Regionwide Trustee Implementation Group Draft Restoration Plan/ Environmental Assessment 1:

Birds, Marine Mammals, Oysters, and Sea Turtles

March 22, 2021

Executive Summary

On April 20, 2010, the *Deepwater Horizon* (DWH) mobile drilling unit exploded, causing a massive release of oil from the BP Exploration and Production, Inc. (BP) Macondo well. The DWH oil spill is the largest off-shore oil spill in U.S. history, discharging millions of barrels of oil over a period of 87 days. The explosion and oil spill led to loss of life and extensive natural resource injuries. Oil spread from the deep ocean to surface and nearshore environments across the Gulf of Mexico, from Texas to Florida. Extensive response actions were undertaken to reduce harm to people and the environment. However, many of these response actions had collateral impacts on the environment and on natural resource services.

As part of a 2016 settlement, BP agreed to pay a total of $8.1 billion in natural resource damages (inclusive of Early Restoration funding) over a 15-year period, and up to an additional $700 million for adaptive management or to address natural resources injuries that are presently unknown but may become apparent in the future. The settlement allocated a specific sum for restoration within specific Restoration Areas and across Restoration Types (described in more detail below). The DWH oil spill Regionwide Trustee Implementation Group (TIG) is responsible for restoring natural resources and their services that were injured by the DWH oil spill within the Regionwide Restoration Area [1]. The Regionwide TIG prepared this Draft Restoration Plan and Environmental Assessment 1: Birds, Marine Mammals, Oysters, and Sea Turtles (RP/EA) to address injuries to natural resources in the Regionwide Restoration Area resulting from the DWH oil spill. The purpose of this RP/EA is to (1) inform the public about DWH Natural Resource Damage Assessment (NRDA) restoration planning efforts, (2) analyze projects[2] that address target Restoration Types, and (3) seek public comment on the proposed restoration alternatives.

The purpose of restoration, as discussed in this RP/EA and in more detail in the *Deepwater Horizon* Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement (PDARP/PEIS), is to make the environment and the public whole for injuries resulting from the DWH oil spill. This will be achieved by implementing restoration actions that return injured natural resources and services to baseline conditions and compensate for interim losses in accordance with the Oil Pollution Act (OPA) and associated NRDA regulations. The PDARP/PEIS and Record of Decision (ROD) are available at: www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan/.

In the PDARP/PEIS, the DWH Trustees adopted a portfolio of 13 Restoration Types that addresses the diverse suite of injuries that occurred at both regional and local scales. The PDARP/PEIS provides a comprehensive restoration plan at a programmatic level to guide and direct the ecosystem-level restoration effort, and established five programmatic restoration goals. To guide the development of this RP/EA, which tiers off the PDARP/PEIS, the Regionwide TIG focused on four Restoration Types under the Replenish and Protect Living

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1. The Regionwide TIG's work in the Regionwide Restoration Area replenishes and protects marine mammals, sea turtles, birds, and oysters. Natural resources affected by the spill often live and migrate across jurisdictional boundaries; therefore, Regionwide Restoration Area projects will be implemented across jurisdictional boundaries.

2. For the purposes of this RP/EA, each proposed project is considered a separate alternative. The terms "project" and "alternative" may be used interchangeably in this document.

Coastal and Marine Resources programmatic restoration goal: Birds, Marine Mammals, Oysters, and Sea Turtles.

To develop and evaluate a reasonable range of alternatives that would partially restore injuries to these Restoration Types, the Regionwide TIG reviewed 5,149 project ideas submitted to the DWH Trustee project portal by the public, non-governmental organizations, and local, state, and federal agencies. The Regionwide TIG screened the project ideas through a four-step process, described in detail in Chapter 2 of this RP/EA. This process resulted in a reasonable range of alternatives in this RP/EA that received full evaluation under OPA NRDA regulatory criteria (15 C.F.R. 990.54) and the National Environmental Policy Act (NEPA).

The Regionwide TIG proposes a reasonable range of alternatives composed of 15 projects in this RP/EA (Table ES-1; this includes a joint project between the Birds and Sea Turtles Restoration Types, which is counted only once). The Regionwide TIG determined that these 15 alternatives are consistent with the Restoration Type-specific goals established in the PDARP/PEIS for birds, marine mammals, oysters, and sea turtles. The Regionwide TIG evaluated the reasonable range of alternatives against criteria established under the OPA NRDA regulations (see Chapter 3) and analyzed the anticipated environmental consequences of these alternatives (summarized in Table ES-2 and described in detail in Chapter 4). After evaluating these 15 alternatives, the Regionwide TIG identified 11 alternatives that are preferred for implementation (Table ES-1).

Table ES-1. Reasonable range of alternatives considered in this RP/EA

Alternative	Estimated project cost	Preferred
Birds		
Alternative 1: Reducing Marine Debris Impacts on Birds and Sea Turtles *(joint project with Sea Turtles Restoration Type)*	$3,520,000	X
Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds	$22,500,000	X
Component 1: Chandeleur Islands, LA	$8,000,000	
Component 2: Pilot Town/Little Dauphin Island, AL	$6,500,000	
Component 3: San Antonio Bay Bird Island, TX	$2,500,000	
Component 4: Matagorda Bay Bird Island (Chester Island), TX	$2,500,000	
Component 5: Round Island, MS	$3,000,000	
Alternative 3: Bird Nesting and Foraging Area Stewardship	$8,510,750	X
Alternative 4: Stewardship and Habitat Creation through Beneficial Use	$6,500,000	
Component 1: Walker Island, AL	$4,000,000	
Component 2: Matagorda Bay Bird Island (Chester Island), TX	$2,500,000	

Alternative	Estimated project cost	Preferred
Marine Mammals		
Alternative 1: Voluntary Modifications to Commercial Shrimp Lazy Lines to Reduce Dolphin Entanglements	$3,179,088	X
Alternative 2: Reducing Impacts to Dolphins from Hook-and-Line Gear and Provisioning through Fishery Surveys, Social Science, and Collaboration	$1,700,000	X
Alternative 3: Enhance Marine Mammal Stranding Network Diagnostic Capabilities and Consistency across the Gulf of Mexico	$2,300,000	X
Alternative 4: Enhance Capacity, Diagnostic Capability, and Consistency of the Marine Mammal Stranding Network in the Gulf of Mexico	$7,887,000	
Oysters		
Alternative 1: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale)	$35,819,974	X
Component 1: East Galveston Bay, TX		
Component 2: Biloxi Marsh, LA		
Component 3: Heron Bay, MS		
Component 4: Mid-lower Mobile Bay, AL		
Component 5: Suwannee Sound, FL		
Alternative 2: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale)	$22,300,000	
Component 1: East Galveston Bay, TX		
Component 2: Biloxi Marsh, LA		
Component 3: Heron Bay, MS		
Component 4: Mid-lower Mobile Bay, AL		
Component 5: Suwannee Sound, FL		
Sea Turtles		
Alternative 1: Pilot Implementation of Automatic Identification System (AIS) in the GOM Inshore Shrimp Fishery to Inform Efforts to Reduce Sea Turtle Bycatch	$2,231,124	X
Alternative 2: Restore and Enhance Sea Turtle Nest Productivity	$7,655,000	X
Alternative 3: Guiding Restoration Success for Nesting Females and Hatchlings in the Northern Gulf of Mexico	$4,446,000	
Alternative 4: Reducing Sea Turtle Bycatch at Recreational Fishing Sites	$3,649,360	X
Alternative 5: Reducing Marine Debris Impacts on Birds and Sea Turtles *(joint project with Birds Restoration Type)*	$3,520,000	X
Alternative 6: Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation	$5,050,000	X
Component 1: Enhancing Response, Coordination, and Preparedness in the Gulf of Mexico	$2,050,000	
Component 2: Texas Rehabilitation Facility	$3,000,000	

GOM – Gulf of Mexico

The following federal and state agencies are the designated Trustees under OPA for the DWH oil spill and are included in the Regionwide TIG:

- U.S. Department of the Interior (DOI), represented by the U.S. Fish and Wildlife Service (USFWS), the National Park Service (NPS), and the Bureau of Land Management (BLM);
- National Oceanic and Atmospheric Administration (NOAA), on behalf of the U.S. Department of Commerce (DOC);
- U.S. Department of Agriculture (USDA);
- U.S. Environmental Protection Agency (EPA);
- The state of Alabama: Department of Conservation and Natural Resources (ADCNR) and Geological Survey of Alabama (GSA);
- The state of Florida: Department of Environmental Protection (FDEP) and Fish and Wildlife Conservation Commission (FWC);
- The state of Louisiana: Coastal Protection and Restoration Authority (CPRA), Department of Natural Resources (LDNR); Department of Environmental Quality (LDEQ); Oil Spill Coordinator's Office (LOSCO); and Department of Wildlife and Fisheries (LDWF);
- The state of Mississippi: Department of Environmental Quality (MDEQ); and
- The state of Texas: Parks and Wildlife Department (TPWD), General Land Office (TGLO), and Commission on Environmental Quality (TCEQ).

NOAA is the lead federal Trustee for preparing this RP/EA pursuant to NEPA. In accordance with 40 C.F.R. 1506.3(a), each cooperating federal agency on the Regionwide TIG will review this RP/EA for adequacy in meeting the standards set forth in its own NEPA implementing procedures. Each federal agency will then decide whether to adopt the analysis to inform its own decision-making and fulfill its responsibilities under NEPA. Adoption of the RP/EA would require signature on the relevant NEPA decision document.

The public is encouraged to review and comment on this RP/EA during the 45-day comment period following public notice of availability. Comments can be submitted during the comment period by one of the following methods:

Online: www.gulfspillrestoration.noaa.gov/restoration-areas/regionwide

By mail: Hard copy addressed to U.S. Fish and Wildlife Service, P.O. Box 29649, Atlanta, GA 30345.

To be considered, mailed comments must be postmarked on or before the comment deadline specified in the *Federal Register* and on the DWH Trustee website.

***During the virtual public meetings**:* The Regionwide TIG will hold two virtual public meetings to facilitate the public review and comment process. A weblink for the public meetings will be available on the DWH Trustee website. The public meetings will take place on:

> **Thursday, April 15, 2021, at 2:00 pm U.S. Central Time and 6:00 pm U.S. Central Time.**

After the comment period closes, the Regionwide TIG will consider all public comments and revise the RP/EA, as appropriate. A summary of comments and the Regionwide TIG's responses, where applicable, will be included in the final RP/EA.

Overall, this RP/EA intends to provide the public with information and analysis necessary to enable meaningful review and comment on the Regionwide TIG's proposal to implement projects addressing injuries to the Birds, Marine Mammals, Oysters, and Sea Turtles Restoration Types. Ultimately, this Draft RP/EA and the corresponding opportunity for the public to review and comment on the document are intended to guide the Regionwide TIG's selection of projects for implementation that best meet its purpose and need, as summarized above and described in more detail in subsequent sections of this document.

Table ES-2. Summary of environmental consequences of alternatives considered in this RP/EA

Key: + Beneficial impact; NI – No impact; s – short-term, minor adverse impact; S – short-term, moderate adverse impact; **S – short-term, major adverse impact;**
l – long-term, minor adverse impact; L – long-term, moderate adverse impact; **L – long-term, major adverse impact**; GHGs – greenhouse gases; EJ – environmental justice.
*Resources not analyzed in detail in this RP/EA.

		Physical resources				Biological resources			Socioeconomic resources								
Alternative	Restoration Type alternatives	Geology and substrates	Hydrology and water quality	Air quality/GHGs*	Noise*	Habitats and Wildlife species (birds and terrestrial species)	Marine and estuarine resources	Protected species	Socioeconomics / EJ*	Cultural resources*	Tourism and recreational use*	Aesthetic and visual resources*	Infrastructure*	Fisheries and aquaculture*	Land and marine management*	Marine transportation*	Public health and safety, including flood and shoreline protection*
Birds Restoration Type projects																	
1	Reducing Marine Debris Impacts on Birds and Sea Turtles *(joint project with Sea Turtles Restoration Type)*	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+	NI	NI	s
2	Conservation and Enhancement of Nesting and Foraging Habitats for Birds, Component 1: Chandeleur Islands, LA	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
2	Conservation and Enhancement of Nesting and Foraging Habitats for Birds, Component 2: Pilot Town/ Little Dauphin Island, AL	+/s	+/s	s	s	+/s	NI	+/s	+	NI	+	NI	NI	+	NI	NI	s
2	Conservation and Enhancement of Nesting and Foraging Habitats for Birds, Component 3: San Antonio Bay Bird Island, TX	+/l	+/s	s	s	+/s	+/s/l	+/s	+	NI	+	NI	NI	+	NI	NI	s

Alternative	Restoration Type alternatives	Physical resources				Biological resources			Socioeconomic resources									
		Geology and substrates	Hydrology and water quality	Air quality/GHGs*	Noise*	Habitats and Wildlife species (birds and terrestrial species)	Marine and estuarine resources	Protected species	Socioeconomics / EJ*	Cultural resources*	Tourism and recreational use*	Aesthetic and visual resources*	Infrastructure*	Fisheries and aquaculture*	Land and marine management*	Marine transportation*	Public health and safety, including flood and shoreline protection*
2	Conservation and Enhancement of Nesting and Foraging Habitats for Birds, Component 4: Matagorda Bay Bird Island (Chester Island), TX	+/s	+/s	s	s	+/s	+/s/l	+/s	+	NI	+	NI	NI	+	NI	NI	s
2	Conservation and Enhancement of Nesting and Foraging Habitats for Birds, Component 5: Round Island, MS	s	NI	s	s	+	NI	+/s	+	NI	+	NI	NI	+	NI	NI	s
3	Bird Nesting and Foraging Area Stewardship	+/s	+/s	NI	s	+/s	s	+/s	+	NI	+	NI	NI	+	NI	NI	s
4	Stewardship and Habitat Creation through Beneficial Use, Component 1: Walker Island, AL	+/s	+/s	s	s	+/s	+/s/l	+/s	+	NI	+	NI	NI	+	NI	NI	s
Marine Mammals Restoration Type projects																	
1	Voluntary Modifications to Commercial Shrimp Lazy Lines to Reduce Dolphin Entanglements	+	NI	NI	s	NI	NI	+	+	NI	+	NI	NI	NI	NI	NI	s

Alternative	Restoration Type alternatives	Physical resources				Biological resources			Socioeconomic resources								
		Geology and substrates	Hydrology and water quality	Air quality/GHGs*	Noise*	Habitats and Wildlife species (birds and terrestrial species)	Marine and estuarine resources	Protected species	Socioeconomics / EJ*	Cultural resources*	Tourism and recreational use*	Aesthetic and visual resources*	Infrastructure*	Fisheries and aquaculture*	Land and marine management*	Marine transportation*	Public health and safety, including flood and shoreline protection*
2	Reducing Impacts to Dolphins from Hook-and-Line Gear and Provisioning through Fishery Surveys, Social Science, and Collaboration	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
3	Enhance Marine Mammal Stranding Network Diagnostic Capabilities and Consistency across the Gulf of Mexico	NI	NI	NI	s	NI	NI	+	+	NI	+	NI	NI	NI	NI	NI	s
4	Enhance Capacity, Diagnostic Capability, and Consistency of the Marine Mammal Stranding Network in the Gulf of Mexico	NI	NI	NI	s	s	NI	s/+	+	NI	+	NI	NI	NI	NI	NI	s
Oysters Restoration Type projects																	
1	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale), Component 1: TX	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+/s	NI	NI	s
1	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale), Component 2: LA	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+/s	NI	NI	s

Alternative	Restoration Type alternatives	Physical resources				Biological resources			Socioeconomic resources								
		Geology and substrates	Hydrology and water quality	Air quality/GHGs*	Noise*	Habitats and Wildlife species (birds and terrestrial species)	Marine and estuarine resources	Protected species	Socioeconomics / EJ*	Cultural resources*	Tourism and recreational use*	Aesthetic and visual resources*	Infrastructure*	Fisheries and aquaculture*	Land and marine management*	Marine transportation*	Public health and safety, including flood and shoreline protection*
1	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale), Component 3: MS	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+/s	NI	NI	s
1	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale), Component 4: AL	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+/s	NI	NI	s
1	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale), Component 5: FL	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+/s	NI	NI	s
2	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale), Component 1: TX	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+/s	NI	NI	s
2	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale), Component 2: LA	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+/s	NI	NI	s
2	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale), Component 3: MS	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+/s	NI	NI	s
2	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale), Component 4: AL	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+/s	NI	NI	s

Alternative	Restoration Type alternatives	Physical resources				Biological resources			Socioeconomic resources								
		Geology and substrates	Hydrology and water quality	Air quality/GHGs*	Noise*	Habitats and Wildlife species (birds and terrestrial species)	Marine and estuarine resources	Protected species	Socioeconomics / EJ*	Cultural resources*	Tourism and recreational use*	Aesthetic and visual resources*	Infrastructure*	Fisheries and aquaculture*	Land and marine management*	Marine transportation*	Public health and safety, including flood and shoreline protection*
2	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale), Component 5: FL	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+/s	NI	NI	s
Sea Turtles Restoration Type projects																	
1	Pilot Implementation of Automatic Identification System (AIS) in the GOM Inshore Shrimp Fishery to Inform Efforts to Reduce Sea Turtle Bycatch	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
2	Restore and Enhance Sea Turtle Nest Productivity	+/S/l	S/l	s	s	+/S	+/s	+/s	+	NI	+	NI	NI	NI	NI	NI	s
3	Guiding Restoration Success for Nesting Females and Hatchlings in the Northern Gulf of Mexico	s	NI	s	s	s	NI	+/s/l	+	NI	+	NI	NI	NI	NI	NI	s
4	Reducing Sea Turtle Bycatch at Recreational Fishing Sites	NI	NI	NI	NI	NI	NI	+/s	+	NI	+	NI	NI	NI	NI	NI	s
5	Reducing Marine Debris Impacts on Birds and Sea Turtles *(joint project with Birds Restoration Type)*	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	NI	NI	NI	s

Alternative	Restoration Type alternatives	Physical resources				Biological resources			Socioeconomic resources								
		Geology and substrates	Hydrology and water quality	Air quality/GHGs*	Noise*	Habitats and Wildlife species (birds and terrestrial species)	Marine and estuarine resources	Protected species	Socioeconomics / EJ*	Cultural resources*	Tourism and recreational use*	Aesthetic and visual resources*	Infrastructure*	Fisheries and aquaculture*	Land and marine management*	Marine transportation*	Public health and safety, including flood and shoreline protection*
6	Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation, Component 1: Enhancing Response Coordination, and Preparedness in the Gulf of Mexico	l	s	s	s	s/l	L	+/l	+	Nl	+	Nl	Nl	Nl	Nl	Nl	s
6	Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation, Component 2: Texas Rehabilitation Facility	l	s	s	s	s/l	s	+/s	+	Nl	+	Nl	Nl	Nl	Nl	Nl	s
No Action		l	l	l	L	L	L	L	l	*/l	l	l	l	l	l	l	l

Document Organization

This RP/EA includes the following chapters and appendices.

Chapter 1: Introduction, Purpose and Need, Proposed Action, and Public Participation. This chapter introduces and provides context for this RP/EA.

Chapter 2: Restoration Planning Process. This chapter provides background on the NRDA restoration planning process, a summary of injuries to resources the Regionwide TIG addresses in this RP/EA, and a description of the process for screening restoration projects and developing a reasonable range of alternatives. This chapter also provides detailed descriptions of the reasonable range of alternatives considered in this RP/EA.

Chapter 3: OPA Evaluation of Alternatives. This chapter presents an evaluation of the reasonable range of alternatives using OPA NRDA regulation evaluation factors. The chapter also describes how the Regionwide TIG selected the preferred restoration alternatives.

Chapter 4: Environmental Assessment. This chapter presents discussion of the affected environment and the environmental impacts that could result from implementation of the reasonable range of alternatives. It describes the basis for supplementary NEPA analysis, and issues related to compliance with federal and state environmental protection laws that may apply to the preferred alternatives.

References: This is a list of literature cited in Chapters 1–4 of this RP/EA.

Appendix A: Draft Monitoring and Adaptive Management (MAM) Plans. This appendix includes draft MAM plans for restoration alternatives that the Regionwide TIG has identified as preferred.

Appendix B: Impact Thresholds. This appendix presents guidelines for NEPA impact determination.

Appendix C: List of Preparers and Reviewers and Acknowledgments. This appendix lists individuals who contributed substantively to the development of this RP/EA.

Appendix D: List of Repositories for the Regionwide RP/EA. This appendix provides a list of the libraries, offices, and other facilities that will hold a hard copy of this RP/EA.

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List of Acronyms and Abbreviations

ADCNR	Alabama Department of Conservation and Natural Resources
AEPs	auditory evoked potentials
AIS	automatic identification system
AMRD	Alabama Marine Resources Division
BLM	Bureau of Land Management
BMPs	best management practices
BP	BP Exploration and Production, Inc.
CEQ	Council on Environmental Quality
CETACEAN	Compilation of Environmental, Threats, and Animal Data for Cetacean Population Health Analyses
C.F.R.	Code of Federal Regulations
CPRA	Louisiana Coastal Protection and Restoration Authority
CZMA	Coastal Zone Management Act
DIVER	Data Integration Visualization Exploration and Reporting
DOC	U.S. Department of Commerce
DOI	U.S. Department of the Interior
DPS	Distinct Population Segment
DWH	*Deepwater Horizon*
E&D	engineering and design
EJ	environmental justice
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FDEP	Florida Department of Environmental Protection
FMP	fishery management plan
F.R.	*Federal Register*
FWC	Florida Fish and Wildlife Conservation Commission
GHGs	greenhouse gases
GIWW	Gulf Intracoastal Waterway
GOM	Gulf of Mexico
GoMAMN	Gulf of Mexico Avian Monitoring Network
GOMESA	Gulf of Mexico Energy Security Act

GMFMC	Gulf of Mexico Fishery Management Council
GSA	Geological Survey of Alabama
GulfMAP	Gulf of Mexico Marine Mammal Health Monitoring and Analysis Platform
HAZWOPER	Hazardous Waste Operations and Emergency Response
LCMRs	living coastal and marine resources
LDEQ	Louisiana Department of Environmental Quality
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
LOSCO	Louisiana Oil Spill Coordinator's Office
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MAM	monitoring and adaptive management
MDEQ	Mississippi Department of Environmental Quality
MMHSRP	Marine Mammal Health and Stranding Response Program
MMPA	Marine Mammal Protection Act of 1972
MMSN	Marine Mammal Stranding Network
MSC	Matagorda Ship Channel
N/A	not applicable
NAAQS	National Ambient Air Quality Standards
NAVD	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act
NFWF-GEBF	National Fish and Wildlife Foundation's Gulf Environmental Benefit Fund
NGOs	nongovernmental organizations
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPS	National Park Service
NRC	National Research Council
NRDA	Natural Resource Damage Assessment
NWR	National Wildlife Refuge
O&M	operations and maintenance
OPA	Oil Pollution Act of 1990

PDARP/PEIS	*Deepwater Horizon* Oil Spill Final Programmatic Damage Assessment and Restoration Plan/Programmatic Environmental Impact Statement
PM	particulate matter
RESTORE	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States (Act)
ROD	Record of Decision
RP/EA	(Draft) Restoration Plan and Environmental Assessment 1: Birds, Marine Mammals, Oysters, and Sea Turtles
SAV	submerged aquatic vegetation
SHPO	State Historic Preservation Office
SOPs	Standard Operating Procedures
STNCC	Sea Turtle Nesting Coordination Committee
STSSN	Sea Turtle Stranding and Salvage Network
TCEQ	Texas Commission on Environmental Quality
TGLO	Texas General Land Office
TIG	Trustee Implementation Group
TNC	The Nature Conservancy
TPWD	Texas Parks and Wildlife Department
UME	unusual mortality event
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
VMSs	vessel monitoring systems

1. Introduction, Purpose and Need, Proposed Action, and Public Participation

The *Deepwater Horizon* (DWH) oil spill Regionwide Trustee Implementation Group (TIG) prepared this Draft Restoration Plan and Environmental Assessment 1: Birds, Marine Mammals, Oysters, and Sea Turtles (RP/EA) to address injuries to natural resources in the Regionwide Restoration Area[1] as a result of the DWH oil spill. The Regionwide TIG is responsible for restoring natural resources and their services that were injured by the DWH oil spill within the Regionwide Restoration Area. The Regionwide TIG prepared this RP/EA to (1) inform the public about DWH Natural Resource Damage Assessment (NRDA) restoration planning efforts, (2) present analyses of projects[2] proposed to restore target Restoration Types, and (3) seek public comment on the restoration alternatives considered in this document. The purpose of restoration discussed in this RP/EA and detailed in the 2016 *Deepwater Horizon* Oil Spill Final Programmatic Damage Assessment and Restoration Plan/Programmatic Environmental Impact Statement (PDARP/PEIS)[3] is to make the environment and the public whole for injuries resulting from the DWH oil spill. The DWH Trustees will accomplish this by implementing restoration actions that return injured natural resources and services to baseline conditions and compensate for interim losses, in accordance with the Oil Pollution Act of 1990 (OPA) and associated NRDA regulations.

The following federal and state agencies are the designated Trustees under OPA for the DWH oil spill and are included in the Regionwide TIG:

- U.S. Department of the Interior (DOI), represented by the U.S. Fish and Wildlife Service (USFWS), the National Park Service (NPS), and the Bureau of Land Management (BLM);
- National Oceanic and Atmospheric Administration (NOAA), on behalf of the U.S. Department of Commerce (DOC);
- U.S. Department of Agriculture (USDA);
- U.S. Environmental Protection Agency (EPA);
- The state of Alabama: Department of Conservation and Natural Resources (ADCNR) and Geological Survey of Alabama (GSA);
- The state of Florida: Department of Environmental Protection (FDEP) and Fish and Wildlife Conservation Commission (FWC);
- The state of Louisiana: Coastal Protection and Restoration Authority (CPRA), Department of Natural Resources (LDNR); Department of Environmental Quality (LDEQ); Oil Spill Coordinator's Office (LOSCO); and Department of Wildlife and Fisheries (LDWF);

1. The Regionwide TIG's work in the Regionwide Restoration Area replenishes and protects marine mammals, sea turtles, birds, and oysters. Natural resources affected by the DWH oil spill often live and migrate across jurisdictional boundaries; therefore, Regionwide Restoration Area projects will be implemented across jurisdictional boundaries.

2. For the purposes of this RP/EA, each proposed project is considered a separate alternative. The terms "project" and "alternative" may be used interchangeably in this document.

3. The PDARP/PEIS and the Record of Decision are available at www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan/.

- The state of Mississippi: Department of Environmental Quality (MDEQ); and
- The state of Texas: Parks and Wildlife Department (TPWD), General Land Office (TGLO), and Commission on Environmental Quality (TCEQ).

The Council on Environmental Quality (CEQ) National Environmental Policy Act (NEPA) implementing regulations require a federal agency to serve as lead agency to supervise the NEPA analysis when more than one federal agency is involved in the same action (40 Code of Federal Regulations [C.F.R.] 1501.5). NOAA serves as the lead federal agency responsible for NEPA compliance for this RP/EA, ensuring its compliance with CEQ NEPA implementing regulations and NOAA NEPA implementing procedures (NOAA 2016a). The other Regionwide TIG Trustees are participating as cooperating agencies pursuant to NEPA (40 C.F.R. 1508.5) and the Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the *Deepwater Horizon* (DWH) Oil Spill (Trustee SOPs).[4]

1.1 Intent to Adopt the RP/EA NEPA Analysis by Cooperating Agencies

Each federal cooperating agency on the Regionwide TIG intends to adopt the NEPA analysis in this RP/EA. In accordance with 40 C.F.R. 1506.3(a), each of the three federal cooperating agencies participating on the Regionwide TIG (DOI, EPA, USDA) will review this RP/EA for adequacy in meeting the standards set forth in its own NEPA implementing procedures. Each agency will then decide whether to adopt the analysis to inform its own federal decision-making and fulfill its responsibilities under NEPA. Adoption of the EA would be completed via signature on the relevant NEPA decision document. More information about OPA and NEPA, as well as their application to DWH oil spill restoration planning, can be found in Chapters 5 and 6 of the PDARP/PEIS.

1.2 Background and Summary of Settlement

In February 2016, and in response to the April 20, 2010 DWH oil spill, the Trustees released the PDARP/PEIS, which details a proposed plan to select and implement restoration projects across the Gulf of Mexico region over a 15-year period. As a programmatic restoration plan, the PDARP/PEIS provides direction and guidance for identifying, evaluating, and selecting future restoration projects to be carried out by the TIGs (Section 5.10.4 and Chapter 7 of the PDARP/PEIS). This RP/EA and other future restoration plans tier from the PDARP/PEIS.

As part of the DWH settlement, BP Exploration and Production, Inc. (BP) agreed to pay a total of $8.1 billion in natural resource damages (inclusive of Early Restoration funding) over a 15-year period, and up to an additional $700 million for adaptive management or to address natural resource injuries that may become apparent in the future. The settlement allocated specific sums for restoration within specific Restoration Areas and Restoration Types. Table 1-1 provides the final settlement allocation for the Regionwide Restoration Area. Section 2.1.1 provides more information about the Restoration Types included in this RP/EA.

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4. The Trustee SOPs are available at: www.gulfspillrestoration.noaa.gov/sites/default/files/wp-content/uploads/DWH-SOPs.pdf.

Table 1-1. Allocation of DWH settlement funds for the Regionwide Restoration Area by restoration goal and Restoration Type

Restoration goal	Restoration Type	Regionwide Early Restoration funds	Regionwide post-settlement funds	Total restoration funding
Replenish and Protect Living Coastal and Marine Resources	Birds	$1,823,100	$70,400,000	$72,223,100
	Marine Mammals	$0	$19,000,000	$19,000,000
	Oysters	$0	$64,372,413	$64,372,413
	Sea Turtles	$29,256,165	$60,000,000	$89,256,165
Monitoring and Adaptive Management (MAM)	Not applicable	$0	$65,000,000	$65,000,000
Administrative Oversight and Comprehensive Planning	Not applicable	$0	$40,000,000	$40,000,000

1.3 DWH Trustees, Trustee Council, and TIGs

Under the authority of OPA, a council of federal and state Trustees was established on behalf of the public to assess natural resource injuries resulting from the DWH oil spill and to work to make the environment and public whole for those injuries. The Trustees act on behalf of the public to (1) assess the natural resource injuries resulting from the oil spill, and (2) develop and implement a restoration plan that would make the environment and public whole for those injuries. Trustees fulfill these responsibilities by developing restoration plans, providing the public with an opportunity to suggest restoration project ideas and to review and comment on the proposed plans, implementing and monitoring restoration projects, managing NRDA funds, and documenting Trustee decisions through a public administrative record. The Trustees are responsible for the governance of restoration planning. To work collaboratively on the NRDA, the Trustees organized a Trustee Council composed of Designated Natural Resource Trustee Officials, or their alternates, for each Trustee agency. For more information on the Trustee Council, including the federal and state agencies that are designated Trustees under OPA for the DWH oil spill, see Chapter 7 of the PDARP/PEIS, incorporated by reference herein.

1.4 Authorities and Regulations

1.4.1 OPA

The DWH oil spill was subject to the provisions of OPA (33 United States Code [U.S.C.] 2701 et seq.), which addresses preventing and responding to oil pollution incidents in navigable waters, adjoining shorelines, and the exclusive economic zone of the United States. The primary goal of OPA is to make the environment and public whole for injuries to natural resources and services resulting from an incident involving an oil discharge (or substantial threat of an oil discharge).

1.4.2 NEPA

Federal Trustees must comply with NEPA and CEQ's NEPA implementing regulations, 40 C.F.R. 1500–1508, when proposing restoration projects. NEPA requires federal agencies to consider the potential environmental impacts of proposed actions. NEPA provides a mandate and framework for federal agencies to determine whether their proposed actions have significant environmental effects[5] and related social and economic effects, consider these effects when choosing between alternative approaches, and inform and involve the public in the environmental analysis and decision-making process.

On July 1, 2020, a notice of initiation was issued and the Regionwide TIG began developing the environmental assessment for this RP/EA prior to the September 20, 2020 effective date for CEQ's Update to the NEPA Regulations (Update to the Regulations Implementing the Procedural Provisions of the National Environmental Policy Act, 85 F. R. 43304; July 16, 2020). Therefore, as permitted by the Update, the Regionwide TIG prepared the environmental assessment according to the 1978 CEQ NEPA regulations that were in effect prior to the Update (40 C.F.R. 1506.13).

In this RP/EA, the Regionwide TIG addresses these requirements by tiering environmental analyses conducted in the PDARP/PEIS; evaluating existing analyses; and, where applicable, incorporating by reference into this RP/EA relevant information and analyses from existing project environmental assessments and conservation plans. Tiering and incorporating by reference from existing analyses reduces redundancy, focuses on issues of significance, and shows the interconnection of the proposed alternatives with existing programs and regional efforts to address resource issues at an ecosystem level. All materials incorporated, adopted, or otherwise used to support the NEPA analysis are publicly available. See Chapter 4 in this RP/EA for more information about tiering and incorporating by reference under NEPA, and how it applies to this RP/EA.

As part of the planning process for the Regionwide TIG, this RP/EA identifies a reasonable range of restoration alternatives to continue addressing DWH injuries to the Birds, Marine Mammals, Oysters, and Sea Turtles Restoration Types; evaluates them under OPA and NEPA; and identifies a subset of alternatives that the Regionwide TIG prefers for implementation.

1.5 Restoration Purpose and Need

The PDARP/PEIS identifies extensive and complex injuries to natural resources and services across the Gulf of Mexico, as well as a need and plan for comprehensive restoration. The purpose of restoration is to make the environment and the public whole for injuries resulting from the incident by implementing restoration actions that return injured natural resources and services to baseline conditions, and compensate for interim losses in accordance with the OPA and associated NRDA regulations. This RP/EA falls within the scope of the purpose and need identified in the PDARP/PEIS. Consistent with the purpose defined in the PDARP/PEIS, the Regionwide TIG has undertaken this restoration planning effort to address injuries to natural resources in the Regionwide Restoration Area by the restoration of birds, marine mammals, oysters, and sea turtles.

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5. "Effects and impacts as used in these regulations are synonymous. Effects includes ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial" (40 C.F.R. 1508.8).

Section 5.3 of the PDARP/PEIS identifies and describes five programmatic goals for restoration work. These programmatic goals work independently and together to benefit injured resources and services. The programmatic goal addressed in this RP/EA is to "Replenish and Protect Living Coastal and Marine Resources."

Consistent with the programmatic goals, the DWH Trustees identified 13 Restoration Types in the PDARP/PEIS (Sections 5.5.2–5.5.14). These specific Restoration Types help guide restoration planning and project selection to accomplish the programmatic restoration goals. This RP/EA addresses the Birds, Marine Mammals, Oysters, and Sea Turtles Restoration Types (PDARP/PEIS Sections 5.5.12, 5.5.11, 5.5.9, and 5.5.10, respectively). Additional information about the purpose and need for DWH NRDA restoration is available in Section 5.3.2 of the PDARP/PEIS.

1.6 Phasing of Alternatives

The PDARP/PEIS provides a structure for TIGs to implement alternatives utilizing a phased approach. For example, a TIG may propose funding a planning phase (e.g., collection/analysis of data critical to the restoration planning process, conducting a planning project or feasibility study, or undertaking engineering and design [E&D] work) in a restoration plan, which would allow TIGs to develop alternatives to the extent necessary to fully consider an implementation phase in a subsequent restoration plan. A phased approach can inform restoration implementation and maximize restoration benefits. Under 15 C.F.R. 990.54(c), planning projects are only to be undertaken when, in the judgment of the Trustees, these projects would provide the information at a reasonable cost and in a reasonable timeframe. Sections 4.1.1–4.1.3 of the PDARP/PEIS discuss phasing as applied in this RP/EA.

1.7 Proposed Action

To address the Trustee programmatic restoration goals and Restoration Type-specific goals described in the PDARP/PEIS, the Regionwide TIG proposes to implement 11 preferred alternatives identified in this RP/EA (Table 1-2), using funds made available through the DWH Consent Decree.

1.8 Reasonable Range of Alternatives

Restoration alternatives in this RP/EA were developed through a review of project ideas that the public and Trustee agencies submitted to the Trustee project portal[6] and to individual state DWH portals. Public involvement is an important component of restoration planning (see Section 1.7 of the PDARP/PEIS and Section 1.12 in this RP/EA). Chapter 2 of this RP/EA summarizes the screening process used to develop the reasonable range of alternatives. This process enables the Trustees to carry out their selected programmatic alternative identified in the PDARP/PEIS, and is consistent with the Consent Decree and OPA. In total, the Regionwide TIG proposes 15 projects as a reasonable range of alternatives in this RP/EA. This includes a joint project between the Birds and Sea Turtles Restoration Types, which is counted only once in this total.

Table 1-2 lists the alternatives considered and their estimated costs, and identifies the alternatives that the Regionwide TIG identified as preferred in this RP/EA. Chapters 2, 3, and 4 of this RP/EA describe the reasonable range of alternatives in more detail.

6. The DWH project portal is available at www.gulfspillrestoration.noaa.gov/restoration/give-us-your-ideas.

Table 1-2. Reasonable range of alternatives considered in this RP/EA

Alternative	Estimated project cost	Preferred
Birds		
Alternative 1: Reducing Marine Debris Impacts on Birds and Sea Turtles *(joint project with Sea Turtles Restoration Type)*	$3,520,000	X
Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds	$22,500,000	X
Component 1: Chandeleur Islands, LA	$8,000,000	
Component 2: Pilot Town/Little Dauphin Island, AL	$6,500,000	
Component 3: San Antonio Bay Bird Island, TX	$2,500,000	
Component 4: Matagorda Bay Bird Island (Chester Island), TX	$2,500,000	
Component 5: Round Island, MS	$3,000,000	
Alternative 3: Bird Nesting and Foraging Area Stewardship	$8,510,750	X
Alternative 4: Stewardship and Habitat Creation through Beneficial Use	$6,500,000	
Component 1: Walker Island, AL	$4,000,000	
Component 2: Matagorda Bay Bird Island (Chester Island), TX	$2,500,000	
Marine Mammals		
Alternative 1: Voluntary Modifications to Commercial Shrimp Lazy Lines to Reduce Dolphin Entanglements	$3,179,088	X
Alternative 2: Reducing Impacts to Dolphins from Hook-and-Line Gear and Provisioning through Fishery Surveys, Social Science, and Collaboration	$1,700,000	X
Alternative 3: Enhance Marine Mammal Stranding Network Diagnostic Capabilities and Consistency across the Gulf of Mexico	$2,300,000	X
Alternative 4: Enhance Capacity, Diagnostic Capability, and Consistency of the Marine Mammal Stranding Network in the Gulf of Mexico	$7,887,000	
Oysters		
Alternative 1: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale)	$35,819,974	X
Component 1: East Galveston Bay, TX		
Component 2: Biloxi Marsh, LA		
Component 3: Heron Bay, MS		
Component 4: Mid-lower Mobile Bay, AL		
Component 5: Suwannee Sound, FL		
Alternative 2: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale)	$22,300,000	
Component 1: East Galveston Bay, TX		
Component 2: Biloxi Marsh, LA		
Component 3: Heron Bay, MS		
Component 4: Mid-lower Mobile Bay, AL		
Component 5: Suwannee Sound, FL		

Alternative	Estimated project cost	Preferred
Sea Turtles		
Alternative 1: Pilot Implementation of Automatic Identification System (AIS) in the GOM Inshore Shrimp Fishery to Inform Efforts to Reduce Sea Turtle Bycatch	$2,231,124	X
Alternative 2: Restore and Enhance Sea Turtle Nest Productivity	$7,655,000	X
Alternative 3: Guiding Restoration Success for Nesting Females and Hatchlings in the Northern Gulf of Mexico	$4,446,000	
Alternative 4: Reducing Sea Turtle Bycatch at Recreational Fishing Sites	$3,649,360	X
Alternative 5: Reducing Marine Debris Impacts on Birds and Sea Turtles *(joint project with Birds Restoration Type)*	$3,520,000	X
Alternative 6: Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation	$5,050,000	X
Component 1: Enhancing Response, Coordination, and Preparedness in the Gulf of Mexico	$2,050,000	
Component 2: Texas Rehabilitation Facility	$3,000,000	

GOM – Gulf of Mexico

1.9 Natural Recovery/No Action Alternative

Under the Natural Recovery/No Action Alternative, the Regionwide TIG would not select or implement any of the restoration alternatives proposed in this RP/EA. In the PDARP/PEIS the DWH Trustees analyzed the Natural Recovery/No Action Alternative programmatically and found that it would not meet the purpose and need for restoring lost natural resources and their services. A No Action Alternative is included in the RP/EA analysis pursuant to NEPA as a "… benchmark, enabling decision makers to compare the magnitude of environmental effects of the action alternatives.[7]" See Section 2.6 for more details.

1.10 Severability

The alternatives identified in this RP/EA are independent of each other and may be individually selected by the Regionwide TIG. A decision not to select one or more of the alternatives does not affect the Regionwide TIG's selection of any remaining alternatives. Alternatives not included in the proposed action for this RP/EA may be considered by the Regionwide TIG or other TIGs for inclusion in future restoration plans.

1.11 Coordination with Other Gulf of Mexico Restoration Programs

As discussed in Section 1.5.6 of the PDARP/PEIS, the Regionwide TIG is committed to coordinating with other Gulf of Mexico restoration programs to maximize the overall ecosystem impact of DWH NRDA restoration efforts. This coordination will help ensure that funds are allocated for critical restoration projects across the affected regions of the Gulf of Mexico and within the Regionwide Restoration Area.

7. CEQ. 03/23/81. Council on Environmental Quality – Forty Most Asked Questions Concerning CEQ's NEPA Regulations.

Throughout the restoration planning process, the Regionwide TIG has coordinated with, and will continue to coordinate with, the other DWH TIGs, and other DWH oil spill and Gulf of Mexico restoration programs, including the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States (RESTORE) Act programs; and the National Fish and Wildlife Foundation's Gulf Environmental Benefit Fund (NFWF-GEBF). The Regionwide TIG seeks to develop synergies with these programs when possible to ensure the most effective use of available funds for maximum ecosystem and resource benefits.

1.12 Public Participation

The Trustees have sought public input into the DWH restoration planning process in a variety of ways. The Trustees conducted an extensive public outreach process during PDARP/PEIS development. Chapter 8 of the PDARP/PEIS describes that process and associated public comments. The Trustees continue to engage with the public through the reviews of restoration plans, TIG and Trustee Council annual meetings, and other public engagements.

1.12.1 Public Involvement in this Draft RP/EA

The Regionwide TIG issued a Notice of Opportunity for Public Input of Project Ideas[8] (referred to in this RP/EA as a "call for project ideas") on September 24, 2019, and issued a notice of initiation of restoration planning on July 1, 2020.

After reviewing and evaluating project ideas (described in Chapter 2 of this RP/EA), the Regionwide TIG developed this RP/EA to (1) inform the public about DWH NRDA restoration planning efforts in the Regionwide Restoration Area, (2) present analyses of potential restoration benefits and environmental consequences of the restoration alternatives, and (3) seek public comment.

The public is encouraged to review and comment on this RP/EA during the 45-day comment period following public notice of availability. Comments can be submitted during the comment period by one of the following methods:

Online**:** www.gulfspillrestoration.noaa.gov/restoration-areas/regionwide.

By mail**:** Hard copy addressed to U.S. Fish and Wildlife Service, P.O. Box 29649, Atlanta, GA 30345.

To be considered, mailed comments must be postmarked on or before the comment deadline specified in the *Federal Register* and on the DWH Trustee website.

During the virtual public meetings**:** The Regionwide TIG will hold two virtual public meetings to facilitate the public review and comment process. A weblink for the public meetings will be available on the DWH Trustee website. The public meetings will take place as follows:

> **Thursday, April 15, 2021, at 2:00 pm U.S. Central Time and 6:00 pm U.S. Central Time.**

8. The Notice of Opportunity for Public Input of Project Ideas is available at: www.gulfspillrestoration.noaa.gov/2019/09/submit-your-ideas-region-wide-trustee-implementation-group-restoration-planning.

After the comment period closes, the Regionwide TIG will consider all public comments and revise the RP/EA as appropriate. A summary of comments and the Regionwide TIG's responses, where applicable, will be included in the final RP/EA.

1.12.2 Decisions to Be Made and Next Steps

This RP/EA intends to provide the public with information and analyses needed to enable meaningful review and comment on the Regionwide TIG's proposal to proceed with selection and implementation of one or more of the alternatives proposed in this RP/EA.

The public, government agencies, and other entities have identified and continue to identify potential restoration project ideas for consideration during the restoration planning process. Alternatives that are not included in the proposed action, not identified as preferred at this time, or not selected for implementation may be considered for inclusion in future restoration plans developed by the Regionwide TIG or other TIGs.

1.12.3 DWH Administrative Record

The Trustees opened a publicly available Administrative Record for the DWH oil spill NRDA, including restoration planning activities, concurrently with publication of the 2010 Notice of Intent (NOI; pursuant to 15 C.F.R. 990.45). DOI, as the lead administrative Trustee, maintains the Administrative Record.[9]

Information about restoration project implementation is provided to the public through the Administrative Record and other outreach efforts, including Trustee websites.

9. The DWH Administrative Record is available at www.doi.gov/deepwaterhorizon/adminrecord.

2. Restoration Planning Process

NRDA restoration under OPA involves evaluating injuries to natural resources and natural resource services to determine the types and extent of restoration necessary to address the injuries. Restoration activities need to produce benefits that are related to, or have a connection with, natural resource injuries and service losses resulting from an oil spill. The DWH Trustees must identify a reasonable range of restoration alternatives and then evaluate those proposed alternatives. The OPA NRDA regulations (15 C.F.R. 990.54) provide criteria used by Trustees to evaluate projects that compensate the public for injuries caused by oil spills. Consistent with OPA regulations (15 C.F.R. 990.53), the Regionwide TIG used a screening process to develop the reasonable range of alternatives evaluated in this RP/EA.

This chapter describes the Regionwide TIG's screening process for developing the reasonable range of alternatives for the Birds, Marine Mammals, Oysters, and Sea Turtles Restoration Types. The reasonable range of alternatives is consistent with the Trustees' selected programmatic alternative and goals identified in the PDARP/PEIS. Consequently, this chapter also summarizes the restoration decisions established in the PDARP/PEIS and Record of Decision (ROD),[10] the relationship of the PDARP/PEIS to this RP/EA and the injuries addressed in it, and the project ideas considered for inclusion in the reasonable range of alternatives. The Regionwide TIG also conducted this restoration planning process in accordance with the Consent Decree, Trustee SOPs, Strategic Frameworks for Restoration Activities, and OPA and NEPA regulations.

2.1 PDARP/PEIS and ROD

On February 19, 2016, the DWH Trustees issued the PDARP/PEIS, which details a programmatic plan to fund and implement restoration projects, to fully allocate the settlement funds that BP is paying out over a 15-year period. Based on the Trustees' assessment of injuries to natural resources in the Gulf of Mexico, the PDARP/PEIS provides a comprehensive, integrated ecosystem restoration approach for implementation.

On March 29, 2016, in accordance with OPA and NEPA, the Trustees published a Notice of Availability of a ROD for the PDARP/PEIS in the *Federal Register* (81 F.R. 17438). Based on the Trustees' injury determination established in the PDARP/PEIS, the ROD sets forth the basis for the Trustees' decision to select Alternative A: Comprehensive Integrated Ecosystem Alternative (DWH NRDA Trustees 2016c).

2.1.1 Relationship of this RP/EA to the PDARP/PEIS

As a programmatic document, the PDARP/PEIS provides direction and guidance for identifying, evaluating, and selecting future restoration projects that the TIGs will implement (see Section 5.10.4 and Chapter 7 of the PDARP/PEIS). The PDARP/PEIS analysis indicates that injuries caused by the DWH oil spill cannot be fully described at the level of an individual species, habitat type, or geographic region.

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[10] The PDARP/PEIS and ROD are available at www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan/.

The Trustees found that extensive injuries to multiple species, habitats, ecological functions, and regions established the need for comprehensive, ecosystem-scale restoration planning.

The Trustees considered this ecosystem context in deciding how best to restore the vast array of resources and services injured by the spill. As Section 1.11 of this RP/EA describes, the PDARP/PEIS employed a comprehensive, integrated ecosystem approach to address these ecosystem-level injuries, while maximizing benefits to injured resources by seeking synergies and building on previous and current planning efforts across Gulf of Mexico restoration programs.

The Consent Decree established a set of Restoration Types that Trustees include in the programmatic alternatives. The Trustees' intent was to identify a diverse set of projects that benefit a broad range of injured resources and services. Ultimately the Trustees identified 13 Restoration Types under 5 programmatic restoration goals in the PDARP/PEIS. The alternatives included in this RP/EA (see Table 1-2 in Section 1.8) are consistent with the restoration approaches described for the four Regionwide TIG Restoration Types (Birds, Marine Mammals, Oysters, and Sea Turtles) associated with the Trustees' programmatic restoration goal to Replenish and Protect Living Coastal and Marine Resources (Table 2-1), as described in Sections 5.5.9–5.5.12 in the PDARP/PEIS.

Table 2-1. Programmatic restoration goal and associated Restoration Types assigned to the Regionwide Restoration Area in the PDARP/PEIS. Bold text in the right-hand column indicates Restoration Types addressed in this RP/EA.

Programmatic restoration goal	Regionwide Restoration Type
Replenish and Protect Living Coastal and Marine Resources	Fish and Water Column Invertebrates
	Sturgeon
	Submerged Aquatic Vegetation
	Birds
	Marine Mammals
	Oysters
	Sea Turtles
	Mesophotic and Deep Benthic Communities

2.2 Summary of Injuries Relevant to this RP/EA

The DWH oil spill introduced numerous contaminants into the environment. Estimated releases included 3.19 million barrels of oil and 7.7 billion standard cubic feet of natural gas discharged into the deep sea, 1.84 million gallons of chemical dispersants used in response to the spill, and an unknown volume (up to 30,000 barrels) of synthetic-based drilling mud released during the blowout and response efforts (Chapter 4 of the PDARP/PEIS). Each of these contaminants introduced chemicals of known and unknown toxicity into the northern Gulf of Mexico. Natural weathering processes (e.g., photooxidation) and intentional burning of the floating oil at sea formed additional contaminants of known and unknown toxicity.

Chapter 4 of the PDARP/PEIS summarizes the injury assessment and documents the nature, degree, and extent of injuries to natural resources and the services they provide. Restoration projects proposed in this RP/EA and in future Regionwide TIG RP/EAs aim to address injuries from the DWH oil spill in the Regionwide Restoration Area.

The sections below summarize the injury assessment from Chapter 4 of the PDARP/PEIS, with specific reference to regionwide living coastal and marine resources (LCMRs) that informed the restoration alternatives in this RP/EA.

2.2.1 Injury to Birds

Section 4.7 of the PDARP/PEIS describes the Trustees' evaluation of injuries to birds. Because of the magnitude of the DWH oil spill, the Trustees were not able to document nor quantify the full scope of injury to birds. However, they collected more than 8,500 dead and oil-impaired birds during the assessment. More than 3,000 live birds were sent to rehabilitation centers; despite responders' tremendous efforts, more than half of these birds were too compromised to survive. The Trustees recognized that these collected birds represent only a fraction of true mortality.

At least 93 resident and migratory species of birds across all five Gulf of Mexico states were exposed to DWH oil in northern Gulf of Mexico habitats, including open water, barrier islands, beaches, bays, and marshes. Controlled laboratory studies helped the Trustees understand the array of avian health effects resulting from exposure to DWH oil, including feather damage, abnormal blood attributes, organ damage, and death.

The Trustees estimated that between 51,600 and 84,500 birds died because of the DWH oil spill. Of those dead birds, breeding age adults would have produced an estimated additional 4,600 to 17,900 fledglings in 2010 and 2011. As the PDARP/PEIS describes, multiple factors likely led to an underestimation of mortality; therefore, the total injury was likely substantially higher. The magnitude of the injury and the number of species affected set the DWH oil spill apart as an unprecedented human-caused injury to birds in the region.

2.2.2 Injury to Marine Mammals

Section 4.9 of the PDARP/PEIS describes the Trustees' evaluation of injuries to marine mammals. The diverse number of species and geographic range of marine mammals affected by the spill is unprecedented. All marine mammals are federally protected under the Marine Mammal Protection Act of 1972 (MMPA). Sperm whales (*Physeter macrocephalus*) and Gulf of Mexico Bryde's whales (*Balaenoptera edeni*) are the only endangered cetacean species that inhabit the Gulf of Mexico, and therefore have additional protection under the Endangered Species Act (ESA). The DWH oil spill contaminated prime marine mammal habitat in the nearshore and offshore waters of the northern Gulf of Mexico. After inhaling, ingesting, aspirating, and potentially absorbing oil components, animals suffered from physical damage and toxic effects to a variety of organs and tissues, including lung disease, adrenal disease, poor body condition, suppression of the immune system, and a suite of other adverse health effects.

Animals that succumbed to these adverse health effects contributed to the largest and longest marine mammal unusual mortality event (UME) on record in the northern Gulf of Mexico. The dead, stranded dolphins in the UME included near-term fetuses from failed pregnancies. Nearly all marine mammal stocks that overlap with the DWH oil spill footprint had demonstrable, quantifiable injuries. For example, the Barataria Bay and Mississippi Sound bottlenose dolphin (*Tursiops truncatus truncatus*) stocks were two of the most severely injured populations, with a 51% and 62% reduction in their population sizes, respectively. Dolphins are long-lived animals, and slow to reach reproductive maturity; without active restoration, these stocks will take approximately 40 to 50 years to recover (DWH MMIQT 2015).

2.2.3 Injury to Oysters

Section 4.6 of the PDARP/PEIS describes the Trustees' evaluation of injuries to oysters. The DWH oil spill adversely affected oysters along hundreds of miles of oiled shoreline. In addition, summer river water releases that occurred as a part of the response to the DWH oil spill adversely affected oysters causing direct mortality and subsequent reproductive failure.

These reductions in the spawning stock of oysters in the northern Gulf of Mexico will affect reproduction and recruitment over multiple generations. The Trustees estimated total losses of oysters from death and reproductive impairment over 7 years (or three generations) to be 4 to 8.3 billion adult equivalents.

The dramatic decreases in oyster densities and the associated reproductive injury imperils the sustainability of oysters in the northern Gulf of Mexico. Further, oyster reefs and beds serve as feeding and foraging habitats for other organisms such as seabirds, shellfish, crabs, and finfish. Therefore, a loss of oysters will have cascading adverse effects on all of these organisms and the functions they support. Oysters also contribute to water quality and clarity through their filtering action, and a reduction in the oyster population could result in a reduction in filtering capacity.

2.2.4 Injury to Sea Turtles

Section 4.8 of the PDARP/PEIS discusses the Trustees' evaluation of injuries to sea turtles. The Trustees quantified injury resulting from the DWH oil spill to four of the five species of sea turtles that inhabit the Gulf of Mexico and were injured by the DWH oil spill (loggerhead (*Caretta caretta*), Kemp's ridley (*Lepidochelys kempii*), green (*Chelonia mydas*), and hawksbill (*Eretmochelys imbricata*)). The Trustees determined that leatherbacks were also injured, but the injury could not be quantified. All of these species are listed as threatened or endangered under the ESA. They are long-lived, migrate widely, and use a variety of habitats across the Regionwide Restoration Area and beyond.

Sea turtles were injured by oil or response activities in open ocean, nearshore, and shoreline environments; and the resulting mortalities spanned multiple species and life stages. The Trustees estimated that between 4,900 and 7,600 large juvenile and adult sea turtles (Kemp's ridleys, loggerheads, and hard-shelled sea turtles not identified to species) and between 55,000 and 160,000 small juvenile sea turtles (Kemp's ridleys, green turtles, loggerheads, hawksbills, and hard-shelled sea turtles not identified to species) were killed by the DWH oil spill. Nearly 35,000 hatchling sea turtles (loggerheads, Kemp's ridleys, and green turtles) were injured by response activities, and thousands more Kemp's ridley and loggerhead hatchlings were lost because of the unrealized reproduction of adult sea turtles that were killed by the DWH oil spill.

2.3 Screening for the Reasonable Range of Alternatives

In developing a reasonable range of alternatives to address the injuries caused by the DWH oil spill, the Regionwide TIG reviewed the Trustees' programmatic restoration goals and Restoration Type-specific goals in the PDARP/PEIS and the Strategic Frameworks for Restoration Activities for each Restoration Type.[11] Consistent with Section 9.4.1.4 of the Trustee SOPs, the Regionwide TIG considered project ideas submitted by the public. Additional information about the screening process that the Regionwide TIG used to generate a reasonable range of alternatives for this RP/EA is described below.

2.3.1 Regionwide TIG Screening Process

On September 24, 2019, the Regionwide TIG solicited project ideas from the public for the four Restoration Types included in the Regionwide Restoration Area: Birds, Marine Mammals, Oysters, and Sea Turtles. The call for project ideas listed priorities for each Restoration Type that the Regionwide TIG established based on the injury assessment and restoration priorities outlined in the PDARP/PEIS and in the Strategic Frameworks.

OPA regulations specify that Trustees consider a reasonable range of restoration alternatives before identifying preferred alternatives (15 C.F.R. 990.53[a][2]). The Regionwide TIG reviewed the PDARP/PEIS programmatic restoration goals and developed a set of selection criteria for identifying projects to include in the reasonable range of alternatives for this RP/EA.

One of the goals of the Regionwide TIG was to identify projects for the reasonable range of alternatives that would have a regionwide impact. Many of the projects submitted for consideration were specific to single locations at a local or state level. The TIG determined that it would consider projects that included restoration approaches or techniques that could be applied in a regionwide context. After screening was complete, the Regionwide TIG scaled up and/or combined site-specific projects into broader projects that could provide regionwide benefits.

The Regionwide TIG reviewed and evaluated 5,149 restoration project ideas proposed by members of the public, nongovernmental organizations (NGOs), and federal, state, and local entities using a four-step screening process: (1) eligibility screening, (2) initial project screening, (3) project-specific screening, and (4) resource-specific screening. Table 2-2 lists the criteria that the Regionwide TIG used in each step. Details about each step are described in subsequent sections.

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11. The Strategic Framework for Bird Restoration Activities is available at www.gulfspillrestoration.noaa.gov/sites/default/files/wp-content/uploads/Birds_Strategic_Framework_06.23.17.pdf.

The Strategic Framework for Marine Mammal Restoration Activities is available at www.gulfspillrestoration.noaa.gov/sites/default/files/wp-content/uploads/Marine_Mammal_Strategic_Framework_06.23.17.pdf.

The Strategic Framework for Oyster Restoration Activities is available at www.gulfspillrestoration.noaa.gov/sites/default/files/wp-content/uploads/Oyster_Strategic_Framework_06.23.17.pdf.

The Strategic Framework for Sea Turtle Restoration Activities is available at www.gulfspillrestoration.noaa.gov/sites/default/files/wp-content/uploads/Sea_Turtle_Strategic_Framework_6.23.17.pdf.

Table 2-2. Overview of the Regionwide TIG's screening steps and criteria for this RP/EA

Screening step	Criteria and considerations
Step 1: Eligibility screening	Project idea passed Step 1 if it: • Would replenish or protect at least one of the four Restoration Types identified in this RP/EA (Birds, Marine Mammals, Oysters, or Sea Turtles) • Stated a primary purpose of restoring at least one of the four Restoration Types • Was not duplicative of another project on the project screening list
Step 2: Initial project screening	Project idea passed Step 2 if it: • Addressed at least one of the restoration approaches or techniques identified in the call for project ideas) • Had a reasonable likelihood of success • Had sufficient information for evaluation • Was not already required under local, state, or federal law
Step 3: Project-specific screening	Project idea passed Step 3 if it: • Was not already fully funded or was scalable to a regionwide scope (if necessary) • Would be an appropriate project for the Regionwide TIG to implement because of the potential for regionwide benefits • Could be implemented or scaled for implementation within the budget framework available for this RP/EA, or could leverage funds for implementation with another source • Was cost-effective or could be modified to be cost-effective • Could be implemented in a reasonable timeframe • Did not have foreseeable issues of compliance with applicable federal, state, or local laws, regulations, or policies • Was consistent with or complemented existing local, state, regional, or federal plans, restoration efforts, long-term management objectives, or species management plans • Did not require other data collection efforts to fill data gaps before implementation
Step 4: Resource-specific screening considerations	Project idea passed Step 4 if it fulfilled specific technical criteria established for each Restoration Type (see Section 2.3.1.1 for details)

2.3.1.1 Step 4: Resource-specific Screening Considerations

During Step 4, the Regionwide TIG evaluated the projects that passed Steps 1–3 for each Restoration Type using a set of technical considerations established by Restoration Type-specific teams made up of Trustees and subject matter experts. Table 2-3 lists the resource-specific screening considerations for each Restoration Type used in Step 4.

Table 2-3. Resource-specific screening criteria for each Restoration Type

Restoration Type	Resource-specific screening considerations
Birds	Project idea passed Step 4 if it: • Was consistent with Birds Restoration Type-specific goals in the PDARP/PEIS • Was consistent with the Strategic Framework for Bird Restoration Activities • Had potential to provide regionwide benefits to birds • Proposed an action that would be likely to receive a permit under existing state and federal requirements Other considerations. Project idea: • Would directly benefit DWH-injured bird species • Was consistent with one or more relevant bird recovery plans, regional management plans, or other conservation plans • Would enhance/provide additional support (i.e., cost-sharing) for an existing bird restoration effort on a regionwide scale • Would provide benefits to multiple DWH-injured bird species • Would provide restoration benefits to birds that are commensurate with overall costs • Would benefit another Restoration Type (i.e., potential for leveraging/cost-sharing) • Would benefit species of regionwide conservation concern • Involved partnerships (e.g., among Trustees, NGOs) • Addressed a time-critical restoration need (e.g., only possible in immediate timeframe; restoration opportunity may be lost prior to next planning cycle) • Would benefit a species that is not currently addressed in an existing project (i.e., provides benefits that complement existing portfolio)
Marine Mammals	Project idea passed Step 4 if it: • Was consistent with Marine Mammals Restoration Type-specific goals in the PDARP/PEIS • Was consistent with the Strategic Framework for Marine Mammal Restoration Activities • Had potential to provide regionwide benefits to marine mammals • Proposed an action that would be likely to receive a permit under existing state and federal requirements Other considerations. Project idea: • Would provide restoration benefits to marine mammals commensurate with overall costs • Would benefit another Restoration Type (i.e., potential for leveraging/cost-sharing) • Addressed direct threats, rather than indirect threats, to marine mammals • Would provide efficiencies in addressing both illegal feeding and hook-and-line restoration approaches • For projects ideas addressing the commercial bycatch restoration approach, the project focused on shrimp trawl and/or menhaden purse seine fishery • For project ideas addressing the understanding threats restoration approach, the project, to a sufficient extent, would provide regionwide benefits to marine mammals; addressed more than one restoration technique and offer efficiencies; specifically addressed marine mammal restoration; or would provide efficiencies with other Restoration Areas (e.g., Open Ocean)

Restoration Type	Resource-specific screening considerations
Oysters	Project idea passed Step 4 if it: • Was consistent with Oysters Restoration Type-specific goals in the PDARP/PEIS • Was consistent with the Strategic Framework for Oyster Restoration Activities • Had potential to provide regionwide benefits to oysters Other considerations. Project idea: • Would make direct contributions to increasing long-term resilience of oyster populations • Would or could cover a range of habitats, reef types, and salinities • Would or could increase metapopulation connectivity • Would leverage or expand existing efforts • Involved or could involve partnerships (e.g., among Trustees, NGOs) • Would provide restoration benefits to oysters commensurate with overall project costs
Sea Turtles	Project idea passed Step 4 if it: • Was consistent with the Sea Turtles Restoration Type-specific goals in the PDARP/PEIS • Was consistent with the Strategic Framework for Sea Turtle Restoration Activities • Addressed at least one priority restoration approach or technique in the call for project ideas • Had potential to provide regionwide benefits to sea turtles • Proposed an action that would be likely to receive a permit under existing state and federal requirements Other considerations. Project idea: • Was consistent with long-term sea turtle recovery plans • Would benefit DWH-injured sea turtle species or life stage(s) • Would complement existing DWH portfolio of restoration benefits to sea turtles • Would leverage or expand existing sea turtle restoration efforts (i.e., cost-savings) • Would provide restoration benefits to sea turtles commensurate with overall costs • Addressed a high-priority recovery action in one or more relevant sea turtle recovery plans • Would benefit another Restoration Type or had potential for leveraging/cost-sharing • Involved partnerships (e.g., among Trustees, NGOs)

During the screening process, the Regionwide TIG identified opportunities to combine components of multiple project ideas into more comprehensive projects that fulfilled required criteria and many of the evaluation criteria outlined in Table 2-3. In some cases, the Regionwide TIG integrated new elements into revised projects or combined project ideas into a single project in subsequent evaluation steps.

2.3.2 Consistency with OPA Criteria

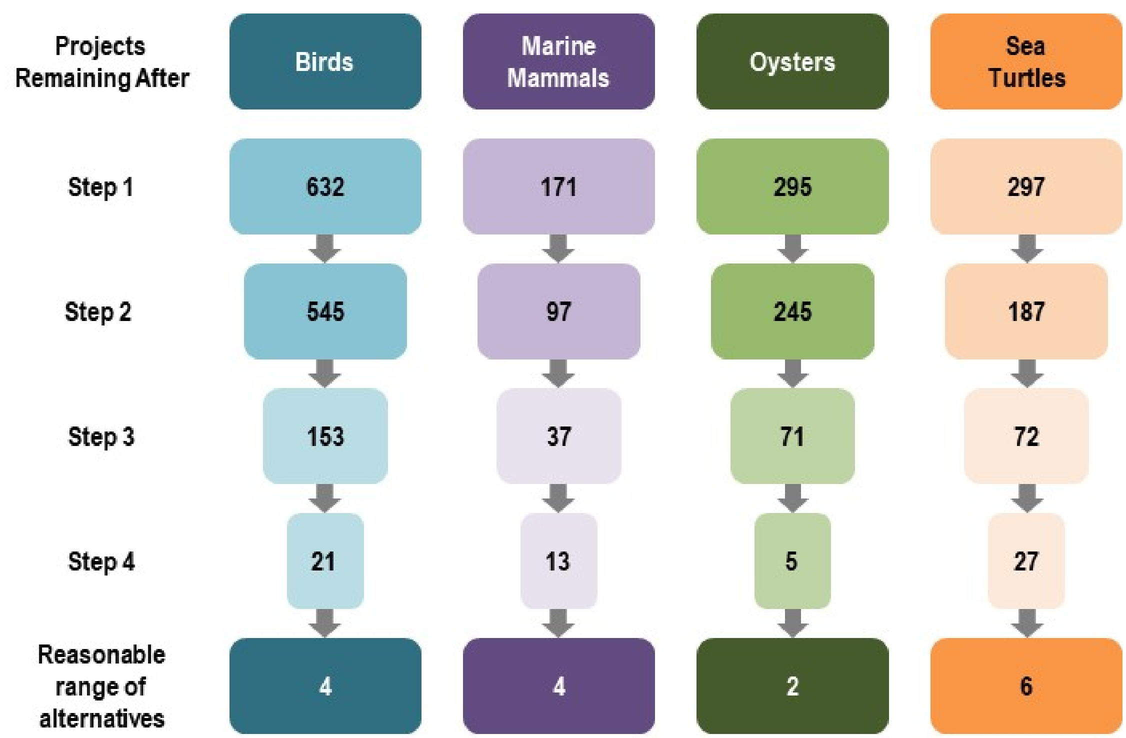
Throughout the screening process, the Regionwide TIG considered the extent to which each project would fulfill evaluation factors established in OPA regulations (15 C.F.R. 990.54[a]). This allowed the TIG to remove project ideas that were not likely to have a favorable result in the formal OPA evaluation of the reasonable range of alternatives (see Chapter 3). The OPA evaluation criteria include:

- Cost to carry out the alternative;
- Extent to which each alternative is expected to meet the goals and objectives of returning the injured natural resources and services to baseline and/or compensating for interim losses;
- Likelihood of success of each alternative;
- Extent to which each alternative would prevent future injury as a result of the incident and avoid collateral injury as a result of implementing the alternative;
- Extent to which each alternative benefits more than one natural resource and/or service; and
- Effect of each alternative on public health and safety.

2.4 Summary of Screening Process

The Regionwide TIG reviewed and screened 5,149 project ideas submitted to the Trustee project portal by October 25, 2019. The Regionwide TIG categorized project ideas by Restoration Type and carried out Steps 1–4 on each group of Restoration Type-specific project ideas. Figure 2-1 summarizes the results of each step of the screening process. (Note that the final counts for the Birds and Sea Turtles Restoration Types both include a project proposed to be jointly funded by those two Restoration Types. In subsequent references to the reasonable range of alternatives, it is counted only once.) The following sections provide an overview of the project ideas considered for each Restoration Type and the results of the screening process.

Figure 2-1. Summary of the stepwise project screening results for all Restoration Types



2.4.1 Birds

The Regionwide TIG identified 632 Birds Restoration Type project ideas for additional screening. Project ideas were grouped according to their alignment with the restoration approaches and techniques outlined in the PDARP/PEIS and Strategic Framework for Bird Restoration Activities. In the call for project ideas, the Trustees prioritized a subset of these restoration approaches and techniques for this RP/EA (Table 2-4). Although most alternatives in this RP/EA utilize the priority approaches and techniques listed in the call for project ideas, some alternatives also utilize other approaches and techniques listed in the Strategic Framework and the PDARP/PEIS to meet specific Restoration Type goals. Table 2-4 lists the restoration approaches and techniques used in the alternatives proposed in this RP/EA.

Table 2-4. Birds Restoration Type restoration approaches and techniques used in this RP/EA

Restoration approach	Restoration techniques
Restore and conserve bird nesting and foraging habitat.	• Enhance habitat through vegetation management. • Improve nesting and foraging area stewardship. • Create or enhance oyster shell rakes and beds.
Create, restore, and enhance barrier and coastal islands and headlands	• Restore or construct barrier and coastal islands and headlands via placement of dredged sediments.
Protect and conserve marine, coastal, estuarine, and riparian habitats	• Acquire lands for conservation. • Develop and implement management actions in conservation areas and/or restoration projects.
Prevent incidental bird mortality.	• Remove derelict fishing gear.

Following Step 4, the Regionwide TIG reviewed the 21 remaining Birds Restoration Type project ideas, combining and adapting the primarily site-specific project ideas to create alternatives applicable at a regionwide scale. Through this process, the Regionwide TIG identified four Birds Restoration Type alternatives for inclusion in the reasonable range of alternatives evaluated in this RP/EA. One of these alternatives is a joint project with the Sea Turtles Restoration Type; this combined project would help address injuries to both birds and sea turtles. Section 2.7.1 describes the four Birds Restoration Type alternatives in detail.

2.4.2 Marine Mammals

The Regionwide TIG identified 171 Marine Mammals Restoration Type project ideas for additional screening. Project ideas were grouped according to their alignment with the restoration approaches and techniques outlined in the PDARP/PEIS and the Strategic Framework for Marine Mammal Restoration Activities. The call for project ideas prioritized a subset of these restoration approaches and techniques for this RP/EA (Table 2-5). Although most alternatives in this RP/EA utilize these priority approaches and techniques, some alternatives also utilize other approaches and techniques listed in the Strategic Framework and the PDARP/PEIS to meet specific Restoration Type goals. Table 2-5 lists the restoration approaches and techniques used in the alternatives proposed in this RP/EA.

Table 2-5. Marine Mammals Restoration Type restoration approaches and techniques used in this RP/EA

Restoration approach	Restoration techniques
Reduce commercial fishery bycatch through collaborative partnerships.	• Develop collaborative partnerships and convene workshops with the commercial fishing industry, gear experts, observer programs, academic institutions and researchers, and state and federal agencies to determine actions that would help reduce bycatch in each fishery or for specific gear types (e.g., research regarding potential gear modifications). • Test, implement, and evaluate potential bycatch reduction actions including gear modifications, fishery best-practice modifications, and outreach programs to promote effective strategies.
Reduce injury and mortality of bottlenose dolphins from hook-and-line fishing gear.	• Conduct systematic surveys of fishers and evaluating stranding data to understand the scale, scope, and frequency of hook-and-line fishing interactions with dolphins. • Conducting human dimension studies to evaluate and characterize anglers' observations, attitudes, and perceptions toward dolphins and gear/fishery practice interactions.
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.	• Expand the MMSN's capabilities along the GOM coast. • Enhance capabilities to rapidly diagnose causes of marine mammal morbidity and mortality to identify threats and mitigate impacts (e.g., conservation medicine). • Develop and increase the technical and infrastructure capabilities to respond to major stranding events or disasters.
Reduce injury, harm, and mortality to bottlenose dolphins by reducing illegal feeding and harassment activities.	• Develop collaborative partnerships and convene workshops with stakeholders to identify, test, and implement measures to reduce interactions

MMSN – Marine Mammal Stranding Network; GOM – Gulf of Mexico

Following Step 4, the Regionwide TIG reviewed the 13 remaining Marine Mammals Restoration Type project ideas, combining and adapting the primarily site-specific project ideas to create alternatives applicable at a regionwide scale. Through this process, the Regionwide TIG finalized four Marine Mammals Restoration Type alternatives for inclusion in the reasonable range of alternatives evaluated in this RP/EA. Section 2.7.2 describes these alternatives in detail.

2.4.3 Oysters

The Regionwide TIG identified 295 Oysters Restoration Type project ideas for additional screening. Project ideas were grouped according to their alignment with the restoration approach and techniques outlined in the PDARP/PEIS and Strategic Framework for Oyster Restoration Activities. The call for project ideas prioritized a subset of these restoration techniques for this RP/EA (Table 2-6). Although most alternatives in this RP/EA utilize these priority techniques, some alternatives also utilize other techniques listed in the Strategic Framework and the PDARP/PEIS to meet specific Restoration Type goals. Table 2-6 lists the restoration approach and techniques used in the alternatives proposed in this RP/EA.

Table 2-6. Oysters Restoration Type restoration approach and techniques used in this RP/EA

Restoration approach	Restoration techniques
Restore oyster reef habitat	• Restore or create oyster reefs through placement of cultch in nearshore and subtidal areas. • Enhance oyster reef productivity through spawning stock enhancement projects. • Develop a network of oyster reef spawning reserves.

Following Step 4, the Regionwide TIG reviewed the five remaining Oysters Restoration Type project ideas, combining and adapting these primarily site-specific project ideas to create alternatives applicable at the regionwide scale. Through this process, the Regionwide TIG finalized two Oysters Restoration Type alternatives for inclusion in the reasonable range of alternatives evaluated in this RP/EA. Section 2.7.3 describes these alternatives in detail.

2.4.4 Sea Turtles

The Regionwide TIG identified 297 Sea Turtles Restoration Type project ideas for additional screening. Project ideas were grouped according to their alignment with the restoration approaches and techniques outlined in the PDARP/PEIS and Strategic Framework for Sea Turtle Restoration Activities. The call for project ideas prioritized a subset of these restoration approaches and techniques for this RP/EA (Table 2-7). Although most alternatives in this RP/EA utilize these priority approaches and techniques, some alternatives also utilize other approaches and techniques listed in the Strategic Framework and the PDARP/PEIS to meet specific Restoration Type goals. Table 2-7 lists the restoration approaches and techniques used in the alternatives proposed in this RP/EA.

Table 2-7. Sea Turtles Restoration Type restoration approaches and techniques used in this RP/EA

Restoration approach	Restoration techniques
Reduce sea turtle bycatch in commercial fisheries through identification and implementation of conservation measures.	• Implement gear modifications (e.g., hook size and type). • Make changes in fishing practices (e.g., reduced soak times). • Improve temporal and spatial fishery management to reduce sea turtle bycatch in GOM commercial fisheries. • Evaluate and implement options for vessel monitoring systems (VMSs) and electronic monitoring.
Enhance sea turtle hatchling productivity and restore and conserve nesting beach habitat.	• Reduce artificial lighting visible from nesting beaches. • Enhance protection of nests by addressing anthropogenic threats. • Acquire lands for conservation of nesting beach habitat. • Provide beach user outreach and education. • Reduce nesting beach barriers
Reduce sea turtle bycatch in recreational fisheries through development and implementation of conservation measures.	• Improve the understanding of bycatch in recreational fisheries in the GOM (e.g., characterization of sea turtle bycatch on hook-and-line gear). • Identify and experimentally implement potential bycatch reduction measures to determine their effectiveness.

Restoration approach	Restoration techniques
Reduce sea turtle bycatch in commercial fisheries through enhanced state enforcement effort to improve compliance with existing sea turtle conservation requirements.	• Provide training for and outreach to state fishery enforcement personnel. • Increase state fishery enforcement resources (for example, additional personnel and necessary equipment and vessels).
Increase sea turtle survival through enhanced mortality investigation and early detection of and response to anthropogenic threats and emergency events.	• Provide enhanced network response and coordination. • Provide enhanced data access and analysis. • Improve coordination and communication between rehabilitation facilities, state coordinators, USFWS, and NOAA. • Enhance preparedness and response capacity for emergency events. • Enhance investigation of mortality sources. • Enhance rehabilitation capability where necessary.

Following Step 4, the Regionwide TIG reviewed the 27 remaining Sea Turtles Restoration Type project ideas, combining and adapting these project ideas to create alternatives applicable at a regionwide scale. Through this process, the Regionwide TIG finalized six Sea Turtles Restoration Type alternatives for inclusion in the reasonable range of alternatives evaluated in this RP/EA. One of these alternatives is a joint project with the Birds Restoration Type; this alternative would help address injuries to both birds and sea turtles. Section 2.7.4 describes the six Sea Turtles Restoration Type alternatives in detail.

2.5 Alternatives Not Considered for Further Evaluation in this RP/EA

The Regionwide TIG developed a reasonable range of alternatives for this RP/EA by following the screening process described in Sections 2.3–2.4. The Regionwide TIG considered the subset of project ideas that passed Step 4 screening; however, while finalizing the reasonable range of alternatives, the Regionwide TIG eliminated some of the projects that (1) needed further technical development; (2) did not align closely with the initial priorities of the Regionwide TIG; or (3) aligned more closely with the priorities of other DWH settlement restoration programs.

2.6 Natural Recovery

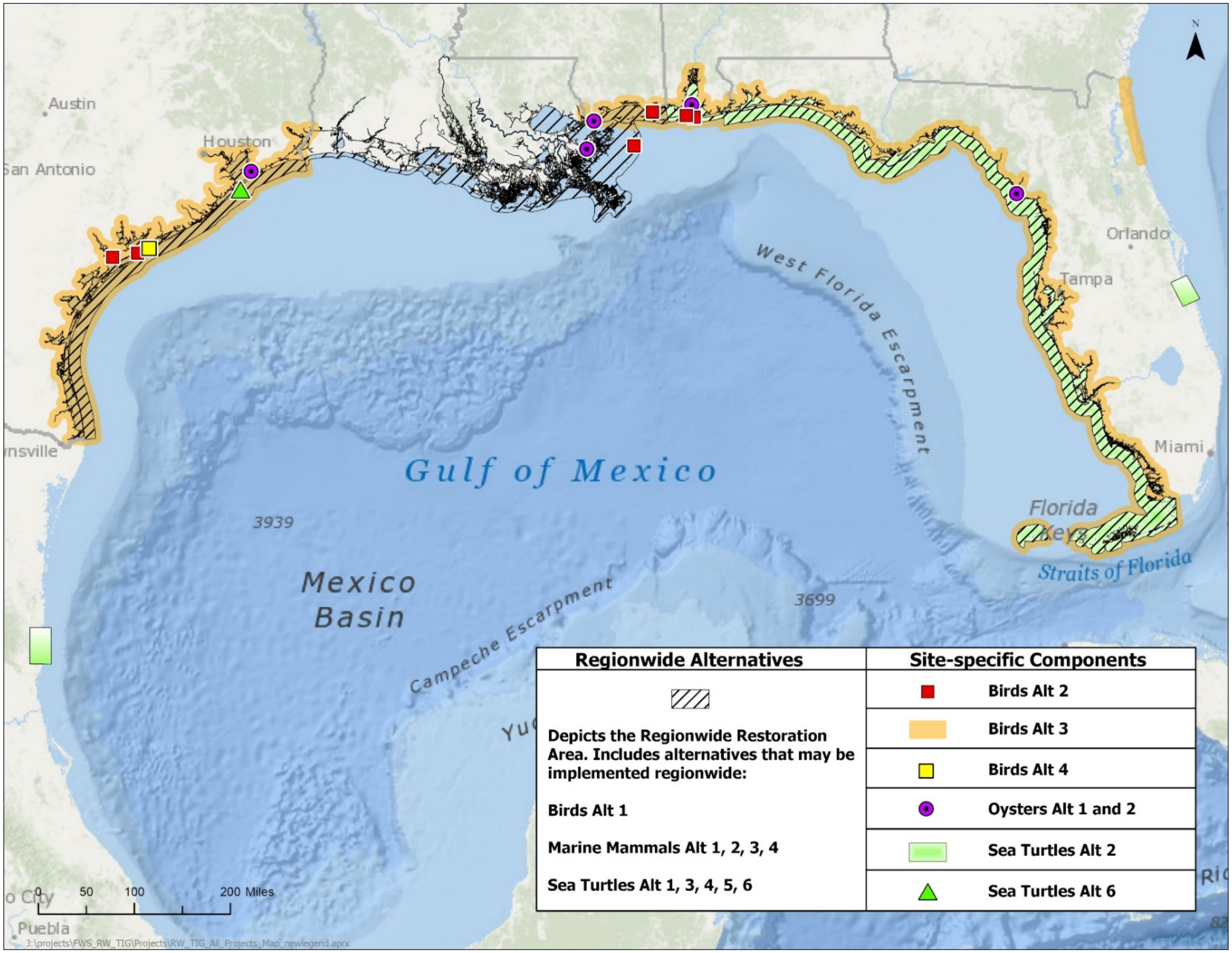
In compliance with OPA regulations, the PDARP/PEIS considered a “natural recovery alternative in which no human intervention would be taken to directly restore injured natural resources and services to baseline” (15 C.F.R. 990.53[b][2]). Under a natural recovery alternative, the Trustees would not use DWH NRDA funding to perform restoration to accelerate the recovery of the Birds, Marine Mammals, Oysters, or Sea Turtles Restoration Types in the Regionwide Restoration Area. Instead, the Trustees would allow natural recovery processes to occur, which could lead to one of four outcomes for injured resources: (1) gradual recovery; (2) partial recovery; (3) no recovery; or (4) further deterioration. Although injured resources could presumably recover to, or near, baseline conditions under this scenario, recovery would take much longer than it would if the Trustees implemented restoration actions. Because technically feasible restoration approaches can effectively compensate for interim natural resource and service losses, the Trustees eliminated the natural recovery alternative from further consideration in the OPA evaluation conducted for the PDARP/PEIS. Based on this determination, the Regionwide TIG did not further evaluate natural recovery as a viable alternative under OPA, and does not further consider natural recovery in this RP/EA.[12]

2.7 Reasonable Range of Restoration Alternatives

The following sections summarize the reasonable range of alternatives for each Restoration Type resulting from the screen process described above. Figure 2-2 shows the locations of alternatives proposed in this RP/EA.

12. NEPA requires evaluation of a No Action Alternative, which differs from the natural recovery alternative under OPA. The environmental consequences of the NEPA No Action Alternative are considered separately in Section 4.3.2.5.

Figure 2-2. Locations of the reasonable range of alternatives



2.7.1 Birds

The Regionwide TIG identified four Birds Restoration Type alternatives for evaluation in this RP/EA (Table 2-8). The Regionwide TIG determined that these alternatives met the screening criteria listed above and sufficiently aligned with priority restoration approaches and techniques (see Section 2.4.1). These alternatives could help meet the Regionwide TIG's programmatic restoration goal to Replenish and Protect Living Coastal and Marine Resources (see Section 2.1.1), and thus warrant further evaluation in this RP/EA.

Table 2-8. Reasonable range of alternatives for the Birds Restoration Type

Alternative	Estimated project cost
Alternative 1: Reducing Marine Debris Impacts on Birds and Sea Turtles *(joint project with Sea Turtles Restoration Type)*	$3,520,000 ($7,040,000 total project cost, split between the Birds and Sea Turtles Restoration Types)
Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds	$22,500,000
Component 1: Chandeleur Islands, LA	$8,000,000
Component 2: Pilot Town/Little Dauphin Island, AL	$6,500,000
Component 3: San Antonio Bay Bird Island, TX	$2,500,000
Component 4: Matagorda Bay Bird Island (Chester Island), TX	$2,500,000
Component 5: Round Island, MS	$3,000,000
Alternative 3: Bird Nesting and Foraging Area Stewardship	$8,510,750
Alternative 4: Stewardship and Habitat Creation through Beneficial Use	$6,500,000
Component 1: Walker Island, AL	$4,000,000
Component 2: Matagorda Bay Bird Island (Chester Island), TX	$2,500,000

2.7.1.1 Birds Alternative 1: Reducing Marine Debris Impacts on Birds and Sea Turtles *(joint project with the Sea Turtles Restoration Type)*

Birds Alternative 1: Reducing Marine Debris Impacts on Birds and Sea Turtles *(joint project with the Sea Turtles Restoration Type)*
Restoration approaches
Birds: Prevent incidental bird mortality. Sea turtles: Increase sea turtle survival through enhanced mortality investigation and early detection of and response to anthropogenic threats and emergency events.
Restoration techniques
Birds: Remove derelict fishing gear. Sea turtles: Provide enhanced investigation of (and response to) mortality sources.
Project location
This regionwide project would target marine debris "hotspots" where marine debris poses a hazard to birds and sea turtles. This may include offshore (e.g., open water, reefs), nearshore (e.g., bays, intertidal beach/mudflats, coastal wetlands), and upland areas across the proposed project area. The Implementing Trustees would identify specific marine debris removal locations, or hotspots. Determination of initial hotspots (during Project Year 1) and identification of new hotspots would continue throughout the life of the project (Project Years 2–7) to address additional locations that require action to reduce marine debris impacts to birds and sea turtles.

