Deepwater Horizon
Natural Resource Damage Assessment
Open Ocean Trustee Implementation Group

Draft Restoration Plan 3 and Environmental Assessment: Birds

March 2023

Cover photograph credits:

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Executive Summary

On April 20, 2010, the *Deepwater Horizon* (DWH) mobile drilling unit exploded, resulting in a massive discharge of oil from the BP Exploration and Production, Inc. (BP) Macondo well, causing loss of life and extensive natural resource injuries. Oil spread from the deep ocean to the surface and nearshore environment from Texas to Florida. Extensive response actions were undertaken to try 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 $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 injuries to natural resources that were unknown at the time of the settlement but may come to light in the future. The settlement allocated a specific sum for restoration across Restoration Areas and Restoration Types.

The purpose of restoration, as discussed in this document and detailed in the 2016 *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan/Programmatic Environmental Impact Statement* (PDARP/PEIS),[1] is to make the environment and the public whole for injuries resulting from the DWH oil spill 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 natural resource damage assessment regulations. The PDARP/PEIS also sets forth the process for subsequent DWH restoration planning to select specific projects for implementation, based on the post-settlement DWH Trustee governance structure. The PDARP/PEIS established a distributed governance structure that assigned a Trustee Implementation Group (TIG) for each of the eight designated Restoration Areas, including the Open Ocean Restoration Area. Each TIG makes all restoration decisions for the funding allocated to its Restoration Area. The Open Ocean TIG (or the TIG) is responsible for restoring natural resources and their services within the Open Ocean Restoration Area that were injured by the DWH oil spill.[2]

The TIG has prepared this draft Restoration Plan 3 and Environmental Assessment: Birds (RP/EA) to address a subset of the injuries to natural resources in the Open Ocean Restoration Area resulting from the DWH oil spill, and to provide the TIG with OPA and National Environmental Policy Act (NEPA) analyses and public input to aid in their decision-making process.

In the PDARP/PEIS, the DWH Trustees developed a set of Restoration Types for inclusion in programmatic alternatives, consistent with the desire to seek a diverse set of projects providing benefits to a broad array of injured resources and services. Ultimately, this process resulted in the inclusion of 13 Restoration Types in the

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[1] The PDARP/PEIS and Record of Decision can be accessed at www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan/.

[2] The Open Ocean TIG addresses a wide range of resources that make use of the open ocean, including water column and ocean bottom fish and invertebrates, sea turtles, birds, marine mammals, sturgeon, and deep-sea coral reefs. Many species that spend part of their lives in the Gulf of Mexico also migrate to other places—as far away as Canada and the Mediterranean Sea. The Open Ocean TIG will address these species throughout their life stages and geographic ranges, including restoration in offshore, coastal, and inland areas, and outside of the Gulf of Mexico.

five programmatic Restoration Goals evaluated for restoration.[3] The project alternatives evaluated in this RP/EA are consistent with the Restoration Approaches under the Birds Restoration Type, as described in Section 5.5.12 of the PDARP/PEIS:

- Restore and conserve bird nesting and foraging habitat;
- Establish or reestablish nesting colonies; and
- Prevent incidental bird mortality.

The OPA NRDA regulations provide that Trustees must consider a reasonable range of restoration alternatives before selecting their preferred alternative(s) (15 CFR § 990.53). The Open Ocean TIG reviewed 76 restoration project ideas (including 59 bird ideas) proposed by individual members of the public, non-governmental organizations, and local, state, and federal agencies – ultimately identifying 11 project alternatives for full evaluation in this document, as summarized in Table ES-1.

Table ES-1 Alternatives Considered in this RP/EA

Alternative		Estimated Project Costs
Predator Removal and Seabird Nesting Colony Restoration at Mona Island This project would increase nesting success and productivity of Caribbean-nesting seabirds (Audubon's shearwater, sooty and bridled terns, magnificent frigatebirds, masked and brown boobies, brown noddy, and white-tailed tropicbird) through invasive species management, habitat restoration, and nesting colony expansion. Restoration activities would include: (1) removal of invasive rodents, cats, and pigs; (2) propagation and planting of native plants and removal of invasive plants; (3) expansion of existing or establishment of new nesting colonies through social attraction techniques;[4] and (4) development and implementation of biosecurity measures.[5]	Preferred	$9,039,500

[3] PDARP/PEIS programmatic Restoration Goals include: 1) Restore and conserve habitat; 2) Restore water quality; 3) Replenish and protect living coastal and marine resources; 4) Provide and enhance recreational opportunities; and 5) Provide for monitoring, adaptive management, and administrative oversight to support restoration implementation. Restoration Types include: 1) Wetlands, Coastal, and Nearshore Habitats; 2) Habitat Projects on Federally Managed Lands; 3) Nutrient Reduction; 4) Water Quality; 5) Fish and Water Column Invertebrates; 6) Sturgeon; 7) Submerged Aquatic Vegetation; 8) Oysters; 9) Sea Turtles; 10) Marine Mammals; 11) Birds; 12) Mesophotic and Deep Benthic Communities; and 13) Provide and Enhance Recreational Opportunities.

[4] For the purposes of this RP/EA, social attraction techniques refer to actions taken to establish or reestablish bird nesting colonies by attracting breeding adults to restoration sites. This could include the placement of bird or egg decoys, mirrors, or sound systems at the restoration site.

[5] For the purposes of this RP/EA, biosecurity measures refer to actions taken, such as the placement of rodenticide bait stations, to reduce the risk of (re)introduction of invasive species (e.g., rodents, cats, pigs, or other invasive species) that harm seabirds and seabird nesting habitat.

Alternative		Estimated Project Costs
Predator Removal and Seabird Nesting Colony Restoration in the Culebra Archipelago This project would increase nesting success and productivity of Caribbean-nesting seabirds (Audubon's shearwater, sooty and bridled terns, brown booby, brown noddy, and red-billed and white-tailed tropicbirds) by enhancing habitat for existing seabird nesting colonies. Restoration activities would include: (1) invasive mammal and plant removal; (2) construction of a predator-proof fence; (3) expansion of existing or establishment of new nesting colonies through social attraction techniques; and (4) development and implementation of biosecurity measures.	Non-preferred	$1,700,000
Seabird Nesting Colony Reestablishment and Protection at Desecheo National Wildlife Refuge This project would increase nesting success and productivity of Caribbean-nesting seabirds (bridled and sooty terns, brown booby, magnificent frigatebird, and brown noddy) by expanding existing and creating new nesting colonies. Restoration activities would include: (1) expansion of existing or establishment of new nesting colonies through social attraction techniques and (2) enhancement of the National Wildlife Refuge's existing biosecurity activities.	Preferred	$214,500
Seabird Nesting Colony Protection and Enhancement at Dry Tortugas National Park This project would increase nesting success and productivity of seabirds (magnificent frigatebird, sooty and bridled terns, brown noddy, and masked booby) through nesting colony monitoring, restoration, and enhancement. Restoration activities, conducted in phases, would include: (1) aerial surveys to establish a seabird population baseline; (2) enhancement of existing biosecurity measures; (3) nesting colony expansion and establishment at protected sites through social attraction techniques; and (4) targeted habitat improvements.	Preferred	$1,183,200
Common Tern Nesting Colony Restoration in the Great Lakes Region This project would increase nesting success, survival, and productivity of the common tern at nesting sites in the Great Lakes region through a multi-phased approach. The first phase would include assembling and coordinating a Great Lakes tern conservation working group to identify and prioritize restoration activities. Phases II and III would include creating a centralized monitoring database and sharing information to identify best management practices and implementing stewardship activities and habitat enhancement activities throughout the region.	Non-preferred	$3,520,000
Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries This project would reduce incidental mortality of great shearwaters, northern gannets, and other DWH-injured seabirds by reducing seabird bycatch in U.S. and Canadian North Atlantic commercial fisheries. Restoration activities, conducted in phases, would include: (1) pilot testing seabird bycatch reduction strategies; (2) identifying and prioritizing seabird bycatch reduction strategies through modeling; (3) establishing and expanding partnerships with commercial fisheries; and (4) continued testing, field studies, and other activities to expand understanding of seabird-fishery interactions and support the voluntary adoption of the most effective seabird bycatch reduction strategies.	Preferred	$5,052,000

Alternative		Estimated Project Costs
Seabird Bycatch Risk Reduction in Gulf of Mexico and Southeast U.S. Pelagic Longline Fisheries This project would reduce the risk of incidental mortality of northern gannets, great shearwaters, and other DWH-injured seabirds by reducing seabird bycatch in the Gulf of Mexico and Southeast Atlantic pelagic longline (PLL) commercial fisheries. Restoration activities would include: (1) modeling seabird bycatch hotpots in the Gulf of Mexico and Southeast U.S. Atlantic Ocean waters; (2) collaborating with PLL captains and crew members to better understand seabird interactions in the fishery and identify seabird bycatch reduction strategies; and (3) implementing a voluntary pilot project with the PLL fishery to test seabird bycatch reduction strategies.	Non-preferred	$1,546,500
Northern Gannet Nesting Colony Restoration in Eastern Canada This project would increase nesting success, survival, and productivity of northern gannets at nesting colonies in eastern Canada. Restoration actions would include: (1) expansion of existing and/or establishment of new nesting colonies through social attraction techniques; (2) management of human and predator disturbance; and (3) land-based removal of washed-up marine debris on colonies where it impacts nesting.	Preferred	$5,680,000
Common Tern Nesting Colony Restoration in Manitoba This project would increase nesting success, survival, and productivity of the common tern at nesting locations in Manitoba, Canada. Restoration activities would include: (1) stewardship and protection of existing colonies; (2) management of human and predator disturbance; and (3) establishment of new colonies at protected sites through social attraction.	Preferred	$4,400,000
Seabird Nesting Habitat Restoration and Colony Reestablishment in the Bahamas This project would increase nesting success and productivity of Caribbean-nesting seabirds (Audubon's shearwater, sooty and bridled terns, brown noddy, brown booby, and white-tailed tropicbird) through stewardship, protection, and creation of nesting colonies. Restoration activities would include: (1) seabird population baseline and site assessments; (2) training and capacity development; (3) development of seabird management plans; (4) eradication of invasive plant and mammal species; (5) nesting colony restoration and enhancement using social attraction; (6) development and implementation of biosecurity measures; and (7) community engagement to support biosecurity efforts.	Non-preferred	$7,150,000
Invasive Goat Removal to Restore Seabird Nesting Habitat in St. Vincent and the Grenadines This project would increase nesting success and productivity of Caribbean-nesting seabirds (magnificent frigatebird, red-billed tropicbird, brown booby, brown noddy, and bridled and sooty terns) by removing invasive goats from Battowia and the Pillories Islands. Restoration activities would include (1) goat eradication, (2) monitoring for rodent presence, and (3) a public outreach campaign.	Preferred	$231,000
	Sum (Preferred)	$25,800,200

Based on information and analyses presented in this document, the Open Ocean TIG is proposing seven project alternatives for implementation, at a total estimated cost of $25,800,200 (Table ES-1). Table E-S 2 provides a summary of the anticipated environmental consequences of the 11 projects (7 preferred; 4 non-preferred), and the no action alternative, evaluated in this RP/EA.

Table ES-2 Summary of Environmental Consequences for Alternatives Considered in this RP/EA

Project	Geology and Substrates	Hydrology and Water Quality	Air Quality	Noise	Habitats	Wildlife Species	Marine and Estuarine Fauna	Protected Species	Socioeconomics and Environmental Justice	Cultural Resources	Infrastructure	Land and Marine Management	Tourism and Recreational Use	Fisheries and Aquaculture	Marine Transportation	Aesthetics and Visual Resources	Public Health and Safety
No Action	l	NE	NE	NE	L	L	l	L	NE	NE	NE	NE	l	NE	NE	l	l
Predator Removal and Seabird Nesting Colony Restoration at Mona Island	s,l,+	s,+	s	S,L,+	S,L,+	S,L,+	NE	S,L,+	s,+	NE	NE	s,+	s,l,+	NE	NE	s,+	s
Predator Removal and Seabird Nesting Colony Restoration in the Culebra Archipelago	s,+	s,+	s	S,+	s,+	S,l,+	NE	S,l,+	s,+	NE	NE	+	s,+	NE	NE	s,l,+	s
Seabird Nesting Colony Reestablishment and Protection at Desecheo NWR	NE	NE	s	+	s,+	s,+	NE	s,+	+	NE	NE	+	+	NE	NE	+	NE
Seabird Nesting Colony Protection and Enhancement at Dry Tortugas National Park	s,+	s,+	s	+	s,+	s,+	NE	s,+	+	NE	NE	+	+	NE	NE	+	NE
Common Tern Nesting Colony Restoration in the Great Lakes Region	S,L,+	S,L,+	s	S,+	S,L,+	S,+	S,L,+	S,+	s,+	NE	NE	s,l,+	s,l,+	NE	NE	s,+	s
Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries	NE	NE	s	+	NE	s,+	s,+	s,+	NE	NE	NE	NE	+	+	NE	NE	NE
Seabird Bycatch Risk Reduction in Gulf of Mexico and Southeast U.S. Pelagic Longline Fisheries	NE	NE	s	+	NE	s,+	s,+	s,+	NE	NE	NE	NE	+	+	NE	NE	NE
Northern Gannet Nesting Colony Restoration in Eastern Canada	s,+	NE	s	s,+	s,+	S,+	NE	s,+	+	NE	NE	+	+	NE	NE	s,+	+
Common Tern Nesting Colony Restoration in Manitoba	S,l,+	s,+	s	s,+	S,+	S,+	+	S,+	s,+	NE	NE	s,l,+	s,l,+	NE	NE	s,+	s,+
Seabird Nesting Habitat Restoration and Colony Reestablishment in the Bahamas	S,+	s,+	s	s,+	S,L,+	S,L,+	NE	S,L,+	s,+	NE	NE	+	+	NE	NE	s,+	s
Invasive Goat Removal to Restore Seabird Nesting Habitat in St. Vincent and the Grenadines	s,+	+	s	+	s,+	s,+	+	s,+	S,+	NE	NE	L	+	NE	NE	s,+	s

+ Beneficial effect
NE No effect
s Short-term minor adverse effect
S Short-term moderate adverse effect
S Short-term major adverse effect
l Long-term minor adverse effect
L Long-term moderate adverse effect
L Long-term major adverse effect

The public is encouraged to review and comment on this draft RP/EA. Following public notice, the draft RP/EA will be available to the public for a 45-day comment period. The deadline for submitting written comments on the draft RP/EA is specified in the public notice published in the *Federal Register* and on the Gulf Spill Restoration website (see link below). Comments must be postmarked no later than 45 days after the start of the comment period. Comments on the draft RP/EA can be submitted during the comment period by one of the following methods:

Online: The public may access a link to the RP/EA's Planning, Environment, and Public Comment portal by navigating first to www.gulfspillrestoration.noaa.gov/restoration-areas/open-ocean

By mail: Hard copy addressed to U.S. Fish and Wildlife Service Gulf Restoration Office, 1875 Century Blvd., 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 Gulf Spill Restoration website.

By toll-free phone: 1-888-467-0009**During one of the public webinars**: The Open Ocean TIG will hold public webinars to facilitate the public review and comment process. A weblink for the public webinars will be provided on the Gulf Spill Restoration website. Webinar dates and times are as follows:

- Tuesday, March 28, 2023, from 12:00 – 1:30 PM Eastern Time
- Tuesday, April 4, 2023, from 4:00 – 5:30 PM Eastern Time

Please note that personal identifying information included in submitted comments (e.g., address, phone number, email address) may be made publicly available.

After the public comment period closes, the Open Ocean TIG will consider all input received during the public comment period and then finalize the RP/EA. A summary of comments received and the TIG's responses will be included in the Final RP/EA.

Overall, this RP/EA is intended to provide the public with information and analysis needed to enable meaningful review and comment on the Open Ocean TIG's proposal to implement projects addressing injuries to birds resulting from the DWH oil spill. Ultimately, this RP/EA and the corresponding opportunity for the public to review and comment on the document are intended to guide the TIG's selection of projects for implementation that best meets its purpose and need, as summarized above, and described in more detail in subsequent sections of this document.

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List of Abbreviations/Acronyms

B

BMP	Best management practice
BP	BP Exploration and Production, Inc.

C

CAA	Clean Air Act
CCP	Comprehensive conservation plan
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWA	Clean Water Act
CZMA	Coastal Zone Management Act

D

DEPP	Bahamas Department of Environmental Planning and Protection
DIVER	Data Integration Visualization Exploration and Reporting
DMR	Bahamas Department of Marine Resources
DOI	U.S. Department of the Interior
DRTO	Dry Tortugas National Park
DWH	*Deepwater Horizon*

E

E&D	Engineering and design
eDNA	environmental DNA
EFH	Essential Fish Habitat
EIS	Environmental impact statement
EO	Executive Order
EPIC	Environmental Protection in the Caribbean
ESA	Endangered Species Act of 1973

F

FMP	Fishery Management Plan
FONSI	Finding of No Significant Impact

G

GHGs	Greenhouse gases
GHISNP	Graham's Harbour Iguana & Seabird National Park

GOMRI	Gulf of Mexico Research Initiative
Gulf	Gulf of Mexico
H	
HMS	Highly migratory species
I	
IBA	Important bird area
M	
MAM	Monitoring and adaptive management
MMPA	Marine Mammal Protection Act
MPA	Marine protected area
N	
NAAQS	National Ambient Air Quality Standards
NAWCA	North American Wetlands Conservation Act
NEFMC	New England Fishery Management Council
NEPA	National Environmental Policy Act of 1969
NFWF-GEBF	National Fish and Wildlife Foundation Gulf Environmental Benefit Fund
NGO	Non-governmental organization
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPS	National Park Service
NRDA	Natural Resource Damage Assessment
NWR	USFWS National Wildlife Refuge
O	
Open Ocean TIG	Open Ocean Trustee Implementation Group
O&M	Operations and maintenance
OPA	Oil Pollution Act of 1990

P

PDARP/PEIS	2016 *Deepwater Horizon* Oil Spill: Final Programmatic Damage Assessment and Restoration Plan/Programmatic Environmental Impact Statement
PLL	Pelagic longline
PRDNER	Puerto Rico Department of Natural and Environmental Resources

R

RESTORE Act	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act
RHA	Rivers and Harbors Act of 1899
ROD	Record of Decision
RP/EA	Restoration plan and environmental assessment

S

SOPs	Standard operating procedures

T

TIG	Trustee Implementation Group

U

UAS	Uncrewed aircraft systems
UNESCO	United Nations Educational, Scientific and Cultural Organization
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USDA-APHIS	U.S. Department of Agriculture – Animal and Plant Health Inspection Service
USDA-NRCS	U.S. Department of Agriculture – Natural Resource Conservation Service
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

1 Introduction

This draft Restoration Plan 3 and Environmental Assessment: Birds (RP/EA) was prepared by the natural resource Trustees[6] of the Open Ocean Trustee Implementation Group (Open Ocean TIG or the TIG), which is responsible for restoring the natural resources and services in the Open Ocean Restoration Area[7] that were injured or lost as a result of the *Deepwater Horizon* (DWH) oil spill. The Open Ocean TIG comprises the four federal DWH Trustee agencies: the National Oceanic and Atmospheric Administration (NOAA), the U.S. Department of the Interior (DOI), the U.S. Department of Agriculture (USDA), and the U.S. Environmental Protection Agency (USEPA).

The TIG prepared this RP/EA to inform the public about the DWH Natural Resource Damage Assessment (NRDA) restoration planning efforts and to seek public comments on the identified reasonable range of alternatives for restoration of injured resources. This RP/EA was prepared in accordance with the *DWH Oil Spill Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* (Final PDARP/PEIS; DWH Trustees, 2016) and Record of Decision (ROD)[8], the Oil Pollution Act of 1990 (OPA), the OPA NRDA regulations (15 Code of Federal Regulation [CFR] Part 990), and the National Environmental Policy Act of 1969 (NEPA) and its implementing regulations.

This RP/EA focuses on alternatives to restore birds. In this document, the TIG identifies its preferred alternatives, which the TIG believes would best help compensate the public for injuries caused by the DWH oil spill in the Open Ocean Restoration Area.

1.1 Background and Summary of Settlement

On April 20, 2010, the DWH mobile drilling unit exploded, caught fire, and eventually sank in the Gulf of Mexico (the Gulf), resulting in a massive release of oil and other substances from BP Exploration and Production, Inc.'s (BP) Macondo well and causing pervasive natural resource injuries across the northern Gulf. Extensive response actions, including cleanup activities and actions to try to prevent the oil from reaching sensitive resources, were undertaken to try to reduce harm to people and the environment. However, many of these response actions had collateral impacts on the environment and natural resource services. The breadth of injuries incurred from the incident are described in detail in Chapter 4 of the Final PDARP/PEIS.

Under the authority of OPA, a council of federal and state Trustees (DWH Trustees) was established to assess natural resource injuries resulting from the incident and to work to make the environment and public whole for those injuries. In accordance with OPA NRDA regulations, on February 19, 2016, the DWH Trustees issued the Final PDARP/PEIS detailing a programmatic plan to fund and implement restoration projects across the Gulf with available restoration funds over a 15-year period. Based on the DWH Trustees' thorough assessment of

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[6] The DWH Trustees are the entities designated pursuant to the Oil Pollution Act of 1990 to act as Trustees on behalf of the public to assess the natural resource injuries resulting from the DWH oil spill and to develop and implement project-specific restoration plans to compensate for those injuries. Together with the members of the Open Ocean TIG, state Trustees designated by the governors of Florida, Alabama, Mississippi, Louisiana, and Texas compose, as a whole, the DWH Trustees.

[7] The Open Ocean TIG addresses restoration for a wide range of resources, including migratory species at important points during their life cycles and across their geographic ranges, including inland, coastal, and offshore areas. Since some species are highly migratory, restoration outside of the Gulf is anticipated. Therefore, the "Open Ocean Restoration Area" does not constitute a bounded geographic area, but, rather, encompasses the restoration of living coastal and marine resources that occurs across geopolitical boundaries.

[8] The PDARP/PEIS, ROD, and Consent Decree can be accessed at www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.

impacts to the Gulf's natural resources, a comprehensive, integrated ecosystem approach for restoration implementation was proposed.

On March 29, 2016, in accordance with OPA and NEPA, the DWH Trustees published a Notice of Availability (NOA) of a ROD for the Final PDARP/PEIS in the Federal Register (81 Federal Register [FR] 17438). Based on the DWH Trustees' injury determination established in the Final PDARP/PEIS, the ROD sets forth the basis for the DWH Trustees' decision to select Alternative A: Comprehensive Integrated Ecosystem Alternative. The Final PDARP/PEIS sets forth the process for DWH restoration planning to select specific projects for implementation and establishes a distributed governance structure that assigns a TIG for each of eight Restoration Areas.[9] The Open Ocean TIG makes all restoration decisions for the funding allocated to the Open Ocean Restoration Area. Chapter 7 of the Final PDARP/PEIS provides detailed information on the DWH Trustees and the TIG governance structure. In April 2016, the United States District Court for the Eastern District of Louisiana entered a Consent Decree resolving civil claims by the DWH Trustees against BP arising from the DWH oil spill.

1.2 Restoration Planning by the Open Ocean TIG

Because of the magnitude of the DWH oil spill, the DWH Trustees began planning for and implementing Early Restoration projects with funding from BP in 2011,[10] before the oil spill's injury assessment was complete. Following settlement, the Consent Decree, and establishment of the TIGs, the Open Ocean TIG took responsibility for implementing five Early Restoration projects (approximately $42.4 million).[11] Restoration planning continued with the approval of the Open Ocean TIG's *Final Restoration Plan 1 and Environmental Assessment: Birds and Sturgeon* (RP1/EA) in March 2019 and *Final Restoration Plan 2/Environmental Assessment: Fish, Sea Turtles, Marine Mammals, and Mesophotic and Deep Benthic Communities* (RP2/EA) in November 2019.[12]

On March 25, 2021, the Open Ocean TIG began developing its third restoration plan by soliciting restoration project ideas from the public.[13] The Trustees considered the reasonable range of restoration alternatives before identifying their preferred alternative(s) (15 CFR § 990.53), as described in this RP/EA. This RP/EA presents a summary of project screening used to develop the reasonable range of alternatives (Chapter 2), a description of the reasonable range (Chapter 2), and analyses of the reasonable range under the OPA NRDA regulations (chapter 3) and NEPA regulations (Chapter 4).

The Final PDARP/PEIS identified five programmatic Restoration Goals and 13 Restoration Types (see Figure 5.4-1 of the Final PDARP/PEIS). Table 1-1 shows the funds allocated by the Open Ocean TIG by Restoration Type. Approximately $14.6 million of the Birds Restoration Type funds were previously allocated through RP1/EA and restoration planning. This RP/EA proposes to allocate approximately $25.8 million of the Open

[9] Unknown Conditions & Adaptive Management, Regionwide, Open Ocean, Alabama, Florida, Mississippi, Louisiana, and Texas.

[10] The Early Restoration Framework Agreement can be accessed at www.gulfspillrestoration.noaa.gov/sites/default/files/wp-content/uploads/2011/05/framework-for-early-restoration-04212011.pdf

[11] These include four projects under the Provide and Enhance Recreational Opportunities Restoration Type for which DOI is the Implementing Trustee, and one project under the Fish and Water Column Invertebrates Restoration Type for which NOAA is the Implementing Trustee.

[12] The Open Ocean TIG RP1/EA can be accessed at www.gulfspillrestoration.noaa.gov/sites/default/files/DWH-ARZ002398.pdf. The Open Ocean TIG RP2/EA can be accessed at www.gulfspillrestoration.noaa.gov/sites/default/files/DWH-ARZ003947.pdf.

[13] The call for projects can be accessed at www.gulfspillrestoration.noaa.gov/2021/03/submit-your-bird-and-sturgeon-restoration-project-ideas-open-ocean-restoration-area.

Ocean Birds Restoration Type funds. For the most up-to-date information regarding project information, see NOAA's Data Integration Visualization Exploration and Reporting (DIVER) website.[14]

Table 1-1 Allocation of DWH Settlement Funds for the Open Ocean Restoration Area by Restoration Type

PDARP/PEIS Restoration Goal	Restoration Type	Total Open Ocean TIG Settlement Funds	Funds Allocated[15]	Funds Proposed in this RP3/EA	Funds Remaining
Replenish and Protect Living Coastal and Marine Resources	Fish and Water Column Invertebrates	$400,000,000	$79,063,216	-	$320,936,784
	Sturgeon	$15,000,000	$2,962,071	-	$12,037,929
	Sea Turtles	$55,000,000	$19,966,838	-	$35,033,162
	Marine Mammals	$55,000,000	$23,501,526	-	$31,498,744
	Birds	$70,000,000	$14,609,974	$25,800,200	$29,589,826
	Mesophotic and Deep Benthic Communities	$273,300,000	$126,816,161	-	$146,483,893
Provide & Enhance Recreational Opportunities	Provide & Enhance Recreational Opportunities	$22,397,916	$22,397,916	-	-
Monitoring & Adaptive Management	N/A	$200,000,000	$10,560,288	-	$189,439,712
Administrative Oversight and Comprehensive Planning	N/A	$150,000,000	$56,472,253	-	$93,527,747
Total Funding for Open Ocean Restoration Area:		$1,240,697,916	$356,349,973	$25,800,200	$884,347,943

1.3 Oil Pollution Act and National Environmental Policy Act Compliance

As an oil pollution incident, the DWH oil spill is subject to the provisions of OPA (33 United States Code [U.S.C.] § 2701 et seq.). A primary goal of OPA is to make the environment and public whole for injuries to

[14] NOAA's DIVER Explorer website for DWH restoration projects can be accessed at www.diver.orr.noaa.gov/web/guest/diver-explorer?siteid=9&sqid=643&subtitle=DWH%20Restoration%20Projects.

[15] This includes funds allocated to restoration planning, Early Restoration projects, projects approved in the Open Ocean TIG's RP1/EA and RP2/EA, and Monitoring and Adaptive Management Implementation Activities, as reported through the NOAA DIVER website. Data is current as of December 31, 2022.

natural resources and services resulting from an incident involving an oil discharge or substantial threat of an oil discharge.

Federal Trustees must comply with NEPA (42 U.S.C. § 4321 et seq.), its regulations (40 CFR §§ 1500-1508), and their own agency-specific NEPA regulations when proposing restoration projects.[16] The Final PDARP/PEIS was intended to be used to tier NEPA analyses in subsequent restoration plans prepared by the TIGs (40 CFR § 1501.11; see Chapter 6 of the Final PDARP/PEIS). A tiered environmental analysis is an analysis that focuses on project-specific issues and summarizes or references (rather than repeats) the broader issues discussed in a programmatic NEPA analysis, in this case the Final PDARP/PEIS. The NEPA analysis in this RP/EA tiers from the Final PDARP/PEIS where applicable.

DOI is the lead federal Trustee for preparing this draft RP/EA pursuant to NEPA (40 CFR § 1501.7). The three other federal agencies of the Open Ocean TIG (NOAA, USDA, and USEPA) act as cooperating agencies for the purposes of compliance with NEPA in the development of this RP/EA (40 CFR §§ 1501.8 and 1508.1). Each cooperating agency will review the analysis in this RP/EA for adequacy in meeting the standards set forth in its own NEPA implementing procedures and subsequently adopt the NEPA analysis, if appropriate (40 CFR § 1506.3).

1.4 Purpose and Need

The Final PDARP/PEIS identifies extensive and complex injuries to natural resources and services across the Gulf 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 OPA and associated NRDA regulations.

This RP/EA falls within the scope of the purpose and need identified in the Final PDARP/PEIS. More specifically, the alternatives identified and evaluated in this RP/EA address the programmatic Restoration Goal to Replenish and Protect Living Coastal and Marine Resources for the Birds Restoration Type. Consistent with the purpose defined in the Final PDARP/PEIS, the Open Ocean TIG has undertaken this restoration planning effort to address injuries to natural resources for which the TIG is authorized in the Consent Decree.

Section 5.3 of the Final PDARP/PEIS identifies and describes five programmatic Restoration Goals for restoration work. These Goals work independently and together to benefit injured resources and services. The programmatic Restoration Goal addressed in this RP/EA is to Replenish and Protect Living Coastal and Marine Resources. Consistent with the Restoration Goals, the DWH Trustees also identified 13 Restoration Types in the Final PDARP/PEIS (Sections 5.5.2 through 5.5.14). These specific Restoration Types help to guide restoration planning and project selection to accomplish the programmatic Restoration Goals. This RP/EA addresses the Birds Restoration Type (Final PDARP/PEIS Section 5.5.12).

As discussed in Section 5.10 of the Final PDARP/PEIS, the Open Ocean TIG recognizes a need for restoration of highly migratory seabird species injured by the DWH oil spill while they were in the Gulf. For many of these injured species, their foraging and nesting habitat occurs outside of the Gulf and, for some, outside of the United States (U.S.). Nesting habitat is often found on remote islands where these species are experiencing high rates of mortality and, in some cases, extirpation due to several factors such as invasive plants and predators. The TIG can maximize the benefits and cost effectiveness of restoration by considering opportunities for restoration across the geographic range and lifecycle for injured species.

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[16] The NEPA analysis provided in this RP/EA follows the 2020 Council on Environmental Quality NEPA Regulations, as revised.

Additional information about the purpose and need for DWH NRDA restoration can be found in Section 5.3.2 of the Final PDARP/PEIS.

1.5 Proposed Action and Alternatives

To identify the reasonable range of alternatives, the Open Ocean TIG solicited public input for project ideas and screened project submittals against OPA NRDA evaluation standards found in 15 CFR § 990.54 and the Trustees' programmatic Restoration Goals identified in the PDARP/PEIS. Further detail on the screening process can be found in Section 2.2. Chapter 3 provides a summary of the OPA analysis, resulting in the seven alternatives identified as preferred for implementation. After considering a reasonable range of alternatives[17] (Table 1-2), the Open Ocean TIG proposes to implement the projects identified as preferred, using funds made available through the DWH Consent Decree. If selected, the preferred alternatives would be implemented over approximately 5 to 10 years. Figure 1-1 provides the approximate location of each restoration alternative. The reasonable range includes five projects that would be implemented within the U.S. and its territories, four projects that would be implemented internationally, and two projects that would be implemented both in the U.S. and internationally.

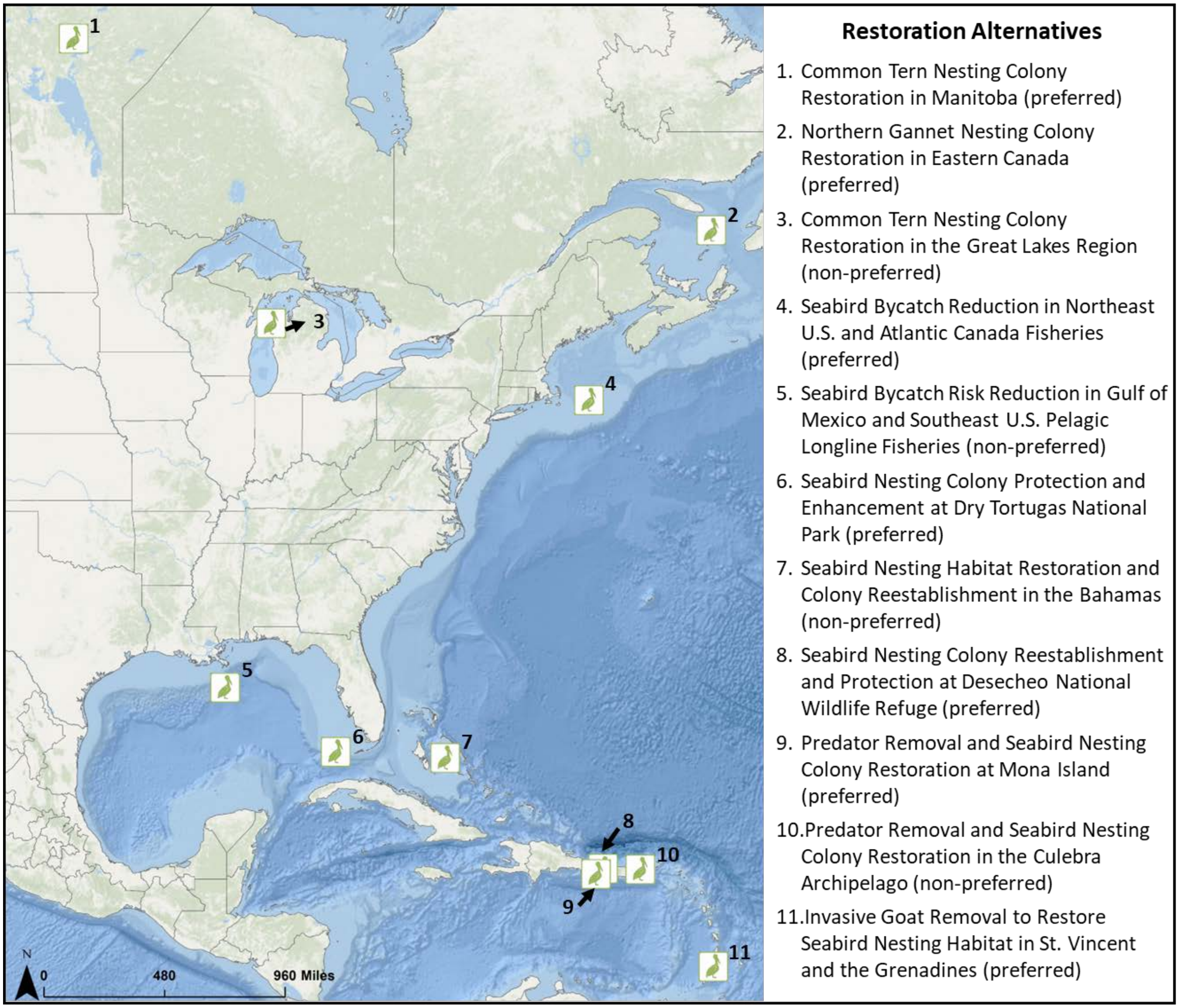
The TIG proposes to approve and fund the preferred alternatives in this RP/EA with an estimated budget of $25,800,200. This would leave a balance of approximately $29.6 million in the Birds Restoration Type for future Open Ocean TIG restoration plans. Detailed information on all alternatives can be found in Section 2.4 of this document.

[17] For the purposes of this RP/EA, each project evaluated in the reasonable range is considered a separate alternative; therefore, the terms "project" and "alternative" are used interchangeably.

Table 1-2 The Reasonable Range of Restoration Alternatives Considered in this RP/EA

Alternative		Project Costs
Predator Removal and Seabird Nesting Colony Restoration at Mona Island	Preferred	$9,039,500
Predator Removal and Seabird Nesting Colony Restoration in the Culebra Archipelago	Non-Preferred	$1,700,000
Seabird Nesting Colony Reestablishment and Protection at Desecheo National Wildlife Refuge	Preferred	$214,500
Seabird Nesting Colony Protection and Enhancement at Dry Tortugas National Park	Preferred	$1,183,200
Common Tern Nesting Colony Restoration in the Great Lakes Region	Non-Preferred	$3,520,000
Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries	Preferred	$5,052,000
Seabird Bycatch Risk Reduction in Gulf of Mexico and Southeast U.S. Pelagic Longline Fisheries	Non-Preferred	$1,546,500
Northern Gannet Nesting Colony Restoration in Eastern Canada	Preferred	$5,680,000
Common Tern Nesting Colony Restoration in Manitoba	Preferred	$4,400,000
Seabird Nesting Habitat Restoration and Colony Reestablishment in the Bahamas	Non-Preferred	$7,150,000
Invasive Goat Removal to Restore Seabird Nesting Habitat in St. Vincent and the Grenadines	Preferred	$231,000
	Sum (Preferred)	$25,800,200

Figure 1-1 Approximate Centroids of the Reasonable Range of Alternatives proposed in this RP/EA



1.5.1 Natural Recovery/No Action

Under the Natural Recovery/No Action Alternative, the Open Ocean 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 pursuant to NEPA as a "… benchmark, enabling decision makers to compare the magnitude of environmental effects of the action alternatives." See Section 3.6 for more details.

1.6 Public Involvement

On March 25, 2021, the Open Ocean TIG issued a notice of solicitation on the Gulf Spill Restoration website[18] requesting project ideas for Sturgeon and Birds Restoration Types. Seventy-six submissions (including 59 bird submissions) were received and screened. The Open Ocean TIG screened project ideas for birds and sturgeon and decided not to include sturgeon projects in this RP/EA. The Trustees decided that it is important to complete the ongoing Open Ocean sturgeon restoration project and Monitoring and Adaptive Management (MAM) activities before proceeding with additional sturgeon restoration. These projects are making important progress in providing information needed to identify restoration that will provide the greatest benefits with the remaining Sturgeon restoration allocation.

On March 11, 2022, the Open Ocean TIG issued a Notice of Intent (NOI) informing the public that it was initiating the drafting of this RP/EA to restore birds.[19] The public is encouraged to review and comment on this draft RP/EA. It is made available for public review and comment for 45 days following public notification as specified in the NOA published in the *Federal Register*. Comments on the draft RP/EA can be submitted during the comment period by one of the following methods:

Online: The public may access a link to the RP/EA's Planning, Environment, and Public Comment portal by navigating first to www.gulfspillrestoration.noaa.gov/restoration-areas/open-ocean

By mail: Hard copy addressed to U.S. Fish and Wildlife Service Gulf Restoration Office, 1875 Century Blvd., Atlanta, GA 30345.

Mailed submissions must be postmarked on or before the comment deadline specified in the *Federal Register* and on the Gulf Spill Restoration website.

By toll-free phone: 1-888-467-0009

During one of the public webinars: The Open Ocean TIG will hold public webinars to facilitate the public review and comment process. A weblink for the public webinars will be provided on the Gulf Spill Restoration website. Webinar dates and times are as follows:

- Tuesday, March 28, 2023, from 12:00 – 1:30 PM Eastern Time
- Tuesday, April 4, 2023, from 4:00 – 5:30 PM Eastern Time

Please note that personal identifying information included in submitted comments (such as name, address, phone number, and email address) may be made publicly available. Personal information is not required to submit comments.

After the close of the comment period, the Open Ocean TIG will consider all comments received and finalize the RP/EA. Revisions will be made, as appropriate. A summary of comments received and the TIG's responses, where applicable, will be included in the final RP/EA.

[18] The notice of solicitation can be accessed at www.gulfspillrestoration.noaa.gov/2021/03/submit-your-bird-and-sturgeon-restoration-project-ideas-open-ocean-restoration-area.

[19] The NOI can be accessed at www.gulfspillrestoration.noaa.gov/2022/03/open-ocean-trustees-initiate-third-restoration-plan.

1.7 Administrative Record

The DWH Trustees opened a publicly available administrative record for the DWH oil spill NRDA, including restoration planning activities, concurrently with publication of the 2010 NOI (pursuant to 15 CFR § 990.45).[20] DOI is the federal trustee that maintains the administrative record. This administrative record site is also used by the Open Ocean TIG for DWH restoration planning.

Information about restoration project implementation is provided to the public through the administrative record and other outreach efforts, including the Gulf Spill Restoration website.

1.8 Coordination with Other Gulf Restoration Programs

The DWH Trustees are committed to coordinating with other Gulf restoration programs to maximize the overall ecosystem benefits from DWH NRDA restoration efforts. During the course of the restoration planning process, the Open Ocean TIG coordinates with 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 Act (RESTORE Act) as implemented by the Gulf Coast Ecosystem Restoration Council; the Gulf Environmental Benefit Fund (GEBF) managed by the National Fish and Wildlife Foundation (NFWF); and other state and federal funding sources. These other restoration efforts are considered in the analysis of cumulative impacts in this RP/EA (Section 4.7). More details about coordination can be found in Section 1.5.6 of the Final PDARP/PEIS.

1.9 Next Steps

The Open Ocean TIG will consider public comments and finalize this RP/EA as appropriate. If the NEPA analysis concludes in a Finding of No Significant Impact (FONSI), the projects selected by the TIG for funding and implementation will be identified in the final RP/EA/FONSI. The reasonable range of alternatives identified in this document consists of alternatives that are independent of each other and may be selected independently by the TIG. A decision not to select one or more of the alternatives does not affect the TIG's selection of any remaining alternatives.

1.9.1 Decisions to be Made

This document is intended to provide the public and decision makers with information and analysis on the Open Ocean TIG's proposal to proceed with the selection and implementation of restoration alternatives to restore birds. To help inform the TIG's decision on which alternatives to implement, the environmental impacts of the alternatives are assessed in Chapter 4 of this document. This draft RP/EA, together with public review and comment, is intended to guide the Open Ocean TIG's selection of projects for implementation that best meet the purpose and need as described in Section 1.4 above.

[20] The DWH Administrative Record can be accessed at www.doi.gov/deepwaterhorizon/adminrecord.

2 Restoration Planning Process

NRDA restoration under OPA is a process that includes evaluating injuries to natural resources and natural resource services to determine the types and extent of restoration needed to address the injuries. Restoration activities need to produce benefits that are related to or have a nexus (i.e., connection) to natural resource injuries and service losses resulting from a spill. As part of the NRDA process, the Trustees consider a reasonable range of restoration alternatives[21] before selecting their preferred alternative(s) (15 CFR § 990.53(a)(2)). The OPA NRDA regulations (15 CFR Part 990) provide factors (also referred to as evaluation standards) to be used by trustees to evaluate projects designed to compensate the public for injuries caused by oil spills. The Open Ocean TIG developed a screening process based on the OPA NRDA regulations at 15 CFR §§ 990.53 to help identify the reasonable range of alternatives evaluated in this plan.

This chapter of the RP/EA describes the screening process used by the Open Ocean TIG to identify the reasonable range of alternatives included in this RP/EA. The reasonable range of alternatives is consistent with the DWH Trustees' selected programmatic alternative and the goals identified in the Final PDARP/PEIS. This chapter summarizes the injuries addressed by this restoration plan and the projects considered in the reasonable range of alternatives. The restoration planning process was also conducted in accordance with the Consent Decree, the Trustee Council's Standard Operating Procedures (SOPs, DWH Trustees 2021a),[22] OPA NRDA regulations, and NEPA and its implementing regulations (40 CFR §§ 1500-1508).

2.1 Summary of Injuries Addressed in this RP/EA

Chapter 4 of the Final PDARP/PEIS summarizes the injury assessment, which documents the nature, degree, and extent of injuries from the DWH oil spill to both natural resources and the services they provide. Restoration projects identified in this RP/EA and in future Open Ocean TIG restoration plans are designed to address injuries to Restoration Types in the Open Ocean Restoration Area resulting from the spill. This third Open Ocean TIG RP/EA proposes alternatives for the Birds Restoration Type described in the Final PDARP/PEIS. This section summarizes the most relevant information from Chapter 4 of the Final PDARP/PEIS injury assessment and establishes the nexus for restoration planning for this Restoration Type.

The Trustees estimated between 51,600 and 84,500 birds died as a direct result of the DWH oil spill, as well as lost reproduction stemming from these mortalities that ranged between 4,600 and 17,900 fledglings. Due to a variety of factors that likely led to underestimation of mortality, the true injury is likely closer to the upper range of the estimates. Ninety-three different bird species associated with oil-affected habitats showed documented injury resulting from the DWH oil spill.[23] Species showing particularly high injury included brown and American white pelicans, laughing gulls, Audubon's shearwaters, northern gannets, clapper rails, black skimmers, white ibis and other wading bird species, double-crested cormorants, common loons, and several species of terns.

In addition, as a result of the immense area affected by the spill, the diversity of habitats involved, and the prolonged nature of the event, there were a number of bird injuries that were not detected or quantified as part of

[21] For the purposes of this RP/EA, each project evaluated in the reasonable range is considered a separate alternative; therefore, the terms "project" and "alternative" are used interchangeably.

[22] The Trustee Council's SOPs can be accessed at www.gulfspillrestoration.noaa.gov/sites/default/files/2021-08-02%20FINAL%20REVISED%20SOP%20clean%20copy%203.0.pdf.

[23] A full list of species injured by the DWH oil spill can be found in Table 4.7-3 in the PDARP/PEIS.

the Trustees' assessment approach. Overall, the magnitude of the injury and the number of species affected makes the DWH oil spill an unprecedented human-caused injury to birds of the region (DWH Trustees, 2016).

Bird injuries have been partially addressed through projects approved in Early Restoration and post-settlement restoration plans. Multiple restoration plans addressing injuries in the Texas, Louisiana, Mississippi, Alabama, Florida, and Regionwide Restoration Areas have targeted restoration efforts for shorebirds and nearshore seabirds that nest and forage along Gulf Coast beaches. The Open Ocean TIG RP1/EA addressed injuries to common loons and black terns, focusing restoration efforts at these species' respective nesting areas in Minnesota and North and South Dakota.

This RP/EA prioritizes project ideas for seabird species that were injured by the spill, and for which DWH restoration projects have not yet been undertaken (either through Early Restoration or post-settlement restoration planning to date). The project ideas closely align with the broad restoration scope of the Open Ocean TIG. The focal seabird species include the common tern, northern gannets, great shearwaters, and Caribbean-nesting seabirds including Audubon's shearwaters. While these species were documented as having been injured within the northern Gulf during the spill, they breed and spend substantial time outside of the Gulf.[24] As such, reducing bycatch and improving nesting conditions in known nesting areas outside the Gulf are effective ways to restore these species.

2.2 Screening for Reasonable Range of Alternatives

In developing a reasonable range of alternatives suitable for addressing the injuries caused by the DWH oil spill, the Open Ocean TIG considered the Trustees' programmatic Restoration Goals and Restoration Type-specific goals specified in the Final PDARP/PEIS, the screening factors in the OPA NRDA regulations (15 CFR § 990.54), input from the public, the current and future availability of funds under the DWH NRDA settlement payment schedule, projects already funded or proposed to be funded by other DWH TIGs or other DWH restoration funding sources (e.g., NFWF GEBF and RESTORE Act), and projects already funded or proposed to be funded by other sources. Consistent with Section 9.4.1.4 of the Trustee Council's SOPs, the Open Ocean TIG considered project ideas submitted by the public, non-governmental organizations (NGOs), and local, state, and federal agencies. Additional information about the screening process applied by the Open Ocean TIG to generate a reasonable range of alternatives for this RP/EA is provided below.

2.2.1 Open Ocean TIG Screening Process

As stated in the request for project ideas, the Open Ocean TIG addresses restoration for a wide range of resources, including migratory species at important points during their life cycles and across their geographic ranges, including inland, coastal, and offshore areas. The Final PDARP/PEIS Section 5.10 states that for sea turtles, marine mammals, and birds, "The Trustees may additionally use funds in the Regionwide and Open Ocean Restoration Areas for restoration outside coastal Gulf of Mexico habitats, and these funds may be used for resource-level planning, prioritization, implementation, and monitoring for resource recovery, among other activities" (DWH Trustees, 2016). This RP/EA evaluates projects that focus on seabird restoration by improving nesting success at known nesting sites outside of the northern Gulf and by reducing the risk of mortality resulting from bycatch in fisheries.

On March 25, 2021, the Open Ocean TIG requested public submission of ideas through May 10, 2021 to inform the TIG's restoration planning. The project screening process developed by the Open Ocean TIG for the purpose

[24] See also the Strategic Framework for Bird Restoration Activities (June 2017) for more life history information for these species: www.gulfspillrestoration.noaa.gov/sites/default/files/wp-content/uploads/Birds_Strategic_Framework_06.23.17.pdf.

of preparing this RP/EA included reviewing ideas submitted by the public via the DWH NRDA project submission portal.[25] Project ideas needed to be submitted or existing ideas needed to be updated during the March 25 to May 10 solicitation period to be considered in this RP/EA. While screening, the TIG considered the following Bird Restoration Type priorities:

- Projects that may benefit seabird species[26] injured by the spill and that prioritize the following Restoration Approaches:
    - Restore and conserve bird nesting and foraging habitat.
    - Establish or reestablish nesting colonies.
    - Prevent incidental bird mortality.

The TIG reviewed the Final PDARP/PEIS programmatic Restoration Goals and developed a set of screening criteria for identifying project ideas to establish a reasonable range of alternatives for restoration in this RP/EA. The TIG reviewed 76 restoration project ideas (59 of which were related to the Birds Restoration Type) proposed by individual members of the public, NGOs, and local, state, and federal agencies.[27] Project review and screening for the Birds project ideas took place through stages and application of criteria identified in Table 2-1 below and summarized in Figure 2-1.

Table 2-1 Overview of Screening Stages and Criteria/Factors Applied by the Open Ocean TIG

Stage of Screening	Criteria/Factors Considered
Initial screening	Project ideas were removed if they: • Were unrelated to birds. • Had insufficient information for evaluation. • Were already required by local, state, or federal law. • Had already been funded. • Were duplicates of other project ideas. The TIG identified 59 project ideas applicable to the Birds Restoration Type.
Consistency with Final PDARP/PEIS Programmatic Goals and Restoration Types	Project ideas were evaluated for consistency with the Replenish and Protect Living Coastal and Marine Resources PDARP/PEIS Programmatic and Birds Restoration Type goals, and the adaptive management processes described in the PDARP/PEIS. After screening for consistency with the PDARP/PEIS, 54 Birds Restoration Type project ideas remained.
Evaluation based on additional Open Ocean TIG criteria	Project ideas were evaluated against additional criteria determined by the TIG: • The extent to which a restoration project addresses the Restoration Approaches and priorities identified for Birds in the public notice for project ideas. • Whether a project does not have foreseeable issues related to compliance with regulatory and/or permitting requirements.

