7/threatened_endangered/Documents/gulf_of_mexico.pdf.

Identify if gulf sturgeon are in marine or in freshwater in your Species and/or Critical Habitat list to determine which federal agency will perform the analysis (e.g. gulf sturgeon CH - marine). Identify if sea turtles are in water or on land in your Species and/or Critical Habitat list to determine which federal agency will perform the analysis (e.g. Loggerhead sea turtle CH - terrestrial).

SPECIES and/or **CRITICAL HABITAT**	**CH UNIT** (if applicable)	**LOCATION** (for sea turtles and gulf sturgeon only)	**DETERMINATION** (see definitions below)
Select One		Select One	Select Most Appropriate
Select One		Select One	Select Most Appropriate
Select One		Select One	Select Most Appropriate
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Select One		Select One	Select Most Appropriate

NE = no effect. This determination is appropriate when the proposed action will not directly, indirectly, or cumulatively impact, either positively or negatively, any listed, proposed, candidate species or designated/proposed critical habitat.

NLAA = not likely to adversely affect. This determination is appropriate when the proposed action is not likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat or there may be beneficial effects to these resources. Response requested is "Concurrence." This conclusion is appropriate when effects to the species or critical habitat will be beneficial, discountable, or insignificant. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or habitat. Insignificant effects relate to the size of the impact, while discountable effects are those that are extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur. If the Services concur in writing with the Action Agency's determination of "is not likely to adversely affect" listed species or critical habitat, the section 7 consultation process is completed.

LAA = likely to adversely affect. This determination is appropriate when the proposed action is likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat. Response requested for listed species is "Formal Consultation". Response requested for proposed and candidate species is "Conference." This conclusion is reached if any adverse effect to listed species or critical habitat may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable or insignificant. In the event the overall effect of the proposed action is beneficial to the listed species or critical habitat, but may also cause some adverse effect on individuals of the listed species or segments of the critical habitat, then the determination should be "is likely to adversely affect." Such a determination requires formal section 7 consultation and will require additional information.

Critical Habitat = No destruction or adverse modification. This determination is appropriate when the proposed action will have no direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical.

F. USFWS Species & Critical Habitat and Effects Determination Requested

1. *List all species, critical habitat, proposed species and proposed critical habitat that may be found in the action area.*
2. *Attach a separate map identifying species/critical habitat locations within the action area.*

For information on species and critical habitat under FWS jurisdiction, visit http://www.fws.gov/endangered/species/.

Identify if gulf sturgeon are in marine or in freshwater in your Species and/or Critical Habitat list to determine which federal agency will perform the analysis (e.g. gulf sturgeon CH - marine). Identify if sea turtles are in water or on land in your Species and/or Critical Habitat list to determine which federal agency will perform the analysis (e.g. Loggerhead sea turtle CH - terrestrial).

SPECIES and/or **CRITICAL HABITAT**	**CH UNIT** (if applicable)	**LOCATION** (for sea turtles and gulf sturgeon only)	**DETERMINATION** (see definitions below)
Select One		Select One	Select Most Appropriate
Select One		Select One	Select Most Appropriate
Select One		Select One	Select Most Appropriate
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		Select One	Select Most Appropriate
		Select One	Select Most Appropriate

NE = no effect. This determination is appropriate when the proposed action will not directly, indirectly, or cumulatively impact, either positively or negatively, any listed, proposed, candidate species or designated/proposed critical habitat.

NLAA = not likely to adversely affect. This determination is appropriate when the proposed action is not likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat or there may be beneficial effects to these resources. Response requested is "Concurrence." This conclusion is appropriate when effects to the species or critical habitat will be beneficial, discountable, or insignificant. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or habitat. Insignificant effects relate to the size of the impact, while discountable effects are those that are extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur. If the Services concur in writing with the Action Agency's determination of "is not likely to adversely affect" listed species or critical habitat, the section 7 consultation process is completed.

LAA = likely to adversely affect. This determination is appropriate when the proposed action is likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat. Response requested for listed species is "Formal Consultation". Response requested for proposed and candidate species is "Conference." This conclusion is reached if any adverse effect to listed species or critical habitat may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable or insignificant. In the event the overall effect of the proposed action is beneficial to the listed species or critical habitat, but may also cause some adverse effect on individuals of the listed species or segments of the critical habitat, then the determination should be "is likely to adversely affect." Such a determination requires formal section 7 consultation and will require additional information.

Critical Habitat = No destruction or adverse modification. This determination is appropriate when the proposed action will have no direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical.