Birds Alternative 1: Reducing Marine Debris Impacts on Birds and Sea Turtles *(joint project with the Sea Turtles Restoration Type)*
Project background and summary
Marine debris is persistent, manufactured and/or processed solid material that is directly or indirectly, intentionally, or unintentionally, disposed of or abandoned in the marine environment, and poses risks to birds and/or sea turtles. Injury and/or mortality of birds and sea turtles from ingestion, entanglement, and entrapment in marine debris, namely derelict fishing gear, are well-documented. For example, birds and sea turtles can become entangled in monofilament fishing line, ingest lead fishing gear (e.g., sinkers), or become trapped in derelict nets, traps, and pots (e.g., ghost fishing). The objective of this project is to reduce the threat and impacts (e.g., entanglement, entrapment, and/or ingestion) of marine debris to DWH-injured bird and sea turtle species across the proposed project area. The project would involve removing marine debris including, but not limited to, derelict fishing gear. This project would entail a coordinated effort among Trustees, NGOs, and other partners to compile data on marine debris to identify hotspots, conduct marine debris removal, engage in prevention through public outreach, and conduct monitoring. Removal of marine debris would benefit multiple species of birds injured by the DWH oil spill, including colonial waterbirds, solitary beach nesting birds, osprey, northern nesting birds, Caribbean nesting birds, and pelagic birds. Sea turtle species that would benefit from the project include: • Kemp's ridley • Loggerhead • Leatherback • Green • Hawksbill Proposed activities would include: • Identifying and prioritizing marine debris hotspots that impact birds and/or sea turtles regionwide. Data compiled from federal and state agencies and other relevant partners (e.g., Sea Turtle Stranding and Salvage Network [STSSN], rescue/rehabilitation organizations, NGOs, dive operators) would inform identification and prioritization of hotspots for marine debris impacts to birds and/or sea turtles. Hotspots would be identified and prioritized for birds and sea turtles separately. • Reducing the number of, and potential for, marine debris-related incidents at hotspots. After identifying and prioritizing marine debris hotspots, the Implementing Trustees would develop a management plan outlining the restoration techniques for each hotspot, a schedule/timeline for restoration and monitoring, and details of data collection/management and monitoring. Implementing Trustees would provide support (e.g., capacity, equipment, fuel, etc.) for organized, large-scale debris removal events, regularly conducted targeted site-specific events, and/or the use of professional divers or marine salvage crews for in-water debris removal around deep structures. Debris removal may be a one-time event or a multi-event effort depending on the degree/frequency of debris accumulation, impact on birds or sea turtles, cost, and logistics. Debris removal may be conducted in coordination with or to enhance existing marine debris networks (e.g., GOM coast clean-ups) and/or as additional stand-alone events. • Conducting public outreach. This could include educational presentations to local communities, stakeholders, and organizations (who may adopt a local cleanup); providing signage in high-use areas (e.g., fishing piers) and near businesses (e.g., fishing gear retailers); increasing availability of and methods for collection and disposal of fishing gear (e.g., monofilament recycling bins, maintenance services, sustainable disposal options); and distributing outreach materials on the dangers of marine debris to birds and sea turtles.

Birds Alternative 1: Reducing Marine Debris Impacts on Birds and Sea Turtles *(joint project with the Sea Turtles Restoration Type)*
Project implementation methodology and timing
NOAA, EPA, and selected Trustee agencies from TX, LA, MS, AL, and FL would be the Implementing Trustees for this alternative[13]. The first activity would be to identify and prioritize marine debris hotspots throughout the proposed project area, consulting with appropriate partners (e.g., NOAA Marine Debris Program, NGOs, local entities, stranding networks, Gulf of Mexico Avian Monitoring Network [GoMAMN]). The second activity would be to determine and implement an approach to hotspot data collection/management. The third activity would be to reduce the number of, and potential for, marine debris-related incidences at hotspots by implementing site-specific restoration techniques. The fourth activity would be to draft a project-level final summary report. that summarizes project outcomes across all sites over the lifetime of the project The Regionwide TIG estimates the following timeline for this 8-year project: • Planning (identification/prioritization of hotspots, determine approach to hotspot data collection/management): Year 1 (initial) and Years 2–7 (as needed with new information/impacts) • Implementing site-specific restoration techniques: Years 2–7 • Monitoring (would run concurrent with project restoration activities): Years 2–7 (estimated 2 times per year for 2 years at each hotspot) • Drafting a final summary report: Year 8
Operations and maintenance
Not applicable
Monitoring summary
Appendix A includes a MAM plan for this alternative.
Costs
The total estimated cost of the joint project is $7,040,000, split between the Birds and Sea Turtles Restoration Types (estimated $3,520,000 from each).

13. Implementing Trustees’ roles will be further identified in accordance with SOP Section 9.5.

2.7.1.2 Birds Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds

This project involves restoration activities across five sites (i.e., components) in the Gulf of Mexico, to help meet regionwide bird habitat restoration goals: (1) Chandeleur Islands, LA; (2) Pilot Town/Little Dauphin Island, AL; (3) San Antonio Bay Bird Island, TX; (4) Matagorda Bay Bird Island (Chester Island), TX; and (5) Round Island, MS. The overall objective for this project is to conduct nesting and foraging habitat conservation, including creation, restoration, and enhancement activities, for the benefit of multiple bird species across a range of habitats. This section summarizes restoration work under each component and provides a map of each site.

Birds Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds – Component 1: Chandeleur Islands, LA
Restoration approaches
• Create, restore, and enhance barrier and coastal islands and headlands • Restore and conserve bird nesting and foraging habitat.
Restoration techniques
This project would involve completing E&D to inform the following potential restoration techniques: • Enhance habitat through vegetation management. • Improve nesting and foraging area stewardship. • Restore or construct barrier and coastal islands and headlands via placement of dredged sediments Implementation of these techniques would occur in subsequent restoration phases.
Project location
St. Bernard Parish, LA; Chandeleur Sound
Project background and summary
The Regionwide TIG proposes to complete E&D for a restoration project benefiting the Chandeleur Islands and the many species that use them, with a particular focus on birds. The Chandeleur Islands chain is a series of barrier islands in eastern St. Bernard and Plaquemines parishes in SE Louisiana, located between the GOM and Chandeleur Sound. The Chandeleur Islands chain includes Chandeleur Island, Gosier Islands, Grand Gosier Islands, Curlew Islands, New Harbor Island, North Island, Freemason Island, and a few unnamed islands. This E&D project focuses on the initial planning phase of restoration of two islands: Chandeleur Island (the seagrass beds behind it and the southern fragmented portion) and New Harbor Island. The islands and seagrass beds that would be the focus of this E&D project are state and federally owned, and collectively managed by USFWS via a Memorandum of Agreement with LDWF as the Breton National Wildlife Refuge (NWR). More than 50 species of flora and fauna are designated as “species of greatest conservation need” on the Chandeleur Islands. Some of these species do not exist anywhere else in Louisiana. New Harbor Island contains the largest density of nesting birds on the island chain. The islands have suffered extensive damage from hurricanes, especially Georges in 1998 and Katrina in 2005. They are also subject to subsidence, sea level rise, and suboptimal sediment input. The islands and seagrass beds were damaged by the DWH oil spill, and then benefited from the construction of spill-related mitigation sand berms. Despite the berm project, the project area is experiencing a high rate of land loss, which threatens the dozens of avian and aquatic species that depend on it for critical habitat. The project would develop an E&D plan to address this land loss. No construction would occur as part of this proposed project.

Birds Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds – Component 1: Chandeleur Islands, LA
Project implementation methodology and timing

DOI and Trustee agencies from LA would be the Implementing Trustees for this component. This project would include evaluating design alternatives and then completion of E&D, permitting, and preparing construction bid documents for the preferred design alternative. The project would complement and enhance the ongoing efforts of the DWH Trustees and other partners to address habitat loss and degradation to nesting and foraging habitats for a wide variety of species.
 	
The design scope for the preferred alternative would include (at a minimum) the following:
 	
1. Design-level data collection and modeling, as needed to supplement preliminary efforts
    a. Island and access surveys
    b. Offshore borrow area surveys
2. Geotechnical investigation
3. Sediment delivery analysis
4. Geotechnical analysis
5. Coastal engineering and analysis
6. Development of construction quantities and estimate of probable costs
 	
This alternative may also include cultural resource, oyster, and/or bird and sea turtle nesting surveys; assessments; and/or appraisals.
 	
The first step in the project would be securing the permits necessary for conducting geotechnical surveys. Geotechnical surveys are weather-dependent, but would be conducted as soon as possible after securing permits and would require at least 3 months to complete. Topography and the terrestrial component would require less than a month to complete. Bathymetry surveys would take less than a month if weather permits. The full E&D process is expected to take 2–3 years.

Operations and maintenance
E&D project; operations and maintenance (O&M) N/A.
Monitoring summary
Section 10 of the Trustee SOPs states that a MAM plan is not required for projects with only E&D activities; therefore, this RP/EA does not include a MAM plan for this project.
Costs
The total estimated project cost is $8,000,000. This includes all costs associated with data collection, modeling and analysis, E&D, permitting, MAM planning, necessary outreach and engagement/stakeholder communications, and project management and administrative costs for lead and supporting agencies.

Figure 2-3. Component 1: Chandeleur Islands, LA

Birds Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds – Component 2: Pilot Town/Little Dauphin Island, AL
Restoration approach
Protect and conserve marine, coastal, estuarine, and riparian habitats
Restoration techniques
This project component includes land acquisition and removal of abandoned infrastructure to enable the following restoration techniques: • Acquire lands for conservation • Develop and implement management actions in conservation areas and/or restoration projects
Project location
The project component includes acquisition and management of the Pilot Town tract, located on the southern edge of St. Andrews Bay on the Fort Morgan peninsula, adjacent to a unit of the Bon Secour NWR. It is located on the north side of State Highway 180 in Gulf Shores, AL. The project also includes the acquisition of the Little Dauphin Island tract, located on Little Dauphin Island in the Mississippi Sound to the NE of Dauphin Island, AL.
Project background and summary
Bon Secour NWR is located on the GOM, 8 miles west of the city of Gulf Shores, AL, and was established to protect neotropical migratory songbird habitat and threatened and endangered species. The Bon Secour NWR represents the best remaining stopover and staging habitat for neotropical migratory songbirds during the fall and spring migration along the Alabama coastline. The Bon Secour NWR is divided into five separate management units along the Fort Morgan Peninsula and Little Dauphin Island. Habitats include sandy beach and dune, sandy shrub scrub, coastal marsh, maritime forest, and estuarine habitat. This project proposes acquisition of two parcels. Pilot Town Tract: The area was established early in the 19th century as a communal town on the Fort Morgan Peninsula. The settlement got its name from the bar pilots who guided sea-going vessels past the sand bars of Mobile Bay. Pilot Town was destroyed in a 1906 hurricane. Currently the habitat is relatively undisturbed except for one small area where the public uses the road to access a boat ramp and kayak/canoe launch. The Pilot Town tract would be an acquisition of approximately 99 acres, with relatively undisturbed habitats that include sandy shrub scrub, coastal marsh, and several brackish inland lagoons. This tract has a paved but abandoned road, conduit, and plumbing previously installed in anticipation of a housing development. This project would fund removal of abandoned infrastructure on the property (including the road, conduit, and plumbing) and install a gate and fencing to manage public access. Additionally, there would be mechanical and chemical treatment of invasive species (especially Chinese tallow, *Triadica sebifera*) to return the parcel to its natural state for bird habitat conservation. Little Dauphin Island Tract: The Little Dauphin Island tract involves the acquisition of approximately 15 acres of bird habitat that is accessible by watercraft only. The tract is not developed and has very little public use. The habitat is mainly low dunes and a small amount of pine savanna. Little Dauphin Island is a noted foraging and loafing area for various colonial and solitary beach nesting birds, including several imperiled shorebird species. The entire island has been designated as critical habitat for the federally threatened piping plover (*Charadrius melodus*). Adding this 15-acre tract to the USFWS' managed lands on Little Dauphin Island would address a gap in habitat management on the island.

Birds Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds – Component 2: Pilot Town/Little Dauphin Island, AL
Project implementation methodology and timing
DOI and Trustee agencies from AL would be the Implementing Trustees for this component. The Nature Conservancy (TNC) has negotiated an option to purchase the Pilot Town tract. TNC would assist in the acquisition and the property would be conveyed to the USFWS for incorporation into the Bon Secour NWR. Removal of part (approximately 750 feet) of the abandoned road on the property, installation of a gate and fencing to manage public access, and chemical and mechanical treatment of invasive plant species (especially Chinese tallow) would occur after acquisition, pending consultation with the Alabama State Historic Preservation Office (SHPO). Working with Alabama, USFWS would complete the Little Dauphin Island tract acquisition for incorporation into the Bon Secour NWR. No habitat management actions are anticipated for this tract under this project.
Operations and maintenance
The USFWS would preserve, protect, and manage the properties after project completion as part of the Bon Secour NWR.
Monitoring summary
Appendix A includes a MAM plan for this alternative.
Costs
The total estimated cost of this project component is $6,500,000.

Figure 2-4. Component 2: Pilot Town/Little Dauphin Island, AL

Birds Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds – Component 3: San Antonio Bay Bird Island, TX
Restoration approaches
• Restore and conserve bird nesting and foraging habitat. • Create, restore, and enhance barrier and coastal islands and headlands.
Restoration techniques
This project component would involve completing the construction of an island and implementing the following restoration techniques: • Enhance habitat through vegetation management. • Create or enhance oyster shell rakes and beds. • Restore or construct barrier and coastal islands and headlands via placement of dredged sediments.
Project location
San Antonio Bay, near Seadrift, TX, North American Vertical Datum of 1988 (NAVD). The project spans portions of State Mineral Lease Tracts 104 and 133 in Calhoun County. The proposed activity is located approximately 0.8 miles south the town Seadrift, 0.75 miles east of Victoria Barge Canal and 0.25 miles north of the Seadrift Boat Channel within shallow open water with depths ranging between -2 and -3 feet NAVD.
Project background and summary
San Antonio Bay is an open water bay. The proposed bird rookery island would be constructed on state-owned submerged lands that are managed by TGLO through the State School Land Board. The proposed island would measure approximately 920 feet long by 450 feet wide, and would have a total footprint of approximately 8 acres, including 4 acres of habitat above the shoreline and 1 acre of submerged reef habitat. The island would be oriented NW-SE based on predominant wind direction from the SE. The island would slope from +3.5 to +4.5 feet at the SE end to +1.0 to +2.5 feet NAVD at the NW end, where the island transitions to a shoreline and shallow lagoon for shorebird habitat. To stabilize the perimeter, the proposed island would include shoreline protection to protect it from wave erosion.

Birds Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds – Component 3: San Antonio Bay Bird Island, TX
Project implementation methodology and timing
The Trustee agencies from TX would be the Implementing Trustee for this component. The project design captures the full range of desired habitats. The island would be longer than it is wide, which would create a gradual slope from the beach area to the upland area and would maximize acreage for each of these habitat types. Although the area of the island above the waterline would be approximately 4 acres, the island would have a total footprint closer to 8 acres. The island design would create a containment berm around the perimeter of the proposed island; this shoreline protection feature would contain the fill material and help reduce the overall construction footprint of the island. Fill material for placement within the containment berm would be provided from an outside source. Material would be analyzed prior to use and no contaminated sediments would be used. The location of the fill material would be identified during final engineering. Equipment, fill, and rock would be transported to the site via existing channels on barges. No new channels or dredging to access the site would be required. The contractor would excavate using aquatic marsh hoes and side cast around the proposed perimeter to create a containment berm with a crest elevation of approximately +6.5 feet NAVD (temporarily) and a crest-width of approximately 5 feet. After constructing the containment berm, the contractor would armor the outside of the containment berm, using a revetment-type shoreline protection, which requires less rock than a breakwater. The containment berm would contain loose sediments and reduce potential fill/impacts to surrounding natural resources. Once the containment berm is constructed, the outside of the berms would be armored with revetment type shoreline protection. The revetment would be constructed with a 2:1 slope and the crest of the final containment berms would be reduced so that the top of the rock would be at +6.0 feet NAVD. A 5-foot-wide toe would be constructed at the base of the revetment. The toe would be constructed to an elevation of approximately +2.5 feet above the bay bottom. An approximately 120-foot-wide shallow water beach opening would be included at the NW side of the island. This gap in the shoreline protection of the island is where a proposed reef would be located. The reef would be constructed with graded riprap to an elevation of approximately -1.0 feet NAVD and would provide substrate for oyster an area for access and a staging/loafing area for several bird species. Since the gap in the shoreline protection would create an area that is more vulnerable to impacts from waves, the island would be directionally oriented to minimize impacts. Project implementation may require avoidance of time periods based on resource concerns in the affected area (e.g., the avoidance of bird and sea turtle nesting season).
Operations and maintenance
Once constructed, the island would be owned by the Permanent School Fund and leased by TGLO to conservation partners for construction and routine O&M activities. It is anticipated that this project would be leased to the Coastal Bend Bays and Estuaries Program for O&M activities, e.g., planting or removing vegetation, surveying bird nesting activity, installing signs restricting access when birds are nesting, installing artificial platforms, and monitoring disturbance and island conditions.
Monitoring summary
Appendix A includes a MAM plan for this alternative.
Costs
The total estimated project cost is $2,500,000.

Figure 2-5. Component 3: San Antonio Bay Bird Island, TX

Birds Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds – Component 4: Matagorda Bay Bird Island (Chester Island), TX
Restoration approaches
• Restore and conserve bird nesting and foraging habitat. • Create, restore, and enhance barrier and coastal islands and headlands.
Restoration techniques
This project would involve completing the construction of an island and implementing the following restoration techniques: • Enhance habitat through vegetation management. • Restore or construct barrier and coastal islands and headlands via placement of dredged sediments.
Project location
Chester Island (formerly Sundown Island) is located in Matagorda Bay; Matagorda County, TX. The location is 3.1 miles east of Port O'Connor and 1.3 miles NW of Matagorda Peninsula, which is a coastal barrier spit.

Birds Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds – Component 4: Matagorda Bay Bird Island (Chester Island), TX
Project background and summary
Chester Island is a colonial waterbird nesting site in Matagorda Bay that is state-owned by TGLO. The island hosts around 18,000 pairs of breeding birds each year and benefits from Audubon's stewardship and ongoing monitoring efforts. Enhancing this critical bird habitat would enable the colonial waterbirds to continue to flourish. The island was formed around 1963, through the placement of dredged materials from the Matagorda Ship Channel (MSC), and it currently is a U.S. Army Corps of Engineers (USACE) dredge placement site. Shorebirds use the dredged materials that form the island for loafing, foraging, and nesting. Due to habitat loss and disturbance on the mainland and barrier islands, dredge placement islands have become an important alternative nesting sites for shorebirds and wintering birds. Dredge material islands may be selected by colonial nesters because of their lack of mammalian predators and the sandy, well-drained substrate, which keeps eggs dry (Audubon 2017). The island has varied in size and shape since its creation, becoming longer and narrower along a SW-NE axis. Uplands on the island consist of unvegetated beach and dune habitat along the edges of the island with scrub-shrub and grassy habitat in the interior portion of the island. Although the repeated placement of dredged sediments (silty sand to fine sand sourced from the MSC and Gulf Intracoastal Waterway [GIWW]), and the installation of geotextile tubes and articulated concrete mat revetments protect the shore and retain sediment, the island is nonetheless vulnerable to ongoing erosive forces and is currently eroding at a faster rate than material is being placed. The primary causes of erosion are high currents near the MSC jetties, wakes from the ship channel and the GIWW, high tides, and strong wind-driven wave forces. Erosion caused by high-velocity currents entering Matagorda Bay from the MSC entrance and waves from Matagorda Bay has shaped the island. Ship wakes from vessels in the MSC exiting Matagorda Bay and passing within 1,000 feet of the SW tip of the island also contribute to erosion. These factors have moved the SW tip of the island northward, and the SE shore has receded 950 feet since 1995. Since Hurricane Harvey on August 25, 2017, the total area of Chester Island had been reduced from 83 acres to 76 acres. The island's maximum elevation ranges from between 10 to 15 feet NAVD. The surrounding area is characterized by shallow bay bottom with soils consisting of clay, sand, and shell hash. The southern end of the island is adjacent to deeper waters while the northern part of the island is associated with extensive shallow water flats. No seagrasses or oyster beds have been detected in any previous surveys or site visits. This project would slow the erosion of Chester Island by adding up to 30 acres of beach habitat using dredged sediment and potentially constructing sediment control and shoreline protection structures such as groins and breakwaters. Sediment sources for the beneficial use of dredged material have been identified from the nearby MSC and GIWW navigation channels to rebuild the eroded land. The use of beach nourishment has the potential to significantly reduce the full cost of this project if it is determined that the island can be maintained through routine placement of dredged material without the need for hardened structures. Shoreline protection/sediment management structures would be constructed with the use of marine barges to transport rock material and construction equipment to place the rock material into the structure configurations. Beach nourishment would be performed using hopper or cutterhead-suction dredges in the MSC and GIWW providing sediment to the island via pipelines and placed into the engineered template with the use of construction equipment such as excavators and dozers.

Birds Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds – Component 4: Matagorda Bay Bird Island (Chester Island), TX
Project implementation methodology and timing
This project would occur in two phases. The Trustee agencies from TX would be the Implementing Trustee for Phase II. Phase I of the project would be funded by Gulf of Mexico Energy Security Act (GOMESA) funds and would be completed in early 2021. Phase I would include the completion of all E&D and permitting for the breakwaters. If E&D determines that sediment control structures are necessary to maintain the island, this permitting would occur during Phase I. A 2017 restoration design (Freese and Nichols 2017) includes design templates to rebuild the island with material dredged by USACE from the MSC and GIWW during channel maintenance. Phase II, under consideration in this RP/EA, would involve construction of the breakwaters, jetties, and groins, and placement of the dredged material. This project design includes constructing a shoreline-protection structure along the high-energy southern shoreline, and building 30 acres of land using dredged sediment. In addition, potential sites for the beneficial use of dredged material would be identified within the project footprint, potentially reducing the cost of the project. The shoreline areas for beach re-nourishment are, listed in order of priority: North End, SE End, SW End, and NE End. Additional structures would be constructed based on remaining funding and future erosion. No vegetative plantings are contemplated as part of this project.
Operations and maintenance
Audubon Texas is currently steward of the island, and in this capacity maintains signage, predator control, and vegetation management. It is anticipated that Audubon Texas would continue stewardship of the island throughout completion of this project.
Monitoring summary
Appendix A includes a MAM plan for this alternative.
Costs
The total estimated cost of this project is $6,500,000 and is expected to come from three sources: • GOMESA – $2,500,000: E&D and some funding toward construction • Regionwide TIG – $2,500,000: Construction and incremental dredge placement • CEPRA – $1,000,000: Construction oversight related to erosion (bi-annual funding)

Figure 2-6. Component 4: Matagorda Bay Bird Island, TX

Birds Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds – Component 5: Round Island, MS
Restoration approach
Restore and conserve bird nesting and foraging habitat.
Restoration technique
Enhance habitat through vegetation management.
Project location
Round Island is located south of the mouth of the Pascagoula River in Mississippi. The island is positioned between the mouth of the Pascagoula River and Horn Island.
Project background and summary
Round Island is 220 acres in size and was created with the NFWF-GEBF funding in 2016. The upland areas of the project site represent the higher elevations of the sand berm that was created to contain beneficial use sediment material, which is approximately 14,000 feet in length. Dense areas of smooth cordgrass *(Spartina alterniflora*) have colonized the low marsh zone and saltmeadow cordgrass (*S. patens*) and saltgrass (*Distichlis spicata*) have formed dense patches in the intermediate and high marsh areas in addition to small areas of bulrush (*Scirpus* spp.), glasswort (*Salicornia virginica*) and saltwort (*Batis maritima*). The areas of higher elevation on the sand berm could be categorized as dune/beach habitat that has been naturally colonized by several native species, including but not limited to yellow nutsedge (*Cyperus esculentus*), *Baccharis halimifolia*, *Fimbristylis* spp., and saltmarsh morning-glory (*Ipomoea sagittate*). Some areas of the berm were planted with sea oats (*Uniola paniculata*) to stabilize the structure. The Round Island berms are composed primarily of sandy materials. Dredge disposal was obtained from the East Pascagoula River Channel interior of the islands and is composed mainly of unconsolidated sediments. A previous construction project created a 14,000-foot berm and pumped dredge material into the island's interior. This proposed project does not involve additional land building; rather, it would focus on the following restoration measures in an approximately 90-acre area: • Colonial waterbird nesting enhancement: The restoration activity would include de-vegetation in a 20-acre area that are potential colonial waterbird nesting sites and currently have appropriate shell hash materials. Addition of materials could occur to enhance nesting habitat would also be included in approximately 20% of this area. • Vegetation management: Includes management of planted vegetation, and removal of invasive species throughout the vegetated portions of the island including berms within the open water area. it would also include the removal of undesirable vegetation in the upland portions of the island to restore some unvegetated sand areas that support nesting by a variety of tern species and black skimmers. • Habitat creation: Includes development of a planting plan, grading plan, construction, and planting of scrub shrub on higher elevations to create stopover, loafing, feeding and potential future nesting habitat. • Predator control: Includes nutria eradication and other mammalian predators (e.g., racoons) as necessary. Currently nutria dig to forage on plant roots under the soil surface and also forage on exposed roots from sand escarpments on the island, all of which degrade habitat. • Debris removal: Removal of marine debris primarily on beaches. The timing and frequency of this activity will be determined during project implementation and as budget allows. • Potential future restoration: If other entities add beneficial use material to the island and create additional habitat, project funds could be utilized as described above on these newly created areas within the project area.

Birds Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds – Component 5: Round Island, MS
Project implementation methodology and timing
The Trustee agency from MS (MDEQ) would be the Implementing Trustee for this component, and would monitor to ensure the restoration measures are creating the desired outcomes. This project would occur over an 8–12-year period.
Operations and maintenance
The project focuses on habitat management on a previous beneficial use project. The project would continue this ongoing maintenance (e.g., debris removal, vegetation management) after initial restoration activities have been completed.
Monitoring summary
Appendix A includes a MAM plan for this alternative.
Costs
The total estimated cost of this project is $3,000,000.

Figure 2-7. Component 5: Round Island, MS

2.7.1.3 Birds Alternative 3: Bird Nesting and Foraging Area Stewardship

Birds Alternative 3: Bird Nesting and Foraging Area Stewardship
Restoration approach
Restore and conserve bird nesting and foraging habitat.
Restoration techniques
• Enhance habitat through vegetation management. • Improve nesting and foraging area stewardship.
Project location
Specific activities and target locations may vary from year to year based on a number of factors including where nesting and/or foraging occurs, what management activities are most successful at each area, and where project implementers are supported by site land managers. The project would occur in coastal Texas, Mississippi, Alabama, and Florida. Proposed initial target areas may include: • Mississippi: Hancock, Harrison and Jackson counties and coastal and barrier islands in the Mississippi Sound • Alabama: Mobile and Baldwin counties and coastal islands in Mobile Bay and the Mississippi Sound • Florida: Florida GOM coastal counties (Escambia-Monroe) and some select sites in NE Florida (Nassau, Duval, and St. Johns counties) • Texas: Texas GOM coastal counties within the Coastal Zone Boundary

Birds Alternative 3: Bird Nesting and Foraging Area Stewardship
Project background and summary
The GOM coast supports a diversity of coastal bird species throughout the year, as nesting grounds during the breeding period, as a stopover for migrating species in the spring and fall, and as wintering habitat for numerous species that breed elsewhere. This project would steward and monitor beach and bay shorebirds by reducing human disturbance and predation of nests and chicks of coastal nesting shorebird species injured by the DWH oil spill. It would also reduce disturbances to birds during stopover and overwintering periods, which could help increase bird productivity and survival. This project would utilize various activities at multiple locations along the GOM coast to conserve and enhance nesting and foraging habitats for birds. The activities proposed would directly address anthropogenic stressors, protect and restore habitat, and reduce other stressors that impact birds that use beaches for nesting, rearing, foraging, resting and refueling during migratory stopovers, and overwintering. It would also increase public awareness of bird conservation issues. This restoration project would complement and enhance ongoing efforts of the Implementing Trustees and other partners to address habitat loss and degradation to nesting and foraging habitats through stewardship projects. Stewardship may be implemented in several ways, depending on the location, and could include: • Stewardship of nesting areas to reduce human disturbance (e.g., exclusion devices and vegetated buffers, virtual fencing around nesting areas, and/or beach wrack and distance buffers); • Lethal and nonlethal predator control; • Vegetation management; • Nesting platforms; • Placement of symbolic and/or permanent fencing; • Signage; • Development of site management plans; • Rooftop management; • Comprehensive monitoring coverage; • Lowered vehicle speed limits or reduced vehicular access; • Bird banding and recapture/re-sighting; • Patrols by wildlife stewards or law enforcement (including training and support); and • Targeted community engagement, outreach, and education. This project would provide a number of benefits, including, but not limited to: increasing acreage of protected regional nesting and foraging habitats of beach nesting shorebirds (e.g., wintering habitat, migratory stopover sites); increasing bird nesting success, survival, and production; increasing acreage of habitat under stewardship and management; increasing public awareness; and establishing and implementing an adaptive management framework to assess threats, implement strategies to address those threats, monitor success, and adapt both within season, where appropriate, and across seasons.
Project implementation methodology and timing
DOI and Trustee agencies from TX, MS, AL, and FL would be the Implementing Trustees for this alternative. Project implementation would occur over 7 years. Planning activities, including siting, design, and required procurement, would most likely occur through Years 1 to 6. Implementation would also likely occur in Years 1 to 6, depending on the nature and scope of the individual activities. Baseline monitoring would occur prior to implementation. Project-specific and resource-level monitoring would likely occur in Years 1 to 6+ and would depend on the date of the implementation of each restoration activity.
Operations and Maintenance
Symbolic fencing (post and rope) would require minor O&M during nesting season and would be removed at the end of the season in most cases. Other O&M needs would be identified and designed during planning work for each restoration activity.

Birds Alternative 3: Bird Nesting and Foraging Area Stewardship
Monitoring Summary
Appendix A includes a MAM plan for this alternative.
Costs
The total estimated cost of this project is $8,510,750.

2.7.1.4 Birds Alternative 4: Stewardship and Habitat Creation through Beneficial Use

This project would create and protect bird habitat through beneficial use of dredge material at two sites in the Gulf of Mexico: (1) Walker Island, AL, and (2) Matagorda Bay Bird Island (Chester Island) TX. This section includes project summaries for restoration activities at both sites.

Birds Alternative 4: Stewardship and Habitat Creation through Beneficial Use – Component 1: Walker Island, AL
Restoration approaches
• Restore and conserve bird nesting and foraging habitat • Create, restore, and enhance barrier and coastal islands and headlands
Restoration technique
This project will involve completing the construction of an island by implementing the following restoration technique: • Restore or construct barrier and coastal islands and headlands via placement of dredged sediments
Project location
Walker Island, AL. Walker Island is located in Bayou St John, in the vicinity of Orange Beach, AL and is owned by the City of Orange Beach.
Project background and summary
Walker Island is part of the Perdido Islands complex which includes Robinson Island (11 acres), Bird Island (15 acres), Walker Island (7 acres), Gilchrest Island (2 acres), and Boggy Point (7 acres). The sensitive habitats of the Perdido Islands support many important species and are an important nesting area for wading herons and terns, including the great blue heron. Robinson and Bird Islands are used by neotropical bird species migrating across the GOM. Walker Island experienced significant damage from Hurricane Ivan in 2004, losing approximately 10% of its land mass from the late 1990s to 2013, and has since continued to erode, especially at its eastern end, from storms, recreational activities, and other factors. The project would increase the extent of the remnant island by beneficially reusing sediment dredged from Perdido Pass to create approximately 4 acres of habitat on the eastern side of the island.

Birds Alternative 4: Stewardship and Habitat Creation through Beneficial Use – Component 1: Walker Island, AL
Project implementation methodology and timing
The Trustee agencies from AL would be the Implementing Trustee for this component. This project would be constructed in two phases. Phase 1 would include engineering and design to determine the most effective use of the dredged materials for the creation of additional bird nesting and stopover habitat. During Phase 2, sand dredged from Perdido Pass during an inlet maintenance event would be pumped and placed according to the resulting design plan. The pass was dredged in 2019, and that material was placed on the adjacent Robinson Island. The newly placed dredged material would be monitored. Specific information on construction methods and design details would be developed during Phase 1 but transport of the dredged material from Perdido Pass to the island is expected to occur via pipelines, and placed with the use of construction equipment such as excavators and dozers. Native vegetation would also be planted on the newly constructed areas if necessary. The Implementing Trustee would ensure that the selected contractor performs submerged aquatic vegetation (SAV) surveys during the design phase in order to avoid, to the maximum extent practicable, placing sediment over SAV. Impacts to existing wetlands during Phase 2 would be avoided to the maximum extent practicable during the development of the design plan.
Operations and maintenance
Walker Island would be managed for wading birds, which would include predator control, vegetation management, and posting signage. A recreational use management plan is currently in development for the Lower Perdido Islands. This project could be incorporated into that planning effort and managed so as to minimize potential recreational use conflicts.
Monitoring summary
Because the Regionwide TIG determined that this is a non-preferred alternative (see analyses in Chapters 3 and 4), this RP/EA does not include a MAM plan for this alternative.
Costs
The total estimated cost of this project is $4,000,000.

Birds Alternative 4: Stewardship and Habitat Creation through Beneficial Use – Component 2: Matagorda Bay Bird Island (Chester Island), TX
Restoration approaches
• Restore and conserve bird nesting and foraging habitat. • Create, restore, and enhance barrier and coastal islands and headlands.
Restoration techniques
This project would involve completing the construction of an island and implementing the following restoration techniques: • Enhance habitat through vegetation management. • Restore or construct barrier and coastal islands and headlands via placement of dredged sediments.
Project location
This component is the same as Component 4 of Birds Alternative 2. See Section 2.7.1.2.
Project background and summary
This component is the same as Component 4 of Birds Alternative 2. See Section 2.7.1.2.
Project implementation methodology and timing
This component is the same as Component 4 of Birds Alternative 2. See Section 2.7.1.2.
Operations and maintenance
This component is the same as Component 4 of Birds Alternative 2. See Section 2.7.1.2.
Monitoring summary
Because the Regionwide TIG determined that this is a non-preferred alternative (see analyses in Chapters 3 and 4), this RP/EA does not include a MAM plan for this alternative. However, because this component is also included as Component 4 of Birds Alternative 2, a preferred alternative, the MAM plan associated with that alternative includes a description of monitoring for this component (see Appendix A).
Costs
This component is the same as Component 4 of Birds Alternative 2. See Section 2.7.1.2.

2.7.2 Marine Mammals

The Regionwide TIG identified four Marine Mammals Restoration Type alternatives for evaluation in this RP/EA (Table 2-9). The Regionwide TIG determined that these alternatives met the screening criteria listed above and sufficiently aligned with priority restoration approaches and techniques (see Section 2.4.2). These alternatives would help meet the Regionwide TIG's programmatic restoration goal to Replenish and Protect Living Coastal and Marine Resources (see Section 2.1.1), and thus warrant further evaluation in this RP/EA.

Table 2-9. Reasonable range of alternatives for the Marine Mammals Restoration Type

Alternative	Estimated project cost
Alternative 1: Voluntary Modifications to Commercial Shrimp Lazy Lines to Reduce Dolphin Entanglements	$3,179,088
Alternative 2: Reducing Impacts to Dolphins from Hook-and-Line Gear and Provisioning through Fishery Surveys, Social Science, and Collaboration	$1,700,000
Alternative 3: Enhance Marine Mammal Stranding Network Diagnostic Capabilities and Consistency across the Gulf of Mexico	$2,300,000
Alternative 4: Enhance Capacity, Diagnostic Capability, and Consistency of the Marine Mammal Stranding Network in the Gulf of Mexico	$7,887,000

2.7.2.1 Marine Mammals Alternative 1: Voluntary Modifications to Commercial Shrimp Lazy Lines to Reduce Dolphin Entanglements

Marine Mammals Alternative 1: Voluntary Modifications to Commercial Shrimp Lazy Lines to Reduce Dolphin Entanglements
Restoration approach
Reduce commercial fishery bycatch through collaborative partnerships.
Restoration techniques
• Develop collaborative partnerships and convene workshops with the commercial fishing industry, gear experts, observer programs, academic institutions and researchers, and state and federal agencies to determine actions that would help reduce bycatch in each fishery or for specific gear types (e.g., research regarding potential gear modifications). • Test, implement, and evaluate potential bycatch reduction actions including gear modifications, fishery best-practice modifications, and outreach programs to promote effective strategies.
Project location
The following locations would be considered for in-water testing, based on commercial shrimp trawl activity and occurrence of a representative sample of various GOM bottlenose dolphin (*Tursiops truncatus truncatus*) estuarine and coastal stocks: Galveston, TX (includes the Galveston and West Bay estuarine bottlenose dolphin stocks, and the Western Coastal stock); Venice, LA (includes the Barataria and Mississippi River Delta estuarine bottlenose dolphin stocks, and the Western and Northern coastal stocks); Pascagoula, MS (includes the Mississippi Sound and Mobile Bay estuarine bottlenose dolphins, and the Northern coastal stock); and Panama City, FL (includes the St. Andrew Bay and St. Joseph Bay Stock estuarine stock, and the Northern coastal stock).

Marine Mammals Alternative 1: Voluntary Modifications to Commercial Shrimp Lazy Lines to Reduce Dolphin Entanglements
Project background and summary
The overall goal of this project is to benefit GOM bottlenose dolphins by decreasing the number of entanglements and associated mortality of dolphins in the lazy lines of commercial shrimp trawl vessels (otter and skimmer) operating within state inshore and coastal waters. Accidental capture of bottlenose dolphins in shrimp trawls or entanglement in lazy lines has been observed, and as a result, an estimated hundreds of dolphins are killed per year in the GOM commercial shrimp trawl fishery. From 1993 to 2019, the majority of observed dolphin mortalities in the GOM shrimp fishery were caused by entanglement in lazy lines. Lazy lines float free during active trawling, and as the net is hauled back, it is retrieved with a boat or grappling hook to guide and empty the trawl nets. Lazy lines are commonly made from a relatively “soft” polypropylene material, which can readily loop and entangle a dolphin. Prior research has identified alternative materials for lazy lines that could less readily loop and entangle dolphins, and these materials show promise for additional testing. These materials are also likely to appeal to commercial fishermen because the materials could help fishermen avoid dolphin entanglements without interfering with fishing activity or reducing catch. This project would be designed to have researchers and the fishing community cooperatively test the performance and usability of previously identified alternative lazy line materials. After in-water testing, the project team would identify the preferred lazy line material that facilitates successful fishing while also decreasing the potential for lethal dolphin entanglements. A plan would then be cooperatively developed to encourage the shrimp trawl fleet to voluntarily adopt the use of the alternative lazy line materials.
Project implementation methodology and timing
NOAA would be the Implementing Trustee for this alternative. This alternative has two phases with four total activities (three activities in Phase I; one activity in Phase II). Phase I would include (1) planning activities, (2) conducting collaborative in-water gear testing with researchers and industry members, and (3) developing a plan for voluntary gear modification throughout the GOM fleet. Cooperative testing of alternative lazy line materials could occur by chartering commercial shrimp trawl vessels and/or testing in a portion of the states’ shrimp trawl fleet. During this stage of the project, trained personnel would be placed aboard contracted shrimp trawl vessels to compare dolphin interaction rates with the modified lazy lines and usability during fishing operations. Once an alternative lazy line is identified based on cooperative testing, a plan would be developed to encourage use of the alternative lazy line throughout the fleet. The plan could include identifying pilot areas to initially implement the plan. This plan would also be cooperatively developed with pertinent stakeholders, including industry members and could include activities such as outreach, training, workshops, distributions, and/or monetary incentives to fishermen to use improved fishing gear. Phase I is time-critical because it would (1) determine the most effective and efficient alternative lazy line material through cooperative in-water testing; and (2) develop a plan for maximizing voluntary fleet-wide adoption. Phase II would involve working collaboratively with stakeholders, including interested members of the shrimp trawl fleet, to adopt broader use of the alternative lazy line material that most effectively reduces the occurrence of lethal entanglements of bottlenose dolphins. Implementation of Phase II could include a voluntary or incentive use program plan with a portion of interested fishermen in each state. The anticipated total project duration for both phases would be approximately 7 years, with approximately 4 to 5 years required for Phase I and approximately 2 to 3 years for Phase II.
Operations and maintenance
There are no additional O&M requirements for this project. All O&M needs for this project are accommodated through existing NOAA programs and facilities.
Monitoring summary
Appendix A includes a MAM plan for this alternative.
Costs
The total estimated cost of the project is $3,179,088.

2.7.2.2 Marine Mammals Alternative 2: Reducing Impacts to Dolphins from Hook-and-Line Gear and Provisioning through Fishery Surveys, Social Science, and Collaboration

Marine Mammals Alternative 2: Reducing Impacts to Dolphins from Hook-and-Line Gear and Provisioning through Fishery Surveys, Social Science, and Collaboration
Restoration approach
• Reduce injury and mortality of bottlenose dolphins from hook-and-line fishing gear. • Reduce injury, harm, and mortality to bottlenose dolphins by reducing illegal feeding and harassment activities.
Restoration techniques
• Conduct systematic surveys of anglers and characterize and evaluate stranding data to understand the scale, scope, and frequency of hook-and-line fishing interactions with dolphins. • Conducting human dimension studies to evaluate and characterize anglers' observations, attitudes, and perceptions toward dolphins and gear/fishery practice interactions • Develop collaborative partnerships and convene workshops with stakeholders to identify, test, and implement measures to reduce interactions.
Project location
Activities in this project would be implemented in TX, LA, MS, AL, and FL.
Project background and summary
Interactions between bottlenose dolphins and hook-and-line fishing gear occur throughout the GOM and are increasing. Hook-and-line (i.e., rod and reel) fishing gear is used by both for-hire boats (i.e., charter and headboats) and private anglers. Dolphin interactions with the gear primarily include (1) dolphins taking the bait or catch directly off the gear; or (2) dolphins scavenging discarded fish. Interactions are problematic for both anglers and dolphins. Interactions may decrease catch for anglers, damage gear, and limit their ability to fish in desired locations. Dolphins can suffer lethal injuries from entanglement in, or ingestion of, the gear, as well as related mortalities (e.g., fishermen retaliation by shooting). When dolphins learn to associate people with food from illegal feeding activities, their natural foraging patterns are disrupted and they favor an abnormal and risky feeding strategy that can lead to injury and death. Fed dolphins can become targets for human acts of retaliation, including anglers who become frustrated by begging dolphins that remove bait/catch from their gear, or scavenge discarded fish. The goals of this project are to reduce interactions between dolphins and hook-and-line fishing gear/fishing practices and to reduce illegal feeding activities, both of which can harm or kill dolphins. This project has four activities: (1) characterize the nature and magnitude of interactions between dolphins and hook-and-line gear and fishery practices through systematic fishery surveys, social science studies, and characterization of hook-and-line fishing gear found on stranded dolphins; (2) characterizing hook-and-line fishing gear found on stranded dolphins and locations of strandings to compare with fishery survey results; (3) characterize anglers' attitudes towards dolphins and their likelihood to take various actions, and to identify potential measures to reduce interactions through human dimension social science studies (e.g., focus groups, interviews); and (4) based on this information, collaboratively identify possible solution(s) that would reduce interactions between bottlenose dolphins and hook-and-line fishing activities. These activities would occur across all GOM states and benefit estuarine and coastal bottlenose dolphins. Conducting this project would lead to future restoration actions that involve developing, testing, and evaluating the identified solution(s) to reduce interactions; partnering with stakeholders to implement the identified solution(s); and systematically repeating fishery and social science surveys.

Marine Mammals Alternative 2: Reducing Impacts to Dolphins from Hook-and-Line Gear and Provisioning through Fishery Surveys, Social Science, and Collaboration
Project implementation methodology and timing
NOAA would be the Implementing Trustee for this alternative. This project has an anticipated project duration of approximately 5 years. The project would involve conducting systematic fishery surveys, characterizing hook-and-line gear found on stranded dolphins, conducting human dimension social science studies, and holding collaborative workshops to identify potential solutions (e.g., gear modifications, fishery practice changes, and deterrence measures) that would reduce interactions between dolphins and fishing gear and illegal feeding. Systematic fishery surveys could be conducted by a professional contractor and include selecting a portion of anglers (for-hire/private) in each GOM state to voluntarily participate in surveys. Locations within each state to select survey respondents would be chosen by examining dolphin strandings with hook-and-line gear attached and coordination with stakeholders (e.g., survey expert, industry representatives, and NOAA gear experts). Information collected from the fishery surveys and other available information on illegal feeding activities, as applicable, would be used to determine locations where social science studies would be conducted. These could occur either in hot-spot locations and/or at select locations in each GOM state including a portion of anglers in those areas. The collaborative workshops would include relevant stakeholders (e.g., anglers, researchers, state and federal agencies) and would be professionally facilitated. Workshops would be held throughout the GOM, with locations determined based on results from the systematic fishery surveys and social science studies. The project is time-critical because it would inform future project phases that could include collaboratively developing and testing the identified solution(s) with anglers and researchers; partnering with stakeholders to implement the evaluated solution(s); and repeating systematic fishery surveys and social science studies.
Operations and maintenance
There are no additional O&M requirements for this project. All O&M needs for this project are accommodated through existing NOAA programs and facilities.
Monitoring summary
Appendix A includes a MAM plan for this alternative.
Costs
The total estimated cost of the project is $1,700,000.

2.7.2.3 Marine Mammals Alternative 3: Enhance Marine Mammal Stranding Network Diagnostic Capabilities and Consistency across the Gulf of Mexico

Marine Mammals Alternative 3: Enhance Marine Mammal Stranding Network Diagnostic Capabilities and Consistency across the Gulf of Mexico
Restoration approach
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.
Restoration techniques
• Expand the MMSN's capabilities along the GOM coast. • Enhance capabilities to rapidly diagnose causes of marine mammal morbidity and mortality to identify threats and mitigate impacts.
Project location
Activities in this project would be implemented in TX, LA, MS, AL, and FL.

Marine Mammals Alternative 3: Enhance Marine Mammal Stranding Network Diagnostic Capabilities and Consistency across the Gulf of Mexico
Project background and summary
On average (based on data from 2005 through 2019), 428 cetaceans (whales or dolphins) are stranded along the GOM coast each year. Of these strandings, 11% are found alive and 89% are found dead. The 1992 Amendments to the MMPA formalized the MMSN. Regional MMSNs authorized[14] by NOAA Fisheries exist across all coastal states to respond to live and dead marine mammal strandings, including injured, entangled, and out-of-habitat small cetaceans, and to rehabilitate live stranded animals. These MMSN organizations include federal, state, and local government agencies, aquaria, universities, and nonprofit groups. Across the proposed project area, the GOM MMSN includes 14 authorized organizations (3 in Texas, 1 in Louisiana, 1 in Mississippi, 1 in Alabama, and 8 in Florida). This project focuses on activities that could support or enhance MMSN diagnostic capabilities to improve treatment and care for live stranded cetaceans and support data collection, reporting, and management consistency across the GOM MMSN as a whole. Specific project activities include: • **Improve diagnostic capabilities.** On average, only 3–5% of all live strandings from the GOM are rehabilitated and released back to the wild. This project would provide GOM MMSN organizations that respond to live stranded animals with hand-held blood analyzers to diagnose illness in the field. This would improve the capability of the GOM MMSN to evaluate animals at the stranding location to help determine whether they may or may not be a good candidate for immediate release or rehabilitation, or whether there is immediate, emergency medical treatment that could improve the animal's outcome. It would also improve outcomes for entangled or out-of-habitat cetaceans, by improving medical care during rescue. • **Provide auditory testing equipment and training.** Cetaceans rely on their hearing for foraging, communication, and predator avoidance. Per National Marine Fisheries Service (NMFS) guidelines (see NOAA 2009), live stranded cetaceans in rehabilitation should undergo a hearing test prior to release to ensure that they have a good likelihood of surviving in the wild. In addition, measuring an animal's hearing can provide important information to improve treatment and care for stranded animals. Cetacean hearing is measured using auditory evoked potentials (AEPs). This project would fund development, purchasing, and training for AEP equipment for the GOM MMSN. Access to AEP equipment would improve animal treatment and care and allow MMSN organizations to better evaluate causes of illness/stranding to increase the potential for immediate release or release after rehabilitation. • **Improve access to laboratory testing.** Analyzing samples (e.g., histopathology, biotoxin, virology, bacteriology) collected from stranded animals is critical to diagnosing causes of illness and death, better understanding population health, and evaluating anthropogenic and natural threats to marine mammals. Since these analyses can be costly, they are frequently a limitation for MMSN organizations and samples can go unanalyzed, which limits experts' understanding of animal health. This project would increase these diagnostic capabilities by establishing contracts with service laboratories to analyze tissue and other diagnostic samples collected from stranded cetaceans across the GOM.

14. Under Marine Mammal Protection Act Section 403. Stranding Response Agreements

Marine Mammals Alternative 3: Enhance Marine Mammal Stranding Network Diagnostic Capabilities and Consistency across the Gulf of Mexico
• **Enhance data management and synthesis.** Providing consistent, accurate, and timely information to marine mammal and conservation managers is critical for understanding population health, identifying emerging threats (e.g., new diseases, hotspots for human interaction, new types of interactions), and developing targeted actions to minimize and mitigate those threats. This project would support a NOAA data manager to work with the GOM MMSN organizations across the five states to provide quality assurance/quality control of stranding data, provide data entry training, and assist with entering and maintaining data in regional marine mammal health and stranding databases (e.g., Gulf of Mexico Marine Mammal Health Monitoring and Analysis Platform [GulfMAP] or Compilation of Environmental, Threats, and Animal Data for Cetacean Population Health Analyses [CETACEAN]). The data manager would also support managers, state agencies, and stakeholders by querying databases and synthesizing stranding data. • **Improve training and cross-network coordination.** Ensuring data are collected consistently across the GOM and that important skills are maintained across MMSN organizations would improve data quality as well as safety for personnel and stranded animals. This project would establish regular (e.g., 3 times per year) training sessions (e.g., Hazardous Waste Operations and Emergency Response [HAZWOPER], identifying signs of human interaction, necropsy techniques, and data/sample management) to improve and maintain the MMSN's capabilities over time and through personnel turnover. It would also establish workshops to improve communication and coordination across the network and share information about new threats and the efficacy of various response actions to those threats, with a focus on human and animal safety. Together, these activities would allow the MMSN to make better rehabilitation/release decisions for live stranded animals, improve understanding of population health, and increase consistency and accuracy of data availability to managers of marine mammals to allow for rapid responses to emerging threats.
Project implementation methodology and timing
NOAA would be the Implementing Trustee for this alternative. Because MMSNs already exist and operate in each of the five GOM states, little time would be required for planning, and implementation could begin immediately. A NOAA data manager would be hired within the first 3 months. Contracts would be established to fund diagnostic services and AEP equipment development in Year 1. Handheld blood analyzer equipment would be purchased within the first 6 months. The project would build upon the already established working relationships between NOAA, the Marine Mammal Health and Stranding Response Program (MMHSRP), and the individual MMSN organizations across the GOM. NOAA would provide regionwide coordination for activities related to bringing consistent diagnostic capabilities, training, and data management, to the overall GOM MMSN. The anticipated project duration is 5 years.
Operations and maintenance
There are no O&M requirements for this project.
Monitoring summary
Appendix A includes a MAM plan for this alternative.
Costs
The total estimated cost of the project is $2,300,000.

2.7.2.4 Marine Mammals Alternative 4: Enhance Capacity, Diagnostic Capability, and Consistency of the Marine Mammal Stranding Network in the Gulf of Mexico

Marine Mammals Alternative 4: Enhance Capacity, Diagnostic Capability, and Consistency of the Marine Mammal Stranding Network in the Gulf of Mexico
Restoration approach
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.
Restoration techniques
• Expand the MMSN's capabilities along the GOM coast. • Enhance capabilities to rapidly diagnose causes of marine mammal morbidity and mortality to identify threats and mitigate impacts. • Develop and increase the technical and infrastructure capabilities to respond to major stranding events or disasters.
Project location
Activities in this project would be implemented in TX, LA, MS, AL, FL.
Project background and summary
The background and motivation for this alternative is the same for the similar, smaller-scale alternative described above (Marine Mammals Alternative 3). This alternative would include all of the diagnostic equipment, data management, and training activities described for Alternative 3, but it would also: • Provide personnel (e.g., stranding response personnel, contract services with veterinarians), additional diagnostic (e.g., ultrasound or x-ray machines) and response equipment (e.g., trucks, trailers, stretchers, etc.), travel support, fuel, and vessel/vehicle maintenance to support stranded animal response. • Provide supplies to support the GOM MMSN to increase data collection, reporting, collaboration, and consistency across networks. These additional project components would allow the GOM MMSN to both improve the response time to live or dead stranded cetaceans and trapped or out-of-habitat marine mammals. They would also increase the networks' capacities to respond to unusual natural or anthropogenic events (e.g., oil spills, harmful algal blooms, freshwater events, hurricanes) and perform necropsies to understand marine mammal health and threats. All of these efforts would help support effective conservation management of marine mammals across the proposed project area.
Project implementation methodology and timing
NOAA and Trustee agencies from TX, LA, AL, MS, and FL would be the Implementing Trustees for this alternative. Because MMSNs already exist and operate in each of the five states along the GOM, little time would be required for planning, and implementation could begin immediately. The project would build upon the already established working relationships between NMFS, MMHSRP, and the individual MMSN organizations across the GOM. NMFS would provide regionwide coordination for activities related to bring consistent diagnostic capabilities, training, and data management, to the overall GOM MMSN. The individual MMSN organizations would likewise work closely with NMFS and the project team to identify staffing and equipment needs to enhance the MMSN at the local level. The anticipated project duration is 5 years.
Operations and maintenance
There are no O&M requirements for this project.
Monitoring summary
Because the Regionwide TIG determined that this is a non-preferred alternative (see analyses in Chapters 3 and 4), this RP/EA does not include a MAM plan for this alternative.
Costs
The total estimated cost of the project is $7,887,000.

2.7.3 Oysters

The Regionwide TIG identified two Oysters Restoration Type alternatives for evaluation in this RP/EA (Table 2-10). The Regionwide TIG determined that these alternatives met the screening criteria listed above and sufficiently aligned with priority restoration approach and techniques (see Section 2.4.3). These alternatives would help meet the Regionwide TIG's programmatic restoration goal to Replenish and Protect Living Coastal and Marine Resources (see Section 2.1.1), and thus warrant further evaluation in this RP/EA.

Table 2-10. Reasonable range of alternatives for the Oysters Restoration Type

Alternative	Estimated project cost
Alternative 1: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale)	$35,819,974
Component 1: East Galveston Bay, TX	TBD
Component 2: Biloxi Marsh, LA	TBD
Component 3: Heron Bay, MS	TBD
Component 4: Mid-lower Mobile Bay, AL	TBD
Component 5: Suwannee Sound, FL	TBD
Alternative 2: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale)	$22,300,000
Component 1: East Galveston Bay, TX	TBD
Component 2: Biloxi Marsh, LA	TBD
Component 3: Heron Bay, MS	TBD
Component 4: Mid-lower Mobile Bay, AL	TBD
Component 5: Suwannee Sound, FL	TBD

2.7.3.1 Oysters Alternative 1: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale)

This regionwide project would construct oyster reefs at five sites across the Gulf of Mexico, on up to 30 acres per site at: (1) East Galveston Bay, TX; (2) Biloxi Marsh, LA; (3) Heron Bay, MS; (4) Mid-lower Mobile Bay, AL; and (5) Suwannee Sound, FL. This section includes a project summary of oyster reef construction activities at each site. Figures 2-8 through 2-13 present maps of each site.

Oysters Alternative 1: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale)
Restoration approach
Restore oyster reef habitat.
Restoration techniques
• Restore or create oyster reefs through placement of cultch in nearshore and subtidal areas. • Enhance oyster reef productivity through spawning stock enhancement projects. • Develop a network of oyster reef spawning reserves.
Project location
The project includes five components, and would be implemented at five sites: (1) East Galveston Bay TX, (2) Biloxi Marsh, LA, (3) Heron Bay, MS, (4) Mid-lower Mobile Bay, AL; and (5) Suwannee Sound, FL. Implementing Trustees (NOAA, and agencies from TX, LA, MS, AL, and FL) would identify specific locations for reef construction during the planning stage of the project.
Project background and summary
The project aims to increase oyster abundance and restore resilience to oyster populations by increasing connectivity through larval transport and the construction of oyster reefs over a range of habitats and salinities. The project would create a network of high-vertical relief brood (protected) reefs that link to existing or created sink (harvest or protected) reefs through larval transport, and increase oyster population sustainability and oyster reef resilience. Based on siting studies (e.g., bathymetry, geologic surveys, etc.) reef design would increase the likelihood that larvae produced on the brood reefs would be transported the sink reefs. To increase resilience, the reefs would be placed along a salinity gradient based on local conditions. Given the annual variation in rainfall, associated freshwater inputs to estuaries, and ensuing variations in salinity, constructing reefs across a range of habitats and salinities increases the likelihood of oyster recruitment and survival. Furthermore, where possible, constructing reefs along an intertidal-subtidal gradient may restore the population linkage that was disrupted by the DWH oil spill. Reefs would be high enough to protect oysters from hypoxic bottom waters. Where possible, reefs would be constructed on suitable hard substrate that does not currently support oysters. If the brood reefs do not receive a natural spat set, hatchery spat or adult oysters may be transplanted to the reefs. A healthy network of oyster reefs would increase the ecosystem services provided by this species, including increased water filtration, shoreline protection, and habitat for reef-dwelling species. This general project summary applies to all components of this alternative. The following section provides additional details that are specific to each component:

Oysters Alternative 1: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale)
Component 1: Texas: Galveston Bay is a mesohaline estuary with access to saltwater on the west end, and a freshwater environment in the eastern area targeted for restoration. This area was heavily impacted by Hurricanes Ike (2008) and Harvey (2017), which buried much of the oyster population in the area. The goal of this component is to increase reef resilience to storms by using high-vertical reef design and strategic reef locations. Historically, this area was mined for shell, and the area currently holds the majority of the commercial oyster leases in Texas. This restoration would build on the Texas TIG's existing work in the area. Restoration would occur in three areas across a three-mile stretch of East Galveston Bay, extending from shoreline areas into subtidal areas 6 feet below mean sea level. Restoration would focus mainly on brood reefs rather than sink reefs to benefit nearby natural reefs. Harvesting would be prohibited in the shoreline area, according to a law restricting harvesting within 300 feet of a shoreline. Subtidal reef could be legally harvested but would be designed with large, vertically placed substrate, such as rock or concrete, to prevent use of an oyster dredge for harvesting. Component 2: Louisiana: This project area is in Mississippi Sound and the northern Biloxi marsh, and would include five or six subsites. Initial project planning activities would investigate substrate at these sites for feasibility, targeting hard sediment and historic reefs. There are many private oyster leases in the interior of the Biloxi marsh, which may assist in providing spat to the area. The construction of the reefs would utilize turtle-friendly high-relief materials, such as reef balls. If spat recruitment appears to be low, the Implementing Trustees may obtain and introduce spat from the oyster hatchery in Grand Isle. All constructed reefs would be closed to harvesting. Component 3: Mississippi: Heron Bay is part of the 29,909-acre Hancock County Marsh Preserve within the Pearl River estuary. In 2017, a living shoreline project was successfully constructed, and included a 46-acre subtidal reef in the bay, and this project would build on this success. Siting of reefs would include considerations of previous benthic surveys of the area and findings from the previous reef construction project under the NRDA Phase III Early Restoration Hancock County Marsh Living Shoreline Project. Previous restoration projects assessed substrate suitability via geophysical probing at five locations within Heron Bay, and sampled oyster habitat and areas that supported oysters in the past (buried shell). Past surveys found that SAV was present only along the fringe of the marsh in the restoration area, likely due to high tidal action. The potential restoration area is restricted from both commercial and recreational harvest. The Mississippi Department of Marine Resources would determine whether removing restrictions is appropriate. Nearby public commercially harvested reefs may benefit from the spat from these created reefs. Component 4: Alabama: The project area will include construction of new reefs or supplementation to existing reef areas at two or more sites on the western shore portions of mid-lower Mobile Bay, over an approximately 15 square-mile area. The project would use information gained from existing data collection and experimental projects currently underway in Alabama, which include a side-scan sonar project to identify potential restoration areas, and a project to examine the best configurations for reef construction at heights above bottom, where low dissolved oxygen is a concern. The reefs would be sited to facilitate spat transport from the brood reefs toward commercially harvestable reefs. These new reefs would be constructed of large, high-relief material. The reefs likely would not have permanent harvest restrictions; instead, harvest regulations would be determined after a certain number of years have passed since restoration or other parameters. Currently, the Alabama Marine Resources Division (AMRD) manages oyster harvest on public reefs by first conducting annual SCUBA quadrat surveys. The AMRD uses these survey results to estimate the total number of legal-size oysters on each individual reef. These estimates are used to develop a flexible harvest goal for each reef system. The flexible harvest goals allow for only a portion of the total oysters on an individual reef system to be harvested. The ADCNR would determine whether removing restrictions is appropriate based on an overall goal of minimizing loss of cultch and maintaining multiple age classes of oysters on reef areas. Harvest, if and when it occurs, would be via tonging or by hand.

Oysters Alternative 1: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale)
Component 5: Florida: The project area ranges from Cedar Key to Horseshoe Point, with a focus on Suwannee Sound. Historically, seagrass has been present in Suwannee Sound, Cedar Key, and Waccasassa Bay. Specific restoration sites would be identified during the planning stage using findings from a separate habitat suitability analysis and mapping work the FL TIG will perform between 2021 and 2023. Restoration likely would focus on sink reefs, as brood reefs may not be necessary. Currently, spat supply does not appear to be a limiting factor in this area. A NFWF-GEBF project, by the University of Florida, has had adequate spat settlement on several of its large restored portions of Lone Cabbage Reef. Another large project SE of Cedar Key is also relying on the natural spatfall from adjacent reefs. Most of the oyster bars currently in the area are intertidal. Reefs would be constructed with fossilized or recycled oyster shell or crushed limestone primarily in intertidal regions, however specific sites would be dictated by the FL TIG work described above. Intertidal reefs in this area are harvested primarily by hand (tonging occurs more on subtidal reefs). Minimal recreational harvest occurs in this area; most harvesting is commercial, by oyster harvesting fleets based in Cedar Key and Suwannee. The reefs likely would not have permanent harvest restrictions; instead, harvest regulations would be determined after a certain number of years have passed since restoration or based on percent coverage parameters. FWC would determine whether removing restrictions is appropriate by using a shell budget, the goal of which is to affect no net loss of cultch and maintain multiple age classes of oysters. A shell budget model is currently being built to assess and manage Apalachicola Bay after the 1,000-acre NFWF-GEBF restoration is complete in 2024. Additionally, there is potential for restoration in Suwannee Sound that may not be in shellfish-approved waters, and therefore will not be open to harvest.
Project implementation methodology and timing
NOAA and selected Trustee agencies from TX, LA, MS, AL, and FL would be the Implementing Trustees for this alternative. Project duration would be 7 years, which would include planning, implementation, and monitoring. The Regionwide TIG may delay implementation to allow for sufficient accumulation of funds for implementation. *Years 1–2: Planning and permitting* During Years 1–2, the Implementing Trustees would use existing bottom mapping, water quality data, habitat suitability indices, and larval transport models to identify appropriate locations for brood and sink reefs for each project component. Additional mapping and larval transport modeling may be necessary to assist with site selection. During Years 1–2, Implementing Trustees would also conduct pre-construction oyster surveys, E&D activities, environmental compliance consultations, and permitting. *Years 3–4: Construction* In Years 3–4, the Implementing Trustees would construct reefs in the waters of each state based on the engineering plans developed in Years 1–2. Post-construction surveys would verify that the reefs meet design specifications. *Years 5–7: Monitoring* Oyster reefs would be monitored for abundance, density, size distribution, and larval settlement.
Operations and maintenance
If monitoring indicates that the brood reefs do not receive a natural spat set, hatchery spat or adult oysters may be transplanted to the reefs.
Monitoring summary
Appendix A includes a MAM plan for this alternative.

Oysters Alternative 1: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale)
Costs
The total estimated cost of constructing up to 30 acres of oyster reefs at each of these five locations is $35,819,974. Costs per site would depend on specific reef designs developed during initial project planning activities. The Regionwide TIG would distribute this budget across the five reef construction sites. Cost estimates are based on building reefs to an average height of 1 foot above the surrounding bottom. Building taller reefs would decrease the acreage, and building shorter reefs would increase the acreage. The cost of materials and placement are based on an average unit cost for recent oyster restoration projects in the region.

2.7.3.2 Oysters Alternative 2: Improving Resilience of Oysters by Linking Brood Reefs and Sink Reefs (Small-scale)

This regionwide project would construct oyster reefs at five sites across the Gulf of Mexico, on up to 17 acres per site: (1) East Galveston Bay, TX; (2) Biloxi Marsh, LA; (3) Heron Bay, MS; (4) Mid-lower Mobile Bay, AL; and (5) Suwannee Sound, FL. This section includes a project summary of oyster reef construction activities at each site. Figures 2-8 through 2-13 present maps of each site.

Oysters Alternative 2: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale)
Restoration approach
Restore oyster reef habitat.
Restoration techniques
• Restore or create oyster reefs through placement of cultch in nearshore and subtidal areas. • Enhance oyster reef productivity through spawning stock enhancement project. • Develop a network of oyster reef spawning reserves.
Project location
The project includes five components, and would be implemented at five sites: (1) East Galveston Bay TX, (2) Biloxi Marsh, LA, (3) Heron Bay, MS, (4) Mid-lower Mobile Bay, AL, (5) Suwannee Sound, FL. Implementing Trustees (NOAA, and implementing agencies from Texas, Louisiana, Mississippi, Alabama, and Florida) would identify specific locations for reef construction during the planning stage of the project.
Project background and summary
See Oysters Alternative 1 in Section 2.7.3.1 for a description of project background and summary. This alternative would construct up to 17 acres of reef per site, instead of up to 30 acres per site in Alternative 1.
Project implementation methodology and timing
See Oysters Alternative 1 in Section 2.7.3.1 for a description of project implementation methodology and timing.
Operations and maintenance
See Oysters Alternative 1 in Section 2.7.3.1 for a description of O&M.
Monitoring summary
Because the Regionwide TIG determined that this is a non-preferred alternative (see analyses in Chapters 3 and 4), this RP/EA does not include a MAM plan for this alternative.

Oysters Alternative 2: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale)
Costs
The total estimated cost of constructing up to 17 acres of oyster reefs at each of these five locations is $22,300,000. Costs per site would depend on specific reef designs developed during initial project planning activities. The Regionwide TIG would distribute this budget across the five reef construction sites. Cost estimates are based on building reefs to an average height of 1 foot above the surrounding bottom. Building taller reefs would decrease the acreage, and building shorter reefs would increase the acreage. The cost of materials and placement were based on an average unit cost for recent oyster restoration projects across the region.

Figure 2-8. Proposed project areas for oyster reef locations for all project components

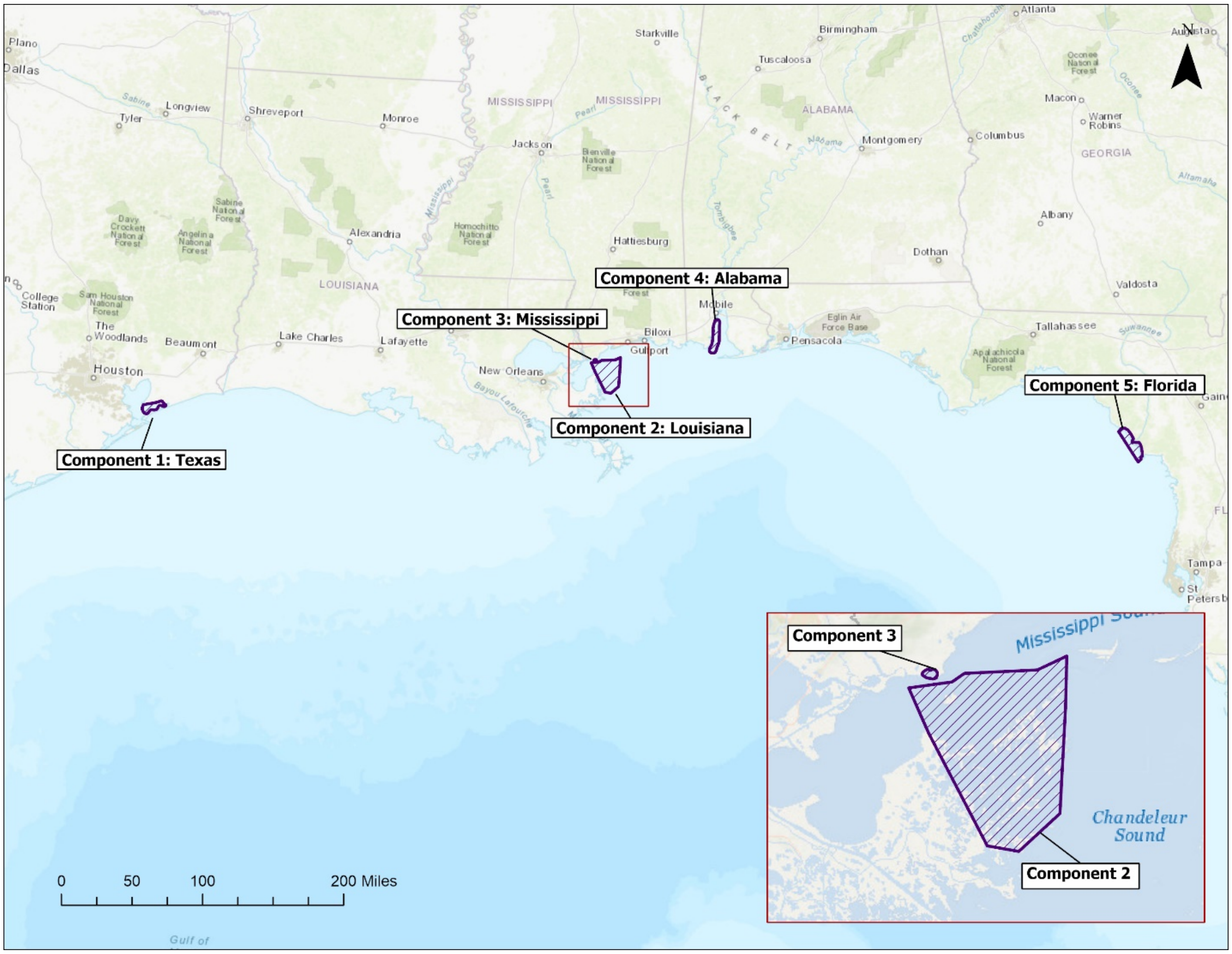


Figure 2-9. Proposed project area for Texas oyster reef locations

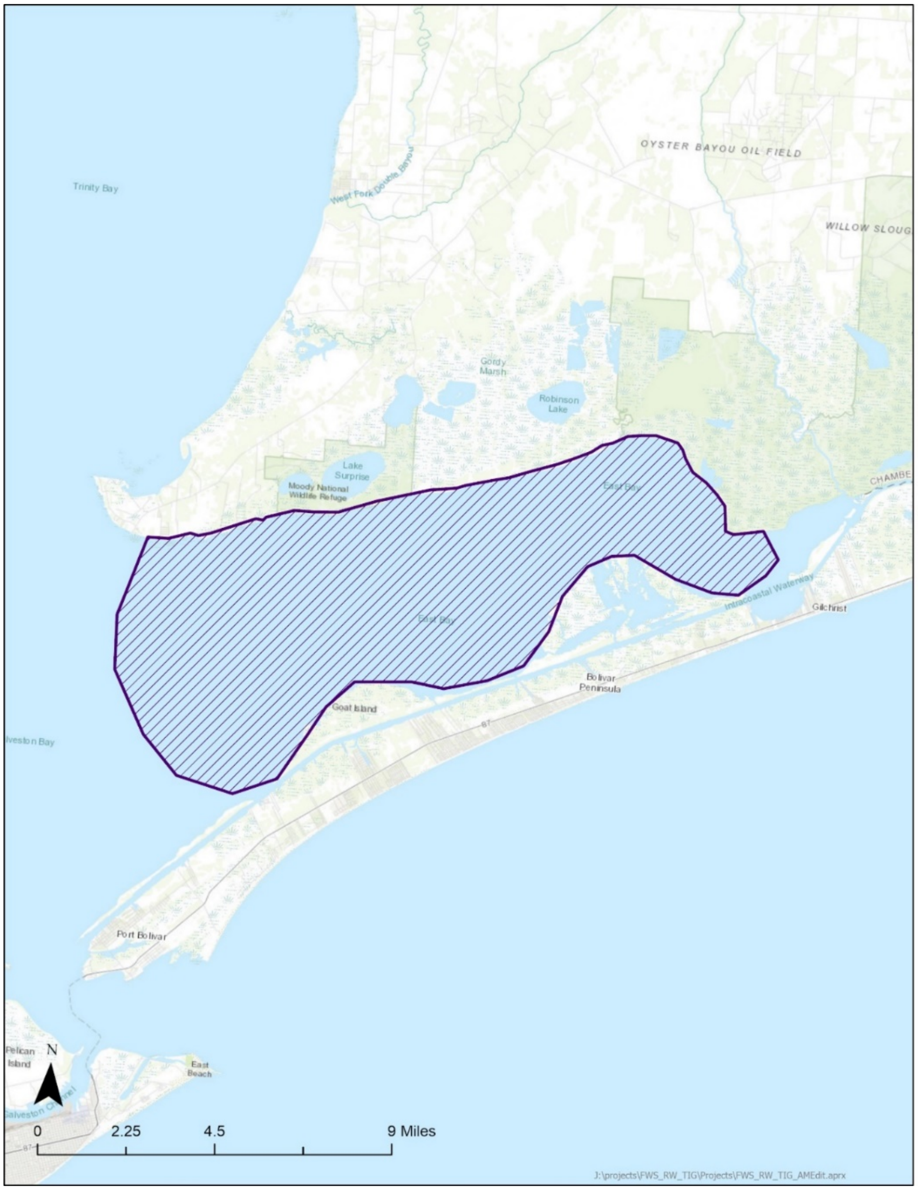


Figure 2-10. Proposed project area for Louisiana oyster reef locations

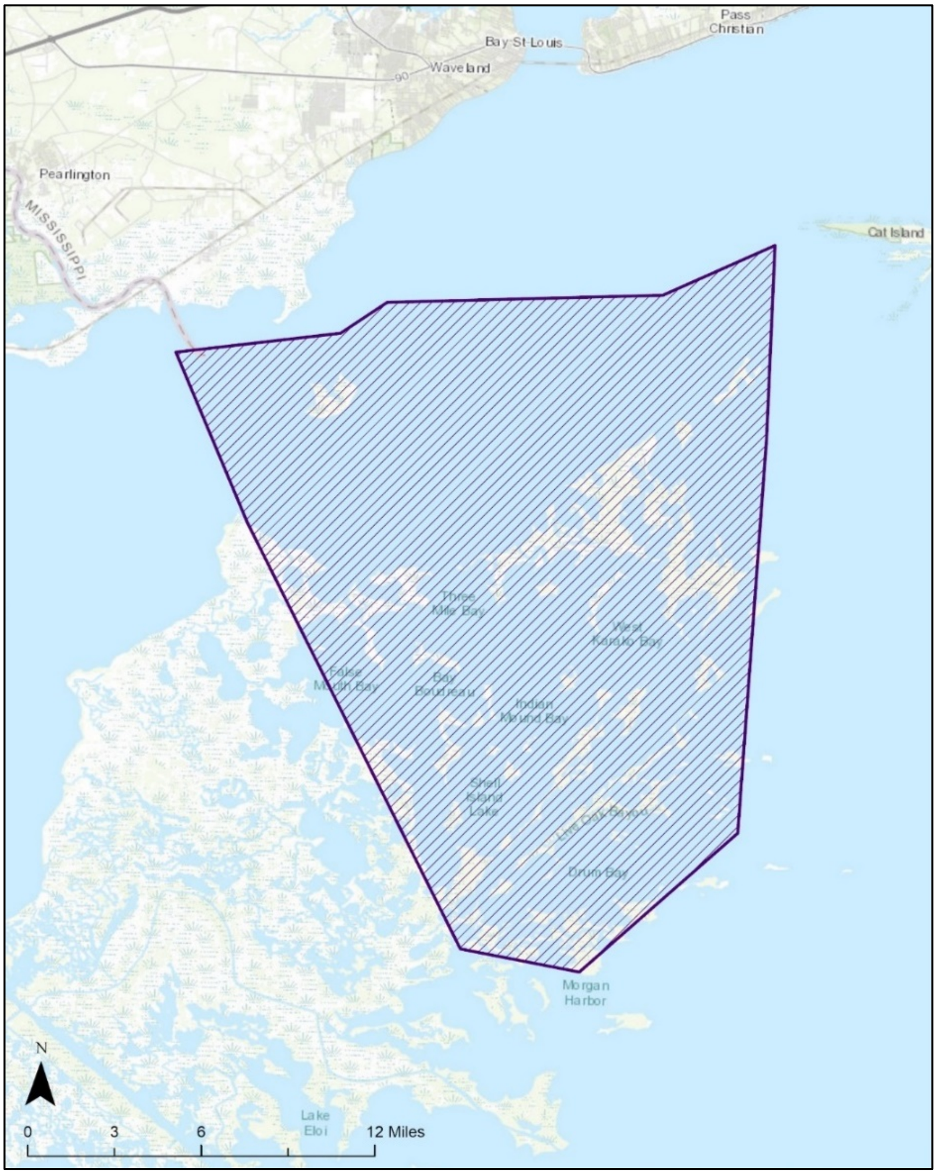


Figure 2-11. Proposed project area for Mississippi oyster reef locations

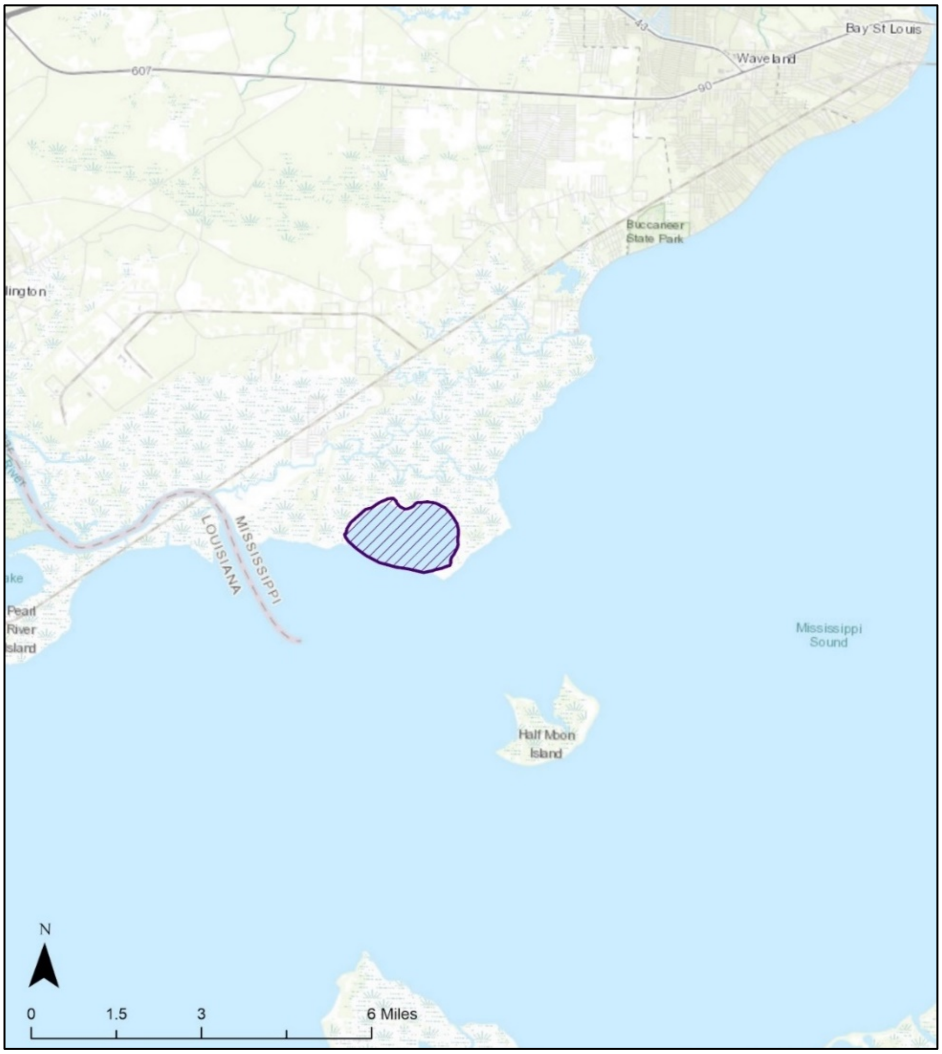
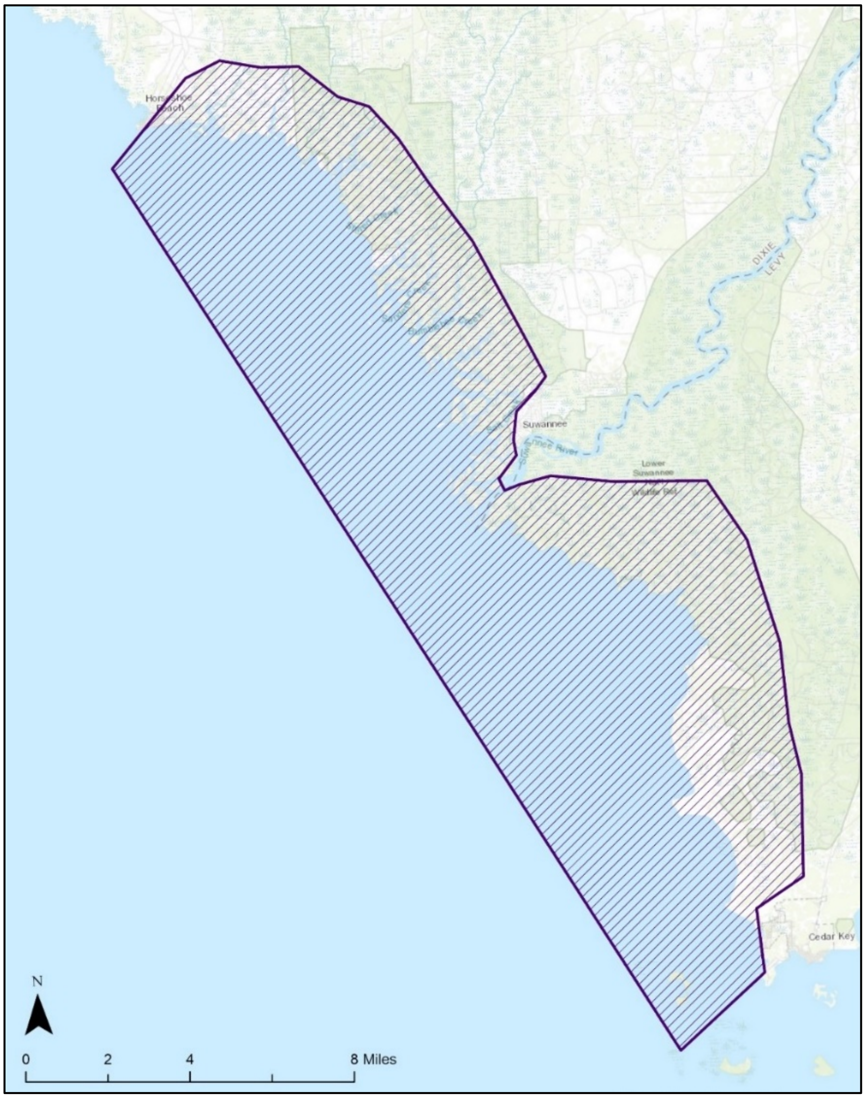


Figure 2-12. Proposed project area for Alabama oyster reef locations

Figure 2-13. Proposed project area for Florida oyster reef locations



2.7.4 Sea Turtles

The Regionwide TIG identified six Sea Turtles Restoration Type alternatives for evaluation in this RP/EA (Table 2-11). The Regionwide TIG determined that these alternatives met the screening criteria listed above and sufficiently aligned with priority restoration approaches and techniques (see Section 2.4.4). These alternatives could help meet the Regionwide TIG's programmatic restoration goal to Replenish and Protect Living Coastal and Marine Resources (see Section 2.1.1), and thus warrant further evaluation in this RP/EA.

Table 2-11. Reasonable range of alternatives for the Sea Turtles Restoration Type

Alternative	Estimated project cost
Alternative 1: Pilot Implementation of Automatic Identification System (AIS) in the GOM Inshore Shrimp Fishery to Inform Efforts to Reduce Sea Turtle Bycatch	$2,231,124
Alternative 2: Restore and Enhance Sea Turtle Nest Productivity	$7,655,000
Alternative 3: Guiding Restoration Success for Nesting Females and Hatchlings in the Northern Gulf of Mexico	$4,446,000
Alternative 4: Reducing Sea Turtle Bycatch at Recreational Fishing Sites	$3,649,360
Alternative 5: Reducing Marine Debris Impacts on Birds and Sea Turtles *(joint project with the Birds Restoration Type)*	$3,520,000 ($7,040,000 total project cost, split between the Birds and Sea Turtles Restoration Types)
Alternative 6: Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation	$5,050,000
Component 1: Enhancing Response, Coordination, and Preparedness in the Gulf of Mexico	$2,050,000
Component 2: Texas Rehabilitation Facility	$3,000,000

2.7.4.1 Sea Turtles Alternative 1: Pilot Implementation of Automatic Identification System (AIS) in the GOM Inshore Shrimp Fishery to Inform Efforts to Reduce Sea Turtle Bycatch

Sea Turtles Alternative 1: Pilot Implementation of Automatic Identification System (AIS) in the GOM Inshore Shrimp Fishery to Inform Efforts to Reduce Sea Turtle Bycatch
Restoration approach
Reduce sea turtle bycatch in commercial fisheries through identification and implementation of conservation measures.
Restoration technique
• Improve temporal and spatial fishery management to reduce sea turtle bycatch in GOM commercial fisheries. • Evaluate and implement options for vessel monitoring systems (VMSs) and electronic monitoring.
Project location
This project would span the nearshore/inshore waters of TX, LA, MS, AL, and FL, with a particular focus on the northern GOM, where spatiotemporal fishing effort is less understood.