[25] The project submission portal can be accessed at www.gulfspillrestoration.noaa.gov/restoration/give-us-your-ideas.

[26] For the purposes of this request for project ideas, "seabird species" include all species in the PDARP/PEIS seabirds guild, as well as bridled tern, brown noddy, common tern, and sooty tern. Seabirds do not include inland or nearshore species such as black skimmers, black terns, Caspian terns, Forster's tern, gull-billed terns, least terns, royal terns, or sandwich terns.

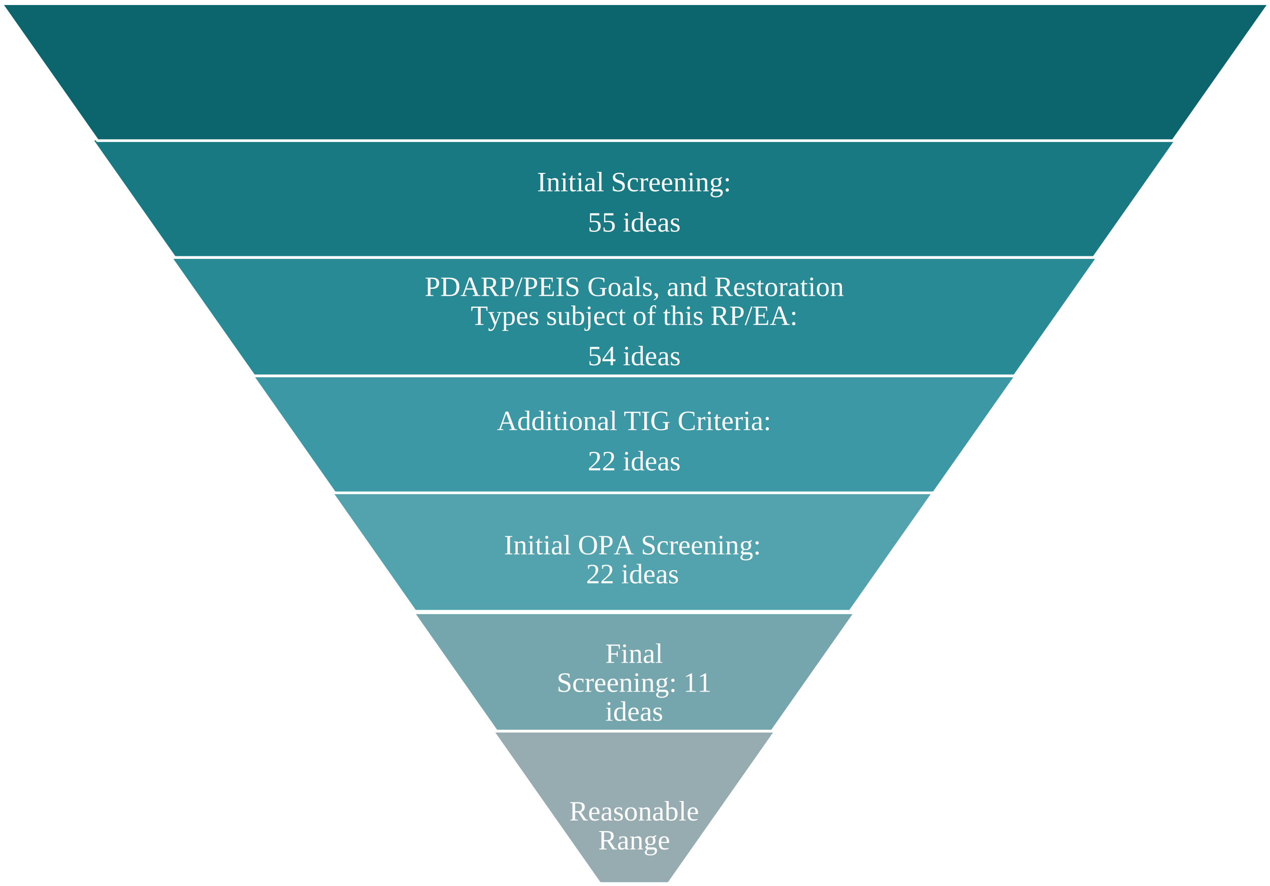
[27] The TIG conducted preliminary screening of 12 Sturgeon Restoration Type project ideas, but subsequently decided not to include sturgeon projects in this RP/EA. See Section 1.6 for more information.

Stage of Screening	Criteria/Factors Considered
	• The extent to which a project could be scaled or leveraged with other funding sources. • Whether the project is consistent with the DWH Strategic Framework for Bird Restoration Activities.[28] • Whether the project is focused on restoring injured seabird species. • Whether the project targets restoration for seabird species that were injured in the greatest numbers. • Whether the project targets restoration that would benefit a suite of injured seabird species. • Whether the project targets seabirds that are unlikely to be restored through other TIGs. This step resulted in 22 Birds Restoration Type project ideas remaining.
Evaluation based on OPA factors	The TIG conducted a preliminary OPA NRDA screening based on:[29] • The cost to carry out the alternative (e.g., cost to benefit ratio). • The extent to which each alternative is expected to meet the Trustees' goals and objectives in returning the injured natural resources and services to baseline and/or compensating for interim losses. • 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. • The extent to which each alternative benefits more than one natural resource and/or service. • The effect of each alternative on public health and safety. This step resulted in 22 Birds Restoration Type project ideas remaining (Figure 2-1).
Final screening and determination of a reasonable range	Similar project ideas were combined, and some ideas were modified to better align with the TIG's restoration objectives. The TIG also considered how the projects might overlap in terms of species benefits and how to select a range of projects to cost-effectively restore for a suite of injured seabird species. This step resulted in 11 Birds Restoration Type projects that are included in the reasonable range of alternatives for evaluation in this RP/EA (Figure 2-1).

[28] The DWH Strategic Framework for Bird Restoration Activities can be accessed at https://www.gulfspillrestoration.noaa.gov/sites/default/files/wp-content/uploads/Birds_Strategic_Framework_06.23.17.pdf.

[29] The TIG conducted a thorough OPA NRDA evaluation of the reasonable range of alternatives, described in Chapter 3.

Figure 2-1 Screening Process Summary



2.3 Alternatives Not Considered for Further Evaluation in this Plan

The reasonable range of alternatives considered for this RP/EA was selected from project ideas that passed through the screening steps outlined above. Project ideas that were screened out are not considered further in this RP/EA. In some cases, project ideas met or nearly met screening criteria, but: (1) need further technical development; (2) did not align as closely with the priorities of the Open Ocean TIG; or (3) may already be receiving funding through other DWH settlement funding mechanisms. Project ideas not included in the reasonable range of alternatives for this RP/EA, or not selected for implementation in the final RP/EA, may be considered for future restoration planning.

2.4 Reasonable Range of Restoration Alternatives Considered

From the process described above, the Open Ocean TIG developed a reasonable range of 11 Bird restoration alternatives for further consideration and evaluation in this RP/EA (Table 2-2, Figures 2-2 and 2-3). Summaries of each of these alternatives are provided in the following subsections of this chapter. OPA NRDA and NEPA evaluations of these alternatives are provided in Chapters 3 and 4 of this document, respectively. A No Action Alternative is included in the RP/EA pursuant to NEPA as a "… benchmark, enabling decision makers to compare the magnitude of environmental effects of the action alternatives."

Table 2-2 Reasonable Range of Alternatives Considered in this RP/EA

Alternative	Project Costs
Predator Removal and Seabird Nesting Colony Restoration at Mona Island	$9,039,500
Predator Removal and Seabird Nesting Colony Restoration in the Culebra Archipelago	$1,700,000
Seabird Nesting Colony Reestablishment and Protection at Desecheo National Wildlife Refuge	$214,500
Seabird Nesting Colony Protection and Enhancement at Dry Tortugas National Park	$1,183,200
Common Tern Nesting Colony Restoration in the Great Lakes Region	$3,520,000
Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries	$5,052,000
Seabird Bycatch Risk Reduction in Gulf of Mexico and Southeast U.S. Pelagic Longline Fisheries	$1,546,500
Northern Gannet Nesting Colony Restoration in Eastern Canada	$5,680,000
Common Tern Nesting Colony Restoration in Manitoba	$4,400,000
Seabird Nesting Habitat Restoration and Colony Reestablishment in the Bahamas	$7,150,000
Invasive Goat Removal to Restore Seabird Nesting Habitat in St. Vincent and the Grenadines	$231,000

Figure 2-2 Restoration Alternatives and Proposed Project Activities in the Caribbean

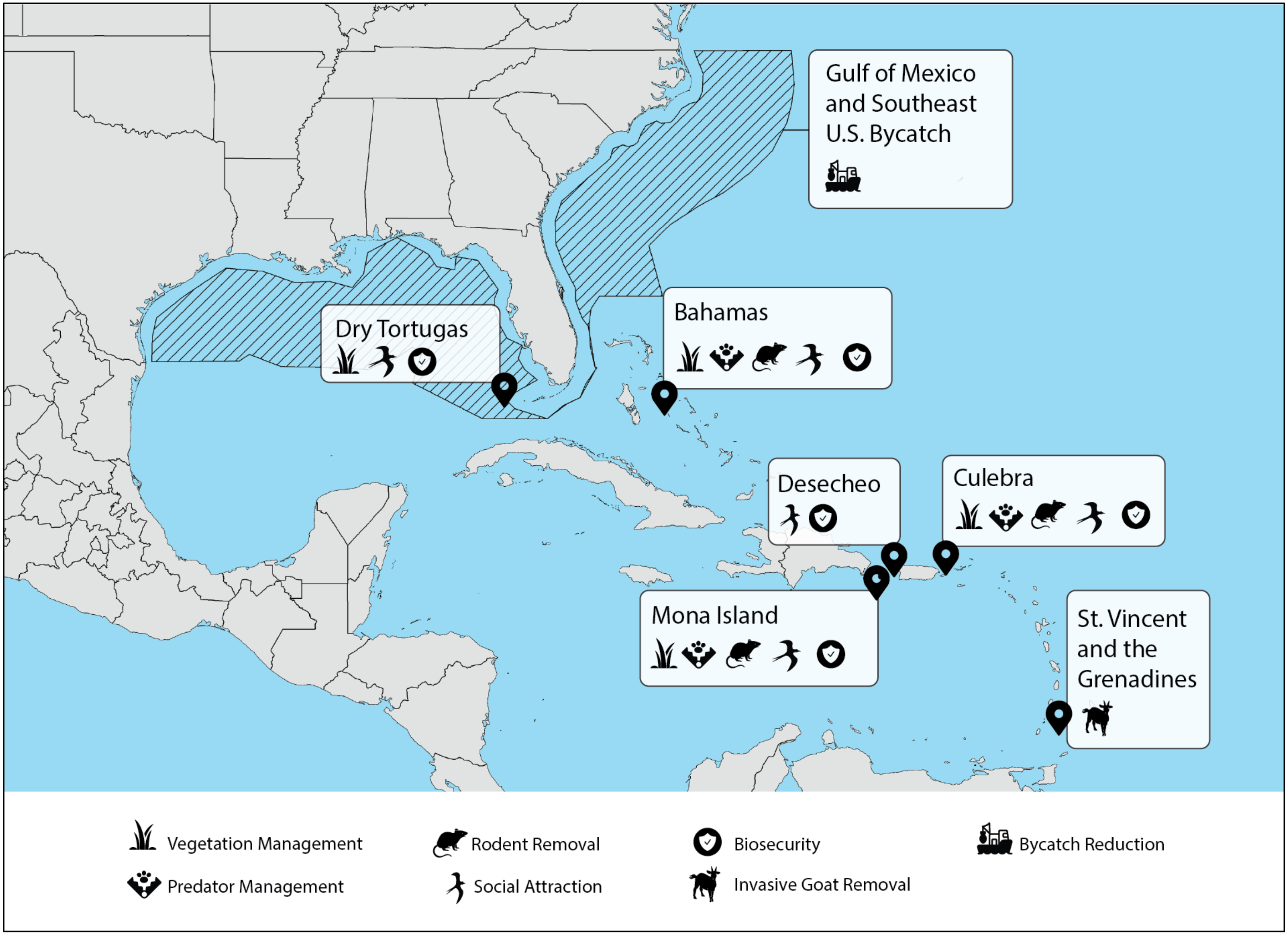
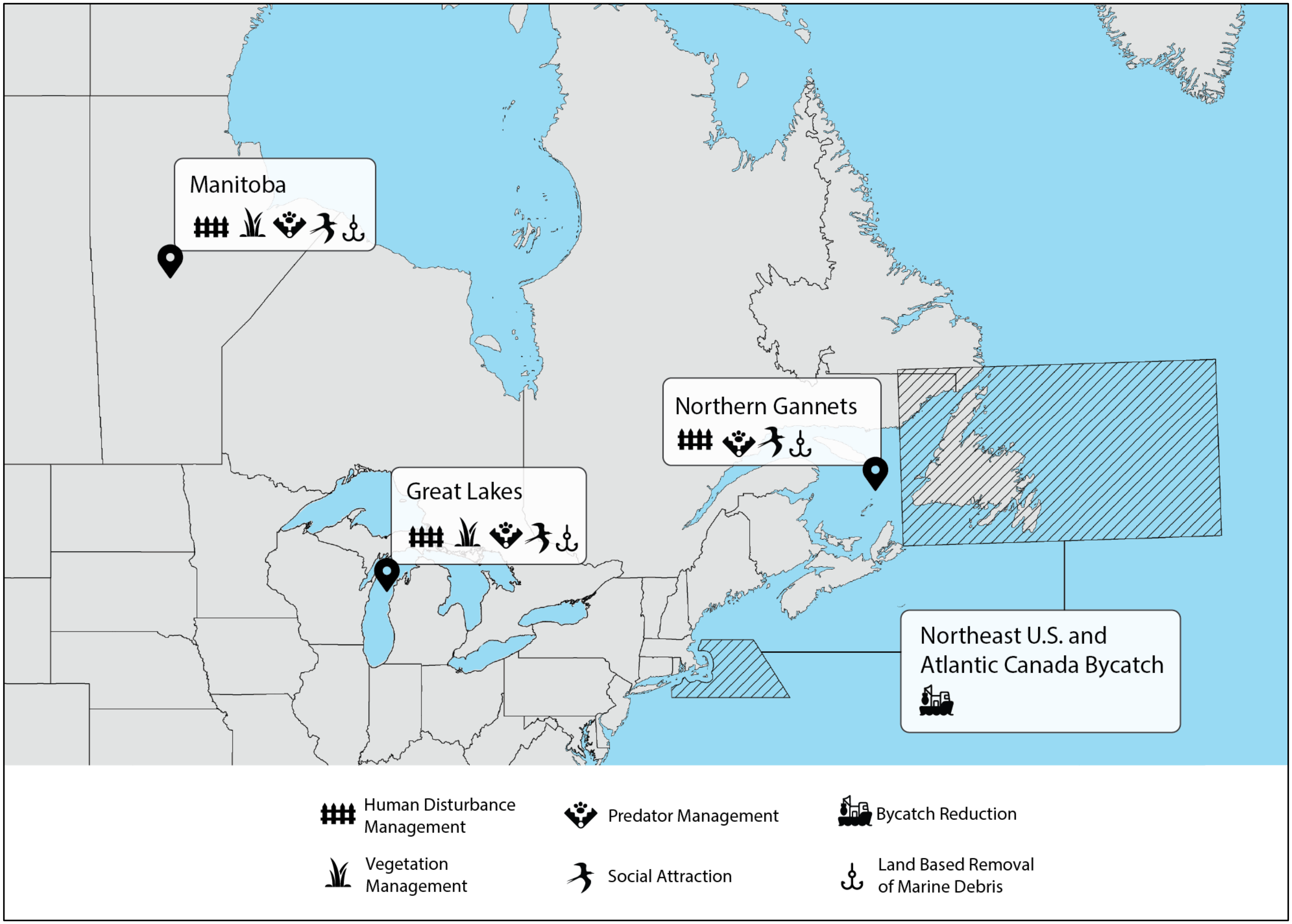


Figure 2-3 Restoration Alternatives and Proposed Project Activities Across North America



2.4.1 Predator Removal and Seabird Nesting Colony Restoration at Mona Island

Restoration Approach
Restore and conserve bird nesting and foraging habitat; Establish or reestablish nesting colonies (PDARP/PEIS Section 5.5.12.2)
Restoration Techniques
Enhance habitat through vegetation management; nesting and foraging area stewardship (i.e., predator management); use acoustic vocalization playbacks and decoys to attract nesting adults to restoration sites (PDARP/PEIS Appendix 5.D.6.1 and 5.D.6.2)
Project Goals and Objectives
The goal of this project is to restore seabirds at Mona Island by implementing a suite of restoration and conservation techniques (including predator management, vegetation management, social attraction, and biosecurity measures).
Project Location
Mona Island, Puerto Rico (Figure 2-4)
Project Summary

DOI would be the lead Implementing Trustee for this project. Project partners may include U.S. federal and Puerto Rican government agencies (USDA-APHIS, U.S. Fish and Wildlife Service [USFWS] Caribbean Ecological Services Field Office, Puerto Rico Department of Natural and Environmental Resources [PRDNER]) as well as NGOs (Island Conservation). This project seeks to increase seabird nesting success and productivity through the removal of invasive plants and animals and the reestablishment of native plants and seabird colonies.

This project would:

- Conduct vegetation management, including removing invasive plant species and propagating and planting native plants. Invasive limeberry shrub (*Triphasia trifolia*) and Australian pine (*Casuarina equisetifolia*) would be removed by hand and with the use of chainsaws in the coastal plains area (southwest portion) of the island. Native plants would be propagated and planted, including puckhout (*Coccoloba microstachya*), seagrape (*Coccoloba uvifera*), beeftree (*Guapira discolor*), sloe (*Reynosia uncinata*), Taylor's jujube (*Ziziphus taylorii*), Puerto Rico palmetto (*Sabal causiarum*), Florida cherry palm (*Pseudophoenix sargentii*), swamp-redwood (*Erythroxylum areolatum*), Long Key locustberry (*Byrsonima lucida*), and bay cedar (*Suriana maritima*).
- Manage predators, including removing invasive rodents through rodenticide application, and removing cats and pigs through trapping and hunting. Project planning efforts conducted in coordination with the PRDNER, USDA-APHIS, and the USFWS Caribbean Ecological Services Field Office could help determine the most appropriate approaches for managing predators. For example, rodenticide applications may be conducted in stages depending on ESA Section 7 consultations with USFWS. Initial stages could include literature searches, limited applications in localized areas (e.g., with non-toxic inert bait), and/or field and laboratory studies to establish a better understanding of the effects of large-scale rodenticide use on Mona Island. Later stages could include larger scale application(s) of rodenticide (aerial application, hand broadcast, and bait stations) that would be designed based on information gleaned from initial stages. Humane approaches to predator removal and eradication would be applied wherever possible in the deployment of traps, hunting, and chemical control.
- Reestablish existing (or establish new) seabird nesting colonies through social attraction techniques. For the purposes of this RP/EA, social attraction techniques refer to actions taken to establish or reestablish bird nesting colonies by attracting breeding adults to restoration sites. This could include the placement of bird or egg decoys, mirrors, or sound systems at the restoration site; and
- Develop and implement biosecurity measures. For the purposes of this RP/EA, biosecurity measures refer to actions taken to reduce the risk of (re)introduction of invasive species such as rodents, cats, pigs, or other invasive species that harm seabirds and seabird nesting habitat. Biosecurity measures for this project may include but are not limited to

education and outreach, monitoring for invasive species presence using remote game cameras or chew tags, and the targeted placement of baited or rodenticide traps at incursion sites.

The presence of invasive, feral mammals (rodents, cats, and pigs) has significantly reduced remnant populations of native and endemic wildlife on Mona Island. The removal of rodents, cats, and pigs on Mona Island could increase the number of birds and restore a portion of the injury from the DWH oil spill for eight seabird species: Audubon's shearwater (*Puffinus lherminieri*), sooty tern (*Onychoprion fuscatus*), magnificent frigatebird (*Fregata magnificens*), bridled tern (*Onychoprion anaethetus*), brown noddy (*Anous stolidus*), white-tailed tropicbird (*Phaethon lepturus*), masked booby (*Sula dactylatra*), and brown booby (*Sula leucogaster*).

Planning efforts by local management agencies and stakeholders have been in progress on Mona Island since 2012 to inform potential future restoration actions, including field trials for feral cat and pig eradication and small-scale work on invasive plants and animals at specific sites on the island. In 2016, the PRDNER Secretary signed a Letter of Intent to support invasive species management on Mona Island, particularly focused on pig eradication. In 2017, restoration actions on the ground supported by the USFWS Coastal Program began a small-scale effort targeting invasive plants and animals in specific sites on the island. A Memorandum of Understanding is being developed between USFWS, USDA-APHIS, PRDNER and Island Conservation, including eradication plans for all the target species (pigs, cats, rodents).

Mona Island is managed as a Natural Reserve by PRDNER. Proposed project activities are consistent with the Mona Island Natural Reserve's management plan (PRDNER, n.d.) and would complement ongoing conservation efforts. All activities would occur on the uninhabited island; the only visitors to the island include resource managers, reserve rangers, seasonal hunters, and occasional researchers and tourists. Once invasive species are removed, social attraction would facilitate the recolonization and growth of several seabird populations, including the Audubon's shearwater, a species of conservation priority for the Caribbean with only one percent of its historical population remaining (Mackin, 2016). With an estimated capacity for 15,000 nesting pairs, Mona Island could harbor a sizeable colony of this species. Recent records of Audubon's shearwater and bridled tern nests suggest that these species may be utilizing the island in small numbers, thereby also facilitating their recovery after restoration efforts. The recent presence of at least five other DWH injured species on nearby Monito Island would provide a promising source population for the recolonization of Mona Island.

Because hand and aerial application of rodenticide poses risks to native birds, raptors, and reptiles, and could result in adverse impacts to non-target species, including endemic and threatened and endangered species on Mona Island, the rodenticide portion of the project may be conducted in stages. Each stage of rodenticide application would be implemented in consultation with PRDNER and the USFWS Caribbean Field Office. Initial stages would include assessments of risk to non-target species. Based on the findings from these initial stages, later stages of rodenticide application could include impact minimization measures such as the use of captive holding of endemic reptiles and birds, provision of veterinary services, or other actions as needed. Project funds would be provided for these kinds of measures. Other project activities would be implemented independently of and concurrently with initial stages of the rodent eradication. Biosecurity measures, as described above, would be implemented to prevent the (re)introduction of invasive animals.

General Project Activities and Implementation Timing

Project activities include planning and design, implementation (including vegetation and predator management, biosecurity measures, and nesting colony expansion through social attraction), and monitoring.

The project is expected to take approximately 8 to 10 years to complete. Planning for all project activities would occur in Years 1 to 3. Implementation would occur in approximately Years 3 to 8. Rodenticide activities may be conducted in stages, with initial stages planned and executed in approximately Years 4 to 6, followed by later stages as determined appropriate. Monitoring would occur for 5 years during and after project implementation through approximately Year 10.

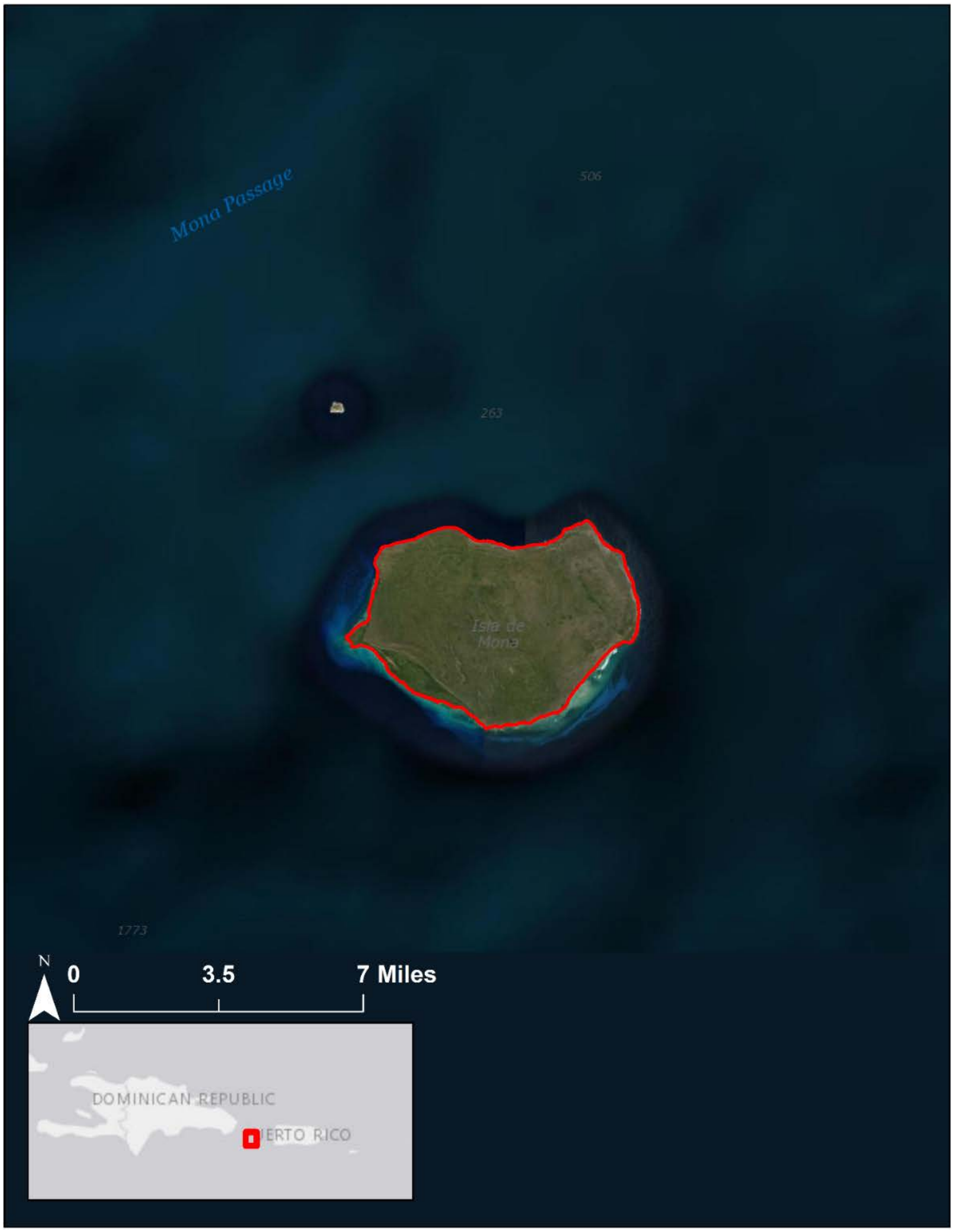
Maintenance

Short-term maintenance activities include but may not be limited to maintaining predator traps and rodenticide bait stations, invasive species removal actions and native plantings, and maintaining social attraction tools (e.g., decoys). Project partners, including the USFWS and PRDNER, would conduct long-term maintenance of the project, as needed, as part of their existing management efforts on the island.

Costs

The total estimated project cost is $9,039,500, which includes planning and design, implementation, impact minimization measures, monitoring and maintenance, oversight, and contingency.

Figure 2-4 Predator Removal and Seabird Nesting Colony Restoration at Mona Island: General Project Location

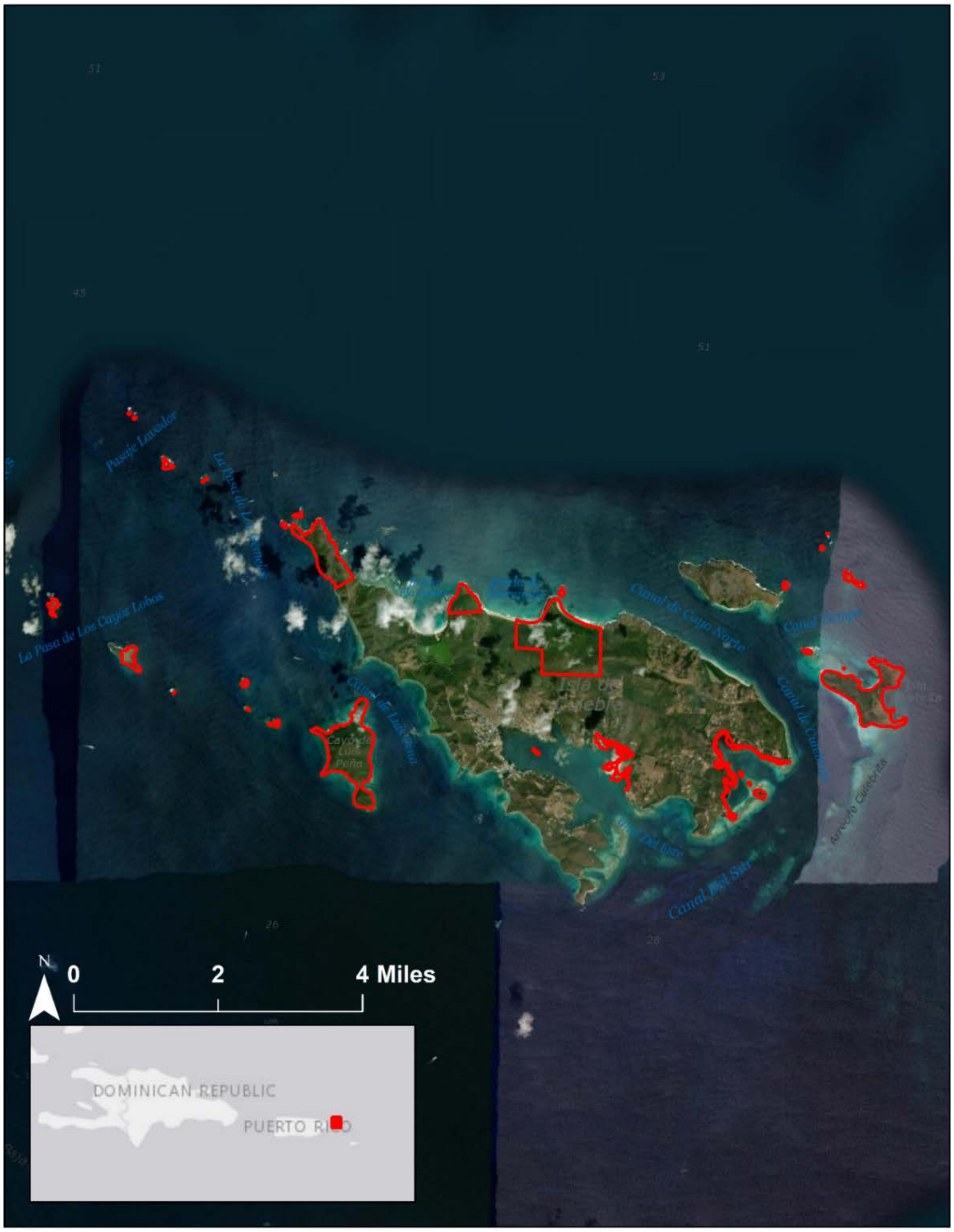


2.4.2 Predator Removal and Seabird Nesting Colony Restoration in the Culebra Archipelago

Restoration Approach
Restore and conserve bird nesting and foraging habitat; Establish or reestablish nesting colonies (PDARP/PEIS Section 5.5.12.2)
Restoration Technique
Nesting and foraging area stewardship (i.e., predator management); use acoustic vocalization playbacks and decoys to attract nesting adults to restoration sites (PDARP/PEIS Appendix 5.D.6.1 and 5.D.6.2)
Project Goals and Objectives
The goal of this project is to restore seabirds in the Culebra Archipelago by implementing a suite of restoration and conservation techniques (including predator management, vegetation management, social attraction, and biosecurity measures).
Project Location
Culebra Archipelago, Puerto Rico (Figure 2-5)
Project Summary
DOI would be the lead Implementing Trustee for this project. Project partners may include NGOs (Island Conservation, Effective Environmental Restoration) and U.S. federal and Puerto Rican government (USFWS Caribbean Islands National Wildlife Refuge [NWR] Complex, Caribbean Landscape Conservation Cooperative, PRDNER). This project would increase the nesting success and productivity of Caribbean-nesting seabirds through a variety of management actions to increase, improve, and restore available nesting habitat. This project would: • **Construct a predator-proof fence** to protect seabird nesting colonies on the Flamenco Peninsula; • **Conduct vegetation and predator management**, including eradicating invasive species including invasive plants, removing dogs and cats through trapping, removing deer and goats through hunting, and eradicating rodents through rodenticide application. Humane approaches to predator removal and eradication would be applied wherever possible in the deployment of traps, hunting, and chemical control. • **Reestablish existing (or establish new) seabird nesting colonies** through social attraction techniques such as species-specific decoys and acoustic playbacks; and • **Develop and implement biosecurity measures**, including placement of rodenticide bait stations to prevent the reintroduction of invasive rodents. The Culebra Archipelago is located to the east of Puerto Rico and is part of the Caribbean Islands NWR Complex. The Culebra NWR is comprised of lands on the main island of Culebra and 22 smaller islands in the same vicinity. This project would work on 10 cays and the Flamenco Peninsula on the main island of Culebra (mostly uninhabited islets and one populated island), with a total footprint of 797 acres. This would be a multi-component project aimed at seabird restoration in the Culebra Archipelago through the application of a variety of management actions to increase, improve, and restore the available habitat for seabird nesting colonies. These restoration actions could increase the number of birds and restore a portion of the injury from the DWH oil spill for seven seabird species: Audubon's shearwater (*Puffinus lherminieri*), sooty tern (*Onychoprion fuscatus*), bridled tern (*Onychoprion anaethetus*), brown noddy (*Anous stolidus*), white-tailed tropicbird (*Phaethon lepturus*), red-billed tropicbird (*Phaethon aethereus*), and brown booby (*Sula leucogaster*). One part of the project would involve constructing a predator-proof fence at the Flamenco Peninsula area where hundreds of sooty terns nest each year. This area is currently being treated for rodent control prior to the commencement of the seabird nesting season each year. The project would include monitoring to measure reproductive success and to examine the success of techniques to improve recruitment such as predator eradication. Nesting habitat mapping, characterization, and quality assessment would be conducted and are important elements in determining adequacy of nesting habitat.

General Project Activities and Implementation Timing
Project activities include planning and design, implementation (including construction of a predator-proof fence, biosecurity measures, and invasive species management), and monitoring. The project is expected to take approximately 5 to 10 years to complete. Planning would occur in Year 1. Implementation would occur in approximately Years 2 to 5. Monitoring would occur for 5 years during and post project implementation through approximately Year 10.
Maintenance
Predator control fencing and rodenticide bait stations would require minor, short-term maintenance. Project partners, including the USFWS and PRDNER, would assist with long-term maintenance of the project as part of their existing management efforts on the NWR.
Costs
The total estimated project cost is $1,700,000, which includes planning and design, implementation, monitoring and maintenance, oversight, and contingency.

Figure 2-5 Predator Removal and Seabird Nesting Colony Restoration in the Culebra Archipelago: General Project Location



2.4.3 Seabird Nesting Colony Reestablishment and Protection at Desecheo National Wildlife Refuge

Restoration Approach
Restore and conserve bird nesting and foraging habitat; Establish or reestablish nesting colonies (PDARP/PEIS Section 5.5.12.2)
Restoration Technique
Develop and implement management actions in conservation areas and/or restoration projects; use acoustic vocalization playbacks and decoys to attract nesting adults to restoration sites (PDARP/PEIS Appendix 5.D.6.1 and 5.D.6.2)
Project Goals and Objectives
The goal of this project is to restore seabirds by reestablishing nesting colonies for five primary seabird species using techniques such as social attraction, biosecurity, and monitoring.
Project Location
Desecheo Island, Puerto Rico (Figure 2-6)
Project Summary

DOI would be the lead Implementing Trustee for this project. Project partners may include NGOs (Island Conservation, Effective Environmental Restoration) and U.S. federal and Puerto Rican government (USFWS Caribbean Islands NWR Complex, PRDNER). This project seeks to maximize the restoration benefits of previously implemented invasive species eradication efforts by reestablishing seabird nesting colonies for five seabird species – bridled tern *(Onychoprion anaethetus),* sooty tern (*Onychoprion fuscatus*), brown booby (*Sula leucogaster*), magnificent frigatebird (*Fregata magnificens*), and brown noddy (*Anous stolidus*) – and enhancing existing biosecurity efforts.

This project would:

- **Reestablish existing (or establish new) seabird nesting colonies** through social attraction techniques such as species-specific decoys, mirrors, and acoustic playbacks; and
- **Enhance existing biosecurity measures**, including placement of rodenticide bait stations to prevent the reintroduction of invasive rodents.

Desecheo NWR is an island located 14 miles west of the mainland of Puerto Rico and is part of the Caribbean Islands NWR Complex. Historically known as an important center of biodiversity and species abundance in the Caribbean, Desecheo was a major seabird rookery and formerly home to one of the largest brown booby nesting populations in the world.

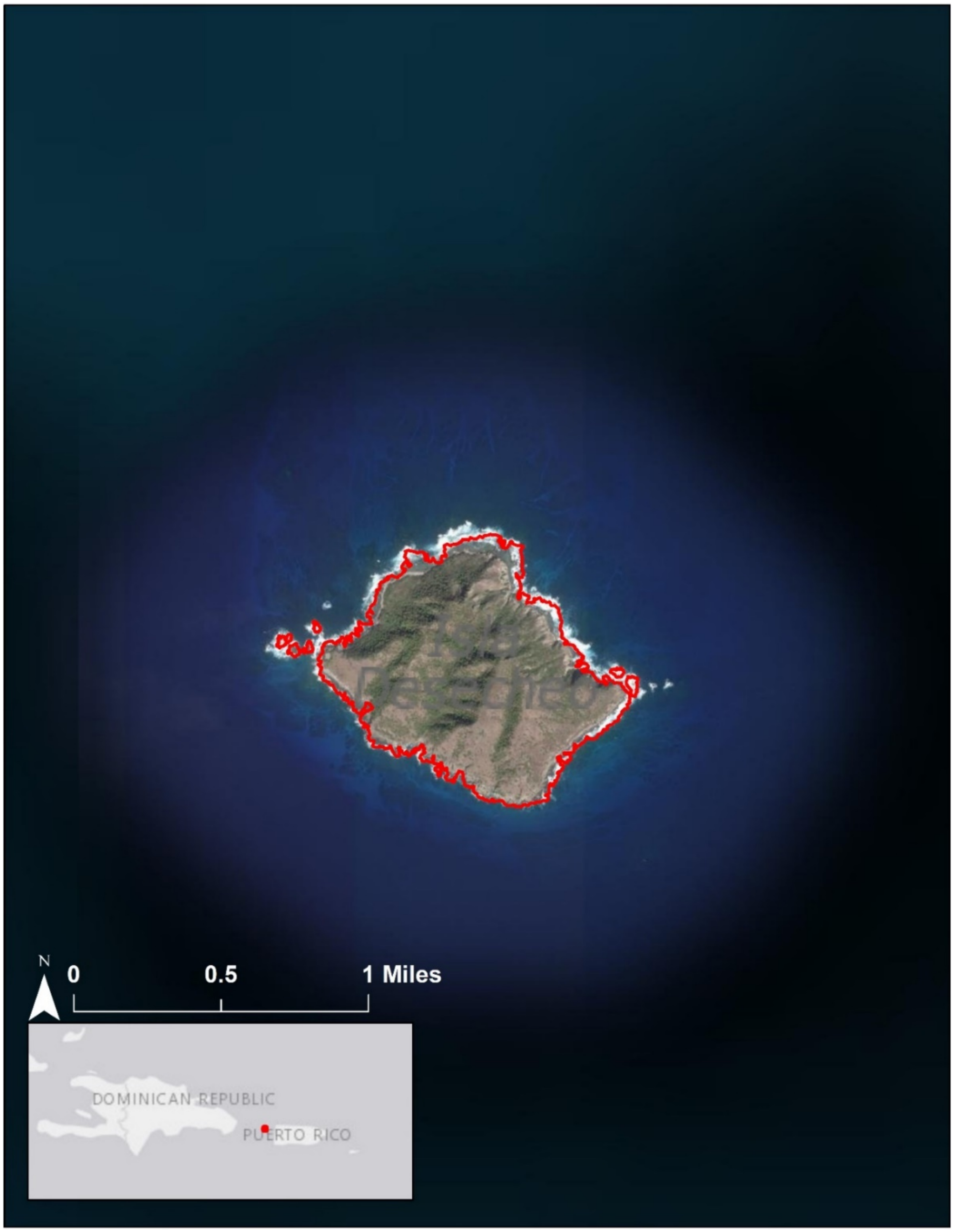
Invasive mammals (rodents, goats, macaques) caused a near-total collapse of the seabird colonies on Desecheo NWR. These invasive mammals were recently eradicated through a collaborative project with USFWS, Island Conservation, USDA-APHIS, and PRDNER. After declines caused by anthropogenic factors, seabirds often fail to reestablish because they typically nest at their place of origin, or they continue to perceive a risk of predation. In the absence of active management, recolonization by the target seabird species is less likely to occur. This project would help reestablish seabird nesting colonies, and, in turn, maximize the return on investment from invasive mammal eradication.

After work conducted in 2016, the NWR successfully eradicated rodents from Desecheo island. The Caribbean Islands NWR Complex developed biosecurity measures following this eradication and continues to protect the area from disturbance and prevent the reinvasion of invasive rodents through a combination of actions including: biosecurity (replenishment of bait stations and monitoring of trail cameras), collaboration with other commonwealth and federal agencies to prevent illegal activities on the island, signage, and education of boaters that use the adjacent islands.

This project aims to reestablish nesting colonies for the five target seabird species on Desecheo NWR through design and implementation of active seabird recovery management and monitoring. Management activities would take place across approximately 300 uninhabited acres within the NWR (that are closed to the public and only visited by resource managers) and would include a combination of social attraction techniques and biosecurity to enhance existing NWR management. NGOs, including Island Conservation and Effective Environmental Restoration, are currently working on social attraction projects on the

NWR. USFWS personnel at the NWR would oversee this project and would continue to coordinate and collaborate with NGO partners. Social attraction techniques would include species-specific decoys (life-size adults, eggs, and chicks), mirrors, and acoustic playbacks to attract birds to suitable nesting sites. These techniques have been shown to reestablish extirpated seabird colonies and increase colony occupancy, nesting density, and distribution for several tern species, white-tailed tropicbirds, magnificent frigatebirds, and boobies. Social attraction trials on the NWR, which focused on bridled tern, brown noddy, and Audubon's shearwater, have shown this technique to be successful, and this project would build upon those successes. Although this project focuses primarily on social attraction activities, it would also involve targeted biosecurity efforts, including placing bait stations at strategic locations to avoid any reinvasion of rodents while minimizing rodenticide use. Potential colony sites would be identified using existing baseline data and expert knowledge of the island. Equipment would be deployed 2 to 4 weeks prior to the onset of egg-laying for each species, and responses would be monitored by direct observation and trail cameras to provide measures of success. Attendance patterns, daily counts, territorial sites, and marked nests for each species would be monitored to estimate seabird nesting success and to infer future recruitment into the nesting population. In addition, annual island-wide surveys would document natural recolonization by seabirds in areas outside of the actively managed sites.
General Project Activities and Implementation Timing
Project activities include planning and design, implementation (including biosecurity measures and colony expansion through social attraction), and monitoring. The project is expected to take approximately 5 to 8 years to complete. Planning would occur in Year 1. Implementation would occur in approximately Years 2 to 5. Monitoring would begin during implementation in Year 2 and continue through approximately Year 8.
Maintenance
Social attraction equipment and rodenticide bait traps may require short-term maintenance. Project partners, including the USFWS and PRDNER would assist with long-term maintenance of the project as part of their existing management efforts on the island.
Costs
The total estimated project cost is $214,500, which includes planning and design, implementation, monitoring and maintenance, oversight, and contingency.

Figure 2-6 Seabird Nesting Colony Reestablishment and Protection at Desecheo National Wildlife Refuge: General Project Location



2.4.4 Seabird Nesting Colony Protection and Enhancement at Dry Tortugas National Park

Restoration Approach
Restore and conserve bird nesting and foraging habitat; Establish or reestablish nesting colonies (PDARP/PEIS Section 5.5.12.2)
Restoration Technique
Enhance habitat through vegetation management; develop and implement management actions in conservation areas and/or restoration projects; use acoustic vocalization playbacks and decoys to attract nesting adults to restoration sites (PDARP/PEIS Appendix 5.D.6.1 and 5.D.6.2)
Project Goals and Objectives
The goal of this project is to inform seabird restoration decisions by establishing a monitoring baseline and to restore seabirds by reestablishing nesting colonies through vegetation management and social attraction techniques.
Project Location
Dry Tortugas National Park, Florida (Figure 2-7)
Project Summary

DOI would be the lead Implementing Trustee for this project, which would be implemented in partnership with the National Park Service (NPS). This project seeks to evaluate both historic and current population size of nesting seabird colonies on Dry Tortugas National Park (DRTO) to establish an updated understanding of baseline conditions to inform the design of future restoration actions, and to actively restore seabird colonies through habitat enhancement, social attraction, and biosecurity measures.

This project would be conducted in phases, as described below. Phase I activities would continue through Phase II.

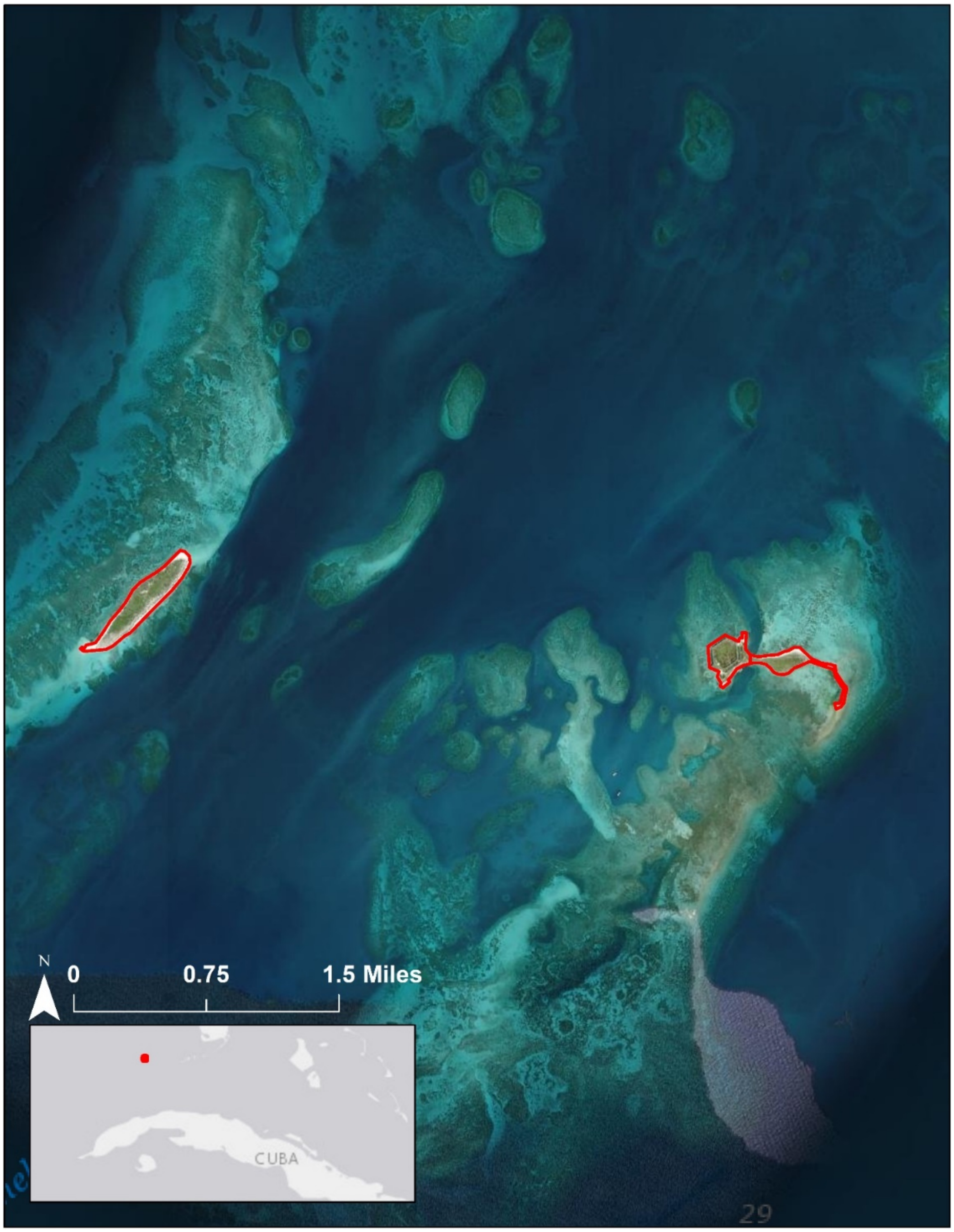
- Phase I:
  - **Compile and analyze existing monitoring data** to inform restoration activities and seabird management;
  - **Conduct additional seabird monitoring** via overflight or uncrewed aircraft systems (UAS, or "drone")[30] surveys to establish a baseline and inform restoration activities and seabird management; and
  - **Enhance existing biosecurity measures**, which could include the placement of rodenticide bait stations.
- Phase II:
  - **Reestablish existing (or establish new) seabird nesting colonies** through social attraction techniques such as species-specific decoys, mirrors, and acoustic arrays of courtship sounds; and
  - **Vegetation management**, such as planting of native bushes and trees.

DRTO currently consists of seven keys that provide important nesting and wintering habitat for a variety of seabirds. Four of these keys (Garden, Bush, Long, and Hospital) typically support seabird nesting annually. The keys of DRTO are one of very few nesting sites within the continental U.S. for the sooty tern (*Onychoprion fuscatus*), bridled tern (*Onychoprion anaethetus*), brown noddy (*Anous stolidus*), masked booby (*Sula dactylatra*), and magnificent frigatebird (*Fregata magnificens*), which were injured by

[30] On October 21, 2022, DOI issued a memorandum updating UAS operations and procurement policy to remove restrictions on UAS use by all DOI Bureaus. NPS would use drones for this project only if drone use is consistent with all laws, regulations, and policies applicable on NPS lands at the time of use. DOI and project partners would confirm the decision to use UAS for this project prior to implementation and would update project plans and budget accordingly. Cost savings would be achieved if drones are used in place of fixed-wing aircraft.

the DWH oil spill. These seabirds rely on the isolated protection and productive terrestrial and marine ecosystems of DRTO to feed, nest, and successfully breed. Due to the high density of nesting on these small keys in DRTO and the remoteness of nesting sites, monitoring of nesting seabird colonies is challenging. As such, previous disparate ground-based monitoring efforts at DRTO have been inefficient, unreliable, and produced less robust data. In Phase I, the project would conduct approximately monthly flyovers via fixed-wing aircraft or drones on all keys in DRTO during peak seabird nesting season (8 months in total from approximately February through September). Geo-referenced aerial imagery would be used by NPS resource managers to establish a current and repeatable understanding of the population baseline for nesting seabird species at DRTO and inform restoration actions to occur during Phase II. Concurrently with baseline monitoring, the project would enhance existing biosecurity measures to maximize the benefits derived from a recent rat eradication and prevent the (re)introduction of other invasive species. In January 2022, the NPS partnered with USDA-APHIS and successfully eradicated invasive black rats (*Rattus rattus*) from Garden, Bush, Long, and Loggerhead Keys at DRTO. Thus, this project seeks to establish an understanding of the current baseline for seabird populations post-eradication to monitor the benefits of this conservation action on colony size, nesting success, and survival over time. Phase II would include nesting colony reestablishment and habitat enhancement actions informed by Phase I activities. The social attraction techniques proposed in this project have reestablished extirpated seabird colonies and increased colony occupancy, nesting density, and distribution in other Caribbean islands. Potential colony sites would be identified using baseline data gathered in Phase I and expert knowledge. Social attraction tools would be deployed 2 to 4 weeks prior to the onset of egg-laying for each species, and bird responses would be monitored via the aerial surveys and/or trail cameras. Vegetation management would include the removal of invasive species and planting of native species that increase nesting habitat (e.g., bushes and trees). DRTO experienced substantial impacts from Hurricane Ian in September 2022. In Phase I, DOI and NPS would evaluate opportunities to leverage hurricane-related emergency response actions with project activities (e.g., planting vegetation, reducing erosion) to increase efficiencies and avoid duplication.
General Project Activities and Implementation Timing
Project activities include planning and design (e.g., baseline monitoring), implementation (including biosecurity measures, social attraction, and habitat enhancements), and performance monitoring. The project is expected to take approximately 5 to 7 years to complete. Phase I would occur from the project start through Year 5. Phase II would begin in Year 3 or 4 and continue through project completion in approximately Year 5. Monitoring would begin in Year 3 or 4 and continue through approximately Year 7.
Maintenance
Overflight equipment (including aircraft/drones and cameras), field supplies, and social attraction supplies may need periodic maintenance. Biosecurity supplies (snap traps, bait traps, etc.) would require minor operations and maintenance (O&M) while deployed. Project partners, including NPS, would conduct long-term maintenance of the project, as needed, as part of their existing management efforts at DRTO.
Costs
The total estimated project cost is $1,183,200 for fixed-wing aircraft, which includes costs for planning and design, implementation, monitoring and maintenance, oversight, and contingency. Cost savings would be achieved if drones are used in place of fixed-wing aircraft. NPS would provide in-kind monetary support, including staff to conduct aerial surveys and analysis, project management, contracting/agreements, coordination, and compliance; and one year of overflights and analysis for existing datasets.