G. Effects of the Proposed Project

I. *Explain the potential beneficial and adverse effects to each species listed above (Describe what, when, and how the species will be impacted and the likely response to the impact. Be sure to include direct, indirect, interdependent, interrelated, connected actions, and cumulative impacts. Where possible, quantify effects. If species are present (or potentially present) and will not be adversely affected describe your rationale. If species are unlikely to be present in the general area or action area, explain why. This justification provides documentation for your administrative record, avoids the need for additional correspondence regarding the species, and helps expedite review.)*

II. *Explain the potential beneficial and adverse effects to critical habitat listed above (Describe what, when, and how the critical habitat will be impacted and the likely response to the impact. Be sure to include direct, indirect, interdependent, interrelated, connected actions, and cumulative impacts. Where possible, quantify effects (e.g. acres of habitat, miles of habitat). Describe your rationale if designated or proposed critical habitats are present and will not be adversely affected.*

III. *If applicable, explain the potential beneficial and adverse effects to marine mammals (Describe what, when, and how the marine mammal species will be impacted and the likely response to the impact. Be sure to include direct, indirect, interdependent, interrelated, connected actions, and cumulative impacts. Where possible, quantify effects. Describe your rationale if marine mammals are present and will not be adversely affected.*

H. Actions to Reduce Adverse Effects

I. *Explain the actions to reduce adverse effects to each species listed above (For each species for which impacts were identified, describe any conservation measures (e.g. BMPs) that will be implemented to avoid or minimize the impacts. Conservation measures are designed to avoid or minimize effects to listed species and critical habitats or further the recovery of the species under review. Conservation measures are considered part of the proposed action and their implementation is required. Any changes to, modifications of, or failure to implement these conservation measures may result in a need to reinitiate this consultation.)*

II. *Explain the actions to reduce adverse effects to critical habitat listed above (For critical habitat for which impacts were identified, describe any conservation measures (e.g. BMPs) that will be implemented to avoid or minimize the impacts. Conservation measures are designed to avoid or minimize effects to listed species and critical habitats or further the recovery of the species under review. Conservation measures are considered part of the proposed action and their implementation is required. Any changes to, modifications of, or failure to implement these conservation measures may result in a need to reinitiate this consultation.)*

III. *If applicable, explain the actions to reduce adverse effects to marine mammals (For marine mammals for which impacts were identified, describe any conservation measures (e.g. BMPs) that will be implemented to avoid or minimize the impacts.)*

I. Bald Eagles

Are bald eagles present in the action area? ☐ NO ☐ YES

If YES, the following conservation measures should be implemented:

1. If bald eagle breeding or nesting behaviors are observed or a nest is discovered or known, all activities (e.g., walking, camping, clean-up, use of a UTV, ATV, or boat) should avoid the nest by a minimum of 660 feet. If the nest is protected by a vegetated buffer where there is *no* line of sight to the nest, then the minimum avoidance distance is 330 feet. This avoidance distance shall be maintained from the onset of breeding/ courtship behaviors until any eggs have hatched and eaglets have fledged (approximately 6 months).
2. If a similar activity (e.g., driving on a roadway) is closer than 660 feet to a nest, then you may maintain a distance buffer as close to the nest as the existing tolerated activity.
3. If a vegetated buffer is present and there is no line of sight to the nest and a similar activity is closer than 330 feet to a nest, then you may maintain a distance buffer as close to the nest as the existing tolerated activity.
4. In some instances, activities conducted at a distance greater than 660 feet of a nest may result in disturbance. If an activity appears to cause initial disturbance, the activity shall stop and all individuals and equipment will be moved away until the eagles are no longer displaying disturbance behaviors.

Will you implement the above measures? ☐ NO ☐ YES

If these measures cannot be implemented, then you must contact the Service's Migratory Bird Permit Office.

Texas – (505) 248-7882 or by email: **permitsR2MB@fws.gov**

Louisiana, Mississippi, Alabama, Florida – (404) 679-7070 or by email: **permitsR4MB@fws.gov**

J. Migratory Birds

Identify the species anticipated in the action area and behaviors (breeding, roosting, foraging) anticipated during project implementation. You may list similar species on a single line and categorize by type (e.g., Wading birds - great blue heron, snowy egret, reddish egret). If species or habitat impacts could occur, identify avoidance and minimization measures to prevent incidental take. Incidental take of Migratory Birds cannot be authorized. Use additional tables on the next page if needed.

I.