Sea Turtles Alternative 1: Pilot Implementation of Automatic Identification System (AIS) in the GOM Inshore Shrimp Fishery to Inform Efforts to Reduce Sea Turtle Bycatch
Project background and summary
Bycatch in the GOM shrimp trawl fishery, which operates in inshore, nearshore, and offshore waters, is a known critical threat to sea turtles. This pilot project would focus on inshore and nearshore vessels to better understand spatiotemporal fishing effort. Data collected through this project would enhance the Trustees' understanding of the overlap of fishing effort, sea turtle distribution, and sea turtle mortality. Enhanced understanding of these areas of overlap would better inform actions to restore sea turtles by reducing bycatch in this fishery regionwide. To accomplish this objective, the project would use an AIS, an automatic tracking technology that uses transponders on vessels, to provide information about spatial and temporal movements. AIS provides a means to collect dynamic navigational data including position, course, and speed. AIS devices are required on commercial service/shipping vessels and large fishing vessels, which includes much of the federally permitted offshore shrimp trawl fishery. There is currently no requirement for smaller shrimp vessels that operate in nearshore/inshore waters to carry any technology that can help inform spatial and temporal patterns of fishing effort. This project would develop and test an electronic monitoring pilot program for inshore shrimp vessels using AIS Class B devices. The project would include the purchase and installation of AIS Class B equipment, and participation by vessel operators would be voluntary. Collection of data on spatial and temporal patterns of shrimp fishing effort would identify areas of overlap between sea turtles and the nearshore/inshore shrimp trawl fishery in order to inform future restoration planning and the training, education, and outreach activities of NOAA's Gear Monitoring Team to reduce sea turtle bycatch and mortality.
Project implementation methodology and timing
The Implementing Trustee for this alternative would be NOAA, with involvement from other Regionwide TIG Trustees. The project would establish a Steering Committee comprised of NOAA observer program and electronic monitoring experts, NOAA sea turtle experts, and state fisheries managers. Year 1 would focus on planning, including identifying eligible vessels for voluntary participation. Implementation would take place in Years 2 and 3 with the focus on outreach to fishers to recruit voluntary participation in the project, purchase of equipment, and engagement with the industry to facilitate the installation/maintenance of equipment. The project would target 500–1,000 vessels and would include extensive outreach and education with eligible vessel operators identified in the planning phase of the project. The Steering Committee would determine whether the vessels would be incentivized to participate in the project and how an incentivized program would be structured and implemented. Data analysis and data reporting tools would be developed to interpret the AIS data in near real time. The duration of this project would be 3 years.
Operations and maintenance
Over the course of the project, the Implementing Trustees would maintain equipment it installs on volunteer vessels. The AIS system is linked to satellites, and no manual download from the actual equipment onboard vessels is necessary to analyze data. All data downloading is completed remotely by NOAA.
Monitoring summary
Appendix A includes a MAM plan for this alternative.
Costs
The total estimated cost of this project is $2,231,124.

2.7.4.2 Sea Turtles Alternative 2: Restore and Enhance Sea Turtle Nest Productivity

Sea Turtles Alternative 2: Restore and Enhance Sea Turtle Nest Productivity
Restoration approach
Enhance sea turtle hatchling productivity and restore and conserve nesting beach habitat.
Restoration techniques
• Reduce artificial lighting visible from nesting beaches. • Enhance protection of nests by addressing anthropogenic threats. • Provide beach user outreach and education. • Reduce nesting beach barriers.
Project location
The project area includes key nesting beaches across the northern GOM (TX, MS, AL, FL), the Archie Carr NWR on the east coast of Florida, and northern Mexico.
Project background and summary
To restore sea turtles lost to the DWH oil spill, this project would develop and implement restoration actions to improve hatchling production for loggerhead, Kemp's ridley, and green sea turtles on sandy beaches throughout the northern GOM (TX, MS, AL, FL), on high-density nesting beaches in and adjacent to Archie Carr NWR on the east coast of FL, and in northern Mexico. During the project's initial planning activities (Phase 1), Implementing Trustees (Texas, MDEQ, Alabama, Florida, DOI) would identify the highest priority threats to key nesting beaches. Information gathered and compiled into a database would include existing and potential nesting beach physical characteristics, nest productivity, existing threats, and management actions. During Phase 2, Implementing Trustees would implement actions that would help nesting females secure access to suitable nesting habitat, successfully excavate nests, and return to the water after nesting; enhance nest success; and enhance hatchling emergence and seaward migration. Actions would align with species-specific recovery plans and state-specific rules and could include removing barriers to beaches, managing nests to protect eggs and hatchlings when necessary and appropriate, monitoring beaches to prevent predation and poaching, reducing lighting near beaches, and restoring beach habitat. The data from this alternative would be incorporated into the Open Ocean TIG's Gulf of Mexico Sea Turtle Atlas.
Project implementation methodology and timing
DOI and selected Trustee agencies from MS, AL, FL, and TX would be the Implementing Trustees for this alternative. Working with local resource managers, Implementing Trustees would assess the highest priority threats to successful nesting in the project area, and then strategize and work with local resource managers to implement appropriate restoration actions to improve nesting success and hatchling production. Conducting nest surveys on remote beaches otherwise not surveyed would be coordinated with state and federal entities. These surveys, also part of the planning phase, would take 3 years and may overlap with other planning activities. Implementation of restoration activities would begin within Years 1 and 2, and would continue for 5–10 years overall, depending on the nature and scope of the restoration actions developed during planning. Some of these restoration actions could include implementing projects to improve nesting beach habitat (e.g., reduce beachfront lighting, restore degraded dunes), barrier removal, or other management efforts to remove impediments to nesting. Some site- or area-specific plans may require construction or physical modifications of the beach to meet restoration goals (e.g., sand placement, removing terrestrial hazards and barriers like dilapidated seawalls and grounded vessels). Other restoration actions would require either providing funding to existing land managers or local communities (e.g., lighting management, ecologically sensitive predator control, leave-no-trace programs, beach education programs, or new monitoring programs).

Sea Turtles Alternative 2: Restore and Enhance Sea Turtle Nest Productivity
Operations and maintenance
Over the course of the project, Implementing Trustees would operate and maintain field vehicles and equipment for documenting sea turtle nesting on a previously un-surveyed beach (to be identified during the project planning phase) or for expanding or improving surveys on a beach with an existing program. This would be done in coordination with state and/or federal entities. Implementing Trustees would also maintain databases and knowledge-sharing platforms throughout the project period.
Monitoring summary
Appendix A includes a MAM plan for this alternative.
Costs
The total estimated cost of this project is $7,655,000.

2.7.4.3 Sea Turtles Alternative 3: Guiding Restoration Success for Nesting Females and Hatchlings in the Northern Gulf of Mexico

Sea Turtles Alternative 3: Guiding Restoration Success for Nesting Females and Hatchlings in the Northern Gulf of Mexico
Restoration approach
Enhance sea turtle hatchling productivity and restore and conserve nesting beach habitat.
Restoration technique
This project would develop and implement a data collection strategy that would help inform future restoration, and would utilize the following techniques: • Reduce artificial lighting visible from nesting beaches. • Enhance protection of nests by addressing anthropogenic threats. • Acquire lands for conservation of nesting beach habitat. • Provide beach user outreach and education. • Reduce nesting beach barriers.
Project location
The project would include nesting beaches for loggerhead and green turtles in TX, LA, MS, AL, and FL. The initial approach would focus on nesting beaches in the Florida Panhandle, Alabama, Mississippi, and potentially Louisiana and Texas. Some nesting beaches are located on barrier islands and other inaccessible locations. This project would accommodate low-accessibility sites to the extent possible.
Project background and summary
Understanding where sea turtles nest most frequently and successfully (i.e., where they produce the most hatchlings) can point to where and how to achieve the most meaningful restoration. More specifically, understanding where sea turtle nests succeed or fail, and why, can help natural resource managers know what to do to best improve sea turtle hatchling production. For example, if nests are often lost through predation on a specific beach, managers can implement nest protection or relocation strategies to protect newly laid eggs. While standardized sea turtle nesting surveys are conducted throughout most of the proposed project area, standardized measures of hatching success are not collected. This project would implement a number of activities to better understand sea turtle nesting behavior and success, which are described in more detail below.

Sea Turtles Alternative 3: Guiding Restoration Success for Nesting Females and Hatchlings in the Northern Gulf of Mexico
Project implementation methodology and timing
DOI would be the Implementing Trustee for this alternative. To learn more about patterns of sea turtle nesting behavior and success, the project would: • Compile hatchling production data from GOM nesting beaches. Project implementers would work with permitted nest monitoring teams to compile information of sea turtle nests (number of eggs laid, eggs hatched, unhatched eggs, dead and live hatched, emerged hatchlings) in a standardized way. Where these monitoring teams do not exist, the project would establish or hire teams to collect data where data are insufficient. Achieving this standardization across the Gulf facilitates interpretation of sea turtle hatchling production data to guide future restoration activities on the nesting beach. • Collect demographic data and distribution of nesting female sea turtles on northern and western GOM beaches using a genetic mark-recapture method. This component is focused on Northern Gulf Recovery Unit loggerhead nesting beaches (and greens where they overlap) where this information is lacking. Project implementers would work with permitted nest monitoring teams or entities, under new or existing permits, to collect one egg from each nest each season for a minimum of 5 years for genetic analysis. This would provide a genetic "fingerprint" of the female that could be used in future years to understand where individual females nest, how often they do so, and how successful they are. • Summarize both hatchling and nesting female data sets. Project staff would integrate information and data from this project with the DWH Sea Turtle Nesting Coordination Committee (STNCC) and GOM Sea Turtle Atlas if/when these are established to guide future restoration activities. Project efforts would include support for conducting several training workshops and travel for site visits, genetic sample analyses, database management, synthesis and interpretation of adult female and hatchling data, and the identification of potential future restoration activities in collaboration with other sea turtle restoration efforts. In addition, the information and data from this project would be integrated with the STNCC and GOM Sea Turtle Atlas if/when these are established to guide future restoration activities. This 12-year project would cover two inter-nesting intervals.
Operations and maintenance
There would be no O&M needs or requirements.
Monitoring summary
Because the Regionwide TIG determined that this is a non-preferred alternative (see analyses in Chapters 3 and 4), this RP/EA does not include a MAM plan for this alternative.
Costs
The total estimated cost of the project is $4,446,000.

2.7.4.4 Sea Turtles Alternative 4: Reducing Sea Turtle Bycatch at Recreational Fishing Sites

Sea Turtles Alternative 4: Reducing Sea Turtle Bycatch at Recreational Fishing Sites
Restoration approach
Reduce sea turtle bycatch in recreational fisheries through development and implementation of conservation measures.
Restoration technique
• Improve the understanding of bycatch in recreational fisheries in the GOM (e.g., characterization of sea turtle bycatch on hook-and-line gear). • Identify and experimentally implement potential bycatch reduction measures to determine their effectiveness.
Project location
This project would be implemented in TX, LA, MS, AL, and FL.
Project background and summary
This project would help restore injured sea turtles by reducing bycatch of sea turtles at shore-based recreational fishing locations, such as fishing piers, bridges, and other shoreline structures. Each year the STSSN documents incidentally hooked and entangled sea turtles at recreational piers and other shore-based fishing sites throughout the GOM. However, these reports are opportunistic and likely only represent a portion of the hook-and-line interactions that are occurring. Many factors determine whether an incidental hooking or entanglement is reported, including public awareness about whom to contact and appropriate measures to take to minimize harm to the turtle. The goal of the project is to identify factors contributing to sea turtle bycatch at shore-based recreational fishing sites through three primary activities carried out under this project: 1. Initial data gathering through assessment and mining of STSSN and existing angler survey data as well as a compilation of existing information on GOM shore-based fishing sites. 2. Conducting surveys and local assessments to better understand angler fishing practices and potential co-factors influencing sea turtle bycatch. These survey data would feed into a comprehensive data analysis to assist in identifying/exploring bycatch co-factors and inform the development and implementation of angler education/incentive programs for reporting bycatch. 3. Implementing angler education and other pilot programs to reduce sea turtle bycatch and bycatch injury. These measures would depend on survey results and could include voluntary modification of fishing practices such as bait or hook type or other identified co-factors.
Project implementation methodology and timing
NOAA would be the Implementing Trustee for this alternative, but may engage other Trustees as co-Implementors, as appropriate. The project would last 5 years and would involve three primary activities (see project summary above). Activity 1 would take place during Years 1–2. This activity would help inform the identification of sites for Activity 2, which would take place during Years 2–4. Angler surveys would take place using NOAA's survey collection *Recreational Angler Survey of Sea Turtle Interactions*, OMB Control No. 0648-0774, exp date: 12/31/2021. Activity 3 would take place during Years 2–5; it would be informed by Activities 1 and 2. Collaboration with municipalities and states at identified fishing sites as well as individual anglers and the STSSN would be important to the success of the project.
Operations and maintenance
There would be no O&M requirements for this project.
Monitoring summary
Appendix A includes a MAM plan for this alternative.
Costs
The total estimated cost of this project is $3,649,360.

2.7.4.5 Sea Turtles Alternative 5: Reducing Marine Debris Impacts on Birds and Sea Turtles *(joint project with the Birds Restoration Type)*

This is a joint project with the Birds Restoration Type. Section 2.7.1.1 provides a description of this project.

2.7.4.6 Sea Turtles Alternative 6: Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation

This multi-component project would (1) enhance STSSN response, coordination, preparedness, and response capacity; and (2) construct a new rehabilitation facility to increase preparedness and response capacity. This section provides a summary of each activity.

Sea Turtles Alternative 6: Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation – Component 1: Enhancing response, coordination, preparedness in the Gulf of Mexico
Restoration approach
Increase sea turtle survival through enhanced mortality investigation and early detection of and response to anthropogenic threats and emergency events.
Restoration techniques
• Provide enhanced network response and coordination. • Provide enhanced data access and analysis. • Improve coordination and communication among rehabilitation facilities, state coordinators, the USFWS, and NOAA. • Provide enhanced preparedness and response capacity for emergency events. • Enhance investigation of mortality sources.
Project location
This project would be implemented in TX, LA, MS, AL, and FL.
Project background and summary
Stranding response networks located in each of the five GOM coast states create an extensive regionwide network that provides critical support and care for injured sea turtles, as well as valuable information about mortality sources. This project would enhance the capabilities of project partners conducting stranding and rehabilitation activities in the GOM by supporting critical enhancement needs for STSSN response efforts that are not already being addressed through other funding sources (e.g., the Sea Turtle Early Restoration Project and NFWF-GEBF). Project funding would provide support for equipment and supply needs (e.g., additional tanks, water filtration equipment, medical equipment) for existing sea turtle rehabilitation facilities. The project could provide support for responding to stranding events, recovering and necropsying dead stranded sea turtles to better understand mortality sources, or filling other identified gaps in STSSN response coverage where sea turtles would benefit from increased response effort and/or capacity. Specific activities could include education and outreach, transporting live sea turtles for rehabilitation, implementing stranding surveys, and providing veterinary services. Stranding response and rehabilitation activities are ongoing along the GOM coast and emergency events can occur any time across the proposed project area. Maintaining the ability and readiness to respond to a periodic, large-scale stranding events resulting from anomalies (e.g., red tide, cold stun) can potentially improve the survival of stranded individuals depending on the factor(s) causing the stranding event.

Sea Turtles Alternative 6: Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation – Component 1: Enhancing response, coordination, preparedness in the Gulf of Mexico
Project implementation methodology and timing
This project would be implemented by a partnership of co-Implementing Trustees. The partnership would include selected Trustee agencies from TX, LA, MS, AL, and FL; NOAA; state STSSN coordinators; and the National STSSN Coordination Team. These entities would coordinate annually to discuss potential priorities of the various stranding network partners. After these discussions, the partners would develop a regional work plan, and the Implementing Trustees would review and approve the combined work plan, which would be submitted to the Regionwide TIG for final approval. The work plan would include a description of the tasks, the identification of the organization to carry out that task, the funding needed, and the mechanism for distributing the funding. Evaluation, prioritization, and addressing critical enhancement needs and current funding gaps for STSSN response would begin upon project approval and would take approximately 5 years to complete.
Operations and maintenance
It is likely that individual organizations would be able to absorb the cost of maintaining most equipment purchased as part of their daily operating tasks. However, Regionwide TIG funds may help repair or replace key pieces of equipment that have exceeded their expected operational life.
Monitoring summary
Appendix A includes a MAM plan for this alternative.
Costs
The total estimated cost of the project is $2,050,000.

Sea Turtles Alternative 6: Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation – Component 2: Texas Rehabilitation Facility
Restoration approach
Increase sea turtle survival through enhanced mortality investigation, and early detection of response to anthropogenic threats and emergency events.
Restoration techniques
• Enhance network response and coordination. • Enhance preparedness and response capacity for emergency events. • Enhance rehabilitation capability where necessary.
Project location
The Texas rehabilitation facility would be located in Galveston, TX. The facility would help strengthen the existing STSSN and improve regionwide response.

Sea Turtles Alternative 6: Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation – Component 2: Texas Rehabilitation Facility
Project background and summary
This project would enhance the capabilities of project partners conducting stranding and rehabilitation activities in the GOM by supporting the construction of a new rehabilitation facility on the upper Texas coast. This activity would address a gap in the network by replacing lost rehabilitation capacity due to the impending closure of an existing facility. Without this sea turtle rehabilitation facility, sea turtles stranding on the upper Texas coast would have to travel 3.5 to 5.5 hours (depending on location) to reach the nearest facility. Dedicated personnel and/or vehicle availability to routinely transport turtles longer distances may not be possible in a timely manner. In addition, the existing facilities may not have capacity to intake more sea turtles during large-scale stranding events. Typically, cold-stunned events occur on the lower Texas coast; however, the existing Galveston facility is often used to house and treat the overflow when the middle and lower coast facilities reach capacity during large events. Between 2015 and 2019, the existing Galveston facility rehabilitated an average of 234 sea turtles per year. Because Texas has so few long-term rehabilitation facilities that can handle critical care (four facilities), 367 miles of coastline, and a large number of live strandings that are rehabilitated on the upper Texas coast, the reduction of one rehabilitation facility would potentially have a significant effect on the ability of the network to successfully provide coverage to rehabilitate and release sea turtles.
Project implementation methodology and timing
The Trustee agencies from TX would be the Implementing Trustee for this component. This alternative would provide partial funding to replace the facility on the upper Texas coast to enhance STSSN rehabilitation capacity in Texas. The project would fund the purchase of all life support systems for two hospital wards and non-releaseable/ ambassador sea turtle holding areas. This includes saltwater pumps for moving saltwater from the bay to the facility, saltwater storage, chiller/heater, off-gas tower, protein skimmers, and all necessary pumps, filters, tanks, in-line heaters, and associated plumbing. Water quality supplies would include fecal coliform testing such as an Idexx system, supplies to measure chlorine levels (for disinfection), salinity, pH, and water quality monitoring and flow systems. The Texas Trustees would implement the construction of the rehabilitation facility on the upper Texas coast. This project component would take approximately 5 years to complete.
Operations and maintenance
The project would leverage O&M costs (which include personnel time) from other sources, and would not use Regionwide TIG funds for O&M activities. To fund O&M, the facility would charge admission to tourists to visit the facility, which would include exhibits that convey environmental and conservation messages, as well as opportunities to view ambassador turtles and the hospital ward and veterinary clinic. The facility would partner with the Texas A&M University Foundation to seek a $2 million endowment to secure funding for salaries and operational costs. The facility would also rely upon gifts, donations, and grants to fund salaries and operational costs. Additional revenue is expected from sales of merchandise from an online store and physical in-house gift shop. Maintenance of the facility would be conducted through a partnership with Texas A&M University's facility services. The university expects that the facility would be financially independent.
Monitoring summary
Appendix A includes a MAM plan for this alternative.
Costs
The total estimated cost of the project is $3,000,000.

3. OPA Evaluation of Alternatives

This chapter presents OPA analyses of the reasonable range of alternatives described in Section 2.7. It begins with a summary of the OPA evaluation standards (Section 3.1), presents an overview of monitoring requirements (Section 3.2), and provides a description of estimated costs (Section 3.3) and best management practices (BMPs; Section 3.4). Sections 3.5–3.8 present OPA analyses by Restoration Type including a brief overview of each alternative and tables summarizing the Trustees' evaluation of each alternative based on the OPA evaluation standards. Section 3.9 synthesizes conclusions of the OPA evaluation of all alternatives.

3.1 Summary of OPA Evaluation Standards

OPA NRDA regulations provide guidance for Trustees to consider and evaluate a reasonable range of restoration alternatives (15 C.F.R. 990.53(a)(2)) before selecting the preferred alternative(s), in accordance with the OPA evaluation standards (15 C.F.R. 990.54). Chapter 2 describes the process for screening and identifying the reasonable range of alternatives. Chapter 3 describes the Trustees' evaluation of the reasonable range of alternatives and the identification of preferred restoration alternatives based on, at a minimum, the factors established in 15 C.F.R. 990.54(a):

- The cost to carry out each alternative;
- The extent to which each alternative is expected to meet the Trustees' goals and objectives of returning the injured natural resources and services to baseline and/or compensating for interim losses;
- The likelihood of success of each alternative;
- The extent to which each alternative would prevent future injury as a result of the incident and avoid collateral injury as a result of implementing the alternative[15];
- The extent to which each alternative would benefit one or more natural resources and/or services; and
- The effect of each alternative on public health and safety.

If the Trustees conclude that two or more alternatives are equally preferable, based on the above factors, they select the most cost-effective alternative (15 C.F.R. 990.54(b)).

3.2 Monitoring Requirements

When developing a restoration plan, NRDA Trustees establish restoration objectives that are specific to the injuries to each natural resource (15 C.F.R. 990.55(b)(2)), and that clearly state the desired project outcomes and the performance criteria by which successful restoration will be evaluated. Establishing performance criteria and monitoring the extent to which restoration fulfills these criteria will help determine whether the restoration successfully meets these objectives under the OPA NRDA regulations (15 C.F.R. 990.55(b)(2)). The monitoring component of a restoration plan is described in more detail in 15 C.F.R. 990.55(b)(3).

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15. In the OPA analysis, the Regionwide TIG examined whether the restoration alternatives had the potential to cause direct or indirect collateral environmental injuries. Projects that involved more than planning/data collection were analyzed in detail in Section 4.3, Environmental Consequences, of this RP/EA.

The Trustees identified Monitoring, Adaptive Management, and Administrative Oversight as a programmatic restoration goal in the PDARP/PEIS. Chapter 5, Appendix E of the PDARP/PEIS describes the Trustee Council's agreement to develop a NRDA MAM Manual to support restoration activities. The MAM Manual helps the Trustees incorporate the best available science into project planning and design, identify and reduce key uncertainties, track and evaluate progress toward restoration goals, determine the need for adaptive management and corrective actions, and support compliance monitoring. The MAM Manual provides a flexible, science-based approach to effectively and efficiently implement restoration over several decades and assessing long-term benefits to the resources and services injured by the DWH oil spill.

MAM plans identify the monitoring protocols necessary to evaluate progress toward meeting project-specific restoration objectives, and the information gathered through MAM activities is used to help guide any necessary corrective action and adaptive management at key decision points during the implementation of a project. These plans are consistent with requirements and guidelines established in the PDARP/PEIS, the Trustee SOPs, and the Trustee Council MAM Manual. The MAM plans include descriptive information regarding monitoring goals, objectives, parameter details (e.g., methods and timing/frequency), potential corrective actions, and/or monitoring schedules depending on the level of detail currently available for the projects. MAM plans are living documents that can be updated and revised to reflect changing conditions and incorporate new information. For example, the plan may need to be revised if the project design is changed, if the initial data analysis indicates that the sampling design is inadequate, if uncertainties are resolved, or if new uncertainties arise during project implementation and monitoring. Revisions to individual MAM plans and new information about monitoring activities will be publicly available through the Trustee Council's Data Integration Visualization Exploration and Reporting (DIVER) website.[16] MAM plans for the preferred alternatives relevant to this RP/EA are included in Appendix A of this document.

3.3 Estimated Project Costs

Costs of alternatives included in this RP/EA reflect estimates based on the most current designs and information available to the Regionwide TIG. Estimated costs reflect all costs associated with implementing the project, potentially including, but not limited to, E&D, permitting, pilot studies, construction/implementation, monitoring, Trustee oversight, and contingencies.

3.4 Best Management Practices

Federal and state regulatory agencies provide information about BMPs as part of the environmental compliance process. BMPs provide guidance on design criteria and offer lessons learned, expert advice, tips from the field, and more. Trustees use appropriate BMPs to avoid or minimize impacts to natural resources, including protected species and their habitats. Specific project designs for all project types must include BMPs and other mitigation measures to avoid or minimize adverse effects to sensitive natural resources. Trustees may find information about BMPs, and select the most appropriate BMPs, through required permitting processes,

16. Project records are available at www.gulfspillrestoration.noaa.gov/restoration-areas/regionwide and through the interactive project map at www.habitat.noaa.gov/storymap/dwh/index.html.

consultations, or environmental reviews, including those described in Appendix 6.A of the PDARP/PEIS. Regulatory agencies that provide technical assistance may also help Trustees identify and design BMPs that are most effective for a specific restoration alternative.

3.5 OPA Evaluation of Alternatives for the Birds Restoration Type

The Regionwide TIG identified four Birds Restoration Type alternatives for detailed analysis in this RP/EA, and evaluated these alternatives consistent with OPA regulations in 15 C.F.R. 990.54(a). The following sections summarize OPA evaluation results for each alternative.

3.5.1 Birds Alternative 1: Reducing Marine Debris Impacts on Birds and Sea Turtles *(joint project with Sea Turtles Restoration Type)*

This alternative would reduce the threat and impacts of marine debris (e.g., entanglement, entrapment, and/or ingestion) to DWH-injured bird and sea turtle species across the proposed project area. The project would remove marine debris including, but not limited to, derelict fishing gear (i.e., monofilament fishing line, nets, trap/pot gear, and other recreational or commercial fishing equipment that has been lost, abandoned, or discarded). This restoration would be jointly implemented (shared costs) between the Birds and Sea Turtles Restoration Types. Implementation would occur throughout the proposed project area at an estimated cost of $7 million, or $3.5 million from each Restoration Type. Section 2.7.1.1 provides a detailed description of this alternative.

Birds Alternative 1: Reducing Marine Debris Impacts on Birds and Sea Turtles (joint project with Sea Turtles Restoration Type)	
Cost to Carry out the Alternative	The total estimated cost of this alternative is approximately $7 million, which would be divided equally between the Birds and Sea Turtles Restoration Types. This cost is based on estimates from similar past projects and expertise developed while implementing bird restoration initiatives. The Regionwide TIG found the cost to be reasonable and appropriate. One example of a similar effort is from the Open Ocean TIG project “Reduce the Impacts of Ghost Fishing by Removing Derelict Fishing Gear from Marine and Estuarine Habitats.” This project is similar in scope, implements similar activities on a similar geographic range, and cost $6.1 million, just below the estimate for this alternative. This alternative is designed to increase the efficiency and effectiveness of restoration actions over its duration through development of a prioritization process during initial planning activities. Marine debris “hotspots” would be determined by identifying areas that pose the highest risk to birds or sea turtles in the GOM. The removal of debris from these hotspots regionwide would help achieve cost efficiencies by reducing the threat/impact of marine debris to both sea turtles and birds. The hotspot analysis is critical to identifying areas where removal of abandoned, lost, or discarded fishing gear and other debris that poses a threat to birds and sea turtles will be most effective for restoration.

Birds Alternative 1: Reducing Marine Debris Impacts on Birds and Sea Turtles (joint project with Sea Turtles Restoration Type)	
Trustee Restoration Goals & Objectives	This alternative would restore natural resources that were injured by the DWH oil spill as described in the PDARP/PEIS, Strategic Framework for Bird Restoration Activities, and the call for project ideas. It would also contribute to the Trustees' programmatic restoration goal to Replenish and Protect Living Coastal and Marine Resources. Specifically, it would address the following Restoration Type goals outlined in the Strategic Framework for Bird Restoration Activities: (1) restore lost birds by facilitating additional production and/or reduced mortality of injured bird species; (2) restore or protect habitats on which injured birds rely; and (3) restore injured birds by species where actions would provide the greatest benefits within geographic ranges that include the GOM. This alternative would address the first goal by reducing marine debris related mortality for birds. It would address the second goal by identifying marine debris "hotspots" and removing debris from these areas that pose high risk to birds. Such hotspots could occur in onshore, nearshore, or offshore habitats, but all efforts to reduce marine debris from areas that birds utilize would help restore their habitats. This project would reduce the risk of birds ingesting, becoming entangled with, or being entrapped by marine debris, namely derelict fishing gear, which would reduce bird injury and mortality (DWH NRDA Trustees 2017a). This alternative would address the third goal by focusing restoration on "hotspots" that represent the largest marine debris threats to birds in the GOM, where DWH related injuries to birds occurred. The alternative's regional approach, with partners across the GOM, would result in a longer-term benefit to injured species across a wider geographic range.
Likelihood of Success	The Regionwide TIG anticipates this alternative would have a high likelihood of success because it enhances and complements existing marine debris removal programs and is based on proven, established techniques (see DWH NRDA Trustees 2017, NOAA's Marine Debris Removal Program, EPA's Trash-Free Waters Program). In addition, the alternative includes a public outreach component to further increase the success of the program through awareness and prevention (NOAA 2020c). The likelihood of success is increased by coordinating efforts among key regional partners to address prevention, removal, data collection, and management of marine debris. The Implementing Trustees (TX, LA, MS, AL, FL, EPA, NOAA) would also implement a MAM plan (see Appendix A) that would assess progress toward project goals, help minimize risk, and address key uncertainties on an ongoing basis.
Avoidance of Collateral Injury	The Regionwide TIG does not expect this alternative to cause collateral injury to natural resources. All vessels and equipment used to survey and remove debris would be operated in a manner designed to avoid adverse impacts to natural resources. While the removal of marine debris could lead to collateral injury to organisms residing in the sediment below the debris or that have settled onto the debris, such impacts would be minor and short-lived. The Implementing Trustees would take all appropriate coordination and protective measures to avoid collateral injury.
Benefits to Multiple Resources	This alternative would benefit multiple bird subgroups, including colonial waterbirds, solitary beach-nesting birds, osprey, northern nesting birds, Caribbean nesting birds, and pelagic seabirds that utilize the nearshore habitat in the project area and were injured by the DWH oil spill. This alternative would also benefit sea turtles, including Kemp's ridley, loggerhead, and green sea turtles, and marine mammals, which may become entangled in marine debris. The removal of marine debris from beaches, dunes, marshes, seagrass beds, and reefs would also be expected to directly benefit these habitats by preventing marine debris related damage to vegetation, soils, and sediments.

Birds Alternative 1: Reducing Marine Debris Impacts on Birds and Sea Turtles (joint project with Sea Turtles Restoration Type)	
Public Health & Safety	The Regionwide TIG does not anticipate impacts to public health and safety from the implementation of this alternative. All vessels and equipment used as a part of the effort for removal and prevention of marine debris would be operated according to standard safety protocols to avoid any public health and safety impacts. The project would be implemented with the assistance of appropriately trained personnel, and participants would be made aware of the potential for injury in collecting marine debris through disclaimers and waivers (as necessary). Volunteers would also be provided protective gear to ensure operational safety during removal activities by volunteer groups. The Implementing Trustees would comply with all relevant safety measures, practices, and regulations during project implementation to maintain a safe, protective environment for those involved with the project.

3.5.2 Birds Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds

This alternative would conserve, create, restore, and/or enhance nesting and foraging habitat for the benefit of multiple DWH-injured bird species across a range of habitats and locations in the proposed project area. Target species and specific restoration techniques that are most appropriate for each project component would be identified and refined during the project planning process. For the proposed locations in Texas (Matagorda Bay Bird Island [Chester Island], San Antonio Bay Bird Island), Mississippi (Round Island), and Alabama (Pilot Town/Little Dauphin Island), the work completed would include restoration planning and implementation. The Louisiana component would involve E&D for restoration work in the Chandeleur Islands. The total estimated cost of the alternative, including all components, is $22.5 million. The OPA analysis below considers all components of the alternative. Section 2.7.1.2 provides a detailed description of this alternative.

Birds Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds	
Cost to Carry of the Alternative	The total estimated cost of this alternative is $22.5 million. These costs are reasonable based on Trustees' experience with similar projects and expertise developed while implementing (1) "beneficial use" projects (i.e., projects that rely on the beneficial use of dredge material deposition to create and sustain bird habitat – Matagorda Bay Bird Island [Chester Island] and San Antonio Bay Bird Island, TX); (2) habitat management projects (i.e., Round Island, MS); (3) land acquisition/ management (i.e., Pilot Town/Little Dauphin Island, AL); and (4) E&D (i.e., Chandeleur Islands, LA). For beneficial use and habitat management components of the alternative, the Regionwide TIG developed costs based on similar projects in relevant Restoration Areas. For land acquisition components, the Regionwide TIG relied on appraisals and previous experience in completing land acquisition projects in developing cost estimates, and would use Government Accountably Office Yellow Book (see www.gao.gov/yellowbook/overview) or other appropriate standards to keep costs reasonable for E&D components. The Regionwide TIG would follow relevant state procurement laws to help ensure reasonable costs for engineering services. The five individual components making up this alternative vary in scope and cost. Below are some examples of roughly comparable restoration efforts, which the Trustees used to determine that the proposed costs are reasonable. Efforts at Round Island, MS, would be similar to the combination of two Florida TIG projects: "Gulf Islands National Seashore Invasive Plant Removal" and "St. Vincent National Wildlife Refuge Predator Control." The Round Island project has increased costs because it is not as accessible as the Florida projects and will include sediment restructuring and debris removal. The Pilot Town/Little Dauphin Island, AL, effort is comparable to a previous Alabama TIG project: "Laguna Cove Little Lagoon Natural Resource Projection," which acquired land in a similar area and at a similar cost per acre. The Chandeleur Islands E&D component for $8 million is similar in scope to the Louisiana TIG E&D project for Raccoon Island for $7 million.
Trustee Restoration Goals & Objectives	This alternative would restore natural resources that were injured by the DWH oil spill as described in the PDARP/PEIS, Strategic Framework for Bird Restoration Activities, and the call for project ideas. It would also contribute to the Trustees' programmatic restoration goal to Replenish and Protect Living Coastal and Marine Resources. It would also address the following Restoration Type goals outlined in the Strategic Framework for Bird Restoration Activities: (1) restore lost birds by facilitating additional production and/or reduced mortality of injured bird species; (2) restore or protect habitats on which injured birds rely; and (3) restore injured birds by species where actions would provide the greatest benefits within geographic ranges that include the GOM. This alternative would address the first goal by enhancing nesting habitat for birds, which could lead to increases in nesting activity and/or success. It would address the second goal by restoring and conserving bird nesting and foraging habitats; creating, restoring, and enhancing barrier and coastal islands and headlands; and protecting and conserving coastal, estuarine, and riparian habitats. More specifically, beneficial use components of the alternative would use dredge material deposition to create and sustain beach habitat for birds, and design and build shore protection features (e.g., breakwaters, reefs, jetties, groins) to reduce coastal habitat erosion. The habitat management components would include removing invasive and unwanted vegetation, planting native shrub species, and debris removal. The land acquisition components would include the acquisition and permanent protection, and in some cases subsequent restoration by partners, of islands that provide valuable habitat for birds. Implementing Trustees (DOI, LA, AL, TX, MS) would utilize approaches that would restore bird habitat regionwide and benefit multiple avian species across the proposed project area. This alternative would address the third goal by restoring habitat for waterbirds, shorebirds, and waterfowl regionwide, thereby benefiting multiple avian species across the project area.

Birds Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds	
Likelihood of Success	The alternative is technically feasible and likely to succeed based on past Trustee experience with similar types of projects (DWH NRDA Trustees 2016a). For example, using dredge material to create bird nesting habitat is a well-established restoration approach that has been successfully utilized in many other locations throughout the United States (Golder et al. 2008). Similarly, vegetation and debris management on beaches is known to help sustain the viability of beach habitat for nesting birds (National Audubon Society 2012; DWH NRDA Trustees 2017a). The conservation and restoration of coastal and barrier islands on which birds already nest is a widely used tool in bird conservation (DWH NRDA Trustees 2016a). Engineering designs would incorporate lessons learned from similar projects implemented in the GOM to help Trustees select the most effective designs and thus increase the likelihood of success for this alternative. The Implementing Trustees would also implement a MAM plan (see Appendix A) that would assess progress toward project goals, help minimize risk, and address key uncertainties on an ongoing basis.
Avoidance of Collateral Injury	The Regionwide TIG does not expect this project to result in substantial collateral injury to natural resources, and any collateral injuries incurred would be expected to be minor compared to the restoration benefits provided by the project. For sites that would involve construction, disturbance would be expected to be short-term (during construction). In all cases, construction would be designed, or required via applicable and relevant permits, to avoid impacts to resources, such as the disturbance of birds/sea turtles during the nesting season, or disturbance to oyster beds. The Implementing Trustees would use BMPs and protective measures to avoid collateral injury.
Benefits to Multiple Resources	This alternative would support the conservation and restoration of a variety of coastal and nearshore habitats (e.g., barrier and coastal islands, beaches, dune, and SAV). The associated habitats of these sites would support a range of bird guilds, including waterfowl, shorebirds, wading birds, and colonial ground-nesting birds. This habitat restoration also would benefit other natural resources that rely on these same habitat types, including sea turtles and fish.
Public Health & Safety	The Regionwide TIG does not anticipate adverse impacts to public health and safety from the implementation of this alternative. E&D projects do not pose a health and safety risk, and any sites that include construction impacts would be clearly marked and closed to public access while the construction is underway. The Implementing Trustees would comply with all relevant safety measures, practices, and regulations during project implementation to maintain a safe, protective environment for those involved with the project.

3.5.3 Birds Alternative 3: Bird Nesting and Foraging Area Stewardship

This alternative would protect bird nesting and foraging habitat through increased stewardship in areas important for birds throughout the Gulf of Mexico and on the Northeast Coast of Florida. The alternative proposes a variety of habitat protection activities, including creation of vegetative buffers and placement of exclusion devices, implementation of predator control strategies, placement of signage and fencing, and public outreach. This alternative would include restoration components in Texas, Mississippi, Florida, and Alabama at an estimated cost of $8.5 million. Section 2.7.1.3 provides a detailed description of this alternative.

Birds Alternative 3: Bird Nesting and Foraging Area Stewardship	
Cost to Carry out the Alternative	The total estimated cost of this alternative is approximately $8.5 million. The Regionwide TIG reviewed the estimated cost of this alternative and found it to be reasonable and appropriate. The total estimated cost of this alternative is based on estimates from similar past projects and expertise developed through implementation of previous bird stewardship initiatives. One example of a similar past project is the Alabama TIG project: "Stewardship of Coastal Alabama Beach Nesting Bird Habitat," which cost $2 million and implemented a similar suite of activities. While this previous project cost much less than the costs estimated for this alternative, activities were implemented only in one state; this alternative would implement similar activities in four states. In addition, stewardship programs often heavily rely on volunteers, which would make this alternative particularly cost efficient. Combining multiple state-level restoration components of this alternative into a single regionwide initiative would also create synergies and facilitate data-sharing, which would result in further cost efficiencies. This alternative would coordinate with existing state and regional (e.g., GoMAMN) monitoring programs to establish monitoring methods, and share existing data and project experience/lessons learned. It would also consolidate and analyze monitoring data collected during the project to best leverage opportunities and maximize the impact of restoration funds.
Trustee Restoration Goals & Objectives	Implementation of this alternative would restore natural resources injured by the DWH oil spill as described in the PDARP/PEIS, the Strategic Framework for Bird Restoration Activities, and the call for project ideas. It would also contribute to the Trustees' programmatic restoration goal to Replenish and Protect Living Coastal and Marine Resources. Specifically, this alternative would address the following Restoration Type goals outlined in the Strategic Framework for Bird Restoration Activities: (1) restore lost birds by facilitating additional production and/or reduced mortality of injured bird species; (2) restore or protect habitats on which injured birds rely; and (3) restore injured birds by species where actions would provide the greatest benefits within geographic ranges that include the GOM. This alternative would address the first goal by enhancing nesting habitat for birds, which could lead to increases in nesting activity and/or success. It would address the second goal by protecting bird habitat through the placement of exclusion devices and vegetated buffers, raised boardwalks over or fences around dunes, lethal and nonlethal predator control, reduced vehicle speed limits or vehicular access, patrols by wildlife stewards or law enforcement, and targeted outreach and education. These efforts would increase bird nesting success, survival, and public awareness of important nesting areas throughout the proposed project area. This alternative would address the third goal by focusing restoration on coastal habitats throughout the GOM where DWH related injuries to birds occurred.
Likelihood of Success	This alternative is technically feasible and has a high likelihood of protecting coastal habitats critically important to the reproduction and nesting success of bird species injured by the DWH oil spill. It would use well-established, standardized restoration techniques that have been used successfully in other locations in the GOM, indicating a high likelihood of success (DWH NRDA Trustees 2012, 2016a, 2017; National Audubon Society 2012). This alternative would complement and enhance Trustees' and other partners' ongoing efforts to address habitat loss and degradation of nesting and foraging habitats regionwide. The Implementing Trustees (TX, MS, AL, FL) would also implement a MAM plan (see Appendix A) that would assess progress toward project goals, help minimize risk, and address key uncertainties on an ongoing basis.

Birds Alternative 3: Bird Nesting and Foraging Area Stewardship	
Avoidance of Collateral Injury	The Regionwide TIG does not expect the implementation of this alternative to result in substantial short- or long-term collateral injuries to natural resources that would outweigh the restoration benefits of this project. This alternative would include limited, minor construction activities, and primarily would focus on habitat protection and stewardship, resulting in benefits to birds. For sites that would involve construction, disturbance would be expected to be short-term (during construction). In all cases, construction would be designed, or required via applicable and relevant permits, to avoid impacts to resources, such as the disturbance of birds/sea turtles during the nesting season. The Implementing Trustees would use BMPs and protective measures to avoid collateral injury.
Benefits to Multiple Resources	This alternative would increase the acreage of protected nesting and foraging habitats of multiple colonial waterbird species and solitary beach-nesting shorebirds. Nesting and foraging area stewardship activities, such as reducing vehicular traffic and controlling invasive predators, could also provide ancillary benefits to other species that use similar habitats (e.g., sea turtles), and could enhance recreational uses that were impacted by the DWH oil spill (e.g., bird watching).
Public Health & Safety	The Regionwide TIG does not anticipate impacts to public health and safety by implementation of this alternative. Bird stewardship as well as habitat and nest enhancements rely on measures such as public education, symbolic fencing, and data gathering that pose no risks to the public. Sign placement similarly poses no risk to the general public. Predator management may involve electric fencing and other activities that could pose minor or temporary risks, but the Trustees would take appropriate measures to mitigate such risks (e.g., signage). The Implementing Trustees would comply with all relevant safety measures, practices, and regulations during implementation to maintain a safe, protective environment for those involved with the project.

3.5.4 Birds Alternative 4: Stewardship and Habitat Creation through Beneficial Use

This alternative would involve beneficial use of dredge material to build bird islands at two locations in the Gulf of Mexico. The alternative would also improve recreational access and would support restoration and/or management to benefit nesting shorebirds and other wildlife. The alternative includes two projects: one in Alabama and the other in Texas, at an estimated cost of $6.5 million. Section 2.7.1.4 provides a detailed description of this alternative.

Birds Alternative 4: Stewardship and Habitat Creation through Beneficial Use	
Cost to Carry Out the Alternative	The total estimated cost of this alternative is approximately $6.5 million. The Regionwide TIG determined that this cost is reasonable based on Trustees' extensive experience and expertise acquired while implementing beneficial use projects across the GOM for decades. As in past DWH restoration projects, the USACE would manage (and would assume the costs of) planning for the dredged placement, and this would create cost savings for this alternative stemming from USACE's extensive past experience with similar projects.

Birds Alternative 4: Stewardship and Habitat Creation through Beneficial Use	
Trustee Restoration Goals & Objectives	Implementation of this alternative would restore natural resources injured by the DWH oil spill as described in the PDARP/PEIS, Strategic Framework for Bird Restoration Activities, and the call for project ideas. It would also contribute to the Trustees' programmatic restoration goal to Replenish and Protect Living Coastal and Marine Resources. Specifically, this alternative would address the following Restoration Type goals outlined in the Strategic Framework for Bird Restoration Activities: (1) restore lost birds by facilitating additional production and/or reduced mortality of injured bird species; and (2) restore or protect habitats on which injured birds rely. This alternative would address the first goal by enhancing nesting habitat for birds, which could lead to increases in nesting activity and/or success. It would meet the second goal by enhancing coastal island habitat, on which birds injured by the DWH oil spill rely on for foraging, nesting, and resting. However, because this alternative would provide funding for restoration in only two locations, its regionwide benefits would be limited. In addition, it employs only one restoration tool of constructing of coastal islands through the beneficial use of dredged sediments, while other alternatives use multiple restoration approaches/techniques to benefit birds regionwide. Relying on a smaller set of restoration approaches potentially limits the Trustees' ability to meet their goals and objectives.
Likelihood of Success	This alternative is technically feasible, and likely to succeed. The islands that would be restored currently provide some nesting and feeding habitat for many bird species. Expanding the islands would increase the capacity to deliver benefits. Shorebirds use sites created or enhanced with dredged materials for resting, foraging, and nesting. Dredge placement islands have become important alternative nesting sites for shorebirds and wintering birds because of habitat loss and disturbance on barrier islands and the mainland. The Implementing Trustees would also implement a MAM plan (see Appendix A) that would assess progress toward project goals, help minimize risk, and address key uncertainties on an ongoing basis.
Avoidance of Collateral Injury	The Regionwide TIG does not expect the implementation of this alternative to result in substantial short- or long-term collateral injuries to natural resources that would outweigh the restoration benefits of this project. For example, the creation of coastal islands would result in the burial of habitat beneath the newly created islands. However, the footprint of habitat loss would be relatively small, and the injuries incurred are expected to be more than offset by the highly valuable bird habitat being created. Coastal island construction could also result in driving wildlife away from the area due to noise, and localized changes in turbidity during sediment deposition, but the injuries are expected to be minor and short-term (during construction). In all cases, construction would be designed, or required via applicable and relevant permits, to avoid impacts to resources, such as the disturbance of birds during the nesting season or the disturbance of oyster beds.
Benefits to Multiple Resources	This alternative is designed to benefit many species of shorebirds and waterbirds (e.g., piping plover, red knot (*Calidris canutus rufa*), American oystercatcher (*Haematopus palliates*), least tern (*Sternula antillarum*)). This alternative could also benefit other wildlife (e.g., crabs, finfish, and sea turtles) that use coastal island habitat and the aquatic systems surrounding them.
Public Health & Safety	The Regionwide TIG does not anticipate impacts to public health and safety from the implementation of this alternative. These sites would be clearly marked and closed to public access while construction is underway. The Implementing Trustees (DOI, TX, AL) would comply with all relevant safety measures, practices, and regulations during project implementation to maintain a safe, protective environment for those are involved with the project.

3.6 OPA Evaluation of Alternatives for the Marine Mammals Restoration Type

The Regionwide TIG identified four Marine Mammals Restoration Type alternatives for detailed analysis in this RP/EA, and evaluated these alternatives consistent with OPA regulations in 15 C.F.R. 990.54(a). The following sections summarize OPA evaluation results for each alternative.

3.6.1 Marine Mammals Alternative 1: Voluntary Modifications to Commercial Shrimp Lazy Lines to Reduce Dolphin Entanglements

This alternative would help decrease entanglements of bottlenose dolphins in commercial shrimp trawl lazy lines and thus related injury and mortality by cooperatively testing the effectiveness and usability of alternative shrimp trawl lazy line materials that are less prone to looping and entangling dolphins. The project would have two phases. Phase I would determine the most effective and efficient alternative lazy line material through cooperative in-water testing; and developing a plan for how to effectively encourage voluntary fleet-wide adoption, as much as practicable. This would entail acquiring modified lazy line materials and equipment and developing standardized protocols and procedures for their use, along with identifying a timeline for in-water testing and testing locations. It would also involve recruiting commercial shrimp trawl vessels for participation in the in-water testing program and training personnel. As a part of implementation, trained personnel would be placed aboard contracted shrimp trawl vessels to compare dolphin interaction rates with the modified lazy lines compared to standard lazy lines, as well as comparisons on usability and performance. Phase II would involve working collaboratively with stakeholders, including interested members of the shrimp trawl fleet, to adopt broader use of the alternative lazy line material that most effectively reduces the occurrence of lethal entanglements of bottlenose dolphins. This alternative would occur at multiple locations within the proposed project area at an estimated cost of $3.2 million. Section 2.7.2.1 provides a detailed description of this alternative.

Marine Mammals Alternative 1: Voluntary Modifications to Commercial Shrimp Lazy Lines to Reduce Dolphin Entanglements	
Cost to Carry Out the Alternative	The total estimated cost of this alternative is $3.2 million. This cost was estimated based on similar past projects and knowledge of the shrimp fishery and its gear requirements. The Regionwide TIG found the costs to be appropriate and reasonable. The phased approach of this alternative would also help keep costs reasonable by allowing adjustments to be made based on the outcomes of Phase I before implementing Phase II.

Marine Mammals Alternative 1: Voluntary Modifications to Commercial Shrimp Lazy Lines to Reduce Dolphin Entanglements	
Trustee Restoration Goals & Objectives	This alternative would restore natural resources injured by the DWH oil spill as described in the PDARP/PEIS, the Strategic Framework for Marine Mammal Restoration Activities, and the call for project ideas. It would also contribute to the Trustees' programmatic restoration goal to Replenish and Protect Living Coastal and Marine Resources. Specifically, the alternative would address the following Restoration Type goals outlined in the Strategic Framework for Marine Mammal Restoration Activities: (1) implement an integrated portfolio of restoration approaches to restore injured bay, sound, and estuary; coastal; shelf; and oceanic marine mammals across the diverse habitats and geographic ranges they occupy; (2) identify and implement restoration activities that mitigate key stressors to support resilient populations; and (3) identify and implement actions that support ecological needs of the stocks; improve resilience to natural stressors; and address fisheries, vessel collisions, noise, industrial activities, illegal feeding and harassment, and hook-and-line fishery interaction. This alternative would support the first goal by supporting a piece of the larger portfolio of restoration for marine mammals. It would support the second by identifying key approaches to mitigate stressors to dolphins in the shrimp trawl fishery (i.e., exploring the potential for the adoption of an alternative material to reduce dolphin entanglement and mortality in commercial shrimp trawl lazy lines). And it would support the third by addressing fisheries interactions with dolphins by promoting the adoption of alternative lazy line materials. The Implementing Trustee, NOAA, would work with commercial shrimp trawlers (otter and skimmer) to evaluate the effectiveness and usability and performance of alternative lazy line materials being less prone to looping and thus entangling dolphins. If the material identified is effective, viable, and adopted, dolphin mortality associated entanglements in the shrimp trawl lazy lines with this type of fishing would be reduced.
Likelihood of Success	This alternative would involve the development of an alternative material to reduce dolphin entanglement in shrimp trawl lazy lines and, as such, there are uncertainties about the effectiveness of the materials, as well as their usability and performance for wide-scale adoption in the GOM shrimp fishery. However, collaboratively conducting in-water testing of alternative gear with commercial fishermen to determine its effectiveness at reducing protected/injured species bycatch in fisheries and fishing operation usability and performance is a well-established process that is technically feasible and known to succeed (DWH NRDA Trustees 2016a). Additionally, NOAA's phased approach would help keep the project on track and encourage the adaptive management of the alternative, with Phase II being adapted as needed based on the results of Phase I. The Implementing Trustee would also implement a MAM plan (see Appendix A) that would assess progress toward project goals, help minimize risk, and address key uncertainties on an ongoing basis.
Avoidance of Collateral Injury	The Regionwide TIG does not expect this alternative to cause collateral injury to natural resources, as it would involve replacing existing fishing gear with alternative materials designed to reduce dolphin bycatch. While dolphins could still become entangled in the new materials during testing, it would be unlikely that the new materials would lead to increased dolphin mortality compared to mortality with standard fishing gear currently used, because materials would be designed specifically to reduce entanglement. Collateral injuries would further be minimized by ongoing monitoring of the environmental consequences of techniques used and adjusting activities as needed. NOAA would utilize BMPs and protective measures to avoid collateral injury.
Benefits to Multiple Resources	This alternative, by design, would reduce dolphin bycatch mortality through gear modifications to shrimp lazy lines. However, this alternative could also benefit other species that get entangled in existing lazy line materials, including sea turtles and other nearshore species that reside in the GOM.

Marine Mammals Alternative 1: Voluntary Modifications to Commercial Shrimp Lazy Lines to Reduce Dolphin Entanglements	
Public Health & Safety	The Regionwide TIG does not expect this alternative to result in negative impacts to public health and safety. Developing alternative materials would not affect public safety, and the testing and adoption of the materials is also unlikely to affect the public. While injuries can occur during fishing activities, the project's use of alternative materials or practices would not be expected to increase the safety risks associated with fishing (which would occur without the project). NOAA would comply with all relevant safety measures, practices, and regulations during project implementation to maintain a safe, protective environment for fishermen, researchers and volunteers involved with the project.

3.6.2 Marine Mammals Alternative 2: Reducing Impacts to Dolphins from Hook-and-Line Gear and Provisioning through Fishery Surveys, Social Science, and Collaboration

This alternative would reduce the number of injuries and mortalities of bottlenose dolphins from interactions with hook-and-line fishing gear and fishing activities, as well as associated with illegally feeding dolphins. The alternative would implement Phase I of a two-phased project. Phase I would characterize the nature and magnitude of interactions between dolphins and hook-and-line gear through systematic fishery surveys, social science studies and evaluation of stranding data and then use this information to collaboratively identify possible solution(s) to reduce interactions. Phase II (not proposed for funding in this RP/EA) would collaboratively develop and test the effectiveness of those solution(s), implement identified solution(s), and systematically repeat fishery surveys and social science studies from Phase I to evaluate success. Phase I project activities would occur throughout the proposed project area for an estimated cost of $1.7 million. Section 2.7.2.2 provides a detailed description of this alternative.

Marine Mammals Alternative 2: Reducing Impacts to Dolphins from Hook-and-Line Gear and Provisioning through Fishery Surveys, Social Science, and Collaboration	
Cost to Carry Out the Alternative	The total estimated cost of this alternative is $1.7 million. This cost is based on estimates from similar past projects and expert knowledge, and the Regionwide TIG found them to be reasonable and appropriate. An example of a similar previous effort is the Alabama TIG project: "Alabama Estuarine Bottlenose Dolphin Protection: Enhancement and Education." The Alabama TIG project was budgeted at $700,000, but this alternative involves more extensive social science outreach and direct engagement with anglers than the Alabama project. This alternative could provide cost efficiencies by using the same information and restoration techniques across multiple areas. Restoration Areas Cost efficiencies may also result from gathering information about hook-and-line interactions and illegal feeding simultaneously.

Marine Mammals Alternative 2: Reducing Impacts to Dolphins from Hook-and-Line Gear and Provisioning through Fishery Surveys, Social Science, and Collaboration	
Trustee Restoration Goals & Objectives	Implementation of this alternative would restore natural resources injured by the DWH oil spill as described in the PDARP/PEIS, the Strategic Framework for Marine Mammal Restoration Activities, and the call for project ideas. It would also contribute to the Trustees' programmatic restoration goal to Replenish and Protect Living Coastal and Marine Resources. Specifically, the alternative would address the following Restoration Type goals outlined in the Strategic Framework for Marine Mammal Restoration Activities: (1) implement an integrated portfolio of restoration approaches to restore injured bay, sound, and estuary; coastal; shelf; and oceanic marine mammals across the diverse habitats and geographic ranges they occupy; (2) identify and implement restoration activities that mitigate key stressors to support resilient populations; and (3) identify and implement actions that support ecological needs of the stocks; improve resilience to natural stressors; and address fisheries, vessel collisions, noise, industrial activities, illegal feeding and harassment, and hook-and-line fishery interaction. This alternative addresses the first goal by contributing one part of an integrated regionwide restoration portfolio. It would address the second goal by reducing a key stressor to bottlenose dolphins – negative interactions with hook-and-line fishing gear and activities. It would support the third by identifying specific actions that can reduce the impacts of hook-and-line fisheries on dolphins. The Implementing Trustee, NOAA, would use the best available information to identify potential solutions to reduce known sources of direct injury and mortality to dolphins. Information from this alternative would inform future restoration actions that could include collaboratively testing the identified solutions with anglers and researchers, partnering with stakeholders to implement effective solutions, and evaluating project results through additional surveys and social science studies.
Likelihood of Success	This alternative is technically feasible and likely to succeed based on past Trustee experience with similar types of projects. More specifically, the proposed survey methods and social science study approaches are widely used and accepted (DWH NRDA Trustees 2016a), and they would likely provide information to inform the development of projects that would reduce dolphin injury and mortality from hook-and-line fishing gear and illegal feeding in the GOM. In addition, researchers have recommended the use of targeted outreach and shown that it can reduce human interactions with dolphins, which further reduces the risk of harm or mortality from interacting with hook-and-line fishing gear (Barco et al. 2010; Powell 2009; Wells et al. 1998). NOAA would also implement a MAM plan (see Appendix A) that would assess progress toward project goals, help minimize risk, and address key uncertainties on an ongoing basis.
Avoidance of Collateral Injury	This alternative is not expected to result in collateral injury to natural resources given the kinds of activities that would be implemented. For example, surveys and desktop research would not be expected to negatively affect the natural resources of the GOM. Conducting outreach to anglers about best practices to help minimize negative interactions would not result in direct substantive interactions with natural resources during the project. Thus, no collateral injuries are expected to result from the project. However, because this alternative would result in future restoration actions that would benefit marine mammals, the Regionwide TIG expects this alternative to be beneficial.
Benefits to Multiple Resources	This alternative is designed to provide restoration benefits to bottlenose dolphins throughout the proposed project area, specifically to coastal and estuarine dolphins. However, it could indirectly benefit sea turtles by identifying and implementing best practices that may also reduce negative sea turtle interactions with hook-and-line gear.

Marine Mammals Alternative 2: Reducing Impacts to Dolphins from Hook-and-Line Gear and Provisioning through Fishery Surveys, Social Science, and Collaboration	
Public Health & Safety	Given that this alternative focuses on information collection activities and identification of potential solution(s), the Regionwide TIG does not anticipate impacts to public health and safety. However, the Implementing Trustee would comply with all relevant safety measures, practices, and regulations during project implementation to maintain a safe, protective environment for those involved with the project.

3.6.3 Marine Mammals Alternative 3: Enhance Marine Mammal Stranding Network Diagnostic Capabilities and Consistency across the Gulf of Mexico

This alternative focuses on activities that would support or enhance MMSN diagnostic capabilities and consistency across the Gulf of Mexico. This project would provide diagnostic equipment to MMSN partners along the Gulf of Mexico, conduct training, provide a data manager, and fund analyses of samples collected from stranded cetaceans. As a result, this project would improve diagnoses of illnesses and causes of death in stranded cetaceans, allow the MMSN to make better rehabilitation/release decisions for live stranded animals, and increase understanding of regionwide cetacean population health. Activities would be implemented throughout the Gulf of Mexico. The estimated project cost is approximately $2.3 million. Section 2.7.2.3 provides a detailed description of this alternative.

Marine Mammals Alternative 3: Enhance Marine Mammal Stranding Network Diagnostic Capabilities and Consistency across the Gulf of Mexico	
Cost to Carry Out the Alternative	The Regionwide TIG reviewed the $2.3 million estimated cost of this alternative and found it to be reasonable and appropriate. This cost is based on estimates from similar past projects, estimates of staffing and analytical costs for similar projects, and expert knowledge. Furthermore, this alternative would build on existing programs, which would allow Trustees to leverage existing expertise, program infrastructure, and partnerships while implementing alternative activities, which would provide cost efficiencies.
Trustee Restoration Goals & Objectives	This alternative would restore natural resources injured by the DWH oil spill as described in the PDARP/PEIS, the Strategic Framework for Marine Mammal Restoration Activities, and the call for project ideas. It would also contribute to the Trustees' programmatic restoration goal to Replenish and Protect Living Coastal and Marine Resources. Specifically, it would increase marine mammal survival through improving understanding of causes of illnesses and death. This would address the following Restoration Type goals from the Strategic Framework for Marine Mammal Restoration Activities: (1) implement an integrated portfolio of restoration approaches to restore injured bay, sound, and estuary; coastal; shelf; and oceanic marine mammals across the diverse habitats and geographic ranges they occupy; and (2) identify and implement restoration activities that mitigate key stressors to support resilient populations. It would address the first goal by contributing a part of an integrated regionwide restoration portfolio for marine mammals, and it would address the second by enabling better rehabilitation and release decisions for live stranded animals and improving understanding of the health of specific marine mammal populations. These activities would help marine mammal and conservation managers identify emerging threats and develop actions that could help mitigate those threats. This alternative would provide regionwide support functions (e.g., diagnostic support, training, and data management support).

Marine Mammals Alternative 3: Enhance Marine Mammal Stranding Network Diagnostic Capabilities and Consistency across the Gulf of Mexico	
Likelihood of Success	This alternative is technically feasible and likely to succeed based on past Trustee experience with similar types of projects (DWH NRDA Trustees 2016a). Specifically, the investments described for the alternative would be highly likely to improve the capacity of the MMSN to diagnose illnesses and treat rescued animals. Its likelihood of success would also be bolstered by its ability to leverage established working relationships among the NMFS Southeast Region Office/Science Center, MMHSRP, and individual MMSN organizations across the GOM. While the Implementing Trustee, NOAA, would lead the effort, other Regionwide TIG Trustees would also participate. In addition, NOAA would implement a MAM plan (see Appendix A) that would assess progress toward project goals, help minimize risk, and address key uncertainties on an ongoing basis.
Avoidance of Collateral Injury	This alternative is not expected to result in collateral injury to natural resources given the kinds of activities that would be implemented. All MMSN activities would be conducted in accordance with long-term existing programs with successful regulatory requirements, permits, and SOPs to avoid collateral injury. The net impact of MMSN activities, which focus on diagnosing causes of illnesses and other causes of strandings, is expected to be largely beneficial.
Benefits to Multiple Resources	This alternative is designed to provide restoration benefits to bottlenose dolphins throughout the proposed project area, specifically coastal and estuarine dolphins. However, other offshore species that strand, especially those that are subject to mass strandings (e.g., short-finned pilot whales, rough-toothed dolphins), may also benefit from enhancing the MMSN's ability to make better rehabilitation/release decisions for live stranded animals and to diagnose illnesses and causes of death regionwide.
Public Health & Safety	The Regionwide TIG does not expect this alternative to result in negative impacts to public health and safety. All established protocols for ensuring safety in handling and responding to marine mammal strandings would be followed. The data collection and analysis activities in this alternative would be led by trained scientists who would comply with all appropriate protocols and health and safety plans. NOAA would comply with all relevant safety measures, practices, and regulations during project implementation to maintain a safe, protective environment for those involved with the project.

3.6.4 Marine Mammals Alternative 4: Enhance Capacity, Diagnostic Capability, and Consistency of the Marine Mammal Stranding Network in the Gulf of Mexico

This alternative is similar to Marine Mammals Alternative 3 described above (see Section 3.6.3). While Alternative 3 would primarily support diagnostic, training, and data management support for the MMSN partners along the Gulf of Mexico, Alternative 4 would also provide funding for personnel, equipment, travel, fuel, and vessel/vehicle maintenance for state-specific MMSN activities. The estimated project cost is $7.9 million. Section 2.7.2.4 provides a detailed description of this alternative.

Marine Mammals Alternative 4: Enhance Capacity, Diagnostic Capability, and Consistency of the Marine Mammal Stranding Network in the Gulf of Mexico	
Cost to Carry Out the Alternative	The total estimated cost of this alternative is $7.9 million. This cost is based on estimates from similar past projects and expert knowledge, and the Regionwide TIG found it to be reasonable and appropriate. Like Marine Mammals Alternative 3, this alternative would build on existing programs, which would allow Trustees to leverage existing expertise, program infrastructure, and partnerships in implementing alternative activities, which would provide cost efficiencies. However, while all the costs of the outlined activities are reasonable, the additional costs included only in this alternative are primarily to augment existing state level programs rather than more centralized activities serving multiple MMSNs. The additional costs included only in this alternative are primarily to augment existing state level programs rather than more centralized activities serving multiple MMSNs.
Trustee Restoration Goals & Objectives	Like Marine Mammals Alternative 3, this alternative aligns with the goals for marine mammals established in the PDARP/PEIS, the Strategic Framework for Marine Mammal Restoration Activities, and the call for project ideas. It would also contribute to the Trustees' programmatic restoration goal to Replenish and Protect Living Coastal and Marine Resources. As with Alternative 3, this would address the following Restoration Type goals from the Strategic Framework for Marine Mammal Restoration Activities: (1) implement an integrated portfolio of restoration approaches to restore injured bay, sound, and estuary; coastal; shelf; and oceanic marine mammals across the diverse habitats and geographic ranges they occupy; and (2) identify and implement restoration activities that mitigate key stressors to support resilient populations. It would address the first goal by contributing a part of an integrated regionwide restoration portfolio for marine mammals, and it would address the second by enabling better rehabilitation and release decisions for live stranded animals and improving understanding of the health of specific marine mammal populations. This alternative, unlike Alternative 3, would also address the second goal by providing staff, equipment, travel, fuel, and vessel/vehicle support for state-specific MMSN activities. A key issue in evaluating this alternative is whether Regionwide TIG funding is best used to support state-specific MMSN activities, or whether Trustee goals in that area could be better met through some other funding mechanism.
Likelihood of Success	Like Marine Mammals Alternative 3, this alternative is technically feasible and likely to succeed based on past Trustee experience with similar types of projects (DWH NRDA Trustees 2016a). The analysis of this criterion under OPA is the same as Marine Mammals Alternative 3 (see Section 3.6.3).
Avoidance of Collateral Injury	Like Marine Mammals Alternative 3, this alternative is not expected to result in substantial collateral injury to natural resources given the kinds of activities that would be implemented. Any possibility of collateral injuries during response and rescue attempts, and associated increases in travel and activity, would be expected to be minimal as all activities would be conducted in accordance with long-term existing programs with successful regulatory requirements, permits, and SOPs to avoid collateral injury. Similar to Marine Mammals Alternative 3, this alternative is expected to have positive impacts on marine mammals by helping them recover from various causes of marine stranding events.
Benefits to Multiple Resources	Like Marine Mammals Alternative 3, this alternative is designed to provide restoration benefits to bottlenose dolphins throughout the proposed project area, specifically coastal and estuarine dolphins. However, other offshore species that strand, especially those that are subject to mass strandings (e.g., short-finned pilot whales, rough-toothed dolphins), may also benefit from enhancing the MMSN's ability to make better rehabilitation/release decisions for live stranded animals and to diagnose illnesses and causes of death regionwide. The analysis of this criterion under OPA is the same as Marine Mammals Alternative 3 (see Section 3.6.3).

Marine Mammals Alternative 4: Enhance Capacity, Diagnostic Capability, and Consistency of the Marine Mammal Stranding Network in the Gulf of Mexico	
Public Health & Safety	As with Marine Mammals Alternative 3, the Regionwide TIG does not expect this alternative to result in negative impacts to public health and safety, as it would utilize established protocols for ensuring safety in handling and responding to marine mammal strandings. While rescue activities could increase under this alternative, such activities would be led by trained scientists. The Implementing Trustee, NOAA, would comply with all relevant safety measures, practices, and regulations during project implementation to maintain a safe, protective environment for those involved with the project.

3.7 OPA Evaluation of Alternatives for the Oysters Restoration Type

The Regionwide TIG identified two Oysters Restoration Type alternatives for detailed analysis in this RP/EA, and evaluated these alternatives consistent with OPA regulations in 15 C.F.R. 990.54(a). The following sections summarize OPA evaluation results for each alternative.

3.7.1 Oysters Alternative 1: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale)

This alternative would increase oyster abundance and resilience at multiple Gulf of Mexico locations by creating a network of brood and sink reefs (up to 30 acres at each of the five sites) over a range of habitats (intertidal to subtidal) and salinities. The constructed reefs would be designed to facilitate larval transport from one site to another. If conditions at one site are not favorable for oyster larvae settlement and growth at a particular time, conditions at another reef site may be favorable, increasing the likelihood of larval settlement and helping to maintain the resilience of the reef network over time. The project would occur across the Gulf states, at an estimated project cost is $35.8 million. Section 2.7.3.1 provides a detailed description of this alternative.

Oysters Alternative 1: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale)	
Cost to Carry Out the Alternative	The total estimated cost of this alternative is $35.8 million. The Regionwide TIG has determined that this cost is reasonable because it was developed based on an average unit cost for recent oyster restoration projects across the northern GOM. Cost estimates are based on building reefs to an average height of 1 foot above the surrounding bottom to ensure the reefs are elevated above potentially hypoxic conditions. This height can be varied, and would be scaled based on site characteristics as well as considerations of cost effectiveness. This alternative would also achieve cost efficiencies by using similar techniques across multiple locations (e.g., where possible, reefs would be connected via larval transport, and reefs would be built across salinity and tidal gradients in a similar manner). This would allow for sharing of information about practices, monitoring methods and metrics, and lessons learned. Using consistent monitoring techniques to gauge performance would also create cost efficiencies by facilitating comparison of results across the GOM. A key to the cost effectiveness of this project is its ability to spread the high fixed costs of mobilization and demobilization across a larger area of reef development, significantly lowering the cost per acre of reef.
Trustee Restoration Goals & Objectives	This alternative would restore natural resources injured by the DWH oil spill as described in the PDARP/PEIS, Strategic Framework for Oyster Restoration Activities, and the call for project ideas. It also aligns with the Trustees' programmatic restoration goal to Replenish and Protect Living Coastal and Marine Resources. Specifically, construction of oyster reefs and facilitation of reef connectivity would address the following Restoration Type goals outlined in the Strategic Framework for Oyster Restoration Activities: (1) restore oyster abundance and spawning stock to support a regional oyster larvae pool sufficient for healthy recruitment levels to subtidal and nearshore oyster reefs; (2) restore resilience to oyster populations that are supported by productive larval source reefs and sufficient substrate in larval sink areas to sustain reefs over time; and (3) restore a diversity of oyster reef habitats that provide ecological functions for estuarine-dependent fish species, vegetated shoreline and marsh habitats, and nearshore benthic communities. This alternative would address the first goal by creating additional reefs to increase oyster abundance and spawning stocks. It would support the second by creating a network of source and sink reefs that are sufficiently connected to allow oyster settlement and growth across the reef network. And it would address the third by establishing reefs in a variety of habitat types to support a variety of ecological functions.

Oysters Alternative 1: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale)	
Likelihood of Success	The Regionwide TIG anticipates this alternative would have a high likelihood of success because similar oyster restoration projects in other regions have successfully addressed specific known threats in a manner that promotes oyster resilience across a variety of biological and chemical gradients. The sink and source reef methodology proposed in for this alternative has been applied to modeling oyster restoration efforts in Virginia (Lipcius et al. 2008) and North Carolina (Haase et al. 2012), and has been demonstrated empirically in Virginia (Schulte et al. 2009). Modeling of reef design, location, and larval transport would increase the likelihood that larvae produced on the brood reefs would have connectivity with the sink reefs. This alternative would maximize the amount of non-harvestable reef, depending on state-specific management frameworks at each site. To increase resilience, reefs would be placed along depth-relief and salinity gradients at each site to the extent practicable. Given annual variations in salinity, this strategy increases the likelihood of larval settlement, growth, and survival on some reefs each year. To enhance reefs that do not have natural spat, hatchery spat or adult oysters could be transplanted to the reefs as part of the adaptive management process. The Implementing Trustees (TX, LA, MS, AL, FL, NOAA) would also implement a MAM plan (see Appendix A) that would assess progress toward project goals, help minimize risk, and address key uncertainties on an ongoing basis.
Avoidance of Collateral Injury	The Regionwide TIG does not expect the implementation of this alternative to result in substantial short- or long-term collateral injuries to natural resources that would outweigh the restoration benefits of this project. For example, although the creation of oyster reefs would result in the burial of habitat beneath the newly created reefs, the footprint of habitat loss would be relatively small, and the injuries incurred are expected to be more than offset by the highly valuable oyster habitat being created. Reef construction could also result in driving wildlife away from the area due to noise, and localized changes in turbidity during reef creation, but the injuries are expected to be minor and short-term (during construction). In all cases, construction would be designed, or required under applicable and relevant permits, to avoid impacts to resources, such as the disturbance of birds during the nesting season or the disturbance of existing oyster beds.
Benefits to Multiple Resources	This alternative aims to increase oyster abundance and restore resilience to oyster populations by increasing reef connectivity through larval transport and construction of oyster habitat over a range of habitats and salinities. The Regionwide TIG anticipates that this alternative would have a wide range of benefits to nearshore and coastal marine resources. A healthy network of oyster reefs would restore the ecosystem services that oysters provide, including improved water quality through filtration, shoreline and estuarine habitat protection through attenuation of wave energy, recreational oyster harvesting, and habitat for reef-dwelling species (e.g., fish and shellfish) and the species that prey upon them (e.g., birds).
Public Health & Safety	Depending on the locations of this alternative's activities, restored reefs may benefit the public health and safety of nearby communities by dissipating wave and storm energy, which would protect infrastructure and reduce shoreline erosion and the degradation of nearby estuarine wetland ecosystems. The Implementing Trustees would comply with all relevant safety measures, practices, and regulations during project implementation to maintain a safe, protective environment for those involved with the project.

3.7.2 Oysters Alternative 2: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale)

This alternative is similar to Oysters Alternative 1, but it would create a smaller network of brood and sink reefs; it would create up to 17 acres of reef at each of the five sites, instead of up to 30 acres per site. As with Oysters Alternative 1, the goal would be to have reefs linked by larval transport over a range of habitats (intertidal to subtidal) and salinities. The project would occur across the Gulf states at an estimated project cost of $22.3 million. Section 2.7.3.2 provides a detailed description of this alternative.

Oysters Alternative 2: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale)	
Cost to Carry Out the Alternative	The total estimated cost of this alternative is $22.3 million, which the Regionwide TIG found to be reasonable and appropriate. Like Oysters Alternative 1, the Regionwide TIG has estimated its cost based on an average unit cost for recent oyster restoration projects across the northern GOM. This alternative would also achieve cost efficiencies by using the same technique across multiple locations, which would allow the project to share documents, methods, and lessons learned across sites (e.g., SOPs, forms, monitoring metrics). Using consistent monitoring techniques to gauge performance would also facilitate comparison of results across the GOM. Cost efficiencies would not be as great as those for Oysters Alternative 1 because fewer acres of reef would be constructed for the same fixed mobilization and demobilization costs.
Trustee Restoration Goals & Objectives	The analysis of this criterion under OPA would be the same as Oysters Alternative 1 (see Section 3.7.1).
Likelihood of Success	Overall, the analysis of this criterion under OPA is similar to that of Oysters Alternative 1 (see Section 3.7.1). However, Alternative 2 would be less likely to meet Trustee objectives than Oysters Alternative 1 because its smaller size would make it less resilient. For example, this alternative would likely be implemented across a narrower range of salinities and depths and would likely produce less spat than Oysters Alternative 1.
Avoidance of Collateral Injury	Overall, the analysis of this criterion under OPA would be similar to that of Oysters Alternative 1 (see Section 3.7.1). In addition, the relatively small scale of this alternative – constructing up to 17 acres of reef site at each of the five sites – would help limit collateral injury to habitats and resources at each restoration site.
Benefits to Multiple Resources	Overall, the analysis of this criterion under OPA would be similar to that of Oysters Alternative 1 (see Section 3.7.1). However, because of the relatively small-scale of this alternative – constructing up to 17 acres of reef at each of the five sites – the benefits would be more limited than a larger-scale reef construction effort.
Public Health & Safety	The analysis of this criterion under OPA is the same as Oysters Alternative 1 (see Section 3.7.1).

3.8 OPA Evaluation of Alternatives for the Sea Turtles Restoration Type

The Regionwide TIG identified six Sea Turtles Restoration Type project alternatives for detailed analysis in this RP/EA, and evaluated these alternatives consistent with OPA regulations in 15 C.F.R. 990.54(a). One alternative is a joint project with the Birds Restoration Type. The following sections summarize OPA evaluation results for each alternative.

3.8.1 Sea Turtles Alternative 1: Pilot Implementation of Automatic Identification System (AIS) in the GOM Inshore Shrimp Fishery to Inform Efforts to Reduce Sea Turtle Bycatch

This alternative would develop and test an electronic monitoring pilot program for inshore shrimp vessels using AIS Class B devices (electronic monitoring devices). The alternative would use the devices to collect data on the spatial and temporal patterns of inshore and nearshore shrimp fishing, which is poorly understood, to inform future restoration planning, and inform and guide training, education, and outreach activities of NOAA's Gear Monitoring Team to reduce sea turtle bycatch and mortality. Projects would be implemented throughout the Gulf of Mexico for an estimated cost of $2.2 million. Section 2.7.4.1 provides a detailed description of this alternative.

Sea Turtles Alternative 1: Pilot Implementation of Automatic Identification System (AIS) in the GOM Inshore Shrimp Fishery to Inform Efforts to Reduce Sea Turtle Bycatch	
Cost to Carry Out the Alternative	The total estimated cost of this alternative is approximately $2.2 million. These costs are based on similar past projects and expertise developed through implementation of other projects using vessel tracking technology. The Regionwide TIG has reviewed these costs and found them to be reasonable and appropriate. The project is designed as a pilot project, and thus would help the Regionwide TIG achieve cost efficiencies by gathering initial data that would be used (1) to assess the effectiveness of the approach; and (2) to identify needed adjustments for future restoration projects that would use the information gained through AIS technology.
Trustee Restoration Goals & Objectives	This alternative would restore natural resources injured by the DWH oil spill as described in the PDARP/PEIS, the Strategic Framework for Sea Turtle Restoration Activities, and the call for project ideas. It also aligns with the Trustees' programmatic restoration goal to Replenish and Protect Living Coastal and Marine Resources. The alternative would gather data to inform future restoration work that addresses the following Restoration Type goals outlined in the Strategic Framework for Sea Turtle Restoration Activities: (1) implement an integrated portfolio of restoration approaches to address all injured life stages (hatchling, juvenile, and adult) and species of sea turtles; (2) restore injuries by addressing primary threats to sea turtles in the marine and terrestrial environment; (3) restore injuries in the various geographic and temporal areas within the GOM and Atlantic Ocean that are relevant to injured species and life stages; and (4) support existing conservation efforts by ensuring consistency with recovery plans and recovery goals for sea turtle species. Specifically, this alternative would address the first goal by contributing one part of an integrated regionwide restoration portfolio for sea turtles. It would address the second goal by gathering data about the spatial and temporal patterns of shrimp fishing efforts, which is critical to knowing where sea turtle bycatch is the most likely to occur. Although this alternative would not directly reduce sea turtle bycatch, its activities would work toward the third goal by identifying the most beneficial locations for future voluntary bycatch mitigation efforts. This, in turn, would inform and guide training, education, and outreach activities of NOAA's Gear Monitoring Team, which would reduce sea turtle bycatch and mortality. This alternative would address the third goal by focusing restoration efforts where injured sea turtle species would gain the highest benefit from the proposed restoration action. It would address the fourth goal by supporting other existing bycatch reduction efforts in this fishery and also identifying priority restoration actions for reducing bycatch.

Sea Turtles Alternative 1: Pilot Implementation of Automatic Identification System (AIS) in the GOM Inshore Shrimp Fishery to Inform Efforts to Reduce Sea Turtle Bycatch	
Likelihood of Success	The alternative would have a high likelihood of success, as it would build on NOAA's long-standing efforts to work with fisherman to reduce bycatch. While NOAA would lead the effort, other Regionwide TIG Trustees and interested state fisheries managers would also participate. The engagement and buy-in of multiple Trustees with connections in the fishing community could help the project succeed. NOAA has evaluated various options for better documenting the fishing patterns of the inshore shrimp fishery and it recommends the use of the AIS Class B devices for this project. This technology is used frequently in the marine environment and the devices are relatively inexpensive and easy to obtain and install on small shrimp vessels. The Implementing Trustee's (NOAA's) extensive experience with implementing and managing similar technologies in fisheries vessels further supports this alternative's likelihood of success. NOAA would also implement a MAM plan (see Appendix A) that would assess progress toward project goals, help minimize risk, and address key uncertainties on an ongoing basis.
Avoidance of Collateral Injury	The Regionwide TIG does not expect this project to cause collateral injury to natural resources. This is a data-gathering project that would assist managers in reducing the number of sea turtle mortalities.
Benefits to Multiple Resources	This alternative is designed to benefit multiple species of sea turtles in the GOM that suffer from bycatch associated with the shrimp fishery. However, any species caught as bycatch in the shrimp fishery (e.g., birds and marine mammals) could also benefit from this alternative if it leads to the identification of effective bycatch reduction efforts.
Public Health & Safety	The Regionwide TIG does not anticipate this alternative to result in negative impacts to public health and safety. In addition, the use of AIS by commercial fishermen could help reduce vessel collisions, resulting in improved safety. NOAA would comply with all relevant safety measures, practices, and regulations during project implementation to maintain a safe, protective environment for those involved with the project.

3.8.2 Sea Turtles Alternative 2: Restore and Enhance Sea Turtle Nest Productivity

The goal of this alternative is to develop and implement restoration actions to improve hatchling production for loggerhead, Kemp's ridley, and green sea turtles on sandy and high-density nesting beaches in the northern Gulf of Mexico, in and adjacent to the Archie Carr NWR in FL, and in northern Mexico. The alternative would identify the highest priority threats to key nesting beaches, and then would implement appropriate restoration actions to help nesting females secure access to suitable habitat, successfully excavate nests, and return to the water after nesting; complete successful nest incubations; and achieve high hatch, emergence, and hatchling seaward migrations. Key restoration actions could include removing barriers to sea turtle beach access, managing nests to protect eggs and hatchlings where necessary and appropriate, monitoring beaches to manage predation and poaching, reducing lighting near beaches, and restoring beach habitat. The estimated project cost is $7.6 million. Section 2.7.4.2 provides a detailed description of this alternative.

Sea Turtles Alternative 2: Restore and Enhance Sea Turtle Nest Productivity	
Cost to Carry Out the Alternative	The total estimated cost of this alternative is $7.6 million. These costs are based on estimates from similar past projects and expertise developed implementing similar sea turtle nest productivity projects. An example of a similar effort is the Open Ocean TIG project “Long-term Nesting Beach Habitat Protection for Sea Turtles” which has a budget of $7 million and a similar scope to this project. The Regionwide TIG has reviewed these costs and found them to be reasonable and appropriate. A number of factors inherent in the project design would help increase cost efficiencies and keep costs reasonable. For example, the project would utilize existing data from past and current programs to inform restoration activities, share data and knowledge among project teams across the GOM to increase effectiveness and efficiency, and use volunteers where appropriate to reduce costs and increase public buy-in of sea turtle restoration efforts.
Trustee Restoration Goals & Objectives	This alternative would restore natural resources injured by the DWH oil spill as described in the PDARP/PEIS, the Strategic Framework for Sea Turtle Restoration Activities, and the call for project ideas. It also aligns with the Trustees’ programmatic restoration goal to Replenish and Protect Living Coastal and Marine Resources. Specifically, the alternative would address the following Restoration Type goals outlined in the Strategic Framework for Sea Turtle Restoration Activities: (1) implement an integrated portfolio of restoration approaches to address all injured life stages (hatchling, juvenile, and adult) and species of sea turtles; (2) restore injuries by addressing primary threats to sea turtles in the marine and terrestrial environment, such as loss or degradation of nesting beach habitat; and (3) restore injuries in the various geographic and temporal areas within the GOM and Atlantic Ocean that are relevant to injured species and life stages. This alternative would contribute to the first goal by contributing to a part of an integrated regionwide restoration portfolio for sea turtles. It would address the second goal by identifying and implementing approaches to protect beaches and improve nesting success and hatchling productivity, such as removing barriers to beaches, managing nests to protect eggs and hatchlings where necessary and appropriate, monitoring beaches to prevent predation and poaching, reducing lighting near beaches, and restoring beach habitat. Each of these actions could help reduce nest, egg, and hatchling mortality, leading to increased reproductive success for sea turtles in the GOM, northern Mexico, and Archie Carr NWR on the east coast of Florida. This alternative would address the third goal by focusing restoration efforts where injured sea turtle species would gain the highest benefit from the proposed restoration action. The project would also coordinate with existing programs to ensure consistency and share data and knowledge.
Likelihood of Success	The alternative would have a high likelihood of success, building on the Trustees’ documented success of working in close coordination and cooperation with partners that have successfully implemented similar projects. For example, the USFWS, in coordination with the Trustees, has led the conservation and recovery of sea turtles on a wide array of nesting beaches in the United States, including those in the GOM. The Trustees have also worked closely with numerous NGOs that work within existing state and federal nest monitoring programs to monitor sea turtle nesting and conduct or promote environmental education and scientific research to promote conservation. This combined experience among multiple partners promotes the success of such efforts. In fact, recent research suggests that the protection of nesting females and sea turtle eggs, which would be a focus of this alternative, has contributed to increasing trends in some sea turtle populations over time (Mazaris et al. 2017). The Implementing Trustees (DOI, TX, MS, AL, FL) would implement a MAM plan (see Appendix A) that would assess progress toward project goals, help minimize risk, and address key uncertainties on an ongoing basis.

Sea Turtles Alternative 2: Restore and Enhance Sea Turtle Nest Productivity	
Avoidance of Collateral Injury	The Regionwide TIG does not anticipate substantial collateral injuries to natural resources from this alternative. While the details of the actions that would be undertaken to enhance sea turtle reproductive success have not been identified, they would likely include actions with minimal impacts on other resources. For example, using fencing to protect nests would exclude birds and other wildlife from using excluded areas of the beach, but the impacts would be minor and restricted to a very small portion of the beach. Reducing lighting and foot traffic on beaches at night during sea turtle nesting season would also have very few impacts on other resources and, in fact, may benefit other species. However, nighttime nesting patrols could result in minor disturbances of wildlife, and predator control efforts, if undertaken, could lead to the loss of some individuals of non-native species from project areas. The Implementing Trustees would implement relevant BMPs and protective measures as appropriate to avoid or minimize collateral injury during the design and implementation of this project.
Benefits to Multiple Resources	This alternative would restore and protect nesting beach habitat. Specific activities could include removing barriers to sea turtle nesting and reducing light pollution near beaches. These actions are designed to directly benefit multiple species of sea turtles, but would also potentially benefit birds and terrestrial species that depend on beach habitat for foraging, nesting, and resting.
Public Health & Safety	The Regionwide TIG does not anticipate impacts to public health and safety from the implementation of this alternative. For example, while the public may be involved in helping monitor beaches or sea turtle nests, these activities would not be expected to increase health or safety risks to the public. If predator control is undertaken, it would be done by trained professionals, not the general public. The Implementing Trustees would comply with all relevant safety measures, practices, and regulations during project implementation to maintain a safe, protective environment for those involved with the project.

3.8.3 Sea Turtles Alternative 3: Guiding Restoration Success for Nesting Females and Hatchlings in the Northern Gulf of Mexico

This alternative would develop and implement a strategy for collecting, analyzing, and interpreting data about green turtle and loggerhead turtle demographics and nesting behavior and success in the Gulf of Mexico. Information gained from this project would be used to identify where and how to most effectively conduct future restoration to benefit sea turtles in the region. This project would occur concurrently with ongoing and future sea turtle restoration projects, leveraging data and lessons learned from those projects as appropriate. The alternative would be implemented at sites across the proposed project area for an estimated cost of $4.4 million. Section 2.7.4.3 provides a detailed description of this alternative.