Figure 2-7 Seabird Nesting Colony Protection and Enhancement at Dry Tortugas National Park: General Project Location



2.4.5 Common Tern Nesting Colony Restoration in the Great Lakes Region

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Restoration Approaches
Restore and conserve bird nesting and foraging habitat; Establish or reestablish nesting colonies (PDARP/PEIS Section 5.5.12.2)
Restoration Techniques
Nesting and foraging area stewardship; use acoustic vocalization playbacks and decoys to attract nesting adults to restoration sites; develop and implement management actions in conservation areas and/or restoration projects (PDARP/PEIS Appendix 5.D.6.1 and 5.D.6.2)
Project Goals and Objectives
The goal of this project is to increase nesting success, survival, and productivity of the common tern at nesting locations in the Great Lakes region through stewardship, information and data sharing, habitat enhancement at existing colony locations, and the creation of new nesting islands.
Project Location
Great Lakes Region in the United States and Canada (Figure 2-8)
Project Summary

DOI would be the lead Implementing Trustee for this project. Project partners would include NGOs, academic institutions, and Tribal, U.S. state, and Canadian provincial fish and wildlife agencies. This project would increase nesting success, survival, and productivity of common terns (*Sterna hirundo*) at nesting locations in the Great Lakes region through implementation of stewardship activities, information and data sharing, habitat enhancement at existing colony locations, and creation of new nesting islands.

The project would be conducted in phases, as described below.

- Phase I: Assemble and coordinate a Great Lakes tern conservation working group that identifies and prioritizes common tern restoration locations. Working group partners would include resource managers and experts, community groups, Tribes, and others with local or indigenous knowledge.
- Phase II: Create, maintain, and disseminate best management practices to promote successful and sustainable tern colonies, create centralized monitoring databases, and standardize and document data collection to ensure consistency of protocol implementation and data quality. This phase would also include threat management (e.g., predator and/or nesting site competitor control, human disturbance) at existing nesting colonies and social attraction (e.g., decoys, sound systems) during the nesting season to attract nesting common terns.
- Phase III: Enhance habitat conditions at existing colonies, pursue construction of new islands, and continue social attraction to enhance common tern nesting. New islands would serve as nesting locations. Habitat conditions would be enhanced through vegetation management.

The common tern was exposed to oil during the DWH oil spill through physical contact and by consuming contaminated prey. The common tern is listed as state endangered, threatened, or as a species of concern in some Great Lakes states and has been extirpated from some Great Lakes states and Canadian provinces. Nesting populations in the Great Lakes region have suffered steep declines in recent decades and have not recovered because of numerous challenges in nesting areas that limit productivity. Some of the primary limitations in this region include record high water levels and loss of natural island nesting sites. Due to loss of natural nesting sites, this species is becoming increasingly dependent on artificial nesting habitat. Sustainable and resilient nesting sites would provide valuable benefits to help maintain and enhance this population.

As noted above, project activities would be implemented in phases. Phase I would include establishment of a Tern Working Group to help select priority sites and activities; creating a focused network across the region and a hub for sharing data, project experiences, and lessons learned; coordinating implementation timing; developing monitoring and data management protocols; and conducting financial administration, among other tasks. Phase II would include creating, maintaining, and disseminating best management practices to promote successful and sustainable tern colonies, creating a centralized monitoring database, and standardizing and documenting data collection to ensure consistency in implementation and data quality. Other activities would

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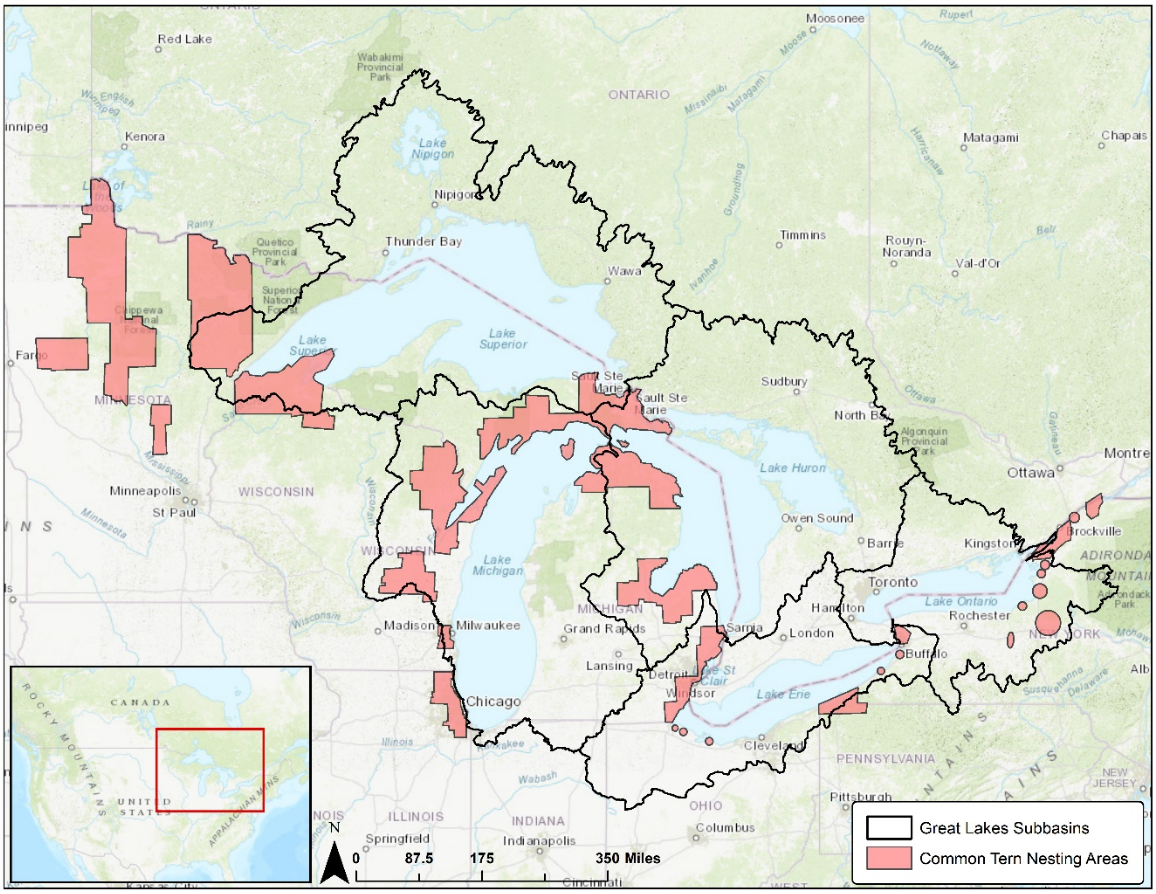
include predator and vegetation management, efforts to reduce human disturbance, and social attraction to newly protected/enhanced sites. Finally, Phase III would include the construction of two to three lacustrine islands to create and enhance common tern nesting island habitat. The islands would likely be sited offshore and be less than 1 acre in size. Additionally, one proposed island in Oneida Lake would be expanded in size from approximately 1,240 square feet to 3,500 square feet and elevated to ensure habitat availability during high water periods. All activities would occur in populated areas. Overall, the project would directly enhance 5-10 acres of nesting habitat across the project locations. Because the common tern nests in dense colonies, it is possible to have a large beneficial impact on the population even with a relatively small management footprint. This project would also provide long-term benefits beyond the direct effect of project activities by providing an important framework for future conservation projects through the creation and maintenance of a network of partners, a list of priority conservation projects, a plan for implementing these projects, and a hub for data for this species and other nesting terns in the Great Lakes region.
General Project Activities and Implementation Timing
Phase I project activities include planning/design (engineering and design [E&D] and permitting). Phase II activities include implementation of social attraction, predator deterrence and monitoring. Phase III activities include implementation of island construction, habitat enhancement, and continued use of social attraction methods and monitoring. The project is expected to take approximately 10 years to complete. Planning activities would likely occur in Years 1 to 3, and implementation would occur after some initial planning starting in approximately Year 2 or 3. Monitoring would occur during and following project implementation and continue through approximately Year 10.
Maintenance
Short-term maintenance activities would include ensuring that all implementation equipment (e.g., predator deterrents, decoys, sound systems) are secured, available as needed, and properly functioning. Long-term monitoring and maintenance of any newly constructed nesting islands would be conducted by the USFWS, in coordination with Canadian provincial fish and wildlife agencies, as needed, as part of existing managed sites.
Costs
The total estimated project cost is $3,520,000, which includes planning and design, implementation, monitoring and maintenance, oversight, and contingency.

Figure 2-8 Common Tern Nesting Colony Restoration in the Great Lakes Region: General Project Locations



2.4.6 Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries

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Restoration Approach
Prevent incidental bird mortality (PDARP/PEIS Section 5.5.12.2)
Restoration Technique
Reduce seabird bycatch through voluntary fishing gear and/or technique modification (PDARP/PEIS Appendix 5.D.6.3)
Project Goals and Objectives
The goal of this project is to improve understanding of bycatch of seabirds in northeastern U.S. and Atlantic Canada commercial fisheries and to work cooperatively with partners to identify and encourage voluntary adoption of effective bycatch reduction strategies within targeted fisheries.
Project Location
Northeastern U.S. and Atlantic Canada (Figure 2-9)
Project Summary
DOI and NOAA would be the lead Implementing Trustees for this project. Project partners may include but are not be limited to NGOs such as the Coonamessett Farm Foundation; universities such as Virginia Polytechnic Institute and State University (Virginia Tech) and Memorial University of Newfoundland; Environment and Climate Change Canada and Canadian provincial fish and wildlife agencies. This project would reduce the risk of mortality for northern gannets (*Morus bassanus*), great shearwaters (*Ardenna gravis*), and other seabirds in northeastern U.S. and Atlantic Canadian commercial fisheries by reducing bycatch through cooperative, voluntary, implementation of bycatch reduction strategies and improved understanding of seabird bycatch. The project would be conducted in phases, as described below. • Phase I: o Pilot test preliminary seabird bycatch reduction strategies in the Cape Cod-based groundfish and Newfoundland cod and herring gillnet fisheries. The Cape Cod pilot would focus on baiting practice modifications designed by local fishermen and stakeholders, while the Newfoundland pilot would focus on visual site deterrents, gear switching and modification, and/or soak time (i.e., the length of time that lines remain in the water) modifications by local fishermen in areas that could benefit northern gannets foraging from colonies; o Identify and prioritize seabird bycatch reduction strategies through modeling of conditions that lead to seabird-fisheries interactions in north Atlantic waters and inform the location and scale of bycatch reduction strategies undertaken in Phase II; and o Establish and expand partnerships with commercial fisheries to gather local knowledge regarding interactions with birds during fishing operations. This could include workshops and surveys. Information gathered would be used to identify seabird bycatch reduction strategies and data collection efforts that would be tested in Phase II. • Phase II: o Pilot test additional seabird bycatch reduction strategies based on new information and partnerships developed during Phase I. The second phase pilot tests would include at least two additional seabird bycatch reduction strategies in cooperation with one or more of the following types of fishing practices: pelagic longline (PLL), trawl, or gillnet in either U.S. or Canadian fisheries; o Conduct field studies to gather local knowledge regarding interactions with birds during fishing operations to better understand potential fisheries interactions. This could include tagging, handling, or capturing birds that have been injured; and o Expand awareness and voluntary use of the most effective seabird bycatch reduction strategies. This would include outreach activities such as development and distribution of educational materials, workshops

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and presentations, and trainings to encourage voluntary adoption of the most effective bycatch reduction strategies by commercial fishermen.

The DWH oil spill had a large impact on northern gannets and great shearwaters. However, restoration options to benefit these species, which spend most of their lives in the marine environment and nest at a small number of remote locations for short durations, are limited. Reducing incidental mortality experienced at sea, such as commercial fisheries seabird bycatch, can help restore these injured species. During the non-nesting season (spring through fall in the northern hemisphere), great shearwaters are most numerous in waters off of New England and Atlantic Canada, with some migrating through the Gulf (Carboneras et al., 2020). All of the western hemisphere's northern gannets breed at six colonies in Atlantic Canada (Figure 2-11), including those that winter in the Gulf, and they are abundant in New England and Atlantic Canada during both fall and spring migration (Nisbet et al., 2013).

During migration and "wintering" periods, northern gannets and great shearwaters utilize offshore waters of the northern U.S. Atlantic coastline for feeding and resting. Individuals are attracted by concentrations of fish, frequently interacting with commercial fishing operations. Such interactions can lead to direct mortality as birds become ensnared by fishing gear while diving in pursuit of the same fish targeted by fishing vessels. Bycatch of northern gannets and great shearwaters has been reported in pelagic and nearshore gillnet, trawl, PLL, and other fisheries.

The proposed project would work with fisheries in which there is a risk of seabird bycatch to (1) identify areas and times when seabird interactions are most intense and (2) test voluntary fishing practice modifications to reduce seabird bycatch. It would incorporate education, training, and outreach, and develop partnerships with fisheries. In addition to quantifying efficacy of the seabird bycatch reduction strategies, pilot performance criteria would include that target catch levels be maintained and/or catch efficiency be improved (e.g., less time lost to removal of non-target bycatch, less bait lost, reductions in damage to fishing gear). Ensuring that seabird bycatch reduction strategies would not affect yield is critical to ensure voluntary adoption by fishermen. The results of the project would be shared broadly through direct engagement with fishermen by partners and used to promote voluntary adoption of seabird bycatch reduction strategies across the regions where the injured species are at risk. Further, information gathered through this project, including through partnerships with commercial fisheries, would be shared with observer programs to help inform observer protocols and improve data collection efforts.

General Project Activities and Implementation Timing

Project activities include planning and development, implementation (including pilot testing seabird bycatch reduction strategies and full implementation of the most effective strategies), and performance monitoring.

The project is expected to take approximately 6 years to complete. Years 1 to 3 (Phase I) would include planning, pilot testing preliminary seabird bycatch reduction strategies, modeling, and identification of partnerships and new seabird bycatch reduction strategies. Years 4 to 6 (Phase II) would include pilot testing of additional seabird bycatch reduction strategies, expansion of the most effective bycatch reduction strategies, and performance monitoring.

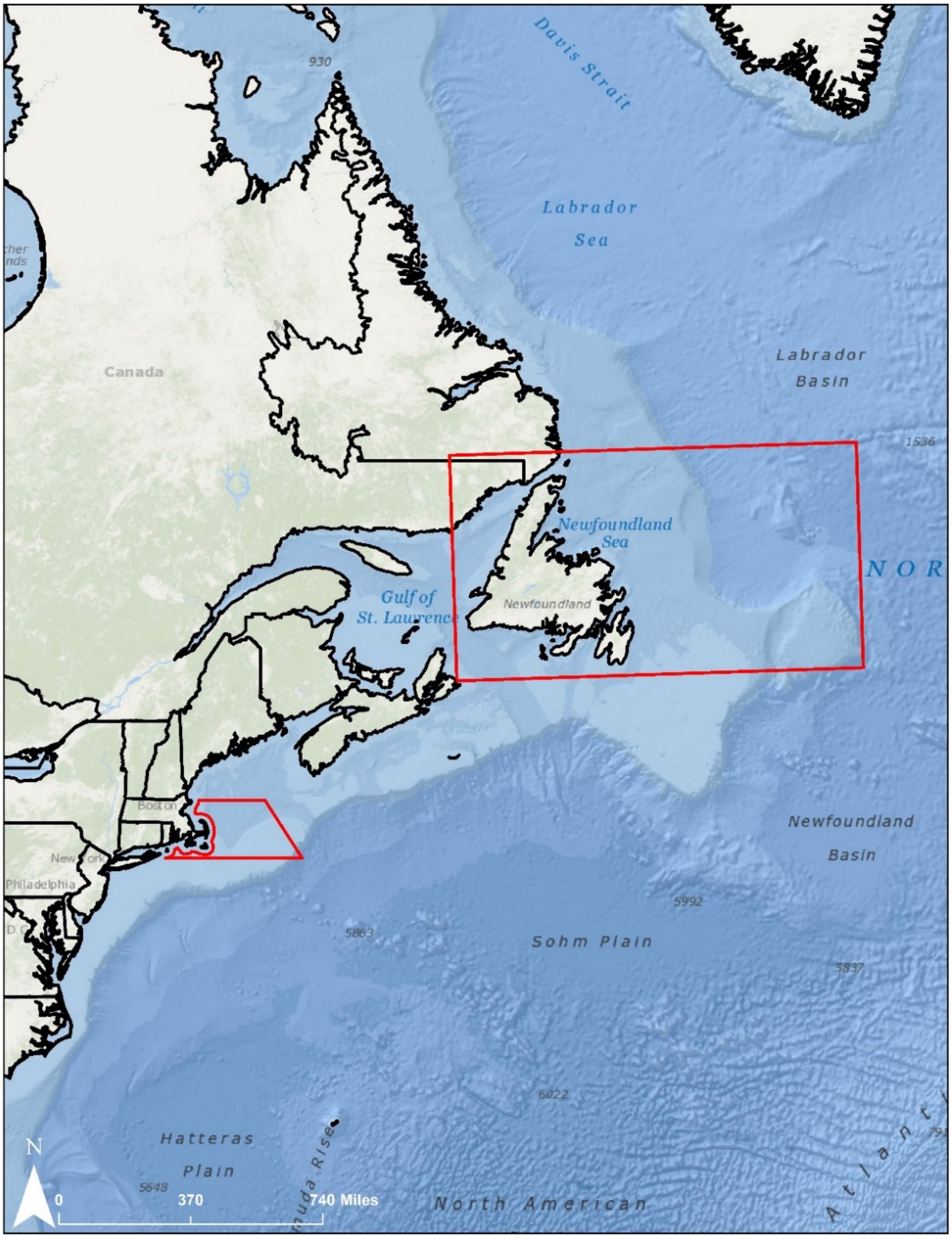
Maintenance

No short- or long-term maintenance activities are anticipated.

Costs

The total estimated project cost is $5,052,000, which includes planning and design, implementation, monitoring, oversight, and contingency.

Figure 2-9 Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries: General Project Location



Note: the red outlines indicate the geographic scope of initial project activities. Subsequent activities may occur across a broader area.

2.4.7 Seabird Bycatch Risk Reduction in Gulf of Mexico and Southeast U.S. Pelagic Longline Fisheries

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Restoration Approach
Prevent incidental bird mortality (PDARP/PEIS Section 5.5.12.2)
Restoration Technique
Reduce seabird bycatch through voluntary fishing gear and/or technique modification (PDARP/PEIS Appendix 5.D.6.3)
Project Goals and Objectives
The goal of this project is to support the ability of commercial PLL fishing vessels to avoid bycatch of northern gannets, great shearwaters, and other injured seabirds through avoidance of seabird encounters in the Gulf of Mexico and South Atlantic.
Project Location
Gulf of Mexico and southeast U.S. coast (Figure 2-10)
Project Summary

DOI and NOAA would be the lead Implementing Trustees for this project. Project partners may include Virginia Polytechnic Institute and State University (Virginia Tech), commercial fishing organizations, and state fish and wildlife agencies. This project would reduce the risk of incidental mortality for northern gannets (*Morus bassanus*), great shearwaters (*Ardenna gravis*), and other injured seabirds by reducing seabird interactions with the commercial PLL fishery in the Gulf and southeast U.S.

This project would:

- **Establish and expand partnerships with PLL fisheries** through surveys with captains and crew members to gather local knowledge on seabird interactions with PLL gear and seabird bycatch reduction strategies, and workshops with the fishing community, management agencies, and other stakeholders to design bycatch reduction strategies;
- **Conduct outreach activities** such as the development and distribution of education materials, workshops, and presentations;
- **Establish partnerships with observer programs** to examine seabird-fishery interactions during gear deployment and enhance observer methods to improve data collection;
- **Develop modeling approaches to identify bycatch hotspot** locations and seasons for seabirds and examine how they vary from year-to-year; and
- **Conduct a small-scale pilot project with the PLL fishery** to test the effectiveness of one or more seabird bycatch reduction strategies.

Incidental catch of seabirds in PLL gear has been identified as a concern for several seabird species injured by the DWH spill. Direct mortality of seabirds occurs when they get hooked or entangled and are drowned as hooks sink, which may also cause indirect mortality of chicks if one or both parents are killed during chick dependency (Brothers et al., 1999; Gilman, 2001). Additionally, seabird bycatch risk varies with fishing tactics at different stages. For example, interactions between seabirds and PLL operations can be highly species-specific and related to regional differences in longline rigging and operating strategies (Zhou et al., 2019).

Seabird bycatch events are not evenly distributed along the Atlantic and Gulf of Mexico coasts, with some locations and seasons having high probabilities of encountering seabirds. Analyzing hotspots of bycatch events would help captains and fisheries managers better understand factors associated with high seabird bycatch and identify opportunities to reduce seabird interactions.

Enhanced characterization of seabird bycatch in the Gulf of Mexico and southeast Atlantic PLL fisheries would provide a more accurate estimate of seabird interactions and help to identify fishing practices that can be tested in a small-scale pilot phase with the PLL fishery. The project would engage the fishing community to establish a broad network of fishermen interested in voluntarily testing seabird bycatch reduction strategies. Through collaboration with PLL captains and crew members, the project would identify how seabird bycatch can be reduced at different stages of operations. The results of the project would be shared

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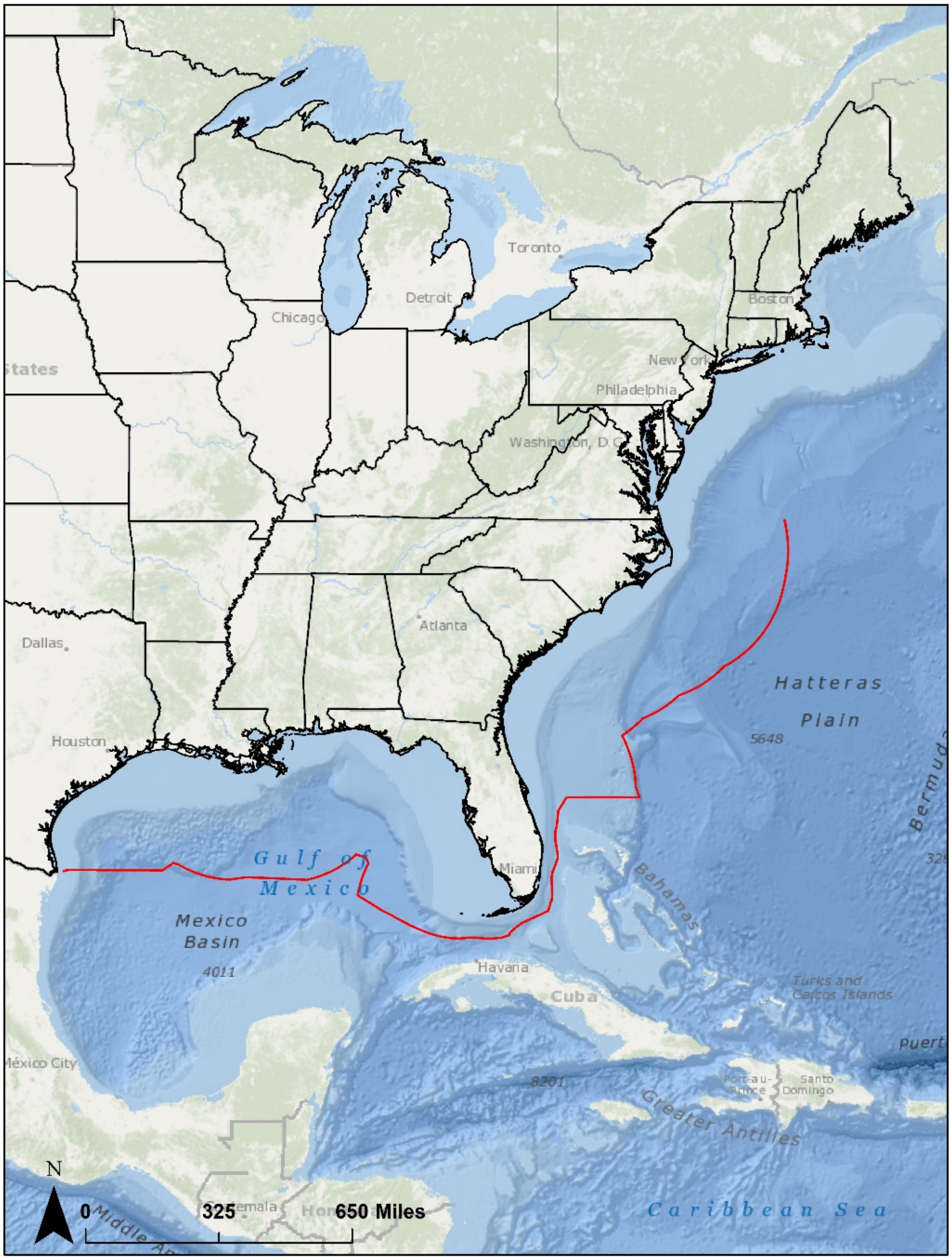
broadly with the fishing industry and managers through direct engagement by partners and used to promote voluntary adoption of seabird bycatch reduction strategies within the fishery.
General Project Activities and Implementation Timing
Project activities include planning and design, implementation (including seabird bycatch hotspot modeling, engagement with the fishing community, and pilot trials of bycatch reduction strategies), and monitoring. The project is expected to take approximately 3 years to complete. Planning and modeling of seabird bycatch hotspots would occur in Years 1 and 2. Fishing community engagement, including surveys and field studies, would occur in Years 2 and 3. A pilot trial of one or more potential seabird bycatch reduction strategies and performance monitoring would occur in Year 3.
Maintenance
No short- or long-term maintenance activities are anticipated.
Costs
The total estimated project cost is $1,546,500, which includes planning and design, implementation, monitoring oversight, and contingency.

Figure 2-10 Seabird Bycatch Risk Reduction in Gulf of Mexico and Southeast U.S. Pelagic Longline Fisheries: General Project Location



2.4.8 Northern Gannet Nesting Colony Restoration in Eastern Canada

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Restoration Approaches
Restore and conserve bird nesting and foraging habitat; Establish or reestablish nesting colonies; Prevent incidental bird mortality (PDARP/PEIS Section 5.5.12.2)
Restoration Techniques
Nesting and foraging area stewardship; develop and implement management actions in conservation areas and/or restoration projects; use acoustic vocalization playbacks and decoys to attract nesting adults to restoration sites; remove derelict fishing gear (PDARP/PEIS Appendix 5.D.6.1, 5.D.6.2, and 5.D.6.3)
Project Goals and Objectives
The goal of this project is to restore northern gannets by implementing a suite of restoration and conservation techniques (including predator management, social attraction, land-based removal of marine debris, and human disturbance management).
Project Location
Nesting sites in New Brunswick, Nova Scotia, Québec, and Newfoundland, Canada (Figure 2-11) and newly-(re)established nesting sites in New Brunswick, Newfoundland, Nova Scotia, and/or Quebec, Canada.
Project Summary
DOI would be the lead Implementing Trustee for this project. Project partners may include but are not limited to the Memorial University of Newfoundland, Environment and Climate Change Canada, Canadian Wildlife Service, Canadian provincial wildlife agencies, the U.S. Geological Survey(USGS), NGOs (including National Audubon Society, Birds Canada, Biodiversity Research Institute), and additional universities. This project would increase nesting success, survival, and productivity of northern gannets (*Morus bassanus*) at nesting locations in Eastern Canada by implementing stewardship activities and establishing new nesting colonies. This project would: • **Conduct land-based removal of marine debris from nests and nest sites** at Cape St. Mary's and Funk, Baccalieu, and Bonaventure Islands such as discarded fishing gear; • **Manage predators through both non-lethal and lethal methods** at Cape St. Mary's and Funk, Baccalieu, and Bonaventure Islands. Humane approaches to predator removal would be applied wherever possible in the deployment of traps and hunting. • **Minimize human disturbance through outreach and management** at Cape St. Mary's and Baccalieu Islands Ecological Reserves and Bonaventure Island Reserve. This includes providing funds to hire staff to monitor for and actively manage human disturbance including conducting outreach with reserve visitors; • **Expand existing (or establish new) seabird nesting colonies** in historical nesting areas or near current foraging and roosting areas using social attraction methodologies (e.g., decoys, sound systems). Colony expansion would occur at Cape St. Mary's and Baccalieu, Funk, and Bonaventure Islands. New colony establishment would be targeted at up to eight locations across New Brunswick, Nova Scotia, and the north shore of the Gulf of St. Lawrence, Québec; and • **Conduct GPS tracking of nesting adults** to inform selection of colony establishment areas and post-nesting dispersal threats. The estimated mortality and lost productivity of northern gannets were among the largest estimates for the bird species affected by the DWH oil spill. The population of northern gannets in North America had been increasing but has been levelling off since 2010 and nesting success has been relatively poor. All northern gannets in North America nest at six nesting colonies in eastern Canada and spend the non-nesting period in the Gulf and along the U.S. Atlantic coast (Figure 2-4). Threats at colonies include predators that kill adults and chicks, such as coyotes (*Canis latrans*), arctic foxes (*Vulpes lagopus*), and red foxes (*Vulpes vulpes*), as well as marine debris such as discarded fishing gear that reduces nesting habitat and entangles and kills adults and chicks. This project would implement conservation activities at nesting colonies (on uninhabited, natural reserve islands and in areas near human populations), which is the most direct and reliable way to restore for the injury to the

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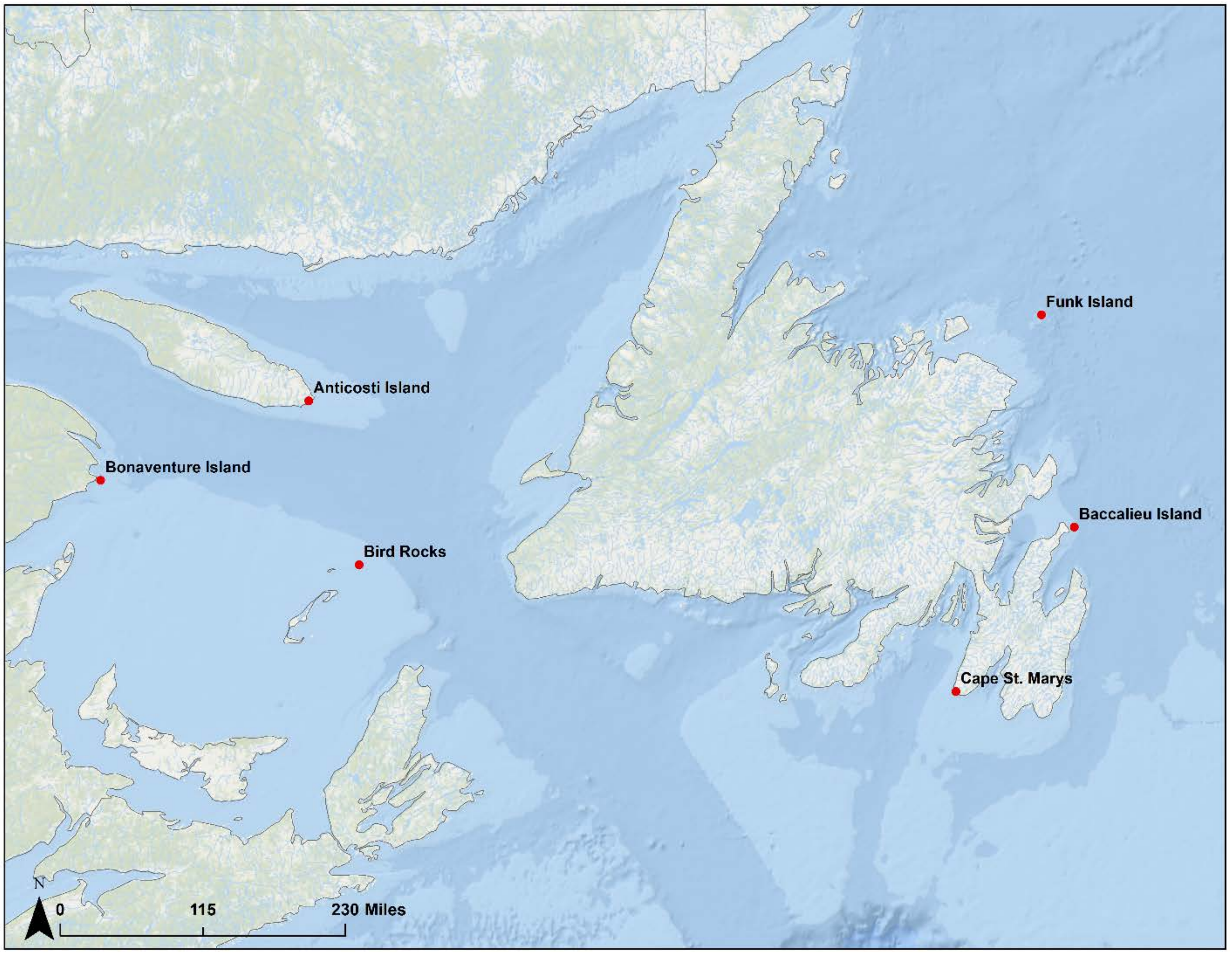
species. While these proposed restoration activities would focus on four of six established colonies mentioned above, additional work may be conducted at the two additional colonies, Anticosti Island and Bird Rocks (Magdalen Islands) should opportunities arise to increase seabird restoration benefits. In addition, the creation of new colonies would ensure long-term population sustainability in case of unpredictable events that may affect existing colonies.
General Project Activities and Implementation Timing
Project activities include planning and design (permitting), implementation (including efforts to reduce human and predator disturbance, social attraction to establish new nesting colonies, and land-based removal of marine debris), and monitoring. The project is expected to take approximately 5 to 7 years to complete. Planning would occur over the first 3 to 6 months. The first 1.5 years would involve identification of target colony reestablishment locations, land-based removal of marine debris, stewardship to prevent human disturbance, and predator control. A pilot test for social attraction to expand existing nesting colonies would also occur during this timeframe. Ongoing predator management, land-based removal of marine debris, stewardship activities, and expansion of the pilot test to new colony locations would begin starting in Year 2. Monitoring would occur during and following project implementation and continue through approximately Year 7.
Maintenance
Short-term maintenance activities would include ensuring that all implementation equipment (e.g., signage or deterrents for human disturbance, predator management equipment, decoys, sound systems) are secured, available as needed, and properly functioning. Project funds would be expected to cover 5 years of described management and colony establishment. Project partners would conduct long-term maintenance activities as part of existing management at protected wildlife areas and seabird sanctuaries.
Costs
The total estimated project cost is $5,680,000, which includes planning and design, implementation, monitoring and maintenance, oversight, and contingency.

Figure 2-11 Northern Gannet Nesting Colony Restoration in Eastern Canada: Existing Nesting Sites



2.4.9 Common Tern Nesting Colony Restoration in Manitoba

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Restoration Approaches
Restore and conserve bird nesting and foraging habitat; Establish or reestablish nesting colonies (PDARP/PEIS Section 5.5.12.2)
Restoration Techniques
Nesting and foraging area stewardship; develop and implement management actions in conservation areas and/or restoration projects; use acoustic vocalization playbacks and decoys to attract nesting adults to restoration sites (PDARP/PEIS Appendix 5.D.6.1 and 5.D.6.2)
Project Goals and Objectives
The goal of this project is to restore common terns in Manitoba by implementing a suite of restoration and conservation techniques (including predator management, vegetation management, social attraction, and human disturbance management).
Project Location
Multiple lakes in Manitoba, Canada, including Lake Winnipeg (McLeod's Island, Egg Islands, Long Point), Kaweenakumik Lake, Lake Winnipegosis, Reindeer Lake, and South Indian Lake (Figure 2-12)
Project Summary
DOI would be the lead Implementing Trustee for this project. Project partners could include, but are not limited to, NGOs (e.g., National Audubon Society) and Canadian First Nations. Partners that have contributed to project planning efforts to-date include Seal River Watershed Initiative, Indigenous Leadership Initiative, Pimachiowin Aki Corporation, Misipawistik Cree Nation, Pauingassi First Nation, Bloodvein River First Nation, Little Grand Rapids First Nation, Poplar River First Nation. This project would increase nesting success, survival, and productivity of the common tern (*Sterna hirundo*) at nesting locations in Manitoba, Canada by implementing stewardship activities and establishing new nesting colonies in protected locations using social attraction techniques. This project would: • **Engage and train indigenous youth and other community members**, through Indigenous Guardians,[31] in common tern conservation and management practices (e.g., vegetation management, predator control, chick banding), stewardship, and other conservation practices; • **Survey nesting islands and surrounding waters** to monitor for predators and/or human disturbance and to gather information on colonies; • **Manage predators or nesting site competitors** as needed using passive deterrence measures (e.g., fencing, nest or chick shelter boxes/enclosures). Other methods, such as capture and relocation or lethal control, would be utilized only if needed; • **Manage human disturbance** by deploying signage and deterrents at colonies, such as post-and-rope fencing, or temporary closures of nesting areas; • **Enhance nesting areas** through land-based removal of marine debris, vegetation management (removing invasive plant species or planting native plants), and enhancing substrates at nesting sites; • **Establish new seabird nesting colonies** in safe, protected areas using social attraction methodologies (e.g., decoys, sound systems); and

[31] The Indigenous Guardians program was launched in 2017, with funding investments from the Government of Canada. Program funding supports Indigenous-led initiatives across Canada, Indigenous rights and responsibilities in protecting and conserving ecosystems, developing and maintaining sustainable economies, and continuing the profound connections between natural landscapes and Indigenous cultures.

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- **Develop and distribute educational materials** to reduce human disturbance of common tern and other waterbird colonies.

The common tern was among the bird species that suffered high mortality from the DWH oil spill. A relatively large nesting population occurs in Manitoba, with an estimated 8,000 pairs in colonies on the three largest lakes (Winnipeg, Manitoba, and Winnipegosis) (Wilson et al., 2014). The numerous smaller lakes throughout the extensive boreal forest biome of Manitoba provide nesting habitat for thousands of additional nesting pairs of common terns (Wilson, 2013). This project focuses on restoration actions for these colonies.

The first 2 years of the project would focus on training local Indigenous Guardians in survey, monitoring, and restoration techniques. Training would include in-region workshops with instructors experienced in common tern research and conservation activities, as well as in-field activities such as colony surveys, chick banding, and restoration site preparation. In subsequent years, tern colonies would be selected and prioritized for protection or enhancement by Indigenous Guardians, through coordination with First Nation community members, elders, and Tribal governments where specific activities are proposed. The focus of on-the-ground conservation activities would reflect the challenges encountered, but the largest proportion of the work would target efforts to reduce human and predator disturbance, social attraction (decoys and sound systems) to attract terns to protected sites, and monitoring to allow for adaptive management.

This project would develop a new indigenous-led wildlife conservation infrastructure and capacity that would be a model for similar programs across Canada and that would leverage further funding from new sources in future years. The timing for this project is particularly opportune because of a recent announcement by the Canadian government of planned future funding of Indigenous Guardians programs that would build long-term capacity and infrastructure for full-time Guardians staff. That full time Guardians staff would help support the seasonal tern Guardian positions envisioned for this project.

General Project Activities and Implementation Timing

Project activities include planning and design (permitting), implementation (including efforts to reduce human and predator disturbance, social attraction to establish new nesting colonies, and stewardship/management), and monitoring.

The project is expected to take approximately 5 to 7 years to complete. Training and planning would likely occur in Years 1 and 2, and implementation would occur starting in Year 2. Monitoring would occur during and following project implementation through approximately Year 7.

Maintenance

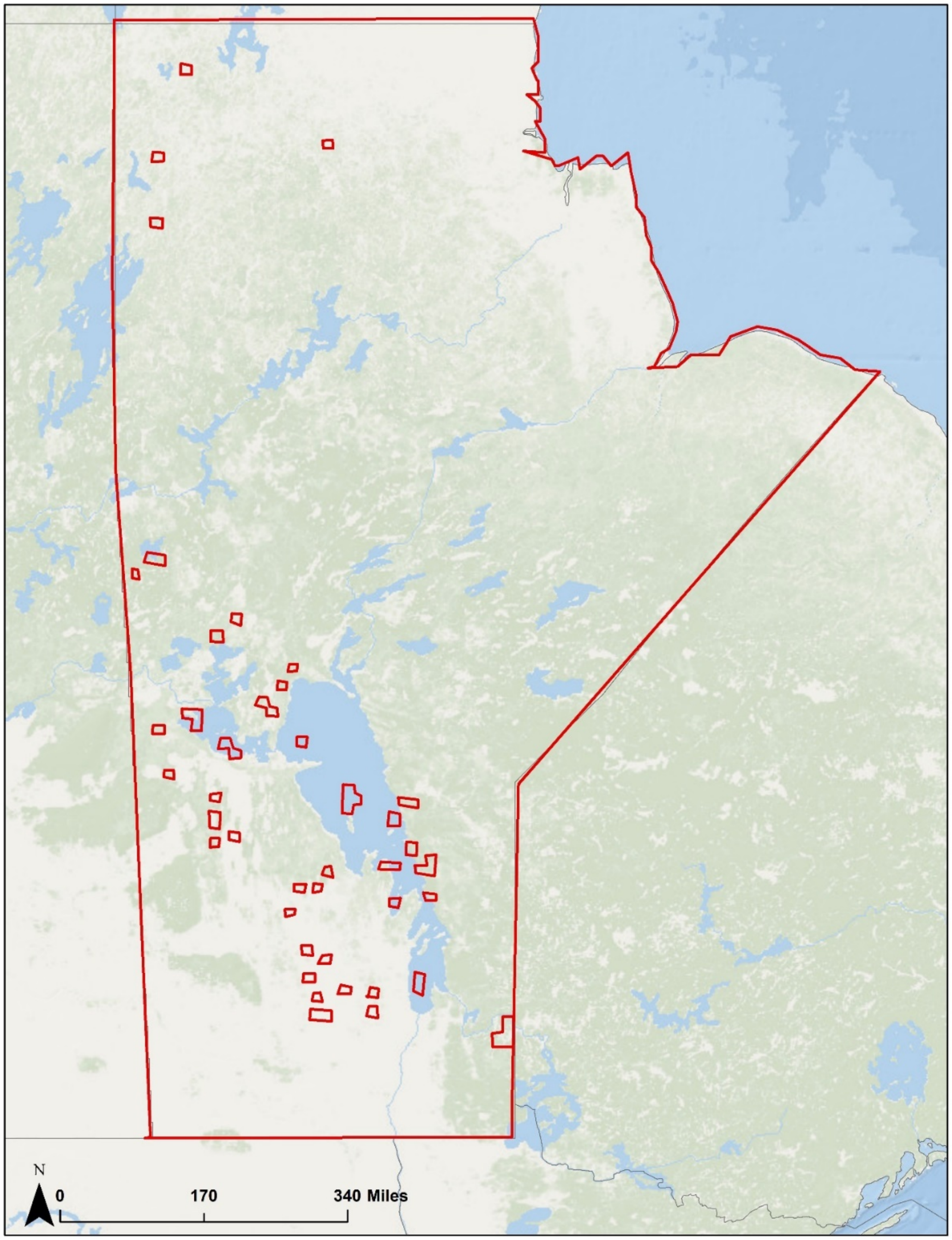
Short-term maintenance activities would include ensuring that all implementation equipment (e.g., signage or deterrents for human disturbance, predator deterrents, decoys, or sound systems for social attraction) are secured, available as needed, and properly functioning.

Long-term maintenance activities include ensuring fencing, predator exclosures, and signage or other deterrents are functioning as well as ensuring nesting sites are maintained throughout each nesting season (e.g., substrate additions such as gravel or sand as needed to enhance nesting areas). Project partners would conduct long-term maintenance as part of their increased seabird stewardship and management capacity.

Costs

The total estimated project cost is $4,400,000, which includes planning and design, implementation, monitoring and maintenance, oversight, and contingency.

Figure 2-12 Common Tern Nesting Colony Restoration in Manitoba: Nesting Locations



2.4.10 Seabird Nesting Habitat Restoration and Colony Reestablishment in the Bahamas

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Restoration Approach

Restore and conserve bird nesting and foraging habitat; Establish or reestablish nesting colonies (PDARP/PEIS Section 5.5.12.2)

Restoration Technique

Enhance habitat through vegetation management; nesting and foraging area stewardship; use acoustic vocalization playbacks and decoys to attract nesting adults to restoration sites (PDARP/PEIS Appendix 5.D.6.1 and 5.D.6.2)

Project Goals and Objectives

The goal of this project is to restore seabirds by implementing a suite of restoration and conservation techniques (including predator management, vegetation management, social attraction, and biosecurity measures).

Project Location

Exuma Cays Land and Sea Park, Conception Island, San Salvador Island, and Cay Sal, Bahamas (Figure 2-13)

Project Summary

DOI would be the lead Implementing Trustee for this project. Project partners may include NGOs and the Bahamian government. This project seeks to increase seabird nesting success and productivity through a variety of colony stewardship and protection techniques as well as establishment of new colonies.

This project would:

- Compile seabird population baseline and site assessment data to establish baseline conditions and inform restoration actions;
- Train Bahamian government staff in seabird conservation and management practices such as vegetation management, predator control, monitoring, and chick banding;
- Develop seabird management plans for the Exuma Land and Sea Park, Conception Island National Park, San Salvador National Park, and Cay Sal Marine Protected Area to help prioritize restoration efforts;
- Enhance nesting sites through vegetation and predator management in priority areas identified during the development of management plans. Invasive plants would be removed manually (herbicides would be used as a last resort where necessary) and native plants would be planted to improve nesting conditions. Predators, including cats, pigs, dogs, and rodents would be removed through hunting, trapping, and rodenticide; activities would be conducted by trained staff using humane approaches wherever possible.
- Reestablish existing (or establish new) seabird nesting colonies through social attraction such as bird and egg decoys, mirrors, and sound systems to attract seabirds;
- Develop and implement biosecurity measures; and
- Conduct community outreach and engagement to support biosecurity.

Project activities would be implemented in a phased approach to ensure that key capacities are built and information gaps are filled. Phase I would include site assessments at the three focal areas and building in-country capacity for seabird restoration (e.g., operational planning, community engagement and support building, organizational and technical capacity building); Phase II would include implementation of restoration activities (invasive species eradication, colony enhancement); and Phase III would include design and implementation of biosecurity measures, community engagement, and monitoring. Activities would occur on both inhabited and uninhabited islands.

Restoration at the focal locations would be conducted in a sequential manner, starting with the restoration of nesting sites in protected areas that are accessible and staffed (Exuma Land and Sea Park). Protected areas often lack active management for nesting seabirds and suffer from invasive predators, such as rodents, that cause reproductive failure and colony abandonment. Invasive vegetation and disturbance can be equally damaging. More remote locations with high expected return on investment, such as the Cay Sal Marine Protected Area, would be addressed in later phases of the project once capacity is established. Additionally, the project would include capacity building and conservation planning activities (e.g., management plan development,

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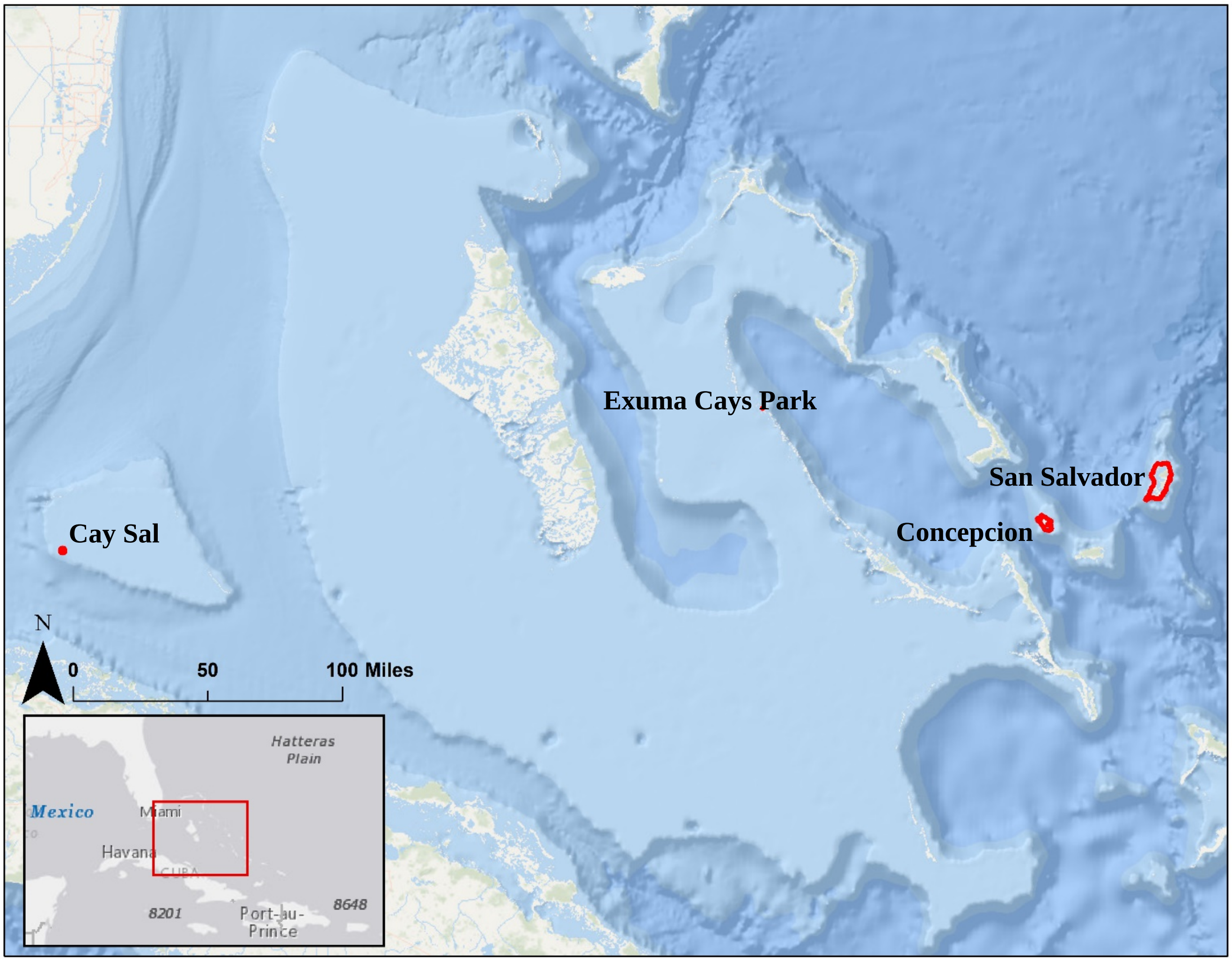
biosecurity measures) that are anticipated to improve management of seabirds at other sites not specifically included in this project, yielding benefits beyond the direct effects of project activities. This project would restore for the injury to Audubon's shearwater (*Puffinus lherminieri*), the Caribbean nesting seabird with the largest documented injury from the DWH oil spill. Based on Mackin's (2016) survey, current nesting colonies for Audubon shearwaters represent 1 percent of their historical nesting area, with many active colonies located on remote islands that are difficult to survey and manage. The Bahamas contain the three most-numerous remaining colonies. However, colonies across the Bahamas are threatened by sea level rise and lack of management that results in increased levels of predation from invasive mammals, such as rodents. In addition to Audubon's shearwater, this project would restore sooty terns (*Onychoprion fuscatus*), bridled terns (*Onychoprion anaethetus*), brown noddies (*Anous stolidus*), brown boobies (*Sula leucogaster*), and white-tailed tropicbirds (*Phaethon lepturus*). A variety of other DWH-injured seabirds and nesting sea turtles may also benefit from these restoration activities. Restoration activities would be targeted at established parks in the Bahamas that have been identified as important sites for seabird conservation, including: Exuma Land and Sea Park, Conception Island and San Salvador National Parks, and Cay Sal Marine Protected Area.
General Project Activities and Implementation Timing
Project activities include planning and design, implementation (including invasive species eradication, biosecurity measures, and colony expansion through social attraction), and monitoring. The project is expected to take approximately 10 years to complete. Planning would occur during Years 1 and 2. Implementation would occur sequentially based on location: approximately Years 1-3 at Exuma Cays Land and Sea Park; Years 4-6 at Conception Island and San Salvador National Parks; and Years 7-9 at Cay Sal. Monitoring would occur during and following project implementation through approximately Year 10.
Maintenance
Social attraction supplies and predator traps may need periodic maintenance. Project partners, including the Bahamian government, would conduct long-term maintenance, as needed.
Costs
The total estimated project cost is $7,150,000, which includes planning and design, implementation, monitoring and maintenance, oversight, and contingency.