Species/Species Group	Behavior	Species/Habitat Impacts and Conservation Measures to Minimize Impacts

Migratory Birds

Continuation page if needed.

II.	SPECIES/SPECIES GROUP	BEHAVIOR	SPECIES/HABITAT IMPACTS and CONSERVATION MEASURES TO MINIMIZE IMPACTS

Pre-existing NEPA Documents

Does this project have any pre-existing, site specific NEPA analysis? Yes ☐ No ☐

If YES, then provide final NEPA analysis, if not final then provide draft. If tiered from a programmatic EIS or EA, then provide the programmatic document or a link below.

NMFS ESA §7 Consultation

We request that all ESA §7 consultation requests/packages be submitted electronically to:
Laurel.Jennings@noaa.gov and **Christy.Fellas@noaa.gov**
Questions about consultation status may be directed to the same email address or by phone:
Laurel Jennings: 206-526-4601 or 206-794-4761 (cell)
Christy Fellas: 727-551-5714

FWS ESA § 7 Consultation

We request that all consultation requests/packages to FWS be submitted electronically to: **Ashley_Mills@fws.gov**. You will be notified when we receive your Biological Evaluation. Upon receipt, we will conduct a preliminary review and provide any comments and feedback, including any requests for modifications or additional information. If modifications or additional information is necessary, we will work with you until the Biological Evaluation form is considered complete. Once complete, we will send your Biological Evaluation to the appropriate Field Office to conduct consultation. If you have questions about consultation status, please contact Ashley Mills by phone 812-756-2712 or email Ashley_Mills@fws.gov.

Name of Person Completing this Form:
Name of Project Lead:
Date Form Completed:
Date Form Updated:

Endangered Species Act Programmatic Biological Opinion

Deepwater Horizon Oil Spill Restoration

National Marine Fisheries Service

Complete this section if your project qualifies for streamlined ESA consultation under the ESA Framework Programmatic Biological Opinion completed by NMFS on January XX, 2016. To be eligible for streamlined ESA consultation with NMFS, you must implement all Project Design Criteria (PDCs) applicable to your project. By checking all boxes below that apply to this project you are confirming that PDCs are incorporated into the project design and construction. The entire Biological Evaluation Form must be completed and include any information necessary to verify that all applicable PDCs are incorporated into the project. If the project incorporates more than one type of restoration, check boxes in all appropriate categories.

You must receive NMFS approval before proceeding with your project. Note that this PDC checklist does not apply to ESA consultation with USFWS.

Full text of the PDCs can be reviewed at: (include link to PDCs on PRD's webpage)

Oyster Reef Creation and Enhancement ○ Yes ○ No

- ☐ Project is designed to avoid techniques and locations listed in the oyster reef creation and enhancement PDCs 1.a-1.e.
- ☐ Follows NMFS' Sea Turtle and Smalltooth Sawfish Construction Conditions (PDC 2.a)
- ☐ Follows NMFS' Vessel Strike Avoidance Measures and Reporting for Mariners (PDC 2.b)
- ☐ In-water construction does not impede sea turtle access to or from nesting sites during nesting season (PDC 2.c)
- ☐ In Gulf sturgeon critical habitat, oyster reef creation and enhancement occurs only on existing shell substrata or relic reef locations (PDC 2.d)
- ☐ Cultch material is free of debris and contaminants (PDC 2.e)
- ☐ Fresh shell has been properly aged or quarantined before being deployed (PDC 2.f)
- ☐ Cultch material is placed in a manner to minimize disturbance of sediment (PDC 2.g)
- ☐ Methods are employed to avoid turbidity impacts to ESA-listed species (PDC 2.h)
- ☐ Plan/drawings for intermittent breaks between oyster reef segment has been provided (2.i)
- ☐ Spill prevention and response plan has been developed (2.j)
- ☐ Design and materials used avoid entanglement and entrapment risks for ESA-listed species (2.k)
- ☐ Monitoring plan is included and final reports will be submitted to NMFS (PDC 3 and 4)

Marine Debris Removal ○ Yes ○ No

- ☐ This project is designed to avoid techniques and locations listed in the marine debris removal PDCs 1.a-1.c
- ☐ All on-water operations shall take place during daylight hours (PDC 2.a)
- ☐ Follows NMFS' Sea Turtle and Smalltooth Sawfish Conditions (PDC 2.b)
- ☐ Follows NMFS' Vessel Strike Avoidance Measures and Reporting for Mariners (PDC 2.c)
- ☐ Project personnel have been notified of procedures if approached by a marine mammal or sea turtle (PDC 2.d)
- ☐ Trash and debris will be disposed of at an upland location (PDCs 2.e)
- ☐ Monitoring plan is included and final reports will be submitted to NMFS (PDC 3 and 4)