Sea Turtles Alternative 3: Guiding Restoration Success for Nesting Females and Hatchlings in the Northern Gulf of Mexico	
Cost to Carry Out the Alternative	The total estimated cost of this alternative is $4.4 million. This cost is based on expertise and estimates gained from implementation of similar past projects. The Regionwide TIG has reviewed these costs and found them to be reasonable and appropriate. The project would also help keep costs down by using an innovative, genetic mark-recapture technique. The technique involves securing genetic samples from one egg from as many nests as feasible (which would have the nesting female's genetic "fingerprint"), allowing researchers to cost efficiently track an individual's movements and nesting patterns over time. This project would also keep costs down by leveraging information from the planned STNCC and the Open Ocean TIG GOM Sea Turtle Atlas, both of which can help guide future restoration activities.
Trustee Restoration Goals & Objectives	This alternative would provide information to help restore injured natural resources described in the PDARP/PEIS, the Strategic Framework for Sea Turtle Restoration Activities, and the call for project ideas. It also aligns with the Trustees' programmatic restoration goal to Replenish and Protect Living Coastal and Marine Resources. Specifically, the alternative would address the following Restoration Type goals outlined in the Strategic Framework for Sea Turtle Restoration Activities: (1) implement an integrated portfolio of restoration approaches to address all injured life stages (hatchling, juvenile, and adult) and species of sea turtles; (2) restore injuries by addressing primary threats to sea turtles in the marine and terrestrial environment; (3) restore injuries in the various geographic and temporal areas within the GOM and Atlantic Ocean that are relevant to injured species and life stages; and (4) support existing conservation efforts by ensuring consistency with recovery plans and recovery goals for sea turtle species. This alternative would address the first goal by contributing one part of an integrated regionwide restoration portfolio for sea turtles. It would address the second goal by identifying patterns of hatchling emergence success and the key threats to hatchling emergence on different beaches. This understanding would help identify key areas to protect as well as the most effective strategies to improve hatchling production. This alternative would address the third goal by focusing restoration efforts where injured sea turtle species would gain the highest benefit from the proposed restoration action. It would address the fourth by informing how effective restoration actions are, and prioritizing restoration actions in the GOM. However, this alternative focuses on data gathering and monitoring. After further evaluation, this project may be most effective as a long-term monitoring program that to help document restoration success for sea turtles rather than as a restoration project.
Likelihood of Success	The Regionwide TIG anticipates this project would have a high likelihood of success in completing its proposed monitoring activities because it would utilize well-established methods to gather information about sea turtle demographics and nesting success. The project would also involve a highly coordinated approach that would leverage recent sea turtle conservation efforts, including volunteer and stakeholder led efforts that have been highly successful in the past, such as Florida's Statewide Nesting Beach Survey and Index Nesting Beach Survey. While the project would also use an innovative genetic mark-recapture technique, this and other genetic techniques have been successfully utilized to understand a range of key questions about sea turtle stocks and inter-connectivity (Komoroske et al. 2017). The Implementing Trustees would also implement a MAM plan that would assess progress toward project goals, help minimize risk, and address key uncertainties on an ongoing basis.

Sea Turtles Alternative 3: Guiding Restoration Success for Nesting Females and Hatchlings in the Northern Gulf of Mexico	
Avoidance of Collateral Injury	The Regionwide TIG does not expect this alternative to cause substantial collateral injuries to natural resources. The main avenue through which injury to natural resources could potentially occur would be through data collection (e.g., disturbing nesting animals, collecting an egg from each nest). However, such activities have been successfully implemented for decades with little harm to sea turtles. The Implementing Trustee, DOI, would thus adhere to all established research protocols, permit requirements, and best practices for conducting field work on sea turtles and in sea turtle nesting environments to ensure collateral injury is avoided.
Benefits to Multiple Resources	This alternative could eventually benefit multiple species of sea turtles in the GOM by potentially increasing the nesting data sets for, and understanding of, green and loggerhead sea turtles. However, this project is primarily a data gathering and long-term monitoring effort that would provide information about hatchling emergence success and factors that influence success including ongoing restoration efforts. In addition, the direct influence of this project on restoration actions remains unclear and, as such, this project may be better implemented as a sea turtle restoration type monitoring project.
Public Health & Safety	The Regionwide TIG does not anticipate impacts to public health and safety. The Implementing Trustees would take all safety measures and follow all established protocols for those involved with this project.

3.8.4 Sea Turtles Alternative 4: Reducing Sea Turtle Bycatch at Recreational Fishing Sites

This alternative focuses on reducing bycatch of sea turtles at shore-based recreational fishing sites, such as fishing piers, bridges, and other shoreline structures, and would help restore injured sea turtles. The project would assess and identify factors contributing to sea turtle bycatch at shore-based recreational fishing sites, and implement voluntary angler education and other programs to reduce bycatch and associated injuries. This alternative would occur throughout the proposed project area, at an estimated cost of $3.6 million. Section 2.7.4.4 provides a detailed description of this alternative.

Sea Turtles Alternative 4: Reducing Sea Turtle Bycatch at Recreational Fishing Sites	
Cost to Carry Out the Alternative	The total estimated cost of this alternative is $3.6 million. This cost is based on estimates from similar past projects and expertise developed conducting similar studies of other recreational angler surveys. The Regionwide TIG has reviewed these costs and found them to be reasonable and appropriate. The project is designed to provide cost efficiencies by first identifying the factors that most increase the likelihood of bycatch occurring (e.g., the type of bait or hook used). This would be done using a combination of historical data gathered by the STSSN and angler surveys that would be conducted regionwide. The use of existing data to inform restoration efforts would also help reduce costs. Subsequent restoration efforts would focus on mitigating key risk factors by developing best practices and implementing new voluntary, incentivized bycatch reduction efforts and/or pilot studies.

Sea Turtles Alternative 4: Reducing Sea Turtle Bycatch at Recreational Fishing Sites	
Trustee Restoration Goals & Objectives	This alternative would restore natural resources injured by the DWH oil spill as described in the PDARP/PEIS, the Strategic Framework for Sea Turtle Restoration Activities, and the call for project ideas. It also aligns with the Trustees' programmatic restoration goal to Replenish and Protect Living Coastal and Marine Resources. Specifically, the alternative would address the following Restoration Type goals outlined in the Strategic Framework for Sea Turtle Restoration Activities: (1) implement an integrated portfolio of restoration approaches to address all injured life stages (hatchling, juvenile, and adult) and species of sea turtles; (2) restore injuries by addressing primary threats to sea turtles in the marine and terrestrial environment, such as bycatch in commercial and recreational fisheries; (3) restore injuries in the various geographic and temporal areas within the GOM and Atlantic Ocean that are relevant to injured species and life stages; and (4) support existing conservation efforts by ensuring consistency with recovery plans and recovery goals for sea turtle species. More specifically, this alternative would address the first goal by contributing to a part of an integrated regionwide restoration portfolio for sea turtles. It would address the second goal by identifying factors contributing to sea turtle bycatch at shore-based recreational fishing sites, and developing and implementing approaches to reduce bycatch, both the number of interactions and the severity of the injuries. This alternative would address the third goal by focusing restoration efforts where injured sea turtle species would gain the highest benefit from the proposed restoration actions. It would address the fourth by helping federal and state managers better understand how to reduce recreational bycatch in the GOM and support species recovery efforts.
Likelihood of Success	While the potential threat to sea turtles from recreational fishing is well understood, there is less documentation on the effectiveness of potential actions to reduce this threat. However, the Regionwide TIG believes that extensive coordination and collaboration among relevant state and federal agencies already working with recreational fishermen would increase this project's likelihood of success. For example, NOAA and several GOM states already conduct regular surveys of recreational fisherman to estimate landings and better understand recreational fishing trends. These efforts could be leveraged to learn more about how frequent sea turtle bycatch is, and what factors contribute to it. Being able to share information among state and federal partners as the project is implemented would also help NOAA make informed decisions about selecting the most appropriate and effective techniques for achieving project goals. NOAA would also implement a MAM plan (see Appendix A) that would assess progress toward project goals, help minimize risk, and address key uncertainties on an ongoing basis.
Avoidance of Collateral Injury	The Regionwide TIG does not expect this alternative to cause collateral injuries to natural resources. More specifically, while best practices for recreational fishing may be developed and shared through this alternative, such efforts would not adversely affect targeted or non-targeted species; in fact, non-targeted species would likely benefit. NOAA would implement relevant BMPs and protective measures, as needed, to avoid or minimize collateral injury during design and implementation of this project.
Benefits to Multiple Resources	This alternative is designed to benefit multiple species of sea turtles. More specifically, identifying and mitigating the factors that increase sea turtle bycatch at shore-based recreational fishing sites would benefit all sea turtle species that are vulnerable to bycatch in the GOM. Outreach activities would also benefit multiple species of sea turtles by increasing awareness of bycatch among anglers, and increasing the likelihood that they would adopt gear or best practices to minimize it. This project could also help reduce recreational fishing related bycatch for other types of wildlife, including birds and marine mammals.

Sea Turtles Alternative 4: Reducing Sea Turtle Bycatch at Recreational Fishing Sites	
Public Health & Safety	The Regionwide TIG does not anticipate this alternative to result in negative impacts to public health and safety. However, NOAA would comply with all relevant safety measures, practices, and regulations during project implementation to maintain a safe, protective environment for those involved with the project.

3.8.5 Sea Turtles Alternative 5: Reducing Marine Debris Impacts on Birds and Sea Turtles (*joint project with Birds Restoration Type*)

This alternative, also described under Birds Alternative 1, would reduce the threat and impacts (e.g., entanglement, entrapment, and/or ingestion) of marine debris to DWH-injured bird and sea turtle species across the Gulf of Mexico. The project would remove marine debris, including, but not limited to, derelict fishing gear (i.e., monofilament fishing line, nets, trap/pot gear, and other recreational/commercial fishing equipment that has been lost, abandoned, or discarded). This would be a joint project between the Birds and Sea Turtles Restoration Types, and would occur regionwide. The estimated project cost is $7 million, or $3.5 million for each Restoration Type. Section 2.7.4.5 provides a detailed description of this alternative.

Sea Turtles Alternative 5: Reducing Marine Debris Impacts on Birds and Sea Turtles (joint project with Birds Restoration Type)	
Cost to Carry Out the Alternative	The analysis of this criterion under OPA is the same as Birds Alternative 1 (see Section 3.5.1).
Trustee Restoration Goals & Objectives	This project would restore natural resources injured by the DWH oil spill as described in the PDARP/PEIS, the Strategic Framework for Sea Turtle Restoration Activities, and the call for project ideas. It also aligns with the Trustees' programmatic restoration goal to Replenish and Protect Living Coastal and Marine Resources. Specifically, the alternative would addresses the following Restoration Type goals outlined in the Strategic Framework for Sea Turtle Restoration Activities: (1) implement an integrated portfolio of restoration approaches to address all injured life stages (hatchling, juvenile, and adult) and species of sea turtles; (2) restore injuries by addressing primary anthropogenic threats to sea turtles in the marine and terrestrial environment; and (3) restore injuries in the various geographic and temporal areas within the GOM and Atlantic Ocean that are relevant to injured species and life stages. This alternative would address the first goal by contributing to a part of an integrated regionwide restoration portfolio for sea turtles. It would address the second goal by identifying marine debris "hotspots" that threaten sea turtles and removing marine debris from these hotspots. This would reduce sea turtles' risk of ingesting, becoming entangled with, or being entrapped by marine debris, which would reduce sea turtle injury and mortality (DWH NRDA Trustees 2017d). This alternative would address the third goal by focusing marine debris clean-up efforts on critical geographic sites (per the hot spot analysis) that will provide the highest restoration benefit to sea turtles within the GOM.
Likelihood of Success	The analysis of this criterion under OPA is the same as Birds Alternative 1 (see Section 3.5.1).
Avoidance of Collateral Injury	The analysis of this criterion under OPA is the same as Birds Alternative 1 (see Section 3.5.1).

Sea Turtles Alternative 5: Reducing Marine Debris Impacts on Birds and Sea Turtles (joint project with Birds Restoration Type)	
Benefits to Multiple Resources	This alternative is likely to benefit multiple sea turtle species that are harmed by marine debris, including Kemp's ridley, loggerhead, and green sea turtles. This alternative would also benefit multiple bird subgroups, including colonial waterbirds, solitary beach-nesting birds, osprey, northern nesting birds, Caribbean nesting birds, and seabirds that utilize nearshore habitats. Marine mammals (e.g., dolphins) that could also become entangled in marine debris are also expected to benefit. The removal of marine debris from uplands, beaches, dunes, marshes, seagrass beds, and reefs would also be expected to directly benefit these habitats by preventing marine debris related damage to vegetation, soils, and sediments.
Public Health & Safety	The analysis of this criterion under OPA is the same as Birds Alternative 1 (see Section 3.5.1).

3.8.6 Sea Turtles Alternative 6: Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation

This alternative has two components. The first component would enhance the capabilities of project partners conducting stranding and rehabilitation activities in the Gulf of Mexico by supporting critical enhancement needs for STSSN response efforts. Project funding would provide support for equipment and supply needs (e.g., additional tanks, water filtration equipment, medical equipment) for existing sea turtle rehabilitation facilities. Project funding could also be used for responding to stranding events, recovering and necropsying dead stranded sea turtles to better understand mortality sources, or filling other identified gaps in STSSN response and rehabilitation capacity. The second component of the project includes construction of a new rehabilitation facility on the upper Texas coast to increase preparedness and response capacity. The total estimated cost of the alternative, including both components, is $5 million. The OPA analysis below considers both components of the alternative. Section 2.7.4.6 provides a detailed description of this alternative.

Sea Turtles Alternative 6: Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation	
Cost to Carry Out the Alternative	The total estimated cost of this alternative is approximately $5 million. This cost is based on estimates from similar past projects and expert knowledge. The Regionwide TIG found them to be reasonable and appropriate. The project would evaluate and prioritize critical investments that are needed to improve STSSN response and rehabilitation activities across the proposed project area to provide critical support and care for stranded sea turtles.
Trustee Restoration Goals & Objectives	This alternative would restore natural resources injured by the DWH oil spill as described in the PDARP/PEIS, the Strategic Framework for Sea Turtle Restoration Activities, and the call for project ideas. It also aligns with the Trustees' programmatic restoration goal to Replenish and Protect Living Coastal and Marine Resources. Specifically, the alternative would address the following Restoration Type goals outlined in the Strategic Framework for Sea Turtle Restoration Activities: (1) implement an integrated portfolio of restoration approaches to address all injured life stages (hatchling, juvenile, and adult) and species of sea turtles; (2) restore injuries by addressing primary threats to sea turtles in the marine and terrestrial environment, such as acute environmental changes; (3) restore injuries in the various geographic and temporal areas within the GOM and Atlantic Ocean that are relevant to injured species and life stages; and (4) support existing conservation efforts by ensuring consistency with recovery plans and recovery goals for each of the sea turtle species. This alternative would address the first goal by contributing one part of an integrated regionwide restoration portfolio for sea turtles. It would address the second goal by improving the ability of the STSSN to rescue and rehabilitate sea turtles that have been harmed by natural and anthropogenic threats in the wild (e.g., disease, harmful algal blooms, vessel collisions, which would reduce sea turtle mortality. This alternative would address the third goal by focusing restoration efforts where injured sea turtle species would gain the highest benefit from the proposed restoration action. It would address the fourth goal by enhancing coordination and capacity across the STSSN, which is a recovery action identified in all sea turtle Recovery Plans.

Sea Turtles Alternative 6: Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation	
Likelihood of Success	The STSSN is a well-established, effective network already operating across the GOM, which makes investment in this network likely to succeed. For the first activity, priority needs for each state would be identified by the State STSSN Coordinator working with the state Implementing Trustees, which would ensure that investments would be made in the most critical areas of need for each state. For the second activity, constructing a rehabilitation facility is also likely to succeed because the STSSN has experience in designing and building similar facilities in other locations. Together, these two activities would likely lead to the STSSN being better able to respond to stranding events and rehabilitate sea turtles – the organization already has demonstrated successfully carrying out such activities and filling key response enhancement needs and this project would only improve their ability to do so. The Implementing Trustees (TX, LA, MS, AL, FL, NOAA) would also implement a MAM plan (see Appendix A) that would assess progress toward project goals, help minimize risk, and address key uncertainties on an ongoing basis.
Avoidance of Collateral Injury	The Regionwide TIG does not expect this alternative to cause substantial collateral injuries to natural resources. More specifically, the actions undertaken under the first activity (needs prioritization) would not result in any effects to natural resources. Under the second activity (improving rehabilitation capacity), the purchasing of needed rehabilitation equipment would also not affect natural resources. However, building a new rehabilitation facility would result in a minor loss of coastal habitat. But habitat losses are expected to be minor, and would be constrained to the footprint of the facility and associated parking structures. Other construction-related impacts (e.g., noise related displacement of wildlife) are also expected to be minor and to occur only during construction. The facility would be designed to avoid habitat impacts to the extent practicable and construction would be conducted as condition by applicable and relevant permits (e.g., avoid disturbance of birds during nesting season). Sea turtle rescues and rehabilitation would be conducted under long-term existing programs with established regulatory requirements and permits that would prevent collateral injury to handled and rehabilitated animals. The Implementing Trustees would implement BMPs and protective measures (e.g., grading or excavating on dry days, using berms or terraces to trap sediment) to avoid or minimize collateral injury during the design and implementation of this alternative.
Benefits to Multiple Resources	This alternative would benefit any of the multiple species of sea turtles in the GOM that need rescue and rehabilitation. However, it may also benefit other species that are vulnerable to stranding (e.g., marine mammals). If marine mammals are sighted either dead or in distress, those strandings can be reported to the MMSN either expediting the response or making the MMSN aware when they otherwise would not have been alerted.
Public Health & Safety	The Regionwide TIG does not anticipate this alternative to result in negative impacts to public health and safety. However, the Implementing Trustees would comply with all relevant safety measures, practices, and regulations during project implementation to maintain a safe, protective environment for those involved with the project.

3.9 Overall OPA Evaluation Conclusions

Through the screening process described in Chapter 2, the Regionwide TIG identified a reasonable range of alternatives for evaluation under OPA (see Table 1-2 in Section 1.8). The Regionwide TIG applied the OPA NRDA regulatory evaluation factors to each restoration alternative to identify preferred alternatives. The Regionwide TIG evaluated 15 alternatives under OPA across four Restoration Types (this total only counts the marine debris project that is jointly funded by in the Birds and Sea Turtles Restoration Types once). Based on the results of these analyses, the Trustees propose to proceed with the implementation of 11 preferred alternatives (Table 3-1), including the marine debris joint project between the Birds and Sea Turtles Restoration Types.

Table 3-1. Preferred alternatives for each Restoration Type

Restoration Type	Preferred alternatives
Birds	• Alternative 1: Reducing Marine Debris Impacts on Birds and Sea Turtles *(joint project with Sea Turtles Restoration Type)* • Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds • Alternative 3: Bird Nesting and Foraging Area Stewardship
Marine Mammals	• Alternative 1: Voluntary Modifications to Commercial Shrimp Lazy Lines to Reduce Dolphin Entanglements • Alternative 2: Reducing Impacts to Dolphins from Hook-and-Line Gear and Provisioning through Fishery Surveys, Social Science, and Collaboration • Alternative 3: Enhance Marine Mammal Stranding Network Diagnostic Capabilities and Consistency across the Gulf of Mexico
Oysters	• Alternative 1: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale)
Sea Turtles	• Alternative 1: Pilot Implementation of Automatic Identification System (AIS) in the GOM Inshore Shrimp Fishery to Inform Efforts to Reduce Sea Turtle Bycatch • Alternative 2: Restore and Enhance Sea Turtle Nest Productivity • Alternative 4: Reducing Sea Turtle Bycatch at Recreational Fishing Sites • Alternative 5: Reducing Marine Debris Impacts on Birds and Sea Turtles *(joint project with Birds Restoration Type)* • Alternative 6: Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation

The Regionwide TIG determined through the OPA evaluation process that four projects did not fully meet the Trustees' goals or priorities for this RP/EA. The Trustees determined that these projects are not preferred because they were not the most cost-effective alternatives within the budgetary constraints of the TIG, or did not fully meet the goals of the Regionwide TIG. Table 3-2 lists the non-preferred alternatives by Restoration Type.

Table 3-2. Non-preferred alternatives for each Restoration Type

Restoration Type	Non-preferred alternatives
Birds	Alternative 4: Stewardship and Habitat Creation through Beneficial Use This project was not selected as a preferred alternative because it would only support restoration activities at two sites (i.e., Walker Bay, AL and Matagorda Bay Bird Island, TX), which would provide limited regionwide benefits to birds. In addition, these benefits would only be achieved through the construction of coastal islands employing beneficial use of dredged sediments, and would not utilize any of the other multitude of restoration approaches/techniques that could benefit birds in the GOM. In comparison, Birds Alternatives 1, 2, and 3 all support restoration that would benefit birds across the region. In addition, Birds Preferred Alternative 2, the alternative that is most similar to Birds Alternative 4, would use a broader array of restoration methods (i.e., land acquisition, habitat management, beneficial use of dredge sediments to create coastal islands, and E&D for barrier island restoration), providing Trustees with greater flexibility to combine such methods to most effectively benefit birds across the region.
Marine Mammals	Alternative 4: Enhance Capacity, Diagnostic Capability, and Consistency of the Marine Mammal Stranding Network in the Gulf of Mexico This project was not selected as a preferred alternative because of its inclusion of capacity enhancements to individual state MMSN organizations. While the Regionwide TIG determined that improving MMSN diagnostic capability and data consistency on a regionwide basis was appropriate within the budgetary constraints of the Regionwide TIG (i.e., the activities covered in Marine Mammals Alternative 3), it also concluded that enhancing capacity of individual state MMSN organizations would be more appropriately addressed through the individual state TIGs.
Oysters	Alternative 2: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale) This project was not selected as a preferred alternative because it was determined that the larger-scale project was more cost effective. It would restore more oyster reef area for the relatively fixed costs of site evaluation and construction mobilization/demobilization.
Sea Turtles	Alternative 3: Guiding Restoration Success for Nesting Females and Hatchlings in the Northern Gulf of Mexico This project was not selected as a preferred alternative because it only involves research and data gathering components. The TIG may consider this alternative as a MAM activity in the future, but it would need further development for such consideration by the TIG.

3.9.1 Consideration of Ecosystem-scale Benefits

After completing the OPA evaluation, and in alignment with the PDARP/PEIS, the Regionwide TIG considered the extent to which individual alternatives complement each other to meet the Trustees' goals for comprehensive, integrated ecosystem restoration (see Section 1.5.3 in the PDARP/PEIS).

LCMRs such as birds, marine mammals, oysters, and sea turtles (the Restoration Types addressed in this RP/EA), along with other habitats and resources such as fish, deep-sea corals, benthic communities, and coastal habitats, are components of an interconnected Gulf of Mexico ecosystem and food web. Sea turtles, cetaceans, and some oceanic fish are long-lived, migrate widely, and use a variety of Gulf habitat types and prey resources.

The Trustees incorporated these ecosystem considerations into the development of the preferred projects by:

- Identifying synergies that may be possible across projects to maximize benefits to multiple resources; and
- Identifying restoration alternatives that address key stressors and could help increase the abundance and resilience of interconnected resources, while addressing injuries to ecological communities and functions.

For example, the Regionwide TIG recognized that reducing marine debris would not only meet the goals of the Birds and Sea Turtles Restoration Types, but would also provide broader benefits to marine and coastal ecosystems injured by the DWH oil spill. In addition, restoration alternatives that promote the removal of or use of modified fishing gear that reduces entanglements, injuries, and mortality of animals can help reduce chronic stressors to LCMRs and support their recovery. Similarly, integrating a diverse set of restoration approaches and techniques under a single alternative to conserve and enhance bird nesting and foraging habitat would allow the Regionwide TIG to maximize regionwide, ecosystem-scale benefits by targeting the most appropriate restoration tools to individual project sites and activities.

Independently and together, this portfolio of preferred alternatives meets the Regionwide TIG restoration goals and advances comprehensive, integrated restoration, as proposed in the PDARP/PEIS.

4. Environmental Assessment

NEPA requires federal agencies to consider the potential environmental impacts of planned actions. Under NEPA (40 C.F.R. 1502.16),[17] federal agencies must comparatively evaluate the environmental effects of the alternatives under consideration, including effects to physical, biological, and socioeconomic resources. The NEPA analysis presented in this chapter is consistent with the PDARP/PEIS and tiers where applicable. To streamline its NEPA evaluation, relevant information, and analyses from the PDARP/PEIS as well as from existing plans, studies, or other material has been incorporated by reference. To determine whether an action has the potential to result in significant impacts, the context and intensity of the action must be considered (see 40 C.F.R. 1508.27).

This RP/EA characterizes adverse impacts as short-term or long-term and minor, moderate, or major. The definition of these types of impacts is consistent with those used in the PDARP/PEIS (refer to Appendix B in this RP/EA). The analysis of beneficial impacts focuses on the duration (short-term or long-term), without attempting to specify the intensity of the benefit. “Adverse” is used in this chapter only to describe the federal Trustees’ evaluation under NEPA. This term is defined and applied differently in consultations pursuant to the ESA and other protected resource statutes.

4.1 Preliminary Phase Restoration Alternatives

An evaluation of environmental consequences related to preliminary planning activities is discussed in Section 6.4.14 of the PDARP/PEIS, incorporated by reference, and included in Appendix B of this RP/EA. Chapter 6 of the PDARP/PEIS states that a TIG may propose to fund preliminary phases of restoration (e.g., initial E&D for a conceptual project, or studies necessary to maximize restoration planning efforts). This would allow the TIG to gather information necessary to develop a project sufficiently before conducting a more detailed analysis in a subsequent restoration plan, or for use in the restoration planning process. This RP/EA proposes three preliminary phase restoration alternatives, primarily for efforts that require additional planning, data collection and/or collation, and development of data-based tools that may inform subsequent restoration efforts. These efforts would provide fundamental information to prioritize and support protection and management activities and to target locations for direct restoration. The OPA evaluation for these alternatives is included in Chapter 3 of this RP/EA. After review, the Regionwide TIG determined that these alternatives fall within the range of impacts described in Section 6.4.14 of the PDARP/PEIS, which provides sufficient NEPA analysis. This analysis is summarized for each of these projects below. After completing these preliminary phase restoration projects, a TIG may propose a related restoration project in a future restoration plan(s) based on the outcomes of these initial efforts. Preliminary phase restoration activities proposed in this RP/EA include:

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17. NEPA implementing regulations refer to C.F.R. parts 1500 – 1508 (1978, as amended in 1986 and 2005). The RW TIG began developing the environmental assessment for this RP/EA before the September 20, 2020 effective date for CEQ’s Update to the NEPA Regulations. Therefore, as permitted by the Update, the Regionwide TIG prepared the environmental assessment under the 1978 CEQ NEPA regulations that were in effect prior to the Update. 40 C.F.R. § 1506.13.

- **Birds Alternative 2**: Conservation and Enhancement of Nesting and Foraging Habitat for Birds – Component 1: Chandeleur Islands, LA
- **Marine Mammals Alternative 2**: Reducing Impacts to Dolphins from Hook-and-line Gear and Provisioning through Fishery Surveys, Social Science, and Collaboration
- **Sea Turtles Alternative 1**: Pilot Implementation of Automatic Identification System (AIS) in the GOM Inshore Shrimp Fishery to Inform Efforts to Reduce Sea Turtle Bycatch

4.1.1 Birds Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds – Component 1: Chandeleur Islands, LA

This E&D project would include evaluating design alternatives followed by E&D, permitting, and preparing construction bid documents for the preferred design alternative to inform future restoration efforts. Specific activities would include all research and field work necessary for, at minimum, the following: design-level data collection and modeling, geotechnical investigation/ analysis, sediment delivery analysis, and coastal engineering and analysis, and development of construction quantities and estimate of probable costs. These activities align with those described and evaluated for preliminary phases of restoration (planning, feasibility studies, design engineering, and permitting activities) in Section 6.4.14 of the PDARP/PEIS. The PDARP/PEIS concluded that while project planning activities could result in impacts through related field work (e.g., sampling soils and sediments, digging soil test pits), such impacts would be very minor and localized to the project site given how small such areas are in relation to an overall project area, and that no additional tiered NEPA analysis is required (see Section 6.4.14 in the PDARP/PEIS). The Regionwide TIG has concluded that potential impacts from this alternative fall within those analyzed for preliminary phases of restoration in the PDARP/PEIS, and thus no further NEPA analysis is required at this time.

4.1.2 Marine Mammals Alternative 2: Reducing Impacts to Dolphins from Hook-and-line Gear and Provisioning through Fishery Surveys, Social Science, and Collaboration

The goal of this project is to develop restoration actions to be implemented in the future to reduce the number of injuries and mortalities of Gulf of Mexico bottlenose dolphins associated with interactions with hook-and-line fishing gear and illegal feeding. This project would involve activities to characterize the scope and magnitude of interactions between dolphins and hook-and line-gear. Based on this information, it would also identify potential solution(s) to reduce interactions and associated mortality. Specifically, the alternative would involve conducting systematic fishery surveys of Gulf of Mexico hook-and-line anglers in a variety of habitats (e.g., coastal and estuarine); characterizing stranding data of bottlenose dolphins with hook-and-line gear attached; conducting human dimension social science studies of anglers; and using collaborative workshops to identify potential solutions (e.g., gear modifications, fishery practice changes, deterrence measures, outreach strategies to facilitate behavior change). Such limited field studies and data analysis would not impact resources or result in environmental consequences. These activities are consistent with those evaluated in Section 6.4.9.2 of the PDARP/PEIS for the Marine Mammals Restoration Type, which concluded that there would only be minimal adverse impacts to physical, biological, and socioeconomic resources from these types of activities, and that any adverse impacts would be more than offset by the benefits provided by this type of project. Further, these activities are consistent with the PDARP/PEIS evaluation of preliminary phases of restoration provided in Section 6.4.14 of the PDARP/PEIS. Therefore, the Regionwide TIG determined that this alternative does not require additional NEPA analysis at this time.

4.1.3 Sea Turtles Alternative 1: Pilot Implementation of Automatic Identification System (AIS) in the GOM Inshore Shrimp Fishery to Inform Efforts to Reduce Sea Turtle Bycatch

This alternative would develop and test an electronic monitoring pilot program for inshore shrimp vessels using AIS Class B devices (electronic monitoring devices). The alternative would use the devices to collect data on spatial and temporal patterns of inshore and nearshore shrimp fishing, which is currently poorly understood, to inform future restoration planning including guiding the training, education, and outreach activities of NOAA's Gear Monitoring Team. Testing electronic monitoring equipment to improve understanding of inshore and nearshore fishing patterns is not likely to have direct impacts on resources in the environment, as installing and testing the devices on existing vessels is not expected to alter the behavior of commercial fisherman in any notable way. This type of data gathering activity is also consistent with the activities classified as preliminary phases of restoration in Section 6.4.14 of the PDARP/PEIS, which noted that planning intended to support the development of projects to propose in more detail in subsequent restoration plans… can increase the effectiveness and efficiency of habitat restoration. This activity is also consistent with Section 6.4.7.2 of the PDARP/PEIS for the Sea Turtles Restoration Type. The Regionwide TIG has concluded that potential impacts from this alternative fall within those analyzed for preliminary phases of restoration in the PDARP/PEIS, and that no further NEPA analysis is required at this time.

4.2 Affected Environment

This section describes the affected environment relevant to the restoration alternatives described in this RP/EA. This includes a description of existing conditions for relevant resources in coastal and near-coastal areas in Texas, Louisiana, Mississippi, Alabama, and Florida, as well as in Mexico and the east coast of Florida. Broad categories of resources discussed include physical resources, biological resources, and human use and socioeconomics.

4.2.1 Physical Resources

This section describes the geology and substrates and hydrology and water quality resources specific to the proposed alternatives.

4.2.1.1 Geology and Substrates

The Gulf of Mexico encompasses approximately 615,000 square miles) of coastal and open ocean habitat, extending across five U.S. states (Texas, Louisiana, Mississippi, Alabama, and Florida), south to Mexico and east to Cuba. Moving seaward from the coastline, the northern Gulf of Mexico is characterized by broad geomorphological zones, including the coastal transition areas, the continental shelf, the continental slope, and the abyssal plain. The bays, estuaries, wetlands, and barrier islands make up the coastal transition zone. The substrates within the range of the projects analyzed in this RP/EA are quite diverse and vary depending on location. The nearshore benthic substrates generally consist of sand, silt, clay, hard bottom substrates, and vegetation (Lavoie et al. 2013). The predominant sediment grain size in nearshore areas is typically sand that becomes increasingly finer with increasing distance from the shore (Lavoie et al. 2013). Approximately 12,000 square miles (~31,080 square kilometers [5%]) of U.S. territorial waters in the Gulf of Mexico have hard bottom substrate (Jenkins 2011). For the purpose of this RP/EA, oysters are considered a geology and substrate resource as well as a biological resource, specifically marine and estuarine fauna (see Section 4.2.2.2.2).

4.2.1.2 Nearshore Coastal Geology and Geomorphology

Section 3.3 of the PDARP/PEIS discuss the geologic and geomorphic conditions of the northern Gulf of Mexico which create the foundation for a continuous gradient of habitats. This section summarizes this discussion that is relevant to this RP/EA.

Sediment sources in the northern Gulf of Mexico coastal environment are predominately fluvial (associated with rivers and streams), especially west of the Alabama-Florida border. The Mississippi River is the primary source of sediment for the central and western Gulf of Mexico coast (including the nearshore environments of Louisiana, Mississippi, and Alabama). Texas has several rivers such as Sabine, Neches, Trinity, and Brazos that contribute sediments to the nearshore waters and bay systems; however, the majority of its offshore sediment deposits are from the Mississippi/Atchafalaya river basins. Mobile Bay, the second largest bay/delta system in the United States (ADCNR 2008), also contributes sediment to the central Gulf of Mexico, primarily via the Mobile and Tensaw Rivers, and in Mississippi, both the Pearl and Pascagoula River systems contribute sediment to the Gulf of Mexico. The sediment of the Florida peninsula nearshore environment differs from the rest of the Gulf of Mexico coastal nearshore environments because it consists of predominately reworked carbonate that originates from the karst bedrock dominating the region (GOMA 2009). This is not true, however, for the Florida Panhandle nearshore environment, which is composed of predominantly quartz sand.

The Mississippi Delta, formed over the past 6,000 years where the river enters the northern Gulf, contains a vast complex of wetlands that grade from freshwater swamps and marshes farther inland, to brackish marshes closer to the Gulf. Historically, a balance was maintained between wetland formation and loss through erosion, as the river periodically changed course within the delta. However, the amount of sediment reaching these wetlands has been greatly reduced because of Mississippi River management practices adopted for the important purposes of maintaining navigation and flood control. Additionally, dredging canals for oil and gas exploration and pipelines, sea-level rise, and subsidence all contribute to the ongoing loss of coastal wetlands.

Sediment deposition along the coastal environment is influenced by numerous physical processes including waves, winds (i.e., aeolian processes), river flows, and tidal currents. Nearshore sediment transport processes are particularly influenced by waves and tidal currents, which can cause frequent entrainment and transport of sediments in intertidal, benthic habitats. In addition, bottom currents transport sediments and deposit them differentially based on grain size, shaping the topographic features along the intertidal zone and continental shelf, and affecting the distribution of sediments, their chemical composition, and the availability of habitat to benthic organisms.

4.2.1.3 Hydrology and Water Quality

The northern Gulf of Mexico receives more than 60% of U.S. water drainage, including outlets from 33 major river systems and 207 bays, estuaries, and lagoons (Kumpf et al. 1999; EPA 2014). Three major estuarine drainage areas and three fluvial drainage areas (Texas Mississippi, and West Florida) have a large influence on water quality in the Gulf of Mexico. Freshwater and sediment from river deltas into the coastal waters affect water quality (Gore 1992) through the discharge of excess nutrients (e.g., nitrogen, phosphorus), sediments, and contaminants from industrial wastewater discharge, urban runoff, and agriculture. With increasing distance from shore, oceanic circulation patterns play a large role in dispersing and diluting anthropogenic contaminants and determining water quality. Because of the influence of the Gulf of Mexico's extensive estuary system and input from the Mississippi River, areas of the Gulf of Mexico closer to shore show regional variation depending on the characteristics of each estuary and distance from the Mississippi River outlet (EPA 2012).

River discharge has an important influence on salinity in nearshore areas along the northern Gulf of Mexico coast. The combined discharge of the Mississippi and Atchafalaya Rivers accounts for more than half of the freshwater flow into the Gulf of Mexico. The input of nutrient-rich freshwater to the coastal area fuels phytoplankton blooms in the water column. Turbidity is high in nearshore areas within the northwestern Gulf of Mexico because of terrigenous sediments. Turbidity in the carbonate sediments off the coast of Florida is much lower compared to areas dominated by terrigenous sediments in the rest of the Gulf of Mexico (Rezak et al. 1990). In areas with fine bottom sediments, currents can resuspend particles to form a turbid sediment layer in the water column that can extend to 66 feet (20 meters) over fine sediment muddy bottoms.

4.2.1.4 Fresh Surface Water

The fresh surface waters that supply the northern Gulf of Mexico coast serve as freshwater reservoirs, maintain nearshore salinity regimes, and serve as sources of nutrients and sediment resources. Freshwater inflow can affect the location, extent, and variety of estuary and nearshore habitat, especially during flood runoff seasons when large amounts of land-based material are transported to coastal environments. The surface waters of the Gulf of Mexico coast are provided by an extensive network of lakes, rivers, freshwater springs, and streams that ultimately discharge into the northern Gulf of Mexico. The inflow of freshwater from these rivers mixes with saline Gulf of Mexico waters and creates an ecologically and economically important estuarine habitat.

Surface water quality is affected by nonpoint sources of pollutants such as agricultural and urban runoff and contaminants released from point discharges including excess nutrients, metals, oil and grease, suspended solids, and biocides. Thermal effluents can also affect the quality of both fresh and marine habitats. Surface water flow is being affected in the Gulf of Mexico region by hydrologic modification from such activities as diversions, ditching, channelization, damming and undersized culverts.

4.2.1.5 Mississippi River Basin

The Mississippi River flows approximately 2,300 miles from Lake Itasca, Minnesota to the Gulf of Mexico, covering a drainage area of approximately 1.2 million square miles. The Mississippi

River Basin drains 41% of the contiguous United States and contributes 90% of the freshwater entering the Gulf of Mexico (EPA 2011). Traffic on the river has increased erosion, turbidity, and re-suspended sediments (EPA 2011). The Mississippi River is a heavily engineered river containing dams, locks, and levees to aid and control its flow.

Freshwater outflow from the Mississippi River Basin enters the northern Gulf of Mexico through two deltas: the Mississippi River Plaquemines-Balize Delta southeast of New Orleans receives about two-thirds of the flow, and the Atchafalaya River/Wax Lake Delta about 125 miles west receives the other one-third of the flow (Committee on Environment and Natural Resources 2010). The Atchafalaya River has also undergone significant hydrologic alterations in the last century. Historically, the discharge from this river accounted for less than 15% of the discharges from the Mississippi River Basin (Dale et al. 2010). Over time, more water was diverted from the Mississippi River into the Atchafalaya River, and by 1960, 30% of Mississippi River Basin discharges were diverted through the Atchafalaya River.

The Mississippi and Atchafalaya Rivers are the primary sources of freshwater, sediment, nutrients, and pollutants to the continental shelf (Murray 1997). Their freshwater discharge is dependent on climatic conditions, but generally peaks in the spring. The freshwater and nutrients are carried predominantly westward along the Louisiana/Texas inner to mid-continental shelf, especially during peak spring discharge. This seasonal delivery of nutrient-laden freshwater to the Gulf of Mexico fuels the seasonal occurrence of hypoxia (low oxygen) along the northwestern portion of the Gulf of Mexico (Murray 1997).

Channelization and human modifications to the Mississippi and Atchafalaya Rivers have negatively impacted natural deltaic cycles in Louisiana by reducing the sedimentary load delivered to state marshes. As a result, the natural processes of coastal land formation have been modified. Historically, a balance was maintained between wetland formation and loss from overbank sediment deposition in actively forming delta lobes and subsidence and deterioration processes in abandoned delta lobes. The suspended sediment load has been greatly reduced by dams on major tributaries, land use changes in the watershed, and alterations to the landscape such as flood risk reduction projects and navigation channels. Overbank flooding of the Mississippi River and its tributaries has been greatly restricted or eliminated, removing the source of sediment and freshwater that built and maintained coastal marshes relative to subsidence and eustatic (global effects on) sea level rise.

4.2.1.6 The Gulf Intracoastal Waterway

The GIWW is a 1,100-mile-long man-made canal along the Gulf of Mexico coastline from Brownsville, TX to Carrabelle, FL (Alperin 1983). The GIWW links all of the Gulf of Mexico coastal ports with the inland waterway system of the United States (Texas DOT 2005). The GIWW is the nation’s third busiest waterway with the Texas portion handling over 58% of the GIWW traffic. However, the use, operation, and maintenance of the GIWW have impacted the entire northern Gulf of Mexico. For example, the GIWW has led to erosion and the decline of wetland quality. Shoreline development along the GIWW and recreational boating use of the system create conflicts with commercial navigation. Construction of the GIWW has led to altered salinities within some lagoons and coastal water bodies (reduction in some areas and increase in others), conveyance of saltwater, intrusion of saltwater into local surficial aquifers, and increased water circulation and entrainment between inland water bodies and the Gulf of

Mexico. Maintenance of the channels has also led to temporary increases in sedimentation and turbidity due to dredging and sediment placement activities.

4.2.1.7 Nearshore Coastal Water Environment

Nearshore coastal environments encompass a broad range of habitats from inland, tidally influenced freshwater ecosystems to 600-foot-deep water off the Gulf of Mexico coast. This includes a variety of wetland and upland habitats including tidal marshes, salt pannes, tidal mudflats, swamps, pine savanna, maritime forests, dunes, and beaches. It also includes aquatic habitats such as estuaries, bayous, bays, SAV, and the open overlying waters of the continental shelf. Estuaries are transitional mixing zones of freshwater and saltwater habitats. The northern Gulf of Mexico estuaries make up 42% of the total estuarine surface area in the continental United States (EPA 1999). The continental shelf is the gently sloping undersea plain, and is an extension of the continent's landmass under the ocean. The waters of the continental shelf are relatively shallow (rarely more than 500 to 650 feet deep) compared to the open ocean (thousands of feet deep).

The nearshore coastal environment is characterized as a relatively shallow, open coastline with complex circulation patterns, weak tidal energies, generally warm water temperatures, seasonally varying stratification strength, and large inputs of freshwater (Committee on Environment and Natural Resources 2010). Nearshore coastal waters of the northern Gulf of Mexico are very productive and exhibit a wide range of chemical and physical characteristics, which are influenced by freshwater influxes. Seasonal cycles, storms, and hurricanes contribute to the variability in coastal Gulf of Mexico systems (Livingston 2003). As noted above, nutrient concentrations in coastal waters are largely determined by the input of freshwater from riverine sources, but they are also affected by periodic upwelling events and onshore flow of deep, nutrient-rich water mediated by shelf circulation (Gilbes et al. 1996).

Hypoxia is an important water quality issue in the nearshore environment. Normal oxygen concentrations in the Gulf of Mexico vary between 8 and 10 milligrams per liter (mg/L; USDOI 2010). However, a large area on the northern Gulf of Mexico continental shelf exhibits seasonally depleted oxygen levels, leading to hypoxic conditions. Hypoxic conditions occur when oxygen concentrations fall below the level necessary to sustain most animal life, which is generally defined by dissolved oxygen concentrations below 2 mg/L (Committee on Environment and Natural Resources 2010). Hypoxia in the Gulf of Mexico results from freshwater discharge and nutrient loading from the Mississippi River, nutrient-enhanced primary production (i.e., eutrophication), decomposition of biomass on the ocean floor, and depletion of oxygen due to water column stratification in the Gulf of Mexico. Hypoxia is known to occur in at least 105 distinct locations within Gulf of Mexico estuaries (NOAA 2011a). Oil and gas exploration, natural seeps, and chlorinated agricultural pesticides also contribute to hypoxic conditions (Turner et al 2003).

4.2.1.8 Marine Debris

Marine debris from multiple sources affects water quality and produces a wide variety of environmental, economic, safety, health, and cultural impacts (NOAA 2016). Stormwater inputs from land surfaces can carry large amounts of debris into coastal waters and ultimately offshore. Marine debris can also include recreational debris from beaches, piers, harbors, riverbanks, marinas, and docks, and from fisheries gear including trawl nets, bottom longlines, crab traps and monofilament lines. Derelict fishing gear and other marine debris can damage the structure of marine habitats, and can introduce plastic particles into marine habitats and reduce water quality. Marine debris can also provide a mechanism for transporting invasive species (DWH NRDA Trustees 2016a). Marine debris issues affecting water quality can lead to beach closures (Oigman-Pszczol and Creed 2007) and can disable vessels when debris comes into contact with propellers or intakes (NOAA 2011b; USCOP 2004). Entanglement affects more than 115 marine species including mammals, turtles, birds, fish, and crabs (NOAA 2014). Marine debris prevention programs, such as the NOAA Marine Debris Program, established in 2005, and EPA's Trash-free Waters Program help reduce and prevent marine debris from various sources before they end up in the marine environment. These types of programs focus on prevention through outreach and education and providing recycling locations at piers for monofilament fishing gear, as well as debris removal activities (NOAA 2018a).

4.2.2 Biological Resources

This section describes the habitats and marine and estuarine fauna and wildlife species relevant to the proposed alternatives. In addition, this section discusses protected species including birds, sea turtles, and marine mammals.

4.2.2.1 Habitats

Section 3.5 of the PDARP/PEIS describes the habitats of the northern Gulf of Mexico. Specifically, Section 3.5.1 describes the nearshore ecosystems including wetlands, barrier islands, beaches and dunes, SAV, and oysters. These coastal areas and nearshore waters are important for nesting, feeding, and migration to a variety of commercial and recreational fisheries, crustaceans, shellfish, marine mammals, sea turtles, and birds (Mendelssohn et al. 2017). This section provides additional information to expand on the PDARP/PEIS.

Wetland and barrier island habitats host wetland vegetation, such as cordgrasses and mangroves, and dune vegetation, such as sea oats. Coastal strand grasses and pine scrub vegetation are present on parts of the dunes, spits, and barrier islands. Mendelssohn et al. (2017) describe in detail barrier island and barrier shoreline habitats throughout the Gulf of Mexico. Marshes in general are also important habitats for terrestrial animals, including amphibians, reptiles, and mammals, and support extraordinary bird species diversity. Salt marsh serves as a critical and highly productive transition zone between the emergent marsh vegetation and open water, aiding the movement of organisms and nutrients between intertidal and subtidal estuarine environments (Levin et al. 2001).

Open water areas are a critical part of the coastal ecosystem and include many different habitat types. Soft bottom habitats support a diverse assemblage of organisms living within or on the sediment, including crustaceans, gastropods, bivalves, and worms, as well as many larger animals such as fish and crabs. SAV consists of rooted vascular plants that grow in fresh, brackish, and saltwater, and are extremely productive habitats within the marine and estuarine waters. Oysters are integrated throughout the coastal ecosystem in both nearshore and subtidal areas, creating habitat for other aquatic organisms (e.g., shellfish, crabs, and finfish), stabilizing shoreline areas, and improving water quality and clarity through their filtering action (Grabowski and Peterson 2007).

4.2.2.1.1 Wetlands

Wetlands include marshes (saltwater, brackish, and freshwater), mudflats, salt pannes, tidal flats, forested wetlands, pine savanna, riparian forests, mangroves, and swamps. Coastal wetlands provide millions of acres of habitat for aquatic and terrestrial organisms that are ecologically and economically important to the Gulf of Mexico coastal region. Coastal wetlands can be created by natural deltaic cycles and floodplain dynamics. For example, the majority of Louisiana's coastal wetlands were built by deltaic processes of the Mississippi River (USACE 1997).

Both tidal and non-tidal wetland habitats provide a wide variety of ecosystem services. Specifically, wetlands provide habitat and foraging grounds for a variety of organisms; protect water quality by capturing suspended sediment and removing excess nutrients and pollutants from upland environments; prevent pollutants from reaching other habitats (Fisher and Acreman 2004; Bricker et al. 1999); have the ability to store and sequester carbon (Chmura et al. 2003; Choi and Wang 2004); and can buffer energy to protect coastal areas against storm surges. In addition, wetlands can decrease flooding through water storage after heavy rainfall. Wetlands provide habitat for countless bird, fish, and native plant species, and serve as a nursery for important recreational and commercial marine species. Many pelagic fish species use wetland habitats, including tidal and non-tidal marshes, tidal flats, and mangrove swamps, for spawning, breeding, or growth to maturity (NOAA 2010). This habitat is discussed below under Essential Fish Habitat (Section 4.2.2.1.5).

Wetlands in the northern Gulf of Mexico region also support turtles, mammals, and other taxa in addition to extraordinary bird species diversity. These habitats are especially important for birds since portions of three major bird flyway corridors occur within the Gulf of Mexico – the Central, Mississippi, and Atlantic (USACE 2009).

Wetland loss in the northern Gulf of Mexico region has occurred at some of the highest rates documented within the United States. Between 2004 and 2009, there was a loss of over 257,153 acres (approximately 1.6%) of wetlands in coastal watersheds adjacent to the Gulf of Mexico. Conversion of estuarine marshes to open water can be attributed to sea level rise, land surface subsidence, and erosion. Freshwater wetlands in the northern Gulf of Mexico region continue to be lost to development and agriculture (Dahl and Stedman 2013).

Coastal wetlands are found in all five Gulf of Mexico states. The northern Gulf of Mexico shoreline has more wetlands than either the Atlantic or Pacific coastlines and is recognized for its vast coastal tidal wetlands (saltwater and estuarine marsh environments). The coastal watersheds with the highest densities of wetlands (greater than 32%) occur along southern Louisiana, Mississippi, and Alabama (Stedman and Dahl 2008).

Mudflats in the northern Gulf of Mexico can be found throughout the Mississippi River Delta and in the intertidal zones of all five Gulf of Mexico states. Although fairly continuous in south Texas (Corpus Christi Bay to Mexico) and in south Florida, particularly near the Everglades, mangroves are also found sporadically in the more northern latitudes of the Gulf of Mexico coast. The five states located along the northern Gulf of Mexico coast contain a variety of non-tidal wetlands commonly found in floodplains along rivers and streams, in isolated depressions surrounded by dry land, and in other low-lying areas (Gulf Restoration Network 2001).

4.2.2.1.2 Barrier Islands

Barrier islands are coastal landforms consisting primarily of unconsolidated deposits of sediments that tend to be oriented parallel to the coastline. Barrier islands can protect wetlands and other estuarine habitats from the direct impacts of the open ocean. They also slow the dispersal of freshwater into the Gulf of Mexico, thus contributing to the total area and diversity of estuarine habitat (BOEM 2012).

Barrier islands consist of beaches (ocean front and, in some places, landward), dune complexes, barrier flats, and back barrier marshes. Often seagrasses are present in waters behind these islands where wave energy is lower. Beaches are generally located on the ocean side of a barrier island where the most influential processes of deposition and erosion occur. Inshore of beach areas, one or more low dune ridges may be formed by the action of wind on sand. Sand dunes act as buffers against high winds and waves and as a reservoir for sand that can replenish beaches and back-barrier habitats during severe storms. Dune vegetation, such as sea oats and seacoast bluestem, has extensive root systems that can trap sand and promote dune building. Dune vegetation is adapted to the constant movement of sand, tidal flooding, and the high salt content of the substrate. Generally, succulent species (e.g., glassworts and saltworts) and vines are found on the beach fronts and wiregrass on highest dunes (LDWF 2012). On larger barrier islands, secondary dunes form behind primary dunes. Secondary dune ridges are more heavily and diversely vegetated. Stable back dune areas can give rise to scrub communities built upon sandy or well-drained soils, with the predominant vegetation being herbaceous shrubs, evergreen oaks, or pines (BOEM 2012).

Barrier islands are often configured in chains that are separated from the mainland by a shallow sound, bay, or lagoon. The islands are typically separated by tidal inlets or passes (NOAA 2012a). The morphology of barrier islands is constantly changing in response to underlying geology, erosion, and deposition processes such as wind, currents, storm surge, overwash, sediment supply, and transport. Movement of barrier islands may be landward, seaward, or laterally along the coast (BOEM 2012). Barrier island systems provide habitat for many species of plants and wildlife, including important nesting areas for birds and sea turtles, and are vulnerable to human impacts. Barrier islands protect wetland systems that form along the islands such as lagoons, estuaries, and/or marshes by limiting erosion caused by daily ocean waves and tides as well as ocean storm events (Stone and McBride 1998). Coastal communities that have developed along the northern Gulf of Mexico are also afforded protection from coastal storms, surges, and tidal flooding by the presence of barrier landforms. Stressors that impact the longevity and resilience of barrier islands in the northern Gulf of Mexico coastal area include storm events, reduction in sediment supply, channelization, saltwater intrusion, sea level rise, and invasive species. Reduction in barrier islands has resulted in increased loss of coastal wetlands and stress to marsh ecosystems due to greater wave and current action.

Barrier islands along the northern Gulf of Mexico are found from Texas to Florida. Eight geographically distinct barrier island systems have been characterized for the Gulf of Mexico from west to east: (1) the lower Texas coast (Laguna Madre and Padre Island); (2) mid-Texas coast (Mustang Island to Matagorda Peninsula); (3) upper Texas coast (Cedar Lakes to Bolivar Peninsula); (4) the deltaic barrier islands of southeast Louisiana from Atchafalaya Bay to Chandeleur Sound; (5) Mississippi Sound and Mobile Bay barrier islands (Cat Island to Bon

Secour Peninsula); (6) Northwest Florida barrier islands from Pensacola to Cape San Blas; (7) southwest Florida barrier islands (Anclote Key to Marco Island); and (8) Florida Bay (Ten Thousand Islands and the Florida Keys) (GOMA 2009; University of Texas 2012; TPWD 2012a; NOAA 2012b). Two areas of the northern Gulf of Mexico coastline within the United States have no barrier islands: the Chenier Plain of southeast Texas and southwest Louisiana (High Island, TX to Vermilion Bay, LA) and the Big Bend area of Florida from Apalachee Bay to Anclote Key.

4.2.2.1.3 Beaches and Dunes

Beaches are defined as land covered by unconsolidated, sand-sized material with minimal vegetation, extending landward from the low water line to dunes or a place where there is a distinct change in material or physical features. Dunes are wind-blown deposits of sand that form just behind the beach face and separate the higher energy beach from lower energy habitats, such as barrier flats, wetlands, and mudflats. Beaches, dunes, and swale wetlands are ecologically and recreationally important shoreline habitats.

Beach sediments along the Gulf of Mexico coast vary between geographic regions but are composed primarily of inorganic quartz from weathered continental rock (Brown et al. 1990; Finkl 2004; and EPA 2004 as cited in Thayer et al. 2003). Estuarine beaches along the bay systems in the northern Gulf of Mexico contain a higher content of organic matter in the sand than coastal beaches as a result of riverine sediment deposition. Beach habitats are dynamic environments that undergo significant change throughout the year. Accretion occurs in the summer as a result of reduced wave energy with erosion processes increasing in the winter due to increased high-energy wave action. These physical processes often lead to seasonal changes in the diversity and abundance of organisms.

Primary dunes in a beach system incur most of the saline and thermal stress from coastal physical processes, and, as a result, vegetation diversity is generally lower on primary dunes than secondary dunes. The latter lie landward of the primary dunes, are older, more stable, and support more diverse and larger types of vegetation such as shrubs and small trees. A swale wetland typically forms in between primary and secondary dunes and acts as a catch basin for water that breaches the primary dune. Vegetation growing in the swale tends to be more tolerant of saltwater inundation. Typical dune plants along the Gulf of Mexico include sea oats (*Uniola paniculata*), beach morning glory (*Ipomoea imperati*), bitter panic grass (*Panicum amarum*), and cordgrass species (*Spartina spp.*).

Beaches are important breeding, nesting, wintering, resting, and foraging habitats for a variety of species. Several species of sea turtles nest on some beaches of the northern, coastal Gulf of Mexico. Many birds, including federally listed, candidate and migratory species, such as piping plover and red knot, use beaches as important wintering and migratory habitats. Other species, such as Wilson's plover (*Charadrius wilsonia*) and snowy plovers (*Charadrius nivosus*) use beaches as important breeding habitat. For example, coastal beaches are home to approximately 70% of the wintering population of the threatened piping plover (Elliott-Smith et al. 2009 as cited in Brown et al. 2011). Gulls and pelicans are also commonly found on Gulf of Mexico beaches. Dune habitats support many different species, including federally listed species such as beach mice. In addition, beaches provide habitat for a range of burrowing invertebrates and meiofauna (microscopically small benthic invertebrates).

Gulf of Mexico coastal beaches and dunes face a variety of threats including development pressure, sea level rise, sediment deficiencies, and habitat sustainability. Coastal population growth and the increasing economic development of ports, refineries, and industries have exacerbated these trends. The highest rates of erosion in the Gulf of Mexico region occur in Louisiana along barrier island and headland shores near the Mississippi delta. In Texas, erosion is rapid along the barrier islands and upper coast headlands. The Mississippi barrier islands are eroding and migrating laterally. The highest rates of erosion in Florida are generally found along the Panhandle barrier island beaches and near tidal inlets. The most stable Gulf of Mexico beaches are along Florida's west coast, where low wave energy and beach nourishment minimize erosion (Morton et al. 2004). In addition to the long-term shoreline change trends, anthropogenic modifications have created pockets of accretion and increased erosion in each of the Gulf of Mexico states.

Currently, inland damming of rivers, creation of jetties, seawalls, and other hard structures, and construction of structures in response to shoreline changes, has substantially altered the natural beach and dune processes. In addition to the direct impacts, these factors have reduced the Gulf of Mexico coast's capacity to adapt to large-scale changes in conditions caused sea level rise and coastal storms (McKenna 2009). Sandy beach and dune habitats are present along the coastline of all five Gulf of Mexico states. The amount of sandy shoreline in each state is dependent upon the physical conditions at the area (e.g., wave action, sediment supply, etc.) and the level of coastal development.

4.2.2.1.4 Submerged Aquatic Vegetation

SAV describes plants that have adapted to living in or on aquatic environments. SAV includes seagrasses, oligohaline grasses, attached macroalgae, and drift algae. Because seagrass is the prominent SAV in Gulf of Mexico coastal habitats, seagrass and SAV are used interchangeably in the discussion below.

Seagrasses are rooted vascular plants that grow in coastal waters and can, except for some flowering structures, live and grow below the water surface. Freshwater and brackish species are important components of estuary systems and inland waters. Seagrasses grow in the littoral (intertidal) and sublittoral (subtidal) zones in salinities ranging from freshwater to saltwater (>32 ppt).

SAV provides habitat, food, and/or shelter for turtles, marine mammals, birds, fish, shellfish, invertebrates, and other aquatic species, and are among the most productive habitats in coastal areas. SAV species filter contaminants and sediments; improve water quality; regenerate and recycle nutrients; and produce, export, and accumulate organic matter. Complex structures of seagrass leaves, roots, and rhizomes attenuate waves; reduce erosion; and promote water clarity while increasing bottom area habitat where communities of benthic organisms can live. SAV coverage has declined in most areas within the Gulf of Mexico due to natural and human-induced stressors including reduced light and water clarity, increased nutrient loading, and physical disturbance caused by dredging, boat propellers, anchors, and groundings.

It is estimated that there are more than three million acres of SAV, both marine and freshwater/brackish, in the Gulf of Mexico, making the northern Gulf of Mexico a globally important SAV area (NOAA 2011c). The northern Gulf of Mexico has four major types of marine habitat where seagrasses are present: (1) lagoons, which can be hypersaline, have turtle grass (*Thalassia spp.*), manatee grass (*Syringodium spp.*), shoal grass (*Halodule spp.*), star grass (*Hypoxis spp.*), and widgeon grass (*Ruppia maritima*); (2) shallow coastal areas that have the above grasses as well as water celery (*Vallisneria americana*); (3) back reefs (the portion of the coral reef ecosystem that extends from the coast to the reef crest) that have turtle grass, manatee grass, and shoal grass; and (4) deep coastal areas that contain paddle grass (*Halophila decipiens*) and star grass, which are tolerant of less light. Although seagrasses can display vertical zonation, this is not the case for all locations. Turtle grass, manatee grass, and shoal grass are the dominant seagrass species in the Gulf of Mexico and can occur in single species stands, but often occur in intermixed beds (Short et al. 2007).

4.2.2.1.5 Essential Fish Habitat

Many coastal wetlands in the Gulf of Mexico coastal region have been designated as one or more types of Essential Fish Habitat (EFH). EFH for shrimp consists of Gulf of Mexico waters and substrates extending from the U.S.-Mexico border to Fort Walton Beach, FL from estuarine waters out to depths of 100 fathoms; waters and substrates extending from Grand Isle, LA to Pensacola Bay, FL between depths of 100 and 325 fathoms; waters and substrates extending from Pensacola Bay, FL to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council (GMFMC), and the South Atlantic Fishery Management Council out to depths of 35 fathoms, with the exception of waters extending from Crystal River, FL to Naples, FL between depths of 10 and 25 fathoms and in Florida Bay between depths of 5 and 10 fathoms (GMFMC 2005). EFH includes all types of aquatic habitats that a managed species requires to spawn, breed, feed, or grow to maturity (NOAA 2013).

Under provisions of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), the GMFMC delineated EFH for federally managed fishery species throughout the Gulf of Mexico. Components of various projects are contained within estuarine and nearshore portions of Ecoregions 2, 3, 4, and 5. Categories of EFH potentially impacted by project components in the estuarine and nearshore areas include open water, emergent saline and brackish marsh, sand/shell bottom, and mud/soft bottom. NMFS also manages highly migratory species (e.g., sharks) for which EFH is identified by geographical area rather than habitat type. Federally managed fishery species having EFH in estuarine and nearshore areas which could potentially be impacted by implementation of restoration activities described within this RP/EA and the category of EFH potentially impacted are identified in Table 4-1.

Table 4-1. Federally managed fishery species and the categories of potentially impacted EFH

Fishery species	Category(s) of EFH
White shrimp (*Penaeus setiferus*)	Emergent marsh, sand/shell bottom, soft bottom
Brown shrimp (*Penaeus aztecus*)	Emergent marsh, sand/shell bottom, soft bottom
Pink shrimp (*Penaeus duorarum*)	Sand/shell bottom
Red drum (*Sciaenops ocellatus*)	Emergent marsh, sand/shell bottom, soft bottom, hard bottom
Gray snapper (*Lutjanus griseus*)	Emergent marsh, sand/shell bottom, soft bottom, hard bottom
Lane snapper (*Lutjanus synagris*)	Sand/shell bottom, soft bottom
Red snapper (*Lutjanus campechanus*)	Sand/shell bottom, soft bottom, hard bottom

Fishery species	Category(s) of EFH
Vermilion snapper (*Rhomboplites aurorubens*)	Hard bottom
Gray triggerfish (*Balistes capriscus*)	Sand/shell bottom
Great hammerhead shark (*Sphyrna mokarran*)	Nearshore waters
Scalloped hammerhead shark (*Sphyrna lewin*)	Estuarine and nearshore waters
Bonnethead shark (*Sphyrna tiburo*)	Estuarine and nearshore waters
Blacknose shark (*Carcharhinus acronotu*)	Nearshore waters
Blacktip shark (*Carcharhinus limbatus*)	Estuarine and nearshore waters
Bull shark (*Carcharhinus leucas*)	Estuarine and nearshore waters
Atlantic sharpnose shark (*Rhizoprionodon terraenovae*)	Estuarine and nearshore waters
Spinner shark (*Carcharhinus brevipinna*)	Estuarine and nearshore waters

4.2.2.2 Marine and Estuarine Fauna

Sections 3.6.2–3.6.3 of the PDARP/PEIS describe the Gulf of Mexico living aquatic resources including resident and migratory fishes, mammals, crustaceans, mollusks, reptiles, and benthic invertebrates. This section provides additional information to expand on the PDARP/PEIS. Nekton that potentially could be found in this area include economically important marine species that use estuaries as nursery and foraging habitats, such as brown and white shrimp, blue crab (*Callinectes sapidus*), red (*Sciaenops ocellatus)* and black drum (*Pogonias cromis*), spotted and sand seatrout (*Cynoscion nebulosus and C. arenarius*), gulf menhaden (*Brevoortia patronus*), bay anchovy (*Anchoa mitchilli*), and southern flounder (*Paralichthys lethostigma*). Additionally, a number of cartilaginous nekton, such as sharks and rays, also are common inhabitants of these shallow estuarine and nearshore habitats. Phytoplankton and zooplankton are common basic components of the aquatic food web found throughout the estuarine and marine portions of the Gulf of Mexico. Benthic organisms are another important food source for birds, fish, marine mammals, and other animals. Mollusks (clams, mussels, oysters, snails), sponges, polychaetes (marine worms), and amphipods (small shrimp-like crustaceans) are examples of benthic organisms.

4.2.2.2.1 Nearshore Benthic Communities

Nearshore benthic communities in the northern Gulf of Mexico are largely composed of macroinvertebrate groups such as mollusks, crustacea, sponges, and polychaetes. These diverse groups are found in habitats spanning from the intertidal zone to the soft sediments on the continental shelf. There are two main components to benthic communities – the infauna and epifauna. The benthic infauna includes worms, mollusks, and crustaceans that live in bottom sediments. These species maintain sediment and water quality and provide a food source for bottom-feeding fish, shrimp, and birds. The benthic epifauna includes commercially important shellfish and finfish that live on the surface of bottom sediments.

Mollusks are soft-bodied animals that may have a hard, external shell composed of calcium carbonate; a hard, internal shell; or no shell at all. Mollusk species are found attached to rocks and shells, on seagrass blades, on plant stems and roots, burrowed into sediment and other substrates, and moving freely on the ocean floor and water column. Mollusk taxa include commercially important organisms such as clams, scallops, and squid, along with snails, slugs, whelks, and other cephalopods (squid, cuttlefish, and octopi). Mollusks are an important food source to many larger benthic and water column species. Two main subgroups of mollusks are gastropods and bivalves. The eastern oyster (*Crassostrea virginica*) is the predominant commercial bivalve species in the Gulf of Mexico.

Crustacea is a class of diverse organisms that vary in many ways including size, mobility, feeding strategy, and habitat preference. There are over a dozen subgroups of crustaceans within the Gulf of Mexico (Felder and Camp 2009). Smaller crustaceans such as isopods, amphipods, and tanaids are ecologically important and have large populations within the northern Gulf of Mexico. Larger crustaceans include commercially important species such as shrimps, crawfishes, lobsters, and crabs. Shrimp are widely distributed in Gulf of Mexico habitats, ranging from estuaries to open water habitat on the continental shelf. Shrimp are also associated with EFH for many other important aquatic species such as red drum, reef fish, coastal migratory species, stone crab (*Menippe mercenaria*), blue crab (*Callinectes sapidus*), and spiny lobster (*Panulirus argus*). Crabs are bottom dwellers in every type of habitat from the saltiest water of the Gulf of Mexico to the almost freshwater of the back bays and estuaries, from the low tide line to waters 120 feet deep (Perry and McIlwain 1986; TPWD 2013). Blue crabs, which are one of the primary species of commercial importance in the Gulf of Mexico, use a wide variety of benthic habitats throughout their life history. Offshore, high-salinity waters are used by blue crabs during their early larval stages. Larvae then move into estuaries and use subtidal and intertidal mudflats, oyster bars, channel edges, tidal marshes, seagrass beds, and soft-sediment shorelines as they grow (NOAA 2012c).

Sponges and polychaetes contribute to benthic biomass and productivity. Sponges are found throughout the northern Gulf of Mexico on substrates that include reefs, mangrove roots, seaweed, and artificial structures (e.g., oil platforms). Polychaetes are present in nearly all marine environments and are common in the sandy and muddy substrates of the Gulf of Mexico; many species use the soft sediment to create burrows. These taxa include many species that are filter feeders. Filter feeders remove and digest phytoplankton and particulate organic matter, and deposit processed materials on the substrate (Turgeon et al. as cited in Felder and Camp 2009).

4.2.2.2.2 Oysters

The eastern oyster is the primary oyster species found across the northern Gulf of Mexico and is the major commercial species. Oysters are important as organisms and providers of habitat, with an integral role in the function and structure of estuarine ecosystems.

The eastern oyster lives in shallow, well-mixed estuaries, lagoons, tidal sloughs of barrier islands, and oceanic bays. This species can be found from 1 foot above the mean low tide line to 40 feet below the mean low tide line and within the Gulf of Mexico is typically found at depths of 0 to 13 feet (Eastern Oyster Biological Review Team 2007). In the Gulf of Mexico, oysters are found in higher abundance in nearshore, shallow, semi-enclosed water bodies close to freshwater sources (GSMFC 2012).

Oysters are an ecological keystone species in most estuaries in the northern Gulf of Mexico, and oyster populations contribute to the integrity and functionality of estuarine ecosystems

(Eastern Oyster Biological Review Team 2007). Self-sustaining oyster populations form reefs that are crucial components of estuaries: they improve water quality, recycle nutrients, and act as natural breakwaters, helping to prevent shoreline erosion and provide habitat for a large number of commercially and recreationally important fish species (Grabowski and Peterson 2007; Coen et al. 2007; Eastern Oyster Biological Review Team 2007; GSMFC 2012; Peterson et al. 2003). The structural complexity of oyster reefs provides refuge, nursery areas, foraging grounds, and breeding grounds for fish (Grabowski et al. 2005; GSMFC 2012) and foraging grounds for birds.

In the Gulf of Mexico, commercial landings of oysters provide some indication of their distribution in the region. Oyster harvests represent a $100 million dollar industry in the Gulf of Mexico.

Table 4-2. 2018 Gulf of Mexico commercial oyster landings in weight and value by state

State	Oyster landings (pounds)	Oyster landings (dollars)
Texas	3,859,415	$23,998,793
Louisiana	10,924,437	$75,972,997
Mississippi	2,552	$19,050
Alabama	25,308	$914,444
Florida (west coast)	516,803	$3,168,604
Total	15,328,515	$104,073,888

Source: NOAA Fisheries Landings (https://foss.nmfs.noaa.gov/apexfoss/f?p=215:200:15979572935014::NO:::)

Table 4-3. Approximate acreage of oyster reef area by state

State	Historic and current Oyster reef areas (acres)	References
Texas	25,081	TPWD n.d.
Louisiana	2,034,992	Frey et al. 2018; LDWF 2012
Mississippi	23,930	DWH NRDA Trustees. 2017c
Alabama	2,675.8	ADCNR 2021
Florida	8,368	Kilgen and Dugas 1989; McNulty et al. 1972

Estimates of oyster reef extent and acreage vary from year to year. These estimates are often based on harvested reefs and may not include reefs that are closed due to pollution or other reasons (e.g., designated as part of marine sanctuaries or no-harvest spawner sanctuaries). In 2009, Beck et al. published an assessment of oyster reefs around the world, including bays in the northern Gulf of Mexico. The assessment was based on estimates of oyster abundance and reef distribution from historical maps, formal surveys of scientists and managers, fishery statistics, and literature reviews. The overall rating for the northern Gulf of Mexico was fair (50–89% lost compared to historical levels of abundance). However, the bays in the northern Gulf of Mexico were rated in better condition than those in other parts of the continental United States, which were generally rated as poor or functionally extinct relative to historic oyster abundance.

4.2.2.2.3 Finfish

The Gulf of Mexico supports diverse assemblages of fish that inhabit freshwater, estuarine, coastal, and marine habitats. This includes more than 15% of all known species of marine fish (McEachran and Fechhelm 1998). Fish assemblages vary based on salinity, temperature, depth, and substrate. The Gulf of Mexico has some of the most productive commercial and recreational finfish fisheries in the world.

In the northern Gulf of Mexico, fish assemblages can be grouped by habitat use. Many pelagic and demersal fish inhabit estuaries during their early life stages. Egg and larval stages of demersal fish often spend time in the upper water column where phytoplankton and zooplankton are concentrated, before ultimately moving to bottom waters. Some fish species migrate between freshwater and saltwater spending most of their adult life in saltwater but spawning in freshwater (anadromous), or the reverse (catadromous). These two groups are collectively referred to as diadromous.

Fish populations in the northern Gulf of Mexico face a variety of stressors including fishing, pollution, habitat degradation and loss, invasive species, and shifting environmental conditions. Fishing, either as targeted catch or as bycatch, is often the dominant source of non-natural mortality. Changes in physical conditions in the marine environment can affect the growth, survival, and reproduction of many fish species. The spatial distribution of marine fish species is largely determined by climate. Factors such as air and water temperatures, ocean acidification, changes in runoff from the land, sea level rise, and altered currents may also affect fisheries in the Gulf of Mexico (Karl et al. 2009).

4.2.2.2.4 Demersal

Demersal fish in the northern Gulf of Mexico can be generally characterized as soft bottom or hard bottom fish, according to their association with particular substrate types. Soft bottom habitat is relatively featureless and has lower species diversity than the more structurally complex hard bottom habitat. Hard bottom generally refers to exposed rock, but can refer to other substrata such as coral and clay, oyster reefs, or even artificial structures.

Demersal fish associated with soft bottom generally prefer certain types of sediments over others; this tendency has led to the naming of three primary fish assemblages according to the dominant shrimp species found in similar sediment/depth regimes (Chittenden and McEachran 1976, reviewed in GMFMC 2004). In the Gulf of Mexico, pink shrimp are most abundant in waters from 36 feet to about 213 feet over calcareous sediments. Common members of the pink shrimp assemblage include Atlantic bumper (*Chloroscombrus chrysurus*), sand perch (*Diplectrum formosum*), silver jenny (*Eucinostomus gula*), dusky flounder (*Syacium papillosum*), and pigfish (*Orthopristis chrysoptera*). Fishes associated with brown shrimp and white shrimp are found on more silty sediments. The brown shrimp assemblage extends from 42 to 299 feet. Examples of fish in the brown shrimp assemblage include porgies (Sparidae), sea robins (Triglidae), batfish (Ogcocephalidae), left eye flounders (Paralichthyidae), cusk-eels (Ophidiidae), and scorpionfishes (Scorpaenidae). The white shrimp assemblage exists in water depths of 11 to 72 feet, and dominant fish include drums (Sciaenidae), Atlantic croaker (*Micropogonias undulates*), snake mackerels (Gempylidae), herrings (Clupeiformes), jacks (Carangidae), and flounders (Pleuronectiformes). Many fish species in the white and brown shrimp assemblages spawn in shelf waters and spend their early life stages in estuaries (GMFMC 2004).

Hard bottom associated fish include most snapper and grouper. The GMFMC manages snappers (*Lutjanus spp.*), groupers (Serranidae), tilefishes (Malacanthidae), jacks, gray triggerfish (*Balistes capriscus*), and hogfish (*Bodianus spp.*) under the reef fish fishery management plan (FMP). Other examples of reef fishes include sea basses (*Centropristis spp.*), grunts (Haemulidae), angelfishes, damselfishes (*Pomacanthidae*), parrotfishes (Scaridae), and wrasses (Labridae) which inhabit hard-bottom habitats in the Gulf of Mexico (Dennis and Bright 1988). Although reef fish are associated with hard-bottom habitat as adults, some species can be found over soft sediments as well, such as porgies. Like soft sediment species, many hard bottom demersal fish are estuarine dependent and spend their juvenile states in coastal habitats.

4.2.2.3 Wildlife Species (Birds and Terrestrial Species)

Section 3.6.6 of the PDARP/PEIS describes the birds of the Gulf of Mexico. This section provides additional information to expand on the PDARP/PEIS. Many species of birds spend all or a portion of their life cycle along the Gulf of Mexico using a variety of habitats at different stages. Many bird species migrate between breeding and wintering habitat in the northern Gulf of Mexico. Parts of the Central, Mississippi, and Atlantic Flyways (well-described routes between wintering grounds and summer nesting grounds) are used by hundreds of millions of birds that converge on the Gulf Coast where they either migrate along the northern Gulf Coast before reaching their destination on the Gulf of Mexico; follow the Mexico-Texas coastline (circum-Gulf migrants); or cross the Gulf of Mexico between Mexico’s Yucatan Peninsula and the Texas Coast (trans-Gulf migrants) (TPWD 2011). The largest concentration of northbound migrating birds crosses the Gulf of Mexico reaching the northern Gulf of Mexico shoreline between the northern Texas coast and the Florida Panhandle (Morrison 2006).

Migratory birds include neotropical (long-distance) and temperate (short-distance) migrants, as well as resident species. The habitat in the analysis area provides suitable breeding, nesting, feeding, foraging, resting, and/or roosting habitat for a number of migratory bird species groups. These groups include wading birds (e.g., egrets and herons; family Ardeidae), shorebirds (e.g., sandpipers and plovers; order Charadriiformes and family Scolopacidae), seabirds (e.g., gulls and terns; family Laridae), marsh birds (e.g., rails and coots; family Rallidae), waterfowl (e.g., ducks and geese; family Anatidae), and land birds, which include raptors (e.g., eagles, hawks, falcons, and owls; families Accipitridae, Falconidae, Strigidae) and numerous passerines (e.g., sparrows, warblers, flycatchers, jays, and wrens; order Passeriformes). The next section discusses each of these groups in more detail below.

4.2.2.3.1 Colonial Waterbirds

Colonial waterbirds nest in social nesting groups (colonies) often containing a mix of species of a similar group (e.g., a wading bird colony may include multiple species of herons and egrets). This guild consists of two principal groups: wading birds (e.g., herons, egrets, ibises) and ground- or beach-nesting species (e.g., terns and gulls). Ground-nesting species can be further divided into species that feed in pelagic (open water) habitats such as cormorants, gulls, and terns and shorebirds that usually feed in open shoreline habitats. Shorebirds are described in more detail below. All three groups feed mostly on aquatic organisms, and as a result, nesting colonies are usually concentrated within appropriate coastal habitats. The location and size of nesting colonies depend directly on the presence of predators, suitable nesting habitat, and adequate food availability (Duke and Kruczynski 1992).

Colonies of wading birds may also be referred to as "rookeries" or "heronries." Wading birds generally have long legs, long necks, and long bills that allow them to forage in shallow water, probing or actively capturing fish, frogs, aquatic insects, crustaceans, and other prey (Terres 1991). Wading birds found along the Gulf of Mexico coast include herons and egrets, storks, ibises and spoonbills, and cranes. Typical wading bird species include great blue heron, great egret, snowy egret, little blue heron, and tricolored heron. Reddish egret and roseate spoonbill are two species within the U.S. restricted in range to habitats in the Gulf of Mexico coast. Colonial-nesting species that feed in open water include cormorants, gulls, terns, and pelicans. These species actively pursue prey (generally fish) by plucking them from the surface or diving underwater to capture fish.

4.2.2.3.2 Waterfowl

Waterfowl include swans, geese, and ducks that migrate from summer nesting areas in the northern United States and Canada along flyways to wintering grounds along the northern Gulf of Mexico coast, as well as resident waterfowl species that breed and inhabit the Gulf of Mexico region year-round (e.g., mottled ducks [*Anas fulvigula*] and whistling ducks [*Dendrocygna spp.*]).

The coastal marshes of Louisiana, Mississippi, and Alabama provide winter habitat for more than half of the wintering duck population using the Mississippi Flyway while the coastal wetlands of Texas provide wintering habitat for more than half of the Central Flyway waterfowl population (Esslinger and Wilson 2002). As a result, the northern Gulf of Mexico coast provides wintering habitat for large continental populations of several waterfowl species including: 95% of gadwall (*Anas strepera*), 80% of green-winged teal (*Anas crecca*), 80% of redhead (*Aythya americana*), 60% of lesser scaup (*Aythya affinis*), and 25% of northern pintail (*Anas acuta*). In addition, the northern Gulf of Mexico coast provides year-round habitat for 90% of the mottled duck population in North America and is a key breeding area for whistling ducks (Esslinger and Wilson 2002). Waterfowl, such as sea ducks (i.e., diving ducks) and dabbling ducks (order Anseriformes), feed and rest within coastal (nearshore and inshore) waters outside of their breeding seasons. Members of the order Gaviiformes (loons) may be present in coastal waters also. Waterfowl that may occur within coastal and inshore waters of a restoration area include species within the subfamilies Aythyinae (diving ducks) and Merginae (sea ducks) (Sibley 2000). Diving ducks include the canvasback (*Aythya valisineria*), ring-necked duck (*A. collaris*), scaups (*A. affinis* and *A. marila*), bufflehead (*Bucephala albeola*), and common goldeneye (*B. clangula*). Hooded mergansers (*Lophodytes cucullatus*) are the primary sea duck species that may occur within the affected area.

4.2.2.3.3 Marsh-dwelling Birds

"Marsh-dwelling bird" is a general term for birds that live in or around marshes and swamps. These marsh birds represent a variety of taxonomic families. They also prefer different types of marsh habitat and structure, some preferring a mix of water and vegetation with others preferring either denser or more open marsh habitats. Along the Gulf of Mexico coast, bird species found in salt and freshwater marshes include grebes, bitterns, rails, gallinules, limpkin, and passerines exemplified by marsh wren, sedge wren, and several sparrow species. Some are year-round residents, but most marsh birds in this region are northern breeders that winter in Gulf of Mexico coastal marshes. Some marsh species that spend the winter in the Gulf of Mexico include the American bittern (*Botaurus lentiginosus*), and eastern black rail (*Laterallus jamaicensis jamaicensis*). Other marsh birds specifically breed in the Gulf of Mexico region such as the least bittern (*Ixobrychus exilis*) and the yellow-crowned night-heron (*Nyctanassa violacea*). Many such as the common gallinule (*Gallinula galeata*), pied-billed grebe (*Podilymbus podiceps*) and the marsh wren (*Cistothorus palustris*) can spend all year in the Gulf of Mexico area, while species such as the black tern (*Chlidonias niger*) are found in Gulf of Mexico marshes during their migration (Audubon 2020).

4.2.2.3.4 Shorebirds

Shorebirds utilize coastal environments for nesting, feeding, resting, and migration stopover. The Gulf of Mexico coast is significant to beach-nesting birds, and includes species that breed on beaches, flats, dunes, bars, barrier islands, and similar nearshore habitats. The northern Gulf of Mexico coast, from the Mississippi River Delta of Louisiana to the Florida Panhandle, represents 18% of the southeastern U.S. coastline and supports a disproportionately high number of beach-nesting bird species. Shorebirds primarily found along the coastline of the restoration area include species within four families: Charadriidae (plovers); Haematopodidae (oystercatchers); Recurvirostridae (avocets and stilts); and Scolopacidae (sandpipers). Fifty-three species of shorebirds regularly occur in the United States (Brown et al. 2001), with 43 species occurring during migration or wintering periods in the restoration area. Six shorebird species breed in the Gulf of Mexico (Helmers 1992): American oystercatcher (*Haematopus palliates*), snowy plover (*Charadrius nivosus*), Wilson's plover (*C. wilsonia*), semipalmated plover (*C. semipalmatus*), killdeer (*C. vociferous*), and black-necked stilt (*Himantopus mexicanus*).

The Lower Mississippi/western Gulf of Mexico coastal region is rich with a variety of shorebird habitats, and the area has some of the most important shorebird habitat in North America, particularly the Laguna Madre ecosystem along the south Texas coast (Brown et al. 2001; Withers 2002). Resident shorebirds primarily rely on the shorelines adjacent to restoration areas for their life functions, while some migrants overwinter along shorelines adjacent to restoration areas. Some shorebird species cross and stopover in restoration areas during their annual migration (DWH Trustees 2014).

4.2.2.3.5 Raptors

Raptors that occur along the northern Gulf of Mexico coast include vultures, osprey, owls, kites, hawks, harriers, caracaras, eagles, and falcons. Raptors may be present as year-round residents, migrants, and wintering species. As a group, raptors prey on other birds, mammals, reptiles, amphibians, fish, carrion, and many invertebrates. Some species feed on a variety of prey items (red-tailed hawk (*Buteo jamaicensis*)) while other species such as the Cooper's hawk (*Accipiter cooperii*) have a narrow range of prey (Sibley 2001). Vultures (family Cathartidae) and crested caracara (*Caracara cheriway*) are primarily scavengers. Many species of raptors construct nests of vegetation off the ground in trees; however, several species construct nests on bluffs, cliffs, or man-made structures, use nests of other species, or nest in cavities (Sibley 2001).

4.2.2.3.6 Terrestrial Wildlife

Terrestrial wildlife species are present throughout the northern Gulf of Mexico coastal region. This section briefly reviews the distribution of these species. Diamondback terrapins (*Malaclemys terrapin*) are present along the Atlantic Coast of the eastern United States from Cape Cod to the Florida Keys, and west along the northern Gulf of Mexico coast to Texas (Griffin et al. n.d.). Beach mice are found in Florida and Alabama. The Alabama beach mouse (*Peromyscus polionotus ammobates*) lives along the coast of Baldwin County, AL; the Perdido Key beach mouse (*P. p. tryssyllepsis*) lives on Perdido Key in Baldwin County, AL and Escambia County, FL; the Santa Rosa beach mouse (*P. p. leucocephalus*) lives on Santa Rosa Island, Escambia County, FL; the Choctawhatchee beach mouse (*P. p. allophrys)* lives in Walton and Bay Counties, FL; and the St. Andrew beach mouse (*P. p. peninsularis*) lives in Bay and Gulf Counties, FL. American alligators (*Alligator mississippiensis*) are found within the great river swamps, lakes, bayous, marshes, and other bodies of water along the northern Gulf of Mexico and Lower Atlantic Coastal Plains (Conant and Collins 1991). American mink (*Mustela vison)* range throughout the Gulf of Mexico coastal region. They prefer small streambanks, lakeshores, and marshes and favor forested wetlands with abundant cover such as shrub thickets, fallen trees, and rocks (DeGraaf and Yamasaki 1986). The North American river otter (*Lontra canadensis*) can be found throughout the Gulf of Mexico coastal region, except on the southwest Texas coast (Smithsonian National Museum of Natural History n.d.).

Stressors affecting terrestrial wildlife in the northern Gulf of Mexico include habitat loss and degradation, pollution, invasive species, predation, and climate change. Terrestrial invasive plant species can alter habitat for wildlife by out-competing native species and reducing suitable habitat. Terrestrial invasive animal species range from invertebrates (e.g., invasive red fire ants (*Solenopsis spp.*)) to mammals (e.g., feral hogs (*Sus scrofa*) or nutria (*Myocastor coypus*)) and can prey upon and compete with other wildlife species and alter habitat through their foraging techniques and other behaviors (e.g., rooting of feral hogs).

4.2.2.4 Protected Species

This section discusses species and their associated habitats that are protected under federal law. This includes ESA-listed species and designated critical habitats, which are under the jurisdiction of either the USFWS or NMFS; marine mammals protected under the MMPA; and EFH and Habitat Areas of Particular Concern protected under the MSFCMA.

Table 4-4 lists the threatened and endangered species and their critical habitats with potential to occur in or near areas where restoration alternatives are proposed. ESA-listed species and habitats in the Gulf of Mexico not listed in this table are not expected to be impacted by the preferred alternatives.