Figure 2-13 Seabird Nesting Habitat Restoration and Colony Reestablishment in the Bahamas: General Project Location



2.4.11 Invasive Goat Removal to Restore Seabird Nesting Habitat in St. Vincent and the Grenadines

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Restoration Approach
Restore and conserve bird nesting and foraging habitat (PDARP/PEIS Section 5.5.12.2)
Restoration Technique
Nesting and foraging area stewardship (i.e., predator management – eradicating invasive goats) (PDARP/PEIS Appendix 5.D.6.1)
Project Goals and Objectives
The goal of this project is to restore seabird nesting habitat by removing invasive goats.
Project Location
Battowia and Pillories Islands, St. Vincent and the Grenadines (Figure 2-14)
Project Summary
DOI would be the lead Implementing Trustee for this project. Project partners may include NGOs (Environmental Protection in the Caribbean, Science Initiative for Environmental Conservation and Education), the Mustique Company, and the Forestry Department of St. Vincent and the Grenadines. This project would increase the nesting success and productivity of seabirds through conservation actions to improve and restore available nesting habitat. This project would: • **Compile available baseline biodiversity information**, including seabird and goat population surveys from Battowia and the Pillories Islands, and aggregate the information to inform goat eradication efforts; • **Monitor for rodent presence** on Battowia and the Pillories; • **Eradicate free-roaming goats from the islands via relocation and/or hunting;** and • **Conduct a public outreach campaign** for public education, to encourage stewardship activities, and communicate project outcomes. Goats have negatively impacted seabird nesting through increased disturbance, erosion, and the elimination of much of the vegetation on Battowia and the Pillories Islands. Goats may also trample seabird nests. Project activities would focus on eradicating goats from the islands to increase nesting success and productivity of seabird species injured by the DWH oil spill, such as the magnificent frigatebird (*Fregata magnificens*), bridled tern (*Onychoprion anaethetus*), sooty tern (*Onychoprion fuscatus*), brown noddy (*Anous stolidus*), brown booby (*Sula leucogaster*), and red-billed tropicbird (*Phaethon aethereus*). All activities would occur on the two uninhabited, privately-owned islands (Battowia is managed as a Wildlife Reserve and Pillories is privately-owned). Outreach and educational activities would help encourage stewardship activities and prevent the reintroduction of goats after eradication. Baseline biodiversity information, including seabird and goat population counts at both Battowia and the Pillories Islands, would be compiled as part of this project. The public would be notified of the project goals and activities through a media campaign, government communications, community meetings, and posters. This would be an opportunity to continue dialogue with community members about conservation threats and receive feedback regarding the project. The public would be given the opportunity to claim free-ranging goats prior to their eradication, and the public may be invited to participate in goat removal efforts. Individuals would be hired to remove any remaining goats. Following eradication, outcomes would be reported to the community during community meetings.
General Project Activities and Implementation Timing
Project activities include planning and design, implementation (including goat eradication and colony restoration), and monitoring.

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The project is expected to take approximately 5 to 7 years to complete. Planning would occur in approximately Years 1 and 2. Implementation would occur in approximately Years 2 to 5. Monitoring would occur during and following project implementation through approximately Year 7.
Maintenance
If needed, short-term maintenance of project supplies may be conducted by project partners. Project partners would also conduct long-term maintenance, as needed.
Costs
The total estimated project cost is $231,000, which includes planning and design, implementation, monitoring, oversight, maintenance, and contingency.

Figure 2-14 Invasive Goat Removal to Restore Seabird Nesting Habitat in St. Vincent and the Grenadines: General Project Location

3 OPA NRDA Evaluation of Alternatives

This chapter provides a thorough OPA NRDA analysis of each alternative within the reasonable range of alternatives considered in this document (see Section 2.4). To avoid redundancy, a summary of the evaluation standards (Section 3.1), overview of monitoring requirements (Section 3.2), description of estimated project costs (Section 3.3), and best management practices (Section 3.4) are provided at the beginning of this chapter. These sections are followed by the project specific OPA NRDA evaluations. The last section provides a summary and conclusions of the OPA NRDA evaluation of all alternatives.

3.1 Summary of OPA NRDA Evaluation Standards

According to the NRDA regulations under OPA, Trustees are responsible for identifying a reasonable range of alternatives (15 CFR § 990.53(a)(2)) that can be evaluated according to the OPA NRDA evaluation standards (15 CFR § 990.54). Chapter 2 describes the screening and identification of a reasonable range of alternatives for evaluation under OPA. Chapter 3 describes the Trustees' evaluation of the reasonable range of alternatives to identify preferred restoration alternatives based on, at a minimum, the following factors found in 15 CFR § 990.54(a):

- The cost to carry out the alternative.
- The extent to which each alternative is expected to meet the Trustees' goals and objectives in returning the injured natural resources and services to baseline and/or compensating for interim losses.
- 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.
- The extent to which each alternative benefits more than one natural resource and/or service.
- The effect of each alternative on public health and safety.
- If the Trustees conclude that two or more alternatives are equally preferable, the OPA NRDA regulations provide that the most cost-effective alternative must be chosen (15 CFR § 990.54(b)).

3.2 Monitoring Requirements

When developing a restoration plan under the OPA NRDA regulations, NRDA Trustees establish restoration objectives that are specific to the natural resources that were injured (15 CFR § 990.55(b)(2)). These objectives should clearly specify the desired project outcome and the performance criteria by which successful restoration under OPA will be determined (15 CFR § 990.55(b)(2)). Regulatory requirements for the monitoring component of a restoration plan are further described in 15 CFR § 990.55(b)(3).

The DWH Trustees identified monitoring, adaptive management, and administrative oversight as one of the programmatic Restoration Goals in the PDARP/PEIS. As described in Chapter 5, Appendix E of the PDARP/PEIS, the Trustee Council committed to a MAM framework to support restoration activities. The MAM framework ensures best available science is incorporated into project planning and design, identifying and reducing key uncertainties, tracking and evaluating progress towards Restoration Goals, determining the need for adaptive management and corrective actions, and supporting compliance monitoring. The DWH NRDA MAM framework provides a flexible, science-based approach to effectively and efficiently implement restoration, over several decades, providing long-term benefits to the resources and services injured by the DWH oil spill.

Project MAM plans identify the monitoring needed to evaluate progress toward meeting project-specific restoration objectives and to support corrective action and adaptive management of the restoration project where applicable. The plans are consistent with the requirements and guidelines set forth in the PDARP/PEIS, the Trustee Council SOPs (DWH Trustees, 2021a), and the Trustees' Monitoring and Adaptive Management Procedures and Guidelines Manual (MAM Manual; DWH Trustees, 2021b).[32]

MAM plans include descriptive information regarding monitoring goals, objectives, parameter details (e.g., methodology and timing/frequency), potential corrective actions, and monitoring schedules. They are intended to be living documents and will be updated as needed to reflect changing conditions and/or to incorporate new information. For example, the plan may need to be revised if the project design changes, if initial data analysis indicates that the sampling design is inadequate, or if any uncertainties are resolved or new uncertainties are identified during project implementation and monitoring. Any future revisions to individual project MAM plans, as well as updates and additional details concerning the status of monitoring activities, would be made publicly available through the Gulf Spill Restoration website. Draft MAM plans for the preferred alternatives are included in Chapter 5 of this document.

3.3 Project Costs

The cost provided for each restoration alternative is the estimated cost to implement the specific restoration project. Cost estimates incorporate contingencies and reflect the most current designs and information available to the Open Ocean TIG at the time of completing this RP/EA. Estimated costs reflect all costs associated with implementing each project alternative, potentially including but not limited to planning, revising/finalizing engineering and design, permitting, construction, project management, project monitoring, maintenance, and Trustee oversight. Should budgets change prior to or during project implementation, Implementing Trustees will seek TIG approval for the updated budgets.

3.4 Best Management Practices

Federal regulatory agencies provide guidance on best management practices (BMPs) as part of the environmental compliance process. BMPs include design criteria, lessons learned, expert advice, tips from the field, and more. DWH Trustees use appropriate BMPs to avoid or minimize impacts to natural resources, including protected and listed 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. BMPs identified in required permits, consultations, or environmental reviews, including those described in Appendix 6.A of the Final PDARP/PEIS that are relevant to the project, would be followed. Through technical assistance with regulatory agencies, additional BMPs may be identified for implementation and would be catalogued in compliance documents. BMPs that each project would employ are described within each project's environmental analysis in Chapter 4.

[32] The Trustees' MAM Manual can be accessed at www.gulfspillrestoration.noaa.gov/monitoring-and-adaptive-management.

3.5 OPA NRDA Evaluation of the Reasonable Range of Alternatives

Below is an evaluation of each of the projects in the reasonable range against the OPA NRDA standards. Full project descriptions for these alternatives are provided in Section 2.4.

3.5.1 Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)

OPA NRDA Evaluation Standard	Evaluation Summary
Cost-effectiveness	The total estimated cost of $9,039,500 includes project planning and design, implementation (primarily vegetation and predator management, social attraction to expand seabird nesting colonies, and biosecurity measures), monitoring, oversight and management, and contingency funds. This project would leverage restoration funds from USFWS, PRDNER, USDA-APHIS, and NGOs (as well as previously conducted restoration efforts to eradicate invasive species from Mona Island), increasing its cost-effectiveness. The costs to carry out this alternative are based on similar, previously implemented projects to restore and conserve birds and DOI's experience with similar work. The Open Ocean TIG has determined that the project costs are reasonable and appropriate.
Goals and Objectives	This project is consistent with the Replenish and Protect Living Coastal and Marine Resources Restoration Goal and underlying Birds Restoration Type goals. The project has a clear nexus to injures as it would help compensate for losses to Caribbean-nesting seabirds caused by the DWH oil spill. Specifically, Audubon's shearwater, sooty and bridled terns, magnificent frigatebird, masked and brown booby, brown noddy, and white-tailed tropicbird, all species that were impacted by the spill, are present on Mona Island and would benefit from this project. The proposed invasive species eradication, nesting colony expansion/establishment, and biosecurity activities align with restoration techniques identified in the PDARP/PEIS and the DWH Strategic Framework for Bird Restoration Activities[33] and would enhance seabird nesting habitat, success, and productivity on Mona Island.
Likelihood of Success	This project utilizes reliable invasive species management and colony restoration methods. Similar methods, including habitat enhancement and predator removal, have successfully restored seabird colonies on other Caribbean islands (e.g., Herrera-Giraldo et al., 2021). Additionally, this project would build on existing restoration work and partnerships, increasing its likelihood of success. As such, the Open Ocean TIG believes this project is technically feasible and anticipates that it would have a high likelihood of success.
Avoid Collateral Injury	All project activities, including rodenticide application for invasive species management, would be conducted by trained personnel in accordance with permit conditions and standard protocols to reduce the risk of collateral injury. Further, the rodenticide portion of this project may be conducted in stages, in consultation with PRDNER and the USFWS Caribbean Field Office, to allow for comprehensive project planning and to incorporate appropriate impact minimization measures for non-target species (e.g., initial stages could include assessments of risk to non-target species, which would help refine later stages of rodenticide application). Mitigation measures to minimize collateral injury to natural resources may include captive holding of non-target species during project implementation and provisioning of veterinary services. However, some non-target fauna may be injured during implementation of this project through accidental trapping or exposure to rodenticide, as described in the NEPA analysis in Section 4.4.1.2.

[33] The DWH Strategic Framework for Bird Restoration Activities can be accessed at www.gulfspillrestoration.noaa.gov/sites/default/files/2021-06%20FL%20Final_FL%20TIG_RP2_EA_1.pdf

OPA NRDA Evaluation Standard	Evaluation Summary
Benefits	This project would result in benefits to several Caribbean-nesting seabird species, including potential increases in productivity and survivorship, as a result of nesting habitat enhancement and colony expansion. Mona Island is protected under territorial and U.S. federal laws to maintain the island's high biodiversity and provide habitat for sensitive, endemic, and Endangered Species Act (ESA)-listed species, which will help ensure project benefits are maintained in the future. Further, the island's high elevation and remote location ensures the long-term sustainability of project benefits when faced with sea level rise and potential reintroduction of invasive species. Invasive species eradication may provide ancillary benefits to a variety of other DWH-injured birds (e.g., brown pelican, royal and gull-billed terns, osprey, ruddy turnstone) and ESA-listed species (e.g., leatherback and hawksbill sea turtles, Mona ground iguana, Mona boa, yellow-shouldered blackbird).
Health and Safety	Project activities would be implemented in such a manner as to avoid impacts on public health and safety, and as such, the Open Ocean TIG does not anticipate any negative impacts to public health and safety. For example, activities would be conducted by trained and permitted personnel and public outreach and educational activities would occur to inform visitors about invasive species and predator removal activities including distributing informational materials. Further, the island would be closed prior to and after rodenticide application to avoid any negative impacts to visitors. Finally, Mona Island is uninhabited and experiences low levels of public visitation throughout the year, so the chance of negatively impacting public health and safety is low.
Summary: Based on the OPA and NEPA evaluations, this project was identified as a preferred restoration alternative at this time.	

3.5.2 Predator Removal and Seabird Nesting Colony Restoration in the Culebra Archipelago (non-preferred)

OPA NRDA Evaluation Standard	Evaluation Summary
Cost-effectiveness	The total estimated cost of $1,700,000 includes project planning and design, implementation (primarily construction of a predator-proof fence, vegetation and predator management, social attraction to expand seabird nesting colonies, and biosecurity measures), monitoring, oversight and management, and contingency funds. The costs to carry out this alternative are based on similar, previously implemented projects to restore and conserve birds and DOI's experience with similar work. The Open Ocean TIG has determined that the project costs are reasonable and appropriate.
Goals and Objectives	This project is consistent with the Replenish and Protect Living Coastal and Marine Resources Restoration Goal and underlying Birds Restoration Type. The project has a clear nexus to injures as it would help compensate for losses to Caribbean-nesting seabirds from the DWH oil spill. Specifically, Audubon's shearwater, sooty and bridled terns, brown noddy, brown booby, and red-billed and white-tailed tropicbirds, all species that were impacted by the spill, are present in the Culebra Archipelago and would benefit from this project. The proposed invasive species eradication and nesting colony expansion/establishment activities align with restoration techniques identified in the PDARP/PEIS and the DWH Strategic Framework for Bird Restoration Activities and would increase and restore nesting habitat.
Likelihood of Success	This project utilizes reliable invasive species eradication and social attraction methods to reestablish nesting colonies. Similar social attraction methods have successfully increased colony occupancy, nesting density, and colony distribution for Caribbean-nesting seabirds on other islands (e.g., Herrera-Giraldo et al., 2021). This project would be implemented in an adaptive manner by evaluating baseline data to determine the best locations for colony expansion and monitoring seabird responses to social attraction. As such, the Open Ocean TIG believes this

OPA NRDA Evaluation Standard	Evaluation Summary
	project is technically feasible and anticipates that it would be successful. However, ongoing anthropogenic threats, such as sea level rise, could reduce the project's likelihood of success.
Avoid Collateral Injury	Invasive species eradication, including rodenticide application, and biosecurity activities would be conducted by trained personnel in accordance with permit conditions and standard rodenticide protocols to reduce the risk of collateral injury. Further, Culebra NWR and USFWS have an extensive history of safely implementing rodenticide application and other predator management activities.
Benefits	This project is likely to result in benefits, such as potential increases in productivity, to several Caribbean-nesting seabird species through nesting habitat enhancement and colony expansion. The Culebra Archipelago and NWR support numerous seabird species and protect sensitive coastal habitats from development and other anthropogenic impacts. However, this project would require additional planning to identify implementation locations and viable restoration approaches. The lengthy planning process required to implement this project and the uncertainty related to where restoration actions may be sited means final project benefits are not well understood.
Health and Safety	While project activities would be implemented in such a manner as to minimize impacts on public health and safety, rodenticide could potentially be used in or near populated areas on Culebra Island. Additional project planning would need to be conducted to identify project implementation locations and mitigation plans to better understand potential impacts to public health and safety.
Summary: Based on the OPA and NEPA evaluations, specifically the evaluation of the likelihood of success, project benefits, and public health and safety when compared to other projects evaluated in this plan that would benefit the same species, this project was not identified as a preferred restoration alternative by the Open Ocean TIG at this time.	

3.5.3 Seabird Nesting Colony Reestablishment and Protection at Desecheo National Wildlife Refuge (preferred)

OPA NRDA Evaluation Standard	Evaluation Summary
Cost-effectiveness	The total estimated cost of $214,500 includes project planning and design, implementation (primarily social attraction to expand seabird nesting colonies and biosecurity measures), monitoring, oversight and management, and contingency funds. This project would leverage existing eradication and biosecurity work by Desecheo NWR, maximizing the overall restoration benefit and preventing reintroduction of invasive species in perpetuity. The costs to carry out this alternative are based on similar, previously implemented projects to restore and conserve birds and DOI's experience with similar work. The Open Ocean TIG has determined that the project costs are reasonable and appropriate.
Goals and Objectives	This project is consistent with the Replenish and Protect Living Coastal and Marine Resources Restoration Goal and underlying Birds Restoration Type. The project has a clear nexus to injures as it would help compensate for losses to Caribbean-nesting seabirds from the DWH oil spill. Specifically, sooty and bridled terns, brown noddy, brown booby, and magnificent frigatebird are all present on Desecheo NWR and would benefit from this project. The proposed biosecurity and nesting colony expansion/establishment activities align with restoration techniques identified in the PDARP/PEIS and the DWH Strategic Framework for Bird Restoration Activities.
Likelihood of Success	This project would utilize reliable social attraction and biosecurity methods to reestablish seabird nesting colonies for bridled tern, brown booby, magnificent frigatebird, sooty tern, and brown noddy. Existing social attraction methods have successfully increased colony occupancy, nesting density, and colony distribution for several tern and booby species on Desecheo (Herrera-Giraldo et al., 2021). This project would be

OPA NRDA Evaluation Standard	Evaluation Summary
	implemented in an adaptive manner by evaluating baseline data to determine the best locations for colony expansion and monitoring seabird responses to social attraction. Therefore, the Open Ocean TIG believes this project is technically feasible and anticipates that it would have a high likelihood of success.
Avoid Collateral Injury	All project activities would be implemented by trained and permitted personnel. Desecheo NWR has an extensive history with rodenticide application and biosecurity activities would be conducted by trained personnel in accordance with permit conditions and standard rodenticide protocols to reduce the risk of collateral injury.
Benefits	Desecheo Island was historically a major seabird rookery and recent successful invasive mammal eradications by Desecheo NWR provide an opportunity to reestablish nesting colonies. The social attraction and biosecurity measures that would be implemented as part of this project would enhance nesting habitat and in turn benefit nesting seabird species on Desecheo through increases in productivity. This project may provide ancillary benefits to a variety of other DWH-injured birds (e.g., Audubon's shearwaters, white-tailed tropicbird, American oystercatcher) and several ESA-listed species (e.g., higo chumbo cactus).
Health and Safety	The Open Ocean TIG does not anticipate any negative impacts to public health and safety. All activities would be implemented by trained and permitted personnel, and further, Desecheo Island is uninhabited, limiting any potential negative impacts on public health and safety.
Summary: Based on the OPA and NEPA evaluations, this project was identified as a preferred restoration alternative at this time.	

3.5.4 Seabird Nesting Colony Protection and Enhancement at Dry Tortugas National Park (preferred)

OPA NRDA Evaluation Standard	Evaluation Summary
Cost-effectiveness	The total estimated cost of $1,183,160 includes project planning and design, implementation (primarily aerial surveys to establish an updated baseline for seabirds in the park, social attraction to enhance seabird colonies, biosecurity measures, and habitat restoration), monitoring, oversight and management, and contingency funds. Significant cost savings are anticipated if drones can be used for aerial surveys. This project would leverage existing NPS work and in-kind funds to establish a population baseline and restore seabird nesting colonies at DRTO. The costs to carry out this alternative are based on similar, previously implemented projects to restore and conserve birds and DOI's experience with similar work. The Open Ocean TIG has determined that the project costs are reasonable and appropriate.
Goals and Objectives	This project is consistent with the Replenish and Protect Living Coastal and Marine Resources Restoration Goal and underlying Birds Restoration Type. The project has a clear nexus to injures as it would help compensate for losses to Caribbean-nesting seabirds from the DWH oil spill, specifically sooty and bridled terns, brown noddy, masked booby, and magnificent frigatebird. The proposed biosecurity and nesting colony expansion/establishment activities align with restoration techniques identified in the PDARP/PEIS and the DWH Strategic Framework for Bird Restoration Activities.
Likelihood of Success	This project would utilize a phased approach to restoration, analyzing existing data and collecting baseline monitoring data in Phase I that would inform restoration activities in Phase II. Proposed restoration actions would include standard social attraction and biosecurity methods that have successfully increased colony occupancy, nesting density, and colony distribution for several tern and booby species on other Caribbean islands (e.g., Herrera-Giraldo et al., 2021). Because this project would take an adaptive approach to restoration, actions would be

OPA NRDA Evaluation Standard	Evaluation Summary
	targeted in areas that have the greatest likelihood of success for restoring seabirds. Therefore, the Open Ocean TIG determined that this project is technically feasible and has a high likelihood of success.
Avoid Collateral Injury	The NPS and USFWS have an extensive history with rodenticide application. Biosecurity activities would be conducted by trained personnel in accordance with permit conditions and standard rodenticide protocols to reduce the risk of collateral injury.
Benefits	This project seeks to increase productivity of multiple Caribbean-nesting seabird species through biosecurity measures to prevent the re-introduction of invasive predators (e.g., rodents) and nesting habitat enhancement and colony expansion through social attraction. DRTO hosts one of the only nesting sites for sooty tern, brown noddy, masked booby, and magnificent frigatebirds in the continental U.S., and the islands provide important nesting and wintering habitat for a variety of seabirds. Biosecurity measures and nesting colony reestablishment may also provide ancillary benefits to a variety of other DWH-injured birds (e.g., Audubon's shearwaters, least and common terns, white-tailed tropicbirds, brown pelicans, laughing gulls), other DWH-injured species such as sea turtles (e.g., green, hawksbill, and loggerhead), and other non-injured species (e.g., roseate terns).
Health and Safety	The Open Ocean TIG does not anticipate any negative impacts to public health and safety. Keys and islands within DRTO are uninhabited, and the NPS would implement biosecurity measures in such a manner as to not impact public health and safety (e.g., activities would be implemented by trained personnel, and if needed, public access would be limited in relevant areas following treatment).
Summary: Based on the OPA and NEPA evaluations, this project was identified as a preferred restoration alternative at this time.	

3.5.5 Common Tern Nesting Colony Restoration in the Great Lakes Region (non-preferred)

OPA NRDA Evaluation Standard	Evaluation Summary
Cost-effectiveness	The total estimated cost of $3,520,000 includes project planning and design, implementation (primarily assembling a working group, disseminating best management practices, social attraction measures to expand colonies, and habitat enhancement including constructing nesting islands), monitoring, oversight and management, and contingency funds. The costs to carry out this alternative are based on similar, previously implemented projects to restore and conserve birds and DOI's experience with similar work. The Open Ocean TIG has determined that the project costs are reasonable and appropriate.
Goals and Objectives	This project is consistent with the Replenish and Protect Living Coastal and Marine Resources Restoration Goal and underlying Birds Restoration Type. The project has a clear nexus to injures as it would help compensate for losses to birds injured by the DWH oil spill, specifically the common tern, which suffered some of the highest avian mortality from the spill. The proposed habitat restoration activities, such as the creation of nesting islands, and predator or vegetation management activities align with restoration techniques identified in the PDARP/PEIS and the DWH Strategic Framework for Bird Restoration Activities.
Likelihood of Success	This project utilizes reliable vegetation and predator management and habitat enhancement methods, and it builds on established organizational partnerships. DOI has successfully implemented similar management actions for other DWH NRDA TIG projects such as the Florida TIG's Egmont Key National Wildlife Refuge Vegetation Management and Dune Retention and St. Vincent National Wildlife Refuge

OPA NRDA Evaluation Standard	Evaluation Summary
	Predator Control projects.[34] This project would be implemented in a phased approach where expert working groups convened in Phase I and centralized databases created in Phase II would inform habitat enhancement and nesting island construction in Phase III. As such, the Open Ocean TIG believes this project is technically feasible. However, rising water levels could threaten the long-term success and sustainability of the project.
Avoid Collateral Injury	The TIG does not anticipate that this project would cause collateral injury to natural resources. The construction of nesting islands has the potential to cause collateral injury; however, the potential impacts of this activity would be evaluated during project planning and design and appropriate BMPs would be identified to minimize collateral injury.
Benefits	This project would result in benefits to the common tern (e.g., increases in reproductive success and survival) through nesting area stewardship and habitat enhancement. Construction of new nesting islands would help increase the resilience of nesting colonies during severe weather events or from fluctuating water levels. Habitat and predator management activities conducted at common tern nesting sites could also result in benefits to other tern species in the area. However, the lengthy planning process required to implement this project and the uncertainty related to where restoration actions may be sited means final project benefits are not well understood.
Health and Safety	The Open Ocean TIG does not anticipate any negative impacts to public health and safety. All project activities would be conducted by trained, partner personnel.
Summary: Based on the OPA and NEPA evaluations, specifically the evaluation of the likelihood of success and project benefits, this project was not identified as a preferred restoration alternative by the Open Ocean TIG at this time.	

3.5.6 Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries (preferred)

OPA NRDA Evaluation Standard	Evaluation Summary
Cost-effectiveness	The total estimated cost of $5,052,000 includes project planning and design, implementation (primarily testing seabird bycatch reduction strategies, hotspot modeling, and expanding fisheries partnerships), monitoring, oversight and management, and contingency funds. The costs to carry out this alternative are based on similar, previously implemented projects to restore and conserve birds and DOI and NOAA's experience with similar work. The Open Ocean TIG has determined that the project costs are reasonable and appropriate.
Goals and Objectives	This project is consistent with the Replenish and Protect Living Coastal and Marine Resources Restoration Goal and underlying Birds Restoration Type. The project has a clear nexus to injures as it would help compensate for losses to birds from the DWH oil spill, specifically northern gannets and great shearwaters, which both sustained high mortality from the spill. The proposed voluntary fishing gear and/or

[34] Information on the Egmont Key National Wildlife Refuge Vegetation Management and Dune Retention project can be accessed at www.gulfspillrestoration.noaa.gov/project?id=274 and information on the St. Vincent National Wildlife Refuce Predator Control project can be accessed at www.gulfspillrestoration.noaa.gov/project?id=181.

OPA NRDA Evaluation Standard	Evaluation Summary
	technique modification activities align with restoration techniques identified in the PDARP/PEIS and the DWH Strategic Framework for Bird Restoration Activities.
Likelihood of Success	This project utilizes reliable, voluntary fishing gear and technique modification methods to restore northern gannets and great shearwaters. This project would be implemented in multiple phases, starting with establishing partnerships with various fisheries, modeling and outreach efforts to learn more about seabird-fishery interactions, and pilot testing efforts to identify successful seabird bycatch reduction strategies. These efforts would help ensure the success of this project. Further, modeling would be conducted to determine when and where to target testing of these strategies. The second phase of the project would expand the most effective strategies to promote voluntary adoption and continue to identify additional strategies for participating fisheries. Therefore, the Open Ocean TIG anticipates this project is technically feasible and has a high likelihood of success.
Avoid Collateral Injury	The TIG does not anticipate that this project would cause collateral injury to natural resources, beyond the potential impacts from existing fishing practices. This project seeks to reduce natural resource injuries to seabirds from fisheries interactions, through voluntary implementation of seabird bycatch reduction strategies, and as such, project activities would not result in any additional collateral injuries to non-targeted species.
Benefits	This project seeks to reduce the risk of bycatch of northern gannets and great shearwaters in northeast U.S. and Atlantic Canada commercial fisheries. Northern gannets and great shearwaters spend most of their lives in the marine environment, and studies suggest that they are particularly susceptible to bycatch. Seabird bycatch reduction strategies may provide ancillary benefits to a variety of DWH-injured (e.g., Audubon's, sooty, Cory's, and Manx shearwaters; common loons, herring and ring-billed gulls, and double-crested cormorant) and non-injured (e.g., red-throated loon, common and thick-billed murres, razorbills) seabird and fish species.
Health and Safety	The Open Ocean TIG does not anticipate any negative impacts to public health and safety. The TIG would work with experienced field personnel during pilot tests and commercial fishermen to voluntarily implement bycatch reduction strategies.
Summary: Based on the OPA and NEPA evaluations, this project was identified as a preferred restoration alternative in this RP/EA at this time.	

3.5.7 Seabird Bycatch Risk Reduction in Gulf of Mexico and Southeast U.S. Pelagic Longline Fisheries (non-preferred)

OPA NRDA Evaluation Standard	Evaluation Summary
Cost-effectiveness	The total estimated cost of $1,546,236 includes project planning and design, implementation (primarily establishing partnerships, identifying seabird bycatch strategies and modeling to identify hotspots), monitoring, oversight and management, and contingency funds. The costs to carry out this alternative are based on similar, previously implemented projects to restore and conserve birds and DOI and NOAA's experience with similar work. The Open Ocean TIG has determined that the project costs are reasonable and appropriate.
Goals and Objectives	This project is consistent with the Replenish and Protect Living Coastal and Marine Resources Restoration Goal and underlying Birds Restoration Type. The project has a clear nexus to injures as it would help compensate for losses to birds from the DWH oil spill, specifically

OPA NRDA Evaluation Standard	Evaluation Summary
	northern gannets and great shearwaters, which both sustained high mortality from the spill. The proposed voluntary fishing practice modification activities align with restoration techniques identified in the PDARP/PEIS and the DWH Strategic Framework for Bird Restoration Activities.
Likelihood of Success	This project seeks to identify reliable, voluntary fishing practice modification methods to restore northern gannets and great shearwaters. This project would engage commercial PLL captains and crew members to gather local knowledge on seabird interactions and collaboratively design bycatch reduction strategies that would be voluntarily implemented in a small-scale pilot test. Therefore, the Open Ocean TIG anticipates this project is technically feasible and has a moderate likelihood of success.
Avoid Collateral Injury	The TIG does not anticipate that this project would cause collateral injury to natural resources, beyond the potential impacts from existing fishing practices. This project seeks to reduce natural resource injuries to seabirds from fisheries interactions, through voluntary implementation of seabird bycatch reduction strategies, and as such, project activities would not result in any additional collateral injuries to non-targeted species.
Benefits	This alternative could benefit northern gannets and great shearwaters by reducing bycatch of these birds in commercial Gulf of Mexico and southeast Atlantic PLL fisheries. However, success depends on identifying effective techniques and strategies to reduce seabird interactions in the PLL fishery and their voluntary adoption. In addition, the magnitude of seabird impacts from these PLL fisheries is estimated to be less than impacts from other East Coast fisheries such as northeast gillnet fisheries. Therefore, the direct benefit of this project at a larger scale is uncertain.
Health and Safety	The Open Ocean TIG does not anticipate any negative impacts to public health and safety. The TIG would work with existing fisheries observer programs and commercial fishermen to voluntarily implement seabird bycatch reduction strategies.
Summary: Based on the OPA and NEPA evaluations, specifically the uncertainty of the anticipated project benefits and likelihood of success, this project was not identified as a preferred restoration alternative by the Open Ocean TIG at this time.	

3.5.8 Northern Gannet Nesting Colony Restoration in Eastern Canada (preferred)

OPA NRDA Evaluation Standard	Evaluation Summary
Cost-effectiveness	The total estimated costs of $5,680,000 includes project planning and design, implementation (primarily predator management, human disturbance management, land-based removal of marine debris, and social attraction to expand colonies), monitoring, oversight and management, and contingency funds. The costs to carry out this alternative are based on similar projects to restore and conserve birds and DOI's experience with similar work. The Open Ocean TIG has determined that the project costs are reasonable and appropriate.
Goals and Objectives	This project is consistent with the Replenish and Protect Living Coastal and Marine Resources Restoration Goal and underlying Birds Restoration Type. The project has a clear nexus to injuries as it would help compensate for losses to birds from the DWH oil spill, specifically northern gannets, which suffered some of the highest avian mortality from the spill. The proposed nesting colony expansion through social attraction and nesting site stewardship and management (e.g., predator control, land-based removal of marine debris, and human disturbance reduction) activities align with restoration techniques identified in the PDARP/PEIS and the DWH Strategic Framework for Bird Restoration Activities.

OPA NRDA Evaluation Standard	Evaluation Summary
Likelihood of Success	This project utilizes reliable human and predator management and marine debris removal methods to help restore northern gannet populations, and it builds on established organizational partnerships. DOI has successfully implemented similar stewardship actions for other DWH NRDA TIG projects such as the Regionwide TIG's Enhanced Management of Avian Breeding Habitat Injured by Response Activities in the Florida Panhandle, Alabama, and Mississippi project.[35] Social attraction techniques have also helped reestablish other seabird species (e.g., Atlantic puffins) at former nesting colonies (e.g., Jones and Kress, 2012). Therefore, the Open Ocean TIG anticipates this project is technically feasible and has a high likelihood of success.
Avoid Collateral Injury	Project partners have an extensive history with lethal and non-lethal predator control of mammalian species. Activities would be carried out by trained personnel in accordance with permit conditions and standard predator-removal protocols to reduce the risk of collateral injury. The Open Ocean TIG does not anticipate that predator removal would negatively impact local predator population levels.
Benefits	Through nesting area stewardship and nesting colony expansion/creation, this project seeks to increase reproductive success and survival of northern gannets. Northern gannets nest at six nesting colonies in eastern Canada, with land-accessible colonies subject to predation and human disturbance, and with all colonies impacted by marine debris. Nesting area stewardship may provide ancillary benefits to a variety of DWH-injured (e.g., Leach's storm-petrel, double-crested cormorant, herring gull) and non-injured (e.g., common murre, Atlantic puffin, great cormorant) bird species.
Health and Safety	The Open Ocean TIG does not anticipate any negative impacts to public health and safety. Predator control and debris removal activities would be conducted by trained partner personnel and would not involve the public.
Summary: Based on the OPA and NEPA evaluations, this project was identified as a preferred restoration alternative at this time.	

3.5.9 Common Tern Nesting Colony Restoration in Manitoba (preferred)

OPA NRDA Evaluation Standard	Evaluation Summary
Cost-effectiveness	The total estimated cost of $4,400,000 includes project planning and design, implementation (primarily predator and human disturbance management, indigenous youth trainings and educational outreach, colony surveys, nesting area enhancements, and social attraction to enhance colonies) monitoring, oversight and management, and contingency funds. This project would leverage unrelated planned future funding of the Indigenous Guardians program to provide long-term capacity and infrastructure for full-time Guardian staff that would support the seasonal positions funded through this project. The costs to carry out this alternative are based on similar, previously implemented projects to restore and conserve birds and DOI's experience with similar work. The Open Ocean TIG has determined that the project costs are reasonable and appropriate.

[35] Information on the Enhanced Management of Avian Breeding Habitat Injured by Response Activities in the Florida Panhandle, Alabama, and Mississippi project can be accessed at www.gulfspillrestoration.noaa.gov/project?id=9.

OPA NRDA Evaluation Standard	Evaluation Summary
Goals and Objectives	This project is consistent with the Replenish and Protect Living Coastal and Marine Resources Restoration Goal and underlying Birds Restoration Type. The project has a clear nexus to injures as it would help compensate for losses to birds from the DWH oil spill, specifically the common tern, which suffered some of the highest avian mortality from the spill. The proposed nesting area stewardship and establishment of new nesting colonies in protected areas activities align with restoration techniques identified in the PDARP/PEIS and the DWH Strategic Framework for Bird Restoration Activities.
Likelihood of Success	This project utilizes effective nesting stewardship methods such as management of human disturbance to restore the common tern. This project also builds on established organizational partnerships. DOI has successfully implemented similar stewardship actions for other DWH NRDA TIG projects such as the Regionwide TIG's Enhanced Management of Avian Breeding Habitat Injured by Response Activities in the Florida Panhandle, Alabama, and Mississippi project. This project would be implemented in an adaptive manner based on monitoring data. Therefore, the Open Ocean TIG determined this project is technically feasible and has a high likelihood of success.
Avoid Collateral Injury	The Open Ocean TIG does not anticipate that this project would cause collateral injury to natural resources. Environmental consequences of proposed techniques would be evaluated during project planning and design and appropriate BMPs would be identified to minimize collateral injury.
Benefits	Through stewardship and nesting colony establishment, this project seeks to increase reproductive success and survival of the common tern. A variety of other DWH-injured birds may benefit from stewardship activities, such as American white pelicans, American coots, killdeer, and least and semipalmated sandpipers. Other wildlife species may also experience ancillary benefits.
Health and Safety	The Open Ocean TIG does not anticipate any negative impacts to public health and safety. Indigenous Guardians supported by the project would receive appropriate training for in-field activities such as colony surveys, chick banding, and restoration site preparation.
Summary: Based on the OPA and NEPA evaluations, this project was identified as a preferred restoration alternative at this time.	

3.5.10 **Seabird Nesting Habitat Restoration and Colony Reestablishment in the Bahamas (non-preferred)**

OPA NRDA Evaluation Standard	Evaluation Summary
Cost-effectiveness	The total estimated cost of $7,150,000 includes project planning and design, implementation (primarily data compilation, development of management plans, vegetation and predator management, social attraction and biosecurity measures to enhance nesting colonies, and educational outreach), monitoring, oversight and management, and contingency funds. This project would include critical capacity-building and lay the groundwork for seabird conservation and management in the Bahamas. The costs to carry out this alternative are based on similar projects to restore and conserve birds and DOI's experience with similar work. The Open Ocean TIG has determined that the project costs are reasonable and appropriate.
Goals and Objectives	This project is consistent with the Replenish and Protect Living Coastal and Marine Resources Restoration Goal and underlying Birds Restoration Type. The project has a clear nexus to injures as it would help compensate for losses to Caribbean-nesting seabirds from the DWH oil spill, specifically Audubon's shearwater which experienced the highest mortality of Caribbean-nesting seabirds from the oil spill. The proposed invasive species eradication and nesting colony expansion/establishment activities align with restoration techniques identified in the PDARP/PEIS and the DWH Strategic Framework for Bird Restoration Activities.

OPA NRDA Evaluation Standard	Evaluation Summary
Likelihood of Success	This project utilizes reliable conservation methods (invasive species management, biosecurity) to restore a variety of Caribbean-nesting seabirds injured by the DWH oil spill. Similar social attraction methods have successfully increased colony occupancy, nesting density, and colony distribution for several tern and booby species in the Caribbean. However, significant capacity building is needed for project partners prior to the implementation of on-the-ground restoration activities. Therefore, this project may have a lower likelihood of success compared to other projects evaluated in this RP/EA.
Avoid Collateral Injury	NGO project partners and USFWS have an extensive history with rodenticide application. Biosecurity activities would be conducted by trained personnel in accordance with permit conditions and standard rodenticide protocols to reduce the risk of collateral injury.
Benefits	This project seeks to increase productivity of multiple Caribbean-nesting seabird species (Audubon's shearwater, sooty and bridled terns, brown noddy, brown booby, and white-tailed tropicbird) through invasive species eradication, colony expansion, and implementation of biosecurity measures. The Bahamas are home to the three most numerous remaining colonies of Audubon's shearwater, with less than one percent of historical nesting colonies remaining. However, this project is estimated to have a lower cost-to-benefit ratio compared to other projects evaluated in this RP/EA due to the need for capacity building prior to implementation of project activities.
Health and Safety	The Open Ocean TIG does not anticipate negative impacts to public health and safety. Biosecurity measures and invasive species eradication would be implemented in such a manner as to not impact public health and safety.
Summary: Based on the OPA and NEPA evaluations, specifically the likelihood of success and project benefits, when compared to other projects evaluated in this plan that would benefit the same species, this project was not identified as a preferred restoration alternative by the Open Ocean TIG at this time.	

3.5.11 Invasive Goat Removal to Restore Seabird Nesting Habitat in St. Vincent and the Grenadines (preferred)

OPA NRDA Evaluation Standard	Evaluation Summary
Cost-effectiveness	The total estimated cost of $231,000 includes project planning and design, implementation (primarily eradicating goats, compiling baseline data, and public outreach), monitoring, oversight and management, and contingency funds. This project would leverage the existing Grenadine Seabird Guardians network of citizen scientists to help reduce long-term monitoring costs. The costs to carry out this alternative are based on similar, previously implemented projects to restore and conserve birds and DOI's experience with similar work. The Open Ocean TIG has determined that the project costs are reasonable and appropriate.
Goals and Objectives	This project is consistent with the Replenish and Protect Living Coastal and Marine Resources Restoration Goal and underlying Birds Restoration Type. The project has a clear nexus to injures as it would help compensate for losses to Caribbean-nesting seabirds from the DWH oil spill, specifically magnificent frigatebird, bridled and sooty terns, brown noddy, brown booby, and red-billed tropicbird. The proposed invasive goat eradication activity aligns with restoration techniques identified in the PDARP/PEIS and the DWH Strategic Framework for Bird Restoration Activities.

OPA NRDA Evaluation Standard	Evaluation Summary
Likelihood of Success	This project utilizes invasive species eradication methods to restore a variety of Caribbean-nesting seabirds injured by the DWH oil spill. This project would be implemented in an adaptive manner by collecting and evaluating baseline data to determine where best to conduct eradication actions. Therefore, the Open Ocean TIG anticipates this project is technically feasible and has a high likelihood of success.
Avoid Collateral Injury	Goat eradication would be conducted by licensed hunters or trained personnel in accordance with permit conditions to reduce the risk of collateral injury.
Benefits	This project seeks to increase productivity of multiple Caribbean-nesting seabird species through nesting habitat enhancement and colony expansion. Invasive goats remove native vegetation on Battowia and Pillories Islands, contribute to erosion and nest disturbance and can trample seabird nests. The isolated nature of the islands increases the likelihood that goats would not be reintroduced once eradicated. Restoration measures may provide ancillary benefits to a variety of land and seabirds and native plants.
Health and Safety	The Open Ocean TIG does not anticipate any negative impacts to public health and safety. The public would be invited to help eliminate invasive goats via hunting in accordance with local hunting permits and regulations.
Summary: Based on the OPA and NEPA evaluations, this project was identified as a preferred restoration alternative at this time.	

3.6 Natural Recovery/No Action Alternative

Pursuant to the OPA NRDA 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" (40 CFR § 990.53[b][2]). Under a natural recovery alternative, no additional restoration would be done by the TIG to accelerate the recovery of Birds in the Open Ocean Restoration Area using DWH NRDA funding at this time.

The TIG would allow natural recovery processes to occur, which could result in 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 compared to a scenario in which restoration actions were undertaken. Given that technically feasible Restoration Approaches are available to compensate for interim natural resource and service losses, in the PDARP/PEIS, the DWH Trustees rejected this alternative from further OPA evaluation in subsequent restoration planning. Based on this determination, incorporating that analysis by reference, the Open Ocean TIG did not further evaluate natural recovery as a viable alternative under OPA.[36]

3.7 OPA Evaluation Conclusions

As described in the sections above, the Open Ocean TIG conducted an OPA NRDA evaluation of each of the projects included in the reasonable range of alternatives for this RP/EA. The Open Ocean TIG's choice of preferred alternatives is based on this evaluation and informed by the NEPA analysis presented in Chapter 4.

A summary of the OPA NRDA evaluation is provided below in Table 3-1.

[36] A no action alternative for each Restoration Type is included in this RP/EA analysis pursuant to NEPA as a "… benchmark, enabling decision-makers to compare the magnitude of environmental effects of the action alternatives." The environmental consequences of the NEPA no action alternatives are considered separately in Chapter 4.

Table 3-1 Summary of OPA NRDA Evaluation for the Reasonable Range of Alternatives

Alternatives	OPA NRDA Evaluation
Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)	The estimated project costs are reasonable and appropriate, and the project would leverage restoration funds from project partners, as well as previously conducted restoration, increasing its cost-effectiveness. This project would increase the number of Caribbean-nesting seabirds and restore a portion of the injury caused by the DWH oil spill by eradicating invasive mammals, establishing new nesting colonies, and implementing biosecurity measures. This project builds off existing successful partnerships and would utilize established conservation and management techniques. Thus, the Open Ocean TIG anticipates this project would be implemented successfully with minimal collateral impacts to natural resources and human health and safety. This project is likely to provide ancillary benefits to other wildlife, including other bird and sea turtle species injured by the DWH oil spill and ESA-listed species. This project was identified as a preferred restoration alternative by the Open Ocean TIG.
Predator Removal and Seabird Nesting Colony Restoration in the Culebra Archipelago (non-preferred)	The estimated project costs are reasonable and appropriate. This project increase the number of Caribbean-nesting seabirds and restore a portion of the injury caused by the DWH oil spill by eradicating seabird predators and establishing nesting colonies. This project builds off existing partnerships with the NWR and utilizes established successful social attraction techniquesd. Thus, the Open Ocean TIG anticipates this project would be implemented successfully with minimal collateral impacts to natural resources and human health and safety. However, additional planning is needed to identify restoration implementation locations and viable restoration approaches, which results in uncertainty in the level of restoration benefits and potential impacts to public health and safety, especially when compared to other projects evaluated in this plan that would benefit the same species. As such, this project was not identified as a preferred restoration alternative by the Open Ocean TIG.
Seabird Nesting Colony Reestablishment and Protection at Desecheo National Wildlife Refuge (preferred)	The estimated project costs are reasonable and appropriate, and this project would leverage existing work by the NWR to eradicate invasive black rats, maximizing restoration benefits across funding sources. This project would increase the number of Caribbean-nesting seabirds and restore a portion of the injury caused by the DWH oil spill by establishing new nesting colonies and preventing the reintroduction of invasive predators. This project builds off existing partnerships with the NWR and utilizes established, successful social attraction techniques. Thus, the Open Ocean TIG anticipates this project would be implemented successfully with minimal collateral impacts to natural resources and human health and safety. This project is likely to provide ancillary benefits to other wildlife, including other bird and sea turtle species injured by the DWH oil spill and ESA-listed species. This project was identified as a preferred restoration alternative by the Open Ocean TIG.
Seabird Nesting Colony Protection and Enhancement at Dry Tortugas National Park (preferred)	The estimated project costs are reasonable and appropriate, and this project would leverage in-kind support from NPS to maximize monitoring and restoration benefits. Further, there would be additional cost savings if drones can be used for the project's aerial surveys. This project would increase the number of Caribbean-nesting seabirds and restore a portion of the injury caused by the DWH oil spill by establishing new nesting colonies and preventing the reintroduction of invasive predators. This project builds off existing partnerships with the NPS and utilizes established, successful social attraction techniques. Thus, the Open Ocean TIG anticipates this project would be implemented successfully with minimal collateral impacts to natural resources and human health and safety. This project is likely to provide ancillary benefits to other wildlife, including other bird and sea turtle species injured by the DWH oil spill. This project was identified as a preferred restoration alternative by the Open Ocean TIG.

Alternatives	OPA NRDA Evaluation
Common Tern Nesting Colony Restoration in the Great Lakes Region (non-preferred)	The estimated project costs are reasonable and appropriate. This project would increase the number of common terns and restore a portion of the injury to this species caused by the DWH oil spill by creating new nesting islands and managing threats (invasive plants and predators) at existing nesting colonies. This project builds off existing successful organizational partnerships, utilizes standard conservation techniques, and would be implemented in a phased approach to allow baseline data to inform new nesting island locations. Thus, the Open Ocean TIG anticipates this project would be implemented successfully with minimal collateral impacts to natural resources and human health and safety. However, rising water levels in the Great Lakes threaten the long-term benefits of the project. Further, the lengthy planning process required to implement this project, and the uncertainty related to where restoration actions may be sited, means final project benefits are not well understood. As such, this project was not identified as a preferred restoration alternative by the Open Ocean TIG in this RP/EA.
Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries (preferred)	The estimated project costs are reasonable and appropriate. This project would help restore bird populations injured by the DWH oil spill (specifically northern gannets and great shearwaters) by reducing the risk of bycatch in commercial fisheries. This project would be implemented in a phased approach to first test bycatch reduction measures, then scale up the most successful measures. Thus, the Open Ocean TIG anticipates this project would be implemented successfully with minimal collateral impacts to natural resources and human health and safety. This project is likely to provide ancillary benefits to other wildlife, including other bird and fish species injured by the DWH oil spill. This project was identified as a preferred restoration alternative by the Open Ocean TIG.
Seabird Bycatch Risk Reduction in Gulf of Mexico and Southeast U.S. Pelagic Longline Fisheries (non-preferred)	The estimated project costs are reasonable and appropriate. This project would help restore bird populations injured by the DWH oil spill (specifically northern gannets and great shearwaters) by reducing bycatch in Gulf of Mexico and southeastern U.S. PLL fisheries. This project would engage commercial PLL captains and crew members to gather local knowledge on seabird interactions and collaboratively design bycatch reduction strategies that would be implemented in a small-scale pilot test. Therefore, the Open Ocean TIG anticipates this project is technically feasible and could have a high likelihood of success with minimal collateral impacts to natural resources and human health and safety. However, success depends on identifying effective techniques and strategies to reduce seabird interactions in the PLL fishery and their voluntary adoption at a larger scale. In addition, seabird impacts from the PLL fishery are relatively low compared to impacts from other Atlantic fisheries such as northeast gillnet fisheries. As such, the Open Ocean TIG did not identify this project as a preferred restoration alternative in this RP/EA.
Northern Gannet Nesting Colony Restoration in Eastern Canada (preferred)	The estimated project costs are reasonable and appropriate. This project would incrase the number of northern gannets and restore a portion of the injury caused by the DWH oil spill by providing nesting area stewardship and management and establishing new nesting colonies. This project builds off established, successful organizational partnerships and would use standard conservation techniques. Thus, the Open Ocean TIG anticipates this project would be implemented successfully with minimal collateral impacts to natural resources and human health and safety. This project is likely to provide ancillary benefits to other wildlife, including other bird species injured by the DWH oil spill. This project was identified as a preferred restoration alternative by the Open Ocean TIG.