Construction of Living Shorelines ◯ Yes ◯ No

- ☐ This project is designed to avoid techniques and locations listed in the living shoreline PDCs 1.a-1.h
- ☐ Follows NMFS' Sea Turtle and Smalltooth Sawfish Conditions (PDC 2.a)
- ☐ All in-water work activities will conducted during daylight hours (PDC 2.b)
- ☐ Piles for navigation of public safety purposes are less than 24" diameter and non-metal if impact hammer used (PDC 2.c)
- ☐ Spill prevention and response plan has been developed (2.d)
- ☐ Fill material is not sourced using hopper dredge or from sea turtle, Gulf sturgeon or smalltooth sawfish critical habitat and in-water borrow sites do not impact turtle nesting beaches (PDC 2.e)
- ☐ Design and materials do not create entrapment or entanglement risks to ESA-listed species and do not block migration (PDC 2.f)
- ☐ In-water construction does not impede sea turtle access to or from nesting sites during nesting season (PDC 2.g)
- ☐ Methods are employed to avoid turbidity impacts to ESA-listed species (PDC 2.h)
- ☐ Follows NMFS' Vessel Strike Avoidance Measures and Reporting for Mariners (PDC 2.i)
- ☐ Monitoring plan is included and final reports will be submitted to NMFS (PDC 3 and 4)

Marsh Creation and Enhancement ◯ Yes ◯ No

- ☐ Project is designed to avoid techniques and locations listed in the marsh creation PDCs 1.a-1.f
- ☐ Follows NMFS' Sea Turtle and Smalltooth Sawfish Conditions (PDC 2.a)
- ☐ Follows NMFS' Vessel Strike Avoidance Measures and Reporting for Mariners (PDC 2.b)
- ☐ All in-water work activities will conducted during daylight hours (PDC 2.c)
- ☐ Spill prevention and response plan has been developed (PDC 2.d)
- ☐ Fill material is not sourced using hopper dredge or from sea turtle, Gulf sturgeon or smalltooth sawfish critical habitat and in-water borrow sites do not impact turtle nesting beaches (PDC 2.e)
- ☐ Design and materials do not create entrapment or entanglement risks to ESA-listed species and do not block migration (PDC 2.f)
- ☐ In-water construction does not impede sea turtle access to or from nesting sites during nesting season (PDC 2.g)
- ☐ Methods are employed to avoid turbidity impacts to ESA-listed species (PDCs 2.h)
- ☐ Monitoring plan is included and final reports will be submitted to NMFS (PDC 3 and 4)

Construction of Non-Fishing Piers

◯ Yes ◯ No

- ☐ This project is designed to avoid locations listed in the non-fishing piers PDCs 1.a
- ☐ Spill prevention and response plan has been developed (PDC 2.a)
- ☐ Design and materials do not create entrapment or entanglement risks to ESA-listed species and do not block migration (PDC 2.b)
- ☐ Follows NMFS' Sea Turtle and Smalltooth Sawfish Construction Conditions (PDC 2.c)
- ☐ Follows NMFS' Vessel Strike Avoidance Measures and Reporting for Mariners (PDC 2.d)
- ☐ Follow Construction Guidelines in Florida for Minor Piling-Supported Structures Constructed in or over Submerged Aquatic Vegetation (SAV), Marsh or Mangrove Habitat (PDC 2.e)
- ☐ In-water construction does not impede sea turtle access to or from nesting sites during nesting season (PDC 2.f)
- ☐ Follows methods and timing for pile driving (2.g)
- ☐ Follows construction sequencing and avoids propwashing (PDC 2.h)
- ☐ Water depth will not be altered (PDC 2.i)
- ☐ Lighting specifications are incorporated for piers on or adjacent to sea turtle nesting beaches (PDC 2.j)
- ☐ Follows educational and fishing signage requirements (PDC 2.k)
- ☐ Methods are employed to avoid turbidity impacts to ESA-listed species (PDC 2.l)
- ☐ Monitoring plan is included and final reports will be submitted to NMFS (PDC 3 and 4)

Check the box to confirm that all applicable requirements are met and a streamlined consultation with NMFS is requested: ☐

Name of person completing this form: ____________________

Date form completed: ____________________

*You must receive NMFS approval before proceeding with your project *