Table 4-4. Federally threatened and endangered species and designated critical habitats that may be affected by alternatives proposed in this RP/EA

Common name	Scientific name	Federal status
Birds		
Piping plover	*Charadrius melodus*	Threatened*
Red knot	*Calidris canutus rufa*	Threatened
Eastern black rail	*Laterallus jamaicensis*	Threatened
Roseate tern	*Sterna dougallii*	Threatened
Least tern	*Sternula antillarum*	Endangered
Northern aplomado falcon	*Falco femoralis septentrionalis*	Endangered
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	Endangered
Whooping crane	*Grus americana*	Endangered
Red-cockaded woodpecker	*Leuconotopicus borealis*	Endangered
Wood stork	*Mycteria americana*	Endangered
Sea Turtles		
North Atlantic DPS – Green	*Chelonia mydas*	Threatened
Northwest Atlantic Ocean DPS – Loggerhead	*Caretta caretta*	Threatened*
Hawksbill sea turtle	*Eretmochelys imbricata*	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	Endangered
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered
Marine Mammals		
West Indian Manatee	*Trichechus manatus latirostris*	Threatened
Fish		
Smalltooth sawfish	*Pristis pectinata*	Endangered
Largetooth sawfish	*Pristis pristis*	Endangered
Gulf sturgeon	*Acipenser oxyrhyrichus desotoi*	Threatened*
Manta ray	*Mobula birostris*	Threatened

DPS – Distinct Population Segment
*Designated Critical Habitat

4.2.2.4.1 Protected Species – Birds

Ten species of marine and coastal birds are listed as threatened under the ESA and are present within the project locations proposed in this RP/EA (Table 4-4): least tern; Eastern black rail; piping plover; roseate tern; red knot, northern aplomado falcon, everglade snail kite, whooping crane, red-cockaded woodpecker, and wood stork. Roseate terns forage offshore and feed by plunge-diving, often submerging completely when diving for fish; restoration activities are unlikely to affect their feeding. Eastern black rails are usually found in higher elevation wetlands along the Gulf of Mexico coast, but have been present in coastal salt marsh (USFWS 2018); although they spend more time further inland, restoration activities could overlap with parts of their habitat range. The eastern black rail is an extremely cryptic species, which has made it challenging to establish a specific habitat area within its broader potential range. The northern aplomado falcon is present on the southern portion of the Texas Gulf Coast and down into Mexico. The Everglade snail kite is found in the southern portion of the Florida Gulf Coast. The whooping crane has a winter population on the Texas coast and Florida coast (Audubon 2020). The red-cockaded woodpecker occurs in all five Gulf of Mexico states in mature pine forests (e.g., longleaf and loblolly pines). The wood stork is present on the Florida Gulf Coast year-round and post breeding spreads across to other parts of the Gulf of Mexico coast.

Piping plover, least tern, and red knot are shorebirds and are the most likely to be affected by the restoration activities due to the specific areas they inhabit. The five Gulf of Mexico coastal states have designated critical habitat for wintering populations of piping plover. These wintering habitats primarily include intertidal beaches and flats between low tide and high tide (USFWS 2001a). The piping plover does not breed on the Gulf of Mexico coast; rather, different sub-populations breed in the Great Plains, Great Lakes, or Atlantic Coast. Least terns most commonly nest in beach habitats, both coastal in coastal areas and along inland rivers and water bodies. Least terns breed throughout the Gulf states, as well as along most of the East Coast. Red knots breed in the Canadian Artic and then winter in southern climates, ranging from the East coast of the United States to South America (USFWS 2014). This wintering and associated migratory habitat includes the U.S. Gulf of Mexico coast. Red knot populations have experienced impacts from increased harvesting of horseshoe crabs, a main food source. The eastern black rail has been observed throughout the Gulf states, which provides year-round habitat (eBird 2020; USFWS 2018).

4.2.2.4.2 Protected Species – Sea Turtles

Five species of federally endangered or threatened sea turtles are present in the Gulf of Mexico: loggerhead, green, Kemp's ridley, hawksbill, and leatherback. The leatherback, Kemp's ridley, and hawksbill are listed as endangered; the NW Atlantic loggerhead DPS and the North Atlantic green turtle, both of which occur in the Gulf of Mexico, are listed as threatened. The USFWS and NMFS share jurisdiction for sea turtles under the ESA with the USFWS having jurisdiction in the terrestrial environment and NMFS having jurisdiction in the marine environment.

NMFS and USFWS have designated critical habitat for the loggerhead turtle in 2014. In the Gulf of Mexico, the designation includes nesting beaches in Florida, Alabama, and Mississippi; nearshore reproductive habitat seaward from these beaches; and a large area of *Sargassum* habitat in the Gulf of Mexico. The USFWS designation (79 F.R. 39756) includes nesting beaches in Jackson County, MS; Baldwin County, AL; and Bay, Gulf, and Franklin Counties in the Florida Panhandle, as well as several counties in southwest Florida and the Florida Keys (and other areas along the Atlantic coast). The NMFS designation (79 F.R. 39856) includes nearshore reproductive habitat within 1-mile (1.6 kilometers) seaward of the mean high-water line at these same nesting beaches. NMFS also designated a large area of shelf and oceanic waters, termed *Sargassum* habitat in the Gulf of Mexico (and Atlantic Ocean) as critical habitat.

NMFS designated three additional categories of critical habitat; of these, two (migratory habitat and overwintering habitat) are along the Atlantic coast, and the third (breeding habitat) is in the Florida Keys and along the Florida east coast (NMFS 2014a). No other ESA-listed sea turtles currently have designated critical habitat in the Gulf of Mexico. Sea turtles have an expansive range; occupy multiple habitats across their lifetime and can migrate long distances during reproduction and between or among foraging areas.

Each species has a small juvenile stage thought to be distributed almost exclusively in offshore oceanic habitats, generally in deep waters of the pelagic zone. This life stage is most often found in close association with *Sargassum* drift algae habitats. Witherington et al. (2012) conducted vessel-based transect surveys from five Florida ports from Pensacola to Key West, extending up to 75 miles (120 kilometers) offshore. The researchers evaluated the abundance, species composition, and behavior of oceanic-stage juvenile sea turtles in the eastern Gulf of Mexico. They found that 89% of all sea turtle observations occurred within 3 feet (1 meter) of floating *Sargassum* and that sea turtle density estimates in *Sargassum* habitats were nearly 100 times higher than in open-water areas where *Sargassum* was not present. Ninety captures of oceanic-stage juvenile sea turtles revealed a species composition dominated by green (49%) and Kemp's ridley sea turtles (42%), with lower abundances of hawksbill (7%) and loggerhead sea turtles (2%).

Following the oceanic stage, sea turtles (except for leatherbacks) transition to shallower continental shelf waters in bays, sounds, and estuaries, where there is appropriate developmental habitat for larger juvenile, and adult life stages. Juveniles and adults of some species may also make regular migrations from shallow to deeper habitats, often associated with changes in ocean temperatures. For leatherback turtles, later-stage habitat includes coastal feeding areas in temperate waters or offshore feeding areas in temperate and tropical waters, depending on the season (Frazier 2001). Table 4-5 is a summary of sea turtle life stages and habitat.

Table 4-5. Summary of sea turtle life stages and habitat in the Gulf of Mexico

Life stage	Habitat	Description
Nesting females, eggs, hatchlings	Sandy beaches in Florida, Alabama, and Texas; sandy beaches in Mexico	Embryos develop while buried in sand after being deposited by the females. Eggs incubate for approximately 60 days after which hatchlings emerge and enter the ocean.
Small juveniles	Open ocean including surface habitats throughout the GOM	Small juveniles spend more than 80 percent of their time at or near the sea surface, limited diving ability, tend to associate with floating *Sargassum*, and drift and swim to remain in surface habitats that provide shelter and prey.
Large juveniles and adults	Continental shelf, nearshore and inshore habitats, and oceanic waters	Large juveniles and adults use the entire water column, from surface to bottom; active swimmers; migrate to breed (adults). Some individuals migrate between neritic and deeper oceanic waters and reproductive migrations may also cross oceanic waters.

4.2.2.4.3 Protected Species – Marine Mammals

Two marine mammal species that are likely to be present in Gulf state waters could be impacted by the alternatives in this RP/EA.

West Indian Manatee. The West Indian manatee (*Trichechus manatus*), the only sirenian found in the northern Gulf of Mexico and listed under the ESA, has two subspecies: *T. m. manatus* (the Antillean manatee) and *T. m. latirostris* (the Florida manatee). The Florida subspecies of the West Indian manatee has been reclassified as threatened (81 F.R. 1597). It is present mainly in warm coastal waters of peninsular Florida, but also exists in the northern Gulf of

Mexico (Hayes et al. 2017). The Florida manatee subspecies is present throughout the southeastern United States, with sightings of individuals as far north as Massachusetts and as far west as Texas (Fertl et al. 2005; Rathbun et al. 1982; Schwartz 1995). Most of the Gulf of Mexico West Indian manatee population is in peninsular Florida (USFWS 2001b), where critical habitat has been designated in Manatee, Sarasota, Charlotte, Lee, Collier, and Monroe Counties.

Bottlenose Dolphins. The bottlenose dolphin is a common inhabitant of the northern Gulf of Mexico, particularly within continental shelf, coastal, and bay, sound, and estuary (estuarine) waters. For NMFS management purposes in the northern Gulf of Mexico, bottlenose dolphins are separated into 35 geographically distinct population units, or stocks, including one Continental Shelf, three coastal, and 31 estuarine (Hayes et al. 2018). The 31 estuarine stocks spend most of their time within their respective bays, sounds and estuaries, with many of them considered “strategic” under the MMPA. The strategic stock designation in many cases is a result of annual human-caused mortality exceeding sustainability levels (i.e., Potential Biological Removal) and/or because most of the stock sizes are currently unknown, but are likely small such that relatively few mortalities and serious injuries would exceed Potential Biological Removal.

4.2.2.4.4 Fish

Fish species listed under the ESA within the northern Gulf of Mexico include: largetooth sawfish, smalltooth sawfish, and Gulf sturgeon (Table 4-4). The smalltooth and largetooth sawfish are listed as endangered due to their capture as bycatch in various commercial and recreational fisheries and to habitat loss and degradation. They occur in shallow, coastal waters within the Gulf of Mexico and generally in nearshore habitats with muddy and sandy bottoms often in sheltered bays, estuaries (particularly mangroves), river mouths, and mud banks (NOAA 2009b).

Gulf sturgeon is listed as threatened due to declines in its population related to the presence of dams and water control structures that block access to historical spawning habitats, loss of habitat, poor water quality, and overfishing (USFWS 1995). It spawns in areas of rock and rubble in coastal rivers from Louisiana to Florida during the summer and occurs in the Gulf of Mexico and its estuaries and bays in the cooler months (USFWS 1995).

4.2.2.4.5 Essential Fish Habitat

EFH and Habitat Areas of Particular Concern protected under the MSFCMA are covered in Section 4.2.2.1.5.

4.3 Environmental Consequences

This section describes the potential environmental impacts of the full implementation alternatives considered in this RP/EA, as required under NEPA. For each resource category, the analysis addresses impacts by discussing any background or methodology that is applicable to all sites.

The resource categories presented in this section correspond to those described in Section 4.2 (Affected Environment) and align with the PDARP/PEIS, specifically Chapter 3 (Ecosystem Setting) and Chapter 4 (Injury to Natural Resources). The analyses below provide a site-specific affected environment for each project, including the No Action Alternative, broken down by restoration alternative and resource category, using the best available information about the alternatives to determine their potential impacts.

4.3.1 Resources Not Analyzed in Detail in this RP/EA

To avoid redundant or unnecessary information, alternatives addressed in this RP/EA were reviewed to determine whether some resources either would not be affected or would have minimal, short-term impacts that are common to all alternatives. This allows for a focused impact analysis by eliminating (from detailed analysis) resource categories with little or no potential for adverse impacts. Based on a review of proposed restoration activities, several resource categories were identified as having no expected adverse impacts or short-term, minor adverse impacts that are common to all Restoration Types (i.e., air quality and greenhouse gases (GHGs); noise; socioeconomics; environmental justice (EJ); cultural resources; tourism and recreation; aesthetics and visual resources; infrastructure; fisheries and aquaculture; land and marine management; marine transportation; and public health and safety) and have been removed from further analysis.

4.3.1.1 Physical Resources

4.3.1.1.1 Air Quality and Greenhouse Gases

EPA defines ambient air in 40 C.F.R. 50.1 as “that portion of the atmosphere, external to buildings, to which the public has access.” In compliance with the Clean Air Act, EPA has promulgated National Ambient Air Quality Standards (NAAQS) to protect public health and welfare. The Clean Air Act established two types of national air quality standards. Primary standards set limits to protect public health, including the health of “sensitive” populations such as children, the elderly, and those suffering from asthma. Secondary standards set limits to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. To date, EPA has issued NAAQS for six criteria air pollutants: carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM) with a diameter less than or equal to a nominal 10 micrometers or 2.5 micrometers (PM_{10} and $PM_{2.5}$, respectively), sulfur dioxide (SO_2), and lead (Pb). Alternatives located in East Galveston Bay and Biloxi Marsh are also within non-attainment counties.[18] East Galveston Bay is in a non-attainment county for O_3 and Biloxi Marsh is in a non-attainment county for SO_2.

GHGs are chemical compounds found in Earth's atmosphere that absorb and trap infrared radiation as heat. As incoming solar radiation is absorbed and emitted back from the Earth's surface as infrared energy, GHGs in the atmosphere prevent some of this heat from escaping into space, instead reflecting the energy back to further warm the surface (CSS 2020). Global atmospheric GHG concentrations are a product of continuous release and storage of GHGs over time. In the natural environment, the release and storage of GHGs are recurring. Deforestation, soil disturbance, and the burning of fossil fuels disrupt the natural carbon cycle by increasing the GHG emission rate over the storage rate, resulting in a net increase of GHGs into the atmosphere. The accumulation of increased GHG levels in the atmosphere increases temperatures and warms the planet through a greenhouse effect (USEIA 2019). The GHGs emitted into the atmosphere through human activities are carbon dioxide (CO_2), methane, NO_2, and fluorinated gases such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (EPA 2016b).

The PDARP/PEIS (Sections 6.4.7., 6.4.9., 6.4.10., and 6.4.12) found that short-term, minor adverse impacts to air quality may occur during construction associated with projects under the Birds, Marine Mammals, Oysters, and Sea Turtles Restoration Types. Past project-specific NEPA evaluations of DWH restoration projects in the Gulf of Mexico similar to those proposed in this RP/EA found that project impacts would be consistent with the PDARP/PEIS findings.

Alternatives in this RP/EA would involve construction activities of habitats, facilities, and placement of cultch; transport of personnel conducting project activities; and vehicle and vessel transportation for implementation and construction. As a result, air quality impacts would be localized and would occur primarily during active construction activities from emissions generated by construction equipment and vehicles. Engine exhaust from construction equipment and other vehicles would contribute to an increase in criteria air pollutants, GHGs, and other air pollutants. Because of the small-scale and short duration of the construction portion of the applicable alternatives, and the low level of increased vehicle traffic anticipated to be generated by the projects, anticipated project emissions are expected to be minor and short-term. These activities are not expected to cause an exceedance of the NAAQS, even when considered cumulatively with other area emissions. Because all the alternatives included in this RP/EA would result in negligible to minor, short-term, adverse impacts, this resource category was not carried forward for detailed analysis for each alternative.

4.3.1.1.2 Noise

The PDARP/PEIS (Chapter 6) states the primary sources of terrestrial noise in the coastal environment are transportation and construction-related activities, which is consistent with areas affected by this RP/EA. The primary sources of ambient (background) noise in the project areas for this RP/EA would be humans, the operation of vehicles, recreational boating and commercial vessels and natural sounds such as wind and wildlife. The level of noise in the project areas

18. A non-attainment county is one that does not meet one or more of the federal air quality standards (NAAQS) for the criteria pollutants (USEPA 2021).

would vary depending on the season, time of day, number and types of noise sources, and distance from the noise source.

The acoustic properties of a sound source (frequency, intensity, and transmission patterns) and the sensitivity of the hearing system in the marine organism determines whether marine organisms detect the sound. A study by the National Research Council (NRC) showed that some sounds may adversely impact marine life in certain situations, while having no perceived effect in other settings (NRC 2003). Potential impacts of sound on marine organisms can range from no or very little effect to various levels of behavioral reactions, physiological stress, threshold shifts, auditory masking, and direct trauma. Responses to sound generally fall into three categories: behavioral, acoustic, and physiological (Nowacek et al. 2007). In addition, research shows that the same level of sound may have different impacts on marine life depending on the specific circumstances of a situation. Some sounds can interrupt important biological behaviors (e.g., courtship, nursing, feeding, and migration), and mask communication between animals (BOEM 2017a; NRC 2003; Richardson et al. 1995). In more extreme instances, exposures to high levels or extended periods of sound can impose physiological effects, including hearing loss and mortality. Furthermore, a sound source can propagate differently depending on the environment including physical environment factors (e.g., salinity, temperature, bathymetry, and seafloor type), sound characteristics (e.g., source level, directionality, source type, and duration for impulsive or continuous signals), frequency (higher frequencies dissipate faster, lower frequencies may travel farther depending on water depth), and intensity (i.e., decibel level; BOEM 2017a).

The PDARP/PEIS (Sections 6.4.7, 6.4.9, 6.4.10, and 6.4.12) found that impacts to noise associated with most of the restoration approaches relevant to this RP/EA would have short-term, minor adverse impacts. The PDARP/PEIS noted that creating or restoring oyster reefs, restoring dunes and beaches, and creating, restoring, and enhancing barrier and coastal islands would increase local noise levels temporarily. The severity of these physical impacts was anticipated to depend to a large degree on the location of the project, the amount of disturbance that these activities would generate, and the distance to sensitive receptors such as recreational users or marine or terrestrial wildlife and marine mammals. Past project-specific NEPA evaluations of DWH restoration projects similar to those proposed in this RP/EA found that project impacts would be consistent with the PDARP/PEIS findings.

Therefore, projects in this RP/EA under the Birds, Marine Mammals, Oysters, and Sea Turtles Restoration Types would result in short-term, minor noise impacts from construction activities and use of equipment. Activities that result in increased noise from the proposed alternatives would primarily be short-term, associated with construction activities, and would be timed to have minimal effects on marine and terrestrial wildlife and marine mammals. Construction noise would conclude once the construction is completed. Long-term adverse impacts to the noise environment are not anticipated for any of the Restoration Types considered in this RP/EA. Therefore, this resource category was not carried forward for detailed analysis.

4.3.1.2 Socioeconomic Resources

4.3.1.2.1 Socioeconomics

Activities described in this RP/EA are not expected to have adverse impacts to any socioeconomic resources. Alternatives that include construction activities could increase employment and associated spending in the project area during construction activities resulting in short-term, minor beneficial socioeconomic impacts. Gear removal actions are not expected to disrupt commercial operations as these programs would be voluntary. Other projects that include activities such as assessments and data collection, and public outreach and education are not expected to have any adverse impacts on human populations. Therefore, this RP/EA does not evaluate this resource category further.

4.3.1.2.2 Environmental Justice

The intent of an EJ evaluation under Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority and Low Income Populations" (1994), is to identify communities and groups that meet EJ criteria, and suggest strategies to reduce potential adverse impacts of projects on affected groups. The purpose of Executive Order 12898 is to identify and address the disproportionate placement of adverse environmental, economic, social, or health impacts from federal actions and policies on minority and/or low-income communities. This order requires lead agencies to evaluate impacts on minority or low-income populations during preparation of environmental and socioeconomic analyses of projects or programs that are proposed, funded, or licensed by federal agencies.

None of the restoration alternatives proposed in this RP/EA are expected to have disproportionately high nor adverse effects on low-income and minority populations. The alternatives under consideration are intended to restore LCMRs and their habitats which will not only benefit these resources, but also provide environmental, educational, recreational, and aesthetic benefits and opportunities for coastal communities. In addition, alternatives that include construction activities could increase employment and associated spending in the project area which could benefit low income and minority populations. Other projects that include activities such as assessments and data collection, and public outreach and education, or voluntary programs are not expected to have disproportionally high impacts on low income and minority populations. Therefore, this RP/EA does not evaluate this resource category further.

4.3.1.2.3 Cultural Resources

People have lived in the coastal region of the Gulf of Mexico for more than 10,000 years (see Section 6.6.5.3 of the PDARP/PEIS). Today many unique and diverse cultures call the Gulf Coast home. These cultures, past and present, are closely linked to the environmental and natural resources that make up the Gulf of Mexico ecosystem, which the restoration alternatives in this RP/EA aim to restore.

Cultural resources are evidence of past and present human activity and encompass a range of traditional, archeological, and built assets, including culturally important landscapes and present-day culturally significant uses of the environment. Cultural resources include historic properties listed in, or eligible for listing in the National Register of Historic Places (36 C.F.R.

60[a-d]). The National Historic Preservation Act of 1966, as amended (NHPA; 16 U.S.C. 470(1)), defines a historic property as “any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on the National Register [of Historic Places].” Historic properties include built resources (bridges, buildings, piers, etc.), archaeological sites, and Traditional Cultural Properties, which are significant for their association with practices or beliefs of a living community that are both fundamental to that community’s history and a piece of the community’s cultural identity. Although often associated with Native American traditions, these properties also may be important for their significance to other ethnic groups or communities.

Historic properties also include submerged resources. Modern technology enables nautical archaeologists to recover data in areas previously inaccessible. Maritime archaeology includes, but is not limited to, the study of vessel and airplane debris. The variety of shipping channels in the Gulf of Mexico includes colonial and modern-day trade routes and activities. In addition, armed conflicts that took place from colonial times to the 1940s have left indelible marks on the Gulf of Mexico. A variety of Spanish, English, and French vessels from merchants, slavers, smugglers, privateers, or pirates, ended up on the bottom of the Gulf of Mexico as a result of conflict, weather, or shipworm damage. Shipwrecks can range from seventeenth century Spanish galleons to World War II-era German U-boats. Small pirogues or canoes may provide data on Native American or local history. Historical records show that there are more than 3,200 shipwrecks in the Gulf of Mexico. Just over 700 shipwrecks or likely shipwrecks have been located, mostly from sonar imaging. About 35 of these have been positively identified as actual historic wrecks that would be eligible for designation on the National Register of Historic Places. These resources could be present in the vicinity of proposed restoration activities. Additional information about these shipwrecks is summarized in the Flower Gardens Banks National Marine Sanctuary Draft Environmental Impact Statement Appendix C (ONMS 2016) and is incorporated by reference here. Bridges, shell middens, harbors, and villages can be submerged because of changing sea levels, coastlines, and other climatic activity. Twelve thousand years ago, the earliest date prehistoric human peoples are known to have been in the Gulf of Mexico region (Aten 1983), sea level was approximately 45 meters lower than present-day levels and exposed much of the continental shelf as dry land (Coastal Environments Inc. 1982). Since known prehistoric sites usually occur in association with certain types of geographic features, these sites should be found in association with those same types of features now submerged on the continental shelf.

As the PDARP/PEIS states, all projects implemented under subsequent restoration plans and tiered NEPA analyses consistent with the PDARP/PEIS would secure all necessary state and federal permits, authorizations, consultations, or other regulatory processes, and ensure the project is in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources. Some alternatives in this RP/EA would involve a study, analysis, or program that would not have the potential to affect cultural resources. For those projects that involve construction, ground disturbance, or other related activities that could potentially alter the historic integrity of any culturally or historically important resources identified during preparations or predevelopment surveys, these areas would be avoided during project implementation. A complete review of all alternatives to satisfy the requirements of Section 106 of NHPA is ongoing and would be completed prior to any activities that would restrict consideration of measures to avoid, minimize, or mitigate any adverse effects on historic properties located in the proposed project area. Alternatives would be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources.

4.3.1.2.4 Tourism and Recreation

Activities included in this RP/EA, specifically restoring/enhancing sea turtle nest productivity, removing marine debris, reducing sea turtle bycatch, enhancing bird nesting/foraging habitat, and conducting bird stewardship, will likely be located in areas with high levels of recreational visitation. In addition, construction of oyster reefs will likely occur in areas with a high level of boating activity. For projects with construction activities, there are likely to be short-term, minor adverse impacts to recreational activities while construction is underway. These impacts will only occur during the construction period with the potential to improve some recreational activities once construction is complete (e.g., educational opportunities). Restoration efforts that increase natural productivity of the shallow water area can result in improvements to the quality of habitat and increase recreational activities resulting in long-term beneficial impacts. Other alternatives that include activities such as assessments and data collection, public outreach, and education are only expected to beneficially affect tourism and recreation. The development of a new sea turtle rehabilitation facility in Texas is expected to result in beneficial impacts to recreation and tourism with additional visitor and educational activities. Therefore, this resource category was not carried forward for detailed analysis.

4.3.1.2.5 Aesthetics and Visual Resources

Most aesthetics and visual resources associated with the Gulf of Mexico are located on the coast or in coastal waters. Alternatives that include activities such as assessments and data collection, public outreach, and education are expected to have negligible impacts to aesthetics and visual resources. Similarly, alternatives that involve nearshore activities (e.g., use of small vessels in response to marine mammal strandings or removal of marine debris) are expected to have negligible impacts on aesthetics and visual resources, as these vessels are typical in coastal waters. Alternatives with construction activities located in coastal areas (e.g., beaches) are expected to have short-term, minor adverse impacts on aesthetics and visual resources with the presence of construction vehicles and equipment. However, these impacts will only occur during the construction period Therefore, this resource category was not carried forward for detailed analysis.

4.3.1.2.6 Infrastructure

The potential impacts to existing infrastructure from alternatives in this RP/EA are expected to be negligible or beneficial. Activities that include construction of habitat, field surveys, and removal of marine debris would use existing marine infrastructure facilities and would not add significantly to the existing uses of these facilities or require any modifications to support the proposed activities. The development of a new sea turtle rehabilitation facility in Texas to support the STSSN would result in a beneficial impact on infrastructure. Therefore, this resource category is not carried forward for detailed analysis.

4.3.1.2.7 Fisheries and Aquaculture

No commercial fisheries or aquaculture operations in project areas would be adversely affected by the alternatives proposed in this RP/EA. In the short-term, water quality may decrease due to implementation of some projects, but these changes would have short-term, negligible to minor adverse impacts. In addition, some projects, such as marine debris removal are expected to improve water quality and generate beneficial impacts to fish habitat. Bird projects and oyster reef enhancements may result in long-term beneficial impacts to fish populations that could result in long-term benefits to some fisheries in localized areas. Projects that reduce sea turtle bycatch are expected to generate beneficial impacts to recreational fishing. In addition, projects that work with industry to reduce bycatch through voluntary actions (e.g., lazy line modifications) are not expected to adversely impact commercial fishing operations. Therefore, any adverse impacts on fisheries or aquaculture under these projects are expected to be short-term and minor or beneficial to this resource category and were not carried forward for detailed analysis.

4.3.1.2.8 Land and Marine Management

Alternatives in this RP/EA are not expected to have impacts on land and marine management. The nature of these efforts may change land ownership but would not change how land is currently used. Because there would be no short- or long-term adverse impacts, this resource category was not carried forward for detailed analysis.

4.3.1.2.9 Marine Transportation

Potential impacts to existing marine transportation from the alternatives included in this RP/EA are expected to be negligible. Activities that include construction of habitat and oyster reefs, field surveys, removal of marine debris, and other restoration activities would not affect marine traffic and transportation in the areas where activities are occurring. Therefore, this resource category was not carried forward for detailed analysis.

4.3.1.2.10 Public Health and Safety Including Flood and Shoreline Protection

Alternatives in this RP/EA would involve construction activities that could result in short-term, minor adverse impacts to public health and safety as a result of the operation of heavy equipment and use of hazardous chemicals or other materials. However, threats to public health and safety from construction activities would be mitigated through construction BMPs, including adequate staging of equipment, limitation of public access to equipment and staging areas, and reduced access during construction periods. BMPs in accordance with Occupational Safety and Health Administration and state and local requirements would be incorporated into construction activities onsite to ensure the proper handling, storage, transport, and disposal of all hazardous materials. Personal protective equipment would be required for all construction personnel and authorized access zones would be established at the perimeter of the worksite during construction.

Alternatives would comply with Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks (1997), and would not present disproportionally high nor adverse environmental health or safety risks to children. Implementation of alternatives in this RP/EA would not increase shoreline erosion or create other health and safety concerns. Therefore, this resource was not carried forward for detailed analysis.

4.3.2 Resources Analyzed in Detail in this RP/EA

4.3.2.1 Birds Restoration Type Alternatives

This section relies on the analyses from relevant portions of Section 6.4.10 of the PDARP/PEIS which evaluated the environmental impacts of bird restoration projects. Table 4-6 identifies where in this RP/EA the analysis of potentially affected resources can be found. Note that Birds Alternative 2, Component 1 was evaluated in Section 4.1.1, under the analysis of Preliminary Phase Restoration Alternatives. Preliminary investigation determined that some resource categories under the Birds Restoration Type would either be unaffected or minimally affected by the restoration alternatives proposed in this RP/EA (see Section 4.3.1).

Table 4-6. NEPA assessment of resource categories for the Birds Restoration Type

Resource categories	Location of analysis in Chapter 4
Physical resources	
Geology and Substrates	Analyzed in detail in Section 4.3.2.1
Hydrology and Water Quality	Analyzed in detail in Section 4.3.2.1
Air Quality	Analyzed in Section 4.3.1
Noise	Analyzed in Section 4.3.1
Biological resources	
Habitats	Analyzed in detail in Section 4.3.2.1
Wildlife Species	Analyzed in detail in Section 4.3.2.1
Marine and Estuarine Fauna	Analyzed in detail in Section 4.3.2.1
Protected Species	Analyzed in detail in Section 4.3.2.1
Socioeconomic resources	
Socioeconomics/EJ	Analyzed in Section 4.3.1
Cultural Resources	Analyzed in Section 4.3.1
Tourism and Recreational Use	Analyzed in Section 4.3.1
Infrastructure	Analyzed in Section 4.3.1
Fisheries and Aquaculture	Analyzed in Section 4.3.1
Marine Transportation	Analyzed in Section 4.3.1
Aesthetics and Visual Resources	Analyzed in Section 4.3.1
Land and Marine Management	Analyzed in Section 4.3.1
Public Health and Safety Including Flood and Shoreline Protection	Analyzed in Section 4.3.1

Table 4-7 provides a summary of the Birds Restoration Type impacts analysis, including any beneficial impacts and the highest intensity of adverse impacts. Subsequent sections discuss the full range of impacts.

Minor adverse impacts are likely to occur to some physical and biological resources, although those impacts would be short-term. To help avoid or minimize adverse impacts, the Implementing Trustee(s) would apply relevant BMPs identified in required permits, consultations, or environmental reviews, or in Appendix 6.A of the PDARP/PEIS. Through technical assistance with regulatory agencies, the Implementing Trustee(s) may identify additional BMPs for implementation, and these would be catalogued in compliance documents.

Table 4-7. Summary of impacts associated with the Birds Restoration Type alternatives

Key: + Beneficial impact; NI – No impact; s – short-term, minor adverse impact; S – short-term, moderate adverse impact; S – short-term, major adverse impact; l – long-term, minor adverse impact; L – long-term, moderate adverse impact; L – long-term, major adverse impact.

Alternative	Birds Restoration Type alternatives	Physical resources		Biological resources		
		Geology and substrates	Hydrology and water quality	Habitats and Wildlife (birds and terrestrial species)	Marine and estuarine resources	Protected species
1	Reducing Marine Debris Impacts on Birds and Sea Turtles *(joint project with Sea Turtles Restoration Type)*	+/s	+/s	+/s	+/s	+/s
2	Conservation and Enhancement of Nesting and Foraging Habitats for Birds, Component 1: Chandeleur Islands, LA	NI	NI	NI	NI	NI
2	Conservation and Enhancement of Nesting and Foraging Habitats for Birds, Component 2: Pilot Town/Little Dauphin Island, AL	+/s	+/s	+/s	NI	+/s
2	Conservation and Enhancement of Nesting and Foraging Habitats for Birds, Component 3: San Antonio Bay Bird Island, TX	+/l	+/s	+/s	+/s/l	+/s
2	Conservation and Enhancement of Nesting and Foraging Habitats for Birds, Component 4: Matagorda Bay Bird Island (Chester Island), TX	+/s	+/s	+/s	+/s/l	+/s
2	Conservation and Enhancement of Nesting and Foraging Habitats for Birds, Component 5: Round Island, MS	s	+	+/s	NI	+/s
3	Bird Nesting and Foraging Area Stewardship	+/s	s	+/s	s	+/s
4	Stewardship and Habitat Creation through Beneficial Use, Component 1: Walker Island, AL	+/s	+/s	+/s	+/s/l	+/s

4.3.2.1.1 Birds Alternative 1: Reducing Marine Debris Impacts on Birds and Sea Turtles (joint project with Sea Turtles Restoration Type) – Preferred Alternative

This alternative would reduce the threat and impacts (e.g., entanglement, entrapment, and/or ingestion) of marine debris to DWH-injured bird and sea turtle species across the Gulf of Mexico. This would be accomplished by identifying and prioritizing marine debris hotspots that could negatively affect birds and sea turtles across the Gulf of Mexico. This is intended to reduce marine debris-related incidences with birds and sea turtles through implementation of site-specific restoration techniques that could include removing marine debris, improving collection and disposal of debris (e.g., monofilament recycling bins, maintenance services, sustainable disposal options), and conducting public outreach (e.g., education, signage, materials). Activities in this alternative with potential adverse impacts include removal of marine debris and installation of signage/recycling bins. Other activities such as increased coordination, public outreach, and data collection/management are not expected to have any adverse impacts on resource categories discussed.

Section 6.4.5.1 of the PDARP/PEIS describes the potential impacts of restoration approaches intended to reduce bycatch mortality through removal of derelict fishing gear, which would have similar impacts to removing other debris. This alternative falls within the scope of the activities and potential environmental consequences analyzed in the PDARP/PEIS. The information included in the PDARP/PEIS informs the impact analysis described below. Overall, the impacts are expected to be largely beneficial with some short-term, minor adverse impacts associated with the marine debris removal.

4.3.2.1.1.1 Physical Resources

The PDARP/PEIS concluded that gear removal activities and equipment may result in short-term, minor adverse impacts on physical resources. These same types of impacts would be expected with the removal of other debris as well. Analyses of potential impacts to different physical resource categories are included below.

Geology and Substrates

This alternative may result in short-term, minor adverse impacts on substrates due to minor increases in turbidity that could result from sediment disturbance during debris assessment surveys and removals. However, the removal of gear such as blue crab traps from the estuarine floor would likely benefit substrates in the long-term by reducing the damage associated with trap movement over the ground.

Hydrology and Water Quality

Short-term, minor adverse impacts on water quality would be expected with minor increases in turbidity during debris assessment surveys and removals. Water quality would be expected to improve after removal of derelict fishing gear and other debris from land-based sources that pollute marine and estuarine habitats. For example, some plastic waste does not decompose through microbial processes, but eventually breaks down into smaller particles (i.e., microplastics), which pose an ingestion risk to marine life. Marine debris can also potentially act to transport pathogens and chemical contaminants of concern.

4.3.2.1.1.2 Biological Resources

The PDARP/PEIS concluded that gear removal activities that cause disturbances to sediments and vegetation may also result in short-term, minor adverse impacts on biological resources. Analyses of potential impacts to different biological resource categories are included below.

Habitats and Wildlife Species

This alternative is designed to provide long-term beneficial impacts to birds and sea turtles by reducing the entanglements and potential entrapment related incidences with marine debris such as derelict fishing gear. Marine debris removal locations could include offshore habitat (e.g., open water, reefs, in-water debris around deep structures), nearshore habitat (e.g., bays, intertidal beach/mudflats, supratidal beach and dune, seagrass beds, coastal wetlands, piers), EFH areas in offshore and nearshore habitat, and/or terrestrial habitat (e.g., beaches, jetties). Short-term, minor adverse impacts to these habitats could occur due to human activities and use of equipment associated with land or water-based efforts (e.g., foot disturbance). However, long-term beneficial impacts to these habitats by removing and/or reducing marine debris (and related bird incidences) in those locations are expected.

Marine and Estuarine Resources

The alternative would result in short-term, minor adverse impacts to benthic and fishery resources, including EFH, through increasing turbidity and disturbance of bottom sediments during debris removal activities. In addition to sea turtles, marine finfish and shellfish would be expected to benefit through reduced entanglements, entrapment, or ingestion of marine debris.

The presence of project-related vessels and equipment could temporarily disturb habitats and wildlife species that use or transit through the hot spot areas. Boat operators associated with the project components would follow NOAA NMFS Southeast Region's *Vessel Strike Avoidance Measures and Reporting for Mariners* which also would minimize potential harm to nekton species in the construction areas. The combination of the mobility of nekton species, the implementation of BMPs, and the short duration of debris removal activities suggest that the alternatives will have short-term, minor adverse effects to aquatic wildlife.

Protected Species

This alternative could result in short-term, minor adverse impacts to protected species, including EFH, through increasing turbidity and disturbing bottom sediments during debris removal activities. Short-term, minor adverse impacts would occur to protected species that were present in areas of removal. However, in the long-term, marine mammals, sea turtles, and birds would be expected to re-populate the areas and benefit through reduced marine debris-related incidences.

4.3.2.1.2 Birds Alternative 2: Conservation and Enhancement of Nesting and Foraging Habitat for Birds – Preferred Alternative

This alternative would conduct nesting and foraging habitat conservation for bird species regionwide by restoring habitats across four sites in the Gulf of Mexico as well as conducting E&D for an additional site. Restoration techniques that have the greatest potential for adverse impacts include creating and/or restoring nesting islands and enhancing habitats through vegetation management. Other activities such as collection of data and information to help with development of a project or to inform future restoration implementation are not expected to have any impacts. This alternative is comprised of five site-specific components in LA, AL, TX (2 sites), and MS. As such, each component is evaluated for its environmental consequences independently. The specific components in this project include:

- Component 1: Chandeleur Islands, LA – This component proposes E&D and planning activities for a conceptual project that, upon further planning, may be proposed in a future restoration plan. See Section 4.1.1 for a description of impacts from planning activities associated with this component.
- Component 2: Pilot Town/Little Dauphin Island, AL
- Component 3: San Antonio Bay Bird Island, TX
- Component 4: Matagorda Bay Bird Island (Chester Island), TX
- Component 5: Round Island, MS

Section 6.4.10.1 of the PDARP/PEIS describes the potential impacts of restoration approaches intended to conserve and restore target habitat areas or land parcels for bird resources. This alternative falls within the scope of the activities and potential environmental consequences analyzed in the PDARP/PEIS. The information in the PDARP/PEIS informs the impact analysis below. Overall, long-term impacts are expected to be beneficial with some short-term, minor adverse impacts associated with ground disturbance activities and/or increased interaction with humans.

4.3.2.1.2.1 Component 2: Pilot Town/Little Dauphin Island, AL

Activities associated with this component that have potential adverse impacts include removal of part of an abandoned road and installation of a gate and fencing to manage public access in the project area, as well as the chemical and mechanical treatment of invasive vegetation such as Chinese tallow.

4.3.2.1.2.1.1 Physical Resources

The PDARP/PEIS concluded that restoration approaches that create, protect, and conserve habitat for birds may result in short-term, minor adverse impacts on physical resources.

Geology and Substrates

The construction activities related to the removal of the abandoned roadbed and installation of the gate and fencing may disturb substrates resulting in short-term, minor adverse impacts in the project area. This component may also result in long-term benefits to geology and substrates by preventing disturbance and loss of soil and reducing erosion.

Hydrology and Water Quality

This component only includes terrestrial activities (i.e., the action area is above the mean high tide line), therefore no impacts to the nearby waterbodies are anticipated. However, ground disturbance (e.g., removal of the road) may result in increased runoff during construction activities which could have short-term, minor adverse impacts on water quality. However, the removal of impervious surfaces would be expected to decrease runoff in the long-term. The use of chemicals for vegetative management may also result in short-term, minor impacts to water quality though appropriate protocols would be closely followed to reduce such impacts, including protocols described in the Bon Secour National Wildlife Refuge Comprehensive Conservation Plan. In the long-term, this component may result in benefits to water quality by preventing development and disturbances where habitat creation has occurred and replanting of native vegetation which can reduce surface water runoff.

4.3.2.1.2.1.2 Biological Resources

The PDARP/PEIS concluded that restoration approaches that create, protect, and conserve habitat for birds may result in short-term, minor to moderate adverse impacts and long-term beneficial impacts on biological resources.

Habitats and Wildlife Species

Component activities may result in short-term, minor adverse impacts to habitats in the project area, which may be adjacent to roadways and infrastructure that will be removed. Restoration may temporarily disrupt terrestrial wildlife use of the area. Impacts are associated primarily with the movement of vehicles and removal of vegetation, noise disruption, and physical disruption to habitats. Removal of invasive vegetation may result in short-term, minor adverse impacts to nesting and foraging activities for birds. These habitats are expected to recover over time, and removal of roadways and invasive vegetation should allow native vegetation from adjacent habitats to re-colonize restored areas. Removal of invasive species would also help restore more suitable habitats for birds and, over time, result in long-term beneficial impacts to bird species in the area.

Marine and Estuarine Resources

This component only includes terrestrial activities (i.e., the action area is above the mean high tide line), therefore no impacts to the nearby marine and estuarine fauna are anticipated with this component. Project implementation would not affect any habitats characterized as EFH. Incorporation of project area into the NWR system may benefit marsh and other categories of EFH in the future by helping protect EFH from development.

Protected Species

The removal of the abandoned road may result in short-term, minor adverse impacts to protected species that use the project area. Protected bird species that potentially use the site are the red knot and piping plover. However, ground-disturbing activities would occur in the upland, shrub/scrub area of the tract, not along the beach area where these species may be foraging and resting. Work areas where Alabama beach mouse and gopher tortoise could be present would be surveyed prior to work taking place. If burrows for either species are identified, Implementing Trustees would contact the USFWS Ecological Services office in Daphne, AL before moving forward with work activities. Treatment of invasive plant species would follow protocols described in the Bon Secour National Wildlife Refuge Comprehensive Conservation Plan to avoid or minimize impacts. Adverse impacts to aquatic species in waterways and wetlands adjacent to restoration areas are not expected. Incorporation of the project areas via land acquisition into the Bon Secour NWR would help ensure the areas are not impacted by development and other activities in the future. Ultimately, these actions would provide long-term benefits to these species.

4.3.2.1.2.2 Component 3: San Antonio Bay Bird Island, TX

The project, located on San Antonio Bay Bird Island would fill approximately 8 acres of water bottoms and water column to supratidal and upland elevations. The fill area would be partially enclosed by the construction of a rock containment dike to protect against wave-induced erosion. This placement of rock would convert water column and water bottom habitats to a hard-bottom reef-type structure. Field surveys indicate that the bay bottom at the project location consists of scattered oyster shell and firm, sandy clay material.

4.3.2.1.2.2.1 Physical Resources

The PDARP/PEIS concluded that restoration approaches that create, protect, and conserve habitat for birds may result in short-term, minor adverse impacts on physical resources.

Geology and Substrates

Creation of the proposed 8-acre bird rookery island would result in the permanent placement of approximately 104,000 cubic yards (cy) of fill material and 13,500 cy of rock into approximately 8 acres of existing bay bottom. Equipment, fill, and rock would be transported to the site via existing channels on barges. No new channels or dredging to access the site would be required. Placement of fill materials would cover existing sediments and result in long-term, minor adverse impacts on those estuarine bottoms with shoreline stabilization measures reducing these impacts. However, protecting bird habitat at this site could have long-term benefits to geology and substrates by preventing disturbance and loss of soil and reducing erosion.

Hydrology and Water Quality

The San Antonio Bay Bird Island would be constructed using the containment-berm method. Therefore, turbidity would be minimized during construction of the island compared to turbidity that would result from open-fill construction. The containment-berm method contains loose soils within the constructed berm. After construction of the berm, revetment would be placed along the outer perimeter of the island for slope protection and would aid in minimizing long-term turbidity associated with potential erosion. Fill material for placement within the containment berm would be provided from an outside source. Material would be analyzed prior to use and no contaminated sediments would be used. The location of the fill material would be identified during final design. Construction would comply with the TCEQ standard of 300 mg/L maximum total suspended solids for return water from dredged material. The construction activities are expected to have short-term, minor adverse impacts to water quality with increases in turbidity. However, protecting bird habitat using this technique at this site could have long-term benefits to water quality by preventing disturbance and loss of soil and reducing erosion from shoreline stabilization measures.

4.3.2.1.2.2.2 Biological Resources

The PDARP/PEIS concluded that restoration approaches that create, protect, and conserve habitat for birds may result in short-term, minor to moderate adverse impacts and long-term beneficial impacts on biological resources.

Habitats and Wildlife Species

The existing habitats affected by the placement of fill material and construction of a rock containment dike include subtidal bay bottoms of unconsolidated sands, silts, and clay. Portions of the site include shell hash and scattered oyster shell both live and dead. Within the 8-acre footprint of the island, the area that comprises these habitats would be permanently lost. However, these habitat types have increased over time with subsidence, erosion, and sea level rise in San Antonio Bay.

Birds use the small area of emergent habitat within and adjacent to the project area as resting and loafing habitat. These individuals would experience temporary disruptions from construction activities, resulting in localized, short-term, minor adverse impacts. When construction activities are complete, a variety of birds could use the restored island site for roosting, loafing, and nesting. Some species may use the island to forage. The project would result in long-term beneficial impacts for a broader group of species

Marine and Estuarine Resources

The placement of both fill and rock would adversely impact benthic communities and cause long-term, minor adverse impacts to these communities in the vicinity of the project area. Construction activities would increase turbidity in the project area, resulting in localized, short-term, minor adverse impacts to aquatic organisms in areas adjacent to the San Antonio Bay. While no seagrass habitat was encountered in the initial surveys, a confirming survey would be required before construction.

Implementation of this alternative would result in short- to long-term, minor adverse impacts to EFH by converting water bottoms categorized as EFH to uplands or areas impacted by rock placement. The rock component of the project would create hard substrate for sessile organism attachment and improve the quality of habitat for federally managed fishery species. Additionally, some of the area impacted by fill placement and where intertidal elevations are created may eventually become vegetated with a variety of wetland species which are a very productive category of EFH.

Mobile organisms like finfish, some shellfish, sea turtles and marine mammals would likely avoid the area impacted by construction activities. When construction activities are complete, turbidity would return to ambient levels, and benthic organisms, nekton and shellfish abundance in the project vicinity would return to pre-construction conditions, except within the area of the 8-acre island footprint. Oysters currently existing in the project footprint, while sparse, would be adversely impacted by project implementation. However, oyster spat are likely to settle on the hard structure created by the rock (approximately 1.19 acres) used for shoreline protection as well as the 0.75 acres of constructed reef habitat. The establishment of oyster reef on the intertidal and subtidal rock would have long-term beneficial impacts to oyster resources, as well as finfish, birds, and other organisms that use these resources in the aquatic food web.

Protected Species

Protected species that may be present near the site or within the project area include the whooping crane, West Indian manatee, green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, and Atlantic bottlenose dolphin. Individuals of these species near or within the affected area may be disturbed by construction activities. These species may experience temporary disruption during construction activities, leading to short-term, minor adverse impacts. BMPs would limit adverse effects of construction to listed species. BMPs would include:

- USFWS Standard Manatee in Water Conditions
- NMFS Sea Turtle and Smalltooth Sawfish Construction Conditions (The smalltooth sawfish is considered extirpated from Texas waters)
- NMFS Measures for Reduction the Entrapment Risk to Protected Species
- NMFS Vessel Strick Avoidance Measures and Reporting for Mariners

In addition, during construction, measures to protect whooping cranes include lowering all construction equipment reaching heights of ≥15 feet (e.g., lattice boom crawler crane) during nighttime hours and periods of low visibility to prevent any potential interference with whooping crane individuals, should they be traveling at lower altitudes in the vicinity of the project. Note that this requirement would only be applicable when whooping cranes are present along the Texas coast (approximately late October through March).

Once the project is complete, long-term benefits are expected to protected species. This includes the whooping crane that may use the restored island site for forage. In addition, other protected species may benefit from an increase in resources important to the aquatic food web.

4.3.2.1.2.3 Component 4: Matagorda Bay Bird Island (Chester Island), TX

Chester Island would be expanded by up to 30 acres of beach habitat using dredged sediment and potentially constructing sediment control and shoreline protection structures such as groins and breakwaters. The dredge source for Chester Island is the nearby MSC and GIWW navigation channels. Environmental compliance requirements for the dredging and placement of material from the MSC and GIWW projects are maintained by USACE separate from the alternative addressed in this section.

4.3.2.1.2.3.1 Physical Resources

The PDARP/PEIS concluded that restoration approaches that create, protect, and conserve habitat for birds may result in short-term, minor adverse impacts on physical resources.

Geology and Substrates

Construction of shoreline protection structures would affect substrates within the footprint of the project through the placement of hard structural materials. This would have long-term, minor to moderate adverse impacts on substrates and geology directly under the structures with the cover and disturbance of existing sediments, but it would be limited to the open bay bottom where they are constructed. Because the adverse impacts are expected to be localized the overall impacts to geology and substrates would likely be minor and short-term. In the addition, the bottom substrates adjacent to the breakwaters could experience long-term benefits from the sediment stabilization and protection of the shoreline from erosion and wave action.

Hydrology and Water Quality

The construction activities are expected to have short-term, minor adverse impacts to water quality from expected increases in turbidity. However, protecting these bird habitats are expected to have long-term benefits to water quality by reducing erosion of this island.

4.3.2.1.2.3.2 Biological Resources

The PDARP/PEIS concluded that restoration approaches that create, protect, and conserve habitat for birds may result in short-term, minor to moderate adverse impacts and long-term beneficial impacts on biological resources.

Habitats and Wildlife Species

Bird populations that utilize the small area of emergent habitat in the project area would experience temporary disruptions during construction activities, resulting in localized, short-term, minor adverse impacts to bird species that use the project area for foraging and resting habitat. When construction is complete, a variety of shorebirds and wading birds would begin using the site for nesting and foraging habitat, resulting in long-term beneficial impacts to bird species. Bird species that would potentially benefit from project implementation include brown pelicans, royal terns, sandwich terns, Caspian terns, laughing gulls, herons, and egrets.

Marine and Estuarine Resources

After construction, some marsh vegetation would likely colonize intertidal sediment elevations, establishing fringe marsh along the shoreline of the enclosed fill area. These vegetated intertidal habitats are likely to provide beneficial impacts to finfish and shellfish species, which are known to use intertidal vegetated habitats as nursery and foraging areas, as well as for protection from predation. Additionally, oyster spat are likely to settle on the hard structure created by the rock, providing localized, minor beneficial impacts to oyster resources.

The placement of both fill and rock would result in localized, long-term, minor adverse impacts to benthic communities in the project area. Construction activities would increase turbidity resulting in localized, short-term, minor adverse impacts to aquatic organisms adjacent to the project area. Mobile organisms like finfish, and some shellfish, sea turtles and marine mammals would likely avoid the project area during construction activities. When construction is complete, turbidity would return to ambient levels, and nekton and shellfish abundance in the project vicinity would return to pre-construction conditions.

Project implementation would result in short- to long-term, minor adverse impacts to EFH by converting water bottoms categorized as EFH to uplands or areas impacted by rock placement. The rock component of the project would create hard substrate for sessile organism attachment and improve the quality of habitat for federally managed fishery species. Additionally, some of the area impacted by fill placement and where intertidal elevations are created may eventually become vegetated with a variety of wetland species which are a very productive category of EFH.

Protected Species

Protected bird species that potentially use the site are the least tern, eastern black rail, red knot, and piping plover. These species may experience temporary disruptions during construction, leading to short-term, minor adverse impacts. When construction is complete, the component would provide long-term beneficial impacts. Likewise, marine mammals in the vicinity of the construction site, such as Atlantic bottlenose dolphin, would experience short-term, minor disruption during construction activities.

4.3.2.1.2.4 Component 5: Round Island, MS

Nesting enhancement activities planned at Round Island include habitat creation and management, vegetation management, and predator control which would occur in an approximately 90-acre area. Currently, nutria on the island dig to forage on plant roots under the soil surface and on exposed roots on the island. Debris removal is also planned in the project area.

4.3.2.1.2.4.1 Physical Resources

The PDARP/PEIS concluded that restoration approaches that create, protect, and conserve habitat for birds may result in short-term, minor adverse impacts on physical resources.

Geology and Substrates

Habitat creation, enhancement, and vegetation management activities, especially those involving construction, such as enhancing nest sites, may have short-term, minor adverse impacts to substrates with disturbance caused using heavy equipment.

Hydrology and Water Quality

There would be no in water work and no direct impacts to hydrology or water quality under this component. Enhancing nesting sites may result in the long-term benefits to water quality with a reduction in erosion and soil loss at the site.

4.3.2.1.2.4.2 Biological Resources

The PDARP/PEIS concluded that restoration approaches that create, protect, and conserve habitat for birds may result in short-term, minor to moderate adverse impacts and long-term beneficial impacts on biological resources.

Habitats and Wildlife Species

The project would eradicate undesirable vegetation in the upland portions of the island to restore some unvegetated sand areas that support nesting by a variety of tern species and black skimmers. Shell and hash materials could be added to treated areas to support bird nesting. These activities would adversely impact vegetated habitats on Round Island, resulting in localized, short-term, minor adverse impacts. The alternative would also plant habitats with more desirable vegetation that supports a variety of bird species expected to use Round Island.

Vegetation control activities and habitat enhancements could cause localized, short-term, minor adverse impacts to bird species using the project area. Replanting these areas with other, more beneficial vegetation and enhancing sand habitats with shell hash would restore and improve the use of habitats on the island. Although the maintenance of nuisance species would affect bird species using those habitats, it would improve nesting habitat for multiple bird species, such as terns, skimmers, wading birds, solitary nesting shorebirds, and gulls. Vegetation management activities would be avoided to the extent practicable during the bird nesting season. Nutria have been known to forage on bird eggs. Predator control would include removal of nutria and other predators (e.g., raccoons) as necessary, from the island. This would result in long-term benefits to nesting birds.

Marine and Estuarine Resources

This component only includes terrestrial activities (i.e., the action area is above the mean high tide line), therefore no impacts to the nearby marine and estuarine fauna are anticipated with this component.

Protected Species

Protected bird species that potentially use the site are the least tern, eastern black rail, red knot, and piping plover. These species may experience temporary disruption during restoration, leading to short-term, minor adverse impacts. Restoration activities would be avoided to the extent practicable during the nesting season. On-going restoration as a result of implementing this component would provide long-term beneficial impacts associated with enhanced habitat. Marine mammals and sea turtles are not likely to experience impacts from construction activities as there is no in-water work associated with this component.

4.3.2.1.3 Birds Alternative 3: Bird Nesting and Foraging Area Stewardship – Preferred Alternative

This alternative includes various activities (e.g., the deployment of vegetative buffers, exclusion devices, predator control strategies, signage and fencing, and public outreach) at multiple locations along the Gulf of Mexico coast and the Northeast coast of Florida to conserve and enhance nesting and foraging habitats for birds. The potential restoration techniques would directly benefit birds by reducing habitat degradation and other stressors.

Section 6.4.10.1 of the PDARP/PEIS describes the potential impacts of restoration approaches intended to conserve and restore target habitat areas or land parcels for bird resources. This alternative falls within the scope of the activities and potential environmental consequences analyzed in the PDARP/PEIS. The information in the PDARP/PEIS informs the impact analysis below. Overall, the impacts in the long-term are expected to be beneficial with some short-term, minor adverse impacts associated with ground disturbance activities and/or increased interactions with humans.

4.3.2.1.3.1 Physical Resources

The PDARP/PEIS concluded that restoration approaches that create, protect, and conserve habitat for birds may result in short-term, minor adverse impacts on physical resources.

Geology and Substrates

Restoration activities would result in short-term, minor adverse impacts to substrates with the construction of buffers fencing, signage, and nesting platforms. These impacts would result from the construction activity itself and from increased vehicle and pedestrian foot traffic during implementation. However, this alternative would lead to long-term benefits to substrates by preventing soil disturbance through the use of signage, exclusion devices and vegetated buffers, fencing around nesting areas, and/or beach wrack and distance buffers.

Hydrology and Water Quality

The restoration activities may have short-term, minor adverse impacts on water quality nearby due to construction activities, especially those at the shoreline, including vegetation management.

4.3.2.1.3.2 Biological Resources

The PDARP/PEIS concluded that restoration approaches that create, protect, and conserve habitat for birds may result in short-term, minor adverse impacts on biological resources.

Habitats and Wildlife Species

Project activities could have short-term, minor adverse impacts on habitats where construction occurs such as installation of buffers, fencing, signage, and nesting platforms. These activities could result in short-term, minor adverse impacts from human disturbance of birds in nearby areas; however, these impacts would be very short-lived, would last only for the duration of the installation, and would result in net benefits to birds by increasing nest success and productivity (NPS 2018). In addition, the project activities would be designed to avoid impacts to sensitive ecological habitat and time periods. Similarly, for all sites where construction activities would occur, disturbance would be expected to occur only during construction, and the project would be designed, or required via applicable and relevant permits, to avoid impacts to resources, such as the disturbance of birds during the nesting season. The long-term benefits to wildlife include increasing bird nesting activity and success.

Marine and Estuarine Resources

The restoration activities especially those at the shoreline, including vegetation management, may have short-term, minor adverse impacts on fish nearby, including EFH, due to construction activities that can affect water quality.

Protected Species

This alternative could have short-term, minor adverse impacts on protected species as a result of construction activities and from increased vehicle and pedestrian foot traffic during implementation. Stewardship actions under this alternative are expected to have long-term, beneficial impacts to protected bird species that already utilize the site including least terns, red knots, and piping plovers.

4.3.2.1.4 Birds Alternative 4: Stewardship and Habitat Creation through Beneficial Use – Non-preferred Alternative

This alternative would create and protect bird habitat through beneficial use of dredge material at two sites: (1) Walker Island, AL and (2) Matagorda Bay Bird Island (Chester Island), TX. The Chester Island component is also included under Alternative 2, Conservation and Enhancement of Nesting and Foraging Habitat for Birds, a preferred alternative. Alternative 2 more closely aligns with Regionwide TIG restoration goals in that it allows for a broader array of restoration methods (e.g., land acquisition, habitat management, beneficial use to restore coastal islands, and E&D for barrier island restoration) than Alternative 4 (beneficial use for coastal islands only). The impacts of this component are discussed under Alternative 2 and are not repeated here. This section discusses activities and potential impacts at Walker Island only.

4.3.2.1.4.1 Component 1: Walker Island, AL

The project would increase the extent of the remnant island to create bird habitat on the eastern side by beneficially reusing sediment dredged from the federally authorized Perdido Pass Navigation Project. The impacts of dredging activities are covered under a separate environmental assessment process led by the USACE.[19] The impact analysis for this alternative will focus on the effects of filling approximately 4 acres of water column and water bottoms to supratidal and upland elevations.

4.3.2.1.4.1.1 Physical Resources

The PDARP/PEIS concluded that restoration approaches that create, protect, and conserve habitat for birds may result in short-term, minor adverse impacts on physical resources.

Geology and Substrates

Construction of temporary retainment dikes and placement of fill material on the eastern end of Walker Island would affect substrates within the footprint of the project. The placement of fill would have long-term, moderate adverse impacts on geology and substrates directly under the placement area, but it would be limited to the open bay bottom. Because the adverse impacts are expected to be localized the overall impacts to geology and substrates would likely be minor and short-term. In addition, bottom substrates adjacent to the fill area would experience long-term benefits because of sediment placement and protection of the shoreline from erosion and wave action.

Hydrology and Water Quality

The construction activities at Walker Island are expected to have short-term, minor adverse impacts to water quality from expected increases in turbidity caused by construction activities. Increased turbidity from sediment placement would be minimal as the sediment is coarser

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19. An Environmental Assessment for the Regional Sediment Management Demonstration Downdrift Placement of Maintenance Dredged Material West of the Perdido Pass Navigation Project, Baldwin County, Alabama was prepared in 2002. A Statement of Findings for this same project was completed in March 2005. During the dredging recertification process in 2009, a Finding of No Significant Impact (FONSI), EA and Section 404(b)(1) Evaluation Report were also completed for the project. These same documents were used in 2014 to recertify the project. A Draft EA addressing new placement areas was completed in 2015 by the USACE Mobile District (USACE, 2015).

material placed behind a retainment dike and will settle rapidly out of the water column. Protecting these bird habitats are expected to have long-term benefits to water quality by reducing erosion of this island.

4.3.2.1.4.1.2 Biological Resources

The PDARP/PEIS concluded that restoration approaches that create, protect, and conserve habitat for birds may result in short-term, minor adverse impacts on biological resources.

Habitats and Wildlife Species

Bird populations that utilize the small area of emergent habitat in the project area would experience temporary disruptions during construction activities, resulting in localized, short-term, minor adverse impacts due to temporary displacement to bird species that use the project area for foraging and resting. When construction is complete, a variety of shorebirds and wading birds would begin using the site for nesting and foraging habitat, resulting in long-term beneficial impacts to bird species. Bird species that would potentially benefit from project implementation include brown pelicans, royal terns, sandwich terns, Caspian terns, laughing gulls, herons, and egrets. Sand placement would also likely result in mortality of small animals (crabs) and burrowing invertebrates and meiofauna (microscopically small benthic invertebrates).

Marine and Estuarine Resources

The placement of fill would result in localized, long-term, minor adverse impacts to benthic communities in the project area. Construction activities would increase turbidity resulting in localized, short-term, minor adverse impacts to aquatic organisms adjacent to the project area in Bayou St. John. Mobile organisms like finfish, some shellfish, marine mammals, and sea turtles would likely avoid the project area during construction activities. When construction is complete, turbidity would return to ambient levels, and nekton and shellfish abundance in the project vicinity would return to pre-construction conditions.

Project implementation would result in short- to long-term, minor adverse impacts to EFH by converting water bottoms categorized as EFH to uplands or areas impacted by fill placement. Some of the area impacted by fill placement and where intertidal elevations are created may eventually become vegetated with a variety of upland species, and wetland species which are a very productive category of EFH. Impacts to existing wetlands would be avoided to the maximum extent practicable during the E&D phase.

There is SAV in the shallow waters east of the island (Barry A. Vittor & Associates, Inc. 2015) that would be impacted by the dredged fill. Sediment placement may result in the loss of individual plants and habitat within the marsh fill footprint; however, these impacts would be limited to localized areas, and similar habitat is available outside of the disturbance area. SAV impacts would be avoided to the maximum extent practicable during the E&D phase of the project. The Implementing Trustee(s) would ensure that the selected contractor performs SAV surveys during the design phase in order to avoid placing sediment over SAV.

After construction, some marsh vegetation would likely colonize intertidal sediment elevations, establishing fringe marsh along the shoreline of the enclosed fill area. These vegetated intertidal habitats are likely to provide beneficial impacts to finfish and shellfish species, which are known to use intertidal vegetated habitats as nursery and foraging areas, as well as for protection from predation.

The presence of project-related vessels and equipment could temporarily disturb habitats and wildlife species that use or transit through the construction areas. Boat operators associated with the project components would follow NOAA NMFS Southeast Region's *Vessel Strike Avoidance Measures and Reporting for Mariners* which also would minimize potential harm to nekton species in the construction areas. The combination of the mobility of nekton species, the implementation of BMPs, and the short duration of construction activities suggest that the alternatives will have short-term, minor adverse effects to aquatic wildlife.

Protected Species

Protected bird species that potentially use the site are the eastern black rail, red knot, and piping plover. These species may experience temporary disruptions during construction, leading to short-term, minor adverse impacts. Likewise, sea turtles and marine mammals in the vicinity of the construction site, such as Atlantic bottlenose dolphin, would experience short-term, minor disruption during construction activities. When construction is complete, the component would provide long-term beneficial impacts to protected species that use the restored island site for roosting, loafing, nesting, and foraging.

4.3.2.2 Marine Mammals Restoration Type Alternatives

This section relies on the analyses from relevant portions of Section 6.4.9 of the PDARP/PEIS which evaluated the environmental impacts of marine mammal restoration projects. Table 4-8 identifies where in this RP/EA the analysis of potentially affected resources can be found. Note that Marine Mammals Alternative 2 was evaluated in Section 4.1.2, under the analysis of Preliminary Phase Restoration Alternatives. Preliminary investigation determined that some resource categories would either be unaffected or minimally affected by the restoration alternatives proposed in this RP/EA (see Section 4.3.1). Because restoration alternatives for marine mammals typically focus on planning and data collection/collation; they are not expected to impact natural resources. Some projects (e.g., shrimp trawl project) will have an activity involving in-water gear research. However, this will not alter existing fishing operations and is not expected to adversely impact wildlife species. Because no Marine Mammals Restoration Type alternatives would result in impacts to EFH, that resource category is not discussed in this section.

Table 4-8. NEPA assessment of resource categories for the Marine Mammals Restoration Type

Resource categories	Location of analysis in Chapter 4
Physical resources	
Geology and Substrates	Analyzed in detail in Section 4.3.2.2
Hydrology and Water Quality	Analyzed in detail in Section 4.3.2.2
Air Quality	Analyzed in Section 4.3.1
Noise	Analyzed in Section 4.3.1
Biological resources	
Habitats	Does not require additional analysis. Planning and data collection/collation activities would not affect any habitat, and the field activities proposed are not expected to adversely affect benthic, marine, or coastal habitats this resource was not carried forward for detailed analysis under the Marine Mammals Restoration Type.
Wildlife Species	Because restoration alternatives for marine mammals typically focus on planning and data collation; they would not impact wildlife species (including birds). Projects involving in-water gear research will not alter existing fishing operation and are not expected to adversely impact wildlife species.
Marine and Estuarine Fauna	Analyzed in detail in Section 4.3.2.2
Protected Species	Analyzed in detail in Section 4.3.2.2
Socioeconomic resources	
Socioeconomics/EJ	Analyzed in Section 4.3.1
Cultural Resources	Analyzed in Section 4.3.1
Tourism and Recreational Use	Analyzed in Section 4.3.1
Infrastructure	Analyzed in Section 4.3.1
Fisheries and Aquaculture	Analyzed in Section 4.3.1
Marine Transportation	Analyzed in Section 4.3.1
Aesthetics and Visual Resources	Analyzed in Section 4.3.1
Land and Marine Management	Analyzed in Section 4.3.1
Public Health and Safety Including Flood and Shoreline Protection	Analyzed in Section 4.3.1

Table 4-9 provides a summary of the Marine Mammals Restoration Type impacts analysis, including any beneficial impacts and the highest intensity of adverse impacts. Subsequent sections of this chapter discuss the full range of impacts.

Minor adverse impacts are likely to occur to some biological resources, although those impacts would be short-term. To help mitigate any adverse impacts, the Implementing Trustee(s) would apply relevant BMPs identified in required permits, consultations, or environmental reviews, or in Appendix 6.A of the PDARP/PEIS. Through technical assistance with regulatory agencies, the Implementing Trustee(s) may identify additional BMPs for implementation, and these would be catalogued in compliance documents.

Table 4-9. Summary of impacts associated with the Marine Mammals Restoration Type alternatives

Key: + Beneficial impact; NI – No impact; s – short-term, minor adverse impact; S – short-term, moderate adverse impact; **S – short-term, major adverse impact**; l – long-term, minor adverse impact; L – long-term, moderate adverse impact; **L – long-term, major adverse impact.**

Alternative	Marine Mammals Restoration Type alternatives	Physical resources		Biological resources		
		Geology and substrates	Hydrology and water quality	Habitats and Wildlife (birds and terrestrial species)	Marine and estuarine resources	Protected species
1	Voluntary Modifications to Commercial Shrimp Lazy Lines to Reduce Dolphin Entanglements	NI	NI	NI	NI	+
2	Reducing Impacts to Dolphins from Hook-and-line Gear and Provisioning through Fishery Surveys, Social Science, and Collaboration	NI	NI	NI	NI	NI
3	Enhance Marine Mammal Stranding Network Diagnostic Capabilities and Consistency across the Gulf of Mexico	NI	NI	NI	NI	+
4	Enhance Capacity, Diagnostic Capability, and Consistency of the Marine Mammal Stranding Network in the Gulf of Mexico	s	s	s	s	s/+

4.3.2.2.1 Marine Mammals Alternative 1: Voluntary Modifications to Commercial Shrimp Lazy Lines to Reduce Dolphin Entanglements – Preferred Alternative

This alternative focuses on testing the performance and usability of previously identified alternative materials for shrimp trawl lazy lines, which would decrease the number of entanglements and associated mortality of dolphins in commercial shrimp trawl lazy lines. The alternative would be carried out in two phases. Phase I would include planning activities, conducting collaborative in-water gear testing with researchers and industry members, and developing a plan for voluntary gear modification throughout the Gulf of Mexico fleet. Phase II of the alternative would involve working collaboratively with stakeholders, including interested members of the shrimp trawl fleet, to adopt broader use of the alternative lazy line material that most effectively reduces the occurrence of lethal entanglements of bottlenose dolphins.

Section 6.4.9.1 of the PDARP/PEIS describes the potential impacts of restoration approaches intended to reduce commercial fishery bycatch through collaborative partnerships. This alternative falls within the scope of the activities and potential environmental consequences analyzed in the PDARP/PEIS. The information in the PDARP/PEIS informs the impact analysis described below. The project would be largely beneficial, with no adverse impacts expected.

4.3.2.2.1.1 Physical Resources

The PDARP/PEIS concluded that collaborative efforts to reduce bycatch would be unlikely to adversely affect physical resources, because such efforts would be unlikely to increase the impacts of fishing activities.

Geology and Substrates

No adverse impacts are expected to geology and substrates.

Hydrology and Water Quality

No adverse impacts are expected. Although deployment of shrimp trawling gear can disturb the water column and reduce water quality through increasing turbidity, the alternative would not intensify or reduce these impacts, as it would not affect shrimping activities.

4.3.2.2.1.2 Biological Resources

The PDARP/PEIS concluded that collaborative efforts to reduce bycatch would be unlikely to adversely affect biological resources, because these efforts would be unlikely to increase the impacts of fishing activities.

Habitats and Wildlife Species

No adverse impacts are expected. Changing lazy line materials are not expected to affect birds or terrestrial wildlife, as these resources do not interact with trawler lazy lines.

Marine and Estuarine Resources

No adverse impacts are expected. Although commercial shrimping can negatively impact shrimp and other bycatch fish species, implementation of this alternative would not affect shrimping activities.

Protected Species

No adverse impacts are expected. The alternative is expected to result in benefits to dolphins, which would be less likely to be harmed by shrimp trawl lazy lines if more effective and efficient materials are successfully adopted. Other protected species that can be accidentally caught in shrimp trawl lazy lines (e.g., sea turtles) may also benefit.

4.3.2.2.2 Marine Mammals Alternative 3: Enhance Marine Mammal Stranding Network Diagnostic Capabilities and Consistency Across the Gulf of Mexico – Preferred Alternative

This alternative would support or enhance MMSN diagnostic capabilities and consistency across the regionwide MMSN. The project would do this by improving diagnostic capabilities, providing auditory testing equipment and training, improving access to laboratory testing, enhancing data management and synthesis, and improving training and cross-network coordination.

Section 6.4.9.3 of the PDARP/PEIS describes the potential impacts of restoration approaches intended to restore marine mammals by improving understanding of marine mammal illness and death and by detecting and addressing key threats. This alternative falls within the scope of the activities and potential environmental consequences analyzed in the PDARP/PEIS. The information in the PDARP/PEIS informs the impact analysis below. The project would be beneficial with no adverse impacts expected.

4.3.2.2.2.1 Physical Resources

The PDARP/PEIS concluded that efforts to increase marine mammal survival through an improved understanding of illness and death and detecting/addressing key threats could result in short-term, minor impacts to physical resources.

Geology and Substrates

This alternative would provide training and equipment to the MMSN, and would not increase or otherwise affect stranding response activities. Thus, no impacts on geology and substrates are expected under this alternative.

Hydrology and Water Quality

Adverse impacts are not expected. As noted above, response activities are not expected to change in this alternative; therefore, associated impacts to hydrology and water quality are not expected.

4.3.2.2.2.2 Biological Resources

The PDARP/PEIS concluded that efforts to increase marine mammal survival through an improved understanding of illness and death and detecting/addressing key threats could result in short-term, minor adverse impacts to biological resources.

Habitats and Wildlife Species

No adverse impacts are expected. As noted above, response activities are not expected to change in this alternative; therefore, associated impacts to habitats and wildlife species are not expected.

Marine and Estuarine Resources

No adverse impacts are expected. Stranding response activities would not directly affect fish or shellfish, as marine mammal strandings and response activities typically occur on beaches that do not harbor these species.

Protected Species

No adverse impacts are expected. This alternative would benefit marine mammals (e.g., coastal and estuarine dolphins, short-finned pilot whales, rough-toothed dolphins) by allowing the MMSN to make better rehabilitation/release decisions for live stranded animals, improve understanding of population health, and increase data consistency, accuracy, and the timeliness of data availability to managers of marine mammals to allow for rapid responses to emerging threats. These findings are consistent with the environmental impact statement on the Marine Mammal Health and Stranding Response Program (MMHSRP; NMFS 2009) and associated ESA consultation with NMFS.

4.3.2.2.3 Marine Mammals Alternative 4: Enhance Capacity, Diagnostic Capability, and Consistency of the Marine Mammal Stranding Network in the Gulf of Mexico – Non-preferred Alternative

This alternative would include all of the diagnostic equipment, data management, and training activities described for Marine Mammals Alternative 3, but it would also (1) provide personnel (e.g., stranding response personnel, contract services with veterinarians), additional diagnostic (e.g., ultrasound or x-ray machines) and response equipment (e.g., trucks, trailers, stretchers, etc.), travel support, fuel, and vessel/vehicle maintenance to support stranded animal response; and (2) provide supplies to support the Gulf of Mexico MMSN to increase data collection, reporting, collaboration, and consistency across networks. These additional project components would allow the MMSN to both improve the response time to live or dead stranded cetaceans and trapped or out-of-habitat marine mammals. They would also increase the networks' capacity to respond to unusual natural or anthropogenic events (e.g., oil spills, harmful algal blooms, freshwater events, hurricanes) and perform necropsies to understand marine mammal health and threats.

Section 6.4.9.3 of the PDARP/PEIS describes the potential impacts of restoration approaches intended to restore marine mammals by improving understanding of marine mammal illness and death and by detecting and addressing key threats. This alternative falls within the scope of the activities and potential environmental consequences analyzed in the PDARP/PEIS. The information in the PDARP/PEIS informs the impact analysis below. The alternative would be largely beneficial, and could have short-term, minor adverse impacts.

4.3.2.2.3.1 Physical Resources

The PDARP/PEIS concluded that efforts to increase marine mammal survival through an improved understanding of illness and death and detecting/addressing key threats could result in short-term, minor impacts to physical resources.

Geology and Substrates

This alternative will increase the capacity for recovering dead and stranded marine mammals. An increase in response activities may lead to short-term, minor adverse impacts to sediment. However, these impacts would be small in scale (i.e., restricted to the stranding/recovery site), and sediment disturbance would likely resolve soon after response operations cease.

Hydrology and Water Quality

An increase in response activities may result in short-term, minor adverse impacts to water quality with an increase in turbidity. However, these impacts would be small in scale (i.e., restricted to the stranding/recovery site), and turbidity would likely resolve soon after response operations cease.

4.3.2.2.3.2 Biological Resources

The PDARP/PEIS concluded that efforts to increase marine mammal survival through an improved understanding of illness and death and detecting and addressing key threats would result in short-term, minor impacts to biological resources.

Habitats and Wildlife Species

Short-term, minor adverse impacts could occur. The primary avenue through which impacts to habitats (e.g., seagrasses), birds, and terrestrial wildlife would occur would be through the disturbance associated with stranding response efforts (e.g., boats, noise, human presence). While this could temporarily drive wildlife species away from the area in which response activities take place, these species could utilize nearby habitat during the duration of the event. Such impacts would be highly localized to the response area, and would cease as soon as the response activities are complete.

Marine and Estuarine Resources

The implementation of this alternative will result in an increase in MMSN activities which may result in short-term, minor adverse impacts to marine and estuarine habitats and fauna because of the potential for increased interactions with boats and vehicles. Such interactions could directly harm marine mammals or temporarily displace them from specific areas. However, these interactions are likely to be very low given the general level of boating and vehicle activity in potentially affected areas. Boat operators associated with the alternative would follow NOAA NMFS Southeast Region's *Vessel Strike Avoidance Measures and Reporting for Mariners*, which would minimize potential harm.

Protected Species

Some incidental, short-term, minor adverse impacts to marine mammals could occur due to increases in rescue/release attempts and associated travel and activity, which could result in accidental injury to non-targeted animals. Such interactions could directly harm marine mammals or temporarily displace them from specific areas. However, these interactions are likely to be very low given the general level of boating and vehicle activity in potentially affected areas. Boat operators associated with the alternative would follow NOAA NMFS Southeast Region's *Vessel Strike Avoidance Measures and Reporting for Mariners*, which would minimize potential harm. Improved responses likely would increase the success of marine mammal rescue, rehabilitation, and release efforts, resulting in net benefits to marine mammals. Furthermore, marine mammal stranding data, as well as other data collected by enhanced stranding networks such as performing necropsies to understand marine mammal health and threats, would better guide NMFS and other natural resource managers in managing and protecting marine mammals and their habitat. The alternative may also benefit injured birds or sea turtles identified during MMSN response activities.

4.3.2.3 Oysters Restoration Type Alternatives

This section relies on the analyses from relevant portions of Section 6.4.12 of the PDARP/PEIS, which evaluated the environmental impacts of oyster restoration projects. Table 4-10 identifies where in this RP/EA the analysis of potentially affected resources can be found. Preliminary investigation determined that some resource categories under the Oysters Restoration Type would either be unaffected or minimally affected by the restoration alternatives proposed in this RP/EA (see Section 4.3.1).

Table 4-10. NEPA assessment of resource categories for the Oysters Restoration Type

Resource categories	Location of analysis in Chapter 4
Physical resources	
Geology and Substrates	Analyzed in detail in Section 4.3.2.3
Hydrology and Water Quality	Analyzed in detail in Section 4.3.2.3
Air Quality	Analyzed in Section 4.3.1
Noise	Analyzed in Section 4.3.1
Biological resources	
Habitats	Analyzed in detail in Section 4.3.2.3
Wildlife Species	Analyzed in detail in Section 4.3.2.3
Marine and Estuarine Fauna	Analyzed in detail in Section 4.3.2.3
Protected Species	Analyzed in detail in Section 4.3.2.3
Socioeconomic resources	
Socioeconomics/EJ	Analyzed in Section 4.3.1
Cultural Resources	Analyzed in Section 4.3.1
Tourism and Recreational Use	Analyzed in Section 4.3.1
Infrastructure	Analyzed in Section 4.3.1
Fisheries and Aquaculture	Analyzed in Section 4.3.1
Marine Transportation	Analyzed in Section 4.3.1
Aesthetics and Visual Resources	Analyzed in Section 4.3.1
Land and Marine Management	Analyzed in Section 4.3.1
Public Health and Safety Including Flood and Shoreline Protection	Analyzed in Section 4.3.1

Table 4-11 provides a summary of the Oysters Restoration Type impacts analysis, including any beneficial impacts and the highest intensity of adverse impacts. Subsequent sections of this chapter discuss the full range of impacts.

Minor adverse impacts are likely to occur to some physical and biological resources, although those impacts would likely be short-term. To help mitigate any adverse impacts, the Implementing Trustee(s) would apply relevant BMPs identified in required permits, consultations, or environmental reviews, or in Appendix 6.A of the PDARP/PEIS. Through technical assistance with regulatory agencies, the Implementing Trustee(s) may identify additional BMPs for implementation, and these would be catalogued in compliance documents.

4.3.2.3.1 Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale Preferred Alternative and Small-scale Non-preferred Alternative)

This analysis applies to both the large- and small-scale Oysters Restoration Type alternatives. Both alternatives would involve constructing new oyster reefs at five sites across the Gulf of Mexico: East Galveston Bay, TX; Biloxi Marsh, LA; Heron Bay, MS; Mid-lower Mobile Bay, AL; and Suwannee Sound, FL, which are described below as project components. The primary difference between the large- and small-scale alternatives is the size of the proposed reefs. The large-scale alternative would construct up to 30 acres of new oyster reef at each of the five sites, while the small-scale alternative would construct up to 17 acres of oyster reef at each site. The goal of these alternatives is to increase oyster abundance and restore resilience to oyster populations at multiple Gulf of Mexico locations by increasing connectivity through larval transport and the construction of oyster habitat over a range of habitats (intertidal to subtidal) and salinities. The alternatives would involve creating a network of high-vertical relief brood reefs that link to existing or created sink reefs through larval transport and increase oyster population sustainability and oyster reef resilience. Some components may also enhance oyster reef productivity through relocating wild or farmed oysters to restoration sites. The remainder of this section includes component summaries, an analysis of impacts common to all components, and analyses of component-specific impacts.

Table 4-11. Summary of impacts associated with the Oysters Restoration Type alternatives

Key: + Beneficial impact; NI – No impact; s – short-term, minor adverse impact; S – short-term, moderate adverse impact; **S – short-term, major adverse impact;** l – long-term, minor adverse impact; L – long-term, moderate adverse impact; **L – long-term, major adverse impact.**

Alternative	Oysters Restoration Type alternatives	Physical resources: Geology and substrates	Physical resources: Hydrology and water quality	Biological resources: Habitats and Wildlife (birds and terrestrial species)	Biological resources: Marine and estuarine resources	Biological resources: Protected species
1	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale), Component 1: East Galveston Bay, Texas	+/s	+/s	+/s	+/s	+/s
1	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale), Component 2: Biloxi Marsh, Louisiana	+/s	+/s	+/s	+/s	+/s
1	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale), Component 3: Heron Bay, Mississippi	+/s	+/s	+/s	+/s	+/s
1	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale), Component 4: Mid-lower Mobile Bay, Alabama	+/s	+/s	+/s	+/s	+/s
1	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale), Component 5: Suwannee Sound, Florida	+/s	+/s	+/s	+/s	+/s
2	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale), Component 1: East Galveston Bay, Texas	+/s	+/s	+/s	+/s	+/s
2	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale), Component 2: Biloxi Marsh, Louisiana	+/s	+/s	+/s	+/s	+/s
2	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale), Component 3: Heron Bay, Mississippi	+/s	+/s	+/s	+/s	+/s
2	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale), Component 4: Mid-lower Mobile Bay, Alabama	+/s	+/s	+/s	+/s	+/s
2	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale), Component 5: Suwannee Sound, Florida	+/s	+/s	+/s	+/s	+/s

4.3.2.3.1.1 Component 1: East Galveston Bay, TX

This component would be located in three areas over a 3-mile stretch of East Galveston Bay, extending from intertidal depths to 6 feet below mean sea level. Both the large- and small-scale alternatives would be conducted in the same general location. Areas of restoration for both alternatives would include both subtidal as well as shoreline habitats that are not located in existing commercial oyster lease areas, focusing mostly on brood reefs which could provide oyster spat for nearby sink reefs. Harvesting would be prohibited in the shoreline area, according to a law restricting harvesting within 300 feet of a shoreline. Subtidal oysters could be legally harvested but would be designed with large, vertically placed substrate (such as limestone dolomite, river rock or concrete structures) to prevent use of an oyster dredge for harvesting.

4.3.2.3.1.2 Component 2: Biloxi Marsh, LA

This component is in the Biloxi Marsh and Mississippi Sound area of St. Bernard Parish, LA and would consist of five or six sites. These new brood reefs could provide oyster spat for nearby existing oyster sink reefs. Initial project planning activities would investigate substrate at these sites for feasibility, targeting hard sediment and historic reefs. The construction of the reefs would utilize turtle-friendly, high-relief materials, such as reef balls. There are many private oyster leases in the interior of the Biloxi Marsh which may assist in providing spat to the newly constructed reefs. If spat recruitment appears to be low, spat may be obtained and introduced from the oyster hatchery in Grand Isle, LA. Oyster harvesting would be restricted at all constructed reefs.

4.3.2.3.1.3 Component 3: Heron Bay, MS

Component 3 is a 20,909-acre site located in the Hancock County Marsh Preserve within the Pearl River estuary. Both the large- and small-scale alternatives would be located in close proximity to the existing subtidal reef that was created under the NRDA Phase III Early Restoration Hancock County Marsh Living Shoreline project. Currently, the potential restoration area is restricted from both commercial and recreational harvest, but these new brood reefs would be near public commercially harvested reefs that are between five and fifteen miles to the southeast of this site, and which may benefit from the spat created by these new reefs. The Mississippi Department of Marine Resources would determine whether removing restrictions is appropriate.

4.3.2.3.1.4 Component 4: Mid-lower Mobile Bay, AL

This component would be located at two or more sites within the lower and mid portions of Mobile Bay in Mobile County, AL, over the approximately 15-mile project area. The four possible sites are Brookley Reef, Hollinger’s Island Reef, Whitehouse or Denton Reef, and Buoy Reef. Both the large- and small-scale alternatives would be sited to facilitate spat transport from the brood reefs toward commercially harvestable reefs. These new reefs would be constructed of large, high-relief material that would still permit harvesting based on limited harvest technique(s). It is likely that these reefs would not be permanently restricted to harvest. Rather, they would be open to harvest after either a certain number of years post-restoration or after meeting other performance criteria, such as percent of spatset coverage, as determined by ADCNR.

4.3.2.3.1.5 Component 5: Suwannee Sound, FL

This component would likely be comprised of multiple sites in Suwannee Sound in Dixie and Levy Counties, FL between Horseshoe Point and Cedar Key. Specific restoration sites would be identified during the planning stage using findings from a separate habitat suitability analysis and mapping work Restoration likely would focus on sink reefs, as brood reefs may not be necessary. Currently, spat supply does not appear to be a limiting factor in this area. Both the large- and small-scale alternatives would construct reefs using fossilized or recycled oyster shell or crushed limestone primarily in intertidal regions of the sound. The newly constructed reefs likely would not have permanent harvest restrictions; instead, harvest regulations would be determined after a certain number of years have passed since restoration or based on percent coverage parameters. FWC would determine whether removing restrictions is appropriate using a shell budget, the goal of which is to affect no net loss of cultch and maintain multiple age classes of oysters. Additionally, there is potential for restoration in Suwannee Sound that may not be in shellfish-approved waters, and therefore will not be open to harvest.

4.3.2.3.2 Impacts Common to All Project Components

Section 6.4.12.1 of the PDARP/PEIS describes the potential impacts from restoration techniques that aim to enhance oyster production by creating brood or sink reefs. The two project alternatives fall within the scope of the activities and potential environmental consequences analyzed in the PDARP/PEIS. This section of the PDARP/PEIS informs the impact analysis below. Overall, the alternatives could have short-term, minor adverse impacts and long-term beneficial impacts.

4.3.2.3.2.1 Physical Resources

The PDARP/PEIS concluded that cultch placement would have short-term, minor adverse impacts and long-term beneficial impacts on physical resources. The analysis presented below is consistent with this conclusion.