Alternatives	OPA NRDA Evaluation
Common Tern Nesting Colony Restoration in Manitoba (preferred)	The estimated project costs are reasonable and appropriate. This project would increase the number of common terns and restore a portion of the injury caused by the DWH oil spill by providing nesting area stewardship and establishing new nesting colonies in protected areas. This project builds off established, successful organizational partnerships and would use standard conservation techniques. Thus, the Open Ocean TIG anticipates this project would be implemented successfully with minimal collateral impacts to natural resources and human health and safety. This project is likely to provide ancillary benefits to other wildlife, including other bird species injured by the DWH oil spill. This project was identified as a preferred restoration alternative by the Open Ocean TIG.
Seabird Nesting Habitat Restoration and Colony Reestablishment in the Bahamas (non-preferred)	The estimated project costs are reasonable and appropriate. This project would increase the number of Caribbean-nesting seabirds and restore a portion of the injury caused by the DWH oil spill by providing nesting area stewardship and management and establishing new nesting colonies. This project would use standard conservation techniques with minimal collateral impacts or impacts to natural resources and human health and safety. However, the project requires significant capacity building with project partners prior to the implementation of restoration activities, reducing the estimated cost-benefit ratio and likelihood of success when compared with other projects evaluated in this plan. As such, this project was not identified as a preferred restoration alternative by the Open Ocean TIG in this RP/EA.
Invasive Goat Removal to Restore Seabird Nesting Habitat in St. Vincent and the Grenadines (preferred)	The estimated project costs are reasonable and appropriate, and this project would leverage an existing citizen science network to provide long-term monitoring, increasing its cost-effectiveness. This project would increase the number of Caribbean-nesting seabirds and restore a portion of the injury caused by the DWH oil spill by eradicating invasive goats and restoring nesting colonies. This project would utilize established conservation and management techniques. Thus, the Open Ocean TIG anticipates this project would be implemented successfully with minimal collateral impacts to natural resources and human health and safety. This project is likely to provide ancillary benefits to other wildlife, including other bird species injured by the DWH oil spill and ESA-listed species. This project was identified as a preferred restoration alternative by the Open Ocean TIG.

4 Environmental Assessment

4.1 Overview of the NEPA Approach

NEPA (40 CFR §1502.16) requires federal agencies to comparatively evaluate the environmental effects of the alternatives under consideration, including effects to physical, biological, and socioeconomic resources. This chapter describes the anticipated adverse and beneficial environmental impacts of the preferred and non-preferred alternatives. Together, these constitute the reasonable range of alternatives for this RP/EA. A no action alternative is also analyzed.

The NEPA analysis presented in this chapter is consistent with the PDARP/PEIS, which is incorporated by reference, and tiers where applicable. Resources analyzed and impact definitions (minor, moderate, major) align with the PDARP/PEIS (Appendix B to this RP/EA).[37] This chapter is organized to describe impacts in a manner that avoids redundancy and unnecessary information by (1) discussing activities that do not require further NEPA analysis in Section 4.2; (2) analyzing resources with similar impacts across alternatives together in Section 4.3; and (3) focusing on impacts that differ across alternatives in the separate project sections in the remainder of the chapter.

To determine whether an action has the potential to result in significant impacts, the context and intensity of the proposed action must be considered. Context refers to area of impacts (local, state-wide, etc.) and duration (i.e., whether they are short- or long-term). Intensity refers to the severity of impact and could include the timing of the action (e.g., more intense impacts would occur during critical periods like high visitation or wildlife breeding/rearing). Intensity is also described in terms of whether the impact would be beneficial or adverse. “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 ESA and other protected resource statutes. The analysis characterizes adverse impacts as short-term or long-term and minor, moderate, or major. The analysis of beneficial impacts focuses on the duration (short-term or long-term) and does not attempt to specify the intensity of the benefit.

This chapter addresses direct, indirect, and cumulative impacts of the proposed alternatives. Section 6.6 and Appendix 6.B of the PDARP/PEIS (Cumulative Impacts) are incorporated by reference into the cumulative impacts analysis, including the methodologies for assessing cumulative impacts, identification of affected resources, and the cumulative impacts scenario. Further, brief project descriptions focusing on activities that would result in environmental impacts are provided in the sections below; complete project descriptions for each alternative are provided in Chapter 2.

To streamline the NEPA process and present a concise document that provides sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact, and to aid the Open Ocean TIG’s compliance with NEPA (40 CFR § 1506.3, 40 CFR § 1508.9), relevant information from existing plans, studies, and other materials has been incorporated by reference. Agencies should “focus on significant environmental issues” and, for issues that are not significant, there should be “only enough discussion to show why more study is not warranted” (40 CFR

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[37] Physical Resources: Geology and Substrates, Hydrology and Water Quality, Air Quality, Noise; Biological Resources: Habitats, Wildlife Species (including Birds), Marine and Estuarine Fauna (Fish, Shellfish, Benthic Organisms), Protected Species; Socioeconomic Resources: Socioeconomics and Environmental Justice, Cultural Resources, Infrastructure, Land and Marine Management, Tourism and Recreational Use, Fisheries and Aquaculture, Marine Transportation, Aesthetics and Visual Resources, Public Health and Safety, including Flood and Shoreline Protection.

§§ 1502.1 and 1502.2). All source documents relied upon for the NEPA analyses are available and links are provided in the environmental consequences discussion where applicable.

4.1.1 Overview of the Approach for Projects Occurring in Locations Not Under the Jurisdiction of the United States

This chapter includes an analysis of the environmental impacts of four projects[38] included in the reasonable range of alternatives that would wholly occur outside the jurisdiction of the U.S., and, therefore, are not subject to NEPA (see Section 4.5). Executive Order (EO) 12114, "Environmental Effects Abroad of Major Federal Actions" (1979) furthers the purpose of NEPA, the Marine Protection Research and Sanctuaries Act, and the Deepwater Port Act for actions taken by U.S. federal agencies with respect to the environment outside the U.S., its territories, and possessions. However, "actions not having a significant effect on the environment outside the United States as determined by the agency" are exempt from this Order (EO 12114, January 4, 1979).

Through the preparation of this RP/EA, DOI, as the federal NEPA lead, does not anticipate any major adverse impacts from the four projects that would occur outside of the jurisdiction of the U.S. However, to aid in its decision-making under OPA, the Open Ocean TIG has prepared NEPA analyses for these projects (Section 4.5) to better understand the potential impacts of each alternative and to remain consistent with the level of environmental analysis completed for projects across the DWH NRDA program. This NEPA analysis does not provide for any regulatory or policy requirements of these projects' host nations. Implementing Trustee(s) and associated project partners would be responsible for complying with host nations' federal, provincial, and/or municipal statutory and regulatory requirements.

4.2 Activities that Do Not Require Further NEPA Analysis

This section summarizes impacts from data gathering and educational project activities that are fully analyzed in the PDARP/PEIS and hence do not require additional NEPA analysis.

4.2.1 Data Gathering and Educational Activities

As discussed in the PDARP/PEIS (Chapter 6), projects may include educational activities (i.e., elements that promote environmental stewardship, education, and outreach) such as creating or enhancing natural resource-related educational programs, designing and installing educational signage and other materials, and/or developing other means of public outreach and engagement. Projects may also include data-related activities such as gathering, compiling, and evaluating information to improve understanding of natural resources and, in turn, future restoration efforts. Data gathering or monitoring may occur by drone, trail camera, passive acoustic monitors, or ground surveys.

All projects in the reasonable range of alternatives in this RP/EA involve data gathering and educational activities related to seabird restoration and as part of larger projects (listed below). Remaining project activities beyond data gathering or educational activities are analyzed in subsequent sections of this chapter.

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[38] The four projects that would be implemented wholly outside the jurisdiction of the U.S. are the Northern Gannet Nesting Colony Restoration in Eastern Canada (preferred), Common Tern Nesting Colony Restoration in Manitoba (preferred), Seabird Nesting Habitat Restoration and Colony Re-establishment in the Bahamas, and Invasive Goat Removal to Restore Seabird Nesting Habitat in St. Vincent and the Grenadines (preferred) projects.

Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred):

- Gather data using trail cameras or ground surveys.

Predator Removal and Seabird Nesting Colony Restoration in the Culebra Archipelago (non-preferred):

- Gather data using trail cameras or ground surveys.

Seabird Nesting Colony Reestablishment and Protection at Desecheo National Wildlife Refuge (preferred):

- Gather data using trail cameras or ground surveys.

Seabird Nesting Colony Protection and Enhancement at Dry Tortugas National Park (preferred):

- Gather using trail cameras or ground surveys.

Common Tern Nesting Colony Restoration in the Great Lakes Region (non-preferred):

- Create a Great Lakes tern conservation working group, including resource managers and experts, community groups, Tribes, and other local groups, to identify and prioritize restoration locations;
- Create a data sharing network and promote best data management practices, including developing centralized monitoring databases, encouraging data standardization and documentation and consistency in implementation and data quality;
- Gather data using trail cameras, passive acoustic monitors, or ground surveys.

Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries (preferred):

- Establish new partnerships and expand existing partnerships with PLL fisheries to gather local knowledge, and establish partnerships with observer programs to improve coverage and bycatch estimates;
- Conduct hotspot modeling to identify potential seabird bycatch hotspots and inform the location and scale of bycatch reduction strategies;
- Conduct educational activities such as trainings to encourage voluntary adoption of bycatch reduction strategies by commercial fishermen;
- Conduct outreach activities such as the development and distribution of educational materials, workshops, and presentations.

Seabird Bycatch Risk Reduction in Gulf of Mexico and Southeast U.S. Pelagic Longline Fisheries (non-preferred):

- Establish and expand partnerships with PLL fisheries through surveys with captains and crew members and through workshops with the fishing community to gather local knowledge, and establish partnerships with observer programs to examine seabird-fishery interactions;
- Develop modeling approaches to identify bycatch hotspot locations and seasons;
- Conduct outreach activities such as the development and distribution of educational materials, workshops, and presentations.

Northern Gannet Nesting Colony Restoration in Eastern Canada (preferred):

- Gather data using trail cameras or ground surveys.

Common Tern Nesting Colony Restoration in Manitoba (preferred):

- Conduct training and educational activities such as engaging and training indigenous youth and other community members, through the Indigenous Guardians, in conservation and management practices;
- Conduct outreach activities such as developing and distributing educational materials to reduce human disturbance of common tern colonies;
- Gather data using trail cameras or ground surveys.

Seabird Nesting Habitat Restoration and Colony Reestablishment in the Bahamas (non-preferred):

- Compile seabird population baseline and site assessment data to establish baseline conditions and inform restoration;
- Gather data using trail cameras, passive acoustic monitors, or ground surveys;
- Develop seabird management plans for the various islands to help prioritize restoration efforts;
- Conduct training and educational activities such as training Bahamian government staff in conservation and management practices;
- Conduct outreach and educational activities to support biosecurity measures in the community.

Invasive Goat Removal to Restore Seabird Nesting Habitat in St. Vincent and the Grenadines (preferred):

- Compile available baseline biodiversity data to inform restoration efforts;
- Gather data using trail cameras, passive acoustic monitors, or ground surveys;
- Conduct outreach and educational activities to encourage stewardship and communicate project outcomes to the community.

4.2.2 Environmental Consequences

The data gathering and educational elements of the alternatives listed above are expected to enhance understanding of seabirds forestoration planning purposes and to increase appreciation for and awareness and understanding of the status of vulnerable ecological resources in the project areas. These activities would involve little or no disturbance of physical or biological resources. Compiling and analyzing data and outreach and training activities are typically conducted from existing facilities and would not involve ground-disturbance. No adverse impacts are anticipated for socioeconomic resources. Implementation of these activities is anticipated to result in long-term benefits to biological resources. The benefits would result from educating local communities, including targeted outreach to youth in some cases, about natural resources, environmental issues, best practices, and conservation. Other benefits include enhancing understanding of seabird communities, for example through the data compilation and evaluation efforts, which would inform future restoration planning and implementation.

After review, the Open Ocean TIG determined that the environmental consequences of the data gathering and educational activities included in these alternatives fall within the range of impacts described in Sections 6.4.13.3 and 6.4.14 of the PDARP/PEIS. The complete project descriptions for these alternatives are provided in Section 2.4. No additional analysis of the environmental consequences of data gathering and educational activities is necessary.

4.3 Resources Analyzed in this RP/EA

To avoid redundancy, projects addressed in this RP/EA were reviewed to determine whether any resources experience no impacts, negligible impacts, or similar minor adverse impacts common to all alternatives such that the resource does not require detailed analysis. The subset of resource categories that experience no impacts to minor adverse impacts similarly across all alternatives are described in Section 4.3.1, rather than being repeated throughout the subsections applicable to each alternative.

Resource categories that are analyzed in greater detail (where applicable) include those resources where impacts are distinct and specific to the individual alternatives. These resource categories are listed below and are described in the respective subsection for each alternative.

- **Physical Resources** – Geology and Substrates, Water Quality
- **Biological Resources** – Habitats, Wildlife Species, Marine and Estuarine Fauna (marine and estuarine fish, shellfish, and benthic organisms), Protected Species
- **Socioeconomic Resources** – Socioeconomics, Public Health and Safety

4.3.1 Resources with Similar Impacts Common to All Alternatives

As noted above, this section includes an analysis of the environmental consequences for the subset of resource categories that experience no impacts to minor adverse impacts similarly across all alternatives. Refer to Sections 4.4 and 4.5 for a description of the affected environment for each alternative.

4.3.1.1 Physical Resources

4.3.1.1.1 Hydrology

Floodplains and wetlands are a subset of the hydrology and water quality resource category. Adverse impacts to floodplains are defined as detectable changes to the natural and beneficial floodplain and an increased risk of flood loss including impacts on human safety, health, and welfare. Adverse impacts to wetlands are defined as measurable impacts on the size, integrity, or connectivity of wetlands and wetland function. Chapter 6 of the PDARP/PEIS found that minor to moderate, temporary, short-term adverse impacts to hydrology may occur during construction activities associated with projects falling under the Birds Restoration Type.

The *Common Tern Nesting Colony Restoration in the Great Lakes Region (non-preferred)* alternative includes the construction and/or enhancement of at least one nesting island through the placement of rock fill or beneficially dredged material, which would result in minor to moderate, short- to long-term adverse impacts. However, specific construction sites would be identified in future phases of the project and may require additional site-specific analysis. All other project activities proposed in this RP/EA would avoid wetland areas, would not appreciably change the elevation of the project location, would not include construction of impervious surfaces, and would, therefore, not negatively impact flood elevations. As such, the other projects in this RP/EA are not anticipated to have any adverse impacts on floodplains or wetlands.

4.3.1.1.2 Air Quality

The USEPA defines ambient air in 40 C.F.R. Part 50 as “that portion of the atmosphere, external to buildings, to which the general public has access.” In compliance with the 1970 Clean Air Act (CAA) and the 1977 and 1990 CAA Amendments, USEPA has promulgated National Ambient Air Quality Standards (NAAQS). The NAAQS include primary standards which set limits to protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly. To date, USEPA has issued NAAQS for seven criteria pollutants: carbon monoxide, sulfur dioxide, particles with a diameter less than or equal to a nominal 10 microns, particles with a diameter less than or equal to a nominal 2.5 microns, ozone, nitrogen dioxide, and lead. Individual states may promulgate their own ambient air quality standards for these criteria pollutants if they are at least as stringent as the federal standards. Only one project within the jurisdiction of the U.S., *Common Tern Nesting Colony Restoration in the Great Lakes Region (non-preferred)*, includes potential project locations in counties currently listed on USEPA's nonattainment counties for any criteria pollutant (USEPA, 2022c).[39] However, until that project advances to a future stage, the exact location of the project activities would not be known, and specific construction sites identified in future phases of the project may require additional site-specific analysis.

Greenhouse gases (GHGs) are chemical compounds found in Earth's atmosphere that absorb and trap infrared radiation as heat. The principal GHGs emitted into the atmosphere through human activities are carbon dioxide, methane, nitrous oxide, and fluorinated gases, such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

- Carbon dioxide enters the atmosphere through the burning of fossil fuels (coal, natural gas, and oil), solid waste, trees, and wood products, and also as a result of certain chemical reactions (e.g., cement manufacturing). Carbon dioxide is removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle.
- Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.
- Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.
- Fluorinated gases are sometimes used as substitutes for stratospheric ozone-depleting substances (e.g., chlorofluorocarbons, hydrochlorofluorocarbons, halons). Hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride are synthetic, powerful GHGs that are emitted from a variety of industrial processes.

Chapter 6 of the PDARP/PEIS found that minor to moderate, short-term adverse impacts to air quality may occur during construction associated with projects falling under the Birds Restoration Type. 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.

All alternatives in this RP/EA are anticipated to involve construction activities, local transport of personnel conducting project activities, and/or vehicle and vessel transportation for implementation and construction. As such, adverse air quality impacts would be localized and occur primarily during active construction or implementation activities from emissions generated by construction or project implementation equipment and vehicles (e.g., boats, cars/trucks, planes). Engine exhaust from construction/implementation equipment would increase criteria air pollutants, GHGs, and other air pollutants. Because of the small scale and short duration of the construction/implementation portion of the applicable alternatives, and the low level of increased vehicle and/or vessel traffic anticipated to be generated by the projects, impacts to air quality are expected to be minor, short-term, and localized. These

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[39] The common tern nests in many U.S. counties across the Great Lakes Region. As part of project activities for *Common Tern Nesting Colony Restoration in the Great Lakes Region*, priority restoration sites would be identified following data gathering and management coordination activities. Counties on the EPA's nonattainment list where the common tern is known to nest include Milwaukee County (ozone), Wisconsin; Lake (ozone) and Cook (ozone) Counties, Illinois; Macomb (ozone), Monroe (ozone), St. Clair (ozone and sulfur dioxide), and Wayne (ozone and sulfur dioxide) Counties, Michigan; and Chautauqua (ozone) and St. Lawrence (sulfur dioxide) Counties, New York.

activities are not expected to cause an exceedance of the NAAQS (for projects occurring within the jurisdiction of the U.S.), even when considered together with other area emissions.

4.3.1.1.3 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 are operation of vehicles, humans, recreational boating vessels, and natural sounds such as wind and wildlife. The level of noise in the project areas vary depending on the season, time of day, number and types of noise sources, and distance from the noise source.

The PDARP/PEIS (Chapter 6) found that adverse impacts to ambient noise associated with most Restoration Approaches relevant to this RP/EA would be minor and short-term, with minor, long-term adverse impacts associated with increased visitation and vehicle use from wildlife viewing. The PDARP/PEIS noted that restoring and conserving bird nesting and foraging habitat and establishing or reestablishing nesting colonies could increase local noise levels temporarily during construction and implementation. 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.

The *Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)* alternative would include the use of barges and helicopters to conduct predator removal activities over several years (see Section 4.3.1). Use of barges to transport equipment to the island would be occasional and consistent with current level of use. As such, no impacts to the soundscape are anticipated from the barges. Helicopters would be present up to 6 months at a time for several years over the 10-year project lifespan. The sound systems used for social attraction (which would run for approximately 12 hours per day, from dusk to dawn) could also result in impacts to the soundscape. The Open Ocean TIG does not consider these natural sounds to attract birds to be an adverse impact. The anticipated maximum audio range would be 950 to 1,500 feet (290 to 457 meters), depending on the ambient noise, which is similar to the sound level of an active seabird nesting colony. Because Mona Island is uninhabited and experiences minor levels of visitation, the soundscape is dominated by natural sounds, with occasional recreational boating noise. As such, the *Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)* alternative could result in moderate, short- to long-term adverse impacts from helicopters or barges to the soundscape.

The *Predator Removal and Seabird Nesting Colony Restoration in the Culebra Archipelago (non-preferred)* and *Common Tern Nesting Colony Restoration in the Great Lakes Region (non-preferred)* alternatives would include construction activities (a fence and nesting islands, respectively) that could involve the use of heavy machinery (excavators, barges, trucks, etc.) and localized human presence through construction implementation. As such, these alternatives could result in moderate, short-term adverse impacts. All other alternatives proposed in this RP/EA would be expected to result in no more than minor, short-term adverse effects to the soundscape.

Consistent with the PDARP/PEIS and past evaluations of DWH NRDA restoration projects, projects in this RP/EA would result in negligible to moderate, short- and long-term, localized adverse impacts to ambient noise. However, ambient noise for all alternatives would benefit from restored seabird nesting colonies, which contribute to the natural soundscape.

4.3.1.2 Socioeconomic Resources

4.3.1.2.1 Environmental Justice

The intent of an environmental justice evaluation under EO 12898, "Federal Actions to Address Environmental Justice in Minority and Low-Income Populations" (1994) is to identify communities and groups that meet environmental justice criteria and suggest strategies to reduce potential adverse impacts of projects on affected groups. The purpose of EO 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.

Appendix D presents general demographic data for the proposed project locations. The projects in this RP/EA are anticipated to benefit natural resources over the long-term. Project implementation, particularly those including construction activities, is anticipated to result in short-term increases in the demand for employment. While some short-term closures to localized areas could occur during project construction, none of these are anticipated in minority or low-income communities. None of the alternatives evaluated in this RP/EA would create a disproportionately high and adverse impact on minority or low-income populations (see Appendix D for details on this analysis).

4.3.1.2.2 Cultural Resources

Cultural resources are evidence of past human activity and encompass a range of traditional, archaeological, and built assets, including culturally important landscapes and present-day culturally significant uses of the environment. In the U.S., cultural resources include historic properties listed in, or eligible for listing in the National Register of Historic Places (36 C.R.R 60 [(a-d]). The National Historic Preservation Act of 1966 (NHPA), as amended (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 that 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.

As stated in the PDARP/PEIS, all projects implemented under subsequent restoration plans and tiered NEPA analyses consistent with the PDARP/PEIS would secure all necessary state/provincial 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. For some projects included in this RP/EA, the action would involve a study, analysis, or program that would not have the potential to affect cultural resources. For any activities with the potential to affect cultural resources for projects under the jurisdiction of the U.S., all required NHPA Section 106 consultations would be completed before those activities would occur. Coordination with State Historic Preservation Offices regarding the extent and nature of cultural resources at the locations under consideration in this RP/EA is ongoing, including with interested Tribes. The current status of compliance reviews for preferred projects is provided in Section 4.9. For projects located in areas outside of the jurisdiction of the U.S., project implementors will follow all laws and regulations that govern the use of and impacts to cultural resources in the project area. All projects would be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources.

Several project action areas include known or potential cultural resources. The bullets below briefly highlight known sensitive cultural resources located within proposed project areas in this RP/EA and anticipated impacts to cultural resources. Because areas of potential ground disturbance would be surveyed, and any identified cultural resources avoided, project activities are not anticipated to have adverse impacts on cultural resources.

- *Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)*. Mona Island's historical and archaeological resources has led to its designation as a Historic Site by the State Office of Historic Preservation of the Institute of Puerto Rican Culture and as a National Historic Landmark by DOI (PRDNER, n.d.). Over 20 culturally sensitive sites, including historical structures, archaeological sites, and caves and caverns with pictographs, have been identified on Mona Island, representing over 500 years of use of the island. Many of these sites have been subject to vandalism and destruction, particularly from extractive industries present on Mona Island in the late 1800s to early 1900s. One of the most notable historical structures is the Mona Island Lighthouse, located on the east side of the island, which is on the list of Historic Light Stations (Brandeis et al., 2012). The structure was built and first lit in 1900. It was deactivated in 1976 and was listed on the U.S. National Register of Historic Places in 1981. Some ground disruption would occur related to vegetation management, staging and operations for predator management (e.g., clearing for helicopter landing areas), and implementation of social attraction. Proposed sites for these activities would be surveyed for cultural resources prior to implementation, and if cultural resources are found, they would either be avoided, or mitigation measures would be implemented in accordance with NHPA consultations. As such, no adverse impacts to cultural resources are anticipated.
- *Predator Removal and Seabird Nesting Colony Restoration in the Culebra Archipelago (non-preferred).* Archaeological investigations at the Culebra NWR offices on Culebra Island have previously found artifacts (ceramic remnants; shells, stones, and coral; food remains) dating back thousands of years (USFWS, 2012a). However, comprehensive archaeological surveys have not been completed across the NWR (USFWS, 2012a). Ground disruption would occur for social attraction activities and the installation of a predator-proof fence. Social attraction sites would be surveyed for cultural resources, and, if any are found, these activities would be sited elsewhere. The predator-proof fence would be constructed in the footprint of an existing chain-link fence, and no new ground disturbance would occur. As such, no adverse impacts to cultural resources are anticipated.
- *Seabird Nesting Colony Protection and Enhancement at Dry Tortugas National Park (preferred).* DRTO contains numerous historical structures and shipwrecks, with many dating back to the Spanish exploration of the Americas in the 1500s (NPS, 2015). Most notably, Garden Key is the site of the 1800s-era Fort Jefferson, which occupies approximately 16 acres of the Key. Fort Jefferson's masonry has severely deteriorated due to exposure to the marine environment, and DRTO has supported and continues to support historical preservation of the structure (NPS, 2015). Loggerhead Key contains an 1800s-era lighthouse and associated structures and the ruins of an early-1900s marine biology laboratory that are subject to historical preservation efforts. DRTO (listed October 26, 1992) and Fort Jefferson (listed November 10, 1970) are listed on the National Register of Historic Places (NPS, 2020). Primary project activities include monitoring of DRTO's nesting seabird colonies remotely by aircraft or drone, which would have no impact on cultural resources. Project personnel would visit the keys to conduct direct visual monitoring; place passive monitoring surveillance equipment; and conduct biosecurity, social attraction, and vegetation management activities. In general, ground disturbing activities would occur in areas that have been previously surveyed for the presence of cultural resources and/or disturbed by past or ongoing work; however, if work is proposed in undisturbed areas, sites would be surveyed for

cultural resources prior to commencement of ground-disturbing activities and, if any cultural resources are found, these activities would be sited elsewhere. The cultural landscape will be considered in consultation with the State Historic Preservation Officer when planning vegetation management actions. As such, no adverse impacts to cultural resources are anticipated.

- *Common Tern Nesting Colony Restoration in the Great Lakes Region (non-preferred).* Hundreds of culturally and historically important locations around the Great Lakes Region are listed on the National Register of Historic Places (NPS, 2020). Most notable are cultural and historical resources connected to the Great Lake's maritime and shipping heritage, such as historical lighthouses and over 6,000 shipwrecks (Great Lakes Shipwreck Museum, n.d.). To increase stewardship and management of shipwrecks, state- and federally-designated management areas have been established, such as the Thunder Bay and Wisconsin Shipwreck Coast National Marine Sanctuaries. Some ground disruption would occur related to vegetation management, construction of new nesting islands and substrate enhancements, and implementation of social attraction. Proposed sites for these activities would be surveyed for cultural resources prior to implementation, and if cultural resources are found, they would either be avoided, or mitigation measures would be implemented in accordance with NHPA consultations. As such, no adverse impacts to cultural resources are anticipated.
- *Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries (preferred).* Thousands of shipwrecks lie along the U.S. Atlantic coast, representing maritime heritage and U.S. war history (e.g., Revolutionary War, Civil War, World War II). Approximately 60 of these shipwrecks from Florida to Maine have been positively identified as historic wrecks that would be eligible for designation on the National Register of Historic Places. This project would involve shore-based desktop work (e.g., development of new methodologies or techniques for seabird bycatch reduction) or would occur in pelagic waters. Any activities conducted in pelagic waters would not result in an increase in existing commercial fishing activity and would be conducted in areas where activities currently occur. Project activities would not occur in locations where cultural resources have been identified to avoid entanglement with and loss of fishing gear. As such, no adverse impacts to cultural resources are anticipated.
- *Seabird Bycatch Risk Reduction in Gulf of Mexico and Southeast U.S. Atlantic Pelagic Longline Fisheries (non-preferred).* At the end of the eighteenth century and beginning of the nineteenth century, the Gulf of Mexico was an arena of commerce, political unrest, war, and piracy. A variety of Spanish, English, and French vessels from merchants, slavers, smugglers, privateers, or pirates ended up on the bottom of the Gulf because of conflict, weather, or shipworm damage. In the twentieth century, during World War II, 56 German U-boats operated in the Gulf using shipping lanes and navigational beacons to locate and torpedo unsuspecting targets (Brooks et al., 2016). More recently, the wreckage associated with the DWH oil spill marks the graves of 11 workers who died aboard the drilling rig in 2010. Historical records show that there are over 3,200 shipwrecks in the Gulf of Mexico. Just over 700 shipwrecks or likely shipwrecks have been located, mostly from sonar imaging. Approximately 35 of these have been positively identified as historic wrecks that would be eligible for designation on the National Register of Historic Places. This project would involve shore-based desktop work (e.g., development of new methodologies or techniques for seabird bycatch reduction) or would occur in pelagic waters. Any activities conducted in pelagic waters would not result in an increase in existing commercial fishing activity and would be conducted in areas where activities currently occur. Project activities would not occur in locations where cultural resources have been identified to avoid entanglement with and loss of fishing gear. As such, no adverse impacts to cultural resources are anticipated.
- *Northern Gannet Nesting Colony Restoration in Eastern Canada (preferred).* Cultural and historical resources have been documented at four of the six northern gannet nesting sites in

Eastern Canada. Thirteen known archeological sites are located within Anticosti Island Ecological Reserve, which overlaps northern gannet nesting areas on Anticosti Island (Government of Québec, 2020). Baccalieu Island contains an automated lighthouse tower on the northern point of the island and a historic lighthouse on the southern point that is maintained and operated by a lighthouse keeper. Bird Rocks contains a historical lighthouse dating from the 1800s that was renovated and automated in 1988. Finally, numerous historical settlement buildings are located on Bonaventure Island that date back to the late 1700s. These buildings are maintained and operated by Bonaventure and Perce Rock Parks. Some ground disruption would occur related to implementation of social attraction. Proposed sites for these activities would be surveyed for cultural resources prior to implementation, and if cultural resources are found, social attraction would be re-sited. As such, no adverse impacts to cultural resources are anticipated.

- *Common Tern Nesting Colony Restoration in Manitoba (preferred).* Over 100 sites in Manitoba are listed on Canada's Register of Historic Places (2022), including historical structures, archaeological sites, and culturally significant natural features. Most of these sites are located within the greater Winnipeg area. Some ground disruption would occur related to vegetation management, substrate enhancements, and implementation of social attraction. Proposed sites for these activities would be surveyed for cultural resources prior to implementation, and if cultural resources are found, they would either be avoided, or mitigation measures would be implemented. As such, no adverse impacts to cultural resources are anticipated.
- *Seabird Nesting Habitat Restoration and Colony Reestablishment in the Bahamas (non-preferred).* Cay Sal, Conception Island National Park, and San Salvador Island National Parks all contain historical building ruins. Remnants of an abandoned Bahamian immigration building are located on the western side of Cay Sal. Ruins of five buildings dating back to the early 1900s are located on the southwestern end of Conception Island. Archaeological digs across San Salvador Island uncovered village ruins of indigenous Tribes, and the island was the first island Christopher Columbus visited in the Bahamas. The West Coast Marine Park on San Salvador contains a plaque on the seafloor and a white cross on shore to mark where Columbus first landed on the island. The Park is eligible for a United Nations Educational, Scientific, and Cultural Organization World Heritage Site designation. Some ground disruption would occur related to vegetation management and implementation of social attraction. Proposed sites for these activities would be surveyed for cultural resources prior to implementation, and if cultural resources are found, they would either be avoided, or mitigation measures would be implemented. As such, no adverse impacts to cultural resources are anticipated.
- *Invasive Goat Removal to Restore Seabird Nesting Habitat in St. Vincent and the Grenadines (preferred).* Artifacts of indigenous Tribes and ruins of a colonial-era sugar mill have been found on Battowia Island (Howard, 1952). Project activities would not involve ground-disturbance and would avoid the sugar mill. As such, the project would have no effect on cultural resources.

4.3.1.2.3 Infrastructure

Potential impacts to existing infrastructure, including public services and utilities, are expected to be negligible from project activities. Activities that include field surveys 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.

4.3.1.2.4 Land and Marine Management

Project activities proposed in this RP/EA largely do not involve changes in land and marine management. Two projects (*Common Tern Nesting Colony Restoration in the Great Lakes Region [non-preferred]* and *Common Tern Nesting Colony Restoration in Manitoba [preferred[*) may include the establishment of temporary or permanent protected areas for nesting seabirds that could result in minor, short- to long-term adverse impacts to land management. These protected areas would only be established by appropriate regulatory authorities. *Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)* would include temporary tourism and recreational closures to protect public health and safety during predator removal activities; however, these closures would be authorized by the Mona Natural Reserve Manager and are consistent with conservation activities outlined in the Natural Reserve Management Plan. Impacts to tourism and recreation from these closures are analyzed in Section 4.3.1.2.5. The seabird bycatch reduction projects would involve pilot studies with commercial fishing fleets and would not interact with any land use practices or influence change on any management plans of marine managed areas. Any adoption of bycatch reduction strategies would be voluntary and negotiated or arranged with willing parties. Finally, the *Invasive Goat Removal to Restore Seabird Nesting Habitat in St. Vincent and the Grenadines (preferred)* project would involve a permanent change in land management. The Pillories Islands are managed by a private entity. Currently, community members are able to free range their goats on the Islands. However, following project implementation, free-ranging goats would no longer be allowed, which is anticipated to result in moderate, long-term adverse impacts. Multiple projects would experience long-term benefits by providing resources to hire reserve managers and/or conduct stewardship and management actions (e.g., invasive species management) in accordance with published management plans.

4.3.1.2.5 Tourism and Recreation

Project activities proposed in this RP/EA largely would not adversely impact tourism and recreation due to the scope of project activities and locations (e.g., open ocean, uninhabited islands). Two projects (*Common Tern Nesting Colony Restoration in the Great Lakes Region [non-preferred]* and *Common Tern Nesting Colony Restoration in Manitoba [preferred]*) may include the establishment of temporary or permanent protected areas for nesting seabirds that could result in minor, short- to long-term adverse impacts to tourism and recreation. Two projects (*Predator Removal and Seabird Nesting Colony Restoration at Mona Island [preferred]* and *Predator Removal and Seabird Nesting Colony Restoration in the Culebra Archipelago [non-preferred]*) would include temporary tourism and recreational closures to protect public health and safety during predator removal activities, which would result in minor, short-term adverse impacts. Finally, the *Predator Removal and Seabird Nesting Colony Restoration at Mona Island [preferred]* project includes live traps used for predator control activities that may impact non-target, important recreational hunting species, such as goats. If any goats are caught, they would be released safely. Lethal traps, such as snares, may also adversely impact goats. In this case, the traps would be sited in areas that are less likely to be used by goats, and more likely to be used by pigs, when possible, to minimize impacts to goats. However, there would likely be some non-target species caught in lethal traps which would result in minor, long-term adverse impacts on recreationally-important non-target species such as goats. However, populations are expected to recover once all project activites are complete. All projects would provide long-term benefits to tourism and recreation by increasing seabird populations that contribute to nature-based tourism and wildlife viewing.

4.3.1.2.6 Fisheries and Aquaculture

Chapter 6 of the PDARP/PEIS (Section 6.4.5.4.3) found that impacts from projects intended to incentivize Gulf of Mexico commercial fishermen to increase gear selectivity and environmental stewardship were described as having the potential to result in benefits and minor to moderate, short- to long-term adverse impacts to socioeconomic resources. Additional analyses of the project specific activities indicated that adverse impacts to socioeconomics are not anticipated; rather, benefits should occur. The two bycatch projects, *Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries (preferred)* and *Seabird Bycatch Risk Reduction in Gulf of Mexico and Southeast U.S. Pelagic*

Longline Fisheries (non-preferred), involve the use of fishing vessels for field studies and data collection related to seabird fishery interactions; however, these activities are unlikely to have any adverse impacts on fisheries and aquaculture since there would be no increase in fishing vessels as a result of this project (project personnel would observe interactions on existing vessels). Further, participation in any project activities would be voluntary and fishing operations are already permitted. In summary, no adverse impacts on fisheries or aquaculture associated with these projects are expected.

No commercial fisheries or aquaculture operations in project areas would be adversely affected by the other projects proposed in this RP/EA in the short- or long-terms. Recreational fisheries are analyzed as part of Tourism and Recreation.

4.3.1.2.7 Marine Transportation

Most alternatives under consideration in this RP/EA would not affect marine transportation due to their locations and scope. Marine transportation, including marine vessel-traffic patterns, navigation channels, public services, or utilities that support those activities, has the potential to be affected by implementation of the *Common Tern Nesting Colony Restoration in the Great Lakes Region (non-preferred)* alternative. Lacustrine islands would be constructed and/or enhanced. However, island siting would occur in future phases of the project, and planning activities would consider marine transportation routes to avoid impacts.

For *Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)*, barges would be used to transport equipment to the island; however, barge operations would be consistent with the current level of use and conducted using existing navigational channels and moorings. As such, the Open Ocean TIG does not anticipate any adverse impacts to marine transportation from this or any alternative in this plan.

4.3.1.2.8 Aesthetics and Visual Resources

Proposed restoration activities would primarily restore or preserve natural landscapes (e.g., island building, predator and invasive plant removal, seabird colony restoration/expansion). No facilities or tower construction, large-scale land clearing, or other related activities are proposed. One project, *Predator Removal and Seabird Nesting Colony Restoration in the Culebra Archipelag*o (non-preferred), includes construction of a predator-proof fence across the Flamenco Peninsula in perpetuity. Although a chain-link fence already exists at the site, the new predator-proof fence would be taller to prevent predators from climbing over and would contain finer mesh to keep small rodents from moving through the fence links. The new predator-proof fence would be painted green to help it blend into the view scape (Hawaii Department of Land and Natural Resources, 2009). As such, minor adverse impacts to aesthetics and visual resources are anticipated over the long term (compared to what currently exists at the site) and long-term benefits are anticipated from the increase in biodiversity following seabird restoration.

Additionally, many of the proposed locations are uninhabited (e.g., open ocean, remote islands) and beyond the sight of visitors. Projects that include predator and goat removal activities may result in minor, short-term adverse impacts due to cages and/or traps and predator carcasses near project areas. However, cages and/or traps would be placed out of sight to the extent possible to discourage human interference, and carcasses would be properly disposed of according to local regulation. The view scape would experience long-term benefits from social attraction activities and restored seabird colonies.

4.4 Environmental Assessment for Projects in Locations Under the Jurisdiction of the United States

4.4.1 Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)

This project would restore nesting seabirds through vegetation management, predator removal, social attraction activities, and biosecurity measures[40] to enhance and reestablish seabird nesting colonies on Mona Island, Puerto Rico. Project activities most relevant to the assessment of environmental consequences include:

- **Vegetation management**. Invasive plants would be removed by hand and with the use of chainsaws in the coastal plains area (southwest portion) of the island. Native plants would be propagated and planted by hand.
- **Predator removal by trapping or hunting**. Predators, including feral cats and pigs, would be eradicated from the island by trapping and hunting methods using the most humane approaches possible. Feral cat and pig eradication activities would be informed by the more than 10 years of planning and field trials that have been conducted by project partners and available information on innovative approaches. Through these planning efforts, project partners have evaluated the most effective eradication methods and developed BMPs to reduce impacts to non-target species, particularly ESA-listed species. Project partners would employ these lessons learned and BMPs during project implementation.
    - Feral cat (*Felis catus*) eradication could include the use of padded leg hold and cage traps, hunting, and sentinel cats. Traps would be placed around the island year-round for approximately 18 months. Traps would be checked for any captured animals approximately daily (either directly by project personnel or though remote monitoring tools such as radio telemetry transmitters or cameras). Trapped cats would be humanely euthanized on site using an air rifle or possibly using chemical euthanasia or carbon dioxide asphyxiation (only chemicals that would not contaminate scavengers of the carcasses would be used). Carcasses would be left in place or moved out of obvious sight to decompose, which would occur within days given the climate. Hunting dogs could help locate cats for handlers (i.e., not kill the cats) in locations and circumstances where it would be effective and where it would not injure the dogs (e.g., hunting dogs would not be used in areas with heavy occurrence of cacti or sharp rocky terrain). Hunting could occur year-round until feral cats are eradicated. Up to six teams of one to four trained dogs could be used; the dogs would have GPS collars to allow the handler to know the location of each dog and recall them as needed. Some trapped feral cats, "sentinel cats," would be sterilized, fitted with radio collars, and released to track and identify remaining populations of feral cats on the island. Up to 50 sentinel cats may be collared and released.

[40] For the purposes of this RP/EA, biosecurity measures refer to actions taken to reduce the risk of (re)introduction of invasive species such as rodents, cats, pigs, or other invasive species that harm seabirds and seabird habitat. Such actions may include but are not limited to education and outreach, monitoring for invasive species presence using game cameras or chew tags, and placing baited or rodenticide traps if incursions occur.

- Feral pig (*Sus scrofa*) eradication would include the use of trapping, hunting, and sentinel pigs. Live traps (pig brigs, walk-in traps), in addition to lethal snares where applicable, could be used for approximately 6 months at a time and placed anywhere around the island where pigs are suspected to be present. Snares, in particular, could be used only if appropriate mitigation measures for non-target species can be identified. As noted above for cats, traps would be checked for any caught animals approximately daily. Trapped pigs would be humanely euthanized on site (likely using an air rifle or rifle, but possibly using chemical euthanasia or carbon dioxide asphyxiation) and carcasses would be left in place or moved out of obvious sight to decompose, which would occur within days. Hunting could occur year-round until feral pigs are eradicated and could occur by land or by air with a helicopter. Hunters would only use non-toxic (i.e., non-lead) shot, and as such, adverse impacts from shot are not anticipated. Ground-based hunting would occur day and night and could be assisted by hunting dogs. Up to six teams of one to four trained dogs could be used to locate the pigs for the handlers (i.e., dogs would not kill the pigs, only locate them). The dogs would have GPS collars to allow the handler to know the location of each dog and recall them as needed. As with cat hunting, dogs would only be used for hunting pigs in locations and circumstances where it would be effective and where it would not injure the dogs. The use of helicopters for pig eradication could take place yearly as necessary for approximately 4 to 6 months at a time. Helicopter-based hunting could occur in the early morning, late afternoon, or early evening, and would only be conducted where necessary, in areas that would avoid disturbing non-target native species if possible. Flight scheduling and operations would be timed and designed to minimize impacts to sensitive species in or near hunting areas such as yellow-shouldered blackbirds and seabirds. To the extent possible, helicopter use would be minimized during peak nesting season and other times with high densities of seabirds. Finally, some trapped feral pigs would be sterilized, fitted with radio collars, and released as "sentinel" pigs to track and identify remaining populations of feral pigs on the island. Up to 50 sentinel pigs may be collared and released. Additionally, female sentinel pigs would be given an estradiol implant (an estrogen hormone used to induce estrus or estrus behavior) to attract more males for eradication.

- **Predator removal via rodenticide**. After the cat and pig eradication, rodents could be eradicated using an anticoagulant rodenticide, applied through aerial application, hand broadcast, and/or bait stations. Field trials (e.g., with non-toxic inert bait) and other planning efforts may be conducted during the initial stages of this project activity to help design later application stages. These planning efforts would help determine optimal bait application rates and better understand impacts to non-target species before widespread application occurs. The rodenticide would be applied at a rate necessary to achieve rodent eradication, while limiting exposure in the environment as much as possible; this would likely include up to three island-wide applications. Aerial broadcast could be used in emergent land areas, including camp areas; bait stations would be distributed in high-use areas and buildings; hand broadcast would be used around coastal areas and where optimal coverage could not be achieved through aerial broadcast (e.g., caves, overhangs). Brodifacoum and diphacinone are both anticoagulant rodenticides registered for conservation purposes and approved by USEPA for use on islands. Brodifacoum is proposed for use in this project because it is more acutely toxic to rodents, thereby reducing the amount of time the bait needs to be available in the environment for rodent consumption and increasing the probability of success in the large-scale rodenticide application necessary for this project. Grain bait pellets are also desirable and palatable to rodents, increasing the probability that every rodent on the island will consume the bait (USFWS, 2016). Diphacinone is more appropriate for use in smaller-scale applications where the bait can remain in the environment for longer. Although the higher toxicity of brodifacoum poses an increased risk for adverse impacts to non-target species, measures would be employed to minimize impacts (as described in the environmental consequences discussion below). See Appendix F for more information on rodenticides.

- **Operations, staging, and monitoring.** As much as possible, existing trails, camps, and helicopter landing areas would be utilized to transport staff and materials around the island. These existing trails, camps, and helicopter landing areas may need enhancing and/or additional maintenance (e.g., to clear branches and vegetation from trails and open areas). If necessary, new trails, camps, and helicopter landing areas would be created to support the movement and staging of materials and staff. Up to three temporary camps (approximately 1,600 square feet [150 square meters] each) could be used near Uvero Beach, the lighthouse, and Cerezos (the center of the island). These temporary camps may require the installation of an above-ground composting restroom, but this would not require ground-disturbance. Three existing helicopter landing areas could be re-cleared and up to three new ones could be cleared, if needed (up to 2,100 square feet [200 square meters] total). If new helicopter landing areas are needed, these would be sited in areas that are already open to minimize any native vegetation removal. New trails would include trails for ATVs and foot-traffic and would not be excavated or paved; the creation of any new trails would be subject to approval from PRDNER, and plans would be put in place to minimize and avoid any native vegetation disturbance, to the extent possible. A system of game/trail cameras would be installed to detect invasive rodents and feral cats and pigs for monitoring purposes. A remote trap monitoring system would be installed to immediately detect trapped animals and allow for quick release of non-target species and humane euthanasia of target species. Environmental DNA (eDNA) would be collected via swabs of plant surfaces to detect pig presence. Finally, up to three drones would be used regularly over the island for 2 years to detect animals with thermal cameras; to remotely check trap monitors and radio collared animals; to map the island; and to potentially apply rodenticide bait to inaccessible areas.
- **Social attraction**. Bird and egg decoys, mirrors, and sound systems would be installed during nesting season in suitable nesting habitat for target species to attract seabirds to recolonize the island. All materials would be installed manually. Decoys (made of recycled, high-density polyethylene and painted to look like target species) would be installed using high strength anchoring epoxy. Mirrors (approximately 12 inches by 6 inches [30 centimeters by 15 centimeters]) and sound systems (amplifier, charge controller, MP3 player, speakers, solar panels, and marine batteries) would be bolted to rocks using hand tools. Social attraction materials would be removed after each nesting season, if possible, and would be removed after project completion.
- **Biosecurity measures**. To prevent the (re)introduction of invasive species (e.g., plants and mammals), a biosecurity plan would be developed and implemented. Measures may include vessel inspections, education and outreach, use of network surveillance cameras near landing areas, baiting cameras with non-toxic bait to lure species and increase detection rates, deployment of chew tags in high-use areas to detect rodents, and deployment of traps (e.g., snap traps) and rodent bait stations if evidence of rodents is found.

4.4.1.1 Affected Environment

This project would occur on Mona Island, a Natural Reserve (designated 1986), Marine Protected Area (expanded in 1997), and National Natural Landmark (designated in 1975). Mona Island is a 13,400-acre tropical island located 41 miles (66 kilometers) west of mainland Puerto Rico and 36 miles (58 kilometers) east of the Island of Hispaniola (Figure 2-2). PRDNER oversees visitor management and natural resources within the reserve. This project proposes to complete predator removal activities (feral cat, pig, and rodent eradication) and restore seabird nesting colonies via social attraction across Mona Island.

The PRDNER *Plan de Manejo y Conservación para la Reserva Natural Islas de Mona y Monito* (Management and Conservation Plan for the Mona and Monito Islands Natural Reserve) (PRDNER, n.d.) provides extensive information about the physical, biological, and socioeconomic resources within Mona Island and is incorporated by reference herein and summarized below.

4.4.1.1.1 Physical Resources

Geology and Substrates and Water Quality

Mona Island is a relatively flat limestone karst plateau with a maximum elevation of approximately 250 feet (76 meters) (Brandeis et al., 2012). The island contains over 20 miles (32 kilometers) of coastline, with the majority comprising sharp cliffs over 200 feet (61 meters) high. Many of these cliffs are interspersed by naturally formed caves that run horizontally throughout the karst. Mona Islands sits within the Mona Passage, which separates the Caribbean Sea from the Atlantic Ocean. Within its location in the sub-tropics, the trade winds heavily influence local air and water currents, with the northeastern portion of the island facing the windward direction. Additionally, the trade winds largely result in the movement of water from the Atlantic Ocean to the Caribbean Sea through the Mona Passage.

As a tropical island, seasonal fluctuations on Mona are dominated by a wet and dry season. Within the rainy late summer and fall months, Mona has a relatively dry climate compared to other Caribbean islands. No natural freshwater sources exist on the island, and natural surface rain collection is scarce due to the well-drained calcareous soils and limestone karst. Some rainwater will accumulate for days to weeks in naturally formed depressions at the surface, but most water drains and accumulates in deposits within the limestone karst or into the freshwater aquifer lens on top of the underlying sea water.

4.4.1.1.2 Biological Resources

Mona Island is a biodiversity haven within Puerto Rico, with a wide variety of plants and animals that are threatened by invasive species. The island is home to numerous endemic species and several ESA-listed species, including the endangered yellow-shouldered blackbird (*Agelaius xanthomus*), endangered hawksbill sea turtle (*Eretmochelys imbricata*), endangered leatherback sea turtle (*Dermochelys coriacea*), threatened Mona boa (*Epicrates monensis monensis*), threatened Mona ground iguana (*Cyclura stejnegeri*), and threatened higo chumbo cactus (*Harrisia portoricensis*).

Habitats

Mona Island is primarily a tropical dry forest terrestrial ecosystem, characterized by long drought seasons and low annual rainfall. Approximately 90 percent of the island's uplands are covered in tropical dry woodland forests and shrublands on the karst outcrop (Brandeis et al., 2012). Small amounts of coastal plains (including sandy beaches and rocky coastline) exist along the western and southern coastlines, and red mangroves (*Rhizophora mangle*) are present along the northwest portion of the island (PRDNER, n.d.). Coastal plains in the southwestern portion of the island are characterized by coastal shrubs; this area was cleared in the 19th century for timber plantations and livestock grazing but has since naturally regrown. Beach grape (*Coccoloba uvifera*) and beach vine (*Ipomoea pescaprae*) are both found on sandy beaches. Over 400 plant species have been documented on Mona Island. Sensitive vegetation species include Sargent's cherry palm (*Pseudophoenix sargentii var. saonae*), holywood (*Guaiacum sanctum*), Mona orchid (*Psychilis monensis*), and black bush (*Caesalpinia portoricencis*). The upper limestone platform contains shrubs (e.g., *Chamaesyce cowellii*), vines (e.g., *Cynanchum monense*), prickly pear cactus (e.g., *Opuntia moniliformis*), spurges (e.g., *Chamaesyce monensis*), and the ESA-listed higo chumbo cactus.