Geology and Substrates

Short-term, minor adverse impacts and long-term beneficial impacts to geology and substrates would occur. These adverse impacts would occur with placement of anchoring buoys, which would disturb surrounding sediment, and with placement of cultch material, which would disturb and cover the substrates onto which cultch is placed. However, restoring degraded oyster habitat would have a long-term benefit to substrates by providing additional habitat suitable for oyster recruitment, and reefs may also reduce wave energy and erosion of adjacent shorelines, and help stabilize sediments in the long-term. The impact of the large-scale alternative on geology and substrates may last longer in duration or have a greater area of impact than the small-scale alternative, but ultimately, both would result in short-term, minor adverse impacts and long-term beneficial impacts.

Hydrology and Water Quality

Short-term, minor adverse impacts and long-term beneficial impacts are expected. Project -related vessels, equipment, and construction activities, primarily cultch placement, could result in an increase in local turbidity. Additionally, anchoring operations associated with installing marker buoys and signs to mark cultch deployment areas could increase turbidity. The projects would also have long-term benefits on water quality because of the newly restored oysters' filter feeding. The impact of the large-scale alternative on hydrology and water quality may last longer in duration or have a greater area of impact than the small-scale alternative, but ultimately, both would result in short-term, minor adverse impacts and long-term beneficial impacts.

4.3.2.3.2.2 Biological Resources

The PDARP/PEIS concluded that short-term, minor adverse impacts on biological resources would be expected as a result of cultch placement. The analysis presented below is consistent with this conclusion.

Habitats and Wildlife Species

Creation of new oyster reef habitat could result in short-term disruptions to bird species during construction. Birds using the restoration sites in intertidal areas for foraging would need to use surrounding areas during construction activities. This would be temporary however, until construction is complete, and would likely provide long-term benefits to birds via increases in foraging habitat t (e.g., American oystercatchers). The impact of the large-scale alternative on habitats may last longer in duration or have a greater area of impact than the small-scale alternative, but ultimately, both are expected to result in short-term, minor adverse impacts and long-term beneficial impacts to bird species.

Marine and Estuarine Resources

Short-term, minor adverse impacts and long-term beneficial impacts are expected to marine and estuarine resources. Cultch placement can smother benthic resources and convert soft bottom habitats to hard bottom habitats, adversely impacting species that depend on this habitat. However, only a small percentage of the soft bottom substrate in project locations would be converted to hard bottom substrate. The projects would have short-term, minor adverse impacts on this habitat. SAV is not expected to occur in these locations. However, any SAV found during the site selection process would be documented and measures would be taken to avoid and minimize any impacts.

Placement of cultch could result in short-term, minor adverse impacts to finfish and shellfish resulting from disturbance and potential injury during cultch placement. Increases in water turbidity could cause mobile organisms to leave the project area in the short-term. However, it is likely that those organisms would return to the project area once construction activities cease, resulting in only short-term adverse impacts to these species.

The presence of project-related vessels and equipment could temporarily disturb habitats and wildlife species that use or transit through the construction areas. Boat operators associated with the project components would follow NOAA NMFS Southeast Region's *Vessel Strike Avoidance Measures and Reporting for Mariners* which also would minimize potential harm to nekton species in the construction areas. The combination of the mobility of nekton species, the implementation of BMPs, and the short duration of construction activities suggest that the alternatives will have short-term, minor adverse effects to aquatic wildlife.

The components of the alternative would, by design, provide long-term benefits to oysters and to commercially important fish species that rely on reefs for foraging (e.g., red and black drum and blue crab), as well as other wildlife that depend on the fish that would benefit from additional reef habitat (e.g., terns, wading birds). The components would also improve the quality of nearby habitat by reducing erosion and improving water quality, providing long-term benefits to marine and estuarine fauna.

The impact of the large-scale alternative on marine and estuarine fauna may have a greater area of impact than the small-scale alternative, but ultimately, both would result in short-term, minor adverse impacts and long-term beneficial impacts.

Protected Species

If individual Gulf sturgeon enter the project area during construction, short-term, minor adverse impacts could result. However, sturgeon are mobile marine species and would likely avoid project activities, suggesting that transitory routes would not be impeded. Therefore, the alternatives are not likely to adversely impact the species.

Placement of cultch material would result in impacts to soft bottoms and sand/shell bottoms categorized as EFH for a number of federally managed fishery species at each project component site. All components would impact EFH for Atlantic sharp-nosed shark, blacktip shark, bull shark, gray snapper, lane snapper, red drum, and white shrimp. Additional component-specific impacts to fishery species EFH are described below in project component specific impacts. Oyster reefs are a category of EFH for several federally managed fishery species (e.g., white shrimp and red drum) and the proposed actions would benefit EFH for such species. The impact of the large-scale alternative on EFH may last longer in duration or have a greater area of impact than the small-scale alternative, but ultimately, both would result in short-term, minor adverse impacts and long-term beneficial impacts.

The presence of project-related vessels and equipment and construction activities could temporarily disturb marine mammals (e.g., dolphins and manatees) and sea turtles in the vicinity of the project area. However, these highly mobile species would likely be able to utilize other habitats during project construction. If individuals did enter construction areas, activities would halt until they leave the site. Boat operators associated with the projects would also follow NOAA NMFS Southeast Region's *Vessel Strike Avoidance Measures and Reporting for Mariners* which also would minimize potential harm. The combination of mobility, the implementation of BMPs, and the short duration of construction activities suggest that the alternatives are unlikely to have adverse effects on these taxa. In addition, sea turtle nesting habitat nor designated or proposed critical habitat would be impacted by these alternatives as neither are located in the proposed project area.

The impact of the large-scale alternative on protected species may have a greater area of impact than the small-scale alternative, but ultimately, both would result in no long-term adverse impacts to protected species.

4.3.2.3.3 Component-specific Impacts

With the exception of EFH, there are no component-specific impacts to physical and biological resources that differ from what was previously analyzed under impacts common to all components (Section 4.3.2.3.2). For EFH, across all components, the placement of cultch material to create oyster reefs would have adverse impacts on soft bottoms and sand/shell bottoms categorized as EFH for multiple additional federally managed fishery species. The impact of the large-scale alternative on EFH may last longer in duration or have a greater area of impact than the small-scale alternative, but ultimately, both would result in short-term, minor adverse impacts and long-term beneficial impacts. The below sections identify the EFH-impacted fish species specific to each component.

4.3.2.3.3.1 Component 1: East Galveston Bay, TX

For this component, the EFH-impacted fish species include bonnethead shark, brown shrimp, hammerhead shark, lemon shark, scalloped hammerhead shark, Spanish mackerel, and spinner shark.

4.3.2.3.3.2 Component 2: Biloxi Marsh, LA

For this component, the EFH-impacted fish species include brown shrimp, finetooth shark, pink shrimp, bonnethead shark, Spanish mackerel, and spinner shark.

4.3.2.3.3.3 Component 3: Heron Bay, MS

For this component, the EFH-impacted fish species include brown shrimp, pink shrimp, Spanish mackerel, and spinner shark.

4.3.2.3.3.4 Component 4: Mid-lower Mobile Bay, AL

For this component, the EFH-impacted fish species include blacknose shark, brown shrimp, finetooth shark, hammerhead shark, pink shrimp, scalloped hammerhead shark, and Spanish mackerel.

4.3.2.3.3.5 Component 5: Suwannee Sound, FL

For this component, the EFH-impacted fish species include lemon shark, nurse shark, pink shrimp, and scalloped hammerhead shark.

4.3.2.4 Sea Turtles Restoration Type Alternatives

This section relies on the analysis from relevant portions of Section 6.4.7 of the PDARP/PEIS, which evaluated the environmental impacts of sea turtle restoration projects. Table 4-12 identifies where in this RP/EA the analysis of potentially affected resources can be found. Note that the Sea Turtles Alternative 1 was evaluated in Section 4.1.3 under the analysis of Preliminary Phase Restoration Alternatives. Preliminary investigation determined that some resource categories under the Sea Turtles Restoration Type would either be unaffected or minimally affected by the restoration alternatives proposed in this RP/EA (see Section 4.3.1).

Table 4-12. NEPA assessment of resource categories for the Sea Turtles Restoration Type

Resources	Location of analysis in Chapter 4
Physical resources	
Geology and Substrates	Analyzed in detail in Section 4.3.2.4
Hydrology and Water Quality	Analyzed in detail in Section 4.3.2.4
Air Quality	Analyzed in Section 4.3.1
Noise	Analyzed in Section 4.3.1
Biological resources	
Habitats	Analyzed in detail in Section 4.3.2.4
Wildlife Species	Analyzed in detail in Section 4.3.2.4
Marine and Estuarine Fauna	Analyzed in detail in Section 4.3.2.4
Protected Species	Analyzed in detail in Section 4.3.2.4
Socioeconomic resources	
Socioeconomics/EJ	Analyzed in Section 4.3.1
Cultural Resources	Analyzed in Section 4.3.1
Tourism and Recreational Use	Analyzed in Section 4.3.1
Infrastructure	Analyzed in Section 4.3.1
Fisheries and Aquaculture	Analyzed in Section 4.3.1
Marine Transportation	Analyzed in Section 4.3.1
Aesthetics and Visual Resources	Analyzed in Section 4.3.1
Land and Marine Management	Analyzed in Section 4.3.1
Public Health and Safety Including Flood and Shoreline Protection	Analyzed in Section 4.3.1

Table 4-13 provides a summary of the Sea Turtles Restoration Type impacts analysis, including any beneficial impacts and the highest intensity of adverse impacts. Subsequent sections of this chapter discuss the full range of impacts.

Minor to moderate adverse impacts are likely to occur to some physical and biological resources, although those impacts would likely be short-term. To help mitigate any adverse impacts, the Implementing Trustee(s) would apply relevant BMPs identified in required permits, consultations, or environmental reviews, or in Appendix 6.A of the PDARP/PEIS. Through technical assistance with regulatory agencies, the Implementing Trustee(s) may identify additional BMPs for implementation, and these would be catalogued in compliance documents.

Table 4-13. Summary of impacts associated with the Sea Turtles Restoration Type alternatives

Key: + Beneficial impact; NI – No impact; s – short-term, minor adverse impact; S – short-term, moderate adverse impact; S – short-term, major adverse impact; l – long-term, minor adverse impact; L – long-term, moderate adverse impact; L – long-term, major adverse impact.

Alternative	Sea Turtles Restoration Type alternatives	Physical resources		Biological resources		
		Geology and substrates	Hydrology and water quality	Habitats and Wildlife (birds and terrestrial species)	Marine and estuarine resources	Protected species
1	Pilot Implementation of Automatic Identification System (AIS) in the GOM Inshore Shrimp Fishery to Inform Efforts to Reduce Sea Turtle Bycatch	NI	NI	NI	NI	NI
2	Restore and Enhance Sea Turtle Nest Productivity	S/l	S/l	+/S	+/S	+/s
3	Guiding Restoration Success for Nesting Females and Hatchlings in the Northern Gulf of Mexico	s	NI	s	NI	+/s/l
4	Reducing Sea Turtle Bycatch at Recreational Fishing Sites	NI	NI	NI	NI	+/s
5	Reducing Marine Debris Impacts on Birds and Sea Turtles *(joint project with Birds Restoration Type)*	+/s	+/s	+/s	+/s	+/s
6	Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation, Component 1: Enhancing Response Coordination, and Preparedness in the Gulf of Mexico	s	s	l	l	+/l
6	Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation, Component 2: Texas Rehabilitation Facility	s/l	s	s/l	s	+/s

4.3.2.4.1 Sea Turtles Alternative 2: Restore and Enhance Sea Turtle Nest Productivity–Preferred Alternative

The goal of this alternative is to develop and implement restoration actions to improve hatchling production for loggerhead, Kemp's ridley, and green sea turtles on key nesting beaches across the Northern Gulf of Mexico, the Archie Carr NWR on the east coast of Florida, and northern Mexico. The alternative would identify the highest priority threats to key nesting beaches, and then would implement appropriate restoration actions to help nesting females secure access to suitable habitat, successfully excavate nests, and return to the water after nesting; complete successful nest incubations; and achieve high hatch, emergence, and hatchling seaward migrations. Key restoration actions could include removing barriers to sea turtle beach access, managing nests to protect eggs and hatchlings where necessary and appropriate, monitoring beaches to manage predation and poaching, reducing lighting near beaches, and restoring beach habitat.

Section 6.4.7.3 of the PDARP/PEIS describes the potential impacts of restoration approaches intended to conserve sea turtle nesting habitat and enhance hatchling productivity. This alternative falls within the scope of the activities and potential environmental consequences analyzed in the PDARP/PEIS. The information in the PDARP/PEIS informs the impact analysis below. The alternative is likely to result in largely beneficial impacts to biological resources, with some short-term, minor adverse impacts related to construction. The data from this alternative would be incorporated into the Open Ocean TIG's Gulf of Mexico Sea Turtle Atlas.

4.3.2.4.1.1 Physical Resources

The PDARP/PEIS concluded that efforts to conserve sea turtle nesting habitat and enhance hatchling productivity would have short-term, minor adverse impacts on physical resources.

Geology and Substrates

Activities under this alternative including those designed to restore degraded dunes, management efforts to remove impediments to nesting (e.g., barrier removal), or other, construction or physical modifications of the beach (e.g., sand placement, removing terrestrial hazards and barriers like dilapidated seawalls and grounded vessels) may result in short-term, moderate adverse impacts to substrates. In addition, short-term, minor adverse impacts could occur as a result of sediment disturbance by people and vehicles during beach surveys, nest management, and beach monitoring. Beach conservation and restoration, may have long-term, minor adverse impacts to beach substrates with an increase in erosion with the removal of some barriers (e.g., seawalls).

Hydrology and Water Quality

Activities that impact sediments and substrates may also impact water quality under this alternative. It is expected that short-term, moderate adverse impacts would occur to water quality with an increase in turbidity. These impacts would be short-term and occur during construction activities or removal of barriers. Water quality is expected to return to ambient levels after these activities are completed. However, increases in erosion with the removal of some barriers (e.g., seawalls) could result in long-term, minor adverse impacts to water quality.

4.3.2.4.1.2 Biological Resources

The PDARP/PEIS concluded that efforts to conserve sea turtle nesting habitat and enhance hatchling productivity could have short-term, minor adverse impacts on biological resources.

Habitats and Wildlife Species

Activities planned under this alternative such as those designed to restore degraded dunes, management efforts to remove impediments to nesting (e.g., barrier removal), or other, construction or physical modifications of the beach (e.g., sand placement, removing terrestrial hazards and barriers like dilapidated seawalls and grounded vessels) may result in short-term, moderate adverse impacts to habitats. In addition, habitat would be adversely affected through increased foot and vehicular traffic on beaches to support survey and nest protection efforts.

During construction and monitoring activities, wildlife species may be displaced but are expected to return once these activities are complete. Sand placement would also likely result in mortality of small animals (crabs) and burrowing invertebrates and meiofauna (microscopically small benthic invertebrates). Overall, impacts to habitats and wildlife are likely to be short-term for most species with overall long-term beneficial impacts (e.g., activities that involve reducing beach lighting). Short-term, minor adverse impacts could occur to wildlife species primarily through implementation of strategies to reduce nest predation through predator management. Where such management is needed, site-specific analysis at every location would inform selection of the most appropriate strategy at each location, as described in the Mammal Damage Management in Alabama EA (USDA 2014). Predator-control activities would likely include the use of exclusionary fencing, but could also include trapping or lethal removal methods (USDA 2014). Installing fencing around nests to exclude predators could prevent other species (e.g., birds) from using excluded areas; however, the area of habitat affected is likely to be small relative to locally available beach habitat (NPS 2018). Potential predator management techniques could have unintended temporary disturbances on waterbirds, raptors, and passerines from noise and habitat intrusion (USDA 2014). However, the potential for such impacts would be minimal and should not affect the overall populations of any non-target wildlife species (USDA 2014). Removing predators that impact productivity of beach-nesting species will result in long-term benefits to bird populations.

Marine and Estuarine Resources

Removal of barriers (e.g., sea walls and grounds vessels) could result in short-term, moderate adverse impacts to marine and estuarine fauna. These activities may decrease water quality with increased turbidity. These adverse impacts are largely expected to be short-term and minor for many species will leave the area while construction is underway and return once these activities are complete. For some species that use structures such as sea walls and grounded vessels, these adverse impacts may be long-term and moderate. However, beach restoration actions could benefit marine and estuarine fauna. Beach habitats contribute to the quantity and quality of adjacent shallow water habitats that serve as nurseries or forage areas for some finfish species. The beach–shallow water interface also provides nutrient exchange to aquatic habitats. Thus, protecting beach habitat could result in a long-term benefit to some marine and estuarine fauna, and could indirectly benefit the food chain that relies on the health of adjacent shallow water areas.

The presence of project-related vessels and equipment could temporarily disturb habitats and wildlife species that use or transit through the construction areas. Boat operators associated with the project components would follow NOAA NMFS Southeast Region's *Vessel Strike Avoidance Measures and Reporting for Mariners* which also would minimize potential harm to nekton species in the construction areas. The combination of the mobility of nekton species, the implementation of BMPs, and the short duration of construction activities suggest that the alternatives will have short-term, minor adverse effects to aquatic wildlife.

Protected Species

Activities planned under this alternative could result in short-term, minor adverse impacts to beach and shoreline habitats (and associated species) through construction and monitoring activities. Short-term, minor adverse impacts to marine mammals (e.g., dolphins, manatees) and sea turtles could occur from increased boat traffic due to accessing some project sites by water. Construction activities would be timed outside of key nesting periods (for sea turtles and birds) and project design would consider locations of key bird nesting habitats to limit these impacts. However, protecting and restoring sea turtle nesting beaches, using sea turtle-friendly lighting, and protecting and monitoring sea turtle nests could provide long-term benefits to sea turtles by increasing nesting success and hatchling survivorship. For example, turtle-friendly lighting would reduce the potential for nesting females and hatchlings to become disoriented during their search for a suitable nesting site and misdirected during their transit to the ocean. Other beach-nesting species would also benefit from reduced beach lighting. Predator control on beaches would help enhance sea turtle hatchling productivity, and it could also benefit other wildlife that nest on beaches (e.g., shorebirds, beach mice).

4.3.2.4.2 Sea Turtles Alternative 3: Guiding Restoration Success for Nesting Females and Hatchlings in the Northern Gulf of Mexico – Non-preferred Alternative

This alternative would implement several to better understand sea turtle nesting behavior and success initially focused on nesting beaches in the Florida Panhandle, Alabama, Mississippi, and potentially Louisiana and Texas. The aim would be to use the information to identify the most effective approaches and locations for improving sea turtle hatchling production in specific areas and throughout the Gulf of Mexico. The alternative would implement a range of activities to gather, synthesize, and apply this information, including:

- Compiling available reproductive output data of hatchlings produced on northern and western Gulf of Mexico nesting beaches.
- Collecting demographic data and distribution of nesting female sea turtles on Gulf of Mexico beaches using a genetic mark-recapture method.
- Summarizing and synthesizing hatchling and nesting female data sets.

Compiling available data about turtle hatchling success from nests that are already being surveyed (see standard protocols described here: https://myfwc.com/media/3133/fwc-mtconservationhandbook.pdf) and desktop analyses to summarize and synthesize existing data sets would have no adverse impacts on natural resources, including sea turtles, and would align with those impacts analyzed for “preliminary phases of restoration,” Section 6.4.14 in the PDARP/PEIS. No further NEPA analysis is required for these activities of this alternative.

Collecting demographic data using genetic mark-recapture methods would include gathering one egg per sea turtle nest to obtain genetic samples (nests typically contain about a hundred eggs). This activity was determined to need additional impact analysis, as described below.

4.3.2.4.2.1 Physical Resources

Overall, this alternative could have short-term, minor adverse impacts to physical resources. The PDARP/PEIS concluded that efforts to enhance hatchling productivity would have short-term, minor adverse impacts on physical resources, as would some activities in the development of preliminary phases of restoration planning, such as data collections. Analysis of potential impacts to different physical resource categories are included below.

Geology and Substrates

Short-term, minor adverse impacts could occur from this alternative as a result of sediment disturbance by people and vehicles traversing the beach during nest surveys, egg collection, and nest monitoring. These impacts would occur only as long as humans remained in the project area.

Hydrology and Water Quality

No impacts to hydrology or water quality are expected. Nest monitoring and egg collection activities would not occur in water.

4.3.2.4.2.2 Biological Resources

Overall, this alternative could have short- and long-term, minor adverse impacts on biological resources, while providing substantial benefits. The PDARP/PEIS concluded that efforts to enhance hatchling productivity would have short-term, minor adverse impacts on biological resources, as would some activities while in development of preliminary phases of restoration planning, such as data collections. As noted above, the adverse impacts from the data compilation, summary and synthesis activities of this project would be consistent with those described in the PDARP/PEIS in Section 6.4.14.

Habitats and Wildlife Species

Short-term, minor adverse impacts could occur to habitats and to any wildlife that utilize these areas at the same time people are traversing the beach to monitor nests and collect eggs. If nest monitors use motorized vehicles to access the beach, the noise from the vehicles could disturb wildlife in the area. These impacts would occur only when nests were under observation. Nest observations are occurring independently of this project across many beaches in the Gulf of Mexico.

Marine and Estuarine Resources

This alternative is expected to have limited in water activities and thus have no adverse impacts to marine and estuarine resources.

Protected Species

Short-term, minor adverse impacts could occur to nesting loggerhead and green turtles from humans and vehicles traversing the area during nest monitoring and egg collection activities. There would also be a long-term, minor adverse impact to loggerhead and green turtle species from the removal of one egg per clutch from potentially becoming a breeding sea turtle. Nest samplers would be trained and permitted prior to conducting egg collection to minimize disturbance and would use already damaged eggs whenever possible. Training teams in collection methods and using damaged eggs when possible would minimize the impact of egg collection. The information gleaned from the alternative’s suite of activities would benefit both turtle species for the long-term.

Activities planned under this alternative could result in short-term, minor adverse impacts to protected wildlife including birds, beach mice, and turtles resulting from disturbance as nest observers traverse the beach. These impacts would persist while nest observers are in the area, and all appropriate BMPs would be followed to minimize disturbance. The project could also result in long-term minor adverse impacts from the removal of the potential of one egg per nest to reach maturity. However, in the long-term, these data collections would result in long-term benefits to the species by better understanding the genetics, nesting, and migration patterns of loggerhead and green sea turtles.

Overall, this alternative would result in substantial long-term benefits to sea turtles. The project would improve the understanding of sea turtle nesting habits, genetic dispersal, and migration patterns.

4.3.2.4.3 Sea Turtles Alternative 4: Reducing Sea Turtle Bycatch at Recreational Fishing Sites – Preferred Alternative

The goal of this alternative is to identify factors contributing to sea turtle bycatch at shore-based recreational fishing sites (e.g., piers, bridges, jetties, and other shoreline structures). Activities would include (1) gathering data through assessment and mining of STSSN and existing angler survey data as well as a compilation of existing information on Gulf of Mexico shore-based fishing sites, (2) conducting surveys and local assessments to better understand angler fishing practices and potential co-factors influencing sea turtle bycatch, and (3) implementing angler education and other pilot programs to reduce sea turtle bycatch and bycatch injury.

Section 6.4.7.4 of the PDARP/PEIS describes the potential impacts of restoration approaches intended to restore sea turtles by reducing bycatch in recreational fisheries through the development and implementation of conservation measures. This alternative falls within the scope of the activities and potential environmental consequences analyzed in the PDARP/PEIS. The information in the PDARP/PEIS informs the impact analysis below. The impacts from the project are expected to be largely beneficial, with only short-term, minor adverse impacts.

4.3.2.4.3.1 Physical Resources

The PDARP/PEIS concluded that efforts to reduce sea turtle bycatch in recreational fisheries through development and implementation of conservation measures would not result in adverse impacts on physical resources.

Geology and Substrates

No adverse impacts are expected. The activities in this alternative would involve conducting desk-based analyses of data, angler surveys, and assessments and developing and implementing angler education/incentive programs to reduce bycatch and bycatch injury. These activities would not affect geology and substrates.

Hydrology and Water Quality

No adverse impacts are expected, for the same reasoning as Geology and Substrates. Activities under this alternative are not expected to affect hydrology and water quality.

4.3.2.4.3.2 Biological Resources

The PDARP/PEIS concluded that efforts to reduce sea turtle bycatch in recreational fisheries through development and implementation of conservation measures could result in short-term, minor adverse impacts on sea turtle and fish populations.

Habitats and Wildlife Species

No adverse impacts are expected. Conducting surveys and implementing bycatch reduction programs for recreational fishing are not expected to adversely affect habitats or wildlife species. The activities would not focus on, or affect, the behavior or wellbeing of birds or terrestrial wildlife. However, the implementation of measures to reduce sea turtle bycatch could benefit some birds that can become accidently hooked in recreational fishing gear (e.g., gulls and pelicans).

Marine and Estuarine Resources

No adverse impacts are expected for fish species that are a focus of recreational anglers, or that are bycatch in recreational fisheries. While fishing results in a depletion of fish populations, the implementation of measures to reduce sea turtle bycatch are unlikely to lead to more recreational landings of targeted fish species or bycatch.

Protected Species

Short-term, minor adverse impacts are possible under this alternative, through potential injuries that could result from testing novel bycatch reduction techniques. Overall, the activities proposed would lead to long-term benefits to sea turtles by reducing bycatch and bycatch-associated injuries. In addition, the implementation of measures to reduce sea turtle bycatch could benefit some birds that can become accidently hooked in recreational fishing gear (e.g., gulls and pelicans).

4.3.2.4.4 Sea Turtles Alternative 5: Reducing Marine Debris Impacts on Birds and Sea Turtles (joint project with Birds Restoration Type) – Preferred Alternative

Section 4.3.2.1.1 provides a full analysis of this joint project between the Birds and Sea Turtles Restoration Types.

4.3.2.4.5 Sea Turtles Alternative 6: Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation – Preferred Alternative

This alternative would enhance STSSN response, coordination, preparedness, and response and rehabilitation capacity through two main components. The first component would enhance the capabilities of project partners conducting stranding and rehabilitation activities in the Gulf of Mexico by supporting critical enhancement needs for STSSN response efforts. Project funding would provide support for equipment and supply needs (e.g., additional tanks, water filtration equipment, medical equipment) for existing sea turtle rehabilitation facilities. The project could provide support for responding to stranding events, recovering, and necropsying dead stranded sea turtles to better understand mortality sources, or filling other identified gaps in STSSN response coverage where sea turtles would benefit from increased response effort and/or capacity. Specific activities could include education and outreach, transporting live sea turtles for rehabilitation, implementing stranding patrols, and providing veterinary services. The second component would support the construction of a new rehabilitation facility on the upper Texas coast to address a gap in the STSSN by replacing lost rehabilitation capacity due to the impending closure of an existing facility.

Section 6.4.7.6 of the PDARP/PEIS describes the potential impacts of activities designed to improve understanding of illnesses and mortality of sea turtles and to detect and respond to natural and anthropogenic threats. This alternative falls within the scope of the activities and potential environmental consequences analyzed in the PDARP/PEIS. The information in the PDARP/PEIS informs the impact analysis below. The alternative would likely result in largely beneficial impacts to biological resources, with some short-term, minor adverse impacts related to construction and long-term, minor adverse impacts due to increased vessels and/or vehicle interactions.

4.3.2.4.5.1 Component 1: Enhancing Response, Coordination, and Preparedness in the Gulf of Mexico

4.3.2.4.5.1.1 Physical Resources

The PDARP/PEIS concluded that efforts to improve understanding of illnesses and mortality of sea turtles and to detect and respond to natural and anthropogenic threats could have short-term, minor adverse impacts on physical resources. The following sections provide analyses of potential impacts to different physical resource categories.

Geology and Substrates

The focus of this component is to increase support for recovering dead and stranded turtles. An increase in STSSN activities may lead to short-term, minor adverse impacts to sediment due to this disturbance. However, these impacts would be small in scale (i.e., restricted to the stranding/recovery site), and sediment disturbance would likely resolve soon after response operations cease.

Hydrology and Water Quality

This component would increase the capacity of the STSSN to respond to stranding events and rehabilitate sea turtles, therefore increases in STSSN activities that affect water quality (e.g., increased turbidity from sediment disturbance during response/recovery) could be slightly intensified. However, these adverse impacts would be short-term and minor.

4.3.2.4.5.1.2 Biological Resources

The PDARP/PEIS concluded that efforts to improve understanding of illnesses and mortality of sea turtles and to detect and respond to natural and anthropogenic threats could have long-term, minor adverse impacts on biological resources.

Habitats and Wildlife Species

An increase in STSSN activities may lead to long-term, minor adverse impacts to habitats (e.g., seagrasses and SAV) and wildlife species (e.g., birds) because of the potential for increased interactions with boats and vehicles. However, these impacts would be small in scale (i.e., restricted to the stranding/recovery site), and disturbance would likely resolve soon after response operations cease.

Marine and Estuarine Resources

The implementation of this alternative will result in an increase in STSSN activities which may result in long-term, minor adverse impacts to marine and estuarine fauna because of the potential for increased interactions with boats and vehicles. Boat operators associated with the alternative would follow NOAA NMFS Southeast Region's *Vessel Strike Avoidance Measures and Reporting for Mariners*, which would minimize potential harm.

Protected Species

The project may result in long-term, minor adverse impacts to protected species (e.g., marine mammals, sea turtles) because of the potential for increased interactions with boats and vehicles associated with increases in STSSN activities. Such interactions could directly harm sea turtles or temporarily displace them from specific areas. However, these interactions are likely to be very low given the general level of boating and vehicle activity in potentially affected areas. Boat operators associated with the alternative would also follow NOAA NMFS Southeast Region's *Vessel Strike Avoidance Measures and Reporting for Mariners*, which would minimize potential harm. The implementation of BMPs and the short duration of project activities suggest that the alternative is unlikely to have adverse effects to protected species. The alternative is also likely to provide long-term benefits to sea turtles through enhanced emergency response and may also benefit injured birds or marine mammals identified during STSSN response activities.

4.3.2.4.5.2 Component 2: Texas Rehabilitation Facility

4.3.2.4.5.2.1 Physical Resources

The PDARP/PEIS concluded that efforts to improve understanding of illnesses and mortality of sea turtles and to detect and respond to natural and anthropogenic threats could have short-term, minor adverse impacts on physical resources.

Geology and Substrates

The construction of a new facility on a dredged material disposal site near Galveston Bay is expected to result in localized, long-term, minor impacts on geology and substrates. These impacts would be limited primarily to the footprint of the building and related infrastructure (parking and access roads). In addition, an increase in STSSN activities may lead to short-term, minor adverse impacts to sediment due to this disturbance. However, these impacts would be small in scale (i.e., restricted to the stranding/recovery site), and sediment disturbance would likely resolve soon after response operations cease.

Hydrology and Water Quality

Short-term, minor adverse impacts could occur. Because this component would increase the capacity of the STSSN to respond to stranding events and rehabilitate sea turtles, increases in STSSN activities that affect water quality (e.g., increased turbidity from sediment disturbance) could be slightly intensified. However, these adverse impacts would be minor and short-term.

4.3.2.4.5.2.2 Biological Resources

The PDARP/PEIS concluded that efforts to improve understanding of illnesses and mortality of sea turtles and to detect and respond to natural and anthropogenic threats could have long-term, minor adverse impacts on biological resources.

Habitats and Wildlife Species

Long-term, minor to moderate adverse impacts would occur to habitats. The construction of a new sea turtle rehabilitation facility would permanently alter the upland scrub-shrub habitat at the immediate building site only. The small impact area will likely result in long-term, minor adverse impacts to birds and fauna currently using the project area. Birds and mobile animals would likely relocate to other suitable areas for nesting, resting and foraging habitats, and thus would not be notably affected. Terrestrial animals that could not relocate would likely not survive construction activities.

In addition, an increase in STSSN activities may lead to short-term, minor adverse impacts to habitats (e.g., seagrasses) and wildlife species because of the potential for increased interactions with boats and vehicles. However, these impacts would be small in scale (i.e., restricted to the stranding/recovery site), and disturbance would likely resolve soon after response operations cease.

Marine and Estuarine Resources

The implementation of this alternative will result in an increase in STSSN activities which may result in short-term, minor adverse impacts to marine and estuarine fauna because of the potential for increased interactions with boats and vehicles. Boat operators associated with the alternative would follow NOAA NMFS Southeast Region's *Vessel Strike Avoidance Measures and Reporting for Mariners*, which would minimize potential harm.

Protected Species

Short-term, minor adverse impacts on some protected species could occur with the development of a new facility and the increase in response activities. For example, increases in STSSN activities could result in increases in negative interactions with boats and vehicles. Such interactions could directly harm sea turtles or temporarily displace them from specific areas. However, these interactions are likely to be very low given the general level of boating and vehicle activity in potentially affected areas. Boat operators associated with the alternative would also follow NOAA NMFS Southeast Region's "Vessel Strike Avoidance Measures and Reporting for Mariners," which would minimize potential harm. The implementation of BMPs and the short duration of project activities suggest that the alternative is unlikely to have adverse effects to protected species. Rather, the alternative is likely to provide substantial long-term benefits to sea turtles through enhanced emergency response, which could improve sea turtle recovery and survival. The project may also benefit injured birds or marine mammals identified during STSSN response activities.

4.3.2.5 No Action Alternative

Section 1502.14(d) of the CEQ Regulations requires the alternatives analysis to "include the alternative of No Action." CEQ states that in some cases "No Action" is "no change" from current management direction or level of management intensity. Therefore, the “No Action” alternative would involve continuing the present course of action until current action changes. Impacts of actions would be compared to those impacts for the existing actions.

Under the No Action Alternative, the Regionwide TIG would not, at this time, select and implement the restoration alternatives in this RP/EA to compensate for lost natural resources or their services resulting from the DWH oil spill. Accordingly, the No Action Alternative would not meet the purpose and need for implementing alternatives that address lost natural resources and their services as described in Section 5.3.2 of the PDARP/PEIS and in Section 2.2 in this RP/EA, because it would not help meet the restoration goals of the Birds, Marine Mammals, Oysters, and Sea Turtles Restoration Types. If this RP/EA is not implemented, none of the preferred alternatives would be selected for implementation, and restoration benefits associated with these alternatives would not be achieved at this time. Under the No Action Alternative past, present, and reasonably foreseeable future actions would be expected to continue. This alternative would not contribute to long-term restoration benefits to physical resources, and would contribute to degradation of resources in the Gulf of Mexico. Under the No Action scenario, recovery from the DWH oil spill would take much longer compared to a scenario of implementing restoration actions. The impacts from the No Action Alternative would largely have short- and long-term, minor to moderate adverse impacts.

4.3.2.5.1 Physical Resources

Some restoration activities described in this RP/EA have the potential to have short- and long-term, minor adverse impacts to physical resources. Under the No Action Alternative, the restoration actions designed to benefit birds, marine mammals, oysters, and sea turtles would not be implemented. Any minor adverse impacts to physical resources would not occur. In addition, expected long-term beneficial impacts to physical resources would not occur, and long-term, minor to moderate adverse impacts would be expected from the continued degradation of project areas. Additionally, indirect impacts would include missed opportunities to build knowledge that data collection and management activities would provide.

4.3.2.5.2 Biological Resources

Without the restoration alternatives described above, birds, sea turtles, marine mammals, and oysters would not experience benefits of restoration. Under the No Action Alternative, biological resources would not benefit from conservation and management actions, and would remain injured for a longer period of time. Under the No Action Alternative, some recovery could result from other federal actions, but not from the federal actions evaluated in this RP/EA. This alternative would have no beneficial impacts to biological resources, and short- and long-term, moderate to major adverse impacts would be anticipated.

4.3.2.6 Comparison of Impacts of Project Alternatives

The environmental analysis demonstrated that there may be short- and long-term minor to moderate adverse impacts and numerous environmental benefits from the restoration alternatives. The No Action Alternative largely would have short- and long-term minor to moderate adverse impacts. Table 4-14 provides a summary of impacts.

Table 4-14. Overall summary of impacts associated with the restoration alternatives in this RP/EA

Key: + Beneficial impact; NI – No impact; s – short-term, minor adverse impact; S – short-term, moderate adverse impact; **S – short-term, major adverse impact;**
l – long-term, minor adverse impact; L – long-term, moderate adverse impact; **L – long-term, major adverse impact.**
*Resources not analyzed in detail in this RP/EA.

Alternative	Restoration Type alternatives	Physical resources				Biological resources			Socioeconomic resources								
		Geology and substrates	Hydrology and water quality	Air quality/GHGs*	Noise*	Habitats and Wildlife species (birds and terrestrial species)	Marine and estuarine resources	Protected species	Socioeconomics / EJ*	Cultural resources*	Tourism and recreational use*	Aesthetic and visual resources*	Infrastructure*	Fisheries and aquaculture*	Land and marine management*	Marine transportation*	Public health and safety, including flood and shoreline protection*
Birds Restoration Type projects																	
1	Reducing Marine Debris Impacts on Birds and Sea Turtles *(joint project with Sea Turtles Restoration Type)*	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+	NI	NI	s
2	Conservation and Enhancement of Nesting and Foraging Habitats for Birds, Component 1: Chandeleur Islands, LA	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
2	Conservation and Enhancement of Nesting and Foraging Habitats for Birds, Component 2: Pilot Town/Little Dauphin Island, AL	+/s	+/s	s	s	+/s	NI	+/s	+	NI	+	NI	NI	+	NI	NI	s
2	Conservation and Enhancement of Nesting and Foraging Habitats for Birds, Component 3: San Antonio Bay Bird Island, TX	+/l	+/s	s	s	+/s	+/s/l	+/s	+	NI	+	NI	NI	+	NI	NI	s

Alternative	Restoration Type alternatives	Physical resources				Biological resources			Socioeconomic resources								
		Geology and substrates	Hydrology and water quality	Air quality/GHGs*	Noise*	Habitats and Wildlife species (birds and terrestrial species)	Marine and estuarine resources	Protected species	Socioeconomics / EJ*	Cultural resources*	Tourism and recreational use*	Aesthetic and visual resources*	Infrastructure*	Fisheries and aquaculture*	Land and marine management*	Marine transportation*	Public health and safety, including flood and shoreline protection*
2	Conservation and Enhancement of Nesting and Foraging Habitats for Birds, Component 4: Matagorda Bay Bird Island (Chester Island), TX	+/s	+/s	s	s	+/s	+/s/l	+/s	+	NI	+	NI	NI	+	NI	NI	s
2	Conservation and Enhancement of Nesting and Foraging Habitats for Birds, Component 5: Round Island, MS	s	NI	s	s	+	NI	+/s	+	NI	+	NI	NI	+	NI	NI	s
3	Bird Nesting and Foraging Area Stewardship	+/s	+/s	NI	s	+/s	s	+/s	+	NI	+	NI	NI	+	NI	NI	s
4	Stewardship and Habitat Creation through Beneficial Use, Component 1: Walker Island, AL	+/s	+/s	s	s	+/s	+/s/l	+/s	+	NI	+	NI	NI	+	NI	NI	s
Marine Mammals Restoration Type projects																	
1	Voluntary Modifications to Commercial Shrimp Lazy Lines to Reduce Dolphin Entanglements	+	NI	NI	s	NI	NI	+	+	NI	+	NI	NI	NI	NI	NI	s

Alternative	Restoration Type alternatives	Physical resources				Biological resources			Socioeconomic resources									
		Geology and substrates	Hydrology and water quality	Air quality/GHGs*	Noise*	Habitats and Wildlife species (birds and terrestrial species)	Marine and estuarine resources	Protected species	Socioeconomics / EJ*	Cultural resources*	Tourism and recreational use*	Aesthetic and visual resources*	Infrastructure*	Fisheries and aquaculture*	Land and marine management*	Marine transportation*	Public health and safety, including flood and shoreline protection*
2	Reducing Impacts to Dolphins from Hook-and-line Gear and Provisioning through Fishery Surveys, Social Science, and Collaboration	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
3	Enhance Marine Mammal Stranding Network Diagnostic Capabilities and Consistency across the Gulf of Mexico	NI	NI	NI	s	NI	NI	+	+	NI	+	NI	NI	NI	NI	NI	s
4	Enhance Capacity, Diagnostic Capability, and Consistency of the Marine Mammal Stranding Network in the Gulf of Mexico	NI	NI	NI	s	s	NI	s/+	+	NI	+	NI	NI	NI	NI	NI	s
Oysters Restoration Type projects																	
1	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale), Component 1: TX	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+/s	NI	NI	s
1	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale), Component 2: LA	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+/s	NI	NI	s

Alternative	Restoration Type alternatives	Physical resources				Biological resources			Socioeconomic resources								
		Geology and substrates	Hydrology and water quality	Air quality/GHGs*	Noise*	Habitats and Wildlife species (birds and terrestrial species)	Marine and estuarine resources	Protected species	Socioeconomics / EJ*	Cultural resources*	Tourism and recreational use*	Aesthetic and visual resources*	Infrastructure*	Fisheries and aquaculture*	Land and marine management*	Marine transportation*	Public health and safety, including flood and shoreline protection*
1	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale), Component 3: MS	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+/s	NI	NI	s
1	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale), Component 4: AL	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+/s	NI	NI	s
1	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale), Component 5: FL	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+/s	NI	NI	s
2	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale), Component 1: TX	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+/s	NI	NI	s
2	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale), Component 2: LA	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+/s	NI	NI	s
2	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale), Component 3: MS	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+/s	NI	NI	s
2	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale), Component 4: AL	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+/s	NI	NI	s

Alternative	Restoration Type alternatives	Physical resources				Biological resources			Socioeconomic resources									
		Geology and substrates	Hydrology and water quality	Air quality/GHGs*	Noise*	Habitats and Wildlife species (birds and terrestrial species)	Marine and estuarine resources	Protected species	Socioeconomics / EJ*	Cultural resources*	Tourism and recreational use*	Aesthetic and visual resources*	Infrastructure*	Fisheries and aquaculture*	Land and marine management*	Marine transportation*	Public health and safety, including flood and shoreline protection*
2	Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Small-scale), Component 5: FL	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	+/s	NI	NI	s
Sea Turtles Restoration Type projects																	
1	Pilot Implementation of Automatic Identification System (AIS) in the GOM Inshore Shrimp Fishery to Inform Efforts to Reduce Sea Turtle Bycatch	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
2	Restore and Enhance Sea Turtle Nest Productivity	+/S/l	S/l	s	s	+/S	+/s	+/s	+	NI	+	NI	NI	NI	NI	NI	s
3	Guiding Restoration Success for Nesting Females and Hatchlings in the Northern Gulf of Mexico	s	NI	s	s	s	NI	+/s/l	+	NI	+	NI	NI	NI	NI	NI	s
4	Reducing Sea Turtle Bycatch at Recreational Fishing Sites	NI	NI	NI	NI	NI	NI	+/s	+	NI	+	NI	NI	NI	NI	NI	s
5	Reducing Marine Debris Impacts on Birds and Sea Turtles *(joint project with Birds Restoration Type)*	+/s	+/s	s	s	+/s	+/s	+/s	+	NI	+	NI	NI	NI	NI	NI	s

Alternative	Restoration Type alternatives	Physical resources				Biological resources			Socioeconomic resources								
		Geology and substrates	Hydrology and water quality	Air quality/GHGs*	Noise*	Habitats and Wildlife species (birds and terrestrial species)	Marine and estuarine resources	Protected species	Socioeconomics / EJ*	Cultural resources*	Tourism and recreational use*	Aesthetic and visual resources*	Infrastructure*	Fisheries and aquaculture*	Land and marine management*	Marine transportation*	Public health and safety, including flood and shoreline protection*
6	Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation, Component 1: Enhancing Response Coordination, and Preparedness in the Gulf of Mexico	l	s	s	s	s/l	L	+/l	+	NI	+	NI	NI	NI	NI	NI	s
6	Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation, Component 2: Texas Rehabilitation Facility	l	s	s	s	s/l	s	+/s	+	NI	+	NI	NI	NI	NI	NI	s
No Action		l	l	l	L	L	L	L	l	*/l	l	l	l	l	l	l	l

4.4 Cumulative Impacts

4.4.1 Impact Methodology

CEQ regulations require the assessment of cumulative impacts in the decision-making process for federal projects, plans, and programs. Cumulative impacts are defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions” (40 C.F.R. 1508.7). The CEQ handbook, “Considering Cumulative Effects” (CEQ 1997), states that cumulative impacts need to be analyzed in terms of the specific affected resource, ecosystem, and human community, and should focus on effects on “important issues of national, regional, or local significance.” Following the CEQ guidance, the goal of the cumulative impacts analysis below is not to capture every theoretically possible impact, but “to count what counts.”

This RP/EA relies on the analysis of cumulative impacts in the PDARP/PEIS (see Section 6.6 and Appendix 6). Where appropriate, the Regionwide TIG tiers off the analysis in the PDARP/PEIS to describe and evaluate potential cumulative impacts of the proposed restoration activities. The PDARP/PEIS describes and discusses the affected environment and evaluates the effects of restoration programs and projects. The Regionwide TIG identified relevant local and site-specific past, present, and reasonably foreseeable future actions that were not analyzed in the PDARP/PEIS through communications with agencies and organizations and review of publicly available databases of planned projects. The Regionwide TIG determined whether the proposed restoration projects would contribute substantially to adverse cumulative impacts in combination with past, present, or reasonably foreseeable future actions.

4.4.2 Resources Affected by Project Alternatives

Section 4.1 categorizes three project alternatives as planning and data collation projects. These activities fall within the PDARP/PEIS definition of an E&D project (see Section 6.4.14 of the PDARP/PEIS). Therefore, these alternatives did not require further NEPA analysis. After a review of affected resources, Section 4.3.1 describes several resources that were expected to have no or minimal impacts common to all project alternatives. These include air quality and GHGs, noise, socioeconomics, EJ, cultural resources, tourism and recreation, aesthetics and visual resources, infrastructure, fisheries and aquaculture, land and marine management, marine transportation, and public health and safety including flood and shoreline protection. Section 4.3.2 includes an environmental consequences analysis for each alternative (excluding planning projects) and relevant affected resources.

This suite of alternatives has a deliberate focus on restoring biological resources, specifically those that are wide-ranging (marine mammals, birds, and sea turtles), and that utilize vast areas of the Gulf of Mexico for different life stages. Thus, it is critical to determine cumulative impacts on the specific physical and biological resources proposed for restoration or improvement under these alternatives, to ensure that restoration benefits outweigh any potential cumulative adverse impacts. The cumulative environmental consequences of the alternatives were analyzed for the following resources:

- *Physical Resources:* geology and substrates (short-term to long-term, minor to moderate adverse impacts expected across all Restoration Types); hydrology and water quality (short-term, minor to moderate adverse impacts).
- *Biological Resources:* habitats and wildlife species, marine and estuarine resources, and protected species (short-to long-term, minor to moderate adverse impacts across numerous Restoration Type projects).

4.4.3 Cumulative Action Scenarios

To effectively consider potential cumulative impacts, the Regionwide TIG identified past, present, and reasonably foreseeable future actions relevant to restoration actions described in this RP/EA. These actions are located within the spatial boundaries of the Gulf of Mexico identified in the PDARP/PEIS. The Regionwide TIG considered the categories of cumulative actions in Section 6.6.4 of the PDARP/PEIS, and identified past, present, and reasonably foreseeable future actions through outreach to local, state, and/or federal experts familiar with major environmental and development initiatives that have a potential to contribute significantly to cumulative impacts. Alternatives considered in previous restoration plans (Final Phase IV Early Restoration Plan and Environmental Assessment, and the PDARP/PEIS) also informed this list of actions. The Regionwide TIG also relied on expert judgments, primarily qualitative, about the potential for adverse impacts, using publicly available information about the likely design and location of these actions. Table 4-15 provides the list of past, present, and reasonably foreseeable future actions considered.

Table 4-15. Description of other past, present, and reasonably foreseeable future actions considered in the cumulative impact analysis

Category	Action description	Resource considered in Cumulative Impact Analysis	State	Related regionwide project
DWH oil spill funded habitat restoration (including RESTORE Act, NRDA, NAS, and NFWF-GEBF)	These programs will leverage other funding sources where available to achieve habitat restoration. These programs seek to restore habitat, barrier island/headland, water quality, and LCMRs. Projects currently funded would improve LCMR populations, dune and marsh habitat, and coastal resiliency through shoreline protection, habitat protection, and acquisition. These programs would restore coastal habitats, water quality, and marine and estuarine fauna.	• Geology and substrates • Hydrology and water quality • Habitats and wildlife species • Marine and estuarine resources • Protected species	All GOM states	All Restoration Types
Recreational Fishing	In 2016, 2.7 million residents of GOM states participated in marine recreational fishing. All participants, including visitors, took almost 21 million trips and caught over 144 million fish. Nearly 64% of the trips were made in west Florida, followed by more than 12% in Alabama, nearly 11% in Louisiana, over 7% in Mississippi, and almost 6% in Texas. The most commonly caught non-bait species were spotted seatrout, gray snapper, red drum, sand seatrout, and red snapper. The largest harvests by weight were for spotted seatrout, red snapper, red drum, king mackerel, Spanish mackerel, and striped mullet (NOAA 2017b).	• Marine and estuarine resources • Protected species	All GOM states	Sea turtle bycatch at recreational fishing sites; marine debris removal.

Category	Action description	Resource considered in Cumulative Impact Analysis	State	Related regionwide project
Commercial Fishing	Commercial fisheries represent a multi-billion-dollar industry to the northern GOM coastal region and have traditionally included finfish, shrimp, oysters, and crabs. State, federal, and international agencies regulate fishery resources within their jurisdiction of the GOM. For species that are not managed by federal regulations, states have the authority to extend state rules into federal waters for residents of that state or vessels landing a catch in that state. The GMFMC is tasked with developing FMPs to manage fish resources in the GOM from the state territorial waters to the exclusive economic zone. Several plans are managed jointly with the South Atlantic Fish Management Council. 1. Coastal Migratory Pelagics of the GOM and South Atlantic FMP 2. Coral and Coral Reefs of the GOM FMP 3. Red Drum Fishery of the GOM FMP 4. Shrimp Fishery of the GOM FMP 5. Spiny Lobster in the GOM and South Atlantic FMP (joint with the South Atlantic Fish Management Council) 6. Reef Fish Resources of the GOM FMP 7. Regulating Offshore Marine Aquaculture in the GOM FMP 8. Consolidated Atlantic Highly Migratory Species FMP (managed by NMFS)	• Marine and estuarine resources • Protected species	All GOM states	Shrimp lazy lines and marine debris
Resource Stewardship: Oyster restoration	Significant efforts have occurred and are underway to restore oyster reefs along the GOM coast. Restoration projects are adding habitat for oysters to colonize, building reef structures, creating off-bottom aquaculture, and improving research and grow-out facilities.	• Geology and substrates • Hydrology and water quality • Habitats and wildlife species • Marine and estuarine resources	All GOM states	Oysters
Resource Stewardship: STSSN and MMSN	There are well-established, existing stranding network programs across the Gulf states. These include conservation programs designed to promote recovery and monitoring.	• Marine and estuarine resources • Protected species	All GOM states	Sea turtles, marine mammals

Category	Action description	Resource considered in Cumulative Impact Analysis	State	Related regionwide project
Resource Stewardship: Marsh and Shoreline Restoration	Marsh restoration occurs and will continue to occur throughout most of the proposed project areas. Marshes help protect infrastructure during storms, provide valuable habitat for wildlife species, improve water quality by the filtering nutrients, and help recharge groundwater. Living shorelines help provide a more natural way of reducing erosion and maintaining coastal habitat.	• Geology and substrates • Hydrology and water quality • Habitats and wildlife species • Marine and estuarine resources	TX, LA, AL, FL	Oysters – benefits to water quality; Birds – additional habitat for stewardship
Resource Stewardship: Land acquisition	Land acquisition by NGOs and federal and state agencies for the purpose of restoration and preservation has occurred and is likely to continue occurring in coastal areas. This includes areas for public use such as recreational trails as well as nature preserves, state parks, and wildlife management areas.	• Geology and substrates • Hydrology and water quality • Habitats and wildlife species • Protected species	TX, AL, MS	Birds – locations for stewardship
Dredge Material Disposal: USACE maintenance dredging and other dredging	Ship channels leading to Mississippi ports as well as the GIWW are routinely dredged to maintain designated depths in order to facilitate waterborne cargo transportation. Harbors, marinas, and other publicly used water bottoms are dredged as needed to maintain navigability. Dredged materials are either beneficially used as part of another project or deposited in a designated disposal location.	• Geology and substrates • Habitats and wildlife species • Marine and estuarine resources	TX, AL, MS	Birds – locations for stewardship
Coastal Development and Land Use: Beach nourishment	Many of the beaches along the GOM coast have a scheduled maintenance plan to re-nourish engineered beaches. These projects aim to restore beaches that have suffered a loss from storms and/or erosion to historical conditions by placing sand from offshore borrow sites via dredge and pipe.	• Geology and substrates • Habitats and wildlife species	All GOM states	Birds, sea turtles
Resource Stewardship: Bird habitat restoration	Significant efforts have occurred and are underway throughout the Gulf coast to restore bird nesting and wintering areas. This has been done through rookery island restoration, stewardship efforts, and targeted land conservation.	• Habitats and wildlife species • Protected species	All GOM states	Birds
Water Quality Improvement Programs	There has been a range of water quality improvement efforts implemented by Alabama through water management and sewage treatment improvements and upgrades.	• Hydrology and water quality	AL	Oysters – water quality improvements

Category	Action description	Resource considered in Cumulative Impact Analysis	State	Related regionwide project
Water Quality Improvement Programs	There has been a range of water quality improvement efforts done by Mississippi through water management and sewage treatment improvements and upgrades. Particular efforts have been made around beach outfall areas to improve coastal releases.	• Hydrology and water quality • Habitats and wildlife species • Marine and estuarine resources	MS	Oysters – water quality improvements; Birds – habitats
Water Quality Improvement Programs	There has been a range of water quality improvement efforts done by Florida through water management and sewage treatment improvements and upgrades. Particular efforts have been made around stormwater and agricultural runoff.	• Hydrology and water quality • Habitats and wildlife species • Marine and estuarine resources	FL	Oysters – water quality improvements
Resource Stewardship: Sea Turtles	Florida has done extensive work on sea turtle beach habitat to support nesting and hatchling success.	• Protected species • Marine and estuarine resources	FL	Turtles

4.4.4 Cumulative Impact Analysis

The following section describes the cumulative impacts of the alternatives in this RP/EA when combined with other past, present, and reasonably foreseeable future actions. In many situations, implementation of the alternatives in this RP/EA would likely help reduce overall adverse impacts by providing a certain level of offsetting benefits, especially when considered in concert with the numerous existing foreseeable future actions in the area. For example, currently more than 50 restoration projects pertaining to birds, sea turtles, oysters, and marine mammals are being implemented through various DWH oil spill funds, with funding expected to continue over the next 15 to 20 years.

4.4.4.1 Physical Resources: Geology, Substrates, Hydrology, and Water Quality

Implementation of the alternatives would cause short- to long-term, minor to moderate adverse impacts to physical resources. Geology, substrates, hydrology, and water quality would be impacted by alternatives for all Restoration Types. Impacts range from short-term, minor adverse impacts to physical resources through the removal of marine debris, to long-term, minor to moderate adverse impacts from the construction of a new sea turtle rehabilitation facility, construction of shoreline protection structures, and removing barriers impeding sea turtle access to nesting sites. In most cases, physical resources would recover quickly, and the limited long-term adverse impacts would be localized to very small geographic areas. Many long-term effects to physical resources would be beneficial. Land acquisition and management activities would have beneficial impacts on geology, substrates, hydrology, and water quality. Restoring degraded oyster habitat through placement of cultch material would have a long-term benefit of providing additional substrate suitable for oyster recruitment. Projects designed to benefit birds, oysters, and sea turtles have construction components that are expected to have short-term, minor adverse impacts on physical resources. However, these impacts are expected to be short-term, localized, with benefits to the affected species expected over the long-term.

Many of the actions in Table 4-15 have the potential to affect physical resources with varying intensity and duration. Past, current, and future implementation of DWH oil spill-related restoration projects associated with all the Restoration Types would continue to have short-term, minor adverse impacts on physical resources over the next few decades. Other anthropogenic sources of impacts to water quality in the Gulf of Mexico include shipping vessels, commercial and recreational fishing vessels, military and national defense operations, and oil and gas industry exploration. Cumulatively, these activities already produce short- to long-term, minor to major adverse impacts to water quality in localized areas of the Gulf of Mexico. Based on this current water quality environment and vast area of geology/substrates, the alternatives would not contribute substantially to cumulative adverse impacts. The long-term beneficial cumulative impacts to physical resources would far outweigh any cumulative impact from past, present, and foreseeable future actions.

4.4.4.2 Biological Resources: Habitats and Wildlife Species, Marine and Estuarine Fauna, and Protected Species

Implementation of the alternatives would primarily cause short- to long-term, minor to moderate adverse impacts to biological resources. Habitats and wildlife species, marine and estuarine resources, and protected species would all be impacted by the alternatives proposed in this

RP/EA. Potential disturbances would occur with marine debris removal, bird and sea turtle nesting habitat restoration at-large (variety of techniques including vegetation management), stewardship (variety of techniques), dredging and sand placement, oyster reef construction, sea turtle nesting research, bycatch reduction, STSSN activities, deployment of monitoring equipment, sampling, and changes in fishing and boating practices. Many of these activities, especially those associated with construction activities or rescue and recovery efforts would be short-term and minor adverse impacts. Others such as the placement of rock and fill may have long-term, minor adverse impacts on benthic communities in local areas while increases in STSSN activities may have long-term, minor adverse impacts on some habitats (e.g., seagrasses). Resources would recover quickly and only a small fraction of any local population would be adversely impacted. Overall, long-term impacts would be beneficial. Biological resources would benefit from the alternatives, as the purpose of these projects is to restore and enhance these resources. Anticipated benefits include increased survivorship and reproductive success of various species of birds, sea turtles, marine mammals, and oyster communities. This would ultimately be accomplished through reduced bycatch/fishing gear interactions, protection and restoration of valuable LCMR habitat, enhanced STSSN and MMSN activities, enhanced ecosystem resilience (e.g., creation of oyster reefs and living shorelines), and marine debris removal. Furthermore, project activities involving data collection would fill data gaps and provide fundamental information that would benefit biological resources in subsequent restoration activities.

All of the actions in Table 4-15 have the potential to affect biological resources with varying intensity and duration. Past, current, and future implementation of oil DWH spill-related projects associated with these Restoration Types would continue to have short-term, minor adverse impacts on biological resources for decades to come. However, because the purpose of these alternatives is to provide long-term benefits to these Restoration Types, it is expected that the benefits would far outweigh the adverse impacts. Numerous past and current resource stewardship activities for the STSSN and MMSN in the throughout the proposed project areas would be enhanced through the activities described in this RP/EA. Data collation alternatives would help bring together and organize past and future project data that in turn would inform future project implementation. Marine protected areas management, protected species management, and fisheries management would continue in the manner in which they currently operate. Land acquisition activities would continue to cumulatively benefit nesting sea turtle habitat. Other regionwide restoration programs would continue to complement DWH oil spill-related restoration projects. Vessels associated with energy exploration and production activities and with general marine transportation would operate in a similar manner or improved manner with the implementation of these project alternatives.

When the alternatives are analyzed in combination with other past, present, and reasonably foreseeable future actions, short- and long-term cumulative adverse impacts to biological resources would likely occur. However, those effects are unlikely to be substantial because the spatial extent of the area of impacts to biological resources is small compared to resource availability and other past, present, and reasonably foreseeable future actions. The alternatives would not contribute substantially to cumulative adverse impacts. The alternatives, in conjunction with other restoration projects and programs, would result in extensive long-term beneficial cumulative impacts to biological resources.

4.5 Compliance with other Environmental Laws and Regulations

Chapters 3 and 4 of this RP/EA provide detailed information and OPA and NEPA analyses for environmental consequences of each restoration alternative and consistency with the PDARP/PEIS. In addition, coordination and reviews to ensure compliance with other legal authorities potentially applicable to the preferred alternatives have begun Biological Evaluation (BE) forms (available in the DWH Administrative Record) for each preferred alternative provide details to regulatory agencies during the technical assistance phase of compliance work. Progress to date suggests that the preferred alternatives would be able to meet permitting and other environmental compliance requirements. All alternatives would be implemented in accordance with applicable laws and regulations.

Table 4-16 shows the status of each preferred alternative at the time of the draft RP/EA in meeting applicable environmental compliance requirements. The status for each project will be updated in the final RP/EA. The statuses in the table are described here:

- Complete (C): this status indicates that the requirements have been met and a response was received from the appropriate agency(ies).
- In Progress (IP): this status indicates that compliance reviews have been requested but an answer has not yet been received the regulatory agency(ies).
- No Effect (NE): this status indicates that the Regionwide TIG determined there is no effect from the preferred alternative to species or habitats protected under the ESA, MSFCMA, or MMPA.
- Phased compliance (Ph): this status indicates that, for a preferred alternative, compliance will need to be re-evaluated later, after initial planning has occurred and locations and methodologies for the work are determined. The Regionwide TIG will fully evaluate the potential effects once the initial planning is complete.
- Statute not applicable to alternative (N/A): this status indicates that the statute is not applicable to a preferred alternative, often due to the scope and/or location of the activities to be carried out under the alternative. For example, if an alternative requires only work in the ocean and ESA-listed species under USFWS jurisdiction are entirely terrestrial. In this example, ESA review with USFWS is not applicable.

Federal environmental compliance responsibilities and procedures follow Trustee SOPs (see Section 9.4.6 of that document). Accordingly, the Implementing Trustee(s) for each alternative will ensure that the status of environmental compliance (e.g., completed vs. in progress) is tracked through the Trustee Council's website. The Implementing Trustee(s) will keep a record of compliance documents (e.g., ESA biological opinions, USACE permits), and will submit them to the DWH Administrative Record.

Implementing Trustees are required to implement alternative-specific mitigation measures (including BMPs) identified in the RP/EA and completed consultations/permits. They are required to ensure that implementation does not have unanticipated effects to listed species and habitats.

Table 4-16. Current status of federal regulatory compliance reviews and approvals of preferred alternatives in this RP/EA

Key: C – Complete; IP – In Progress; NE – No Effect; Ph – Phased Compliance; N/A – Statute not applicable to alternative; Asterisk (*) represents preliminary planning projects

Preferred alternative	Coastal Zone Management Act (CZMA)	Endangered Species Act – Section 7 (NMFS)	Endangered Species Act – Section 7 (USFWS)	Magnuson Stevens Act (EFH; NMFS)	Marine Mammal Protection Act (MMPA (NMFS)	Marine Mammal Protection Act (MMPA (USFWS)	National Historic Preservation Act (NHPA)	Rivers and Harbors Act/Clean Water Act (USACE permit)	Coastal Barrier Resources Act (USFWS)
Bird projects									
Reducing Marine Debris Impacts on Birds and Sea Turtles (*joint project with Sea Turtles Restoration Type*)	IP	IP	IP	IP	IP	IP	IP	IP	IP
Conservation and Enhancement of Nesting and Foraging Habitat for Birds: Chandeleur Islands, LA*	IP	IP	IP	IP	IP	IP	IP	IP	IP
Conservation and Enhancement of Nesting and Foraging Habitat for Birds: Pilot Town/Little Dauphin Island, AL	IP	IP	IP	N/A	N/A	N/A	IP	IP	IP
Conservation and Enhancement of Nesting and Foraging Habitat for Birds: San Antonio Bay Bird Island, TX	IP	IP	IP	IP	IP	IP	IP	IP	IP
Conservation and Enhancement of Nesting and Foraging Habitat for Birds: Matagorda Bay Bird Island (Chester Island), TX	IP	IP	IP	IP	IP	N/A	IP	IP	IP
Conservation and Enhancement of Nesting and Foraging Habitat for Birds: Round Island, MS	IP	IP	IP	N/A	N/A	N/A	N/A	IP	IP
Bird nesting and Foraging Area Stewardship	IP	IP	IP	IP	IP	IP	IP	IP	IP

Preferred alternative	Coastal Zone Management Act (CZMA)	Endangered Species Act – Section 7 (NMFS)	Endangered Species Act – Section 7 (USFWS)	Magnuson Stevens Act (EFH; NMFS)	Marine Mammal Protection Act (MMPA (NMFS)	Marine Mammal Protection Act (MMPA (USFWS)	National Historic Preservation Act (NHPA)	Rivers and Harbors Act/Clean Water Act (USACE permit)	Coastal Barrier Resources Act (USFWS)
Marine mammal projects									
Voluntary Modifications to Commercial Shrimp Lazy Lines to Reduce Dolphin Entanglements	IP	IP	IP	IP	IP	IP	IP	IP	IP
Reducing Injury and Mortality of Bottlenose Dolphins by Utilizing Fishery Surveys, Social Science, and Collaborative Problem-solving*	IP	IP	IP	IP	IP	IP	IP	IP	IP
Enhance Marine Mammal Stranding Network Diagnostic Capabilities and Consistency across the Gulf of Mexico	IP	IP	IP	IP	IP	IP	IP	IP	IP
Oyster projects									
Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale) – TX	IP	IP	IP	IP	IP	IP	IP	IP	IP
Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale) – LA	IP	IP	IP	IP	IP	IP	IP	IP	IP
Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale) – MS	IP	IP	IP	IP	IP	IP	IP	IP	IP
Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale) – AL	IP	IP	IP	IP	IP	IP	IP	IP	IP
Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs (Large-scale) – FL	IP	IP	IP	IP	IP	IP	IP	IP	IP

Preferred alternative	Coastal Zone Management Act (CZMA)	Endangered Species Act – Section 7 (NMFS)	Endangered Species Act – Section 7 (USFWS)	Magnuson Stevens Act (EFH; NMFS)	Marine Mammal Protection Act (MMPA (NMFS)	Marine Mammal Protection Act (MMPA (USFWS)	National Historic Preservation Act (NHPA)	Rivers and Harbors Act/Clean Water Act (USACE permit)	Coastal Barrier Resources Act (USFWS)
Sea turtle projects									
Pilot Implementation of Automatic Identification System (AIS) in the GOM Inshore Shrimp Fishery to Reduce Sea Turtle Bycatch*	IP	IP	IP	IP	IP	IP	IP	IP	IP
Restore and Enhance Sea Turtle Nest Productivity	IP	IP	IP	IP	IP	IP	IP	IP	IP
Reducing Sea Turtle Bycatch at Recreational Fishing Sites	IP	IP	IP	IP	IP	IP	IP	IP	IP
Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation: Enhancing Response, Coordination, and Preparedness in the Gulf of Mexico	IP	IP	IP	IP	IP	IP	IP	IP	IP
Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation: Texas Rehabilitation Facility	IP	IP	IP	IP	IP	IP	IP	IP	IP

4.5.1 Additional Federal Laws

Additional federal laws may apply to the alternatives considered in this RP/EA. Legal authorities applicable to restoration alternative development were fully described in the context of the DWH restoration planning in the PDARP/PEIS (see Section 6.9, Compliance with Other Applicable Authorities, and Appendix 6.D, Other Laws and Executive Orders). This RP/EA incorporates that material by reference.

Examples of applicable laws or Executive Orders include, but are not limited to, the list below. Additional detail on each of these laws or Executive Orders is available in Chapter 6 of the PDARP/PEIS.

- ESA (16 U.S.C. 1531 et seq.)
- MSFCMA (16 U.S.C. 1801 et seq.)
- MMPA (16 U.S.C. et seq.)
- CZMA (16 U.S.C. et seq.)
- NHPA (16 U.S.C. 470 et seq.)
- Coastal Barrier Resources Act (16 U.S.C. et seq.)
- Clean Air Act (42 U.S.C. 7401 et seq.)
- Federal Water Pollution Control Act (Clean Water Act, 33 U.S.C. 1251 et seq.)
- Rivers and Harbors Act (33 U.S.C. 401 et seq.)
- Marine Protection, Research and Sanctuaries Act
- Estuary Protection Act
- Archaeological Resource Protection Act
- National Marine Sanctuaries Act
- Farmland Protection Policy Act
- Paperwork Reduction Act (44 U.S.C. 3501 et seq.)
- Executive Order 11988: Floodplain Management (now as augmented by Executive Order 13690, January 30, 2015)
- Executive Order 11990: Protection of Wetlands
- Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations
- Executive Order 12962: Recreational Fisheries
- Executive Order 13112: Safeguarding the Nation from the Impacts of Invasive Species
- Executive Order 13175: Consultation and Coordination with Indian Tribal Governments
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Appendix A: Monitoring and Adaptive Management Plans

Birds Restoration Type MAM plans

Monitoring and Adaptive Management Plan: Reducing the Threat and Impacts of Marine Debris to Birds and Sea Turtles Regionwide **A-2**

Monitoring and Adaptive Management Plan: Conservation and Enhancement of Nesting and Foraging Habitat for Birds **A-11**

Monitoring and Adaptive Management Plan: Bird Nesting and Foraging Area Stewardship .. **A-20**

Marine Mammals Restoration Type MAM plans

Monitoring and Adaptive Management Plan: Voluntary Modifications to Commercial Shrimp Lazy Lines to Reduce Dolphin Entanglements **A-29**

Monitoring and Adaptive Management Plan: Reducing Impacts to Dolphins from Hook-and-Line Gear and Provisioning through Fishery Surveys, Social Science, and Collaboration **A-38**

Monitoring and Adaptive Management Plan: Enhance Marine Mammal Stranding Network Diagnostic Capabilities and Consistency Across the Gulf of Mexico **A-46**

Oysters Restoration Type MAM plans

Monitoring and Adaptive Management Plan: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs **A-54**

Sea Turtles Restoration Type MAM plans

Monitoring and Adaptive Management Plan: Pilot Implementation of Automatic Identification System (AIS) in the Gulf of Mexico Inshore Shrimp Fishery to Inform Efforts to Reduce Sea Turtle Bycatch **A-62**

Monitoring and Adaptive Management Plan: Restore and Enhance Sea Turtle Nest Productivity **A-68**

Monitoring and Adaptive Management Plan: Reducing Sea Turtle Bycatch at Recreational Fishing Sites **A-76**

Monitoring and Adaptive Management Plan: Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation **A-83**

Monitoring and Adaptive Management Plan: Reducing the Threat and Impacts of Marine Debris to Birds and Sea Turtles Regionwide

1. Introduction, Purpose and Need, and Public Participation

This project Monitoring and Adaptive Management (MAM) Plan identifies the monitoring and data collection needed to evaluate progress toward meeting the project's objectives and to support necessary adaptive management. This plan was developed in accordance with the MAM Plan template provided in the MAM Manual Version 1.0 and was adapted to fit the needs of this project (DWH NRDA Trustees 2017a). This MAM Plan is a living document and may be updated as needed to reflect changing conditions. More specifically, the Regionwide Trustee Implementation Group (TIG) will update this plan as project components are more fully developed and siting and design activities are completed. While general areas of implementation and design are defined for this project, the exact locations and site-specific design details will be developed as a part of project implementation. Because such details have not yet been resolved, many aspects of this MAM Plan have not yet been determined (e.g., parameters to track, the method and frequency of measuring specific parameters). Future revisions to this document will be made publicly as part of project implementation through the Data Integration, Visualization, Exploration, and Reporting (DIVER) Portal (www.diver.orr.noaa.gov/web/guest/home) and accessible through the Trustee Council's website (www.habitat.noaa.gov/storymap/dwh/).

1.1 Project Overview

Marine debris is persistent, manufactured, or processed solid material that is directly or indirectly, intentionally, or unintentionally, disposed of or abandoned in the marine environment, and poses a risk to birds or sea turtles. Injury and mortality of birds and sea turtles from ingestion, entanglement, and entrapment in marine debris, namely derelict fishing gear, are well documented. For example, birds and sea turtles can become entangled in monofilament fishing line, ingest lead fishing gear (e.g., sinkers), or become trapped in derelict nets, traps, and pots (e.g., ghost fishing).

The objective of this project is to reduce the threat and impacts (e.g., entanglement, entrapment, and ingestion) of marine debris to birds and sea turtles injured by the *Deepwater Horizon* DWH oil spill across the Gulf states. The project would involve removing marine debris including, but not limited to, derelict fishing gear (e.g., monofilament fishing line, nets, trap/pot gear, and other recreational/commercial fishing equipment that has been lost, abandoned, or discarded). This project would entail a coordinated effort among Trustees, nongovernmental organizations (NGOs), and other partners to compile data on marine debris "hotspots," conduct marine debris removal, engage in prevention through public education, and conduct monitoring. Funding for this joint project would come from the Regionwide TIG Birds and Sea Turtles Restoration Types.

Removal of marine debris would benefit multiple species of birds injured by the DWH oil spill, including colonial waterbirds, solitary beach nesting birds, osprey, northern nesting birds, Caribbean nesting birds, and pelagic birds.

Sea turtle species that would benefit from the project include:

- Kemp’s ridley
- Loggerhead
- Leatherback
- Green
- Hawksbill

Proposed activities include:

- **Identifying and prioritizing marine debris hotspots that impact birds and/or sea turtles regionwide:** Data compiled from federal and state agencies and other relevant partners (e.g., Sea Turtle Stranding and Salvage Network (STSSN), rescue/rehabilitation organizations, NGOs, dive operators) would inform identification and prioritization of hotspots for marine debris impacts to birds and sea turtles. Hotspots for birds and sea turtles would be identified and prioritized separately.
- **Reducing the number of, and potential for, marine debris-related incidences at hotspots:** After identifying and prioritizing marine debris hotspots, the Implementing Trustees would develop a management plan outlining the restoration techniques for each hotspot, a schedule/timeline for restoration and monitoring, and details of data collection/management and monitoring. Implementing Trustees would provide support (e.g., capacity, equipment, fuel, etc.) for organized, large-scale debris removal events, regularly conducted targeted site-specific events, and/or the use of professional divers or marine salvage crews for in-water debris removal around deep structures. Debris removal may be a one-time event or a multi-event effort depending on the degree and frequency of debris accumulation, impact on birds or sea turtles, cost, and logistics. Debris removal may be conducted in coordination with or to enhance existing marine debris networks (e.g., Gulf coast clean-ups) or as additional stand-alone events.
- **Conducting public outreach:** This could include making presentations to local communities, stakeholders, and organizations (that may adopt a local cleanup); providing signage in high-use areas (e.g., fishing piers) and near businesses (e.g., fishing gear retailers); increasing the availability of and methods for collection and disposal of fishing gear (e.g., monofilament recycling bins, maintenance services, sustainable disposal options); and distributing outreach materials about the dangers of marine debris to birds and sea turtles.

1.2 Restoration Type and Project-Specific Objectives

This project is designed to address the Birds and Sea Turtles Restoration Types, defined in the 2016 *Deepwater Horizon* Oil Spill Final Programmatic Damage Assessment and Restoration Plan/Programmatic Environmental Impact Statement (PDARP/PEIS). (The PDARP/PEIS and the Record of Decision (ROD) are available at www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan/.) The overall objectives that are relevant to these Restoration Types, as defined in the Strategic Frameworks for Bird and Sea Turtle Restoration Activities (DWH NRDA Trustees 2017b, 2017c) include:

- For birds, to restore lost birds by facilitating additional production and/or reduced mortality of injured bird species.
- For sea turtles, to restore injuries by addressing primary threats to sea turtles in the marine and terrestrial environment such as bycatch in commercial and recreational fisheries, acute environmental changes (e.g., cold water temperatures), loss or degradation of nesting beach habitat (e.g., coastal armoring and artificial lighting), and other anthropogenic threats.

The project-specific objective is to reduce the threat and impacts (e.g., entanglement, entrapment, and ingestion) of marine debris to DWH-injured bird and sea turtle species across the Gulf of Mexico, including but not limited to reducing derelict fishing gear.

1.3 Conceptual Setting

Previous and existing efforts to remove marine debris from coastal areas have been implemented in various locations in the Gulf in recent years. However, DWH Natural Resource Damage Assessment (NRDA) Regionwide TIG recognized the need for a coordinated, comprehensive effort that aimed to reduce threats of marine debris to sea turtles and birds, which are important regional natural resources that were injured by the DWH oil spill. Key factors that affect the success of this project include: (1) the ability to identify high-risk hotspots of marine debris accumulation with the potential to affect birds or sea turtles; (2) the ability to successfully remove marine debris from the coastal environment and prevent re-accumulation; and (3) the willingness of stakeholders to engage in efforts that prevent improper disposal of materials that could become marine debris, and their willingness remove marine debris once it is in the environment.

This restoration project would reduce the amount of marine debris, including derelict fishing gear, at key hotspots located throughout the Gulf where it poses a hazard to birds and sea turtles. The project would be implemented regionwide, providing benefits across multiple Restoration Areas. Examples of external drivers that could affect achievement of project objectives include: patterns of marine debris deposition and transport from terrestrial sources and locations; public participation in assisting with prevention efforts; frequency and severity of storms that influence marine debris deposition and transport patterns; and the ability of project implementers to locate and remove marine debris.

1.3.1 Potential Sources of Uncertainty

Potential sources of uncertainty are defined as those that may affect the ability to achieve project restoration objectives. Sources of uncertainty, the degree of uncertainty, and the level of uncertainty associated with project activities will vary.

Uncertainties or information gaps have the potential to affect adaptive management decisions for individual or multiple restoration projects. These decisions may include how to improve the likelihood of achieving favorable project outcomes or selecting corrective actions in the event a project is not performing as intended.

Potential sources of uncertainty could include (but are not limited to):

- Ability to identify hotspots in which to target removal efforts
- Sources and composition of marine debris encountered in specific locations may vary over time
- Environmental conditions (e.g., extreme weather events and changes in large-scale circulation features) may affect marine debris distribution patterns
- Whether population-level impacts of marine debris interactions on birds and sea turtles can be quantified, and whether reduction of these impacts afforded by marine debris removal activities can be quantified
- Efficacy of public education efforts in increasing appropriate disposal of fishing gear and other marine debris may be affected by local cultural norms, changes in human population, and usage levels
- Effective coordination among Trustee and non-Trustee project partners during entire project lifecycles across two Restoration Types
- Effective coordination of resource-level monitoring across projects implementing different techniques

This list should not be considered exhaustive; additional uncertainties may be identified as the project is implemented and monitored. These uncertainties may affect the achievement of the restoration objectives of the project. For example, environmental conditions that influence marine debris deposition patterns can vary at different spatial and temporal scales, and might not remain consistent throughout the life of the project. If any drivers or stressors are negatively impacting the project, adaptive management may be necessary to ensure that project objectives are being achieved. The adaptive management strategy for this project is outlined in Section 3.

2. Project Monitoring

Performance monitoring would be conducted to evaluate project success and identify the need for potential corrective actions or adaptive management. It is likely that the activities implemented in each project component will not be identical, given differences in site conditions that are likely to be present. Therefore, specific parameters and methodologies will be identified as part of an update to this MAM Plan. Potential project objectives and monitoring parameters that could be used to assess and track project progress and performance are described below. Efforts would be made to apply a consistent methodology for data collection and project monitoring to help inform future restoration planning for birds and sea turtles.

Relevant baseline information is critical to monitor the progress of restoration project implementation against current conditions. At the outset of this project, information should be compiled to establish relevant baselines to facilitate robust monitoring and evaluation of project implementation. Baseline information could come from existing sources or data collected at the beginning of the project. For this project, examples of relevant baseline information to identify hotspots might include:

- Locations with a high frequency of marine debris-related bird or sea turtle injuries or mortality
- Locations with a high occurrence of marine debris likely to impact birds or sea turtles (including sources of marine debris and pathways for introduction)
- Locations where bird or sea turtle habitats (i.e., roosting, nesting, or foraging locations) intersect with high recreational use locations (e.g., boat ramps, fishing piers, jetties, artificial and natural reefs) or commercial fishing activities (e.g., derelict pots/traps or other commercial debris)
- Amount and type of materials removed per organized event prior to project implementation, method used, and location
- Number and locations of existing monofilament recycling containers, and other services available for sustainable disposal of fishing gear, at the outset of the project
- Number and locations of signage informing the public of appropriate disposal of fishing gear, at the outset of the project

Implementing Trustees would evaluate project success by assessing the amount of gear recovered, weight or volume of collected debris, size of footprint of debris removed (e.g., area or miles of beach), and total amount and type of debris. Monitoring of marine debris removed from hotspots would occur an estimated twice annually for the duration of the project. Monitoring would include observation of debris re-accumulation, use/maintenance of monofilament bins (if present), and debris-related injuries or mortalities to birds and sea turtles (if available). Relevant information on debris-related injuries to birds and sea turtles would also be leveraged from other programs and data sources such as stranding networks to provide a more complete temporal assessment of such incidents.

Specific restoration locations, and thus appropriate activities, would be identified by Implementing Trustees at the onset of this regionwide project, and would continue throughout the life of the project. Implementing Trustees would define objectives and associated monitoring parameters relevant for the focal species and their habitats, as well as the geographic area and specific components of the sampling design for each activity, using the MAM Manual for guidance (DWH NRDA Trustees 2017a). Thus, this section describes objectives and parameters that are likely to be relevant to the project. The following table provides draft project objectives and potential parameters that could be used in project monitoring; it is preliminary and is not exhaustive or prescriptive.

Draft project objectives and potential parameters

Draft Project Objectives	Potential Parameters
Locate marine debris	• Completion of hotspot analysis for prioritizing debris removal
Remove marine debris	• Number, type, and duration of marine debris removal events, including number of participants at each event • Amount (e.g., mass, volume, weight, number), type, and footprint [area or miles]) of marine debris removed
Increase methods and capacity for fishing gear collection and disposal	• Number and use of monofilament recycling or disposal bins installed and maintained by site • Number and use of new mechanisms for sustainable disposal of fishing gear by site (e.g., arrangement of new maintenance services, expansion of sustainable disposal options)
Provide public education to reduce (re-) accumulation of marine debris	• Number and type of educational opportunities (e.g., presentations to stakeholders and user groups, volunteer trainings at marine debris removal events) including number of individuals educated by site • Number and type of outreach materials installed (e.g., signage) or distributed by site

3. Adaptive Management

As discussed in the PDARP/PEIS, adaptive management is a form of structured decision-making applied to the management of natural resources in the face of uncertainty (Pastorok et al. 1997; Williams 2011). It is an iterative process that integrates monitoring and evaluation of management actions with flexible decision-making, where adjustments are made to management approaches based on observed outcomes (NRC 2004). Within the context of ecological restoration, adaptive management addresses key uncertainties by linking science to restoration decision-making (Steyer and Llewellyn 2000; Thom et al. 2005). Performance may be evaluated in terms of implementation of the project plan, expected project outputs, or the ability of the project to achieve the desired restoration outcomes.

Collecting data on the above parameters may highlight differences between re-accumulation rates across location types (reefs, piers, jetties, etc.) or regions. These data would inform adaptive management needed during implementation and future restoration planning, such as adjusting the types and amount of effort invested in particular locations to enhance effective reduction of marine debris presence and impacts at hotspots. In addition, adaptive management could include periodic regionwide review of available information to potentially identify additional hotspots that warrant inclusion in project activities.

4. Evaluation

Project MAM would include carefully planned evaluations of the selected parameters (potentially including the examples in Section 2) throughout the project's lifetime. By thoughtfully designing evaluation methods for the design and implementation of project restoration activities, the project team could assess if the project is meeting its restoration objectives and could determine the need for adaptive management. As specific parameters for given project components are selected, this MAM Plan will be updated accordingly.

5. Project-Level Decisions: Performance Criteria and Potential Corrective Actions

This section describes how knowledge gained from the evaluation of the monitoring data described in Section 2 would be used at the project-level (1) to determine whether the project, once implemented, is considered successful, and (2) to inform the need for potential corrective actions. Project success would be determined by comparing monitoring data to project-specific performance criteria for the key parameters related to the restoration objectives described in Section 2. Performance criteria and potential corrective actions would continue to be developed, and this MAM Plan would be updated accordingly. For example, thresholds for corrective action would need to be determined by the project team on a case-by-case basis, and may be adjusted over time.

More specifically, performance criteria for this project would be evaluated using the monitoring data described above to (1) determine whether activities to remove marine debris and prevent its deposition and accumulation, once implemented, are considered successful, and to (2) inform the need for potential corrective actions or further activities needed. A variety of factors including previously identified key uncertainties, unanticipated consequences, previously unknown conditions, or unanticipated environmental drivers may all influence project success. For example, public education activities aimed to reduce (re-)accumulation of marine debris might not be sufficient to significantly prevent marine debris deposition. Corrective actions may be identified post-implementation to address failure to meet performance criteria associated with this objective might include expanded outreach efforts within coastal communities, partnerships with waste collection companies, etc.

6. Monitoring Schedule

Monitoring will run concurrently to project activities, occurring twice annually (estimated) at each ‘hotspot,’ and monitoring data will be collected in relation to each implemented marine debris removal event. The project monitoring schedule will be determined when siting and design are completed for the different project components, and the parameters that will be measured have been selected. For example, the established monitoring schedule will depend on the timing, location, and magnitude of the marine debris removal events, which will vary by state and location.

7. Data Management

To the extent practicable, after consideration of ongoing federal and/or state-specific efforts (e.g., current protocols, existing databases), all environmental and biological data generated during monitoring activities will be documented using standardized field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, project-specific datasheets will be drafted prior to conducting any project monitoring activities. Electronic data file names should include the date on which the file was created, a ReadMe file that describes when and by whom the file was created, and any explanatory notes about the file contents. If a data file is revised, a new copy will be made and the original preserved. The Implementing Trustees will verify and validate monitoring data and information and will ensure that all data are entered or converted into agreed upon/commonly used digital format labeled with metadata.

7.1 Data Review and Clearance

A standardized reporting format would be developed to the extent practicable (e.g., from standardized data sheet). Prior to publication, data will be reviewed and verified for completeness. A quality check is done by comparing the entered electronic data to the original hard copy data sheet. Data are validated and any necessary corrections are made. Upon validation, data are approved for analysis, reporting and archiving.

After any and all errors are addressed, data are considered to have completed a QA/QC review. Before submitting the monitoring data and information package, Implementing Trustees shall confirm with one another that the package is approved for submission. The Implementing Trustees will give the other TIG members time to review the data before publication in DIVER. No data release can occur if it is contrary to federal or state laws.

7.2 Data Storage and Accessibility

After all data has been verified by QA/QC procedures, it will be stored on DIVER and, where applicable, on Implementing Trustee databases.

7.2 Data Sharing

Data will be made publicly available through DIVER and, where applicable, Implementing Trustee databases, in accordance with the applicable data sharing policies and regulations in operation at the time of data collection.

8. Reporting

Project monitoring reports will be prepared and uploaded to DIVER annually. In addition, consistent with Trustee Council Standard Operating Procedures and any future amendments, the Implementing Trustee will develop a final, high-level summary report prior to project close-out (Section 10.7.1 of SOPs; DWH NRDA Trustees 2016). This final report will provide a range of information about the project, including activities, key achievements, and lessons learned.