Mona Island's coastal marine habitats consist of edge and patch reefs, groove and spur reefs, underwater caverns, and rocky reefs. The southern and western portions of the island contain shallow (less than 20 feet deep) coastal lagoons enclosed by coral reef structures (NOAA, 2019; PRDNER, n.d.). ESA-listed elkhorn (*Acropora palmata*), staghorn (*Acropora cervicornis*), and boulder star (*Orbicella franksi*) corals are known to be present in these reef areas, and the waters around Mona Island are designated as critical habitat for elkhorn and staghorn coral. The coastal lagoons and coral reefs provide protection for more than 50 marine plants, including seagrass species such as turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), and shoal grass (*Halodule wrightii*) (NOAA, 2015; PRDNER, n.d.). The northern coast of the island has strong currents and is characterized by vertical submarine walls with kelp forests, corals, and sponges. The waters immediately adjacent to the island are categorized as estuarine and marine deep waters (USFWS, 2022). Beyond the immediate coastal terrace, water depths drop quickly to more than 1,800 feet (549 meters). Waters up to 9 nautical miles (16 kilometers) from Mona are part of the Mona Marine Protected Area.

Wildlife Species

Birds

Mona Island has been identified as an Important Bird Area by BirdLife International. Over 110 bird species have been documented on Mona Island, with represented groups including seabirds, raptors, aquatic coastal foragers (e.g., shorebirds), insectivores, canopy foragers, omnivores, frugivores, and granivores. Over 40 of these species are wintering migrants, typically present between November and February, such as a subspecies of peregrine falcon (*Falco peregrinus anatum*), songbirds, and cormorants. The Puerto Rican archipelago, including Mona Island, supports 16 seabird species, five of which are year-round residents (red-footed booby [*Sula sula*], brown booby [*Sula leucogaster*], masked booby [*Sula dactylatra*], magnificent frigatebird [*Fregata magnificens*], and brown pelican [*Pelecanus occidentalis*]). These seabird species nest in a variety of habitats across the island, including cliff-side caves within the limestone karst. A large red-footed booby nesting colony forms yearly along the northern coast of the island (Cabo Norte). Of the terrestrial-foraging birds, four are endemic to Puerto Rico and/or Mona Island: a subspecies of the granivorous common ground-dove (*Columbina passerine exigua*), locally known as the Mona Island roll; the Puerto Rican vireo (*Vireo latimeri*), or locally, the bienteveo; the Puerto Rican Antillean bobito (*Contopus portoicensis*); and the ESA-listed yellow-shouldered blackbird. The Puerto Rican vireo, the Puerto Rican Antillean bobito, and the ESA-listed yellow-shouldered blackbird are all insectivorous and primarily inhabit the shrublands present on the upper limestone karst.

Herpetofauna

There are 11 herpetofauna species that that live on Mona Island, nine of which are endemic. Of these 11 species, there are two snakes (Mona racer [*Borikenophis variegatus*] and the ESA-listed Mona boa); one blind snake lizard (Mona blindsnake [*Atillotyphlops monensis]*); one amphibian (Mona coqui [*Eleutherodactylus monensis*]); and six lizards (Tropical house gecko [*Hemidactylus mabouia*, native, not endemic], Mona geckolet [*Sphaerodactylus monensis*], Mona anole [*Anolis monensis*], Mona skink [*Spondylurus monae*], Mona ground lizard [*Pholidoscelis alboguttatus*], and the ESA-listed Mona ground iguana). All herpetofuna species are broadly distributed throughout the island's habitats. The three snake species are carnivorous, with the Mona boa feeding on invasive black rats (*Rattus rattus*) among other species. The amphibians and lizards are primarily insectivorous, although the Mona ground iguana is primarily herbivorous.

Terrestrial mammals

The only native terrestrial mammals present on Mona Island are frugivorous and insectivorous bats that live within subterranean limestone caves. The five species present include the Parnell's mustached bat (*Pteronotus parnellii*), Leach's single leaf bat (*Monophyllus redmani*), the velvety free-tailed bat (*Molossus molossus*), the Jamaican fruit bat (*Artibeus jamaicensis*), and the Antillean ghost-faced bat (*Moormoops blainevillii*). The greater bulldog bat (*Noctilio leporinus*), a piscivorous bat that is known to consume crabs, was historically reported on Mona Island but has not been confirmed in recent surveys (Rodríguez-Durán and Padilla-Rodríguez, 2010).

During the 1800s and early 1900s, Mona Island was used for extractive purposes such as guano mining, hunting, timber planting, and raising of livestock. Residents introduced a variety of invasive mammals (black rats, feral cats, feral goats [*Capra aegagrus hircus*], feral pigs) both unintentionally and intentionally (e.g., for hunting, food). As human habitation ceased on Mona Island, these invasive populations grew exponentially due to the lack of natural predators and management ability, impacting native wildlife through direct predation and habitat damage from foraging activities.

Marine and Estuarine Fauna

<u>Marine mammals and sea turtles</u>
Marine mammals have not been documented within the immediate coastal zone of Mona Island. However, nine species of marine mammals are known to inhabit or traverse the deeper waters within the Mona Marine Protected Area: humpback whales (*Megaptera novaengliae*) (present January through March), short-finned pilot whales (*Globicepephala macrorhyncha*), short-beaked common dolphins (*Delphinus delphis*), Cuvier's beaked whales (*Zyphius cavirostris*), killer whales (*Orcinus orca*), Atlantic spotted dolphins (*Stenella frontalis*), spinner dolphins (*Stenella longirostris*), and ESA-listed sperm whales (*Physeter macrocephalus*) and fin whales (*Balaenoptera physalus*) (PRDNER, n.d.).

ESA-listed hawksbill, green (*Chelonia mydas*), and leatherback sea turtles have been documented in the marine habitat surrounding Mona Island, with green sea turtles foraging in seagrass beds and hawksbill sea turtles foraging on sponges in the coral reef and submarine cliff habitats. Mona Island serves as a significant nesting site for hawksbill sea turtles, which nest year-round (with a peak in August and September) on the sandy beaches along the southwestern to southern shorelines. Green sea turtles also nest on occasion on Mona's sandy beaches.

<u>Fish</u>
Mona Island's coral reef system supports approximately 300 species of marine fish. Important recreational and commercial fishing species that inhabit waters around the island include the queen conch (*Strombus gigas*), Caribbean spiny lobster (*Panulirus argus*), black sea urchin (*Diadema antillarum*), sea cucumber (*Cittarium pica*), crabs, groupers (including the Nassau grouper [*Epinephelus striatus*]), and snappers. The waters and reefs surrounding Mona Island are federally-designated Essential Fish Habitat (EFH) for ten species: blue marlin (adult) (*Makaira nigricans*), Caribbean reef shark (*Carcharhinus perezi*; all life stages), oceanic whitetip shark (*Carcharhinus longimanus*; all life stages), white marlin (*Tetrapturus albidus*; adult, juvenile), yellowfin tuna (*Thunnus albacares*; spawning, eggs, larval), corals (post-egg, larval), queen conch (post-egg, larval), spiny lobster (post-egg, larval), reef fish (post-egg, larval), and longbill spearfish (*Tetrapturus pfluegeri*; all life stages).

Protected species
A list of federally threatened, endangered, proposed, candidate, and other species of concern for this site, as identified through USFWS IPaC (USFWS, 2022) and the National Marine Fisheries Service's (NMFS) ESA species list (NMFS, 2022b), is presented in Appendix E. Mona Island has been federally designated as critical habitat for the yellow-shouldered blackbird, Mona boa, Mona ground iguana, elkhorn coral, staghorn coral, and hawksbill sea turtle (marine and terrestrial). As noted above, the ESA-listed higo chumbo cactus is also found on the island.

4.4.1.1.3 Socioeconomic Resources

Evidence of human inhabitation of Mona Island dates to pre-Columbus exploration. From the 1800s through its designation as a Natural Reserve in 1985, Mona Island was used for a variety of extractive activities such as guano mining, timber plantations and harvesting, military bomb practice, and livestock raising. The only structure that exists pertaining to these historical uses is the Mona Island Lighthouse, located on the east side of the island, which is on the list of Historic Light Stations (Brandeis et al., 2012).

The structure was deactivated in 1976 and was listed on the U.S. National Register of Historic Places in 1981.

With its current designation as a Natural Reserve, Mona Island contains only a few permanent structures to support the Reserve's management and tourists. PRDNER owns and maintains a small airstrip located in the southwest corner of the island for official and/or emergency use. Dock facilities, restrooms, cabins, and a research center are located at Sardinera Beach in the southeast corner of the island. There are no permanent residents on Mona; however, PRDNER staff may stay on the island for weeks to months, and the island is open to the public for restricted recreational activities such as hiking and camping, specifically on Pájaros and Sardinera beaches. All visitors must obtain a permit, and up to 100 visitors are allowed on the island at a time. Camping is only allowed from May to November. Members of the public are allowed to access the island to hunt feral pigs and goats from December to April. Mona Island is the only location in Puerto Rico where big game hunting is permitted. Hunting game provides recreational opportunities while also reducing the impact of game on the island's natural environment. Hunting is not for subsistence, and meat from Mona may not be transported into Puerto Rico because of brucellosis. In 2018, between January and February, 202 hunters invested more than 5,000 hours hunting and captured approximately 291 goats and nine pigs (PRDNER, 2018). All staff and visitors access Mona Island via boat.

4.4.1.2 Environmental Consequences

The following evaluation of the environmental consequences of this proposed project incorporates by reference existing NEPA analyses of predator removal activities in the Southeastern U.S. and Puerto Rico. USDA-APHIS-WS previously analyzed invasive mammal removal in Puerto Rico through trapping and hunting in their *Environmental Assessment for Managing Damages Caused by Mammal and Reptile Species in Puerto Rico* (herein referred to as the "USDA EA"; USDA, 2021). The USDA EA concluded that trapping and hunting of mammalian predators would have no effect on physical resources and could result in minor to moderate, short-term adverse impacts to biological resources (primarily non-target species) from increased human activity and the potential to capture non-target species. The USDA EA also concluded that adverse impacts to socioeconomic resources from trapping and hunting are unlikely, but there is a potential for minor, short-term adverse impacts to human health and safety from potential interactions with carcasses or traps in the environment; given these activities would be conducted by trained personnel in areas with minimal human activity, the risk of adverse impacts is low.

In addition to the USDA EA, this analysis incorporates previous DWH predator removal environmental assessments, including the *St. Vincent National Wildlife Refuge Predator Control* project from the Florida TIG's first post-settlement RP/EA (FL TIG, 2019) and the *Northeast Florida Coastal Predation Management* project from the FL TIG's second RP/EA (FL TIG, 2021). These analyses concluded that the projects, which include trapping and hunting of predators, would have negligible impacts on physical resources from human disturbance, minor short-term adverse impacts on biological resources also from increased human disturbance and potential trampling of vegetation during project implementation, no adverse impacts on socioeconomic resources, and long-term benefits to biological resources from increased biodiversity of native species.

USFWS previously analyzed rodent eradication via aerial application and hand broadcast of rodenticide in their *Environmental Assessment for Restoration of Habitat on the Desecheo National Wildlife Refuge through the Eradication of Non-Native Rats* (herein incorporated by reference and referred to as the Desecheo EA; USFWS, 2016). The Desecheo EA concluded that rodent eradication would have no effect on physical resources; moderate, short-term adverse impacts to biological resources due to increased human activity and the potential for rodenticide to impact non-target species; and minor, short-term adverse impacts to socioeconomic resources such as human health and safety from human interaction with rodenticide. The above-referenced EAs concluded that physical, biological, and socioeconomic resources would benefit from predator removal and/or eradication activities. Table 4-1 indicates the locations within this RP/EA where the reader can find detailed analyses of this project's impacts on physical, biological, and socioeconomic resources.

Table 4-1 NEPA Analysis by Resource for *Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)*

Resource	Location of Analysis in Chapter 4
Physical Resources	
Geology and Substrates	Analyzed in Section 4.4.1.2.1
Hydrology and Water Quality	Hydrology: Analyzed in Section 4.3.1 (Resources with Similar Impacts Common to All Alternatives) Water Quality: Analyzed in Section 4.4.1.2.1
Air Quality	Analyzed in Section 4.3.1
Noise	Analyzed in Section 4.3.1
Biological Resources	
Habitats	Analyzed in Section 4.4.1.2.2
Wildlife Species	Analyzed in Section 4.4.1.2.2
Marine and Estuarine Fauna	Analyzed in Section 4.4.1.2.2
Protected Species	Analyzed in Section 4.4.1.2.2
Socioeconomic Resources	
Socioeconomics and Environmental Justice	Socioeconomics: Analyzed in Section 4.4.1.2.3 Environmental Justice: Analyzed in Section 4.3.1
Cultural Resources	Analyzed in Section 4.3.1
Infrastructure	Analyzed in Section 4.3.1
Land and Marine Management	Analyzed in Section 4.3.1
Tourism and Recreational Use	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
Public Health and Safety	Analyzed in Section 4.4.1.2.3

4.4.1.2.1 Physical Resources

Vegetation Management

Upland soils would be disturbed during mechanical removal of invasive plants and subsequent planting of native vegetation, though adverse impacts would be minor and short-term, resolving as plants take root. Increased foot traffic during invasive removal activities (hand removal or through use of chainsaws), would disturb substrates in the short-term, and could have negligible to minor adverse impacts on water quality from sedimentation caused by ground disturbance from plant removal and from foot traffic during transit. Removing invasive plants and planting native vegetation would result in long-term benefits to the island's physical resources, and would reduce erosion, which also benefits water quality.

Predator Management by Trapping or Hunting
Consistent with the USDA EA, trapping and hunting predator removal activities would not adversely impact physical resources (USDA, 2021). In most cases, cat and pig carcasses would be left in place to avoid additional disturbance and to allow for natural decomposition. Euthanasia and hunting activities would not involve any chemicals or lead shot that could contaminate soils or water.

Predator Management using Rodenticide
Brodifacoum rodenticide application would result in negligible to minor, short-term adverse impacts to physical resources. Minimal disturbance to upland soils could occur during staging, from hand broadcast of rodenticide, during the deployment of bait stations, or during post-application monitoring. However, rodenticide application is unlikely to contaminate soils. In previous rodent eradication projects, post-application monitoring has not found lingering brodifacoum residue in soils (USFWS, 2016). Rodenticide application is also unlikely to impact water quality. Measurable levels of brodifacoum are unlikely to be found in the water column after use due to its low solubility and strong chemical affinity to the grain in bait pellets. During the 2012 eradication of rodents on Desecheo NWR, no brodifacoum residue was found in nearshore or offshore waters prior to or after applications (USFWS, 2016).

Operations, Staging, and Monitoring
Staging and operations, including the use and enhancement of existing (and limited creation of new, if needed) trails, camp areas, and helicopter landing areas, are likely to result in minor, long-term adverse impacts to geology and substrates over the approximately 6 years during which project personnel would be implementing the project and monitoring activities. Impacts would be minor because existing disturbed areas would be utilized whenever possible. Any new trails, camp areas, and helicopter landing areas would be sited in previously disturbed areas, involve limited tamping of soil (but no paving), and would be located in open areas when possible to avoid clearing native vegetation. Further, any of these new trails or staging areas would avoid sensitive resources and would be subject to approval from the PRDNER. Up to three temporary camp areas would be staged in previously cleared and disturbed areas and would not further disturb soils. New temporary camp areas may require above-ground composting restroom facilities, but these would not require ground disturbance. Three existing helicopter landing areas could be re-cleared, subject to the approval of PRDNER, and three new helicopter landing areas could be cleared in previously disturbed or cleared areas if possible in the following areas: one around Cerezos (the center of island), one in the northwest near the small lighthouse, and one in the northeast near the red-footed booby colony. These clearings could result in minor, long-term adverse impacts to physical resources. Monitoring activities, including installing game/trail cameras, installing a remote trap monitoring system, collecting eDNA from plant surfaces, remotely checking trap monitors and radio collared animals, mapping the island, and potentially applying rodenticide bait to inaccessible areas would result in negligible to minor, short-term adverse impacts to geology and substrates disturbed by project personnel transporting equipment and installing cameras and monitors. Since all operations, staging, and monitoring would occur from land, no impacts to water quality are anticipated.

Social Attraction and Biosecurity Measures
Social attraction activities (bird and egg decoys, mirrors, sound systems) and the implementation of biosecurity measures would not result in any adverse impacts to water quality, geology, or substrates. Manual deployment of decoys and mirrors would ensure soils are only minimally disturbed in the short-term; disturbance would result from foot traffic to and from the site to deploy these devices. The deployment of cameras, chew tags, and traps and bait stations (if needed to respond to incursions from invasive species) would also occur manually to ensure minimal disturbance to physical resources.

Summary
In summary, this project is anticipated to result in negligible to minor, short- to long-term (over the life of the project) adverse impacts and long-term benefits to physical resources.

4.4.1.2.2 Biological Resources

Vegetation Management
All vegetation management activities would occur on land and would not impact marine and estuarine fauna. Removal of invasive plants and planting of native vegetation could negatively impact terrestrial habitats (including vegetation) and wildlife during implementation due to trampling, human activity, and noise. Invasive plants would be removed by hand, if possible, with limited use of chainsaws where needed. Project staff would implement BMPs for working in sensitive areas, such as moving slowly and deliberately to avoid frightening birds and other animals, traveling carefully by foot, avoiding use of machinery, and avoiding sensitive areas when possible. As such, any adverse impacts would be minor and short-term. Removal of invasive plant species and planting native vegetation in the project area would have long-term benefits to biological resources by enhancing habitat quality.

Predator Management by Trapping or Hunting
Marine habitats and wildlife are unlikely to be impacted by trapping and hunting activities. Project staff would access the island via existing passages, buoys, and docks to avoid disturbing the marine environment. All trapping and hunting would occur on land or by air. Activities would be conducted during the day, and any night activities would be limited to reduce disturbance to nocturnal species and limit light pollution on sea turtle nesting beaches.

Terrestrial habitats and wildlife are likely to experience minor to moderate, short- to long-term adverse impacts from project activities. Consistent with the USDA EA, trapping and hunting predator removal activities could result in minor to moderate, long-term adverse impacts to terrestrial habitats and wildlife, including protected species, due to increased human and dog activity (for land-based dog assisted hunting for cats and pigs), increased noise from human presence and take-off and landing of helicopters, trampling of vegetation, and accidental trapping of non-target species (USDA, 2021). Cat and pig removal would be partially or wholly completed prior to rodent removal (see below). Cat and pig carcasses would be left in place to reduce further disturbance, unless present in a sea turtle or Mona iguana nesting area, in which case the carcass would be removed to avoid attracting predators. Euthanasia and hunting activities would not involve any chemicals that could contaminate scavengers of the carcasses. For all hunting activities, hunters would only use non-toxic (i.e., non-lead) shot. For hunting assisted by dogs, dogs would only be used to help locate cats or pigs for the handlers. Further, dogs would only be used in locations and circumstances where it would be effective and where it would not injure the dogs (e.g., hunting dogs would not be used in areas with heavy occurrence of cacti or sharp, rocky terrain).

For all live trapping activities, BMPs would be employed to minimize the risk of accidentally trapping terrestrial birds, reptiles, mammals, and amphibians, including protected species. BMPs could include using the most selective methods for target species, using attractants that are specific to target species, and placing traps in areas that avoid exposure to non-target species (USDA, 2021). For example, leg-hold traps would be placed above-ground (e.g., attached to trees or on elevated buckets), to the greatest extent possible, to avoid trapping of non-target species. If leg-hold traps are placed on the ground to increase effectiveness, measures would be employed to minimize non-target species impacts (e.g., covering the trap during the day and deactivating it early in the morning after traps are checked) (Herrera-Giraldo et al., 2015). Lethal traps, such as snares, may also adversely impact non-target species. Snares would be used in limited situations, where needed, if appropriate avoidance and minimization measures can be identified and would be sited in areas that are less likely to be used by non-target species. Additionally, traps would be checked approximately daily, and if a non-target animal is inadvertently caught it would be released if the animal is injury-free or it is otherwise safe to release the animal (or provided veterinary care if possible). Despite these measures, non-target species (including native and non-native species such as goats) could unintentionally be caught in traps, resulting in minor, long-term adverse impacts. However, population impacts to non-target species are not anticipated.

All trapping and hunting methods would be conducted as humanely as possible and would be implemented appropriately and by trained personnel. Consistent with the USDA EA, live trapping, when used appropriately, is humane, and checking traps approximately daily would ensure staff are able to address injuries quickly and minimize suffering. The trapped animal would likely experience some stress from the capture, but this would be temporary (i.e., less than a day before the trap is checked and the animal released, if possible). Using trained personnel would ensure lethal methods of trapping and hunting are as quick and humane as possible. Staff would also follow American Veterinary Medical Association (AVMA) and American Association of Zoo Veterinarians (AAZA) guidelines for euthanasia, as applicable (AVMA, 2020; AAZA, 2006).

Predator removal activities via trapping and hunting would result in long-term benefits to habitats, wildlife, and protected species due to decreased predation and habitat damage from feral cats and pigs.

Predator Management using Rodenticide

As described in Section 2.4.1, because rodenticide application could result in adverse impacts to non-target species, including endemic and ESA-listed species, the initial planning stages of the rodenticide portion of the project could include localized and monitored field trials to better understand the project's potential impacts to non-target species, especially protected species. Accordingly, compliance with Section 7 of the ESA for this portion of the project could also be conducted in stages. DOI, as the Implementing Trustee, has been in consultation with the USFWS Caribbean Ecological Services Office regarding initial planning and goals for this proposed project. While some short-term, moderate adverse effects to ESA-listed species are expected from this project, initial planning, including field trials, research, or other efforts, would allow the Implementing Trustee to identify the most effective means to avoid and minimize those impacts before any large-scale rodenticide application occurs. Following the initial planning stages, the Implementing Trustee, in consultation with the USFWS Caribbean Ecological Services Office, would determine whether the potential impacts to non-target species are such that island-wide application of rodenticide is appropriate, or if changes should be made to later stages of the project (e.g., limited applications or no applications in subsequent stages). If additional applications of rodenticide are determined to be appropriate, the Open Ocean TIG would determine whether additional Section 7 consultation under the ESA or other environmental compliance is needed. The Implementing Trustee would adhere to any conditions or requirements resulting from consultations and permitting documents.

Habitats, Wildlife Species, and Protected Species

Rodenticide activities could result in minor to moderate, short-term adverse impacts to terrestrial habitats, wildlife, and protected species due to human disturbance associated with bait application (e.g., trampling of vegetation, staging activities) and increased noise from human presence and take-off and landings of helicopters. Project staff would employ BMPs for working in sensitive areas to avoid impacts where possible. Implementation of the rodenticide activities (e.g., staging and preparation) would avoid sensitive habitats and flora and fauna, such as sea turtle nesting beaches. These activities would also occur, to the extent possible, on previously disturbed areas. However, brodifacoum rodenticide bait and aerial application would occur in sensitive habitats. Although rodenticide bait would be applied in higo chumbo habitat, plants are not known to be impacted by rodenticide (USFWS, 2016). Human disturbance during the application of rodenticide and placing of bait stations would result in minor, short-term adverse impacts to habitats and vegetation due to trampling, and minor, short-term adverse impacts to wildlife, including protected species (e.g., ESA-listed Mona ground iguana, Mona boa, and yellow-shouldered blackbird), due to increased human presence and noise.

Moderate, short- to long-term adverse impacts are anticipated from unintentional exposure of non-target species to rodenticide. As noted in Section 4.4.1, brodifacoum is the proposed rodenticide over diphacinone because it is more toxic to rodents, thereby reducing the amount of time the bait needs to be available in the environment for rodents' consumption and increasing the probability of a full and successful eradication. Aerial application would occur when endangered species are present, and bait is anticipated to be in the environment for multiple weeks to ensure availability for all rodents. Wildlife and protected species may consume bait pellets that are in the environment or through poisoned rodent carcasses, consumption of which could also be lethal. Initial project planning stages may include field trials and other research to identify the most effective strategies to minimize impacts to non-target species, including exposure to poisoned carcasses. BMPs determined through initial project planning would be employed during rodenticide application to minimize impacts to non-target species; these measures could include captive holding of non-target species to prevent inadvertent consumption of rodenticide during application(s).

Terrestrial mammals. The only native terrestrial mammals on Mona Island are frugivorous and insectivorous (fruit and insect eating) bats that roost within the subterranean cave system. Rodenticide application could result in minor, short- to long-term adverse impacts to insectivorous bats from inadvertent exposure, and potential mortality to insectivorous bats from secondary exposure or mortality through consumption of prey that has consumed bait pellets. Brodifacoum is toxic to mammals and typically only requires one dose to be lethal (USFWS, 2016). Although bats could experience secondary exposure to rodenticide by feeding on insects that ingest the pellets, it is unlikely that this exposure would be lethal. Bat species that have been documented on Mona Island (see Section 4.4.1.1.2) eat a variety of foods including fruit, nectar, and many species of flying insects. Most of the adult insects that these bats forage on (e.g., moths, bees, winged ants, mosquitoes, wasps) have diets that would not include feeding on bait. It is unlikely that insectivorous bats would eat enough of the types of insects (most likely beetles) that would feed on the pellets to cause lethal effects. If greater bulldog bats, a piscivorous bat that consumes crabs, still occur on Mona Island, they could experience secondary exposure. Crabs are known to consume rodenticide bait pellets; as such, the greater bulldog bat could be at risk of secondary exposure to rodenticide if they consume contaminated crabs. Land crabs on Palmyra Atoll have been documented to retain brodifacoum in their system for up to 56 days, although they did not display effects from the rodenticide (USDA, 2006 as cited in USFWS 2016). Although unlikely, there is potential that some greater bulldog bats could eat land crabs in sufficient numbers during that window after application to adversely impact individuals. However, population levels for any of the Mona Island bat species would not be affected by rodenticide application(s) for this project. Therefore, minor, short-term adverse impacts could occur to bat species.

Birds. Over 110 species of birds have been documented on Mona Island, including the ESA-listed yellow-shouldered blackbird. Both resident and migratory wintering birds utilize Mona for nesting, foraging, and/or roosting. Migratory wintering birds are typically present from November through April, while resident seabirds primarily nest from August to December. Additional seabird nesting has been documented during March and April. Brodifacoum is highly toxic to birds due to its anticoagulation mechanism of effect, and as such, similar to terrestrial mammals, rodenticide application could result in minor to moderate adverse impacts to birds.

Birds at highest risk of exposure to rodenticide include omnivorous and granivorous ground-feeding birds (such as the endemic common ground-dove) as they may be exposed directly through consumption of bait pellets. Carnivores and scavengers (e.g., raptors) are also at risk from secondary exposure through consumption of contaminated prey or carrion, which could be lethal. The highest risk would occur during and immediately following (up to 2 weeks after) bait application. The ESA-listed yellow-shouldered blackbird is omnivorous but also considered an arboreal insectivore since it eats primarily insects. As such, the ESA-listed yellow-shouldered blackbird is unlikely to directly consume bait pellets. Seabirds (which primarily consume marine fish and squid), frugivores, aquatic coastal foragers, and terrestrial foragers that primarily consume insects or plants are less likely to be exposed due to foraging traits that decrease the probability of primary or secondary exposure. To minimize potential impacts, aerial broadcasts would be conducted outside of peak seabird nesting season, when populations are at lower numbers. However, this may result in aerial broadcast coinciding with times when migratory birds may be present.

Overall, although rodenticide activities could result in minor to moderate, short- and long-term impacts to birds, rodent eradication would reduce or eliminate the depredation of eggs, chicks, and adults that is currently causing failed nesting attempts and population declines (Jones et al., 2008; Towns et al., 2006), thereby providing long-term benefits to many bird species.

Herpetofauna. Mona Island contains nine endemic reptile and amphibian species. While some of those species could ingest rodenticide directly or from secondary exposure through consumption of contaminated prey, the impacts of brodifacoum to reptiles and amphibians are not well-understood. Herpetofauna have different circulatory physiology compared to mammals and birds and are also cold-blooded, and therefore may not experience the same toxic effects. Previous rodent eradication projects in the Caribbean (including neighboring Monito Island and Desecheo Island) have been inconclusive regarding lethal effects on terrestrial reptiles that consume bait pellets (e.g., García et al., 2002; Harper et al., 2011; USFWS, 2016), although some non-target reptile mortality has been documented. Reptiles, in particular the Mona Boa, may consume poisoned rodent carcasses and be at risk of secondary exposure to brodifacoum. However, the likelihood of the Mona boa consuming sufficient poisoned rodent carcasses to be lethal is low, as rodents are likely to die in below-ground burrows and the Mona boa primarily inhabits trees. Additionally, research studies investigating rodenticide impacts to reptiles found that reptiles likely have a lower risk probability when exposed to rodenticide (e.g., Mauldin et al., 2019, Herrera-Giraldo et al., 2015). Despite the limited understanding of the impacts of brodifacoum on herpetofauna, this project is anticipated to result in only minor to moderate, short-term adverse impacts to reptiles and amphibians. The risk window is relatively short, beginning with the date of application and lasting until brodifacoum has disappeared from the environment (see Appendix F for more information). Further, monitoring following rodent eradication programs has demonstrated increases in terrestrial reptile populations (e.g., Daltry, 2006; Newman, 1994; North et al., 1994; Parrish, 2005; Towns, 1991; Towns, 1994; Towns et al., 2001) and no substantial adverse impacts at the population level.

Project planning would occur prior to implementation to identify mitigation strategies for rodenticide use to minimize adverse impacts to habitats, wildlife, and protected species. In past projects, mitigation strategies, such as timing activities to avoid at-risk migratory birds and intensive captive hold programs to safeguard non-target species, have proven successful at reducing mortality to non-target species (USFWS, 2016). To the extent possible, rodenticide application would be conducted outside of the migration and wintering season for migratory birds and the peak nesting season for seabirds. All appropriate permits would be applied for and obtained prior to project implementation, and permit terms and conditions would be followed. Veterinary services would also be available if needed. In summary, all possible measures would be taken to avoid impacts to habitats and wildlife, but potential exposure to and consumption of rodenticide bait pellets could result in short-term, moderate adverse impacts to wildlife, including protected species. Overall, however, the trapping, hunting, and use of rodenticide for predator removal would have long-term benefits to biological resources as a result of the decrease in predators and is consistent with recovery criteria for the ESA-listed species on Mona Island.

Marine and Estuarine Fauna

The likelihood of coral exposure to rodenticide would be negligible, and although the impacts of brodifacoum on corals has not been tested, invertebrates are largely not affected due to its toxicity as an anticoagulant (USFWS, 2016). Marine mammals would likely have similar impacts from brodifacoum to other terrestrial mammals, when consumed in large enough quantities. Similar to terrestrial reptiles, brodifacoum's effects on sea turtles is not well understood. Despite limited understanding for marine reptiles, marine and estuarine fauna are unlikely to be impacted by rodenticide broadcast due to the low probability of exposure at levels that would adversely impact fauna. Only low levels of bait are anticipated to enter the marine environment (during aerial or hand application) due to the use of deflectors (to direct the broadcast away from the marine environment when applying near the coastline) and because there are no flowing streams or running water on the island. Activities would also occur only during the dry season. Previous bait applications and subsequent monitoring have found minimal to no residual levels of bait in fish tissue after rodenticide applications (USFWS, 2016). Further, bait pellets are designed to break down quickly in water, so exposure to marine wildlife is unlikely. Finally, due to the low solubility (0.24 mg/L at pH 7.4 for brodifacoum) and the size of the rodenticide bait, marine fauna are unlikely to consume enough of the bait to cause any impacts (USFWS, 2016). For example, due to their size, it is estimated that sea turtles would have to consume thousands of bait pellets to ingest enough brodifacoum to experience sub-lethal effects (USFWS, 2016). While juvenile green sea turtles are known opportunistic foragers, exposure to rodenticide through the water column is anticipated to be negligible for sea turtles due to their foraging behaviors, mitigation measures to reduce bait drift into the marine environment (e.g., a deflector bucket on the helicopter, hand broadcast near the coastline), and bait decomposition rates in water that would result in pellets breaking down within hours.

Operations, Staging, and Monitoring

Operations, staging, and monitoring would occur on land with the exception of vessel use to transport project personnel to the island. Vessel traffic, including use of barges, is not anticipated to be appreciably different than prior to project implementation. Barges would utilize existing navigational channels and moorings to avoid impacts to sensitive shallow water habitats. Vessel use is therefore anticipated to have negligible adverse impacts to marine and estuarine fauna.

Operations and staging for land-based project activities (use of trails, camping areas, and helicopter landing areas) would result in minor to moderate, short- to long-term adverse impacts to biological resources as a result of trampling of vegetation, removal of vegetation for trails, increased human activity, and noise from human presence and take-off and landings of helicopters. Vegetation surveys would be conducted if needed to ensure activities avoid sensitive species. Additional trails and roads may be needed to transport supplies, for hunting, and to place bait. Helicopter landing areas and camping areas would also be utilized. These staging activities would be limited to previously disturbed areas to the extent possible and would avoid all sensitive plants, minimizing impacts. Any new trails would be created under the permission of PRDNER, would be sited in previously disturbed areas if possible, and would include cleared dirt trails (i.e., no gravel or paving). Trails would also avoid the clearing and/or disruption of native plants. Any new camp areas would not require additional vegetation removal and the helicopter landing areas, which would be re-cleared subject to the approval of PRDNER, would ensure no sensitive plants are impacted. Overall, the creation of new trails, camp areas, and helicopter landing areas would remove some vegetation and is anticipated to result in minor to moderate adverse impacts to habitats and wildlife in the long-term (i.e., duration of the project). The creation of new trails would be avoided if possible, but any new trails created may remain in use after the project is completed and therefore would result in minor to moderate, long-term adverse impacts to habitats where they are developed.

Monitoring activities, including installing game/trail cameras, installing a remote trap monitoring system, and collecting eDNA from plant surfaces could result in minor, short-term adverse impacts to wildlife due to increased noise and disturbance from project personnel activities. The use of drones to monitor the island and potentially apply rodenticide bait would result in minor to moderate, short-term adverse impacts to biological resources. Studies have indicated that seabirds and other wildlife can experience minor to moderate disturbances from drones or other unmanned aircraft systems including from the noise and visual effects of the drone, such as the size and shape of the drone and its flight pattern (Rhodes and Spiegel, 2017). Drone use, to the extent possible, would be designed to minimize adverse impacts to wildlife, including avoiding a drone profile that resembles a predator species, avoiding areas with congregating wildlife, avoiding maneuvers directly above or nearby wildlife, and using low-noise, smaller drones flown at high altitudes when possible (Rhodes and Spiegel, 2017). Avian resource managers would be present during drone operations to provide expertise on avoiding bird strikes or spooking nesting seabirds.

Social Attraction and Biosecurity Measures
The deployment and use of social attraction tools (bird and egg decoys, mirrors, sound systems) and the implementation of biosecurity measures would be conducted manually, causing only minor disturbances in the short-term as humans transit the area. Biosecurity measures may also have minor, short-term adverse impacts on biological resources during implementation as project personnel install cameras, bait stations, traps, or chew tags due to the increased noise and human disturbance overall. Any bait traps utilized would be deployed only after consultations and coordination with PRDNER and the USFWS Caribbean Ecological Services Office regarding the rodenticide portion of the project (and deployments would be consistent with terms and conditions of the consultation). If snap traps are deployed, non-target species have the potential to activate snap traps and be injured or killed, but that potential would be minimized by placing snap traps in elevated locations where ground foragers would not readily interact with them. The use of biosecurity measures would be limited, depending on the need and success of prior predator removal activities, and would be implemented in targeted areas. Biological resources would benefit from improved biodiversity with restored seabird colonies and reduced introductions of invasive species.

Summary
The Open Ocean TIG has begun technical assistance with relevant regulatory agencies related to potential adverse impacts to biological resources including protected species and habitats. See Table 4-14 for this project's environmental compliance status. In summary, this project is anticipated to result in minor to moderate, short- to long-term adverse impacts and long-term benefits to biological resources.

4.4.1.2.3 Socioeconomic Resources

Vegetation Management and Predator Management by Trapping or Hunting
All vegetation and predator removal methods with the potential to adversely impact human health and safety would be performed by trained and permitted personnel to reduce risks. Visible carcasses would be removed from obvious sight to avoid any adverse impacts to visitors. Live traps used for predator control activities may impact non-target, important recreational hunting species, such as goats. These impacts are analyzed in Section 4.3.1.2.5. As an uninhabited, ecologically important island, local communities appreciate the need to preserve and protect biodiversity. As such, public concern regarding the removal of mammalian predators such as cats and pigs is not anticipated. Hunting of game, such as goats and pigs, is currently permitted on Mona and valued as a recreational opportunity. Further, all predator removal activities would be conducted by trained personnel using the most humane approach possible. Finally, vegetation and predator management would also have long-term benefits to socioeconomic resources by restoring natural environments and biodiversity.

Predator Management using Rodenticide
Health and safety impacts would be minimized by closing the island to visitors during hunting and trapping activities and rodenticide application as well as temporarily closing the island for several weeks after the rodenticide application process. A moratorium on fishing and goat harvesting would also be put in place during rodenticide application and for several months or up to 2 years after application. Project personnel may consider captive holding of goats to prevent inadvertent consumption of bait pellets while foraging on vegetation. Monitoring would occur to determine when it is safe to reopen the island. These closures would result in minor, short-term adverse impacts to businesses that provide recreational trips to the island. As noted above, in the long-term, predator removal activities would benefit socioeconomic resources.

Public outreach and educational activities would occur to inform visitors about invasive species and predator removal activities, encourage actions that reduce the risk of reintroduction of invasive species (for biosecurity measures), and to inform and educate on predator removal activities including the use of rodenticide. All project personnel and visitors to the island would be provided with written materials stating that rodent bait containing a rodenticide would be present on the island, describing its appearance and its intended purpose. Educational materials such as signage may also be utilized. Signs would be posted in at least two languages (Spanish and English) to indicate the presence of rodenticide as well as trapping and hunting activities. Adequate signage would be installed to ensure that all users of the island are aware of the temporary presence of a toxicant.

Operations, Staging, Monitoring, Social Attraction, and Biosecurity Measures
Operations, staging, monitoring, and social attraction activities such as sound systems, mirrors, and decoys would not impact public health and safety. Most project operations would occur when visitors are not present on the island (i.e., when the island is closed to visitors). Social attraction activities would be implemented near seabird colonies and would not impact any visitors to the island. Biosecurity measures such as vessel inspections, education and outreach, surveillance cameras near landing areas, cameras with non-toxic bait, and chew tags in high-use areas to detect rodents would also not impact public health and safety. Vessel inspections could result in minor disturbances to vessel operators but would be temporary and only as needed. Traps such as snap traps and rodent bait stations may also be used as biosecurity measures in targeted areas if evidence of rodents is detected; these would be deployed by project personnel and are unlikely to impact public health and safety. Further, education materials would be distributed to inform the public of these activities. Overall, these activities would result in long-term benefits from improvements to biodiversity following seabird restoration.

Summary
In summary, this project is anticipated to result in minor, short-to long-term, adverse impacts as well as benefits to socioeconomic resources.

4.4.2 Predator Removal and Seabird Nesting Colony Restoration in the Culebra Archipelago (non-preferred)

This project would restore nesting seabirds through invasive plant species removal, native plantings, predator removal, social attraction activities, and biosecurity measures to reestablish seabird nesting colonies in the Culebra Archipelago. Project activities most relevant to the assessment of environmental consequences include:

- **Construction of a predator-proof fence** at the Flamenco Peninsula on Culebra Island to replace the existing chain-link fence. The new fence would be located in the same footprint as the existing fence, and the fence corridor would be approximately 13 feet wide by 1,970 feet long (4 meters by 600 meters). The fence would span the width of the Flamenco Peninsula (Figure 4-1), eliminating movement of animals over the landscape into the peninsula tip. The fence would be composed of anodized aluminum or wooden posts and stainless-steel wires and fastenings, a predator-proof mesh and skirt, and a rolled hood to prevent animals from climbing over (Figure 4-2). Fence posts would be set into the ground approximately 10 feet (3 meters) apart; approximately 3 feet (1 meter) of the post would be buried, while the remaining 6 feet (2 meters) remains above ground. Marine grade stainless steel mesh with an aperture of 0.2 x 1.0 inches (0.5 x 2.5 centimeters) would be attached to the entire face of the base fence and would form a skirt of horizontal mesh extending 1 foot (0.3 meters) at ground level to prevent predators from tunneling under the fencing. Access doors would be incorporated into locations where the fence crossed existing trails and at endpoints for management access. A double-door system would be implemented to prevent predators from moving through open doors. Final design specifications would be subject to site conditions, material availability, and prototype testing.

- **Vegetation management**. Invasive plants would be removed by hand from the Flamenco Peninsula and smaller cays surrounding Culebra Island.
- **Predator removal**. Predators and invasive mammals, including feral cats, feral dogs, deer, and feral goats, would be removed from portions of Culebra NWR, particularly areas protected by the proposed predator-proof fence, using humane approaches. Feral cats and dogs would be trapped using leg-hold and cage traps, then humanely euthanized on site (likely using an air rifle, but possibly using chemical euthanasia or carbon dioxide asphyxiation). Trapping would take place prior to or after seabird nesting season across the NWR. Traps would be checked for any captured animals approximately daily (either directly by project personnel or though remote monitoring tools such as radio telemetry transmitters or cameras). Deer and feral goats would be removed via land-based hunting prior to or after seabird nesting season. For all hunting activities, hunters would only use non-toxic (i.e., non-lead) shot, and as such, adverse impacts are not anticipated. Carcasses would be left in place to decompose (which would occur within days) or cremated with a portable incinerator. Concurrently, rodents would be removed using rodenticide (described in more detail below). Rodenticide activities may include the use of brodifacoum through hand broadcast and bait stations. Mitigation measures would be employed to minimize impacts to habitats and species.
- **Social attraction**. Bird and egg decoys, mirrors, and sound systems would be installed during nesting season in suitable nesting habitat for target species to attract seabirds to recolonize the NWR. All materials would be installed manually. Decoys (made of recycled, high-density polyethylene and painted to look like target species) would be installed using high strength anchoring epoxy. Mirrors (approximately 12 inches by 6 inches [30 centimeters by 15 centimeters]) and sound systems (amplifier, charge controller, MP3 player, speakers, solar panels, and marine batteries) would be bolted to rocks using hand tools. Social attraction materials would be removed after each nesting season, if possible, and would be removed after project completion.
- **Biosecurity measures**. To prevent the (re)introduction of invasive species (including, but not limited to, plants, mammals, herpetofauna, and invertebrates), a biosecurity plan would be developed and implemented. Measures may include vessel inspections, education and outreach, use of network surveillance cameras near landing areas, baiting cameras with non-toxic bait to lure species and increase detection rates, deployment of chew tags in high-use areas to detect rodents, and deployment of traps (e.g., snap traps) and rodent bait stations if evidence of rodents is found.
- Use of drones for project monitoring. The implementing Trustee and project partners would only use drones if the use is consistent with all laws, regulations, and policies applicable in the project implementation location at the time of use. Drones would not fly higher than 400 feet above sea level, and more commonly would be operated between 150 and 250 feet above sea level.

4.4.2.1 Affected Environment

This project would occur within the Culebra NWR (designated 1909), which encompasses approximately 1,510 acres (610 hectares) of Culebra Island and 23 uninhabited small islands and their surrounding coral reefs, shoals, and water. The Culebra Archipelago is located approximately 20 miles (32 kilometers) east of mainland Puerto Rico within the Lesser Antilles. The USFWS oversees visitor management and terrestrial, marine, and cultural resources within Culebra NWR. This project proposes to complete predator removal activities and restore seabird nesting colonies via social attraction on 10 cays (including Culebrita and Luis Peña) and the Flamenco Peninsula on the main island of Culebra (Figure 4-1).

The *Culebra NWR Comprehensive Conservation Plan* (CCP; USFWS, 2012a) provides extensive information about physical, biological, and socioeconomic resources within Culebra NWR and is incorporated by reference herein.

Figure 4-1 ***Predator Removal and Seabird Nesting Colony Restoration in the Culebra Archipelago (non-preferred)*** **Proposed Project Location**

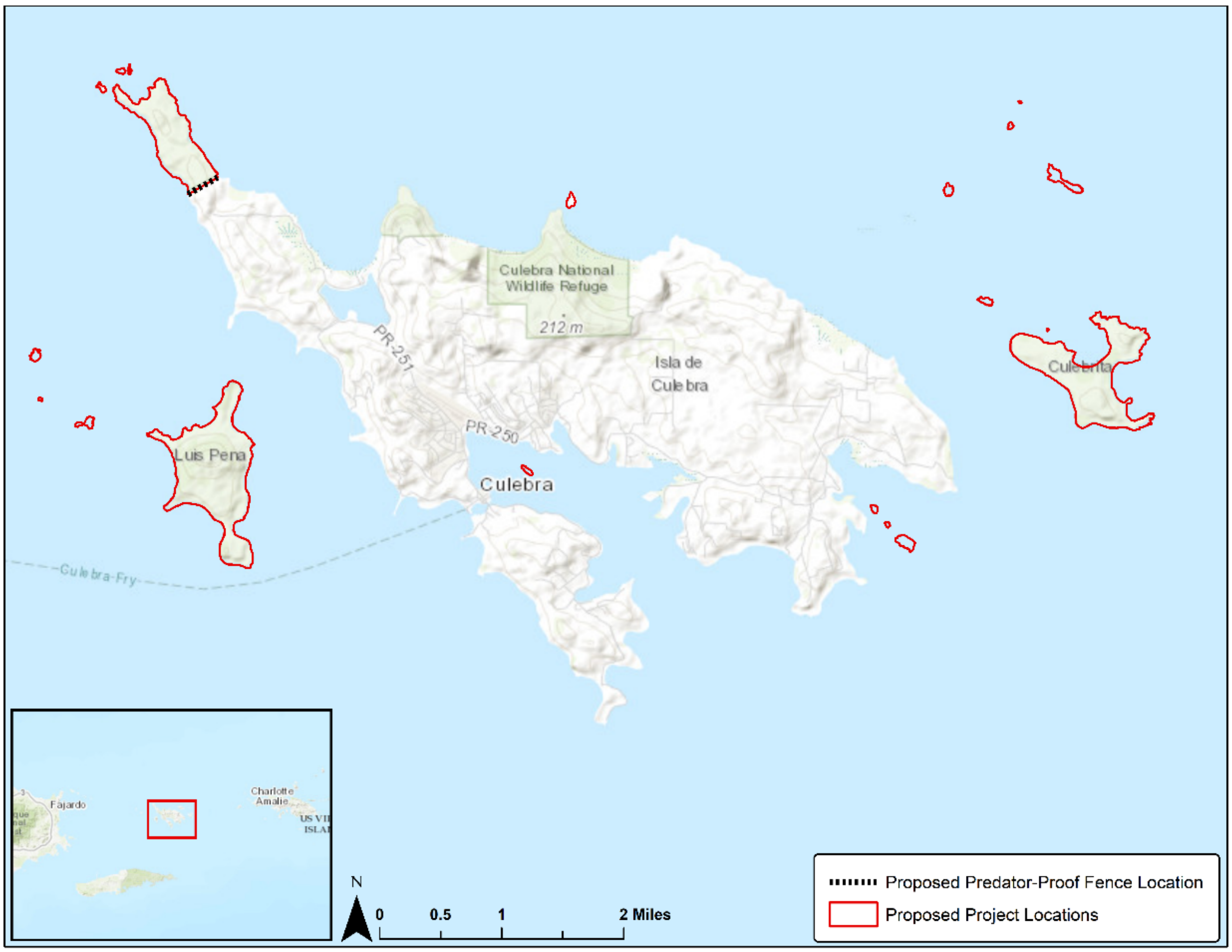


Figure 4-2 Example Predator-Proof Fence at Kilauea Point National Wildlife Refuge

4.4.2.1.1 Physical Resources

The Culebra Archipelago is composed of Culebra Island with surrounding 23 smaller cays, the largest of which are Culebrita to the east, Cayo Norte to the northeast, and Cayo Luis Peña and Cayo Lobo to the west. Culebra Island encompasses approximately 10 square miles (16 square kilometers) of land, with a relatively longer coastline due to its irregular topography. The highest point on Culebra Island is Mount Resaca, with an elevation of 650 feet (192 meters). Substrates across the archipelago are primarily volcanic in origin, with dominant rock types including andesite lava, lava breccia, and tuffs. Alluvial sediments (silts and clays) are often found in the coastal zone. Soils in the archipelago are composed of these parent materials and are typically very shallow and well-drained. Dominant soil types include Rockland, Descalabrado-Rockland complex, and Descalabrado clay loam (USFWS, 2012a).

The Culebra Archipelago is bounded to the north by the Atlantic Ocean, to the south by the Vieques Sound, to the west by the Barriles Passage, and to the east by the Virgin Passage. Within its location in the sub-tropics, the trade winds heavily influence local air and water currents, with the northeastern portion of the archipelago facing the windward direction. Additionally, the trade winds largely result in the movement of water from the Atlantic Ocean to the Caribbean Sea through the passages to the west and east of the archipelago.

As a tropical island, rainfall is seasonally distributed, with a dry season persisting from December through April and the wet season corresponding with the Atlantic hurricane season. No natural fresh surface water sources exist within the archipelago, and rainwater collects in a series of underground aquifers. This groundwater has a high mineral concentration, often exceeding the USEPA standards for drinking water, and groundwater water quality on Culebra Island is often threatened by contamination from septic tanks in populated areas (USFWS, 2012a). Coastal water quality around Culebra Island is often impaired due to waste accumulation, roadway runoff, land-based runoff of pesticides and fertilizers, and inadequate sewage systems.

4.4.2.1.2 Biological Resources

Terrestrial habitats within the Culebra Archipelago are characterized by six community types: sandy beaches and rocky cliffs, coastal strand forest, mangroves (including red, black, and white mangroves and buttonwoods), lagoons, dry forests, and grasslands. Plants within these communities are generally hardy to persist through the dry season and trade winds, typically including seagrapes (*Coccoloba uvifera*) in the coastal zone, and scrub-shrub plants in the dry forest areas. Grasslands primarily occur within the Flamenco Peninsula on Culebra Island (around the location of the proposed predator-proof fence) and represent an altered habitat type from decades of agricultural and military use; these habitats are slowly returning to a more natural wooded vegetated state. Two ESA-listed plants are known to occur on Culebra Island, *Leptocereus grantianus* and *Peperomia wheeleri*; however, neither are known to occur within NWR boundaries.

The Culebra Archipelago supports diverse terrestrial fauna, and multiple areas within the NWR are designated as Critical Wildlife Areas under the Puerto Rico Comprehensive Wildlife Conservation Strategy (PRDNER, 2005). Native terrestrial fauna includes birds, herpetofauna (reptiles and amphibians), and mammals (bats). Over 115 species of resident and migratory birds have been documented in the Culebra Archipelago, 20 of which are seabirds that inhabit the rocky shores, cliffs, cays, and sandy beaches found across the archipelago. The Flamenco and Zoni Lagoons on Culebra Island are waterfowl focus areas (PRDNER, 2005) that support a variety of colonial nesting shorebirds and wading birds, such as the ESA-listed roseate tern (*Sterna dougallii*). Migratory terrestrial bird guilds present across the archipelago include raptors, doves and pigeons, and songbirds. Over 20 species of herpetofauna have been identified within the Culebra Archipelago, including the ESA-listed Culebra giant anole (*Anolis roosevelti*) and the Virgin Islands tree boa (*Epicrates monensis granti*). The only native mammals are frugivorous and insectivorous bats, which inhabit forest stands.

Terrestrial habitats and fauna have experienced significant disruptions since the 1800s due to agricultural production, military development and training, residential development, and tourism across the Culebra Archipelago. Native plants were clear-cut, particularly within the Flamenco Peninsula, and replaced with non-native invasive plants including acacia trees (*Acacia* spp.) and guinea grass (*Panicum maximum*). Non-native invasive animals introduced to the archipelago include iguanas, white-tailed deer (*Odocoileus virginianus*), black and Norway (*Rattus norvegicus*) rats, and feral dogs (*Canis lupus familiaris*), goats, and cats. These species directly prey on sensitive native flora and fauna and destroy habitat on which native fauna rely.

Coastal marine habitats within the Culebra Archipelago include seagrass beds and highly productive coral reefs, which support a variety of reef fish, mollusks, crustaceans, sea turtles, and marine mammals. Waters surrounding the archipelago have been federally-designated as EFH for 13 species: spiny lobster, reef fish, coral, queen conch, blue and white marlin, swordfish (*Xiphias gladius*), and sailfish (*Istiophorus platypterus*), as well as Caribbean reef, nurse (*Ginglymostoma cirratum*), lemon (*Negaprion brevirostris*), oceanic whitetip, and tiger (*Galeocerdo cuvier*) sharks. Green, hawksbill, and leatherback sea turtles can be found in marine habitats surrounding the Culebra Archipelago, and these species also nest on the islands' sandy beaches. Marine mammals documented in around Culebra NWR include several dolphin species, humpback whales, and ESA-listed sperm, blue (*Balaenoptera musculus*), and sei (*Balaenoptera borealis*) whales.

A list of federally threatened, endangered, proposed, candidate, and other species of concern for this site, as identified through USFWS IPaC (USFWS, 2022) and NMFS' ESA species list (NMFS, 2022b), is presented in Appendix E. Federally designated critical habitat for elkhorn and staghorn coral, the Culebra Island giant anole, and green sea turtle is present in and around Culebra NWR.

4.4.2.1.3 Socioeconomic Resources

Evidence of human inhabitation of the Culebra Archipelago dates back to the 600s A.D. Artifacts from these early inhabitants have been found across Culebra Island, with limited artifacts on the surrounding small cays. After portions of the Culebra Archipelago were designated as a NWR in 1909, the U.S. Navy took over administrative duties and used several of the small cays and the Flamenco Peninsula on Culebra Island for bombing practice up to 1976. At that time, NWR lands were transferred to DOI and Puerto Rico for administration.

Only one-quarter of the Culebra Archipelago's land mass is incorporated into the NWR. Remaining areas, primarily most of Culebra Island, are part of the Culebra municipality that is administered by a mayor and municipal assembly. Fewer than 2,500 residents live on Culebra Island (USFWS, 2012a), and the island is largely comprised of low income and minority communities. Culebra Island has undergone significant changes during the past 200 years through clearing for agriculture, military development and training, housing construction, and tourism. Most portions of the island have been altered by human activities.

Residents and visitors use Culebra NWR for a variety of passive recreational activities such as hiking, wildlife viewing, hunting, and fishing. A significant portion of the NWR, particularly the smaller outlying cays, are not open to the public due to unexploded ordnance.

4.4.2.2 Environmental Consequences

This project would occur on ten cays (including Culebrita and Cayo Luis Peña) and the Flamenco Peninsula on the main island of Culebra within the Culebra NWR, encompassing approximately 800 acres (325 hectares). Proposed project areas have previously been heavily used for and altered by U.S. naval practices prior to the 1980s. The State of Hawaii and the USFWS Pacific Islands Office have implemented multiple similar predator-proof fence construction projects to protect nesting seabirds across the Hawaiian Islands, and these activities have been analyzed in multiple EAs. The Final Environmental Assessment for the Ka'ena Point Ecosystem Restoration Project (herein referred to as the Ka'ena EA) found that the construction of a predator-proof fence may result in minor to moderate, short-term adverse impacts to physical, biological, and socioeconomic resources and long-term benefits to biological resources (Hawaii Department of Land and Natural Resources, 2009). The Ka'ena EA is incorporated by reference herein.

Vegetation management, predator removal, social attraction (specifically, deployments of decoys and sound systems), biosecurity measures, and the potential use of drones proposed under this project are similar or identical in nature to the activities that would occur during implementation of the *Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)* project. It is anticipated that the environmental consequences to physical, biological, and socioeconomic resources from those activities would also be very similar. To reduce redundancy, the following discussion of environmental consequences is limited to those activities, techniques, and anticipated impacts that are unique to this project. Table 4-2 indicates the locations within this RP/EA where the reader can find detailed analyses of this project's impacts on physical, biological, and socioeconomic resources.

Table 4-2 NEPA Analysis by Resource for Predator *Removal and Seabird Nesting Colony Restoration in the Culebra Archipelago (non-preferred)*

Resource	Location of Analysis in Chapter 4
Physical Resources	
Geology and Substrates	Analyzed in Sections 4.4.1.2.1 (*Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)*) and 4.4.2.2.1
Hydrology and Water Quality	Hydrology: Analyzed in Section 4.3.1 (Resources with Similar Impacts Common to All Alternatives) Water Quality: Analyzed in Sections 4.4.1.2.1 and 4.4.2.2.1
Air Quality	Analyzed in Section 4.3.1
Noise	Analyzed in Section 4.3.1
Biological Resources	
Habitats	Analyzed in Sections 4.4.1.2.2 and 4.4.2.2.1
Wildlife Species	Analyzed in Sections 4.4.1.2.2 and 4.4.2.2.1
Marine and Estuarine Fauna	Does not require additional analysis. Project activities would not include any in-water work or disrupt marine or estuarine fauna.
Protected Species	Analyzed in Sections 4.4.1.2.2 and 4.4.2.2.1
Socioeconomic Resources	
Socioeconomics and Environmental Justice	Socioeconomics: Analyzed in Sections 4.4.1.2.3 and 4.4.2.2.3 Environmental Justice: Analyzed in Section 4.3.1
Cultural Resources	Analyzed in Section 4.3.1
Infrastructure	Analyzed in Section 4.3.1
Land and Marine Management	Analyzed in Section 4.3.1
Tourism and Recreational Use	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
Public Health and Safety	Analyzed in Sections 4.4.1.2.3 and 4.4.2.2.3

4.4.2.2.1 Physical Resources

Fence Construction

The existing chain-link fence along the Flamenco Peninsula would be removed and replaced with a predator-proof fence in the same footprint. Materials for the predator-proof fence would be moved to the construction site using vehicles along the existing, unpaved roadbed. Some minor grading may need to occur for the fence using a bulldozer and excavator; however, total ground disturbance would occur over less than 0.5 acres (0.2 hectares) and would occur in already disturbed areas. Fence posts would be hand-dug and hammered into the ground using hand tools, and the predator-proof mesh would be pinned to the ground and/or buried under the substrate. A container would be temporarily left at the site during construction to securely store materials, tools, and equipment. While construction would have minor, short-term impacts soil, sediments, and water quality due to localized erosion, there would be no lasting changes in runoff patterns or water percolation through soils and sediments. Additionally, BMPs would be implemented to minimize erosion and soil runoff into coastal areas (e.g., not disrupting the ground during inclement weather). Materials for long-term maintenance would be kept at NWR offices on Culebra Island and brought to the fence using vehicles and ATVs.

Summary
In summary, this project is anticipated to result in short-term, minor adverse impacts and long-term benefits to physical resources.

4.4.2.2.2 Biological Resources

Fence Construction
Fence construction could have short-term, minor adverse impacts to terrestrial biological resources during implementation due to trampling, human activity, and noise. Some vegetation would need to be removed from the fence corridor; however, the proposed fence site is in the same footprint as the previous fence, has been highly impacted by U.S. Navy activities, no native vegetative communities exist, and the total impacted area would be less than 0.5 acres (0.2 hectares). ESA-listed plant species are not known to exist near the fence site. The corridor would be surveyed for sensitive plants and the final alignment would be contingent on avoiding sensitive biological resources. Any sensitive plants found near the corridor would be given a minimum 15-foot (4.5-meter) buffer of human activity. Sensitive plants within the fenced zone would benefit from decreased predation by non-native invasive species, particularly rodents and deer.

To the extent possible, fence construction would occur outside of seabird nesting season so as not to disturb migratory birds, and the fence would be sited with enough distance from nesting areas to minimize opportunities for collisions. The fence would restrict the movement of non-native invasive species such as rodents, deer, and feral goats, cats, and dogs, but it could also permanently restrict the movement of non-target native herpetofauna (including ESA-listed species), potentially causing minor, long-term adverse impacts to native wildlife. However, herpetofauna present on Culebra Island (i.e., small frogs, anoles, and snakes) typically have small home ranges, so migratory patterns are unlikely to be affected by the fence. Fence construction would have long-term benefits for native biota from reduced predation by non-native invasive predators.

Predator Management using Rodenticide
The rodenticide brodifacoum would be applied using hand broadcast and bait boxes on the Flamenco Peninsula on Culebra Island (following the construction of the predator-proof fence) and small cays. Application rates would be subject to USEPA and Supplemental Label approval but would likely entail four applications over the course of 2 months to ensure enough bait is present in the environment to result in eradication. Targeted predator removal areas could overlap with forested areas on the Flamenco Peninsula known to be inhabited by the ESA-listed Virgin Islands tree boa (ESA endangered). While the Virgin Islands tree boa primarily consumes anoles, it has been documented feeding on rodents and could be secondarily exposed to brodifacoum through consumption of rodent carcasses, resulting in mortality. As such, if rodenticide is applied within tree boa habitat, these activities could have moderate, short-term adverse impacts to the Virgin Islands tree boa, but the project is not anticipated to impact global population levels due to the boa’s presence on other Caribbean islands. The Virgin Islands tree boa is highly susceptible to invasive mammalian predators and would experience long-term benefits from predator removal. The Culebra Island giant anole is not known to inhabit the Flamenco Peninsula, and, as such, would not be affected by project activities. The Open Ocean TIG would coordinate and complete consultation with relevant regulatory agencies, if necessary, on this project regarding potential adverse impacts to protected species and habitats prior to project implementation.

Summary

The Open Ocean TIG would coordinate and complete consultation with relevant regulatory agencies as necessary on this project regarding potential adverse impacts to protected species and habitats prior to project implementation. In summary, this project is anticipated to result in minor-to-moderate, short-term and minor, long-term adverse impacts and long-term benefits to biological resources.

4.4.2.2.3 Socioeconomic Resources

Fence Construction

The predator-proof fence would be constructed across the Flamenco Peninsula (1,970 feet [600 meters] long), stopping the movement of predators from municipal lands onto NWR lands. Although the fence would restrict movement of invasive predators, gates would be included in the final design to facilitate access by NWR staff and the public, where already allowed. The construction location may be temporarily closed to protect public health and safety during construction and while rodenticide is present in the environment. Local businesses could benefit from the fence construction construction if local contractors are hired to complete the construction.

Summary

In summary, project activities would result in minor, short-term adverse impacts and long-term benefits to socioeconomic resources.

4.4.3 Seabird Nesting Colony Reestablishment and Protection at Desecheo National Wildlife Refuge (preferred)

This project would restore nesting seabirds by reestablishing nesting colonies and implementing biosecurity measures to prevent the incursion of invasive species at Desecheo NWR. Project activities most relevant to the assessment of environmental consequences include:

- **Social attraction**. Bird and egg decoys, mirrors, and sound systems would be installed during nesting season in suitable nesting habitat for target species to attract seabirds to recolonize the island. All materials would be installed manually and would be removed once the project is complete. Decoys (made of recycled, high-density polyethylene and painted to look like target species) would be installed using high strength anchoring epoxy. Mirrors (approximately 12 inches by 6 inches [30 centimeters by 15 centimeters]) and sound systems (amplifier, charge controller, MP3 player, speakers, solar panels, and marine batteries) would be bolted to rocks using hand tools. Social attraction materials would be removed after each nesting season, if possible, and would be removed after project completion.
- **Biosecurity measures**. To prevent the (re)introduction of invasive species (including, but not limited to, plants, mammals, herpetofauna, and invertebrates), the project would enhance existing biosecurity efforts. Measures may include vessel inspections, education and outreach, use of network surveillance cameras near landing areas, baiting cameras with non-toxic bait to lure species and increase detection rates, deployment of chew tags in high-use areas to detect rodents, and deployment of traps (e.g., snap traps) and rodent bait stations if evidence of rodents is found.
- Use of drones for project monitoring. The implementing Trustee and project partners would only use drones if the use is consistent with all laws, regulations, and policies applicable in the project implementation location at the time of use. Drones would not fly higher than 400 feet above sea level, and more commonly would be operated between 150 and 250 feet above sea level.

4.4.3.1 Affected Environment

Historical explorations of Desecheo in the 19th and 20th centuries identified the island as an important seabird rookery. These findings prompted the federal government to designate Desecheo as a wildlife preserve in 1912 and as a National Wildlife Refuge in 1976. Desecheo NWR encompasses approximately 360 acres (147 hectares) of Desecheo Island and small rocky islets located 13 miles (21 kilometers) west of Puerto Rico. USFWS oversees the conservation and management of natural resources within the NWR. In 2016, the NWR, in partnership with PRDNER, NGOs, and USDA-APHIS-WS, planned and implemented an invasive rodent, goat, and macaque eradication effort. Since the successful eradication of these invasive species, the NWR has been implementing seabird social attraction and has developed and implemented biosecurity measures to prevent the (re)introduction of invasive species. This project proposes to enhance these biosecurity and seabird colony reestablishment activities over the entirety of Desecheo Island.

The *Desecheo NWR Comprehensive Conservation Plan* (CCP; USFWS, 2012b) and Desecheo EA provide extensive information about physical, biological, and socioeconomic resources within the island and are incorporated by reference herein.

4.4.3.1.1 Physical Resources

Desecheo is a small, mountainous tropical island that is approximately 300 acres (121 hectares) in size (USFWS, 2012b). The surface of the island is very jagged with steep slopes ranging from 20 to 35 degrees (USFWS, 2012b). The majority of the island's surface features are calcareous rocks. The soils are made up of gravelly or sandy material that likely weathered from the calcareous parent materials. These soils are very permeable and have a low available water capacity. The highest point of the island sits approximately 700 feet (213 meters) above sea level.

Desecheo Island sits atop a submarine ridge in the northeastern part of the Mona Passage, a broad, shallow strait connecting the Caribbean Sea with the Atlantic Ocean. Local air patterns and water currents are highly influenced by the trade winds, which result in the movement of water from the Atlantic Ocean to the Caribbean Sea through the Mona Passage. As a tropical island, the climate is defined by a dry season from November to May and a wet season from June through October, coinciding with the Atlantic hurricane season. The island's well-drained soils and steep topography contribute to the lack of permanent freshwater. Some rainwater will collect in natural depressions for short periods of time (days to weeks). Desecheo is located away from many land-based anthropogenic runoff areas. As such, coastal waters are largely pristine. Various estuarine and marine wetlands constitute the coastal areas of the island (USFWS, 2022).

4.4.3.1.2 Biological Resources

Terrestrial habitats on Desecheo are categorized as tropical dry forests, with lower slopes of the island dominated by seasonal deciduous woodlands and ridges and wind-exposed slopes dominated by shrubs, grass, and cactus habitats. A few small, narrow sand beaches exist along the southern edge of the island, which serve as landing spots for NWR boats (USFWS, 2012b). Shallow caves are found within the limestone rock around the shoreline. Over 160 plant species were historically known to be present on Desecheo; however, with the introduction of invasive goats, up to 65 of those species are suspected to be extirpated from the island (USFWS, 2016). The ESA-listed higo chumbo cactus is present within the wind-exposed slopes of the island.

Desecheo NWR provides foraging, reproduction, and resting habitat for a variety of sensitive terrestrial fauna, prompting its designation as a Puerto Rican Critical Wildlife Area. Over 75 bird species are known to inhabit Desecheo, of which only 10 are residents. Historically, Desecheo Island was an important seabird rookery, supporting thousands of brown boobies, red-footed boobies, brown noddies (*Anous* *stolidus*), bridled terns (*Onychoprion anaethetus*), magnificent frigatebirds, and laughing gulls (*Leucophaeus atricilla*); however, military exercises through the 1970s, invasive predators, and habitat destruction by feral goats resulted in the disappearance of these species. Recent social attraction work at Desecheo NWR has been successful in reintroducing nesting seabirds (Herrera-Giraldo et al., 2021). In addition to seabirds, over 35 land bird species inhabit Desecheo, most of which are migratory wintering birds such as the peregrine falcon, doves and pigeons (e.g., the white-crowned pigeon [*Patagioenas leucocephala*]), and cuckoos (e.g., yellow-billed cuckoos [*Coccyzus americanus*]). Five native reptiles are present on Desecheo: the Puerto Rican racer (*Alsophis puertoricensis*); the Desecheo ground lizard (*Ameiva exsul desechensis*); the Desecheo anole (*Anolis desechensis*); the Desecheo dwarf gecko (*Sphaerodactylus levinsi*); and the slippery-back skink (*Mabuya mabouya*). The Puerto Rican racer consumes other reptiles and small birds, while the remaining primarily consume insects and small amphibians. The only native mammals on Desecheo are bats that inhabit the limestone caves present along the shoreline (species have not been identified to-date; USFWS, 2016). In addition to native fauna, non-native invasive species have been introduced to Desecheo, included goats, black rats, macaques, and green iguanas (*Iguana iguana*), which have contributed to habitat destruction and the decline of native wildlife populations, particularly seabirds. Desecheo NWR previously implemented a goat and rodent eradication effort.

Nearshore coastal waters around Desecheo comprise one of the most pristine, largest contiguous reefs in the U.S. Caribbean (USFWS, 2016). Most reefs are at a depth of greater than 50 feet (15 meters), with the deepest reefs occurring at depths up to 130 feet (40 meters). The southern edge of the island has a more developed reef platform due to the lack of strong wave action, while the northern edge contains deep, sponge-encrusted submarine walls. Approximately 44 percent of the reef contains hard coral, 25 percent algae, 4 percent soft coral, and 11 percent other organisms (USFWS, 2016). Waters surrounding Desecheo are designated as critical habitat for ESA-listed elkhorn and staghorn corals. This productive coral reef habitat supports a wide variety of marine fauna, such as tropical reef fish (e.g., wrasses, gobies, and damselfish). Marine mammals inhabiting waters surrounding Desecheo include sperm whale, humpback whale, sei whale, and several species of dolphins (USFWS, 2012b). ESA-listed hawksbill and green sea turtles have been observed in coastal areas, with hawksbill sea turtles occasionally nesting on Desecheo’s small beaches.

A list of federally threatened, endangered, proposed, candidate, and other species of concern for this site, as identified through USFWS IPaC (USFWS, 2022) and NMFS’ ESA species list (NMFS, 2022b), is presented in Appendix E. Federally designated critical habitat for elkhorn and staghorn coral is present in the waters surrounding Desecheo; however, no in-water work would occur.

4.4.3.1.3 Socioeconomic Resources

Desecheo was used for several human activities prior to its designation as a NWR in the 1970s. In early 1900s, the island was used as a short-term camp by fishers, who attempted to raise livestock and farm on the island. During World War II and through the 1960s, the island was use as a bombing and gunnery range, resulting in unexploded ordnance around the island. Some remnant structures are present on the island from these activities.

Desecheo NWR is not open to the public without a special use permit and does not support any regular recreational activities or provide any services to the public (USFWS, 2012b). Due to its use as a military target and training range, unexploded ordnances are present throughout the island and pose a threat to public health and safety. Future access is contingent upon cleanup of ordnance (USFWS, 2012b). NWR staff and others with special use permits visit the island for resource management, including for recently implemented rodent eradication and subsequent social attraction work. These individuals are briefed on the known location of the ordinance and measures for reducing risk to their health and safety.

The waters surrounding Desecheo are managed by the Puerto Rico Department of Natural and Environmental Resources as a no-take marine reserve. The public uses these waters for recreational SCUBA diving, snorkeling, and wildlife observation.

4.4.3.2 Environmental Consequences

Project activities would occur over the entirety of Desecheo Island and would build off existing social attraction and biosecurity work currently being implemented by the NWR.

Social attraction (specifically, deployments of decoys and sound systems), biosecurity measures, and the potential use of drones proposed under this project are similar or identical in nature to the activities that would occur during implementation of the *Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)* project. It is anticipated that the environmental consequences to physical, biological, and socioeconomic resources from those activities would also be very similar. To reduce redundancy, the following discussion of environmental consequences is limited to those activities, techniques, and anticipated impacts that are unique to this project. Table 4-3 indicates the locations within this RP/EA where the reader can find detailed analyses of this project's impacts on physical, biological, and socioeconomic resources.

Table 4-3 NEPA Analysis by Resource for *Seabird Nesting Colony Reestablishment and Protection at Desecheo National Wildlife Refuge (preferred)*

Resource	Location of Analysis in Chapter 4
Physical Resources	
Geology and Substrates	Analyzed in Sections 4.4.1.2.1 (*Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)*) and 4.4.3.2.1
Hydrology and Water Quality	Hydrology: Analyzed in Section 4.3.1 (Resources with Similar Impacts Common to All Alternatives) Water Quality: Does not require additional analysis. Project activities would not include any in-water work or disrupt water quality on or around the island.
Air Quality	Analyzed in Section 4.3.1
Noise	Analyzed in Section 4.3.1
Biological Resources	
Habitats	Analyzed in Sections 4.4.1.2.2 and 4.4.3.2.2
Wildlife Species	Analyzed in Sections 4.4.1.2.2 and 4.4.3.2.2
Marine and Estuarine Fauna	Does not require additional analysis. Project activities would not include any in-water work or disrupt marine or estuarine fauna.
Protected Species	Analyzed in Sections 4.4.1.2.2 and 4.4.3.2.2
Socioeconomic Resources	
Socioeconomics and Environmental Justice	Socioeconomics: Analyzed in Sections 4.4.1.2.3 and 4.4.3.2.3 Environmental Justice: Analyzed in Section 4.3.1
Cultural Resources	Analyzed in Section 4.3.1
Infrastructure	Analyzed in Section 4.3.1
Land and Marine Management	Analyzed in Section 4.3.1

Resource	Location of Analysis in Chapter 4
Tourism and Recreational Use	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
Public Health and Safety	Does not require additional analysis. Desecheo NWR is not open to the public, and project activities (including the handling of rodenticide bait) would be carried out by trained personnel who are briefed on locations of unexploded ordinance.

4.4.3.2.1 Physical Resources

Biosecurity Measures, Social Attraction

Implementation of both social attraction and biosecurity measures would require regular bi-monthly visits to Desecheo NWR by project staff, and some minor ground disturbance may occur from project implementation as staff transit the area. However, these activities would not result in appreciably more ground-disturbance than already occurs for existing biosecurity and management of the island.

Summary

In summary, this project is anticipated to result in negligible adverse impacts to physical resources.

4.4.3.2.2 Biological Resources

Biosecurity Measures

As part of implementation of biosecurity measures, if a rodent incursion is detected on Desecheo, rodenticide bait boxes and snap traps may be placed near the incursion site to prevent their spread. Bait boxes would be designed to limit exposure to non-target species, and snap traps would be placed in elevated locations to avoid interference with non-target species. Snap traps have the potential to unintentionally injure or kill small herpetofauna; however, given the low probability of their use and mitigation measures to avoid non-target species, adverse impacts would not rise above minor, short-term impacts. No impacts are anticipated for terrestrial ESA-listed species (nesting sea turtles and the higo chumbo cactus) as these species would be avoided during implementation.

The Open Ocean TIG has completed technical assistance with relevant regulatory agencies regarding potential adverse impacts to protected species and habitats. Adverse impacts to ESA-listed species and critical habitat under NMFS and USFWS purview from rodenticide application has been previously evaluated in the Desecheo EA and associated consultations (USFWS, 2016). ESA consultations for species under NMFS and USFWS purview is complete per the existing consultations. See Table 4-14 for this project’s current environmental compliance status.

Summary

In summary, this project is anticipated to result in minor, short-term adverse impacts and long-term benefits to biological resources.

4.4.3.2.3 Socioeconomic Resources

Biosecurity Measures, Social Attraction

Desecheo NWR is closed to the public due to unexploded ordinances on the island. However, tourists frequently visit the waters surrounding Desecheo for snorkeling, SCUBA diving, and wildlife viewing. Biosecurity measures, including the use of rodenticide in bait boxes, would not affect the island’s surrounding water quality or marine biological resources that could, in turn, adversely impact human health and safety through consumption and/or contact. Continued biosecurity and social attraction would provide long-term benefits for socioeconomics, such as nature-based tourism companies, from improved biodiversity on the island.

Summary
In summary, the project is anticipated to result in long-term benefits to socioeconomic resources.

4.4.4 Seabird Nesting Colony Protection and Enhancement at Dry Tortugas National Park (preferred)

This project would contribute to the restoration of seabirds by reestablishing nesting colonies in the DRTO using several different techniques. During Phase I, additional monitoring would inform restoration activities, enhanced biosecurity would increase management of invasive predators, and vegetation management activities could be conducted to enhance habitat conditions. During Phase II, monitoring, enhanced biosecurity, and vegetation management activities would continue, and social attraction and additional habitat enhancement would be also conducted. Project activities most relevant to the assessment of environmental consequences include:

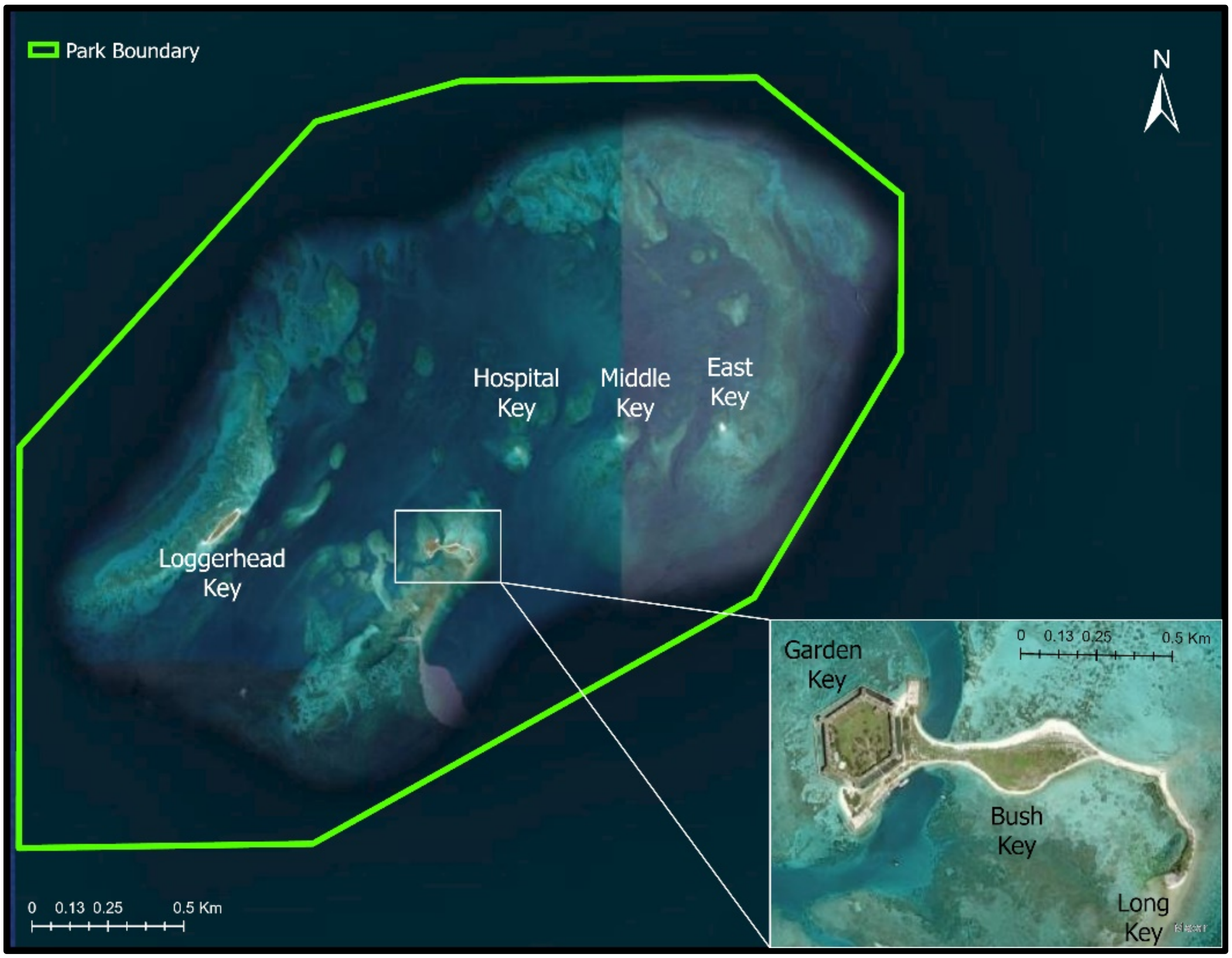
- **Monitoring**. Overflight or drone surveys would be conducted during Phase I to collect additional data on presence of nesting seabird species and colonies to establish baseline and inform subsequent restoration activities. Surveys would be conducted at least monthly from February through September on an annual basis through the project lifespan. Aircraft would stage from existing airfields on the Florida Peninsula and fly to DRTO to conduct the aerial surveys.
- **Biosecurity measures**. To prevent the (re)introduction of invasive species (including, but not limited to, plants, mammals, herpetofauna, and invertebrates), the project would enhance existing biosecurity efforts at DRTO. Measures may include vessel inspections, education and outreach, use of network surveillance cameras near landing areas, baiting cameras with non-toxic bait to lure species and increase detection rates, deployment of chew tags in high-use areas to detect rodents, and deployment of traps (e.g., snap traps) and rodent bait stations if evidence of rodents is found.
- **Vegetation management**. Vegetation management such as mechanical removal of invasive species and planting of native species to enhance habitat for nesting seabirds would be conducted during Phase II on some or all of DRTO’s seven keys. These activities may be leveraged in coordination with response and restoration from Hurricane Ian, which impacted the Dry Tortugas in September 2022.
- **Social attraction.** Bird and egg decoys, mirrors, and sound systems would be installed during nesting season in suitable nesting habitat for target species to attract seabirds to recolonize the island. All materials would be installed manually and would be removed once the project is complete. Decoys (made of recycled, high-density polyethylene and painted to look like target species) would be installed using high strength anchoring epoxy. Mirrors (approximately 12 inches by 6 inches [30 centimeters by 15 centimeters]) and sound systems (amplifier, charge controller, MP3 player, speakers, solar panels, and marine batteries) would be bolted to rocks using hand tools. Social attraction materials would be removed after each nesting season, if possible, and would be removed after project completion. Social attraction methods would be used to reestablish seabird colonies in areas identified as suitable based on baseline data gathered in Phase I and enhanced through Phase I and II biosecurity and habitat enhancements.

4.4.4.1 Affected Environment

DRTO was established by the U.S. Congress on October 26, 1992, as part of the national park system. DRTO encompasses 100 square miles (161 square kilometers) of seven small keys and their surrounding coral reefs, shoals, and water. The NPS oversees the management of visitors and terrestrial, marine, and cultural resources within DRTO's boundaries. NPS recently partnered with USDA-APHIS to plan, fund, and implement black rat eradication on Bush, Garden, Long, and Loggerhead Keys. This project proposes to build off the rat eradication work by establishing a seabird monitoring baseline, implementing biosecurity measures to prevent black rat reintroduction, and restoring and enhancing seabird colonies in the DRTO (Figure 4-3).

The *DRTO Final General Management Plan Amendment/Environmental Impact Statement* (GMP; NPS, 2015) provides extensive information about physical, biological, and socioeconomic resources within DRTO and is incorporated by reference herein.

Figure 4-3 The Seven Keys of Dry Tortugas National Park



4.4.4.1.1 Physical Resources

The proposed project would be located on keys within DRTO, located approximately 70 miles (113 kilometers) west of Key West, Florida. DRTO consists of seven atoll-like tropical islands along the southern edge of the Florida shelf. All lands within DRTO are at or below sea level (NPS, 2015). As tropical atolls, soils are largely composed of well-drained fine sands. The keys are constantly changing in shape, size, and elevation, and in some cases disappearing and reappearing entirely, due to sand movement from wind and wave energy.

DRTO is located away from many land-based anthropogenic runoff areas. It is bounded to the north by the shallow Florida Bay, to the south by the Straits of Florida, to the west by the Gulf of Mexico, and to the east by the Atlantic Ocean. As such, the marine waters are largely pollution-free, leading to the area's designation as an Outstanding Florida Water Body (Florida Department of Environmental Protection, 2022). Despite the tropical climate with a designated rainy season, freshwater is scarce on the keys due to sandy soil and evaporation from sun exposure.

4.4.4.1.2 Biological Resources

Uplands on DRTO keys consist of tropical island habitats such as beaches and associated intertidal habitats. The USGS' National Land Cover Database categorizes upland areas as woody wetlands, emergent herbaceous wetlands, and barren land (sand/rock) (USGS, 2016). Over 200 plant and terrestrial animal species have been documented at DRTO, of which more than three-quarters are non-native (NPS, 2015). Bush and Long Keys have a higher proportion of native plants due to limited visitation to the islands and a lack of permanent human habitation. The islands within DRTO provide critical nesting and feeding habitat for several migratory bird species, including but not limited to white-tailed tropicbird (*Phaethon lepturus*), magnificent frigatebird, masked booby, brown pelicans, terns, and brown noddy. DRTO hosts one of the only continental U.S. nesting colonies of magnificent frigatebird. The only terrestrial mammal known to inhabit DRTO is the invasive black rat. Terrestrial herpetofauna include exotic species such as geckos, anoles, and frogs, and native species such as the Florida Keys mole skink (*Plestiodon egregious*), which is a Florida State Species of Concern.

Ninety-nine percent of DRTO is comprised of near-pristine open water marine habitats (NPS, 2015). Most notably, DRTO contains some of the oldest and most pristine tropical coral reefs in North America. Communities of ESA-listed elkhorn coral occur near several of the keys. DRTO is ecologically connected to the broader Florida Keys coral reef ecosystem with interdependent habitats such as seagrasses, coral reefs, and mangroves that support life stages of many key reef species. More than 300 reef fish species have been documented in DRTO, including several species important to commercial and recreational fisheries such as groupers, snappers, spiny lobster, and pink shrimp (*Pandalus borealis*) (NPS, 2015). More than 25 species of marine mammals have been sighted in and around DRTO. However, only the common bottlenose dolphin (*Tursiops truncates*) and West Indian manatee (*Trichechus manatus*) are known to occur within DRTO boundaries (NPS, 2015). Green and loggerhead (*Caretta caretta*) sea turtles nest on the keys, and all five species of sea turtles are known to inhabit the waters of DRTO.

A list of federally threatened, endangered, proposed, candidate, and other species of concern for this site, as identified through USFWS IPaC (USFWS, 2022) and NMFS' ESA species list (NMFS, 2022b), is presented in Appendix E. Federally designated critical habitat for loggerhead sea turtle (LOGG-T-FL-34) is present within the project site.

4.4.4.1.3 Socioeconomic Resources

The Dry Tortugas are located on the southwestern edge of Monroe County, Florida. DRTO is administered and managed by the NPS, with staff dedicated to park administration, visitor protection, science and resource management, maintenance, and interpretation. Areas within DRTO are zoned for a variety of historic preservation, research, and public visitation purposes. Garden Key (the site of Fort Jefferson) is zoned for historic preservation and is open year-round for public access (NPS, 2015). The central portion of Loggerhead Key (including the lighthouse and associated structures) is also zoned for historic preservation. Remaining portions of Loggerhead Key are zoned as research natural areas. The public is allowed on Loggerhead Key except during seabird and sea turtle nesting season (approximately

April to September). Bush Key is zoned for natural and cultural use and is also closed to public access during seabird and sea turtle nesting season. East Key is also closed during nesting season. Hospital and Long Key are permanently closed to public access, and Middle Key is a sandbar that emerges only intermittently.

DRTO contains numerous historical structures and shipwrecks, with many dating back to the Spanish exploration of the Americas in the 1500s (NPS, 2015). Most notably, Garden Key is the site of 1800s-era Fort Jefferson, which occupies approximately 16 acres of the Key. Fort Jefferson's masonry has severely deteriorated due to exposure to the marine environment, and DRTO has supported and continues to support historical preservation of the structure (NPS, 2015). Loggerhead Key contains an 1800s-era lighthouse and associated structures and the ruins of an early-1900s marine biology laboratory that are subject to historical preservation efforts. DRTO (listed October 26, 1992) and Fort Jefferson (listed November 10, 1970) are listed on the National Register of Historic Places (NPS, 2022).

Visitors can access DRTO by commercial or private boats or seaplanes. Passenger ferries are the primary mode of visitor transportation, bringing up to 200 visitors to Garden Key from Key West each day (NPS, 2015). Once on the islands, visitors participate in a variety of recreational activities such as swimming, snorkeling, land-based fishing, wildlife viewing, camping, kayaking, and SCUBA diving. Visitors are required to pack in and out all goods that they require for their visit, including water, due to the lack of freshwater on the islands. Previous visitor surveys indicated that peak visitation typically occurs from April to July (NPS, 2015).

4.4.4.2 Environmental Consequences

Project activities could occur on any of the seven keys in the Dry Tortugas, Loggerhead, Garden, Bush, Long, Hospital, Middle, and East Keys, and would build off existing biosecurity work previously implemented by the NPS on Garden, Bush, Long, and Loggerhead Keys.

Monitoring of nesting seabird colonies on the DRTO keys would be conducted via fixed-wing aircraft or drone. Aerial photographs and GPS data would be collected approximately monthly during peak seabird nesting season, generally February through September, and the data would be used to create imagery of nesting seabird colonies that would allow NPS resource managers to characterize the population baseline for nesting seabird species at DRTO and inform restoration actions to occur during Phases I and II.

NPS previously analyzed the management of black rats (including monitoring and rodenticide use) in their *Integrated Pest Management Plan and NEPA Compliance for the Management of the Non-Native Black Rat (Rattus rattus) at Dry Tortugas National Park* (herein referred to as the NPS Pest Management Plan; NPS, 2012), which is incorporated by reference below. The NPS Pest Management Plan analyzed a multi-faceted approach to monitoring for and removing black rats, including preventing the re-introduction of black rats after their removal. Such actions included use of rodenticide in tamper proof bait boxes and monitoring for rat presence using snap traps. The NPS Pest Management Plan determined that these actions would have negligible to minor, short-term adverse impacts to wildlife and terrestrial habitats primarily due to disturbance when placing and checking the bait boxes and traps.Social attraction (specifically, deployments of decoys, mirrors, and sound systems), biosecurity measures, and vegetation management proposed under this project are similar or identical in nature to the activities that would occur during implementation of the *Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)* project. It is anticipated that the environmental consequences to physical, biological, and socioeconomic resources from those activities would also be very similar. To reduce redundancy, the following discussion of environmental consequences is limited to those activities, techniques, and anticipated impacts that are unique to this project. Table 4-4 indicates the locations within this RP/EA where the reader can find detailed analyses of this project's impacts on physical, biological, and socioeconomic resources.

Table 4-4 NEPA Analysis by Resource for *Seabird Nesting Colony Protection and Enhancement at Dry Tortugas National Park (preferred)*

Resource	Location of Analysis in Chapter 4
Physical Resources	
Geology and Substrates	Analyzed in Sections 4.4.1.2.1 (*Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)*) and 4.4.3.2.1
Hydrology and Water Quality	Hydrology: Analyzed in Section 4.3.1 (Resources with Similar Impacts Common to All Alternatives) Water Quality: Analyzed in Section 4.4.1.2.1 and 4.4.3.2.1.
Air Quality	Analyzed in Section 4.3.1
Noise	Analyzed in Section 4.3.1
Biological Resources	
Habitats	Analyzed in Sections 4.4.1.2.2 and 4.4.3.2.2
Wildlife Species	Analyzed in Sections 4.4.1.2.2 and 4.4.3.2.2
Marine and Estuarine Fauna	Does not require additional analysis. Project activities would not include any in-water work or disrupt marine or estuarine fauna.
Protected Species	Analyzed in Sections 4.4.1.2.2 and 4.4.3.2.2
Socioeconomic Resources	
Socioeconomics and Environmental Justice	Socioeconomics: Analyzed in Sections 4.4.1.2.3 and 4.4.3.2.3 Environmental Justice: Analyzed in Section 4.3.1
Cultural Resources	Analyzed in Section 4.3.1
Infrastructure	Analyzed in Section 4.3.1
Land and Marine Management	Analyzed in Section 4.3.1
Tourism and Recreational Use	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
Public Health and Safety	Analyzed in Sections 4.4.1.2.3 and 4.4.3.2.3

4.4.4.2.1 Physical Resources

Monitoring

Primary monitoring activities would be conducted remotely, involving the collection of aerial imagery and GPS data via aircraft or drone; thus, the Phase I monitoring activities would have no impact on physical resources. During Phase II, passive monitoring using direct observation and/or deployment of trail cameras would require project staff to visit the keys, which may result in short-term, minor ground disturbance caused by foot traffic while hiking into and out of the locations where trail cameras would be deployed.

Biosecurity Measures, Social Attraction, and Vegetation Management
Social attraction, biosecurity measures, and vegetation management would be implemented as needed, and would entail visits to the keys by project staff. Some short-term, minor localized ground disturbance may result from the project activities. However, these activities are not anticipated to result in appreciably more ground disturbance than currently occurs with existing biosecurity and resource management at DRTO. Upland soils would be disturbed and could potentially erode during mechanical removal of invasive plants and subsequent planting of native vegetation, though adverse impacts to geology, substrates, and water quality would be minor and short-term. Removal of invasive plants and planting native vegetation would result in long-term benefits to the island's physical resources, reducing erosion of substrates, which also benefits water quality.

Summary
In summary, this project is anticipated to result in negligible-to-minor, short-term adverse impacts and long-term benefits to physical resources.

4.4.4.2.2 Biological Resources

Monitoring
Collection of aerial imagery and GPS data via aircraft or drone would be conducted in a manner to minimize impacts to biological resources. No impacts are anticipated for habitats or groud-dwelling wildlife. The target altitude of fixed-wing aircraft would be between 600 and 900 feet above sea level to collect high quality imagery and avoid disrupting birds and other biological resources. If drones are used, the target altitude would be no higher than 400 feet above sea level, and more commonly between 150 and 250 feet above sea level. Aircrafts and drones have the potential to strike birds during flight. NPS staff that are familiar with bird behavior (particularly for ESA-listed piping plover, which occur within DRTO) would be present during all flight operations. NPS and USFWS's BMPs for avoiding impacts to natural resources when using unmanned aircrafts would be followed (NPS, 2017; USFWS, 2017). In most cases, imagery would be collected from one visit per colony. Flights would be conducted for each key's colonies approximately once per month during peak seabird nesting season, generally between February and September. On the ground, passive monitoring using direct observation and/or deployment of trail cameras would require project staff to visit the keys, which may disturb wildlife, causing them to temporarily relocate to similar habitat nearby. However, wildlife are expected to return once monitoring activities are complete. As such, adverse impacts from these overflights are anticipated to be short-term and minor. Birds would experience long-term benefits from robust monitoring that would inform future resource management at DRTO.

Biosecurity Measures, Social Attraction, and Vegetation Management
As part of implementation of biosecurity measures, if a rodent incursion is detected on any of the keys, rodenticide bait boxes may be placed near the incursion site to prevent their spread. Any biosecurity measures involving use of rodenticide and snap traps would build on NPS and USDA-APHIS's recent and ongoing rat eradication program (NPS, 2012). For example, bait boxes and snap traps would be elevated 6 inches off the ground to minimize potential impacts to non-target organisms (NPS, 2012). The Open Ocean TIG has completed technical assistance with relevant regulatory agencies regarding potential adverse impacts to protected species and habitats. See Table 4-14 for this project's current environmental compliance status. All social attraction equipment would be removed after each nesting season, if possible, and after project completion.

Summary
In summary, this project is anticipated to result in minor, short-term adverse impacts and long-term benefits to biological resources.

4.4.4.2.3 Socioeconomic Resources

Monitoring
Monitoring activities conducted by aircraft or drone and on the ground are not anticipated to result in adverse impacts to socioeconomics or public health and safety. The locations that would be surveyed by drone (primarily bird nesting areas) are unlikely to be transited by visitors, as visitors are discouraged from disturbing nesting birds. Monitoring would be conducted by trained project personnel and would be passive in nature (e.g., overflights, observational surveys) with no potential to impact public health and safety.

Biosecurity Measures, Social Attraction, and Vegetation Management
Biosecurity measures, including the use of rodenticide in bait boxes, would not affect the island's surrounding water quality or biological resources that could, in turn, adversely impact human health and safety through consumption and/or contact. Continued biosecurity, social attraction, and vegetation management would improve biodiversity on the keys resulting in long-term benefits on wildlife-related tourism and recreation businesses.

Summary
In summary, the project is anticipated to result in long-term benefits to socioeconomic resources.

4.4.5 Common Tern Nesting Colony Restoration in the Great Lakes Region (non-preferred)

This project would contribute to the restoration of seabirds by increasing nesting success, survival, and productivity of the common tern (*Sterna hirundo*) at nesting locations in the Great Lakes region through data management, stewardship coordination, information and data sharing, habitat enhancement at existing colony locations, and creation of new nesting islands. Section 4.2 describes Phase I (working group coordination) and II (best management practices, database development, data documentation) activities that do not require further NEPA analysis. Phase II and III project activities most relevant to the assessment of environmental consequences include:

- **Human disturbance management.** During Phase II, human disturbance would be managed at existing nesting colonies through post-and-rope fencing, temporary closures of nesting areas, and/or educational measures.
- **Predator or competitor management.** During Phase II, predators (including mammals, birds, and reptiles) and nesting site competitors would be managed at locations where predation and competition is observed or has historically occurred. These activities and implementation locations would be informed by the data management and stewardship coordination activities in Phases I and II. Passive measures would be pursued as the first option, including but not limited to fencing/exclosures, overhead wire or monofilament grids, and/or nest or chick shelter boxes/enclosures. Human presence and activity would be added to deter predators/competitors where necessary and effective (e.g., hazing using bird deterrent lasers, noise, owl decoys). Where extreme impacts to nesting terns may potentially occur (i.e., complete colony failure or abandonment), live capture and relocation (e.g., great horned owls [*Bubo virginianus*]) or lethal removal (e.g., trapping of mink [*Neogale vison*]) would be considered as a last resort, in partnership with state/provincial and federal management agencies, Tribes, and other partners. If traps are used, they would be checked for any captured animals approximately daily (either directly by project personnel or though remote monitoring tools

such as radio telemetry transmitters or cameras). Project staff would conduct predator removal efforts as humanely as possible and following any applicable regulations.

- **Vegetation management.** In Phase III, vegetation would be removed from priority areas identified during the data management and coordination activities. This would include a mix of invasive vegetation removal, as well as removal of overgrown vegetation to improve common tern nesting conditions. Target species would primarily be manually removed, but prescribed fire may be implemented at some sites where feasible. As a last resort, chemical removal with herbicides would be considered where necessary (e.g., rhizomatous grasses and other species which cannot be exterminated by mechanical removal or burning) and where targeted treatment can be conducted without risk to surrounding aquatic resources. Additionally, native vegetation may be planted to enhance nesting conditions if vegetation is too sparse.
- **Construction of new nesting islands**. Two to three lacustrine islands would be constructed using rock fill and/or placement of dredge material to create/enhance common tern nesting island habitat. The size of constructed nesting islands would vary according to local hydrography and other design factors but would typically be less than 1 acre (0.4 hectares) in size. The islands would be sited to reduce the potential for future predator disturbance (e.g., sited offshore). One proposed island in Oneida Lake (near Syracuse, New York) would be expanded from 1,240 square feet to 3,500 square feet (378 square meters to 1067 square meters) and elevated to ensure habitat availability during high water periods.
- **Social attraction.** In Phases II and III, common tern bird and egg decoys, sound systems, and artificial nests would be installed during nesting season in areas where common terns have previously nested and on new nesting islands. All materials would be manually installed. Decoys (made of recycled, high-density polyethylene and painted to look like target species) would be installed using high strength anchoring epoxy or drilled into soils. Sound systems (amplifier, charge controller, MP3 player, speakers, solar panels, and marine batteries) would be bolted to rocks or drilled into soils using hand tools. Nesting boxes, nest rafts, and nesting platforms would be placed in suitable nesting areas to enhance nesting site conditions. Social attraction materials would be removed after each nesting season, if possible, and would be removed after project completion.
- Use of drones for project monitoring. The implementing Trustee and project partners would only use drones if the use is consistent with all laws, regulations, and policies applicable in the project implementation location at the time of use. Drones would not fly higher than 400 feet above sea level, and more commonly would be operated between 150 and 250 feet above sea level.

4.4.5.1 Affected Environment

This project would occur at current or historical nesting locations of the common tern across the Great Lakes region, including those in Minnesota, Wisconsin, Illinois, Michigan, Ohio, New York, and Ontario, Canada. Figure 4-4 displays locations in the Great Lakes where the common tern is known to nest, and where project activities could occur. Exact project locations would be identified in Phases II and III following data compilation and prioritization of restoration actions by the Tern Working Group. If additional sites or activities are included in the project, additional analysis may be needed. Potential project locations could include but are not limited to Interstate Island, Minnesota; Chequamegon Bay, or Green Bay, Wisconsin; Portage Bay or St. Ignace, Michigan; Cedar Point NWR or Willow Point Wildlife Area, Ohio; Oneida Lake, New York; and Presqu’ile Provincial Park, Ontario.

Within the Great Lakes, the common tern primarily nests on sandy or cobble beaches along freshwater shorelines and lakes, or on artificial sites such as dredge spoils and navigational buoys. Optimal nesting sites are isolated (e.g., lacustrine islands or peninsulas) to minimize exposure to predator and human disturbance. The common tern's nests are typically located within a few yards of the shoreline, making them susceptible to high water levels and wave action. The following sections provide a summary of the physical, biological, and socioeconomic resources in the Great Lakes region where the common tern nests.

Figure 4-4 Common Tern Nesting Locations and Potential Project Sites

4.4.5.1.1 Physical Resources

The common tern nests along the mainland shorelines and islands of the five Great Lakes, in addition to some inland lakes (e.g., Lake Champlain, Oneida Lake, Lake St. Clair, Lake of the Woods, Leach Lake), and rivers (e.g., the St. Clair River, the Detroit River, the Niagara River, the St. Lawrence River) in the region. For example, Oneida Lake is the largest water body fully within New York. Its surface currents typically follow the prevailing wind, which is most often from the northwest (Central New York Regional Planning and Development Board, 2003). Additionally, Willow Point Wildlife Area sits along the southern shore of Sandusky Bay in Lake Erie, a relative flat area composed of open water and marshland (Ohio DNR, n.d.).