9. Roles and Responsibilities

This project would be implemented by multiple Trustees. NOAA, EPA, and selected Trustee agencies from Alabama, Florida, Louisiana, Mississippi, and Texas would work in cooperation with project partners (e.g., NGOs, state resource agencies, local governments) to implement the project and related MAM activities. Implementing Trustees' roles will be further identified in accordance with SOP Section 9.5.

10. Monitoring and Adaptive Management Budget

The budget for this project includes support for the full range of monitoring and adaptive management activities described above, including field sampling, data management, report writing, and adaptive management.

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Monitoring and Adaptive Management Plan: Conservation and Enhancement of Nesting and Foraging Habitat for Birds

1. Introduction, Purpose and Need, and Public Participation

This project Monitoring and Adaptive Management (MAM) Plan identifies the monitoring and data collection needed to evaluate progress toward meeting the project's objectives and to support necessary adaptive management. This plan was developed in accordance with the MAM Plan template provided in the MAM Manual Version 1.0 and was adapted to fit the needs of this project (DWH NRDA Trustees 2017a). This MAM Plan is a living document and will be updated as needed to reflect changing conditions. More specifically, the Regionwide Trustee Implementation Group (TIG) will update this plan as project components are more fully developed and siting and design activities are completed. While general areas of implementation and design are defined for this project, the exact locations and site-specific design details will be developed as a part of project implementation. Because such details have not yet been resolved, many aspects of this MAM Plan have not yet been determined (e.g., parameters to track, the method and frequency of measuring specific parameters). Future revisions to this document will be made publicly available as part of project implementation through the Data Integration, visualization, Exploration, and Reporting (DIVER) Portal (www.diver.orr.noaa.gov/web/guest/home) and accessible through the Trustee Council's website (www.habitat.noaa.gov/storymap/dwh/).

1.1 Project Overview

The large number of individuals, diversity of species, broad geographic range, and specific life history requirements of birds injured by the *Deepwater Horizon* (DWH) oil spill necessitate a portfolio of restoration techniques to address those injuries. Habitat loss and alteration together rank as one of the greatest threats to birds using the Gulf of Mexico. Habitat loss is extensive along the Gulf Coast and is related to numerous stressors, including human development, habitat modification, catastrophic weather, and sea-level rise from factors associated with climate change and coastal subsidence. This project proposes to restore, enhance, and protect nesting and foraging areas for multiple bird species across a wide range of habitats and locations in the Gulf of Mexico.

In particular, this project involves restoration activities at five sites (i.e., components) in the Gulf of Mexico to help meet regionwide bird habitat restoration objectives: (1) Chandeleur Islands, LA; (2) Pilot Town/Little Dauphin Island, AL; (3) San Antonio Bay Bird Island, TX; (4) Matagorda Bay Bird Island (Chester Island), TX; and (5) Round Island, MS. Implementing Trustees (Louisiana, Alabama, Texas, Mississippi, and the National Oceanic and Atmospheric Administration [NOAA]) would identify specific locations for habitat restoration during the planning stage of the project.

The above general project summary applies to all components of this project. The following section provides additional details that are specific to each component of the project.

- **Component 1: Chandeleur Islands, Louisiana:**
  - This engineering and design (E&D) project would focus on the initial planning phase of restoration of two islands: Chandeleur Island (the seagrass beds behind it and the southern fragmented portion) and New Harbor Island.
- **Component 2: Pilot Town/Little Dauphin Island, Alabama:**
  - This project component includes land acquisition and management of the Pilot Town tract, located on the southern edge of St. Andrews Bay on the Fort Morgan peninsula, adjacent to a unit of the Bon Secour National Wildlife Refuge, AL, and the acquisition of the Little Dauphin Island tract, located on Little Dauphin Island in the Mississippi Sound to the NE of Dauphin Island, AL.
- **Component 3: San Antonio Bay Bird Island, Texas:**
  - This project component would involve completing the construction of a bird rookery island on state-owned submerged lands. The proposed bird rookery island would measure approximately 920 feet long by 450 feet wide, and would have a total footprint of approximately 8 acres, including 4 acres of habitat above the shoreline and 1 acre of submerged reef habitat.
- **Component 4: Matagorda Bay Bird Island (Chester Island), Texas:**
  - Chester Island is a colonial waterbird nesting site in Matagorda Bay that is state-owned. This project would slow the erosion of Chester Island by adding up to 30 acres of beach habitat using dredged sediment and potentially constructing sediment control and shoreline protection structures such as groins and breakwaters.
- **Component 5: Round Island, Mississippi:**
  - This project component would implement colonial waterbird nesting habitat enhancement through vegetation management, habitat creation, predator control, debris removal, and potential future restoration at Round Island, which is a 220-acre area created with funding from the National Fish and Wildlife Foundation-Gulf Environmental Benefit Fund.

1.2 Restoration Type and Project-Specific Objectives

This project is primarily designed to address the Birds Restoration Type, as defined in the 2016 *Deepwater Horizon* Oil Spill Final Programmatic Damage Assessment and Restoration Plan/Programmatic Environmental Impact Statement (PDARP/PEIS). (The PDARP/PEIS and the Record of Decision (ROD) are available at www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan/.) The overall objectives for birds that are relevant to this project, as identified in the *Strategic Framework for Bird Restoration Activities* (DWH NRDA Trustees 2017b) include:

- Restore lost birds by facilitating additional production and/or reduced mortality of injured bird species.
- Restore or protect habitats on which injured birds rely.

- Restore injured birds by species where actions would provide the greatest benefits within geographic ranges that include the Gulf of Mexico.

The overall objective for this project is to conduct nesting and foraging habitat conservation, including creation, restoration, and enhancement activities, for the benefit of multiple bird species across a range of habitats. Target species and component-specific objectives will be identified as part of the project planning process.

1.3 Conceptual Setting

The project would utilize consistent restoration techniques in Alabama, Louisiana, Mississippi, and Texas to conserve and enhance nesting and foraging habitats for birds. The restoration techniques proposed would directly address habitat loss and degradation stressors that impact birds. Habitat conservation and enhancement projects based on the anticipated restoration techniques have been widely implemented. This restoration project would complement and enhance, on a regionwide scale, ongoing efforts of DWH Trustees and other partners to address habitat loss and degradation of nesting and foraging habitats in individual sites. Habitat restoration activities are expected to provide ancillary benefits to other species and improve quality of habitats such as seagrass beds, beaches, dunes, and marshes that were impacted by the oil spill.

External drivers that could affect achievement of project objectives include frequency and severity of storms and prevailing abiotic conditions that influence sand and sediment deposition and transport patterns, which could negatively affect habitat creation and restoration efforts. Ecosystem linkages and factors that could influence this habitat restoration and conservation project include the location and availability of dredge material (where new habitat is being formed or restored), suitability and quality of created or restored habitat to support ecological needs of bird species, proximity of other rookeries from which birds might colonize the new habitats, and connectivity with foraging areas and migratory routes (where applicable).

1.3.1 Potential Sources of Uncertainty

Potential sources of uncertainty are defined as those that may affect the ability to achieve project restoration objectives. Sources of uncertainty, the degree of uncertainty, and the level of uncertainty associated with project components will vary.

Uncertainties or information gaps have the potential to affect adaptive management decisions for individual or multiple restoration projects. These decisions may include how to improve the likelihood of achieving favorable project outcomes or selecting corrective actions in the event a project is not performing as intended.

Potential sources of uncertainty could include (but are not limited to):

- Land use changes
- Frequency of high-intensity overwash or nest site flooding
- Short- and long-term fate of natural or placed material
- Natural variability in ecological and physical processes, such as wave-driven transport or vegetation growth, and in the associated habitat responses

- Occurrence of sufficient numbers of adults of the target bird species to support a breeding colony
- Response of target birds to the restoration techniques
- Occurrence of forage base to support a breeding colony
- Return rates to breeding colonies
- Climate variability, such as changes in extreme weather events, sea level rise, changes in freshwater inflows, etc., and the resulting effects on bird survival and reproductive success
- Quality and availability of baseline data on bird habitat use and other relevant biological parameters
- The ability to identify appropriate areas in which to target restoration efforts
- Whether, when, and to what extent benefits to bird populations will manifest in measurable ways
- Measurement of improvements in pertinent, location-appropriate metrics of habitat quality
- Effective coordination between Trustee and non-Trustee project partners during entire project lifecycles
- Effective coordination of resource-level monitoring across projects implementing different techniques

This list should not be considered exhaustive; additional uncertainties may be identified as the project is implemented and monitored. These uncertainties may affect the achievement of the restoration objectives of the project. For example, if the intensity and frequency of hurricanes increase in the region, nesting areas could be impacted. The target species for this project are highly vulnerable to disturbance because they commonly forage and nest in areas that are also highly utilized by humans, and they are located in areas that are susceptible to weather disturbance events such as hurricanes (Enwright et al. 2017). If any drivers or stressors are negatively impacting the project, adaptive management may be necessary to ensure that project objectives are being achieved. The adaptive management strategy for this project is outlined in Section 3.

2. Project Monitoring

Performance monitoring would be conducted to evaluate project success and identify the need for potential corrective actions or adaptive management. It is likely that the activities implemented in each project component will not be identical, given differences in site conditions that are likely to be present. Therefore, specific parameters and methodologies will be identified as part of an update to this MAM Plan. Potential project objectives and monitoring parameters that could be used to assess and track progress and performance are described below. Monitoring parameters would be established consistent with the MAM Manual Version 1.0 (DWH NRDA Trustees 2017a).

Efforts would be made to apply a consistent methodology for project monitoring. Resource-level monitoring is intended to support bird restoration by fulfilling data and information needs common across groups of projects. Coordinated monitoring across sites, states, and potentially beyond the northern Gulf of Mexico may be needed to enable characterization of overall restoration success.

Relevant baseline information is critical to monitor the progress of restoration project implementation against current conditions. At the outset of this project, information should be compiled to establish relevant baselines to facilitate robust monitoring and evaluation of project implementation. Baseline information could come from existing sources or data collected at the beginning of the project. For this project, examples of relevant baseline information might include:

- Data on bird population distribution, abundance, and trends, and relevant biological data (e.g., reproductive output, survivorship)
- Nesting and foraging areas that host bird species with documented DWH oil spill injuries
- Condition and area (e.g., acreage) of habitats identified for restoration efforts
- Indicators and benchmarks (values of the indicators) associated with habitat quality sufficient to support bird nesting and foraging
- Identification of existing restoration, protection, and outreach efforts to conserve and enhance bird habitat being performed by Trustees and non-Trustee organizations

Underpinning all objectives of this project, a general monitoring parameter should include metrics of bird abundance and occupancy of habitat by species (e.g., number of pairs, number of nests, number of colonies) where specific habitat enhancement activities are conducted.

At the outset of implementation for each project component, the Implementing Trustee would define specific restoration objectives, activities, and associated monitoring parameters and metrics as relevant for the focal species and their habitats. The geographic area and specific components of the sampling design for each activity would also be defined. This section describes a general monitoring objective and example parameters and metrics that could be used to assess the components of this project. The following table provides draft project objectives and potential parameters that could be used in project monitoring; it is preliminary and is not exhaustive or prescriptive.

Draft project objective and potential parameters

Draft Project Objective	Potential Parameters
Increase acreage of conserved or enhanced regional nesting and foraging habitat to benefit multiple bird species	• Key areas identified for habitat restoration, conservation, and management • Nature, number, extent, duration, and timing of management actions for habitats conserved, enhanced, or restored, including engineering and design planning • Acreage of conserved or enhanced habitat, by habitat type and focal species • Improvement in habitat quality, based on indicators and benchmarks, by habitat type and focal species • Area monitored and other metrics of monitoring efforts (e.g., number of transects, number of sites, number of colonies) • Bird abundance, density, or occupancy (e.g., number of pairs, number of nests, number of colonies) • Bird nesting success, survival, and productivity

3. Adaptive Management

As discussed in the PDARP/PEIS, adaptive management is a form of structured decision-making applied to the management of natural resources in the face of uncertainty (Pastorok et al. 1997; Williams 2011). It is an iterative process that integrates monitoring and evaluation of management actions with flexible decision-making, where adjustments are made to management approaches based on observed outcomes (NRC 2004). Within the context of ecological restoration, adaptive management addresses key uncertainties by linking science to restoration decision-making (Steyer and Llewellyn 2000; Thom et al. 2005). Performance may be evaluated in terms of implementation of the project plan, expected project outputs, or the ability of the project to achieve the desired restoration outcomes.

The project would apply consistent restoration techniques across multiple Restoration Areas to directly address habitat loss and degradation stressors that impact birds. Data collected on bird abundance and habitat occupancy and use will be fundamental monitoring parameters underpinning all activities of this regionwide project. These data would inform adaptive management needed during implementation and future restoration planning, such as adjusting the types and amount of effort invested in particular locations to improve habitat conservation and enhancement activities. Where gaps in scientific understanding exist, an adaptive management approach may involve additional science support activities such as targeted data collection to reduce key uncertainties or other analyses that inform the selection, design, and optimization of restoration projects.

4. Evaluation

Project MAM would include carefully planned evaluations of the selected parameters (potentially including the example in Section 2.1) throughout the project's lifetime. By thoughtfully designing evaluation methods for the design and implementation of project restoration activities, the project team could assess if the project is meeting its restoration objectives and could determine the need for adaptive management. Evaluation of project success would involve comparing target values to the baseline values for each parameter. As specific parameters for given project components are selected, this MAM Plan will be updated accordingly.

5. Project-Level Decisions: Performance Criteria and Potential Corrective Actions

This section describes how knowledge gained from the evaluation of the monitoring data described in Section 2.1 would be used at the project-level (1) to determine whether the project, once implemented, is considered successful, and (2) to inform the need for potential corrective actions. Project success would be determined by comparing monitoring data to project-specific performance criteria for the key parameters related to the restoration objectives described in Section 2. Performance criteria and potential corrective actions will continue to be developed, and this MAM Plan will be updated accordingly. For example, thresholds for corrective action will need to be determined by the project team on a case-by-case basis, and may be adjusted over time.

6. Monitoring Schedule

The project monitoring schedule will be determined when project implementation plans are completed for each project component, wherein the monitoring parameters will be identified.

7. Data Management

To the extent practicable, after consideration of ongoing federal and/or state-specific efforts (e.g., current protocols, existing databases), all environmental and biological data generated during monitoring activities will be documented using standardized field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, project-specific datasheets will be drafted prior to conducting any project monitoring activities. Electronic data file names should include the date on which the file was created, a ReadMe file that describes when and by whom the file was created, and any explanatory notes about the file contents. If a data file is revised, a new copy will be made and the original preserved. The Implementing Trustees will verify and validate monitoring data and information and will ensure that all data are entered or converted into agreed upon/commonly used digital format labeled with metadata.

7.1 Data Review and Clearance

A standardized reporting format would be developed to the extent practicable (e.g., from standardized data sheet). Prior to publication, data will be reviewed and verified for completeness. A quality check is done by comparing the entered electronic data to the original hard copy data sheet. Data are validated and any necessary corrections are made. Upon validation, data are approved for analysis, reporting and archiving.

After any and all errors are addressed, data are considered to have completed a QA/QC review. Before submitting the monitoring data and information package, Implementing Trustees shall confirm with one another that the package is approved for submission. The Implementing Trustees will give the other TIG members time to review the data before publication in DIVER. No data release can occur if it is contrary to federal or state laws.

7.2 Data Storage and Accessibility

After all data has been verified by QA/QC procedures, it will be stored on DIVER and, where applicable, on Implementing Trustee databases.

7.3 Data Sharing

Data will be made publicly available through DIVER and, where applicable, Implementing Trustee databases, in accordance with the applicable data sharing policies and regulations in operation at the time of data collection.

8. Reporting

Project monitoring reports will be prepared and uploaded to DIVER annually. In addition, consistent with Trustee Council Standard Operating Procedures and any future amendments, the Implementing Trustee will develop a final, high-level summary report prior to project close-out (Section 10.7.1 of SOPs; DWH NRDA Trustees 2016). This final report will provide a range of information about the project, including activities, key achievements, and lessons learned.

9. Roles and Responsibilities

This project would be implemented by multiple Trustees. DOI and selected Trustee agencies from Alabama, Louisiana, Mississippi, and Texas would work in cooperation with project partners (e.g., nongovernmental organizations [NGOs], state resource agencies, local governments) to implement the project and related MAM activities. Implementing Trustees' roles will be further identified in accordance with SOP Section 9.5.

10. Monitoring and Adaptive Management Budget

The budget for this project includes support for the full range of monitoring and adaptive management activities described above, including field sampling, data management, report writing, and adaptive management.

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Monitoring and Adaptive Management Plan: Bird Nesting and Foraging Area Stewardship

1. Introduction, Purpose and Need, and Public Participation

This project Monitoring and Adaptive Management (MAM) Plan identifies the monitoring and data collection needed to evaluate progress toward meeting the project's objectives and to support necessary adaptive management. This plan was developed in accordance with the MAM Plan template provided in the MAM Manual Version 1.0 and was adapted to fit the needs of this project (DWH NRDA Trustees 2017a). This MAM Plan is a living document and may be updated as needed to reflect changing conditions. More specifically, the Regionwide Trustee Implementation Group (TIG) will update this plan as project components are more fully developed and siting and design activities are completed. While general areas of implementation and design are defined for this project, the exact locations and site-specific design details will be developed as a part of project implementation. Because such details have not yet been resolved, many aspects of this MAM Plan have not yet been determined (e.g., parameters to track, the method and frequency of measuring specific parameters). Future revisions to this document will be made publicly available as part of project implementation through the Data Integration, Visualization, Exploration, and Reporting (DIVER) Portal (www.diver.orr.noaa.gov/web/guest/home) and accessible through the Trustee Council's website (www.habitat.noaa.gov/storymap/dwh/).

1.1 Project Overview

The Gulf of Mexico coastal region supports a diversity of coastal bird species throughout the year, as nesting grounds during the breeding period, as a stopover for migrating species in the spring and fall, and as wintering habitat for numerous species that breed elsewhere. This project would steward and monitor beach-nesting birds by reducing human disturbance and predation of nests and chicks of coastal nesting shorebird species injured by the *Deepwater Horizon* (DWH) oil spill. It would also reduce disturbances to birds during stopover and overwintering periods, which could help increase bird productivity and survival.

This project would involve various activities at multiple locations along the Gulf Coast to conserve and enhance nesting and foraging habitats for birds. The activities proposed would directly address anthropogenic stressors, habitat degradation, and other stressors that impact birds. This restoration project would complement and enhance ongoing efforts of the Implementing Trustees and other partners to address habitat loss and degradation to nesting and foraging habitats through stewardship projects. Stewardship may be implemented in several ways, depending on the location, and could include:

- Stewardship of nesting areas to reduce human disturbance (e.g., exclusion devices and vegetated buffers, virtual fencing around nesting areas, and/or beach wrack and distance buffers)
- Lethal and nonlethal predator control
- Vegetation management

- Nesting platforms
- Signage
- Development of site management plans
- Rooftop management
- Implement or increase monitoring coverage
- Lowered vehicle speed limits or reduced vehicular access
- Bird banding and recapture/re-siting
- Patrols by wildlife stewards or law enforcement (including training and support)
- Targeted community engagement, outreach, and education

Specific activities and target locations may vary from year to year based on a number of factors including where nesting and foraging occurs, what management activities are most successful at each area, and where project implementers are supported by site land managers. The project would occur in coastal Texas, Mississippi, Alabama, and Florida. Proposed initial target areas may include:

- Mississippi: Hancock, Harrison, and Jackson counties and coastal and barrier islands in the Mississippi Sound
- Alabama: Mobile and Baldwin counties and coastal islands in Mobile Bay and the Mississippi Sound
- Florida: Florida Gulf Coast counties (Escambia to Monroe) and some select sites in NE Florida (Nassau, Duval, and St. Johns counties)
- Texas: Texas Gulf Coast counties within the Coastal Zone Boundary

This project would provide a number of benefits, including, but not limited to increasing acreage of protected regional nesting and foraging habitats of beach-nesting birds (e.g., wintering habitat, migratory stopover sites); increasing bird nesting success, survival, and production; increasing acreage of habitat under stewardship and management; increasing public awareness; and establishing and implementing an adaptive management framework to assess threats, implement strategies to address those threats, monitor success, and adapt within season and, where appropriate, across seasons.

1.2 Restoration Type and Project-Specific Objectives

This project is primarily designed to address the Birds Restoration Type, as defined in the 2016 *Deepwater Horizon* Oil Spill Final Programmatic Damage Assessment and Restoration Plan/Programmatic Environmental Impact Statement (PDARP/PEIS). (The PDARP/PEIS and the Record of Decision (ROD) are available at www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan/.) The overall objectives for birds that are relevant to this project, as identified in the *Strategic Framework for Bird Restoration Activities* (DWH NRDA Trustees 2017b) include:

- Restore lost birds by facilitating additional production and/or reduced mortality of injured bird species.
- Restore or protect habitats on which injured birds rely.
- Restore injured birds by species where actions would provide the greatest benefits within geographic ranges that include the Gulf of Mexico.

The overall project restoration objective is to directly address anthropogenic stressors, protect and restore habitat, and reduce other stressors that impact birds that use beaches for nesting, rearing, foraging, resting and refueling during migratory stopovers, and overwintering. It would also increase public awareness of bird conservation issues. Target species and more specific project objectives and locations will be identified as part of the project planning process.

1.3 Conceptual Setting

The project would utilize consistent restoration techniques across multiple Gulf states to conserve and enhance nesting and foraging habitats for birds (i.e., Alabama, Florida, Mississippi, and Texas). Stewardship projects based on the restoration techniques have been widely implemented, and would complement and enhance, on a regionwide scale, ongoing efforts of DWH Trustees and other partners to address habitat loss and degradation to nesting and foraging habitats in individual Restoration Areas.

Drivers are outside forces, natural or anthropogenic, that have the potential to influence the outcomes of a restoration project (DWH NRD Trustees 2017b: Section E.6.3). Drivers tend to be large-scale, long-term forces that are not easily controlled at the scale of a single restoration project (Harwell et al. 2016). External drivers that could affect achievement of project objectives include natural disturbances (e.g., red tide events, sea level rise, catastrophic weather, storms, frequency and intensity of overwash, and flooding in restored areas) that could negatively affect habitat creation and restoration efforts; human disturbance and the willingness of the public to engage in stewardship efforts; and changes in land and resource use. Ecosystem linkages and factors that could influence this habitat restoration and conservation project include the suitability and quality of created or restored habitat to support ecological needs of bird species; proximity of other nesting locations from which birds might colonize the new habitats; connectivity with foraging areas; migratory routes (where applicable), and other important bird habitat types.

1.3.1 Potential Sources of Uncertainty

Potential sources of uncertainty are defined as those that may affect the ability to achieve project restoration objectives. The sources of uncertainty, the degree of uncertainty, and the level of uncertainty associated with project components are expected to vary.

Uncertainties or information gaps have the potential to affect adaptive management decisions for individual or multiple restoration projects. These decisions may include how to improve the likelihood of achieving favorable project outcomes or selecting corrective actions in the event a project is not performing as intended.

Potential sources of uncertainty could include (but are not limited to):

- Land use changes
- Whether people respond positively to stewardship efforts to reduce disturbance
- Frequency of high-intensity overwash or nest site flooding
- Short- and long-term fate of natural and placed material
- Natural variability in ecological and physical processes (such as wave-driven transport or vegetation growth) and in the associated habitat responses

- Occurrence of sufficient numbers of adults of the target bird species to support a breeding colony
- Response of target birds to the restoration techniques
- Occurrence of forage base to support beach-nesting birds
- Return rates to breeding locations
- Climate variability, such as changes in extreme weather events, sea level rise, changes in freshwater inflows, etc., and the resulting effects on bird survival and reproductive success
- Quality and availability of baseline data on bird habitat use and other relevant biological parameters
- The ability to identify appropriate areas in which to target restoration efforts
- Whether, when, and to what extent benefits to bird populations will manifest in measurable ways
- Effective coordination among Trustee and non-Trustee project partners during entire project lifecycles
- Effective coordination of resource-level monitoring across projects implementing different techniques
- Efficacy of public education efforts in improving stewardship and protection of nesting and foraging areas

This list should not be considered exhaustive; additional uncertainties may be identified as the project is implemented and monitored. These uncertainties may affect the achievement of the restoration objectives of the project. For example, if the intensity and frequency of hurricanes increase in the region, nesting areas could be impacted. The target species for this project are highly vulnerable to disturbance because they commonly forage and nest in areas that are also highly utilized by humans, and they are located in areas that are susceptible to weather disturbance events such as hurricanes (Enwright et al. 2017). If any drivers or stressors are negatively impacting the project, adaptive management may be necessary to ensure that project objectives are being achieved. The adaptive management strategy for this project is outlined in Section 3.

2. Project Monitoring

Performance monitoring would be conducted to evaluate project success and identify the need for potential corrective actions or adaptive management. It is likely that the activities implemented in each project component will not be identical, given differences in site conditions that are likely to be present. Therefore, specific parameters and methodologies will be identified as part of an update to this MAM Plan. Potential project objectives and monitoring parameters that could be used to assess and track project progress and performance are described below. Monitoring parameters would be established consistent with the MAM Manual Version 1.0 (DWH NRDA Trustees 2017a).

Efforts would be made to apply a consistent methodology for project monitoring. Resource-level monitoring is intended to support bird restoration by fulfilling data and information needs common across groups of projects. Coordinated monitoring across sites, states, and potentially beyond the northern Gulf of Mexico is needed to enable characterization of overall restoration success. Coordination would include consideration of ongoing state-specific efforts. For example, in Florida, data is collected according to the Breeding Bird Protocol for Shorebirds and

Seabirds. Since 2011, the associated Florida Shorebird Database, a centralized data repository for all breeding information, has been the data source for all reproductive metrics.

Relevant baseline information is critical to monitor the progress of restoration project implementation against current conditions. At the outset of this project, information should be compiled to establish relevant baselines to facilitate robust monitoring and evaluation of project implementation. Baseline information could come from existing sources or data collected at the beginning of the project. For this project, examples of relevant baseline information might include:

- Data on bird population distribution, abundance, and trends, and relevant biological data (e.g., reproductive output, survivorship)
- Nesting and foraging areas that host bird species with documented DWH oil spill injuries
- Condition and area (e.g., acreage) of habitats identified for restoration efforts
- Reports or studies of incidents of predation (particularly by mammals) on birds
- Assessment of existing threats to important nesting and foraging areas
- Identification of existing restoration, protection, and outreach efforts to enhance bird habitat stewardship being performed by Trustees and non-Trustee organizations
- Number of locations with symbolic fencing or signage informing the public of permitted recreational use in areas designated for bird nesting or foraging

Underpinning all objectives of this project, a general monitoring parameter should include metrics of bird abundance and occupancy of habitat by species (e.g., number of pairs, number of nests, number of colonies) where specific stewardship activities are conducted.

At the onset of implementation for each project component, the Implementing Trustee would define specific restoration objectives, activities, and associated monitoring parameters and metrics relevant for the focal species and their habitats. The geographic area and specific components of the sampling design for each activity would also be defined. Thus, this section describes general monitoring objectives and example parameters and metrics that are likely to be relevant to assess the components of this project. The following table provides draft project objectives and potential parameters that could be used in project monitoring; it is preliminary and is not exhaustive or prescriptive.

Draft project objective and potential parameters

Draft Project Objectives	Potential Parameters
Protect and restore bird habitat and reduce key stressors that impact birds that use beaches for nesting, rearing, foraging, resting and refueling during migratory stopovers, and overwintering	• Key areas identified for habitat restoration, conservation, and management; • Acreage of protected habitat, by habitat type and focal species; • Area monitored and other metrics of monitoring efforts (e.g., number of transects, number of sites, number of colonies); • Bird abundance, density, or occupancy (e.g., number of pairs, number of nests, number of colonies); • Bird nesting success, survival, and production
Maintain or increase public awareness of bird conservation issues	• Acreage of posted signage describing permitted recreational uses in designated areas; • Number and type of educational opportunities (e.g., presentations to key stakeholders and user groups, law enforcement training sessions, and on-site visitor engagements) including number of individuals educated; • Number and type of outreach materials distributed (e.g., mailers to beachfront residents, content through earned or traditional media).

3. Adaptive Management

As discussed in the PDARP/PEIS, adaptive management is a form of structured decision-making applied to the management of natural resources in the face of uncertainty (Pastorok et al. 1997; Williams 2011). It is an iterative process that integrates monitoring and evaluation of management actions with flexible decision-making, where adjustments are made to management approaches based on observed outcomes (NRC 2004). Within the context of ecological restoration, adaptive management addresses key uncertainties by linking science to restoration decision-making (Steyer and Llewellyn 2000; Thom et al. 2005). Performance may be evaluated in terms of implementation of the project plan, expected project outputs, or the ability of the project to achieve the desired restoration outcomes.

Data collected on bird abundance, habitat occupancy, and habitat use would inform adaptive management needed during implementation and/or future restoration planning. Corrective actions could include adjusting the types and amount of effort invested in particular locations to enhance habitat stewardship activities, and perhaps identification of additional locations that warrant inclusion in project activities. Where gaps in scientific understanding exist, an adaptive management approach to bird restoration may involve additional science support activities such as targeted data collection to reduce key uncertainties or other analyses that inform the selection, design, and optimization of restoration projects.

4. Evaluation

Project MAM would include carefully planned evaluations of the selected parameters (potentially including the examples in Section 2) throughout the project’s lifetime. By thoughtfully designing evaluation methods for the design and implementation of project restoration activities, the project team could assess if the project is meeting its restoration objectives and could determine the need for adaptive management. Evaluation of project success would involve comparing target values to the baseline values for each parameter. As specific parameters for given project components are selected, this MAM Plan will be updated accordingly.

5. Project-Level Decisions: Performance Criteria and Potential Corrective Actions

This section describes how knowledge gained from the evaluation of the monitoring data described in Section 2 would be used at the project-level (1) to determine whether the project, once implemented, is considered successful, and (2) to inform the need for potential corrective actions. Project success would be determined by comparing monitoring data to project-specific performance criteria for the key parameters related to the restoration objectives described in Section 2. Performance criteria and potential corrective actions will continue to be developed, and this MAM Plan will be updated accordingly. For example, thresholds for corrective action will need to be determined by the project team on a case-by-case basis, and may be adjusted over time.

6. Monitoring Schedule

The project monitoring schedule will be determined when project implementation plans are completed for each project component, wherein the monitoring parameters will be identified.

7. Data Management

To the extent practicable, after consideration of ongoing federal and/or state-specific efforts (e.g., current protocols, existing databases), all environmental and biological data generated during monitoring activities will be documented using standardized field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, project-specific datasheets will be drafted prior to conducting any project monitoring activities. Electronic data file names should include the date on which the file was created, a ReadMe file that describes when and by whom the file was created, and any explanatory notes about the file contents. If a data file is revised, a new copy will be made and the original preserved. The Implementing Trustees will verify and validate monitoring data and information and will ensure that all data are entered or converted into agreed upon/commonly used digital format labeled with metadata.

7.1 Data Review and Clearance

A standardized reporting format would be developed to the extent practicable (e.g., from standardized data sheet). Prior to publication, data will be reviewed and verified for completeness. A quality check is done by comparing the entered electronic data to the original hard copy data sheet. Data are validated and any necessary corrections are made. Upon validation, data are approved for analysis, reporting and archiving.

After any and all errors are addressed, data are considered to have completed a QA/QC review. Before submitting the monitoring data and information package, Implementing Trustees shall confirm with one another that the package is approved for submission. The Implementing

Trustees will give the other TIG members time to review the data before publication in DIVER. No data release can occur if it is contrary to federal or state laws.

7.2 Data Storage and Accessibility

After all data has been verified by QA/QC procedures, it will be stored on DIVER and, where applicable, on Implementing Trustee databases.

7.3 Data Sharing

Data will be made publicly available through DIVER and, where applicable, Implementing Trustee databases, in accordance with the applicable data sharing policies and regulations in operation at the time of data collection.

8. Reporting

Project monitoring reports will be prepared and uploaded to DIVER annually. In addition, consistent with Trustee Council Standard Operating Procedures and any future amendments, the Implementing Trustee will develop a final, high-level summary report prior to project close-out (Section 10.7.1 of SOPs; DWH NRDA Trustees 2016). This final report will provide a range of information about the project, including activities, key achievements, and lessons learned.

9. Roles and Responsibilities

This project would be implemented by selected Trustee agencies in Alabama, Florida, Mississippi, and Texas, who would work in cooperation with project partners (e.g., nongovernmental organizations [NGOs], state resource agencies, local governments) to implement the project and related MAM activities. Implementing Trustees' roles will be further identified in accordance with SOP Section 9.5.

10. Monitoring and Adaptive Management Budget

The budget for this project includes support for the full range of monitoring and adaptive management activities described above, including field sampling, data management, report writing, and adaptive management.

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Monitoring and Adaptive Management Plan: Voluntary Modifications to Commercial Shrimp Lazy Lines to Reduce Dolphin Entanglements

1. Introduction, Purpose and Need, and Public Participation

This project Monitoring and Adaptive Management (MAM) Plan identifies the monitoring and data collection needed to evaluate progress toward meeting the project's objectives and to support necessary adaptive management. This plan was developed in accordance with the MAM Plan template provided in the MAM Manual Version 1.0 and was adapted to fit the needs of this project (DWH NRDA Trustees 2017a). This MAM Plan is a living document and will be updated as needed to reflect new information or changing conditions. More specifically, the Regionwide Trustee Implementation Group (TIG) will update this plan as project components are more fully developed and siting and design activities are completed. While general areas of implementation and design are defined for this project, the exact locations and site-specific design details will be developed as a part of project implementation. Because such details have not yet been resolved, many aspects of this MAM Plan have not yet been determined (e.g., parameters to track, the method and frequency of measuring specific parameters). Future revisions to this document will be made publicly available as part of project implementation through the Data Integration, Visualization, Exploration, and Reporting (DIVER) Portal (www.diver.orr.noaa.gov/web/guest/home) and accessible through the Trustee Council's website (www.habitat.noaa.gov/storymap/dwh/).

1.1 Project Overview

This project aims to benefit Gulf of Mexico bottlenose dolphins (*Tursiops truncatus*) by decreasing the number of entanglements and associated mortality of dolphins in the lazy lines of commercial shrimp vessels (otter and skimmer) operating within state inshore and coastal waters. Accidental capture of bottlenose dolphins in shrimp trawls or entanglement in lazy lines has been observed, and as a result, hundreds of dolphins are killed per year by the commercial shrimp trawl fishery in the Gulf of Mexico. From 1993 to 2019, the majority of observed dolphin mortalities in the Gulf of Mexico shrimp fishery were caused by entanglement in lazy lines. Lazy lines float free during active trawling, and as the net is hauled back, it is retrieved with a boat or grappling hook to guide and empty the trawl nets. Lazy lines are commonly made from a relatively "soft" polypropylene material, which can readily loop and entangle a dolphin. Prior research has identified alternative materials for lazy lines that could less readily loop and entangle dolphins, and these materials show promise for additional testing. These materials are also likely to appeal to commercial shrimpers because these materials could help the shrimpers avoid dolphin entanglements without interfering with their fishing activity or reducing their catch. This project would be designed to have researchers and the fishing community cooperatively test the performance and usability of previously identified alternative lazy line materials. After in-water testing, the project team would identify the preferred lazy line material that facilitates successful fishing while also decreasing the potential for lethal dolphin entanglements. A plan would then be cooperatively developed to encourage the shrimp trawl fleet to voluntarily adopt the use of the alternative lazy line materials.

The Implementing Trustee for this project would be the National Oceanic and Atmospheric Administration (NOAA). The following locations in the Gulf of Mexico would be considered for in-water testing, based on commercial shrimp trawl activity and occurrence of a representative sample of various bottlenose dolphin bay, sound, and estuary (BSE) and coastal stocks, potentially including: Galveston, Texas (includes the Galveston Bay and West Bay BSE stocks, and the Western Coastal stock); Venice, Louisiana (includes the Barataria Bay Estuarine System and Mississippi River Delta BSE stocks, and the Western and Northern Coastal stocks); Pascagoula, Mississippi (includes the Mississippi Sound and Mobile Bay BSE stocks, and the Northern Coastal stock); and Panama City, Florida (includes the St. Andrew Bay and St. Joseph Bay BSE stocks, and the Northern Coastal stock).

1.2 Restoration Type and Project-Specific Objectives

This project primarily addresses the Marine Mammals Restoration Type, defined in the 2016 *Deepwater Horizon* Oil Spill Final Programmatic Damage Assessment and Restoration Plan/Programmatic Environmental Impact Statement (PDARP/PEIS). (The PDARP/PEIS and the Record of Decision (ROD) are available at www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan/.) The overall goals for this Restoration Type relevant to this project, as identified in the *Strategic Framework for Marine Mammal Restoration Activities* (DWH NRDA Trustees 2017b) include:

- Implement an integrated portfolio of restoration approaches to restore injured BSE, coastal, shelf, and oceanic marine mammals across the diverse habitats and geographic ranges they occupy.
- Identify and implement restoration activities that mitigate key stressors in order to support resilient populations. Collect and use monitoring information, such as population and health assessments and spatiotemporal distribution information.
- Identify and implement actions that support ecological needs of the stocks; improve resilience to natural stressors; and address direct human-caused threats such as bycatch in commercial fisheries, vessel collisions, noise, industrial activities, illegal feeding and harassment, and hook-and-line fishery interactions.

This project aims to provide restoration benefits to bottlenose dolphins in the Gulf of Mexico by decreasing the number of entanglements and associated mortality of dolphins in commercial shrimp trawl lazy lines. Specific project objectives include:

- Collaboratively conducting in-water testing with shrimpers and researchers to test the performance and usability of alternative lazy lines to determine the most effective at meeting the project objective
- Developing a plan for voluntarily implementing in the shrimp trawl fleet the use of an alternative lazy line as identified through cooperative testing
- Partnering with stakeholders to potentially implement the voluntary or incentivized use of the identified alternative lazy line

These project objectives may be further refined in future versions of this MAM Plan.

1.3 Conceptual Setting

Data on bottlenose dolphin threats, injuries, and mortalities are collected and analyzed by NOAA and will be used to help establish baseline conditions for this project. The majority of the observed bottlenose dolphin mortalities in regional commercial shrimp trawls are from entanglement in shrimp trawl lazy lines versus capture within the trawl body. Alternative lazy lines that could prevent entanglements have been identified through prior testing. However, these alternatives have not been robustly tested to account for potential fishing and dolphin behavior variables by area to ensure the selected alternative lazy line type would be successful for use across the Gulf of Mexico. Another key factor that may affect project implementation and performance include the level of buy-in of commercial shrimpers, which may be influenced by logistical constraints, cost constraints, or perception. Changes to the fishery itself, whether due to economic, policy, or environmental considerations, would also likely affect project implementation and performance. Conducting collaborative in-water testing with the commercial shrimp industry across the region and developing voluntary implementation plans would help mitigate these factors. The shrimp fishery is also a threat to other resources (e.g., sea turtles and protected fish species), and the activities undertaken in this project should be coordinated with restoration projects targeting those resources.

Bottlenose dolphins face a variety of natural and anthropogenic stressors and will be the focus of a variety of restoration and conservation efforts. Therefore, the DWH restoration activities to support these resources need to be well coordinated and multifaceted—one project must be considered in the context of the whole restoration portfolio. When evaluating and monitoring project success, it is important to look across the set of restoration projects for these resources and determine whether it is appropriate to provide complimentary management activities or to address other threats.

1.3.1 Potential Sources of Uncertainty

This project relies on existing data and future data collection to inform management decisions and stakeholder buy-in. A number of potential sources of uncertainty could affect project performance and success. Potential sources of uncertainties include:

- Data limitations and biases in existing regional commercial shrimp fishery mortality estimates for bottlenose dolphins
- Changes in shrimp fishery activity (spatially, temporally, size, gear) in the future (e.g., responding to changing regulations, economic activity)
- Changes in cetacean activity and behavior in the future (e.g., responding to changing environmental conditions, human activities)
- Changes in responsiveness and behavior by commercial shrimpers
- Similarities and differences of dolphin interactions with shrimpers in each area of the Gulf of Mexico
- The quality, availability, and usability of existing data
- The ability to cultivate sufficient regional buy-in from stakeholders
- The likelihood that restoration actions would reduce cetacean mortality
- The ability to quantify restoration benefits from implemented actions (e.g., observer coverage is not sufficient to detect a relative percent change of lazy line entanglements)

This list should not be considered exhaustive; additional uncertainties may be identified as the project is further developed, implemented, and monitored. These uncertainties may affect the achievement of the restoration objectives of the project. For example, changes in economic, social, or political conditions may make fisherman less willing to adopt or test novel gear to reduce dolphin entanglements. If any drivers or stressors negatively affect the project, adaptive management may be necessary to ensure project objectives are being achieved. The adaptive management strategy for the project is outlined in Section 3.

2. Project Monitoring

Performance monitoring would be conducted to evaluate project success and to identify the need for potential corrective actions or adaptive management. It is likely that the activities implemented in each project component or geographic location across the Gulf of Mexico will not be identical, given differences in site conditions that are likely to be present. Therefore, updated objectives and specific parameters and methodologies would be identified as part of an update to this MAM Plan. The following table provides draft project objectives and potential parameters that could be used in project monitoring; it is preliminary and is not exhaustive or prescriptive.

Draft project objective and potential parameters

Draft Project Objectives	Potential Parameters
Collaboratively conducting in-water testing with shrimpers and researchers to test the performance and usability of alternative lazy lines to determine the most effective at meeting the project goal	• Development of an in-water testing plan with study design, standardized protocols, procedures for evaluating alternative lazy line materials/techniques, and key personnel for training and implementation • Number of completed vessel trips for in-water testing • Reporting of key findings from in-water testing and potential future implementation actions • Identification of effective alternative lazy line material(s)
Developing a plan for voluntarily implementing in the shrimp trawl fleet the use of an alternative lazy line as identified through cooperative testing	• Development of a list of potential mechanisms to encourage voluntary adoption of the recommended alternative lazy line materials/techniques • Development of a specific voluntary implementation plan for reducing dolphin entanglements in shrimp lazy lines
Partnering with Stakeholders to Implement the Voluntary Use of the Identified Alternative Lazy Line	• Number of shrimpers educated about adopting alternative lazy lines • Number of shrimpers providing feedback about performance and usability of alternative lazy lines

3. Adaptive Management

As discussed in the PDARP/PEIS, adaptive management is a form of structured decision-making applied to the management of natural resources in the face of uncertainty (Pastorok et al. 1997; Williams 2011). It is an iterative process that integrates monitoring and evaluation of management actions with flexible decision-making, where adjustments are made to management approaches based on observed outcomes (NRC 2004). Within the context of ecological restoration, adaptive management addresses key uncertainties by linking science to restoration decision-making (Steyer and Llewellyn 2000; Thom et al. 2005). Performance may be evaluated in terms of implementation of the project plan, expected project outputs, or the ability of the project to achieve the desired restoration outcomes.

For this project, an adaptive management approach would be taken to ensure that high-priority restoration activities are identified and effectively and efficiently implemented in high-risk interaction areas to decrease the relative risk of shrimp trawl lazy line entanglements with coastal and BSE bottlenose dolphins. The project team would use an iterative process to plan, evaluate, implement, and monitor activities so that the project can address the uncertainties inherent in ecological restoration of protected species.

The objectives are specifically designed to use the best available information to identify the most effective lazy line alternatives for implementation that meet project objectives. During in-water testing and plan development, adaptive management would focus on the sufficiency of the available data to identify the most effective and efficient materials/techniques for reducing entanglements without intolerable impact on fishing operations. During each phase, it would be important to ensure engagement and cooperation of the stakeholders in developing, testing, and implementing the lazy line options. Therefore, the level of stakeholder engagement would be monitored to determine whether additional outreach is needed. During plan development and outreach activities, the team would make initial plans for the best approaches for implementation of the preferred lazy line types (and appropriate monitoring parameters) specific to each geographic area. As development of techniques and implementation progresses, the project team would continue to evaluate the implementation success at each site (if needed) and adjust the implementation approaches to make use of the best available information (e.g., from earlier objectives from this project and other DWH Marine Mammals Restoration Type projects) and conditions in the field. Additionally, in the post-execution period, the team would continue to monitor the shrimp fishery for geographic areas that may become a priority as additional data (from this project or any other ecological activities in the Gulf of Mexico) become available.

4. Evaluation

Project monitoring would require carefully planned evaluation of the parameters in Section 2.0. By thoughtfully designing evaluation methods for both the implementation of project restoration activities and the outcomes of the activities, the project team would assess if the project is meeting the restoration objectives and determine whether adaptive management is needed.

To track progress and determine success of project implementation, the project team would evaluate the following parameters:

1. Development of an in-water testing plan with study design, standardized protocols, and procedures for evaluating alternative lazy line materials/techniques, and identification of key personnel for training and implementation
2. Number of completed vessel trips for in-water testing
3. Identification of effective alternative lazy line material(s)
4. Development of a list of potential mechanisms to encourage voluntary adoption of the recommended alternative lazy line materials/techniques

5. Development of a specific voluntary implementation plan for reducing dolphin entanglements in shrimp lazy lines

Parameter 1 would be evaluated by the project team, subject experts, and regional stakeholders during project calls, webinars, and meetings. The activities could include searching the literature and previous workshop recommendations; seeking out presentations on pilot study data analyses; and conducting a risk assessment. The project team would monitor the progress of this activity and make a yes/no determination of whether and when each of the activities is complete.

Once Objective 1 is complete, the project team would conduct the collaborative in-water testing to evaluate alternative lazy line materials/techniques. This would define the targeted number of technologies to move toward implementation (by geographic area, if necessary) in Parameters 3–4. The project team would monitor the progress of these activities and make a yes/no determination of whether and when each of the activities is complete, and if enough data are available to make decisions. For Parameters 3–4, the project team would coordinate and participate in collaborative discussions with relevant experts and stakeholders in the Gulf of Mexico to develop restoration implementation plans for each high-risk interaction area. The project team would monitor the progress of this activity and make a yes/no determination of whether and when the activity is complete.

To track progress and determine success of project outcomes, the project team would evaluate the following parameters:

- Reporting of key findings from in-water testing relative to future implementation actions
- Number of shrimpers educated about adopting alternative lazy line materials/techniques
- Number shrimpers providing feedback about performance and usability of alternative lazy line materials/techniques

These parameters (and new or revised parameters identified in Objective 2) would be evaluated by the project team, subject experts, and regional stakeholders during project calls, webinars, and meetings. The project team would monitor the progress of these activities/metrics and make a yes/no determination of whether/when each of the activities are complete based on criteria set by the project team during preliminary planning for the project.

For this project, evaluations of other outcomes would be determined for the implementation actions during Objective 2 based on the specific plans developed. As the specific parameters for given project components are selected, this MAM Plan will be updated accordingly.

5. Project-Level Decisions: Performance Criteria and Potential Corrective Actions

This section describes how knowledge gained from the evaluation of monitoring data would be used at the project-level (1) to determine whether the project, once implemented, is considered successful, and (2) to inform the need for potential corrective actions. Project success would be determined by comparing monitoring data to project-specific performance criteria for the key parameters related to project restoration objectives described in Section 2.

6. Monitoring Schedule

The schedule for the project monitoring will be determined when siting and design are completed for the different project components, and the parameters that will be measured have been selected.

7. Data Management

To the extent practicable, after consideration of ongoing federal and/or state-specific efforts (e.g., current protocols, existing databases), all environmental and biological data generated during monitoring activities will be documented using standardized field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, project-specific datasheets will be drafted prior to conducting any project monitoring activities. Electronic data file names should include the date on which the file was created, a ReadMe file that describes when and by whom the file was created, and any explanatory notes about the file contents. If a data file is revised, a new copy will be made and the original preserved. The Implementing Trustees will verify and validate monitoring data and information and will ensure that all data are entered or converted into agreed upon/commonly used digital format labeled with metadata.

7.1 Data Review and Clearance

A standardized reporting format would be developed to the extent practicable (e.g., from standardized data sheet). Prior to publication, data will be reviewed and verified for completeness. A quality check is done by comparing the entered electronic data to the original hard copy data sheet. Data are validated and any necessary corrections are made. Upon validation, data are approved for analysis, reporting and archiving.

After any and all errors are addressed, data are considered to have completed a QA/QC review. Before submitting the monitoring data and information package, Implementing Trustees shall confirm with one another that the package is approved for submission. The Implementing Trustees will give the other TIG members time to review the data before publication in DIVER. No data release can occur if it is contrary to federal or state laws.

7.2 Data Storage and Accessibility

After all data has been verified by QA/QC procedures, it will be stored on DIVER and, where applicable, on Implementing Trustee databases.

7.3 Data Sharing

Data will be made publicly available through DIVER and, where applicable, Implementing Trustee databases, in accordance with the applicable data sharing policies and regulations in operation at the time of data collection.

8. Reporting

Project monitoring reports will be prepared and uploaded to DIVER annually. In addition, consistent with Trustee Council Standard Operating Procedures and any future amendments, the Implementing Trustee will develop a final, high-level summary report prior to project close-out (Section 10.7.1 of SOPs; DWH NRDA Trustees 2016). This final report will provide a range of information about the project, including its activities, key achievements, and lessons learned.

9. Roles and Responsibilities

NOAA would be the Implementing Trustee for this project and would be responsible for the management of all activities related to project monitoring and adaptive management.

10. Monitoring and Adaptive Management Budget

The budget for this project includes support for the full range of monitoring and adaptive management activities described above, including field sampling, data management, report writing, and adaptive management.

References

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Monitoring and Adaptive Management Plan: Reducing Impacts to Dolphins from Hook-and-Line Gear and Provisioning through Fishery Surveys, Social Science, and Collaboration

1. Introduction, Purpose and Need, and Public Participation

This project Monitoring and Adaptive Management (MAM) Plan identifies the monitoring and data collection needed to evaluate progress toward meeting the project's objectives and to support necessary adaptive management. This plan was developed in accordance with the MAM Plan template provided in the MAM Manual Version 1.0 and was adapted to fit the needs of this project (DWH NRDA Trustees 2017a). This MAM Plan is a living document and will be updated as needed to reflect new information or changing conditions. More specifically, the Regionwide Trustee Implementation Group (TIG) will update this plan as project components are more fully developed and siting and design activities are completed. While general areas of implementation and design are defined for this project, the exact locations and site-specific design details will be developed as a part of project implementation. Because such details have not yet been resolved, many aspects of this MAM Plan have not yet been determined (e.g., parameters to track, the method and frequency of measuring specific parameters). Future revisions to this document will be made publicly available as part of project implementation through the Data Integration, Visualization, Exploration, and Reporting (DIVER) Portal (www.diver.orr.noaa.gov/web/guest/home) and accessible through the Trustee Council's website (www.habitat.noaa.gov/storymap/dwh/).

1.1 Project Overview

Interactions between bottlenose dolphins and hook-and-line fishing gear occur throughout the Gulf of Mexico and are increasing. Hook-and-line (i.e., rod and reel) fishing gear is used by both for-hire boats (i.e., charter and head boats) and private anglers. Dolphin interactions with the gear primarily include (1) dolphins taking the bait or catch directly off the gear; or (2) dolphins scavenging discarded fish. Interactions are problematic for both anglers and dolphins. Interactions may decrease catch for anglers, damage gear, and limit their ability to fish in desired locations. Dolphins can suffer lethal injuries from entanglement in, or ingestion of, the gear, as well as related mortalities (e.g., retaliation by shooting dolphins). When dolphins learn to associate people with food from illegal feeding activities, their natural foraging patterns are disrupted and they favor an abnormal and risky feeding strategy that can lead to injury and death. Fed dolphins can become targets for human acts of retaliation, including anglers who become frustrated by begging dolphins that remove bait/catch from their gear or scavenge discarded fish.

This project aims to reduce interactions between dolphins and hook-and-line fishing gear and fishery practices and to reduce illegal feeding activities, both of which can harm or kill dolphins.

Activities in this project would be implemented across all Gulf of Mexico states, benefiting estuarine and coastal bottlenose dolphins. Conducting this project would lead to future restoration techniques that involve developing, testing, and evaluating the identified solutions to reduce interactions; partnering with stakeholders to implement the identified solutions; and systematically repeating fishery and social science surveys. The National Oceanic and Atmospheric Administration (NOAA) would be the Implementing Trustee for this project.

1.2 Restoration Type and Project-Specific Objectives

This project is designed to primarily address the Marine Mammals Restoration Type, defined in the 2016 *Deepwater Horizon* Oil Spill Final Programmatic Damage Assessment and Restoration Plan/Programmatic Environmental Impact Statement (PDARP/PEIS). (The PDARP/PEIS and the Record of Decision (ROD) are available at www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan/.) The overall goals for this Restoration Type that are relevant to this project, as identified in the *Strategic Framework for Marine Mammal Restoration Activities* (DWH NRDA Trustees 2017b) include:

- Implement an integrated portfolio of restoration approaches to restore injured bay, sound, and estuary (BSE); coastal; shelf; and oceanic marine mammals across the diverse habitats and geographic ranges they occupy.
- Identify and implement restoration activities that mitigate key stressors to support resilient populations. Collect and use monitoring information, such as population and health assessments and spatiotemporal distribution information.
- Identify and implement actions that support ecological needs of the stocks; improve resilience to natural stressors; and address direct human-caused threats such as bycatch in commercial fisheries, vessel collisions, noise, industrial activities, illegal feeding and harassment, and hook-and-line fishery interactions.

Specific project objectives include:

- Characterizing the nature and magnitude of interactions between dolphins and hook-and-line gear and fishery practices through systematic fishery surveys, social science studies, and characterization of hook-and-line fishing gear found on stranded dolphins
- Characterizing anglers' attitudes towards dolphins and their likelihood to take restoration actions, and identifying potential measures to reduce interactions through human dimension social science studies (e.g., focus groups and interviews).
- Collaboratively identifying possible solutions that would reduce interactions between bottlenose dolphins and hook-and-line fishing activities.

These project objectives may be further refined in future versions of this MAM Plan.

1.3 Conceptual Setting

Strandings of bottlenose dolphins with hook-and-line gear are documented in every Gulf of Mexico state, impacting all three coastal bottlenose dolphin stocks which span the state's nearshore coastal waters, along with numerous BSE stocks in each state. There are also enforcement cases involving anglers retaliating against dolphins out of frustration for the dolphin's depredation behavior. However, known strandings represent a minimum rate of occurrence and may be 3–11 times higher because only a portion of animals that strand are detected and recovered. Therefore, tracking and quantifying the types and numbers of adverse interactions is complicated by low reporting rates, the low rate of enforcement coverage of anglers and recreators across the Gulf of Mexico, and the low percentage of stranded and recovered carcasses with obvious signs of gear or intentional harm interactions.

Changes to human behavior (e.g., fishing, recreation, and tourism), whether due to economic, policy, or environmental considerations, would also likely affect project implementation and performance. The hook-and-line fishery is also a threat to other resources in the Gulf of Mexico (e.g., sea turtles, seabirds, or protected fish species), and the activities undertaken in this project should be coordinated with restoration projects targeting those resources.

Bottlenose dolphins in the Gulf of Mexico face a variety of natural and anthropogenic stressors and will be the focus of a variety of restoration and conservation efforts. Therefore, the DWH restoration activities to support these resources need to be well coordinated and multifaceted—one project must be considered in the context of the whole restoration portfolio. When evaluating and monitoring project success, it is important to look across the set of restoration projects for these resources and determine whether it is appropriate to provide complimentary management activities or to address other threats.

1.3.1 Potential Sources of Uncertainty

This project relies on both existing data and future data collection to inform management decisions and stakeholder buy-in. A number of potential sources of uncertainty could affect project performance and success. Potential sources of uncertainties include:

- The scope and scale of hook-and-line gear entanglements, intentional harm, and illegal feeding across the Gulf of Mexico
- Changes in human activity (spatially, temporally) in the future (e.g., responding to changing regulations, economic activity)
- Changes in cetacean activity and behavior in the future (e.g., responding to changing environmental conditions, human activities)
- Changes in responsiveness and behavior by anglers or recreators
- Similarities and differences of dolphin interactions with anglers and recreators in each area of the Gulf of Mexico
- The quality, availability, and usability of existing data
- The ability to identify accurate locations of high-risk areas for interactions between dolphins and the hook-and-line fishery
- The ability to identify actionable restoration actions
- The ability to cultivate buy-in from stakeholders

This list should not be considered exhaustive; additional uncertainties may be identified as the project is further developed, implemented, and monitored. These uncertainties may affect the achievement of the restoration objectives of the project. For example, restoration activities could be less effective than expected if dolphins change their behavior and no longer use the habitats that have been targeted by restoration actions. If drivers or stressors negatively affect the project, adaptive management may be necessary to ensure that project objectives are being achieved. The adaptive management strategy for the project is outlined in Section 3.

2. Project Monitoring

Performance monitoring would be conducted to evaluate project success and to identify the need for potential corrective actions or adaptive management. It is likely that the activities implemented in each project component or geographic location across the Gulf of Mexico will not be identical, given differences in site conditions that are likely to be present. Therefore, updated objectives and specific parameters and methodologies would be identified as part of an update to this MAM Plan. The following table provides draft project objectives and potential parameters that could be used in project monitoring; it is preliminary and is not exhaustive or prescriptive.

Draft project objective and potential parameters

Draft Project Objectives	Potential Parameter
Characterizing the nature and magnitude of interactions between dolphins and hook-and-line gear and fishery practices through systematic fishery surveys, social science studies, and characterization of hook-and-line fishing gear found on stranded dolphins	• Development of a catalog of interaction hot-spots and other areas of concern • Number of anglers participating in fishery surveys • Completion of analyses and reports on the characterization of the nature and magnitude of interactions
Characterizing anglers' attitudes towards dolphins and their likelihood to take restoration actions, and identifying potential measures to reduce interactions through human dimension social science studies (e.g., focus groups and interviews)	• Number of anglers and recreators participating in social science surveys, interviews, and/or focus groups • Completion of analyses and reports on characterizing angler attitudes
Collaboratively identifying possible solutions that would reduce interactions between bottlenose dolphins and hook-and-line fishing activities	• Development of an annotated list of potential solutions, including discussion of potential implementation design, protocols, and stakeholders for reducing interactions between dolphins and the hook-and-line fishery

3. Adaptive Management

As discussed in the PDARP/PEIS, adaptive management is a form of structured decision-making applied to the management of natural resources in the face of uncertainty (Pastorok et al. 1997; Williams 2011). It is an iterative process that integrates monitoring and evaluation of management actions with flexible decision-making, where adjustments are made to management approaches based on observed outcomes (NRC 2004). Within the context of ecological restoration, adaptive management addresses key uncertainties by linking science to restoration decision-making (Steyer and Llewellyn 2000; Thom et al. 2005). Performance may be evaluated in terms of implementation of the project plan, expected project outputs, or the ability of the project to achieve the desired restoration outcomes.

For this project, an adaptive management approach would be taken to ensure that restoration activities are identified and prioritized in high-risk areas to decrease the relative risk of hook-and-line gear entanglements, illegal feeding, and intentional harm to coastal and BSE bottlenose dolphins. The project team would use an iterative process to plan, evaluate, and monitor survey, study, and workshop activities so that the project can address the uncertainties inherent in ecological restoration of protected species.

Adaptive management would focus on developing the most effective and efficient surveys, social science studies, and collaborative workshops as the team gains additional understanding of the problem through new data sources and analysis, including developing study designs for recurring data collection and analysis. During this process, it would be important to ensure engagement and cooperation of the stakeholders in developing and implementing studies and workshops. Therefore, the level of stakeholder engagement would be monitored to determine whether additional outreach is needed.

4. Evaluation

Project monitoring would require carefully planned evaluation of the parameters in Section 2.0. By thoughtfully designing evaluation methods for both the implementation of project restoration activities and the outcomes of the activities, the project team would assess if the project is meeting the restoration objectives and determine whether adaptive management is needed.

To track progress and determine success of project implementation, the project team would evaluate the following parameters:

1. Development of a catalog of interaction hot-spots and other areas of concern
2. Number of anglers and recreators participating in fishery surveys, interviews and focus groups
3. The completion of analyses and reports from surveys, focus groups, workshops, and/or characterization of gear found on stranded animals
4. Development of an annotated list of potential solutions, including discussion of potential implementation design, protocols, and stakeholders for reducing interactions between dolphins and the hook-and-line fishery

Parameter 1 would be evaluated by the project team, subject experts, and regional stakeholders during project calls, webinars, and meetings. The activities for parameter 1 could include searching the literature and previous workshop recommendations; seeking out presentations on pilot study data analyses, retrospective and prospective data analysis from strandings or other interactions reports to NOAA and the social science surveys and studies; and conducting a risk assessment. The project team would monitor the progress of these activities and make a yes/no determination of whether and when the activity is complete.

Parameters 2 and 3 would be measured directly from project engagement results. The project team would monitor these engagement rates over the course of project activities to ensure that the studies are based on enough participants and represent a broad set of opinions and stakeholders.

Once objectives 1–3 are complete, the project team would develop an annotated list of recommendations (Objective 4, Parameter 1). This would define the targeted number of mechanisms to move toward implementation (by geographic area or other types of scenarios, if necessary). The project team would monitor the progress of this activity and make a yes/no determination of whether and when the activity is complete.

For this project, evaluations of outcomes would be determined for the implementation actions recommended by the products from Objective 4 based on the specific plans developed for each location and scenario. As the specific parameters for given project components are selected, this MAM Plan will be updated accordingly.

5. Project-Level Decisions: Performance Criteria and Potential Corrective Actions

This section describes how knowledge gained from the evaluation of monitoring data would be used at the project-level (1) to determine whether the project, once implemented, is considered successful, and (2) to inform the need for potential corrective actions. Project success would be determined by comparing monitoring data to project-specific performance criteria for the key parameters related to project restoration objectives described in Section 2.

6. Monitoring Schedule

The schedule for project monitoring will be determined when siting and design are completed for the different project components, and the parameters that will be measured have been selected.

7. Data Management

To the extent practicable, after consideration of ongoing federal and/or state-specific efforts (e.g., current protocols, existing databases), all environmental and biological data generated during monitoring activities will be documented using standardized field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, project-specific datasheets will be drafted prior to conducting any project monitoring activities. Electronic data file names should include the date on which the file was created, a ReadMe file that describes when and by whom the file was created, and any explanatory notes about the file contents. If a data file is revised, a new copy will be made and the original preserved. The Implementing Trustees will verify and validate monitoring data and information and will ensure that all data are entered or converted into agreed upon/commonly used digital format labeled with metadata.

7.1 Data Review and Clearance

A standardized reporting format would be developed to the extent practicable (e.g., from standardized data sheet). Prior to publication, data will be reviewed and verified for completeness. A quality check is done by comparing the entered electronic data to the original hard copy data sheet. Data are validated and any necessary corrections are made. Upon validation, data are approved for analysis, reporting and archiving.

After any and all errors are addressed, data are considered to have completed a QA/QC review. Before submitting the monitoring data and information package, Implementing Trustees shall confirm with one another that the package is approved for submission. The Implementing Trustees will give the other TIG members time to review the data before publication in DIVER. No data release can occur if it is contrary to federal or state laws.

7.2 Data Storage and Accessibility

After all data has been verified by QA/QC procedures, it will be stored on DIVER and, where applicable, on Implementing Trustee databases.

7.3 Data Sharing

Data will be made publicly available through DIVER and, where applicable, Implementing Trustee databases, in accordance with the applicable data sharing policies and regulations in operation at the time of data collection.

8. Reporting

Project monitoring reports will be prepared and uploaded to DIVER annually. In addition, consistent with Trustee Council Standard Operating Procedures and future amendments, the Implementing Trustee will develop a final, high-level summary report prior to project close-out (Section 10.7.1 of SOPs; DWH NRDA Trustees 2016). This final report will provide a range of information about the project, including its activities, key achievements, and lessons learned.

9. Roles and Responsibilities

NOAA would be the Implementing Trustee for this project and would be responsible for the management of all activities related to project MAM.

10. Monitoring and Adaptive Management Budget

The budget for this project includes support for the full range of monitoring and adaptive management activities described above, including field sampling, data management, report writing, and adaptive management.

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Monitoring and Adaptive Management Plan: Enhance Marine Mammal Stranding Network Diagnostic Capabilities and Consistency Across the Gulf of Mexico

1. Introduction, Purpose and Need, and Public Participation

This project Monitoring and Adaptive Management (MAM) Plan identifies the monitoring and data collection needed to evaluate progress toward meeting the project's objectives and to support necessary adaptive management. This plan was developed in accordance with the MAM Plan template provided in the MAM Manual Version 1.0 and was adapted to fit the needs of this project (DWH NRDA Trustees 2017a). This MAM Plan is a living document and will be updated as needed to reflect new information or changing conditions. More specifically, the Regionwide Trustee Implementation Group (TIG) will update this plan as project components are more fully developed and siting and design activities are completed. While general areas of implementation and design are defined for this project, the exact locations and site-specific design details will be developed as a part of project implementation. Because such details have not yet been resolved, many aspects of this MAM Plan have not yet been determined (e.g., parameters to track, the method and frequency of measuring specific parameters). Future revisions to this document will be made publicly available as part of project implementation through the Data Integration Visualization Exploration and Reporting (DIVER) Portal (www.diver.orr.noaa.gov/web/guest/home) and accessible through the Trustee Council's website (www.habitat.noaa.gov/storymap/dwh/).

1.1 Project Overview

On average (based on data from 2005 through 2019), 428 cetaceans (whales or dolphins) are stranded along the GOM coast each year. Of these strandings, 11% are found alive and 89% are found dead. The 1992 Amendments to the MMPA formalized the MMSN. Regional MMSNs authorized by NOAA Fisheries exist across all coastal states to respond to live and dead marine mammal strandings, including injured, entangled, and out-of-habitat small cetaceans, and to rehabilitate live stranded animals. These MMSN organizations include federal, state, and local government agencies, aquaria, universities, and nonprofit groups. Across the proposed project area, the MMSN includes 14 authorized organizations (3 in Texas, 1 in Louisiana, 1 in Mississippi, 1 in Alabama, and 8 in Florida). This project focuses on activities that could support or enhance MMSN diagnostic capabilities to improve treatment and care for live stranded cetaceans and support data collection, reporting, and management consistency across the GOM MMSN as a whole. Specific project activities include:

- **Improve diagnostic capabilities.** This project would provide MMSN organizations that respond to live stranded animals with hand-held blood analyzers to diagnose illness in the field. It would also improve outcomes for entangled or out-of-habitat cetaceans by improving medical care during rescue.

- **Provide auditory testing equipment and training.** Cetaceans rely on their hearing for foraging, communication, and predator avoidance. Cetacean hearing is measured using Auditory Evoked Potentials (AEP). This project would fund equipment development, purchasing, and training for the Gulf of Mexico MMSN. Access to AEP equipment would improve animal treatment and care and allow MMSN organizations to better evaluate causes of illness and stranding to increase the potential for immediate release or release after rehabilitation.
- **Improve access to laboratory testing.** Analyzing samples collected from stranded animals is critical to diagnosing causes of illness and death, better understanding population health, and evaluating anthropogenic and natural threats to marine mammals. This project would increase these diagnostic capabilities by establishing contracts or other funding mechanisms for service laboratories to analyze tissue and other diagnostic samples collected from stranded cetaceans across the Gulf of Mexico.
- **Enhance data management and synthesis.** Providing consistent, accurate, and timely information to marine mammal and conservation managers is critical for understanding population health, identifying emerging threats, and developing targeted actions to minimize and mitigate those threats. This project would support a NOAA data manager to work with MMSN organizations in the Gulf of Mexico to provide quality assurance/quality control (QA/QC) of stranding data, provide data entry training, and assist with entering and maintaining data in regional marine mammal health and stranding databases. The data manager would also support managers, state agencies, and stakeholders by querying databases and synthesizing stranding data.
- **Improve training and cross-network coordination.** Ensuring data are collected consistently across the Gulf of Mexico and that important skills are maintained across MMSN organizations to improve data quality as well as safety for personnel and stranded animals. This project would establish regular training sessions to improve and maintain MMSN capabilities over time and through personnel turnover. It would also establish workshops to improve communication and coordination across the network and share information about new threats and the efficacy of various response actions to those threats, with a focus on human and animal safety.

Together, these activities would allow the MMSN to make better rehabilitation/release decisions for live stranded animals; improve understanding of population health; and increase data consistency and accuracy; and ensure the timeliness of data availability to managers of marine mammals to allow for rapid responses to emerging threats. NOAA would be the Implementing Trustee for this project. Activities in this project would be implemented throughout the proposed project area.

1.2 Restoration Type and Project-Specific Objectives

This project is designed to primarily address the Marine Mammals Restoration Type, defined in the 2016 *Deepwater Horizon* Oil Spill Final Programmatic Damage Assessment and Restoration Plan/Programmatic Environmental Impact Statement (PDARP/PEIS). (The PDARP/PEIS and the Record of Decision (ROD) are available at www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan/.) The overall goals for this Restoration Type that are relevant to this project, as identified in the *Strategic Framework for Marine Mammal Restoration Activities* (DWH NRDA Trustees 2017b) include:

- Implement an integrated portfolio of restoration approaches to restore injured bay, sound, and estuary (BSE); coastal; shelf; and oceanic marine mammals across the diverse habitats and geographic ranges they occupy.
- Identify and implement restoration activities that mitigate key stressors in order to support resilient populations. Collect and use monitoring information, such as population and health assessments and spatiotemporal distribution information.

The primary project objective is to enhance MMSN diagnostic capabilities to improve treatment and care for live stranded cetaceans and support data collection, reporting, and management consistency across the Gulf of Mexico MMSN as a whole. This project objective may be further refined or divided into multiple objectives in future versions of this MAM Plan.

1.3 Conceptual Setting

Volunteer MMSNs authorized by NOAA Fisheries, including 14 organizations in the Gulf of Mexico, respond to live and dead marine mammal strandings, including injured, entangled, and out of habitat small cetaceans. However, even though many of the species and threats are similar across the region, each organization faces a unique combination of logistical (e.g., personnel turnover, funding, access to equipment/vehicles) and environmental challenges (e.g., diseases, hotspots for human interaction, new types of interactions). Therefore, this project will attempt to facilitate the coordination and support activities necessary to ensure that each MMSN can conduct their activities in a manner consistent with other MMSNs in the region so that (1) live stranded marine mammals have the best possible care and (2) data from across the region can be pooled to support local and regional decision making, monitoring, and adaptive management.

This project would build upon the already established working relationships between the National Marine Fisheries Service (NMFS) Southeast Region/Science Center (which administers and coordinates the regional MMSN), the NMFS Marine Mammal Health and Stranding Response Program (MMHSRP), and the individual regional MMSN organizations. NMFS would work with the project team to provide regionwide coordination of activities to bring consistent diagnostic capabilities, training, and data management to the overall regional MMSN. However, a key factor that may affect project implementation and performance includes the level of buy-in from stranding network partners and other stakeholders, which may be influenced by logistical and cost constraints, changes to the MMPA or other regulatory frameworks/permitting processes could also affect the project.

1.3.1 Potential Sources of Uncertainty

This project relies on existing data to inform management decisions and stakeholder buy-in. A number of potential sources of uncertainty could affect project performance and success. Potential sources of uncertainties include:

- The progress of development and coordination/integration of marine mammal-related databases and data management
- Changes in cetacean activity and behavior in the future (e.g., responding to changing environmental conditions, human activities), leading to differences in the frequency and distribution of strandings
- Changes to the MMPA or other regulatory frameworks/permitting processes

- The number of carcasses with salvageable tissue samples and the proportion of collected samples that meet sample quality objectives
- The likelihood that restoration actions would reduce cetacean mortality
- The ability to quantify restoration benefits from implemented actions (e.g., measuring decreasing frequencies of strandings or successfully tracking rehabilitated animals)

This list should not be considered exhaustive; additional uncertainties may be identified as the project is further developed, implemented, and monitored. These uncertainties may affect the achievement of the restoration objectives of the project. For example, changes in regulatory processes could either hamper or facilitate planned restoration actions. If drivers or stressors negatively affect the project, adaptive management may be necessary to ensure that project objectives are being achieved. The adaptive management strategy for the project is outlined in Section 3.

2. Project Monitoring

Performance monitoring would be conducted to evaluate project success and to identify the need for potential corrective actions or adaptive management. It is likely that the activities implemented in each project component or geographic location across the Gulf of Mexico will not be identical, depending on the status of the respective MMSN organizations. Therefore, updated objectives and specific parameters and methodologies would be identified as part of an update to this MAM Plan. The following table provides draft project objectives and potential parameters that could be used in project monitoring; it is preliminary and is not exhaustive or prescriptive.

Draft project objective and potential parameters

Draft Project Objective	Potential Parameters
Enhance MMSN diagnostic capabilities to improve treatment and care for live stranded cetaceans and support data collection, reporting, and management consistency across the GOM MMSN as a whole	• Proportion of strandings with quality-assured data, diagnostic analyses, and reports • Proportion of live-stranded dolphins that receive hearing tests and other diagnostics • Proportion of deceased stranded animals for which a probable cause of death is determined

The performance of the NOAA data manager will be crucial for the success of this objective. This parameter (or a similar metric) would track the manager's data QA/QC workload and the manager's ability to provide access to data in a timely manner. NMFS would evaluate relevant metrics annually through the duration of the project and meet with the data manager to discuss successes, issues, and overall performance.

Adequate funds for analyzing samples collected from stranded animals is frequently a limitation for the MMSN. This parameter would evaluate whether there has been an increase in the ability of each MMSN to determine cause of death (recognizing that the ability to determine cause of death can decline as decomposition advances) Given the efforts in this project to share data, provide additional training and standardized methods, and provide additional funds for service contracts to each MMSN in the region to analyze tissue and diagnostic samples. The metric would be assessed by NMFS annually, including discussions with each MMSN about their performance as well as the region overall.

3. Adaptive Management

As discussed in the PDARP/PEIS, adaptive management is a form of structured decision-making applied to the management of natural resources in the face of uncertainty (Pastorok et al. 1997; Williams 2011). It is an iterative process that integrates monitoring and evaluation of management actions with flexible decision-making, where adjustments are made to management approaches based on observed outcomes (NRC 2004). Within the context of ecological restoration, adaptive management addresses key uncertainties by linking science to restoration decision-making (Steyer and Llewellyn 2000; Thom et al. 2005). Performance may be evaluated in terms of implementation of the project plan, expected project outputs, or the ability of the project to achieve the desired restoration outcomes.

For this project, an adaptive management approach would be taken to ensure that the data generated by enhanced stranding networks, as well as the increased capabilities and capacities through training and diagnostics of the MMSN, is improving marine mammal survival through timely conservation actions informed by improved information of key causes of morbidity and mortality. Adaptive management would focus on real-time monitoring of strandings data, similar to the efforts already underway at NMFS, and would include annual check-ins at the regional and local levels with MMSN stakeholders. Throughout the process, it would be important to ensure engagement and cooperation of the stakeholders. Therefore, the level of engagement of the stakeholders would be monitored to determine whether additional coordination is needed. As development of specific activities progresses, the project team would continue to evaluate the implementation success at the state level and adjust the implementation approaches to make use of the best available information (e.g., from other DWH marine mammal restoration projects) and conditions in the field. Additionally, in the post-execution period, NMFS would continue to monitor strandings and the MMSN performance as additional data (from this project or any other ecological activities in the region) become available.

4. Evaluation

Project monitoring would require carefully planned evaluation of the selected parameters (potentially including the examples in Section 2). By thoughtfully designing evaluation methods for both the implementation of project restoration activities and the outcomes of the activities, the project team would assess if the project is meeting the restoration objectives and determine the need for adaptive management. As parameters are selected, this MAM Plan will be updated accordingly. To track progress and determine success of project implementation and outcomes, the project team could evaluate the parameters listed above.

NMFS manages and evaluates very similar parameters for the existing MMSNs in the Gulf of Mexico, and NMFS would take the lead on comparing the results of the project to historical measurements, then work with the project team to evaluate the progress of these activities over time. The project team would conduct annual evaluations about whether each activity has resulted in the desired outcome. The project team would facilitate discussions with MMSN organizations to review results and make adaptive management decisions if necessary. As the specific parameters for given project components are selected, this MAM Plan will be updated accordingly.

5. Project-Level Decisions: Performance Criteria and Potential Corrective Actions

This section describes how knowledge gained from the evaluation of monitoring data would be used at the project-level (1) to determine whether the project, once implemented, is considered successful, and (2) to inform the need for potential corrective actions. Project success would be determined by comparing monitoring data to project-specific performance criteria for key parameters related to project restoration objectives.

6. Monitoring Schedule

For the example parameters provided, all metrics will be monitored in real time by NMFS. Annual evaluations and reports will be completed at the end of each year of the project duration. As actual parameters are established, this MAM Plan would be updated accordingly.

7. Data Management

To the extent practicable, after consideration of ongoing federal and/or state-specific efforts (e.g., current protocols, existing databases), all environmental and biological data generated during monitoring activities will be documented using standardized field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, project-specific datasheets will be drafted prior to conducting any project monitoring activities. Electronic data file names should include the date on which the file was created, a ReadMe file that describes when and by whom the file was created, and any explanatory notes about the file contents. If a data file is revised, a new copy will be made and the original preserved. The Implementing Trustees will verify and validate monitoring data and information and will ensure that all data are entered or converted into agreed upon/commonly used digital format labeled with metadata.

7.1 Data Review and Clearance

A standardized reporting format would be developed to the extent practicable (e.g., from standardized data sheet). Prior to publication, data will be reviewed and verified for completeness. A quality check is done by comparing the entered electronic data to the original hard copy data sheet. Data are validated and any necessary corrections are made. Upon validation, data are approved for analysis, reporting and archiving.

After any and all errors are addressed, data are considered to have completed a QA/QC review. Before submitting the monitoring data and information package, Implementing Trustees shall confirm with one another that the package is approved for submission. The Implementing Trustees will give the other TIG members time to review the data before publication in DIVER. No data release can occur if it is contrary to federal or state laws.

7.2 Data Storage and Accessibility

After all data has been verified by QA/QC procedures, it will be stored on DIVER and, where applicable, on Implementing Trustee databases.

7.3 Data Sharing

Data will be made publicly available through DIVER and, where applicable, Implementing Trustee databases, in accordance with the applicable data sharing policies and regulations in operation at the time of data collection.

8. Reporting

Project monitoring reports will be prepared and uploaded to DIVER annually. In addition, consistent with Trustee Council Standard Operating Procedures and any future amendments, the Implementing Trustee will develop a final, high-level summary report prior to project close-out (Section 10.7.1 of SOPs; DWH NRDA Trustees 2016). This final report will provide a range of information about the project, including its activities, key achievements, and lessons learned.

9. Roles and Responsibilities

NOAA would be the Implementing Trustee for this project and would be responsible for the management of all activities related to project MAM.

10. Monitoring and Adaptive Management Budget

The budget for this project includes support for the full range of monitoring and adaptive management activities described above, including field sampling, data management, report writing, and adaptive management.

References

DWH NRDA (Deepwater Horizon Natural Resource Damage Assessment) Trustees. 2016. "Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the *Deepwater Horizon* (DWH) Oil Spill." https://www.gulfspillrestoration.noaa.gov/sites/default/files/DWH%20TC%20SOP%202.0%20with%20appendices.pdf.

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Monitoring and Adaptive Management Plan: Improving Resilience for Oysters by Linking Brood Reefs and Sink Reefs

1. Introduction, Purpose and Need, and Public Participation

This project Monitoring and Adaptive Management (MAM) Plan identifies the monitoring and data collection needed to evaluate progress toward meeting the project's objectives and to support necessary adaptive management. This plan was developed in accordance with the MAM Plan template provided in the MAM Manual Version 1.0 and was adapted to fit the needs of this project (DWH NRDA Trustees 2017a). This MAM Plan is a living document and will be updated as needed to reflect new information or changing conditions. More specifically, the Regionwide Trustee Implementation Group (TIG) will update this plan as project components are more fully developed and siting and design activities are completed. While general areas of implementation and design are defined for this project, the exact locations and site-specific design details will be developed as a part of project implementation. Because such details have not yet been resolved, many aspects of this MAM Plan have not yet been determined (e.g., parameters to track, the method and frequency of measuring specific parameters). Future revisions to this document will be made publicly available as part of project implementation through the Data Integration, Visualization, Exploration, and Reporting (DIVER) Portal (www.diver.orr.noaa.gov/web/guest/home) and accessible through the Trustee Council's website (www.habitat.noaa.gov/storymap/dwh/).

1.1 Project Overview

The project aims to increase oyster abundance and restore resilience to oyster populations by increasing connectivity through larval transport and constructing oyster habitat within a range of habitats and salinities. The project would create a network of high-vertical relief brood (protected) reefs. These brood reefs would be linked by larval transport to sink reefs (harvested or protected) that either already exist or that would be created through the project. This interlinked network of reefs would increase oyster population sustainability and oyster reef resilience. The reef design would help ensure connectivity between larvae produced on the brood reefs and the sink reefs. The selected project sites may contain both subtidal and intertidal habitat, to address the lost connection between these habitats identified in the 2016 *Deepwater Horizon* Oil Spill Final Programmatic Damage Assessment and Restoration Plan/Programmatic Environmental Impact Statement (PDARP/PEIS). (The PDARP/PEIS and the Record of Decision (ROD) are available at www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan/.)

To increase resilience, the reefs would be placed along a salinity gradient based on local conditions. Given annual variation in rainfall, associated freshwater inputs to estuaries, and ensuing variations in salinity, constructing reefs across a range of habitats and salinities increases the likelihood of oyster recruitment and survival. Furthermore, where possible, constructing reefs along an intertidal-subtidal gradient may restore the population linkage that was disrupted by the *Deepwater Horizon* (DWH) oil spill. Reefs would be constructed high enough to protect oysters from hypoxic bottom waters. Where possible, reefs would be constructed on suitable hard substrate that does not currently support oysters. If the brood reefs do not receive a natural spat set, hatchery spat or adult oysters would be transplanted to the reefs. A healthy network of oyster reefs would increase the ecosystem services provided by this species, including increased water filtration, shoreline protection (depending upon reef design and location), and habitat for reef-dwelling species.

The project includes five components, and would be implemented in five sites, each of which is located in a different Gulf state: (1) East Galveston Bay, TX; (2) Biloxi Marsh, LA; (3) Heron Bay, MS; (4) Mid-Lower Mobile Bay, AL; and (5) Suwannee Sound, FL. Implementing Trustees (National Oceanic and Atmospheric Administration [NOAA] and Trustee agencies from Texas, Louisiana, Mississippi (Mississippi Department of Environmental Quality), Alabama, and Florida) would identify specific locations for reef construction during the planning stage of the project.

The above general project summary applies to all components of this project. The following section provides additional details that are specific to each component of the project:

- **Component 1: Texas:**
  - Restoration would occur in three areas across a 3-mile stretch of East Galveston Bay, extending from shoreline areas into subtidal areas 6 feet below mean sea level.
  - Restoration would focus mainly on brood reefs rather than sink reefs to benefit nearby natural reefs.
- **Component 2: Louisiana:**
  - This project area would include five or six subsites. Initial project planning activities would investigate substrate at these sites for feasibility, targeting hard sediment and historic reefs.
  - The construction of the reefs would utilize turtle-friendly high-relief materials, such as reef balls.
- **Component 3: Mississippi:**
  - The project would be focused in Heron Bay, part of the 20,909-acre Hancock County Marsh Preserve within the Pearl River estuary.
  - Siting of reefs would include consideration of previous benthic surveys of the area and findings from the previous reef construction project under the Natural Resource Damage Assessment (NRDA) Phase III Early Restoration Hancock County Marsh Living Shoreline Project.
- **Component 4: Alabama:**
  - The project area would include new reef construction or supplement existing reef areas at two or more sites on the western shore portions of mid-lower Mobile Bay, over an approximately 15-mile area.
  - The reefs would be sited to facilitate spat transport from the brood reefs toward commercially harvestable reefs.

- **Component 5: Florida:**
  - This project site would range from Cedar Key to Horseshoe Point, with a focus on Suwannee Sound.
  - Restoration likely would focus on sink reefs, as brood reefs may not be necessary in the area.
  - Reefs would be constructed with fossilized oyster shell, recycled oyster shell, or crushed limestone in intertidal regions of the sound.

1.2 Restoration Type and Project-Specific Objectives

This project is designed to primarily address the Oysters Restoration Type, defined in the PDARP/PEIS. The overall objectives for oysters that are relevant to this project, as identified in the *Strategic Framework for Oyster Restoration Activities* (DWH NRDA Trustees 2017b) include:

- Restore oyster abundance and spawning stock to support a regional oyster larvae pool sufficient for healthy recruitment levels to subtidal and nearshore oyster reefs.
- Restore resilience to oyster populations that are supported by productive larval source reefs and sufficient substrate in larval sink areas to sustain reefs over time.
- Restore a diversity of oyster reef habitats that provide ecological functions for estuarine-dependent fish species, vegetated shoreline and marsh habitats, and nearshore benthic communities.

In addition, the specific objective of the project is to increase oyster abundance and restore resilience to oyster populations by increasing connectivity through larval transport and the construction of oyster habitat over a range of habitats and salinities. This project objective may be further refined or divided into multiple objectives in future versions of this MAM Plan.

1.3 Conceptual Setting

Salinity and reef connectivity are two key factors that affect the distribution, survival, and growth of oysters in the Gulf of Mexico. Gulf of Mexico oysters need salinities between 10 to 30 practical salinity unit (psu) (Turner 2006) to successfully survive, grow, and reproduce. Oyster growth slows below this range, and oyster predation and disease increase above this range. However, the salinity of any specific location can change substantially over time due to spatial and temporal variability in rainfall, which affects the amount of freshwater entering the Gulf of Mexico through streams and rivers. Thus, creating reefs across gradients of salinity (i.e., across habitats that are close to or far from freshwater outlets into the Gulf of Mexico) can help ensure that at least some of the reefs provide suitable salinities for oysters each year. Reef connectivity is also critical to sustaining oysters in the Gulf of Mexico. In the northern Gulf of Mexico, intertidal oysters typically supply larvae to subtidal reefs. Injury to the intertidal reefs resulting from the DWH oil spill caused the loss of larval supply to subtidal reefs, reducing the ability of oysters to successfully reproduce. By restoring reefs along a depth/tidal gradient, this project aims to restore this connectivity, which will help sustain subtidal reefs over the long term.

1.3.1 Potential Sources of Uncertainty

Potential sources of uncertainty are defined as those that may affect the ability to achieve project restoration objectives. Sources of uncertainty, the degree of uncertainty, and the level of uncertainty associated with project components will vary.

Uncertainties or information gaps have the potential to affect adaptive management decisions for individual or multiple restoration projects. These decisions may include how to improve the likelihood of achieving favorable project outcomes or selecting corrective actions in the event a project is not performing as intended.

Potential sources of uncertainty could include (but are not limited to):

- Whether there is sufficient suitable bottom over a range of salinities for restoration
- Rainfall amount, which can affect the salinity of restored areas
- Colonization of brood and sink reefs by oysters
- Occurrence, frequency, and intensity of hypoxia events in project locations
- Occurrence, frequency, and intensity of tropical storms and hurricanes

This list should not be considered exhaustive; additional uncertainties may be identified as the project is further designed, implemented, and monitored. These uncertainties may affect the achievement of the restoration objectives of the project. For example, tropical storms and hurricanes can damage or bury reefs, which could greatly reduce project benefits or cause the project to fail. Similarly, rainfall amounts can affect the salinity to which restored reefs are exposed; if drought occurs in restored areas, driving up salinity, oysters may suffer from increased disease and predation. If any drivers or stressors are negatively impacting the project, adaptive management may be necessary to ensure that project objectives are being achieved. The adaptive management strategy for this project is outlined in Section 3.

2. Project Monitoring

Performance monitoring would be conducted to evaluate project success and to identify the need for potential corrective actions or adaptive management. It is likely that the activities implemented in each project component will not be identical, given differences in site conditions that are likely to be present. Therefore, specific parameters and methodologies will be identified as part of an update to this MAM Plan. The draft project objective and associated potential parameters that could be used to assess and track project progress and performance are listed in the following table. As noted in Section 1.2, this draft project objective may be refined further in future versions of this MAM Plan.

Draft project objective and potential parameters

Draft Project Objectives	Potential Project Parameters
Increase Oyster Abundance and Restore Oyster Resilience by Constructing a Network of Interconnected Reef Habitat across a Range of Depths and Salinities	• **Oyster habitat created**: Habitat created (m^2 or acres, depending on scale) • **Oyster reef salinity and depth gradients**: Salinity (ppt), depth at low tide (m), low tide exposure (hrs) • **Oyster reef interconnectivity and recruitment**: Larval oyster settlement (# spat/shell or # spat/m^2) • **Oyster habitat productivity**: Live oysters (oysters/m^2), oyster mortality (%), oyster size class distribution (# oysters in each size class per m^2) • **Explanatory variables**: Substrate on which reef was constructed (e.g., hard bottom, soft bottom), reef configuration (e.g., mound, furrow, flat cultch placement), oyster reef volume (m^3), water temperature (°C), dissolved oxygen (mg/l), storm related effects on oyster habitat productivity (e.g., changes in live oyster per m^2)

3. Adaptive Management

As discussed in the PDARP/PEIS, adaptive management is a form of structured decision-making applied to the management of natural resources in the face of uncertainty (Pastorok et al. 1997; Williams 2011). It is an iterative process that integrates monitoring and evaluation of management actions with flexible decision-making, where adjustments are made to management approaches based on observed outcomes (NRC 2004). Within the context of ecological restoration, adaptive management addresses key uncertainties by linking science to restoration decision-making (Steyer and Llewellyn 2000; Thom et al. 2005). Performance may be evaluated in terms of implementation of the project plan, expected project outputs, or the ability of the project to achieve the desired restoration outcomes.

Adaptive management could be used at several points throughout the project. First, it may be used in initial site selection. If sites chosen for restoration are determined not to be suitable for oyster restoration (i.e., the location has soft bottom habitat, has poor water quality, or is not likely to be connected to other reefs by larval transport), other sites would be considered. Second, it could be used during project implementation to improve project performance. For example, if larvae do not reach and settle on constructed brood reefs, Trustees could consider placing brood stock or spat (i.e., larvae that have settled on and attached to a hard surface) on these reefs, factoring in whether the reef is harvestable. If sink reefs do not receive a natural spat set, Trustees could attempt to determine why and, if possible, take appropriate actions to improve spat set. Third, it could be used after project implementation to improve understanding of factors that improved or hindered project success. For example, if specific configurations of restored oyster reefs seem more productive or resilient than others, future projects could be designed to incorporate such configurations.

4. Evaluation

Project MAM would include carefully planned evaluations of the selected parameters (potentially including the examples in Section 2) throughout the project's lifetime. By thoughtfully designing evaluation methods for the design and implementation of project restoration activities, the project team could assess whether the project is meeting its restoration objectives and determine the need for adaptive management. Such evaluations could include tracking the productivity of reefs over time, comparing reef performance (e.g., density, mortality, spat set) with appropriate reference sites, assessing reef inter-connectivity, and evaluating whether the gradients over which reefs were constructed improved the resiliency of the restored network of oyster reefs overall. As specific parameters for given project components are selected, this MAM Plan will be updated accordingly.

5. Project-Level Decisions: Performance Criteria and Potential Corrective Actions

This section describes how knowledge gained from the evaluation of the monitoring data described in Section 2 would be used at the project-level (1) to determine whether the project, once implemented, is considered successful, and (2) to inform the need for potential corrective actions. Project success would be determined by comparing monitoring data to project-specific performance criteria for the key parameters related to the restoration objectives described in Section 2. For example, the amount of oyster habitat created could be compared against the habitat restoration objective that Trustees set for the project to determine if the project is successful. However, at this stage, project-specific performance criteria have not yet been identified for any example parameter identified in Section 2. Such criteria and potential corrective actions will continue to be developed, and this MAM Plan will be updated accordingly.

6. Monitoring Schedule

The project monitoring schedule will be determined when siting and design are completed for the different project components, wherein monitoring parameters will be identified.

7. Data Management

To the extent practicable, after consideration of ongoing federal and/or state-specific efforts (e.g., current protocols, existing databases), all environmental and biological data generated during monitoring activities will be documented using standardized field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, project-specific datasheets will be drafted prior to conducting any project monitoring activities. Electronic data file names should include the date on which the file was created, a ReadMe file that describes when and by whom the file was created, and any explanatory notes about the file contents. If a data file is revised, a new copy will be made and the original preserved. The Implementing Trustees will verify and validate monitoring data and information and will ensure that all data are entered or converted into agreed upon/commonly used digital format labeled with metadata.

7.1 Data Review and Clearance

A standardized reporting format would be developed to the extent practicable (e.g., from standardized data sheet). Prior to publication, data will be reviewed and verified for completeness. A quality check is done by comparing the entered electronic data to the original hard copy data sheet. Data are validated and any necessary corrections are made. Upon validation, data are approved for analysis, reporting and archiving.

After any and all errors are addressed, data are considered to have completed a QA/QC review. Before submitting the monitoring data and information package, Implementing Trustees shall confirm with one another that the package is approved for submission. The Implementing Trustees will give the other TIG members time to review the data before publication in DIVER. No data release can occur if it is contrary to federal or state laws.

7.2 Data Storage and Accessibility

After all data has been verified by QA/QC procedures, it will be stored on DIVER and, where applicable, on Implementing Trustee databases.

7.3 Data Sharing

Data will be made publicly available through DIVER and, where applicable, Implementing Trustee databases, in accordance with the applicable data sharing policies and regulations in operation at the time of data collection.

8. Reporting

Project monitoring reports will be prepared and uploaded to DIVER annually. In addition, consistent with Trustee Council Standard Operating Procedures and any future amendments, the Implementing Trustee will develop a final, high-level summary report prior to project close-out (Section 10.7.1 of SOPs; DWH NRDA Trustees 2016). This final report will provide a range of information about the project, including activities, key achievements, and lessons learned.

9. Roles and Responsibilities

This project's components will be implemented by multiple Trustees including NOAA and selected Trustee agencies from Texas, Louisiana, Mississippi, Alabama, Florida who will work in cooperation with project partners (e.g., nongovernmental organizations [NGOs], state resource agencies, local governments) to develop and implement each project component. For each component, the lead Implementing Trustee will also serve as the lead coordinator and implementer of MAM activities. Implementing Trustees' roles will be further identified in accordance with SOP Section 9.5.

10. Monitoring and Adaptive Management Budget

The budget for this project includes support for the full range of monitoring and adaptive management activities described above, including field sampling, data management, report writing, and adaptive management.

References

DWH NRDA (Deepwater Horizon Natural Resource Damage Assessment) Trustees. 2016. "Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the *Deepwater Horizon* (DWH) Oil Spill." https://www.gulfspillrestoration.noaa.gov/sites/default/files/DWH%20TC%20SOP%202.0%20with%20appendices.pdf.

DWH NRDA Trustees. 2017a. "Monitoring and Adaptive Management Procedures and Guidelines Manual Version 1.0." Appendix in *Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the DWH Oil Spill*. December. http://www.gulfspillrestoration.noaa.gov/.

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Monitoring and Adaptive Management Plan: Pilot Implementation of Automatic Identification System (AIS) in the Gulf of Mexico Inshore Shrimp Fishery to Inform Efforts to Reduce Sea Turtle Bycatch

1. Introduction, Purpose and Need, and Public Participation

This project Monitoring and Adaptive Management (MAM) Plan identifies the monitoring and data collection needed to evaluate progress toward meeting the project's objectives and to support necessary adaptive management. This plan was developed in accordance with the MAM Plan template provided in the MAM Manual Version 1.0 and was adapted to fit the needs of this project (DWH NRDA Trustees 2017a). This MAM Plan is a living document and will be updated as needed to reflect new information or changing conditions. More specifically, the Regionwide Trustee Implementation Group (TIG) will update this plan as project components are more fully developed and siting and design activities are completed. While general areas of implementation and design are defined for this project, the exact locations and site-specific design details will be developed as a part of project implementation. Because such details have not yet been resolved, many aspects of this MAM Plan have not yet been determined (e.g., parameters to track, the method and frequency of measuring specific parameters). Future revisions to this document will be made publicly available as part of project implementation through the Data Integration, Visualization, Exploration, and Reporting (DIVER) Portal (www.diver.orr.noaa.gov/web/guest/home) and accessible through the Trustee Council's website (www.habitat.noaa.gov/storymap/dwh/).

1.1 Project Overview

Bycatch in the Gulf of Mexico shrimp trawl fishery, which operates in inshore, nearshore, and offshore waters, is a known critical threat to sea turtles. This pilot project would focus on inshore and nearshore vessels to better understand spatiotemporal fishing effort. Data collected through this project would enhance the Trustees' understanding of the overlap of fishing effort, sea turtle distribution, and sea turtle mortality. Enhanced understanding of these areas of overlap would better inform actions to restore sea turtles by reducing bycatch in this fishery regionwide.

To accomplish this objective, the project would use automatic identification system (AIS), an automatic tracking technology that uses transponders on vessels, to provide information about spatial and temporal movements. AIS provides a means to collect dynamic navigational data including position, course, and speed. AIS devices are required on commercial service/shipping vessels and large fishing vessels, which includes much of the federally permitted offshore shrimp trawl fishery. There is currently no requirement for smaller shrimp vessels that operate in nearshore or inshore waters to carry technology that can help inform spatial and temporal patterns of fishing effort. This project would develop and test an electronic monitoring pilot program for inshore shrimp vessels using AIS Class B devices. The project would include the purchase and installation of AIS Class B equipment, and participation by vessel operators would be voluntary. Collection of data on spatial and temporal patterns of shrimp fishing effort would identify areas of overlap between sea turtles and the nearshore/inshore shrimp trawl fishery in order to inform future restoration planning and the training, education, and outreach activities of National Oceanic and Atmospheric Administration's (NOAA) Gear Monitoring Team to reduce sea turtle bycatch and mortality.

1.2 Restoration Type Goals and Project-Specific Objectives

This project is designed to primarily address the Sea Turtles Restoration Type, as defined in the 2016 *Deepwater Horizon* Oil Spill Final Programmatic Damage Assessment and Restoration Plan/Programmatic Environmental Impact Statement (PDARP/PEIS). (The PDARP/PEIS and the Record of Decision (ROD) are available at www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan/.) The overall goal for sea turtles that is relevant to this project, as identified in the Strategic Framework for Sea Turtles Restoration Activities (DWH NRDA Trustees 2017b) is:

- Restore injuries by addressing primary threats to sea turtles in the marine and terrestrial environment such as bycatch in commercial and recreational fisheries, acute environmental changes (e.g., cold water temperatures), loss or degradation of nesting beach habitat (e.g., coastal armoring and artificial lighting), and other anthropogenic threats.

The project-specific objective is to collect data to enhance understanding of overlap of fishing effort, sea turtle distribution, and sea turtle mortality.

1.3 Conceptual Setting

This project would depend on volunteers to install and operate AIS on their shrimp trawl vessels to transmit their vessel location throughout fishing trips. Therefore, the number of volunteers and the distribution of their fishing effort within the Gulf of Mexico are critical factors that will determine the success of this project. Other drivers that could influence achievement of project objectives might include mismatched spatiotemporal coverage of AIS data relative to sea turtle distributions and information about sea turtle mortality, as well as market forces or weather patterns that influence fishing activity.

1.3.1 Potential Sources of Uncertainty

Potential sources of uncertainty are defined as those that may affect the ability of a project to achieve its restoration objectives. Potential sources of uncertainty for this project could include:

- The number of volunteers recruited may be insufficient to produce enough data for the analysis to accurately differentiate trawling activity from transit between trawling locations, which is needed to understand fishing effort
- Data quality and quantity may be affected if the volunteers do not maintain and operate the equipment properly or during all phases of their trips
- Data collection (whether data are collected and reported regularly and efficiently)
- The spatial coverage of AIS data would depend on the distribution of the fishing effort of the volunteers rather than on a sampling plan, so some areas may not be sufficiently covered to derive robust interpretations of shrimp trawling effort patterns in different areas
- How data and analyses generated in this project are used by managers

This list should not be considered exhaustive; additional uncertainties may be identified as the project is further developed, implemented, and monitored. These uncertainties may affect the achievement of the restoration goals and objectives of the project. For example, changes in economic, social, or political conditions may make fisherman less willing to adopt or test novel gear to reduce sea turtle bycatch. If any drivers or stressors negatively affect the project, adaptive management may be necessary to ensure project's goals and objectives are being achieved. The adaptive management strategy for the project is outlined in Section 3.

2. Project Monitoring

Performance monitoring would be conducted to evaluate project success and identify the need for potential corrective actions or adaptive management. Relevant baseline information is critical for such an effort. At the outset of this project, information should be compiled to establish relevant baselines in existing patterns of nearshore and inshore shrimp trawling in the Gulf of Mexico, as well as any reports of sea turtle bycatch in these fisheries, to facilitate robust monitoring and evaluation of project implementation. Baseline information could come from existing sources, where available, or data collected at the beginning of the project. For this project, example types of relevant baseline information might include:

- Number of permitted vessels by state
- Maps of known shrimp trawling effort based on existing data (i.e., electronic logbooks, vessel monitoring systems data)
- Locations of reported sea turtle bycatch or strandings reported via the NOAA's shrimp trawl observer program and/or Sea Turtle Stranding and Salvage Network
- Locations where sea turtle habitats (i.e., known nesting or foraging locations) intersect with high-use locations

Prior to project implementation, specific restoration objectives, activities, and associated monitoring parameters and metrics will be defined by each Implementing Trustee, as relevant for the focal species and their habitats, and the geographic area and specific components of the sampling design for each activity. The following table provides draft project objectives and potential parameters that could be used in project monitoring; it is preliminary and is not exhaustive or prescriptive.

Draft project objective and potential parameters

Draft Project Objective	Potential Parameters
Collect data to enhance understanding of overlap of fishing effort, sea turtle distribution, and sea turtle mortality	• Number of vessels, by state, that voluntarily carry AIS and contribute to the project, and length of time they participate • Summary data products of reported effort data, such as maps of fishing effort within and across Gulf of Mexico states • Data summaries provided to the NOAA Gear Monitoring Team for use in community outreach opportunities • Web-based platform to serve data products, including 'heat maps' showing area use, real-time fishing effort maps, and active units by state

3. Adaptive Management

As discussed in the PDARP/PEIS, adaptive management is a form of structured decision-making applied to the management of natural resources in the face of uncertainty (Pastorok et al. 1997; Williams 2011). It is an iterative process that integrates monitoring and evaluation of management actions with flexible decision-making, where adjustments are made to management approaches based on observed outcomes (NRC 2004). Within the context of ecological restoration, adaptive management addresses key uncertainties by linking science to restoration decision-making (Steyer and Llewellyn 2000; Thom et al. 2005). Performance may be evaluated in terms of implementation of the project plan, expected project outputs, or the ability of the project to achieve the desired restoration outcomes.

This is a data-gathering project with the intent to inform future restoration projects on the most beneficial locations to focus voluntary bycatch mitigation efforts to reduce nearshore and inshore sea turtle bycatch. Due to the nature of this project, MAM is built into the projects as an ongoing evaluation of the program and the analysis of the data collected. The distribution of participating fishermen across Gulf of Mexico states will inform adaptive management of where and how efforts to recruit volunteers are implemented geographically to ensure sufficient data coverage. Data collected on the nearshore and inshore shrimp trawling effort would inform adaptive management needed during implementation or future restoration planning, particularly in ongoing activities by NOAA Gear Management Team.

4. Evaluation

Project MAM would include carefully planned evaluations of the selected parameters (potentially including the examples in Section 2) throughout the project's lifetime. By thoughtfully developing evaluation methods for the design and implementation of project restoration activities, the project team could assess if the project is meeting its restoration objectives or determine the need for adaptive management. Such evaluations could include assessing vessel participation rates as well as the quality of data that AIS devices are providing. As the specific parameters for given project components are selected, this MAM Plan will be updated accordingly.

5. Project-Level Decisions: Performance Criteria and Potential Corrective Actions

This section describes how knowledge gained from the evaluation of the monitoring data would be used at the project-level (1) to determine whether the project, once implemented, is considered successful, and (2) to inform the need for potential corrective actions. Project success would be determined by comparing monitoring data to project-specific performance criteria for the key parameters related to the project's restoration objectives. However, project-specific performance criteria have not yet been identified for any parameter identified in Section 2. Such criteria and potential corrective actions will continue to be developed, and this MAM Plan will be updated accordingly.

6. Monitoring Schedule

The project monitoring schedule will be determined when siting and design are completed, and when the parameters that will be measured have been selected.

7. Data Management

To the extent practicable, after consideration of ongoing federal and/or state-specific efforts (e.g., current protocols, existing databases), all environmental and biological data generated during monitoring activities will be documented using standardized field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, project-specific datasheets will be drafted prior to conducting any project monitoring activities. Electronic data file names should include the date on which the file was created, a ReadMe file that describes when and by whom the file was created, and any explanatory notes about the file contents. If a data file is revised, a new copy will be made and the original preserved. The Implementing Trustees will verify and validate monitoring data and information and will ensure that all data are entered or converted into agreed upon/commonly used digital format labeled with metadata.

7.1 Data Review and Clearance

A standardized reporting format would be developed to the extent practicable (e.g., from standardized data sheet). Prior to publication, data will be reviewed and verified for completeness. A quality check is done by comparing the entered electronic data to the original hard copy data sheet. Data are validated and any necessary corrections are made. Upon validation, data are approved for analysis, reporting and archiving.

After any and all errors are addressed, data are considered to have completed a QA/QC review. Before submitting the monitoring data and information package, Implementing Trustees shall confirm with one another that the package is approved for submission. The Implementing Trustees will give the other TIG members time to review the data before publication in DIVER. No data release can occur if it is contrary to federal or state laws.

7.2 Data Storage and Accessibility

After all data has been verified by QA/QC procedures, it will be stored on DIVER and, where applicable, on Implementing Trustee databases.

7.3 Data Sharing

Data will be made publicly available through DIVER and, where applicable, Implementing Trustee databases, in accordance with the applicable data sharing policies and regulations in operation at the time of data collection.

8. Reporting

Project monitoring reports will be prepared and uploaded to DIVER annually. In addition, consistent with Trustee Council Standard Operating Procedures and future amendments, the Implementing Trustee will develop a final, high-level summary report prior to project close-out (Section 10.7.1 of SOPs; DWH NRDA Trustees 2016). This final report will provide a range of information about the project, including activities, key achievements, and lessons learned.

9. Roles and Responsibilities

The Implementing Trustee for this Project would be NOAA, with involvement from other Regionwide TIG Trustees, and the project would establish a Steering Committee comprised of NOAA observer program and electronic monitoring experts, NOAA sea turtle experts, and state fisheries managers.

10. Monitoring and Adaptive Management Budget

The budget for this project includes support for the full range of monitoring and adaptive management activities described above, including field sampling, data management, report writing, and adaptive management.

References

DWH NRDA (Deepwater Horizon Natural Resource Damage Assessment) Trustees. 2016. "Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the *Deepwater Horizon* (DWH) Oil Spill." https://www.gulfspillrestoration.noaa.gov/sites/default/files/DWH%20TC%20SOP%202.0%20with%20appendices.pdf.

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Monitoring and Adaptive Management Plan: Restore and Enhance Sea Turtle Nest Productivity

1. Introduction, Purpose and Need, and Public Participation

This project Monitoring and Adaptive Management (MAM) Plan identifies the monitoring and data collection needed to evaluate progress toward meeting the project's objectives and to support necessary adaptive management. This plan was developed in accordance with the MAM Plan template provided in the MAM Manual Version 1.0 and was adapted to fit the needs of this project (DWH NRDA Trustees 2017a). This MAM Plan is a living document and will be updated as needed to reflect new information or changing conditions. More specifically, the Regionwide Trustee Implementation Group (TIG) will update this plan as project components are more fully developed and siting and design activities are completed. While general areas of implementation and design are defined for this project, the exact locations and site-specific design details will be developed as a part of project implementation. Because such details have not yet been resolved, many aspects of this MAM Plan have not yet been determined (e.g., parameters to track, the method and frequency of measuring specific parameters). Future revisions to this document will be made publicly available as part of project implementation through the Data Integration, Visualization, Exploration, and Reporting (DIVER) Portal (www.diver.orr.noaa.gov/web/guest/home) and accessible through the Trustee Council's website (www.habitat.noaa.gov/storymap/dwh/).

1.1 Project Overview

To restore sea turtles injured by the *Deepwater* Horizon (DWH) oil spill, this project would develop and implement restoration actions to improve hatchling production for loggerhead, Kemp's ridley, and green sea turtles on sandy beaches throughout the northern Gulf of Mexico (i.e., Texas, Mississippi, Alabama, Florida), on high-density nesting beaches in and adjacent to Archie Carr National Wildlife Refuge, Florida, and in Northern Mexico. During the project's initial planning activities (Phase 1), Implementing Trustee agencies from Texas, Mississippi, Alabama, Florida, the Department of the Interior [DOI]) would identify the highest priority threats to key nesting beaches. Information gathered and compiled into a database would include existing and potential nesting beach physical characteristics, nest productivity, existing threats, and management actions. During Phase 2, Implementing Trustees would implement actions that would help nesting females secure access to suitable nesting habitat, successfully excavate nests, and return to the water after nesting; enhance nest success; and enhance hatchling emergence and seaward migrations. Actions would align with species-specific recovery plans and state-specific rules and could include removing barriers to beaches, managing nests to protect eggs and hatchlings when necessary and appropriate, monitoring beaches to prevent predation and poaching, reducing lighting near beaches, and restoring beach habitat.

1.2 Restoration Type Goals and Project-Specific Objectives

This project is designed to primarily address the Sea Turtles Restoration Type, as defined in the 2016 *Deepwater Horizon* Oil Spill Final Programmatic Damage Assessment and Restoration Plan/Programmatic Environmental Impact Statement (PDARP/PEIS). (The PDARP/PEIS and the Record of Decision (ROD) are available at www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan/.) The overall goals for sea turtles that are relevant to this project, as identified in the Strategic Framework for Sea Turtles Restoration Activities (DWH NRDA Trustees 2017b) include:

- Implement an integrated portfolio of restoration approaches to address all injured life stages (hatchling, juvenile, and adult) and species of sea turtles.
- Restore injuries by addressing primary threats to sea turtles in the marine and terrestrial environment such as bycatch in commercial and recreational fisheries, acute environmental changes (e.g., cold water temperatures), loss or degradation of nesting beach habitat (e.g., coastal armoring and artificial lighting), and other anthropogenic threats.
- Restore sea turtles in the various geographic and temporal areas within the Gulf of Mexico and Atlantic Ocean that are relevant to injured species and life stages.
- Support existing conservation efforts by ensuring consistency with recovery plans and recovery goals for each of the sea turtle species.

The overall project objective is to improve sea turtle hatchling production in the Gulf of Mexico, on the east coast of Florida, and in northern Mexico. More specific project objectives include:

- Developing a database that includes existing and potential nesting beach physical characteristics, nest productivity, existing threats, and management actions
- Implement actions that would help nesting females successfully nest and return to the water, enhance nest success, and enhance hatchling emergence and seaward migrations

1.3 Conceptual Setting

Sea turtles are highly migratory, freely accessing nesting habitats throughout the region. Successful implementation of a regionwide project for sea turtle nesting beach restoration requires close coordination and cooperation among natural resource managers throughout the Gulf of Mexico states and Mexico. Currently, beach characteristic data are only available at a few sites in the northern Gulf of Mexico and do not represent the entirety; nest surveys on remote beaches are intermittently conducted at best. Threat identification is empirical at best and not collated in one location. Compiling nesting beach information in one database and working with local knowledge, the Sea Turtle Nesting Coordination Committee (STNCC) will operate in a regionwide manner to guide restoration actions on nesting beaches throughout the Gulf of Mexico and Florida Atlantic coast that are relevant to the injured species and life stages.

External drivers that could affect achievement of project objectives include prevailing environmental conditions that influence sand and sediment deposition and transport patterns, which could negatively affect restoration efforts on nesting beaches, as well as nest site selection patterns by female sea turtles relative to restoration sites. Specific sites for restoration activities will be identified during development of the beach characteristics database; it is anticipated that site- and area-specific plans will be implemented on at least one key nesting beach in each Gulf of Mexico state and Mexico.

1.3.1 Potential Sources of Uncertainty

Potential sources of uncertainty are defined as those that may affect the ability of a project to achieve its restoration objectives. Sources of uncertainty, the degree of uncertainty, and the level of uncertainty associated with projects will vary.

This project proposes to implement restoration actions to improve hatchling production for sea turtles on sandy beaches in the Gulf of Mexico. Potential sources of uncertainty could include:

- Land use changes
- Frequency of high intensity overwash or nest site flooding
- Natural variability in ecological and physical processes, such as wave-driven transport or vegetation growth, and in the associated habitat responses
- Response of nesting female sea turtles to restoration techniques
- Climate variability, such as changes in extreme weather events, sea level rise, changes in freshwater inflows, etc., and the resulting effects on sea turtle nesting success and hatchling production
- The ability to identify appropriate areas in which to target restoration efforts
- Whether requests of equipment, supplies, or other needs are conducted in a coordinated, consensus-based manner regionwide
- Whether requests of equipment, supplies, or other needs are fulfilled and measurably improve outcomes for nesting sea turtles, their nests, eggs, and hatchlings
- Whether equipment and supplies are maintained effectively by partner organizations within their individual budgets
- Whether and how data and analyses that are generated in this project are used by managers

This list should not be considered exhaustive; additional uncertainties may be identified as the project is further designed, implemented, and monitored. These uncertainties may affect the achievement of the restoration objectives for this project. For example, environmental conditions, (e.g., storms, tidal cycles, washover frequencies) that influence sand deposition patterns can vary at different spatial and temporal scales, and might not remain consistent throughout the life and spatial extent of the project. If any drivers or stressors are negatively impacting project implementation, adaptive management may be necessary to ensure project objectives are being achieved. The adaptive management strategy for the project is outlined in Section 3.

2. Project Monitoring

Performance monitoring would be conducted to evaluate project implementation success and identify the need for potential corrective actions or adaptive management. Relevant baseline information is critical to such an effort. At the outset of this project, information should be compiled to establish relevant baselines to facilitate robust monitoring and evaluation of project implementation. Baseline information could come from existing sources, where available, or data collected at the beginning of the project. For this project, examples of relevant baseline information might include:

- Compilation and maps of known nesting and hatchling production patterns (e.g., numbers of nests per year, nest densities, hatching success, hatchling production) by species and location
- Maps and descriptions of threats that have affected sea turtle nesting success or hatchling production
- Identification of priority locations for restoration efforts based on documented high frequency of nesting or occurrence of threats, and/or areas that have received relatively little attention

Biological monitoring (e.g., nesting activity and density, abiotic characteristics of nesting beaches, lighting intensity) would continue throughout the project and include post-restoration monitoring. Pre- and post-restoration monitoring would be based on the specific action being implemented. For example, barrier removal and beach restoration projects would require pre- and post-surveys of beach contours, while lighting retrofit projects should include pre- and post-lighting surveys.

Prior to project implementation, specific restoration objectives, activities, and associated monitoring parameters and metrics will be defined by each Implementing Trustee, as relevant for the focal species and their habitats, and the geographic area and specific components of the sampling design for each activity. The following table provides draft project objectives and potential parameters that could be used in project monitoring; it is preliminary and is not exhaustive or prescriptive.

Draft project objective and potential parameters

Draft Project Objectives	Potential Parameters
Establish Gulf of Mexico nesting beach management inventory	• Abiotic (e.g., substrate type, moisture content, elevation) conditions of nesting beaches compiled across the region • Sea turtle nesting data (e.g., number of nests, nest densities, hatching success, hatchling production, monitoring program characteristics) compiled for nesting beaches across the region • Threats to successful nesting (e.g., barriers, lighting, disturbance), incubation (e.g., overwash, predation, compaction, moisture content), or hatchling orientation and seaward migration (e.g., barriers, lighting, disturbance) compiled for nesting beaches across the region • Management actions (e.g., barrier removal, nest relocation, predator control, light management, habitat restoration) to reduce nesting beach threats and increase hatchling production compiled for the region.
Reduce ongoing impacts that interfere with nesting success and hatchling production in the Gulf of Mexico	• Nature, number, extent, duration, and timing of management actions for habitats conserved, enhanced, or restored, (e.g., number and type of barriers removed, number and type of lights made turtle-friendly) • Acreage of restored or enhanced beach habitat • Improvements in nesting habitat quality, based on indicators and benchmarks • Area monitored, and other metrics of monitoring effort (e.g., frequency of monitoring) • Number of sea turtle nests, eggs, and hatchlings successfully protected by restoration activities • Number of Kemp's ridley sea turtles, nests, eggs, and hatchlings successfully protected in Tamaulipas, Mexico

3. Adaptive Management

As discussed in the PDARP/PEIS, adaptive management is a form of structured decision-making applied to the management of natural resources in the face of uncertainty (Pastorok et al. 1997; Williams 2011). It is an iterative process that integrates monitoring and evaluation of management actions with flexible decision-making, where adjustments are made to management approaches based on observed outcomes (NRC 2004). Within the context of ecological restoration, adaptive management addresses key uncertainties by linking science to restoration decision-making (Steyer and Llewellyn 2000; Thom et al. 2005). Performance may be evaluated in terms of implementation of the project plan, expected project outputs, or the ability of the project to achieve the desired restoration outcomes.

This project will occur over multiple years and adaptive management may be used to effectively direct the use of funds. The initial planning phase will provide information that the Implementing Trustees can use to measure progress against monitoring objectives and parameters, as well as to inform planning and implementation of specific restoration techniques at high-density nesting sites. The information collected during the planning phase and during project implementation will inform Implementing Trustees about whether restoration efforts are successfully increasing sea turtle nesting success and hatchling production, and about emerging and changing sea turtle threats, so that the Implementing Trustees can adaptively manage project resources to enhance project outcomes.

4. Evaluation

Project MAM would include carefully planned evaluations of the selected parameters (potentially including the examples in Section 2) throughout the project's lifetime. By thoughtfully designing evaluation methods for the design and implementation of project restoration activities, the project team could assess if the project is meeting its restoration objectives or determine the need for adaptive management. Evaluation of project success would involve comparing target values to the baseline values for each parameter. As the specific parameters for given project components are selected, this MAM Plan will be updated accordingly.

5. Project-Level Decisions: Performance Criteria and Potential Corrective Actions

This section describes how knowledge gained from the evaluation of the monitoring data would be used at the project-level (1) to determine whether the project, once implemented, is considered successful, and (2) to inform the need for potential corrective actions. Project success would be determined by comparing monitoring data to project-specific performance criteria for the key parameters related to the project's restoration objectives. However, project-specific performance criteria have not yet been identified for any parameter identified in Section 2. Such criteria and potential corrective actions will continue to be developed, and this MAM Plan will be updated accordingly.

6. Monitoring Schedule

The project monitoring schedule will be determined when siting and design are completed, and when the parameters that will be measured have been selected.

7. Data Management

To the extent practicable, after consideration of ongoing federal and/or state-specific efforts (e.g., current protocols, existing databases), all environmental and biological data generated during monitoring activities will be documented using standardized field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, project-specific datasheets will be drafted prior to conducting any project monitoring activities. Electronic data file names should include the date on which the file was created, a ReadMe file that describes when and by whom the file was created, and any explanatory notes about the file contents. If a data file is revised, a new copy will be made and the original preserved. The Implementing Trustees will verify and validate monitoring data and information and will ensure that all data are entered or converted into agreed upon/commonly used digital format labeled with metadata.

7.1 Data Review and Clearance

A standardized reporting format would be developed to the extent practicable (e.g., from standardized data sheet). Prior to publication, data will be reviewed and verified for completeness. A quality check is done by comparing the entered electronic data to the original hard copy data sheet. Data are validated and any necessary corrections are made. Upon validation, data are approved for analysis, reporting and archiving.

After any and all errors are addressed, data are considered to have completed a QA/QC review. Before submitting the monitoring data and information package, Implementing Trustees shall confirm with one another that the package is approved for submission. The Implementing Trustees will give the other TIG members time to review the data before publication in DIVER. No data release can occur if it is contrary to federal or state laws.

7.2 Data Storage and Accessibility

After all data has been verified by QA/QC procedures, it will be stored on DIVER and, where applicable, on Implementing Trustee databases.

7.3 Data Sharing

Data will be made publicly available through DIVER and, where applicable, Implementing Trustee databases, in accordance with the applicable data sharing policies and regulations in operation at the time of data collection.

8. Reporting

Project monitoring reports will be prepared and uploaded to DIVER annually. In addition, consistent with Trustee Council Standard Operating Procedures and any future amendments, the Implementing Trustee will develop a final, high-level summary report prior to project close-out (Section 10.7.1 of SOPs; DWH NRDA Trustees 2016). This final report will provide a range of information about the project, including activities, key achievements, and lessons learned.

9. Roles and Responsibilities

This project would be implemented by multiple Trustees. DOI and selected Trustee agencies from Mississippi, Alabama, Florida, and Texas would work in cooperation with project partners (e.g., nongovernmental organizations, state resource agencies, local governments) to implement the project and related MAM activities. Implementing Trustees' roles will be further identified in accordance with SOP Section 9.5.

10. Monitoring and Adaptive Management

The budget for this project includes support for the full range of monitoring and adaptive management activities described above, including field sampling, data management, report writing, and adaptive management.

References

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Monitoring and Adaptive Management Plan: Reducing Sea Turtle Bycatch at Recreational Fishing Sites

1. Introduction, Purpose and Need, and Public Participation

This project Monitoring and Adaptive Management (MAM) Plan identifies the monitoring and data collection needed to evaluate progress toward meeting the project's objectives and to support necessary adaptive management. This plan was developed in accordance with the MAM Plan template provided in the MAM Manual Version 1.0 and was adapted to fit the needs of this project (DWH NRDA Trustees 2017a). This MAM Plan is a living document and may be updated as needed to reflect changing conditions. More specifically, the Regionwide Trustee Implementation Group (TIG) will update this plan as project components are more fully developed and siting and design activities are completed. While general areas of implementation and design are defined for this project, the exact locations and site-specific design details will be developed as a part of project implementation. Because such details have not yet been resolved, many aspects of this MAM Plan have not yet been determined (e.g., parameters to track, the method and frequency of measuring specific parameters). Future revisions to this document will be made publicly available as part of project implementation through the Data Integration, Visualization, Exploration, and Reporting (DIVER) Portal (www.diver.orr.noaa.gov/web/guest/home) and accessible through the Trustee Council's website (www.habitat.noaa.gov/storymap/dwh/).

1.1 Project Overview

This project would help restore injured sea turtles by reducing bycatch of sea turtles at shore-based recreational fishing locations, such as fishing piers, bridges, and other shoreline structures. Each year the Sea Turtle Stranding and Salvage Network (STSSN) documents incidentally hooked and entangled sea turtles at recreational piers and other shore-based fishing sites throughout the Gulf of Mexico. However, these reports are opportunistic and likely only represent a portion of the hook-and-line interactions that are occurring. Many factors determine whether an incidental hooking or entanglement is reported, including public awareness about who to contact and appropriate measures to take to minimize harm to the turtle. The objective of the project is to identify factors contributing to sea turtle bycatch at shore-based recreational fishing sites through three primary activities:

1. Initial data gathering through assessment of existing STSSN and angler survey data as well as a compilation of existing information on regional shore-based fishing sites.
2. Conducting angler surveys and local assessments to better understand angler fishing practices and potential co-factors influencing sea turtle bycatch. Survey data would be incorporated into a comprehensive data analysis to assist in identifying/exploring bycatch co-factors and inform the development and implementation of angler outreach/incentive programs for reporting bycatch.

3. Implementing angler education and other pilot programs to reduce sea turtle bycatch and bycatch injury. These measures would depend on survey results and could include voluntary modification of fishing practices such as bait or hook type or other identified co-factors.

1.2 Restoration Type Goals and Project Restoration Objectives

This project is designed to primarily address the Sea Turtles Restoration Type, as defined in the 2016 *Deepwater Horizon* Oil Spill Final Programmatic Damage Assessment and Restoration Plan/Programmatic Environmental Impact Statement (PDARP/PEIS). (The PDARP/PEIS and the Record of Decision (ROD) are available at www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan/.) The overall goal for sea turtles that is relevant to this project, as identified in the Strategic Framework for Sea Turtles Restoration Activities (DWH NRDA Trustees 2017b) is:

- Restore injuries by addressing primary threats to sea turtles in the marine and terrestrial environment such as bycatch in commercial and recreational fisheries, acute environmental changes (e.g., cold water temperatures), loss or degradation of nesting beach habitat (e.g., coastal armoring and artificial lighting), and other anthropogenic threats.

The project-specific restoration objective is to identify factors contributing to sea turtle bycatch at shore-based recreational fishing sites through implementation of the three primary activities listed in the previous section.

1.3 Conceptual Setting

Bycatch of sea turtles in shore-based recreational fisheries occurs throughout the Gulf of Mexico, generally with highest numbers in the spring/summer, from March through August. However, these reports are opportunistic and likely only represent a portion of the hook-and-line interactions that are occurring. There are many factors involved in whether an incidental capture is reported, including public awareness of who to contact and what to do with the animal; factors such as currents, wind, location at which a turtle dies relative to the coast; and whether a turtle strands in an area where it can be detected by humans. This project would depend on volunteers to respond to surveys and to test fishing practice modifications (e.g., changes in bait or hook type). Therefore, the number of volunteers and the distribution of their fishing effort within the region are critical factors that will determine the success of this project. Other factors that could influence achievement of project objectives might include mismatched spatiotemporal coverage of survey data relative to sea turtle distributions and information about sea turtle mortality used to prioritize project locations.

1.3.1 Potential Sources of Uncertainty

Potential sources of uncertainty are defined as those that may affect the ability of a project to achieve its restoration objectives. Sources of uncertainty, the degree of uncertainty, and the level of uncertainty associated with projects will vary.

Potential sources of uncertainty could include:

- Whether clear hotspots can be identified in which to target reduction, survey, and education efforts
- The number and distribution of volunteers to complete surveys and test measures intended to reduce sea turtle bycatch may be insufficient to adequately identify important co-factors in

sea turtle interactions with recreational gear and to adequately inform implementation of mitigation testing
- Efficacy of public education efforts in increasing appropriate disposal of fishing gear and reporting of bycatch interactions
- Identifying appropriate incentives with commercial entities that market fishing gear to enhance reporting of sea turtle bycatch in recreational hook-and-line gear

This list should not be considered exhaustive; additional uncertainties may be identified as the project is further designed, implemented, and monitored. These uncertainties may affect the achievement of the restoration objectives of the project. For example, if the programs or incentives to promote changes in recreational fishing behavior are ineffective, the benefits of the project to sea turtles would be limited. If any drivers or stressors are negatively impacting the project, adaptive management may be necessary to ensure that project objectives are being achieved. The adaptive management strategy for the project is outlined in Section 3.

2. Project Monitoring

Performance monitoring would be conducted to evaluate project success and identify the need for potential corrective actions or adaptive management. Relevant baseline information is critical for such an effort. At the outset of this project, information should be compiled to establish relevant baselines of the extent of shore-based sea turtle bycatch, as well as existing efforts to reduce these interactions to facilitate robust monitoring and evaluation of project implementation. Baseline information could come from existing sources, where available, or data collected at the beginning of the project. For this project, example types of relevant baseline information might include:

- Regionwide shore-based locations with documented sea turtle bycatch (interactions and mortality)
- Locations with a high occurrence of shore-based recreational fishing activities likely to impact sea turtles
- Locations where sea turtle habitats (i.e., known nesting or foraging locations) intersect with high-use recreational locations (e.g., boat ramps, fishing piers, jetties, artificial and natural reefs)
- Existing information about factors associated with sea turtle bycatch in recreational hook-and-line fishing gear, such as bait types, hook types, times of day, water depth, habitat types, etc.
- Number and locations of existing monofilament recycling containers, and other services available for sustainable disposal of fishing gear
- Number and locations of signage informing the public of appropriate disposal of fishing gear

Before restoration implementation begins, specific restoration objectives, activities, and associated monitoring parameters and metrics will be defined by each Implementing Trustee, as relevant for the focal species and their habitats, and the geographic area and specific components of the sampling design for each activity. The following table provides draft project objectives and potential parameters that could be used in project monitoring; it is preliminary and is not exhaustive or prescriptive.

Draft project objective and potential parameters

Draft Project Objectives	Potential Parameters
Compile an inventory of shore-based fishing sites in the Gulf of Mexico with documented sea turtle captures	• Compilation of sites of documented sea turtle bycatch in shore-based, recreational hook-and-line fishing gear, with an emphasis on severity of injuries and outcomes for turtles, by species • Characterization of the sites relative to variables that could influence bycatch of sea turtles and adjacent benthic habitats
Conduct angler surveys to better understand angler fishing practices and potential co-factors influencing sea turtle bycatch at select shore-based fishing sites	• Number and results of new or enhanced angler surveys conducted per site • Number of observations of sea turtle fisheries interactions (with an emphasis on severity of injuries and outcomes for turtles, by species) per site • Characterization of co-factors that could influence bycatch of sea turtles (e.g., bait type, hook type, time of day, night fishing allowed, pier lighting, fish cleaning stations, length, water depth where fishing occurs) and adjacent benthic habitats (e.g., community type, distance from structures)
Implement angler education and other pilot programs to reduce sea turtle bycatch and injury	• Number and type of educational opportunities including number of individuals educated by state • Number of actionable voluntary fishing practices identified and implemented per site • Number of volunteers and tests per site and fishing practice • Number of observations of sea turtle bycatch (with emphasis on severity of injuries and outcomes for turtles, by species) per site

3. Adaptive Management

As discussed in the PDARP/PEIS, adaptive management is a form of structured decision-making applied to the management of natural resources in the face of uncertainty (Pastorok et al. 1997; Williams 2011). It is an iterative process that integrates monitoring and evaluation of management actions with flexible decision-making, where adjustments are made to management approaches based on observed outcomes (NRC 2004). Within the context of ecological restoration, adaptive management addresses key uncertainties by linking science to restoration decision-making (Steyer and Llewellyn 2000; Thom et al. 2005). Performance may be evaluated in terms of implementation of the project plan, expected project outputs, or the ability of the project to achieve the desired restoration outcomes.

Data collected on the number and locations of sea turtle bycatch observations will be a fundamental monitoring parameter underpinning all objectives and activities of this project. These data would inform adaptive management needed during implementation or future restoration planning, such as adjusting the types and amount of effort invested in particular locations to enhance effective reduction of sea turtle bycatch in shore-based, recreational hook-and-line fishing gear, and perhaps identification of additional locations that warrant inclusion in project activities. Similarly, monitoring the number and locations of successful angler surveys and education outreach programs will inform adaptive management of where and how bycatch reduction efforts or whether more surveys or outreach programs are implemented.

4. Evaluation

Project MAM would include carefully planned evaluations of the selected parameters (potentially including the examples in Section 2) throughout the project's lifetime. By thoughtfully designing evaluation methods for the design and implementation of project restoration activities, the project team could assess if the project is meeting its restoration objectives or determine the need for adaptive management. Evaluation of project success would involve comparing target values to the baseline values for each parameter. As the specific parameters for given project components are selected, this MAM Plan will be updated accordingly.

5. Project-Level Decisions: Performance Criteria and Potential Corrective Actions

This section describes how knowledge gained from the evaluation of the monitoring data would be used at the project-level (1) to determine whether the project, once implemented, is considered successful, and (2) to inform the need for potential corrective actions. Project success would be determined by comparing monitoring data to project-specific performance criteria for the key parameters related to the project's restoration objectives. However, project-specific performance criteria have not yet been identified for any parameter identified in Section 2. Such criteria and potential corrective actions will continue to be developed, and this MAM Plan will be updated accordingly.

6. Monitoring Schedule

The project monitoring schedule would be determined when siting and design are completed, and when the parameters that will be measured have been selected.

7. Data Management

To the extent practicable, after consideration of ongoing federal and/or state-specific efforts (e.g., current protocols, existing databases), all environmental and biological data generated during monitoring activities will be documented using standardized field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, project-specific datasheets will be drafted prior to conducting any project monitoring activities. Electronic data file names should include the date on which the file was created, a ReadMe file that describes when and by whom the file was created, and any explanatory notes about the file contents. If a data file is revised, a new copy will be made and the original preserved. The Implementing Trustees will verify and validate monitoring data and information and will ensure that all data are entered or converted into agreed upon/commonly used digital format labeled with metadata.

7.1 Data Review and Clearance

A standardized reporting format would be developed to the extent practicable (e.g., from standardized data sheet). Prior to publication, data will be reviewed and verified for completeness. A quality check is done by comparing the entered electronic data to the original hard copy data sheet. Data are validated and any necessary corrections are made. Upon validation, data are approved for analysis, reporting and archiving.

After any and all errors are addressed, data are considered to have completed a QA/QC review. Before submitting the monitoring data and information package, Implementing Trustees shall confirm with one another that the package is approved for submission. The Implementing Trustees will give the other TIG members time to review the data before publication in DIVER. No data release can occur if it is contrary to federal or state laws.

7.2 Data Storage and Accessibility

After all data has been verified by QA/QC procedures, it will be stored on DIVER and, where applicable, on Implementing Trustee databases.

7.3 Data Sharing

Data will be made publicly available through DIVER and, where applicable, Implementing Trustee databases, in accordance with the applicable data sharing policies and regulations in operation at the time of data collection.

8. Reporting

Project monitoring reports will be prepared and uploaded to DIVER annually. In addition, consistent with Trustee Council Standard Operating Procedures and any future amendments, the Implementing Trustee will develop a final, high-level summary report prior to project close-out (Section 10.7.1 of SOPs; DWH NRDA Trustees 2016). This final report will provide a range of information about the project, including activities, key achievements, and lessons learned.

9. Roles and Responsibilities

This project's components would be implemented by multiple Trustees. DOI and selected Trustee agencies from Texas, Mississippi, Alabama, and Florida. would work in cooperation with project partners (e.g., nongovernmental organizations [NGOs], state resource agencies, local governments) to develop and implement each project component. For each component, the lead Implementing Trustee would also serve as the lead coordinator and implementer of MAM activities. Implementing Trustees' roles will be further identified in accordance with SOP Section 9.5.

10. Monitoring and Adaptive Management Budget

The budget for this project includes support for the full range of monitoring and adaptive management activities described above, including field sampling, data management, report writing, and adaptive management.

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Monitoring and Adaptive Management Plan: Regionwide Enhancements to the Sea Turtle Stranding and Salvage Network and Enhanced Rehabilitation

1. Introduction, Purpose and Need, and Public Participation

This project Monitoring and Adaptive Management (MAM) Plan identifies the monitoring and data collection needed to evaluate progress toward meeting the project's objectives and to support necessary adaptive management. This plan was developed in accordance with the MAM Plan template provided in the MAM Manual Version 1.0 and was adapted to fit the needs of this project (DWH NRDA Trustees 2017a). This MAM Plan is a living document and will be updated as needed to reflect new information or changing conditions. More specifically, the Regionwide Trustee Implementation Group (TIG) will update this plan as project components are more fully developed and siting and design activities are completed. While general areas of implementation and design are defined for this project, the exact locations and site-specific design details will be developed as a part of project implementation. Because such details have not yet been resolved, many aspects of this MAM Plan have not yet been determined (e.g., parameters to track, the method and frequency of measuring specific parameters). Future revisions to this document will be made publicly available as part of project implementation through the Data Integration, Visualization, Exploration, and Reporting (DIVER) Portal (www.diver.orr.noaa.gov/web/guest/home) and accessible through the Trustee Council's website (www.habitat.noaa.gov/storymap/dwh/).

1.1 Project Overview

Stranding response networks located in each of the five Gulf of Mexico coast states create an extensive regionwide network that provides critical support and care for injured sea turtles, as well as valuable information about mortality sources. This project would enhance the capabilities of project partners conducting stranding and rehabilitation activities in the region by supporting critical enhancement needs for Sea Turtle Stranding and Salvage Network (STSSN) response efforts that are not already being addressed through other funding sources (e.g., the Sea Turtle Early Restoration Project and National Fish and Wildlife Foundation Gulf Environmental Benefit Fund). The project includes the two components described below.

The first component would provide support for critical needs and gaps (e.g., equipment and supplies and services) to enhance existing sea turtle response organizations and rehabilitation facilities. The project could provide support for responding to stranding events, recovering and necropsying dead stranded sea turtles to better understand mortality sources, or filling other identified critical needs and gaps in STSSN response coverage where sea turtles would benefit from increased response effort or capacity. Specific activities could include the development and distribution of education and outreach materials, transport needs for live sea for rehabilitation, implementing stranding surveys, and providing veterinary services. Stranding response and rehabilitation activities are ongoing along the Gulf of Mexico coast and emergency events can occur any time across the proposed project area. Maintaining the ability and readiness to respond to periodic, large-scale stranding events resulting from anomalies (e.g., red tide, cold stun) can potentially improve the survival of stranded individuals depending on the factors causing the stranding event.

The second component would enhance the capabilities of project partners conducting stranding and rehabilitation activities in the Gulf of Mexico by supporting the construction of a new rehabilitation facility on the upper Texas coast. This activity would address a gap in the network by replacing lost rehabilitation capacity due to the impending closure of an existing facility. Without this sea turtle rehabilitation facility, sea turtles stranding on the upper Texas coast would have to be transported 3.5 to 5.5 hours (depending on location) to reach the nearest facility. Dedicated personnel or vehicle availability to routinely transport turtles longer distances may not be possible in a timely manner. In addition, the existing facilities may not have capacity to intake more sea turtles during large-scale stranding events. Typically, cold stun events occur on the lower Texas coast; however, the existing Galveston facility is often used to house and treat the overflow when the middle and lower coast facilities reach capacity during large events. Between 2015 and 2019, the existing Galveston facility rehabilitated an average of 234 sea turtles per year. Because Texas has only four long-term rehabilitation facilities that can handle critical care for 367 miles of coastline, and a large number of live strandings that are rehabilitated on the upper Texas coast, the reduction of one rehabilitation facility would potentially have a significant effect on the ability of the network to successfully provide coverage to rehabilitate and release sea turtles.

1.2 Restoration Type Goals and Project-Specific Objectives

This project is designed to primarily address the Sea Turtles Restoration Type, as defined in the 2016 *Deepwater Horizon* Oil Spill Final Programmatic Damage Assessment and Restoration Plan/Programmatic Environmental Impact Statement (PDARP/PEIS). (The PDARP/PEIS and the Record of Decision (ROD) are available at www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan/.) The overall goals for sea turtles that are relevant to this project, as identified in the Strategic Framework for Sea Turtles Restoration Activities (DWH NRDA Trustees 2017b) include:

- Restore sea turtles in the various geographic and temporal areas within the Gulf of Mexico and Atlantic Ocean that are relevant to injured species and life stages.
- Support existing conservation efforts by ensuring consistency with recovery plans and recovery objectives for each of the sea turtle species.

The project-specific restoration objective is to enhance the capabilities of project partners conducting stranding and rehabilitation activities in the Gulf of Mexico. This project objective may be further refined or divided into multiple objectives in future versions of this MAM Plan.

1.3 Conceptual Setting

Sea turtles move throughout the Gulf of Mexico and are subject to natural and anthropogenic threats during all life stages and in all habitats. Stranding events such as red tides, cold stuns, major freshwater intrusions, and recruitment pulses through inlets and passes leading to vessel strikes and entrapment occur regionwide. These factors lead to an unpredictable distribution of mass stranding events, although there may be local features that consistently contribute to higher rates of individual strandings. Therefore, enhanced capacity for stranding response and rehabilitation activities is beneficial along the entire Gulf Coast.

Rehabilitation facilities located in each of the five Gulf of Mexico coast states comprise an extensive regionwide network that provides critical support and care for injured sea turtles. However, the capacities of these facilities may limit the number of animals that can be successfully rehabilitated following extreme mass stranding events. Enhancements to these facilities may increase the number of turtles successfully rehabilitated and released back to the wild and/or decrease rehabilitation time. Replacing the facility on the upper Texas coast and acquiring life support systems for veterinary hospital wards may also increase the number of turtles successfully rehabilitated and released back to the wild and/or decrease rehabilitation time. The specific needs of rehabilitation facilities are expected to vary across the Gulf of Mexico as the needs cannot be predicted without evaluation, and it is likely that continual evaluation will be required to assess changing needs over the life of the project.

1.3.1 Potential Sources of Uncertainty

Potential sources of uncertainty are defined as those that may affect the ability of a project to achieve its restoration objectives.

This project is intended to enhance response and rehabilitation capacity for the STSSN regionwide. Potential sources of uncertainty include the following:

- Whether requests of equipment, supplies, or other needs can be conducted in a coordinated, consensus-based manner regionwide.
- Whether requests of equipment, supplies, or other needs measurably maximize rehabilitation outcomes of stranded sea turtles.
- Project success could be affected if equipment and supplies are not maintained effectively by partner organizations within their individual budgets.
- Whether data can be collected and reported regularly and efficiently.
- The number, locations, and magnitudes of mass stranding events are highly variable and may overwhelm one or more portions of the regionwide STSSN, regardless of any reasonable level of preparedness based on past performance. These variable factors may also result in very low numbers of strandings during the monitoring period.
- Logistical constraints in the worldwide network of suppliers could result in a shortage of supplies needed for stranding response regardless of the amount of funding available to purchase supplies.
- Extreme weather events could damage the capacity of the STSSN to respond to strandings in a given locale or could damage rehabilitation facilities, reducing the number of animals that can be successfully rehabilitated. Weather events could also coincide with stranding events, reducing the effectiveness of the stranding response.
- Economic factors may lead to attrition in STSSN personnel and difficulty in finding replacements.
- Political factors may result in loss of support of the STSSN, reducing funding from sources other than the *Deepwater Horizon* (DWH) Program.

This list should not be considered exhaustive; additional uncertainties may be identified as the project is further designed, implemented, and monitored. These uncertainties may affect the achievement of the restoration objectives of the project. For example, environmental or other drivers influence variable strandings patterns relative to location of strandings response and rehabilitation capacity in the Gulf of Mexico, and these patterns might not remain consistent throughout the life of the project. If any drivers or stressors are negatively impacting the project, adaptive management may be necessary to ensure project objectives are being achieved. The adaptive management strategy for the project is outlined in Section 3.

2. Project Monitoring

Performance monitoring would be conducted to evaluate project success and identify the need for potential corrective actions or adaptive management. Relevant baseline information is critical to such an effort. At the outset of this project, information should be compiled to establish relevant baselines in existing patterns of sea turtle strandings and their causes, where known. Baseline information could come from existing sources, where available, or data collected at the beginning of the project. For this project, example types of relevant baseline information might include:

- Compilation and maps of known strandings by species, location, and event (where possible, e.g., cold stunning, oil spill, harmful algal bloom)
- Maps and description of events that warranted STSSN response, including number, types, durations, and spatial scales
- Identification of priority locations for enhanced response and rehabilitation efforts based on documented high frequency of strandings or areas that have received relatively little attention but are likely to have strandings
- Existing response capacity (e.g., number of trained personnel, necessary field equipment)
- Existing rehabilitation capacity (e.g., number of tanks maintained in compliance with U.S. Fish and Wildlife Service permits; adequate water filtration systems; inventory of diagnostic, medical, therapeutic equipment, and supplies)
- Availability of veterinary staff with appropriate training and experience in marine turtle treatment and care.

Prior to project implementation, specific restoration objectives, activities, and associated monitoring parameters and metrics will be defined by each Implementing Trustee, as relevant for the focal species and their habitats, and the geographic area and specific components of the sampling design for each activity. The following table provides draft project objectives and potential parameters that could be used in project monitoring; it is preliminary and is not exhaustive or prescriptive.

Draft project objective and potential parameters

Draft Project Objective	Potential Parameters
Enhance the capabilities of project partners conducting stranding and rehabilitation activities in the Gulf of Mexico	• Response capacity (e.g., tallies or descriptions of equipment secured or maintained) • Characterization of responses (e.g., descriptions or tallies of the types and frequency of specific activities supported by the network) • Rehabilitation capacity (e.g., new facility constructed, number of sea turtles that can be rehabilitated at any given time increased diagnostic, medical, or therapeutic capabilities) • Outcomes of turtles treated (e.g., number or percentage of sea turtles treated that were successfully rehabilitated, enhancements to captive management for those not releasable)

3. Adaptive Management

As discussed in the PDARP/PEIS, adaptive management is a form of structured decision-making applied to the management of natural resources in the face of uncertainty (Pastorok et al. 1997; Williams 2011). It is an iterative process that integrates monitoring and evaluation of management actions with flexible decision-making, where adjustments are made to management approaches based on observed outcomes (NRC 2004). Within the context of ecological restoration, adaptive management addresses key uncertainties by linking science to restoration decision-making (Steyer and Llewellyn 2000; Thom et al. 2005). Performance may be evaluated in terms of implementation of the project plan, expected project outputs, or the ability of the project to achieve the desired restoration outcomes.

This project will occur over multiple years and adaptive management would be used to more effectively direct the use of funds if performance criteria are not met. The operation of the STSSN is a critical activity necessary not only to rescue, rehabilitate, and release sea turtles in a timely manner, but also to provide information that supports other activities that decrease mortality such as fisheries bycatch. Information from the STSSN can also be used to inform restoration planners and resource managers about emerging and changing sea turtle threats and as a result target threat reduction activity.

4. Evaluation

Project MAM would include carefully planned evaluations of the selected parameters (potentially including the examples in Section 2) throughout the project's lifetime. By thoughtfully designing evaluation methods for the design and implementation of project restoration activities, the project team could assess if the project is meeting its restoration objectives or could determine the need for adaptive management. Such evaluations could include assessing whether key equipment and materials is being secured, tracking whether increases in capacity are leading to an increase in rescue and rehabilitation activities, and evaluating whether increases in capacity are leading to improved outcomes for sea turtles. As the specific parameters for given project components are selected, this MAM Plan will be updated accordingly.

5. Project-level Decisions: Performance Criteria and Potential Corrective Actions

This section describes how knowledge gained from the evaluation of the monitoring data would be used at the project-level (1) to determine whether the project, once implemented, is considered successful, and (2) to inform the need for potential corrective actions. Project success would be determined by comparing monitoring data to project-specific performance criteria for the key parameters related to the project's restoration objectives. However, project-specific performance criteria have not yet been identified for any parameter identified in Section 2. Such criteria and potential corrective actions will continue to be developed, and this MAM Plan will be updated accordingly.

6. Monitoring Schedule

The project monitoring schedule will be determined when siting and design are completed for the different project components, and when the parameters that will be measured have been selected.

7. Data Management

To the extent practicable, after consideration of ongoing federal and/or state-specific efforts (e.g., current protocols, existing databases), all environmental and biological data generated during monitoring activities will be documented using standardized field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, project-specific datasheets will be drafted prior to conducting any project monitoring activities. Electronic data file names should include the date on which the file was created, a ReadMe file that describes when and by whom the file was created, and any explanatory notes about the file contents. If a data file is revised, a new copy will be made and the original preserved. The Implementing Trustees will verify and validate monitoring data and information and will ensure that all data are entered or converted into agreed upon/commonly used digital format labeled with metadata.

7.1 Data Review and Clearance

A standardized reporting format would be developed to the extent practicable (e.g., from standardized data sheet). Prior to publication, data will be reviewed and verified for completeness. A quality check is done by comparing the entered electronic data to the original hard copy data sheet. Data are validated and any necessary corrections are made. Upon validation, data are approved for analysis, reporting and archiving.

After any and all errors are addressed, data are considered to have completed a QA/QC review. Before submitting the monitoring data and information package, Implementing Trustees shall confirm with one another that the package is approved for submission. The Implementing Trustees will give the other TIG members time to review the data before publication in DIVER. No data release can occur if it is contrary to federal or state laws.

7.2 Data Storage and Accessibility

After all data has been verified by QA/QC procedures, it will be stored on DIVER and, where applicable, on Implementing Trustee databases.

7.3 Data Sharing

Data will be made publicly available through DIVER and, where applicable, Implementing Trustee databases, in accordance with the applicable data sharing policies and regulations in operation at the time of data collection.

8. Reporting

Project monitoring reports will be prepared and uploaded to DIVER annually. In addition, consistent with Trustee Council Standard Operating Procedures and any future amendments, the Implementing Trustee will develop a final, high-level summary report prior to project close-out (Section 10.7.1 of SOPs; DWH NRDA Trustees 2016). This final report will provide a range of information about the project, including activities, key achievements, and lessons learned.

9. Roles and Responsibilities

This project would be implemented regionwide by a partnership of co-Implementing Trustees (i.e., NOAA and Trustee selected agencies from Texas, Louisiana, Mississippi, Alabama, and Florida), state STSSN coordinators, and the National STSSN Coordination Team. Implementing Trustees' roles will be further identified in accordance with SOP Section 9.5. These entities would coordinate annually to discuss potential priorities of the various stranding network partners. After these discussions, the partners would develop a regional work plan, and the Implementing Trustees would review and approve the combined work plan, which would be submitted to the Regionwide TIG for final approval. The work plan would include a description of the tasks, the identification of the organization to carry out that task, the funding needed, and the mechanism for distributing the funding. Evaluation, prioritization, and addressing critical enhancement needs and current funding gaps for STSSN response would begin upon project approval and would take approximately 5 years to complete.

10. Monitoring and Adaptive Management Budget

The budget for this project includes support for the full range of monitoring and adaptive management activities described above, including data collection, data management, report writing, and adaptive management.

References

DWH NRDA (Deepwater Horizon Natural Resource Damage Assessment) Trustees. 2016. "Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the *Deepwater Horizon* (DWH) Oil Spill." https://www.gulfspillrestoration.noaa.gov/sites/default/files/DWH%20TC%20SOP%202.0%20with%20appendices.pdf.

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Appendix B: Impact Thresholds

Table B-1. Guidelines for NEPA impact determinations in the PDARP/PEIS

Resource	Impact duration	Impact intensity definitions		
		Minor	Moderate	Major
Physical resources				
Geology and substrates	Short-term: During construction period. Long-term: Over the life of the project or longer.	Disturbance to geologic features or soils could be detectable, but could be small and localized. There could be no changes to local geologic features or soil characteristics. Erosion and/or compaction could occur in localized areas.	Disturbance could occur over local and immediately adjacent areas. Impacts to geology or soils could be readily apparent and result in changes to the soil character or local geologic characteristics. Erosion and compaction impacts could occur over local and immediately adjacent areas.	Disturbance could occur over a widespread area. Impacts to geology or soils could be readily apparent and could result in changes to the character of the geology or soils over a widespread area. Erosion and compaction could occur over a widespread area. Disruptions to substrates or soils may be permanent.
Hydrology and water quality	Short-term: During construction period. Long-term: Over the life of the project or longer.	Hydrology: The effect on hydrology could be measurable, but it could be small and localized. The effect could only temporarily alter the area's hydrology, including surface and ground water flows. Water quality: Impacts could result in a detectable change to water quality, but the change could be expected to be small and localized. Impacts could quickly become undetectable. State water quality standards as required by the Clean Water Act could not be exceeded. Floodplains: Impacts may result in a detectable change to natural and beneficial floodplain values, but the	Hydrology: The effect on hydrology could be measurable, but small and limited to local and adjacent areas. The effect could permanently alter the area's hydrology, including surface and ground water flows. Water quality: Effects to water quality could be observable over a relatively large area. Impacts could result in a change to water quality that could be readily detectable and limited to local and adjacent areas. Change in water quality could persist; however, it could likely not exceed state water quality standards as required by the Clean Water Act.	Hydrology: The effect on hydrology could be measurable and widespread. The effect could permanently alter hydrologic patterns including surface and ground water flows. Water quality: Impacts could likely result in a change to water quality that could be readily detectable and widespread. Impacts could likely result in exceedance of state water quality standards and/or could impair designated uses of a water body. Floodplains: Impacts could result in a change to natural and beneficial floodplain values that could have substantial consequences over a

Resource	Impact duration	Impact intensity definitions		
		Minor	Moderate	Major
		change could be expected to be small, and localized. There could be no appreciable increased risk of flood loss including impacts on human safety, health, and welfare. Wetlands: The effect on wetlands could be measurable but small in terms of area and the nature of the impact. A small impact on the size, integrity, or connectivity could occur; however, wetland function could not be affected and natural restoration could occur if left alone.	Floodplains: Impacts could result in a change to natural and beneficial floodplain values and could be readily detectable, but limited to local and adjacent areas. Location of operations in floodplains could increase risk of flood loss, including impacts on human safety, health, and welfare. Wetlands: The action could cause a measurable effect on wetlands indicators (size, integrity, or connectivity) or could result in a permanent loss of wetland acreage across local and adjacent areas. However, wetland functions could only be permanently altered in limited areas.	widespread area. Location of operations could increase risk of flood loss, including impacts on human safety, health, and welfare. Wetlands: The action could cause a permanent loss of wetlands across a widespread area. The character of the wetlands could be changed so that the functions typically provided by the wetland could be permanently lost.
Air quality	Short-term: During construction period. Long-term: Over the life of the project or longer.	The impact on air quality may be measurable, but could be localized and temporary, such that the emissions do not exceed the Environmental Protection Agency's (EPA's) *de minimis* criteria for a general conformity determination under the Clean Air Act (40 C.F.R. 93.153).	The impact on air quality could be measurable and limited to local and adjacent areas. Emissions of criteria pollutants could be at EPA's *de minimis* criteria levels for general conformity determination.	The impact on air quality could be measurable over a widespread area. Emissions are high, such that they could exceed EPA's *de minimis* criteria for a general conformity determination.
Noise	Short-term: During construction period.	Increased noise could attract attention, but its contribution to the soundscape would be localized and unlikely to affect current user activities.	Increased noise could attract attention and contribute to the soundscape including in local areas and those adjacent to the action, but could not dominate. User activities could be affected.	Increased noise could attract attention and dominate the soundscape over widespread areas. Noise levels could eliminate or discourage user activities.

Resource	Impact duration	Impact intensity definitions: Minor	Moderate	Major
	Long-term: Over the life of the project.			
Biological resources				
Habitats	Short-term: Lasting less than two growing seasons. Long-term: Lasting longer than two growing seasons.	Impacts on native vegetation may be detectable, but could not alter natural conditions and could be limited to localized areas. Infrequent disturbance to individual plants could be expected, but would not affect local or range-wide population stability. Infrequent or insignificant one-time disturbance to locally suitable habitat could occur, but sufficient habitat could remain functional at both the local and regional scales to maintain the viability of the species. Opportunity for increased spread of non- native species could be detectable but temporary and localized and could not displace native species populations and distributions.	Impacts on native vegetation could be measurable but limited to local and adjacent areas. Occasional disturbance to individual plants could be expected. These disturbances could affect local populations negatively but could not be expected to affect regional population stability. Some impacts might occur in key habitats, but sufficient local habitat could retain function to maintain the viability of the species both locally and throughout its range. Opportunity for increased spread of non- native species could be detectable and limited to local and adjacent areas, but could only result in temporary changes to native species population and distributions.	Impacts on native vegetation could be measurable and widespread. Frequent disturbances of individual plants could be expected, with negative impacts to both local and regional population levels. These disturbances could negatively affect range- wide population stability. Some impacts might occur in key habitats, and habitat impacts could negatively affect the viability of the species both locally and throughout its range. Actions could result in the widespread increase of non-native species, resulting in broad and permanent changes to native species populations and distributions.
Wildlife species (including birds)	Short-term: Lasting up to two breeding seasons, depending on length of breeding season. Long-term: Lasting more	Impacts to native species, their habitats, or the natural processes sustaining them could be detectable, but localized, and could not measurably alter natural conditions. Infrequent responses to disturbance by some individuals could be expected, but without interference to feeding, reproduction, resting,	Impacts on native species, their habitats, or the natural processes sustaining them could be measurable but limited to local and adjacent areas. Occasional responses to disturbance by some individuals could be expected, with some negative impacts to feeding, reproduction, resting, migrating, or	Impacts on native species, their habitats, or the natural processes sustaining them could be detectable and widespread. Frequent responses to disturbance by some individuals could be expected, with negative impacts to feeding, reproduction, migrating, or other factors resulting in a decrease in both local and range-

Resource	Impact duration	Impact intensity definitions: Minor	Moderate	Major
	than two breeding seasons.	migrating, or other factors affecting population levels. Small changes to local population numbers, population structure, and other demographic factors could occur. Sufficient habitat could remain functional at both the local and range- wide scales to maintain the viability of the species. Opportunity for increased spread of non- native species could be detectable but temporary and localized, and these species could not displace native species populations and distributions.	other factors affecting local population levels. Some impacts might occur in key habitats. However, sufficient population numbers or habitat could retain function to maintain the viability of the species both locally and throughout its range. Opportunity for increased spread of non- native species could be detectable and limited to local and adjacent areas, but could only result in temporary changes to native species population and distributions.	wide population levels and habitat type. Impacts could occur during critical periods of reproduction or in key habitats and could result in direct mortality or loss of habitat that might affect the viability of a species. Local population numbers, population structure, and other demographic factors might experience large changes or declines. Actions could result in the widespread increase of non-native species resulting in broad and permanent changes to native species populations and distributions.
Marine and estuarine fauna (fish, shellfish, benthic organisms)	Short-term: Lasting up to two spawning seasons, depending on length of season. Long-term: Lasting more than two spawning seasons.	Impacts could be detectable and localized but small. Disturbance of individual species could occur; however, there could be no change in the diversity or local populations of marine and estuarine species. Any disturbance could not interfere with key behaviors such as feeding and spawning. There could be no restriction of movements daily or seasonally. Opportunity for increased spread of non- native species could be detectable but temporary and localized and these species could not displace native species populations and distributions.	Impacts could be readily apparent and result in a change in marine and estuarine species populations in local and adjacent areas. Areas being disturbed may display a change in species diversity; however, overall populations could not be altered. Some key behaviors could be affected but not to the extent that species viability is affected. Some movements could be restricted seasonally. Opportunity for increased spread of non-native species could be detectable and limited to local and adjacent areas, but could only result in temporary changes to native species population and distributions.	Impacts could be readily apparent and could substantially change marine and estuarine species populations over a wide- scale area, possibly river-basin-wide. Disturbances could result in a decrease in fish species diversity and populations. The viability of some species could be affected. Species movements could be seasonally constrained or eliminated. Actions could result in the widespread increase of non-native species resulting in broad and permanent changes to native species populations and distributions.

Resource	Impact duration	Impact intensity definitions		
		Minor	Moderate	Major
Protected species	<u>Short-term</u>: Lasting up to one breeding/growing season. <u>Long-term</u>: Lasting more than one breeding/growing season.	Impacts on protected species, their habitats, or the natural processes sustaining them could be detectable, but small and localized, and could not measurably alter natural conditions. Impacts could likely result in a "may affect, not likely to adversely affect" determination for at least one listed species.	Impacts on protected species, their habitats, or the natural processes sustaining them could be detectable and some alteration in the numbers of protected species or occasional responses to disturbance by some individuals could be expected, with some negative impacts to feeding, reproduction, resting, migrating, or other factors affecting local and adjacent population levels. Impacts could occur in key habitats, but sufficient population numbers or habitat could remain functional to maintain the viability of the species both locally and throughout their range. Some disturbance to individuals or impacts to potential or designated critical habitat could occur. Impacts could likely result in a "may affect, likely to adversely affect" determination for at least one listed species. No adverse modification of critical habitat could be expected.	Impacts on protected species, their habitats, or the natural processes sustaining them could be detectable, widespread, and permanent. Substantial impacts to the population numbers of protected species, or interference with their survival, growth, or reproduction could be expected. There could be impacts to key habitat, resulting in substantial reductions in species numbers. Results in an "is likely to jeopardize proposed or listed species/adversely modify proposed or designated critical habitat (impairment)" determination for at least one listed species.
Socioeconomic resources				
Socio-economics and environmental justice Note: Evaluation of potential environmental justice issues will be fully addressed	<u>Short-term</u>: During construction period. <u>Long-term</u>: Over the life of the project or longer.	A few individuals, groups, businesses, properties, or institutions could be affected. Impacts could be small and localized. These impacts are not expected to substantively alter social and/or economic conditions.	Many individuals, groups, businesses, properties, or institutions could be affected. Impacts could be readily apparent and detectable in local and adjacent areas and could have a noticeable effect on social and/or economic conditions.	A large number of individuals, groups, businesses, properties, or institutions could be affected. Impacts could be readily detectable and observed, extend over a widespread area, and have a substantial influence on social and/or economic conditions.

Resource	Impact duration	Impact intensity definitions: Minor	Impact intensity definitions: Moderate	Impact intensity definitions: Major
in future tiered documents.		Actions could not disproportionately affect minority and low-income populations.	Actions could disproportionately affect minority and low-income populations. However, the impact could be temporary and localized.	Actions could disproportionately affect minority and low-income populations, and this impact could be permanent and widespread.
Cultural resources	Short-term: During construction period. Long-term: Over the life of the project or longer.	The disturbance of a site(s), building, structure, or object could be confined to a small area with little, if any, loss of important cultural information potential.	Disturbance of a site(s), building, structure, or object not expected to result in a substantial loss of important cultural information.	Disturbance of a site(s), building, structure, or object could be substantial and may result in the loss of most or all its potential to yield important cultural information.
Infrastructure	Short-term: During construction period. Long-term: Over the life of the project or longer.	The action could affect public services or utilities but the impact could be localized and within operational capacities. There could be negligible increases in local daily traffic volumes resulting in perceived inconvenience to drivers but no actual disruptions to traffic.	The action could affect public services or utilities in local and adjacent areas and the impact could require the acquisition of additional service providers or capacity. Detectable increase in daily traffic volumes (with slightly reduced speed of travel), resulting in slowed traffic and delays, but no change in level of service (LOS). Short service interruptions (temporary closure for a few hours) to roadway and railroad traffic could occur.	The action could affect public services or utilities over a widespread area resulting in the loss of certain services or necessary utilities. Extensive increase in daily traffic volumes (with reduced speed of travel) resulting in an adverse change in LOS to worsened conditions. Extensive service disruptions (temporary closure of one day or more) to roadways or railroad traffic could occur.
Land and marine management	Short-term: During construction period. Long-term: Over the life of the project or longer.	The action could require a variance or zoning change or an amendment to a land use, area comprehensive, or management plan, but could not affect overall use and management beyond the local area.	The action could require a variance or zoning change or an amendment to a land use, area comprehensive, or management plan, and could affect overall land use and management in local and adjacent areas.	The action could cause permanent changes to and conflict with land uses or management plans over a widespread area.

Resource	Impact duration	Impact intensity definitions		
		Minor	Moderate	Major
Tourism and recreational use	Short-term: During construction period. Long-term: Over the life of the project or longer.	There could be partial developed recreational site closures to protect public safety. The same site capacity and visitor experience could remain unchanged after construction. The impact could be detectable and/or could only affect some recreationists. Users could likely be aware of the action but changes in use could be slight. There could be partial closures to protect public safety. Impacts could be local. There could be a change in local recreational opportunities; however, it could affect relatively few visitors or could not affect any related recreational activities.	There could be complete site closures to protect public safety. However, the sites could be reopened after activities occur. There could be slightly reduced site capacity. The visitor experience could be slightly changed but still available. The impact could be readily apparent and/or could affect many recreationists locally and in adjacent areas. Users could be aware of the action. There could be complete closures to protect public safety. However, the areas could be reopened after activities occur. Some users could choose to pursue activities in other available local or regional areas.	All developed site capacity could be eliminated because developed facilities could be closed and removed. Visitors could be displaced to facilities over a widespread area and visitor experiences could no longer be available in many locations. The impact could affect most recreationists over a widespread area. Users could be highly aware of the action. Users could choose to pursue activities in other available regional areas.
Fisheries and aquaculture	Short-term: During construction period. Long-term: Over the life of the project or longer.	A few individuals, groups, businesses, properties, or institutions could be affected. Impacts could be small and localized. These impacts are not expected to substantively alter social and/or economic conditions.	Many individuals, groups, businesses, properties, or institutions could be affected. Impacts could be readily apparent and detectable in local and adjacent areas and could have a noticeable effect on social and/or economic conditions.	A large number of individuals, groups, businesses, properties, or institutions could be affected. Impacts could be readily detectable and observed, extend over a widespread area, and could have a substantial influence on social and/or economic conditions.
Marine transportation	Short-term: During construction period.	The action could affect public services or utilities, but the impact could be localized and within operational capacities. There could be negligible increases in local daily marine traffic volumes,	The action could affect public services or utilities in local and adjacent areas, and the impact could require the acquisition of additional service providers or capacity.	The action could affect public services utilities over a widespread area resulting in the loss of certain services or necessary utilities. Extensive increase in daily marine traffic volumes could occur (with

Resource	Impact duration	Impact intensity definitions		
		Minor	Moderate	Major
	Long-term: Over the life of the project or longer.	resulting in perceived inconvenience to operators but no actual disruptions to transportation.	Detectable increase in daily marine traffic volumes could occur (with slightly reduced speed of travel), resulting in slowed traffic and delays. Short service interruptions could occur (temporary delays for a few hours).	reduced speed of travel), resulting in extensive service disruptions (temporary closure of one day or more).
Aesthetics and visual resources	Short-term: During construction period. Long-term: Over the life of the project or longer.	There could be a change in the view shed that was readily apparent but could not attract attention, dominate the view, or detract from current user activities or experiences.	There could be a change in the view shed that was readily apparent and attracts attention. Changes could not dominate the viewscape, although they could detract from the current user activities or experiences.	Changes to the characteristic views could dominate and detract from current user activities or experiences.
Public health and safety, including flood and shoreline protection	Short-term: During construction period. Long-term: Over the life of the project or longer.	Actions could not result in 1) soil, ground water, and/or surface water contamination; 2) exposure of contaminated media to construction workers or transmission line operations personnel; and/or 3) mobilization and migration of contaminants currently in the soil, ground water, or surface water at levels that could harm the workers or general public. Increased risk of potential hazards (e.g., increased likelihood of storm surge) to visitors, residents, and workers from decreased shoreline integrity could be temporary and localized.	Project construction and operation could result in (1) exposure, mobilization and/or migration of existing contaminated soil, ground water, or surface water to an extent that requires mitigation; and/or (2) could introduce detectable levels of contaminants to soil, ground water, and/or surface water in localized areas within the project boundaries such that mitigation/remediation is required to restore the affected area to the preconstruction conditions. Increased risk of potential hazards to visitors, residents, and workers from decreased shoreline integrity could be sufficient to cause a permanent change in use patterns and area	Actions could result in 1) soil, ground water, and/or surface water contamination at levels exceeding federal, state, or local hazardous waste criteria, including those established by 40 C.F.R. 261; 2) mobilization of contaminants currently in the soil, ground water, or surface water, resulting in exposure of humans or other sensitive receptors such as plants and wildlife to contaminant levels that could result in health effects; and 3) the presence of contaminated soil, ground water, or surface water within the project area, exposing workers and/or the public to contaminated or hazardous materials at levels exceeding those permitted by the

Resource	Impact duration	Impact intensity definitions		
		Minor	Moderate	Major
			avoidance in local and adjacent areas.	federal Occupational Safety and Health Administration (OSHA) in 29 C.F.R. 1910. Increased risk of potential hazards to visitors, residents, and workers from decreased shoreline integrity could be substantial and could cause permanent changes in use patterns and area avoidance over a widespread area.

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Appendix D: List of Repositories for the Regionwide RP/EA

Repository	Address	City	State	Zip
Dauphin Island Sea Laboratory, Admin Building	101 Bienville Blvd.	Dauphin Island	AL	36528
Thomas B. Norton Public Library	221 W. 19th Ave.	Gulf Shores	AL	36542
Alabama Department of Conservation and Natural Resources, State Lands Division, Coastal Section Office	31115 Five Rivers Blvd.	Spanish Fort	AL	36527
Weeks Bay National Estuarine Research Reserve	11300 U.S. Hwy. 98	Fairhope	AL	36532
Mobile Public Library, West Regional Library	5555 Grelot Rd.	Mobile	AL	36606
Franklin County Public Library	160 Hickory Dip	Eastpoint	FL	32328
Okaloosa County Library	185 Miracle Strip Pkwy. SE	Ft. Walton	FL	32548
Panama City Beach Public Library	125000 Hutchison Blvd.	Panama City Beach	FL	32407
Southwest Branch Library	12248 Gulf Beach Hwy.	Pensacola	FL	32507
Wakulla County Library	4330 Crawfordville Hwy.	Crawfordville	FL	32327
Walton County Library, Coastal Branch	437 Greenway Trail	Santa Rosa Beach	FL	32459
Santa Rosa County Clerk of Court, County Courthouse	6865 Caroline St.	Milton	FL	32570
Bay County Public Library	898 W. 11th St.	Panama City	FL	32401
Gulf County Public Library	110 Library Dr.	Port St. Joe	FL	32456
Jefferson R.J. Bailar Public Library	375 S Water St.	Monticello	FL	32344
Taylor County Public Library	403 N. Washington St.	Perry	FL	32347
Dixie County Public Library	16328 SE U.S. Hwy. 19	Cross City	FL	32628
Levy County Public Library	7871 NE 90th St.	Bronson	FL	32621
Homosassa Public Library	4100 S. Grandmarch Ave.	Homosassa	FL	34446
Land O'Lakes Branch Library	2818 Collier Pkwy.	Land O' Lakes	FL	34639
Pinellas Public Library	1330 Cleveland St.	Clearwater	FL	33755
Temple Terrace Public Library	202 Bullard Pkwy.	Temple Terrace	FL	33617
South Manatee Branch Library	6081 26th St.	West Bradenton	FL	34207
Jacaranda Public Library	4143 Woodmere Park Blvd.	Venice	FL	34293
Mid County Regional Library	2050 Forrest Nelson Blvd.	Port Charlotte	FL	33952
Riverdale Branch Library	2421 Buckingham Rd.	Fort Myers	FL	33905
St. Tammany Parish Library	310 W. 21st Ave.	Covington	LA	70433
Terrebonne Parish Library	151 Library Dr.	Houma	LA	70360
New Orleans Public Library, Louisiana Division	219 Loyola Ave.	New Orleans	LA	70112
East Baton Rouge Parish Library	7711 Goodwood Blvd.	Baton Rouge	LA	70806

Repository	Address	City	State	Zip
Jefferson Parish Library, East Bank Regional Library	4747 W. Napoleon Ave.	Metairie	LA	70001
Jefferson Parish Library, West Bank Regional Library	2751 Manhattan Blvd.	Harvey	LA	70058
Plaquemines Parish Library	8442 Hwy. 23	Belle Chase	LA	70037
St. Bernard Parish Library	2600 Palmisano Blvd.	Chalmette	LA	70043
St. Martin Parish Library	201 Porter St.	Martinville	LA	70582
Alex P. Allain Library	206 Iberia St.	Franklin	LA	70538
Vermillion Parish Library	405 E. St. Victor St.	Abbeville	LA	70510
Lafourche Parish Public Library (formerly Martha Sowell Utley Memorial Library)	314 St. Mary St.	Thibodaux	LA	70301
South Lafourche Public Library	16241 E. Main St.	Cut Off	LA	70345
Calcasieu Parish Public Library Central Branch	301 W. Claude St.	Lake Charles	LA	70605
Iberia Parish Library	445 E. Main St.	New Iberia	LA	70560
Mark Shirley, Louisiana State University AgCenter	1105 W. Port St.	Abbeville	LA	70510
Sandy Ha Nguyen, Coastal Communities Consulting	925 Behrman Hwy., Suite 15	Gretna	LA	70056
Biloxi Public Library, Local History and Genealogy Department	580 Howard Ave.	Biloxi	MS	39530
West Biloxi Public Library	2047 Pass Rd.	Biloxi	MS	39531
Waveland Public Library	333 Coleman Ave.	Waveland	MS	39576
Vancleave Public Library	12604 Hwy. 57	Vancleave	MS	39565
Hancock County Library System	312 Hwy. 90	Bay St. Louis	MS	39520
Gulfport Harrison County Library	1708 25th Ave.	Gulfport	MS	39501
Pass Christian Public Library	111 Hiern Ave.	Pass Christian	MS	39571
Orange Grove Branch Library	12135 Old Hwy. 49	Gulfport	MS	39503
Kathleen McIlwain Public Library	2100 Library Ln.	Gautier	MS	39553
Pascagoula Public Library	3214 Pascagoula St.	Pascagoula	MS	39567
Ina Thompson Moss Point Library (formerly Moss Point Library)	4119 Bellview	Moss Point	MS	39563
Ocean Springs Municipal Library	525 Dewey Ave.	Ocean Springs	MS	39564
Kiln Public Library	17065 Hwy. 603	Kiln	MS	39556
Margaret Sherry Memorial Library	2141 Popps Ferry Rd.	Biloxi	MS	39532
East Central Public Library	21801 Slider Rd.	Moss Point	MS	39555
Jerry Lawrence Memorial Library (formerly D'Iberville Library)	10391 AutoMall Pkwy.	D'Iberville	MS	39540
Mercy Housing & Human Development	1135 Ford St.	Gulfport	MS	39507
Center for Environmental and Economic Justice	336 Rodenberg Ave.	Biloxi	MS	39531
STEPS Coalition	11975 Seaway Rd., Ste. A240	Gulfport	MS	39503

Repository	Address	City	State	Zip
Gulf Islands National Seashore Visitors Center	3500 Park Rd.	Ocean Springs	MS	39564
Mississippi Commercial Fisheries United	6421 Beatline Road	Long Beach	MS	39560
Jack K. Williams Library, Texas A&M University at Galveston	200 Seawolf Pkwy., Bldg. 3010	Galveston	TX	77554
Port Arthur Public Library	4615 9th Ave.	Port Arthur	TX	77672
Mary and Jeff Bell Library Texas A&M	6300 Ocean Dr.	Corpus Christi	TX	78412
Rosenberg Library	2310 Sealy St.	Galveston	TX	77550