Soils and sediments in nesting areas are primarily comprised of well-drained sands, gravels, and cobbles formed from the erosion of the lakebeds and shoreline bluffs. Optimal nesting topography gently slopes to the water's edge. Some shorelines in Indiana, Ohio, Michigan, and Wisconsin are bordered by sandy dunes, which represent the highest elevations adjacent to common tern nesting areas. Shorelines along which the common tern nests are typically located within FEMA flood zones and subject to over wash and wave action. For example, Presqu'ile Provincial Park in Ontario is a dynamic barrier bar peninsula system composed of limestone. The park is often subjected to strong natural phenomena like ice and windstorms that erode and shape the peninsula.

The Great Lakes – Michigan, Superior, Huron, Erie, and Ontario – form the largest surface freshwater system in the world, together holding nearly one-fifth of the Earth's surface freshwater. The five lakes are hydrologically interconnected and drain to the Atlantic Ocean via the Saint Lawrence River. The Great Lakes have over 10,000 miles (16,093 kilometers) of shoreline and serve as a drain for more than 200,000 square miles (32,187 square kilometers) of land, ranging from forested areas to agricultural lands, cities, and suburbs (USEPA, 2022b). The lakes' sizes result in ocean-like characteristics such as wave action, tides, and strong currents. Water within the Great Lakes is primarily glacial melt from the last ice age. However, a small ratio of new water exists from precipitation, rivers, and groundwater springs balanced by evaporation and drainage to the Atlantic Ocean. These water bodies are highly altered ecosystems, subject to high levels of pollution, eutrophication, invasive species, and fluctuating water levels.

4.4.5.1.2 Biological Resources

The Great Lakes region lies within the boreal forest biome, which is dominated by conifer trees such as balsam fir (*Abies balsamea*), white spruce (*Picea glauca*), northern white-cedar (*Thuja occidentalis*), paper birch (*Betula papyrifera*), and quaking aspen (*Populus tremuloides*). Lower canopy flora includes deciduous trees and shrubs such as dogwood (*Cornus* sp.), tag alder (*Alnus serrulata*), and soapberry (*Shepherdia canadensis*). These forest habitats have been subject to logging, urbanization, and deforestation for agriculture, such that limited old-growth forest remains. Common terns typically nest within sandy and/or gravelly beach habitat with sparse grass and shrub cover that the terns use to build nest and for protection from predators. Occasionally, common terns have been documented nesting in estuaries, bays, and marshes on matted vegetation.

The boreal forest, thousands of lakes and islands, and wetlands within the Great Lakes region provide important nesting, roosting, and foraging habitat for migratory and resident birds, particularly waterfowl, neotropical migrants, and colonially-nesting birds. Species of particular importance include the bald eagle (*Haliaeetus leucocephalus*), northern harrier (*Circus hudsonius*), common loon (*Gavia immer*), double-crested cormorant (*Nannopterum auritum*), common tern, bobolink (*Dolichonyx oryzivorus*), least bittern (*Ixobrychus exilis*), common merganser (*Mergus merganser*), and Kirtland's warbler (*Setophaga kirtlandii*). Other colonially-nesting birds such as ring-billed (*Larus delawarensis*) and herring (*Larus smithsonianus* or *Larus argentatus smithsonianus*) gulls compete for nesting sites with the common tern; these species typically arrive at nesting sites before the common tern, which results in the tern nesting closer to the water and increasing susceptibility to over wash and wave action.

A variety of mammals and other birds prey on common tern eggs and chicks, including raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), red fox (*Vulpes vulpes*), mink, great horned owl, black-crowned night heron (*Nycticorax nycticorax*), gulls, crows, rodents, and feral cats and dogs. Common tern nesting colonies located near populated areas are at higher risk of anthropogenically-driven predation from feral or stray animals.

The Great Lakes and associated inland lakes contain a variety of freshwater fish and crustaceans that support recreational and commercial fisheries and wildlife in the region. However, shipping operations have led to the spread of aquatic invasive species, most notably the zebra mussel (*Dreissena polymorpha*), which has fouled beaches, harmed fisheries, clogged water infrastructure, and lead to the regional extinction of native species. Zebra mussels are the most significant bottom-dwelling organism in Oneida Lake, and at one point in 1992 were reaching densities as high as 140,000 mussels per square meter and is believed to have caused the extinction of three bivalve clam species (Central New York

Regional Planning and Development Board, 2003). More than 180 non-native species have entered the Great Lakes, most of which were transported in the ballast water of ocean-going ships (Environment and Climate Change Canada and USEPA, 2021).

A list of federally threatened, endangered, proposed, candidate, and other species of concern for this site, as identified through USFWS IPaC (USFWS, 2022) and NMFS' ESA species list (NMFS, 2022b), is presented in Appendix E. The States of Minnesota, Wisconsin, Illinois, Michigan, Pennsylvania (extirpated), New York, and Ohio have all listed the common tern on each of their state endangered species lists. Federally designated critical habitats for Canada lynx (*Lynx canadensis*), gray wolf (*Canis lupus*), Hine's emerald dragonfly (*Somatochlora hineana*), Indiana bat (*Myotis sodalist*), piping plover (*Charadrius melodus*), poweshiek skipperling (*Oarisma poweshiek*), and rabbitsfoot (*Quadrula cylindrica cylindrica*) are present within the Great Lakes region (USFWS, 2022).

4.4.5.1.3 Socioeconomic Resources

The Great Lakes are one of the world's largest surface freshwater ecosystems and supply 84 percent of North America's surface fresh water and 21 percent of the world's surface fresh water, which is used for consumption, transportation, power, recreation, and other uses. In addition to its value as a surface water source, the Great Lakes represent a dominant part of North American physical and cultural heritage (USEPA, 2022a). The region has been home to Native Americans for nearly 10,000 years. In the 1600s, Europeans arrived and utilized the region for animal furs and farmland.

The Great Lakes region has a population of more than 30 million people, accounting for approximately 10 percent of the U.S. population and more than 30 percent of the Canadian population (USEPA, 2022a). Over 120 cities border the Great Lakes, of which the five largest are Toronto, Ontario on the northwestern shore of Lake Ontario; Chicago, Illinois, on the southwestern shore of Lake Michigan; Mississauga, Ontario, on the northwestern shore of Lake Ontario; Milwaukee, Wisconsin, on the western shores of Lake Michigan; and Hamilton, Ontario, on the western tip of Lake Ontario. Across the region, large city centers are interspersed by vast suburban and rural areas.

The Great Lakes region is also a crucial part of the economies in the U.S. and Canada because of the number of shipping routes. The largest volume of goods transported are iron ore, grain, and potash. Due to the harsh winters of the region, shipping slows in the winter when ice forms on the lakes. The major ports in the region are Chicago, Illinois; Cleveland, Ohio; Detroit, Michigan; Duluth, Minnesota; and Milwaukee, Wisconsin.

In addition to shipping and logistics, other significant sectors of the economy include manufacturing, agriculture, mining and energy, finance, and tourism. The manufacturing industry is the coastal regions' largest employer (59 percent) followed second by tourism and recreation (17 percent) (Michigan Sea Grant, 2020). Across the Great Lakes, tourism and outdoor recreation supported more than 300,000 jobs in 2018 (Michigan Sea Grant, 2020). The regions' three national parks and three national lakeshores drew approximately 6.5 million visitors in 2018. Boating, angling, and wildlife viewing are popular activities. One study found that in 2011, birdwatching at six natural areas along Lake Erie generated more than $26 million and contributed $1.9 million in tax revenues (Xie, 2012). Agriculture, fishing, and food production are also significant sectors of the economy (10 percent) (Michigan Sea Grant, 2020). In the Willow Point Wildlife Area in Ohio, hunting, trapping, and fishing are all popular activities (Ohio DNR, n.d.). However, in the area surrounding Oneida Lake, the construction of locks and dams as well as agricultural and lumbering practices has led to the extinction of many aquatic species of recreational fishing importance, such as Atlantic salmon (Central New York Regional Planning and Development Board, 2003).

4.4.5.2 Environmental Consequences

This project would take a phased approach to common tern restoration, beginning with the creation of a Tern Working Group, data standardization, and monitoring database development. Environmental consequences from these data management and education and outreach activities are analyzed in Section 4.2. Five restoration activities (human disturbance management, predator/competitor management, vegetation management, nesting island construction, and/or social attraction,) could be implemented in Phases II and III to restore common tern populations. As noted in the project description in Chapter 2 and Section 4.4.5.1, specific sites for these activities have not yet been identified. Once specific sites are identified, any additional environmental review would occur during implementation planning. The Implementing Trustee(s) would review and affirm that the site-specific conditions are consistent with those described in this RP/EA. If the site-specific conditions indicate that the impacts would not be consistent with those described in this RP/EA, the Open Ocean TIG would determine whether to undertake additional site-specific environmental review, consistent with NEPA and other environmental compliance requirements, or forego implementation at that location. Any necessary additional NEPA analysis would be prepared by the Implementing Trustee(s) or appropriate federal agency and included in the Administrative Record and DIVER once completed.

The Open Ocean TIG analyzed the impacts of seabird nesting island construction in freshwater waterbodies in its RP1/EA, which is incorporated by reference herein (Open Ocean TIG, 2019a). The Regionwide TIG analyzed the impacts of herbicide use for vegetation management in its RP1/EA, which is incorporated by reference herein (RW TIG, 2021).

Predator management, vegetation management (specifically, mechanical removal of invasive species and planting of native plants), social attraction (specifically, deployments of decoys and sound systems) measures, and the potential use of drones proposed under this project are similar or identical in nature to the activities that would occur during implementation of the *Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)* project. It is anticipated that the environmental consequences to physical, biological, and socioeconomic resources from those activities would also be very similar. To reduce redundancy, the following discussion of environmental consequences is limited to those activities, techniques, and anticipated impacts that are unique to this project. Table 4-5 indicates the locations within this RP/EA where the reader can find detailed analyses of this project's impacts on physical, biological, and socioeconomic resources.

Table 4-5 NEPA Analysis by Resource for *Common Tern Nesting Colony Restoration in the Great Lakes Region (non-preferred)*

Resource	Location of Analysis in Chapter 4
Physical Resources	
Geology and Substrates	Analyzed in Sections 4.4.1.2.1 (*Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)*) and 4.4.5.2.1
Hydrology and Water Quality	Hydrology: Analyzed in Section 4.3.1 (Resources with Similar Impacts Common to All Alternatives) Water Quality: Analyzed in Sections 4.4.1.2.1 and 4.4.5.2.1
Air Quality	Analyzed in Section 4.3.1
Noise	Analyzed in Section 4.3.1

Resource	Location of Analysis in Chapter 4
Biological Resources	
Habitats	Analyzed in Sections 4.4.1.2.2 and 4.4.5.2.2
Wildlife Species	Analyzed in Sections 4.4.1.2.2 and 4.4.5.2.2
Marine and Estuarine Fauna	Analyzed in Sections 4.4.1.2.2 and 4.4.5.2.2
Protected Species	Analyzed in Sections 4.4.1.2.2 and 4.4.5.2.2
Socioeconomic Resources	
Socioeconomics and Environmental Justice	Socioeconomics: Analyzed in Sections 4.4.1.2.3 and 4.4.5.2.3 Environmental Justice: Analyzed in Section 4.3.1
Cultural Resources	Analyzed in Section 4.3.1
Infrastructure	Analyzed in Section 4.3.1
Land and Marine Management	Analyzed in Section 4.3.1
Tourism and Recreational Use	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
Public Health and Safety	Analyzed in Sections 4.4.1.2.3 and 4.4.5.2.3

4.4.5.2.1 Physical Resources

Human Disturbance Management and Predator or Competitor Management

Management of human disturbance would require foot traffic that may disrupt soils and sediments near common tern nesting sites; however, foot traffic is not expected to occur at a greater level than currently occurs for management and stewardship activities. Installation of post-and-rope fencing around common tern nesting colonies may have negligible to minor, short-term adverse impacts on soils and sediments as a result of minor erosion from hand-digging post holes. Installation of predator or competitor management structures (e.g., fencing/exclosures, wire grids, chick shelters) would require foot traffic to seabird nesting areas that may result in localized disruption of soils and sediments. Management of predator or competitor disturbance may have negligible to minor, short-term adverse impacts on soils and sediments as a result of minor erosion from moving materials to the implementation site and hand-digging holes for installation. Management of human disturbance and predators/competitors would provide long-term benefits to physical resources, as they can be disturbed by human activities that also disturb nesting birds. Establishing temporary protected areas can help reduce erosion and benefit localized soils and sediments.

Vegetation Management

Site preparation for prescribed fires may involve the use of machinery such as roller choppers, gyro tracs, and excavators, and/or other mechanical treatments to create habitat conditions which facilitate desired fires. Clearing, plowing, and disking may be used to prepare fire breaks, zones devoid of fuel that border burn units and help manage fire boundaries. The MS TIG's 2016-2017 Restoration Plan/Environmental Assessment (MS TIG, 2017) analyzed impacts to physical resources from prescribed fire and determined that those types of activities could have moderate, short-term adverse impacts to geology and substrates and minor to moderate, short-term adverse impacts to water quality and wetlands. Site preparation and implementation of prescribed fire for this project would result in moderate, short-term adverse impacts to geology and substrates and neglible-to-minor, short-term adverse impacts to water quality if the prescribed fire results in localized erosion until native vegetation regrows.

Site preparation for chemical removal may involve the use of ATVs or other small equipment. The Regionwide TIG's RP1/EA (RW TIG, 2021) analyzed impacts to physical resources from chemical treatment of invasive vegetation and determined that the activity could have minor, short-term adverse impacts to geology and substrates from accessing habitat and potential minor, and could have short-term adverse impacts to water quality in the event of an accidental spill. Care would be taken to obtain permits and handle chemicals according to the manufacturer's instruction, particularly in aquatic systems. All federal, state, and local regulations permitting the use of herbicides would be complied with by the project implementer. As such, chemical vegetation management would result in minor, short-term adverse impacts to geology and substrates. Herbicides would only be used if the use does not impact aquatic resources. As such, no impacts to water quality would occur. Physical resources would benefit from vegetation management due to the improved growing conditions for native plants that help prevent erosion.

Construction of New Nesting Islands

The construction of nesting islands would involve the placement of rock fill and/or dredged sediments and would require the use of water-based barges, excavators, and/or dredges to place fill materials. Island construction techniques, if and where conducted, would be site-specific and comply with requirements to minimize disturbance to nearby waters or wetlands. The Open Ocean TIG RP1/EA concluded that nesting island construction from the placement of beneficially dredged material would result in minor, short-term adverse impacts to water quality and long-term benefits for geomorphology. Further, dredged materials have been used elsewhere in the Great Lakes region to restore islands to benefit birds and other wildlife (e.g., Cat Island in Green Bay, Wisconsin [Brown County, 2014]). Water quality would be temporarily adversely impacted due to an increase in turbidity during construction, but it would be short in duration and offset by the project benefits over the long-term. Soils and sediments would experience moderate, long-term adverse impacts due to the geomorphological change from subtidal to island habitat area. Physical resources would experience long-term benefits, including a decrease in wind and wave action, improvement in water flow patterns and sediment transport, and improvement to integrity of the floodplain. Planning and design would consider wave action, water currents, and water elevation to reduce overall erosion. Sediments and/or rock fill used to create the islands would be locally sourced either from beneficial use of previously permitted dredged material or appropriate terrestrial sources. All materials would be free from contaminants and/or invasives to mitigate impacts to water quality.

Social Attraction

Installation of artificial nests (e.g., nest boxes, nest rafts, floating nest platforms) would require foot traffic to seabird nesting areas that may result in localized disruption of soils and sediments. Artificial nests would be deployed in known nesting areas prior to the onset of seabird nesting season (approximately March) and removed after chicks have fledged (approximately June). However, these activities are not anticipated to result in appreciably greater impacts than currently occurs for bird management at the proposed project sites. As such, social attraction activities would have negligible impacts on soils and sediments in the project area.

Summary

In summary, this project would have minor to moderate, short- to long-term adverse impacts and long-term benefits to physical resources.

4.4.5.2.2 Biological Resources

Human Disturbance Management

Project implementation would require foot traffic that may disturb coastal habitats and associated wildlife near common tern nesting sites; however, foot traffic is not expected to occur at a greater level than currently occurs for management and stewardship activities. As such, it is expected to have a negligible adverse impact on biological resources in the project area. Placing post-and-rope fencing around bird colonies may have negligible to minor, short-term adverse impacts on habitats, terrestrial wildlife, and protected species as a result of human presence during installation and slight habitat alteration. However, fencing would be sited away from sensitive habitats or wildlife for the purposes of excluding the public from those sensitive areas, which would benefit biological resources in the long-term.

Predator or Competitor Management Through Trapping or Hunting

Management of competitor disturbance would require foot traffic and temporary installation of management infrastructure (e.g., fencing/exclosures, wire grids, chick shelters) that may have negligible to minor, short-term adverse impacts on habitats and non-target species. Common tern nesting site competitors (herring and ring-billed gulls, double-crested cormorants) may experience moderate, short-term adverse impacts due to hazing and nesting site exclusion. However, the project is not anticipated to adversely affect population levels, and competitors would find suitable nesting habitat elsewhere. All hazing and/or take of birds protected under the Migratory Bird Treaty Act (MBTA) would be conducted under applicable permits. Common terns would experience long-term benefits from predator and competitor management due to increased nesting success.

Vegetation Management

Prescribed fire would result in minor to moderate, short-term adverse impacts to target habitats and their associated wildlife due to site preparation activities and burning. Burn lines would be cut to prevent the unintended spread of fire beyond the targeted burn area. Wildlife would be anticipated to move away from the area during operations.

Chemical treatments and the use of herbicides would have no effect on freshwater habitats and marine or estuarine fauna due to the limited use. Accidental spills may have up to minor, short-term adverse impacts to spill-site habitats and fauna. Misapplication could also result in minor, short-term adverse impacts to vegetation adjacent to target species (MS TIG, 2017). Personnel would apply herbicide in accordance with the direction and guidance provided on the appropriate USEPA labels and state statutes during land-based activities. Herbicides would not be applied within 60 feet of any ESA-listed plant species, plant species of concern, or freshwater habitats unless analysis indicates herbicide use is the best way to protect the ecosystem from invasive plants. Vegetation management (including the use of prescribed fire and chemical treatment) would provide long-term benefits to wildlife and habitats by restoring natural vegetative communities and increasing biodiversity.

Construction of New Nesting Islands

New nesting islands would result in a habitat transition from benthic and open water habitats to terrestrial and aquatic habitats. Marine and estuarine fauna may experience minor to moderate, short-term adverse impacts during construction due to disturbance and increased turbidity. Benthic habitats and organisms in the footprint of the island would experience moderate, long-term adverse impacts due to the habitat conversion. Multiple ESA-listed freshwater clams and mussels are present throughout the Great Lakes; proposed island sites would be surveyed for these species to avoid sites with ESA-listed species. Construction would occur outside the common tern nesting season (summer), and sediments may be delivered over ice during winter at one site (Oneida Lake). Construction of nesting islands would provide long-term benefits to common terns and other shorebirds and waterbirds by increasing nesting habitat that is protected from predators and human disturbance and that is resilient to rising water levels.

Social Attraction
Installation of artificial nests (e.g., nest boxes) would require foot traffic to seabird nesting areas; however, all placements would occur prior to the onset of nesting season and removals would occur after the nesting season to not disturb nesting seabirds so impacts would be negligible. Artificial nests would help facilitate seabird reproduction and potentially improve nesting outcomes over the long-term.

Summary
As noted in the project description in Chapter 2 and Section 4.4.5.1, the specifics of some Phase II activities would not be identified until Phase I concludes; thus, the Open Ocean TIG would coordinate and complete consultation with relevant regulatory agencies as necessary on this project regarding potential adverse impacts to protected species and habitats prior to project implementation. In summary, this project would have minor to moderate, short- to long-term adverse impacts and long-term benefits to biological resources.

4.4.5.2.3 Socioeconomic Resources

Human Disturbance Management, Predator or Competitor Management
Management of human and competitor disturbances would require foot traffic, the installation of post-and-rope fencing or shelter enclosures, temporary closures around common tern nesting colonies, and/or removal and relocation of predators. These activities would not impact socioeconomics or public health and safety.The management of disturbances would provide long-term benefits for nature-based tourism businesses as nesting colonies recover and enhance wildlife viewing opportunities.

Vegetation Management
Prescribed fire and herbicide use may be implemented at some sites where feasible, which could result in minor, short-term adverse impacts on public health and safety. Prescribed fires may result in temporary, localized smoke and could deviate from established fire plans. Chemical vegetation management would require use of herbicide that could be hazardous if spilled or handled improperly. However, fires and herbicide application would be implemented by trained personnel and BMPs would be followed to minimize any potential impacts on public health and safety, such as ensuring boundaries are in place to avoid anyone entering the area during a burn or application.

Site preparation for prescribed fires and nesting island construction activities could result in minor, short-term disruptions to regional economies during construction and implementation. Site preparation may involve the use of machinery such as roller choppers, gyro tracs, and excavators, and/or other mechanical treatments to create habitat conditions which facilitate desired fires. Clearing, plowing, and disking may be used to prepare fire breaks, zones devoid of fuel that border burn units and help manage fire boundaries. Vegetation management would have long-term benefits for nature-based tourism businesses as nesting colonies recover and enhance wildlife viewing opportunities.

Construction of New Nesting Islands
Construction locations may be temporarily closed to protect public health and safety during implementation activities. However, the project is not anticipated to adversely impact public health and safety. Activities would be conducted by trained and permitted personnel and would follow relevant construction practices to minimize impacts to public health and safety. Construction could involve water-based barges, excavators, and/or dredges that would be used to place fill materials for the islands. Disruptions to regional economics during construction and implementation could result from increased noise and traffic in the area and potential closures of certain areas during construction. Construction activities could also result in benefits to socioeconomic resources as a result of potential increases in jobs to support the construction of the islands.

Summary
In summary, this project would result in minor, short-term adverse impacts and long-term benefits on socioeconomic resources.

4.4.6 Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries (preferred)

Gillnet fisheries target groundfish, such as cod, haddock, and flounder, among other commercially important fish. Gillnets are deployed in the water column and pose a risk of entanglement to diving birds, sea turtles, and marine mammals. Few effective seabird bycatch reduction methods have been developed for gillnets; however, increasing visibility and reducing encounter rate should reduce entanglement of seabirds (Wiedenfeld, 2016). Other fisheries gear that pose risk of seabird bycatch include other types of nets, such as trawls and purse seines, and these types of gear can cause both seabird collisions and entanglement of wildlife. Longline fisheries typically target larger fish species such as tuna and swordfish with bait that includes squid, mackerel, and sardines. Multiple hooks are suspended on a long line and are often marked with light sticks. The bait or lights may attract turtles, marine mammals, and seabirds. Direct mortality of birds occurs when they are hooked or entangled and are drowned as hooks sink, which may also cause indirect mortality of chicks if one or both parents are killed during chick dependency (Brothers et al., 1999; Gilman, 2001). This project would aim to reduce bycatch of northern gannet (*Morus bassanus*) and great shearwaters (*Ardenna gravis*) in northeastern U.S. and Canadian Atlantic commercial fisheries. Project activities most relevant to the assessment of environmental consequences include:

- **Pilot testing bycatch reduction strategies.** In Phases I and II, seabird bycatch reduction strategies, such as changes in fishing practices or bird deterrents and/or gear alterations, would be pilot tested in Cape Cod and Newfoundland commercial fisheries. Phase I would focus on baiting practice modifications in the Cape Cod-based groundfish gillnet fishery and visual site deterrents, gear switching and modification, and soak time modifications in the Newfoundland cod and herring gillnet fishery. These Phase I pilot trials would conduct voluntary comparative field-testing with commercial fishing vessels and gather efficacy data through on-board observations during the tests. Phase II would pilot test at least two additional seabird bycatch reduction strategies in either U.S. or Canadian PLL, trawl, gillnet, purse seine, or scallop fisheries.
- **Field studies.** In Phase II, field studies would be conducted to gather local knowledge regarding interactions with birds during fishing operations. This could include tagging, handling, or capturing live seabirds that have been injured to understand potential fisheries interactions. These activities would be conducted under existing permits or would be permitted; this may be done by partners who are not official NOAA observers.

This project could include gear and fishing practice testing for the following U.S. fisheries: groundfish gillnet, flounder trawl, scallop, PLL, and purse seine. Target U.S. fisheries operate year-round with seasonal peaks. Target Canadian Fisheries are active April to November.

4.4.6.1 Affected Environment

This project would occur in the Atlantic Ocean offshore of Cape Cod, Massachusetts and Newfoundland, Canada. Primary project activities involve establishing partnerships, conducting workshops, engaging with local fishers and stakeholders for outreach and education, and collecting and analyzing data to design pilot tests for bycatch reduction practices. Many of these activities will be conducted from existing facilities on land. Vessel-based activities would include pilot studies conducted in the Atlantic, off the coast of New England and Canada, and may include baiting practice modifications (Cape Cod, Massachusetts project area; Figure 2-6), visual site deterrents, gear switching and modification, and soak time modifications (Newfoundland, Canada project area; Figure 2-6). Pilot studies would be conducted in waters where commercial fishing vessels are permitted and already operating in U.S. and Canadian waters for Cape Cod-based groundfish and Newfoundland-based cod and herring.

Existing U.S. groundfish fishery (including the use of gillnet) impacts have been analyzed under the consolidated Fishery Management Plan (FMP), Environmental Impact Statement (EIS), Regulatory Impact Review, and Initial Regulatory Flexibility Analysis for the Northeast Multi-Species Fishery FMP (New England Fishery Management Council [NEFMC], 1985) and recent amendments (see www.nefmc.org/management-plans/northeast-multispecies). Implementation of the FMP has undergone ESA Section 7 consultations (NMFS, 2013). The FMP and amendments provide extensive information about the physical, biological, and socioeconomic resources within the northeast Atlantic fisheries and are incorporated by reference herein. Further, the PDARP/PEIS evaluated the environmental consequences of bycatch reduction measures as a Restoration Approach for Fish and Water Column Invertebrates (6.4.5.4) and Sea Turtles (6.4.7.4). The Open Ocean TIG RP2/EA (Open Ocean TIG, 2019b) also evaluated the environmental consequences of bycatch reduction devices (Section 4.4.3.2). While these Restoration Approaches were evaluated to restore for other marine resources, the methods and environmental consequences evaluated are similar. Both the PDARP/PEIS and Open Ocean TIG RP2/EA are incorporated by reference herein.

4.4.6.1.1 Physical Resources

This section describes the geology, substrates, hydrology, and water quality off the coast of the northeastern U.S. and Canada. The Northeast Multi-Species Fishery occupies a vast area of open water. The physical resources in this area are diverse and vary depending on location. This project would occur within two areas, one off the coast of Cape Cod, and another off the coast of Newfoundland in the Atlantic Ocean. The fisheries targeted for bycatch reduction are in nearshore, continental shelf, continental slope, and deep-water open ocean habitats. This area consists of shallow banks, ledges, and deep basins. The substrates on the shelf are mostly sand, with areas of silt/clay, gravel, gravel/sand mixtures, and large rocky areas (NEFMC, 1985). In general, sediments are finer with increasing depth and distance from land (NEFMC, 2020).

Oceanographic features such as currents, temperature gradients, eddies, and fronts influence the distribution patterns of many oceanic species, including groundfish. The Gulf Stream, the North Atlantic Current, and the Labrador Current influence the climate and the physical oceanographic conditions in this region. Several notable banks are located within the project areas, including Georges Bank, east of Cape Cod, and Grand Banks, southeast of Newfoundland. These large, shallow banks are well mixed due to currents, waves, wind, and storms (NEFMC, 1985).

Water quality and hydrology in the nearshore environment is strongly influenced by coastal watersheds and drainage systems. Freshwater from watersheds enters coastal waters, discharging sediments, nutrients (e.g., nitrogen, phosphorus), and contaminants from industrial wastewater discharge and urban and agricultural runoff. Oceanic circulation patterns influence water quality by dispersing and diluting coastal waters. Salinity, temperature, and turbidity in nearshore coastal waters are also strongly influenced by freshwater inputs.

4.4.6.1.2 Biological Resources

This section describes the habitats, marine and estuarine fauna, and wildlife in the Cape Cod and Newfoundland project areas in the Atlantic, including protected species, critical habitat, and EFH for federally-managed species.

Although Cape Cod is often thought of as a geographic dividing line between warm and cool temperate biota, this area includes subtropical, tropical, temperate, and arctic taxa at different times of year (NEFMC, 1985). Benthic habitats may include unconsolidated soft sediments, seagrass, and cold-water corals (NEFMC, 2018; NOAA, n.d.). Shallow, well-mixed, nutrient-rich waters (e.g., on Georges Bank) maintain high plankton productivity. Consequently, benthic habitats and the water column in these areas support a productive community of invertebrates (e.g., coral, squid), fishes, marine mammals, sea turtles, and seabirds.

The water column provides habitat for a diverse assemblage of fishes and invertebrates. Smaller organisms support the food web and contribute to production of ecologically, recreationally, and commercially valuable fish species. Commercially important species managed by the Northeast Multi-Species FMP include Atlantic cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), redfish (*Sebastes* sp.), pollock (*Pollachius pollachius*), silver hake (*Merluccius bilinearis*), red hake (*Urophycis chuss*), white hake (*Urophycis tenuis*), yellowtail flounder (*Limanda ferruginea*), American plaice (*Hippoglossoides platessoides*), witch flounder (*Glyptocephalus cynoglossus*), winter flounder (*Pseudopleuronectes americanus*), and windowpane flounder (*Scophthalmus aquosus*). Other managed species in the project area include Atlantic sea scallop (*Placopecten magellanicus*), Atlantic mackerel (*Scomber scombrus*), and summer flounder (*Paralichthys dentatus*).

Atlantic salmon (*Salmo salar*), Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), and shortnose sturgeon (*Acipenser brevirostrom*) are listed as threatened or endangered in the region; however, are not expected to occur in the project area. Five species of sea turtle occur in the northwest Atlantic Ocean, including hawksbill, leatherback, Kemp's ridley (*Lepidochelys kempii*), loggerhead and green sea turtle. Hawksbill is considered extremely rare in the region. The other four sea turtles occur in the region seasonally in the summer months. All five sea turtle species are ESA-listed. The NMFS *2020 Stock Assessment Report* lists numerous marine mammal species with the potential to occur in the project areas, including more than 30 species of whales and dolphins (Hayes et al., 2021). Among these, North Atlantic right whale (*Eubalaena glacialis*), fin whale, sei whale, sperm whale, and blue whale are listed as endangered. Critical habitat is designated for North Atlantic right whale in the Gulf of Maine and Georges Bank (Hayes et al., 2021).

USFWS Birds of Conservation Concern in the Cape Cod project area include Audubon's shearwater (*Puffinus lherminieri*), band-rumped storm-petrel (*Oceanodroma castro*), Cory's shearwater (*Calonectris ectinat*), and manx shearwater (*Puffinus puffinus*) (USFWS, 2022). In the Cape Cod project area, red knot (*Calidris canutus rufa*) and roseate tern may occur and are listed as threatened and endangered, respectively (USFWS, 2022). No critical habitat is designated for these species in this area.

A list of federally threatened, endangered, proposed, candidate, and other species of concern for this site, as identified through USFWS IPaC (USFWS, 2022) and NMFS' ESA species list (NMFS, 2022b), is presented in Appendix E. The Newfoundland project area is outside the jurisdiction for U.S. protected species, critical habitat, and EFH.

4.4.6.1.3 Socioeconomic Resources

This proposed project would be implemented along the Atlantic coast of the U.S. and Canada and would focus on the Cape Cod-based groundfish gillnet fishery and Newfoundland-based cod and herring gillnet fishery during Phase I. Phase II could involve additional fisheries including trawl, scallop dredge, PLL, and purse seine fisheries. Socioeconomic resources of the Atlantic are described in the consolidated FMP (NEFMC, 1985) and recent amendments and this information is incorporated by reference herein. NEFMC (1985) provides a detailed socioeconomic evaluation for several significant ports along the coast of Massachusetts and Maine.

While New England is highly populous and socially and economically diverse, particularly in urban centers, the coast is generally more rural, and economies are supported by a mix of tourism, commercial fishing, and other offshore resource extraction (e.g., oil and gas; sand and gravel; wind and wave energy).

Tourism on the coast of New England, particularly in the summer, is an economically important industry. The NPS estimates that visitors to Cape Cod National Seashore in 2021 spent more than $500 million, supporting approximately 6,000 local jobs (NPS, 2022). Visitors vacation, go to the beach, participate in recreational sports and activities, view wildlife from land and boats, and consume seafood harvested recreationally and commercially. In 2017, NOAA estimated that 5 million residents participated in recreational fishing on the Atlantic coast, and 6 percent of those were in Massachusetts (NMFS, 2018a).

The commercial fishing industry traditionally supported large economies along the coasts of Cape Cod and Newfoundland. In 2017, NOAA estimated that landings of commercial fish in New England generated over $1.2 billion (NMFS, 2018a). In addition to supporting the fishers themselves, the industry supports jobs for suppliers of fishing gear and at docks, marinas, and other local businesses. Fish processors, wholesale distributors, fish retail, and restaurants are all supported by commercial fishing. Decreasing stocks and the increasing cost of operations have impacted the broader commercial fishing industry. However, in 2019, the commercial fishing and seafood industry in Massachusetts generated the largest employment among New England states, contributing nearly 150,000 jobs and the largest sales, totaling $16.3 billion, with value-added impacts of $6.3 billion, and income impacts of $4 billion (NMFS, 2022a). Aquaculture is also an important regional industry. It is estimated that commercial fishing and aquaculture contribute 12 percent of jobs and 11 percent of gross revenues in the Cape Cod region (Cape Cod Commission 2020).

Other commercial infrastructure and activities in the offshore marine environment include renewable energy production (e.g., wind turbines), sand and gravel mining, and construction and maintenance of cables and pipelines.

Fishery resources in the project area are managed by the regional fishery management councils, the NEFMC, and by NMFS. FMPs establish the spatial and temporal extent of areas closed to fisheries.

4.4.6.2 Environmental Consequences

This project does not propose a change in fishing effort in terms of locations fished or the introduction of novel gear type. During Phase I, for the Cape Cod-based groundfish gillnet fishery, seabird bycatch reduction strategies to be pilot tested would include modification of fishing practices and visual site deterrents. For the Newfoundland cod and herring gillnet fishery, seabird bycatch reduction strategies could include soak time modifications or gear switching (e.g., switching from gillnets to longlines). These Phase I pilot trials would conduct voluntary comparative field-testing with commercial fishing vessels and gather efficacy data through on-board observations during the tests. Phase II would pilot test at least two additional seabird bycatch reduction strategies in either U.S. or Canadian PLL, trawl, or gillnet fisheries. Bycatch reduction pilot studies would be conducted in waters where commercial fishing vessels would be permitted and already operating in the U.S. and Canada. Overall, the goal of this project is to improve existing fishing practices and gear usage to reduce bycatch and benefit seabirds, including northern gannets and great shearwaters.

As noted above, the consolidated FMP/EIS for the Northeast Multi-Species Fishery FMP (NEFMC, 1985), amendments, existing ESA consultation (NMFS, 2013), the PDARP/PEIS (DWH Trustees, 2016), and the Open Ocean TIG RP2/EA (Open Ocean TIG, 2019b) are incorporated by reference herein.

Biological and socioeconomic resources would largely benefit from the project. Participation in pilot studies would be voluntary, and program implementation would be contingent on catch levels and/or catch efficiency being maintained or improved. BMPs identified in required permits, consultations, or environmental reviews, including those described in Appendix 6.A of the PDARP/PEIS that are relevant to this project would be applied. Through technical assistance with regulatory agencies, additional BMPs may be identified for implementation and would be catalogued in compliance documents. Table 4-6 indicates the locations within this RP/EA where the reader can find detailed analyses of this project's impacts on physical, biological, and socioeconomic resources.

Table 4-6 NEPA Analysis by Resource for *Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries (preferred)*

Resource	Location of Analysis in Chapter 4
Physical Resources	
Geology and Substrates	Analyzed in Section 4.4.6.2.1
Hydrology and Water Quality	Hydrology: Analyzed in Section 4.3.1 (Resources with Similar Impacts Common to All Alternatives) Water Quality: Analyzed in Section 4.4.6.2.1
Air Quality	Analyzed in Section 4.3.1
Noise	Analyzed in Section 4.3.1
Biological Resources	
Habitats	Analyzed in Section 4.4.6.2.2
Wildlife Species	Analyzed in Section 4.4.6.2.2
Marine and Estuarine Fauna	Analyzed in Section 4.4.6.2.2
Protected Species	Analyzed in Section 4.4.6.2.2
Socioeconomic Resources	
Socioeconomics and Environmental Justice	Socioeconomics: Analyzed in Section 4.4.6.2.3 Environmental Justice: Analyzed in Section 4.3.1
Cultural Resources	Analyzed in Section 4.3.1
Infrastructure	Analyzed in Section 4.3.1
Land and Marine Management	Analyzed in Section 4.3.1
Tourism and Recreational Use	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
Public Health and Safety	Analyzed in Section 4.4.6.2.3

4.4.6.2.1 Physical Resources

Pilot Testing of Seabird Bycatch Reduction Measures and Field Studies

Sections 6.4.5.4.1 and 6.4.7.1.1 of the PDARP/PEIS describe the potential impacts to physical resources from Restoration Approaches intended to restore fish and water column invertebrates and sea turtles, respectively, and are incorporated here by reference. Impacts from projects intended to improve fishing gear use to reduce bycatch were described as having no impact to physical resources. Project activities involving gears that do not disturb the seafloor (e.g., gillnet, purse seine, PLL) would be consistent with these findings. Any project activities involving trawling or dredging (e.g., for scallops) would be conducted in accordance with existing and applicable FMPs.

This project does not propose a change in fishing behavior in terms of fishing effort. Pilot studies would take place during existing fishing efforts. Normal groundfish fishing practices involve deploying and hauling of gear. The seabird bycatch reduction pilot studies would not alter fishing behavior in terms of fishing effort or gear type utilized and are therefore not anticipated to result in any change in impacts to physical resources in the northwest Atlantic Ocean beyond what currently occurs for the fisheries.

Summary
In summary, no impacts to physical resources are anticipated.

4.4.6.2.2 Biological Resources

Sections 6.4.5.4.2 and 6.4.7.1.2 of the PDARP/PEIS describe the potential impacts to biological resources from Restoration Approaches intended to restore fish and water column invertebrates and sea turtles, respectively, and are incorporated here by reference. Impacts from projects intended to improve fishing gear use to reduce bycatch[41] were described as having long-term benefits to biological resources with no anticipated adverse impacts.

Pilot Testing of Seabird Bycatch Reduction Measures and Field Studies
This project involves seabird bycatch reduction practice pilot studies that implement baiting practice modifications, gear switching and modifications, visual site deterrents, and soak time modifications. This project would take place on existing vessels during regular fishing efforts. Long-term benefits for wildlife and protected avian species are expected due to the reduction of seabird bycatch from modified fishing practices. There are no anticipated impacts to habitats associated with this offshore project. This project would not increase or change current effort in the existing groundfish fishery analyzed in NMFS ESA consultations (2013).

Because this project primarily involves gear and fishing practice modifications, no adverse impacts to biological resources are anticipated. There is potential for minor, short-term adverse impacts resulting from modifications that are determined to not be effective (e.g., they increase bycatch); however, these impacts would be identified during pilot testing and tests could be stopped or changed to address identified impacts. Long-term benefits to biological resources, including commercially important fish, sea turtles, marine mammals, and birds are expected due to the reduction of bycatch.

Summary
The Open Ocean TIG has completed technical assistance with relevant regulatory agencies related to potential adverse impacts to protected species and habitats. See Table 4-14 for this project's environmental compliance status. In summary, implementation of this seabird bycatch reduction project could have short-term, minor adverse impacts and is anticipated to have long-term benefits to biological resources.

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[41] Restoration Approaches under the Fish and Water Column Invertebrate and Sea Turtles Resotration Types that are intended to improve fishing gear use to reduce bycatch include: Reduce mortality among Highly Migratory Species and other oceanic fishes; Voluntary fisheries-related actions to increase fish biomass; and Reduce sea turtle bycatch in commercial fisheries through identification and implementation of conservation measures.

4.4.6.2.3 Socioeconomic Resources

Sections 6.4.5.4.3 and 6.4.7.1.3 of the PDARP/PEIS describe the potential impacts to socioeconomic resources from Restoration Approaches intended to restore fish and water column invertebrates and sea turtles, respectively, and are incorporated here by reference. Impacts from projects intended to improve fishing gear use to reduce bycatch were described as having the potential to cause minor to moderate, short- to long-term adverse impacts and long-term benefits to socioeconomic resources.

Pilot Testing of Bycatch Reduction Measures and Field Studies

Implementation of this seabird bycatch reduction project is not anticipated to impact catch weights that could affect economic opportunities of fishing communities. There is the potential for practice modifications, site deterrents, or gear switching to be less efficient than traditional practices; however, pilot study participation would be voluntary. Modified practices would need to retain fish at a comparable rate and not result in an increased effort per unit catch (e.g., not increase travel times/cost to reach fishing grounds) to be certified as an acceptable practice for this project. As such, no impacts are anticipated for socioeconomics. Since project activities would occur within existing commercial fisheries, no impacts are anticipated to public health and safety.

Summary

In summary, implementation of this seabird bycatch reduction project is anticipated to have no impacts to socioeconomic resources.

4.4.7 Seabird Bycatch Risk Reduction in Gulf of Mexico and Southeast U.S. Pelagic Longline Fisheries (non-preferred)

The impacts of existing PLL fishing methods on seabirds is described in Section 4.4.6. The primary goal of this project is to reduce the risk of seabird bycatch on commercial PLL fishing vessels in the Gulf and the southeastern Atlantic coast of the U.S. to benefit northern gannets and great shearwaters. Incidental catch of seabirds in PLL gear has been identified as a concern for several seabird species.

Seabird bycatch events varies in time and geographic location across the Atlantic and Gulf of Mexico, with a high probability of bycatching seabirds in some locations and seasons. Analyzing hotspots of bycatch events would help captains and fisheries managers to reduce bycatch. For example, a hotspot analysis was conducted with PLL data on observed seabird bycatch on the eastern seaboard from North Carolina to New England (Bi et al., 2021). Initial findings led to simulation modeling studies to identify ways to redeploy fleet effort to reduce seabird risk without losing fleet revenue. This proposed project would better characterize seabird bycatch in the Gulf and Southeast Atlantic PLL fishery. Project activities would include building on the observer data synthesis conducted by Bi et al. (2021).

Project activities most relevant to the assessment of environmental consequences include:

- **Pilot testing seabird bycatch reduction strategies.** One or more seabird bycatch reduction strategies would be pilot tested in the Gulf or southeast Atlantic commercial PLL fisheries. Strategies that have been successfully used in PLL fisheries elsewhere and could be tested with this project include, but are not limited to, weighted branchlines, blue-dyed bait, strategic offal discards, voluntary night-setting of longlines, specific bait species best practices (including live versus dead bait), streamer lines, seabird handling best practices, and bycatch hotspot communication networks that could allow vessels to avoid areas of high seabird interactions.
- **Field studies.** Field studies would be conducted to gather local knowledge regarding interactions with birds during fishing operations, examine seabird-fishery interactions during gear deployment, and enhance observer methods to identify opportunities to reduce seabird interactions.

4.4.7.1 Affected Environment

This project would occur in the Gulf and southeast Atlantic coast of the U.S. Primary project activities involve engaging with commercial PLL fishing communities through surveys and workshops, developing models to identify hotspots of northern gannets and great shearwaters, field studies to examine seabird-fishery interaction, and pilot studies to test bycatch reduction strategies. Community engagement and model development activities would be conducted from existing facilities on land. Vessel-based activities would include field studies and pilot studies conducted in the Gulf and southeast Atlantic PLL fishery. Pilot studies may include strategies that have been successfully used in PLL fisheries elsewhere, including, but not limited to, weighted branchlines, blue-dyed bait, strategic offal discards, voluntary night-setting of longlines, specific bait species best practices (e.g., live versus dead bait), streamer lines, seabird handling best practices, and bycatch hotspot communication networks that could allow vessels to avoid areas of high seabird interactions. Pilot studies would be conducted in waters where commercial fishing vessels are permitted and already operating in Gulf and southeast Atlantic PLL fishery.

Existing PLL fishery impacts have been analyzed under the EIS for the *Final Consolidated Atlantic Highly Migratory Species Fishery (HMS) Management Plan* (NMFS, 2006; NMFS, 2018b; see www.media.fisheries.noaa.gov/dam-migration/atlantic-hms-consolidated-fmp.pdf). Implementation of the FMP has undergone ESA Section 7 consultations (NMFS, 2004). The FMP and amendments provide extensive information about the physical, biological, and socioeconomic resources within the Gulf and southeast Atlantic fisheries and are incorporated by reference herein. Further, the PDARP/PEIS evaluated the environmental consequences of bycatch reduction measures as a Restoration Approach for Fish and Water Column Invertebrates (Section 6.4.5.4) and Sea Turtles (Section 6.4.7.4). The Open Ocean TIG RP2/EA (Open Ocean TIG, 2019b) also evaluated the environmental consequences of bycatch reduction devices (Section 4.4.3.2). While these Restoration Approaches were evaluated to restore for other marine resources, the methods and environmental consequences evaluated are similar. Both the PDARP/PEIS and Open Ocean RP2/EA are incorporated by reference herein.

4.4.7.1.1 Physical Resources

This section describes the geology, substrates, hydrology, and water quality of Gulf and southeast Atlantic coast of the U.S. The HMS fishery occupies a vast area of open water in the Gulf and Atlantic Ocean. HMS are found in a wide variety of coastal and ocean habitats including estuaries, nearshore areas, the continental shelf, continental slope, and open ocean. The substrates within this area are quite diverse and vary depending on location. The nearshore benthic substrates generally consist of sand, silt, clay, and hard bottom.

Water quality and hydrology in the nearshore environment is strongly influenced by coastal watersheds and drainage systems. Freshwater from watersheds enters coastal waters, discharging sediments, nutrients (e.g., nitrogen, phosphorus), and contaminants from industrial wastewater discharge and urban and agricultural runoff. Oceanic circulation patterns influence water quality by dispersing and diluting coastal waters. Salinity, temperature, and turbidity in nearshore coastal waters are also strongly influenced by freshwater inputs.

Oceanographic features such as currents, temperature gradients, eddies, and fronts influence the distribution patterns of many oceanic species, including HMS. The North Equatorial Current continues through the Caribbean Basin to enter the Gulf through the Yucatan Straits. The current continues through the Florida Straits to join the other water masses to form the Gulf Stream, influencing the climate of the eastern coast of the U.S. and separating the coastal waters from the Sargasso Sea. Variations in flow capacities of the Florida Straits and the Yucatan Straits produce the clockwise movement of the Loop Current, the major hydrographic feature of the Gulf.

4.4.7.1.2 Biological Resources

This section describes the habitats, marine and estuarine fauna, and wildlife across the Gulf and southeast Atlantic, including protected species, critical habitat, and EFH for federally-managed species.

The coastal estuaries, nearshore, and continental shelf marine waters in this region support a large and diverse number of plant and animal species. Subtidal seagrasses occur throughout the area, which contribute primary productivity to the ecosystem and provide habitat for many species of invertebrates, fishes, marine mammals, and sea turtles. Vast areas of unconsolidated sediments also support diverse assemblages of epibenthic and infaunal organisms. Areas with hardbottom substrates support oyster and coral growth, both of which are reef building and can develop complex reef communities. Pelagic sargassum, which floats on the surface of the Gulf and Atlantic, also supports a highly diverse community of invertebrates, pelagic fishes, birds, and sea turtles. Each of these habitat types provide immense value to animals for refuge, nursery, nesting, and foraging.

The water column also provides habitat for a large and diverse assemblage of fishes and invertebrates. This project would occur primarily within the pelagic zone. Commercially important species managed by the HMS FMP include Atlantic tunas, swordfishes, sharks, and Atlantic billfishes. Recreationally important species include bluefish (*Pomatomus saltatrix*), pompano (*Trachinotus carolinus*), red drum (*Sciaenops ocellatus*), Spanish mackerel (*Scomberomorus maculatus*), spotted seatrout (*Cynoscion nebulosus*), flounder (*Paralichthys* spp.), cobia (*Rachycentron canadum*), tarpon (*Megalops atlanticus*), and sheepshead (*Archosargus probatocephalus*). Federally protected fish species such as Gulf sturgeon (*Acipenser oxyrinchus desotoi*) and smalltooth sawfish (*Pristis pectinata*) also inhabit nearshore coastal waters. Nearshore waters along the Gulf coast are designated critical habitat for Gulf sturgeon.

Five sea turtle species inhabit the project area (green, hawksbill, Kemp’s ridley, leatherback, and loggerhead). The leatherback, Kemp’s ridley, and hawksbill are listed as federally endangered; loggerhead and green turtles are listed as federally threatened. Numerous cetacean species are present Gulf waters, including the Northern Gulf of Mexico Stock of Atlantic spotted dolphin and all bay, sound, and estuary stocks of bottlenose dolphins along Florida’s Gulf Coast and the Gulf of Mexico Eastern Coastal, Northern Gulf of Mexico Continental, and Gulf of Mexico Northern Coastal Stocks of bottlenose dolphins (Hayes et al., 2021). Atlantic right whales forage and migrate along the coast and West Indian manatee occur in nearshore waters.

In the Gulf project area, critical habitat is designated for eight federally-protected species, including green, leatherback, loggerhead, and hawksbill sea turtles; smalltooth sawfish; Gulf sturgeon; and elkhorn and staghorn corals. Along the southeastern U.S. Atlantic Coast, critical habitat is designated for loggerhead sea turtles and the West Indian manatee.

Seabirds spend most of their lives in open marine waters, roosting and feeding at the water surface the entire year. In the nesting season, mature adults return briefly to nesting areas on islands or along coastlines. Nesting of pelagic species in the Gulf region is very limited and includes only a few locations containing tern colonies. Seabirds regularly observed within the Gulf include petrels, shearwaters, storm-petrels, tropicbirds, frigatebirds, boobies, gannets, phalaropes, gulls, terns, skuas, and jaegers (McKinney et al., 2009; Peake and Elwonger, 1996; Ribic et al., 1997). The piping plover, red knot, roseate tern, and wood stork (*Mycteria americana*) are ESA-listed.

A list of federally threatened, endangered, proposed, candidate, and other species of concern for this project, as identified through USFWS IPaC (USFWS, 2022) and NMFS’ ESA species list (NMFS, 2022b), is presented in Appendix E

4.4.7.1.3 Socioeconomic Resources

This proposed project would be implemented along the Gulf and South Atlantic coasts and the PLL fisheries in these areas. Socioeconomic resources of the Gulf are described in detail in the OO RP2/EA (Section 4.3.3) and incorporated by reference herein. The population of the Gulf coastal counties and parishes was approximately 15.8 million in 2017 according to the U.S. Census. The Southeast Atlantic region covered by this proposed project includes the area from Florida to North Carolina, which has an approximately 3 million people living on the coasts of Georgia, South Carolina, and North Carolina.

Urban centers near the coast of the Gulf and South Atlantic, cities such as Jacksonville, Florida and Houston, Texas, are highly populous and socially and economically diverse. Other regions near the coast, however, are more rural, and dominant industries vary regionally across the coastline. Some states, such as Texas and Louisiana, have large oil and gas industries. Other states, such as Florida, are strongly supported by tourism. Ports are significant contributors to the coastal economy. In 2020, the Ports of Houston and Southern Louisiana ranked first and second, respectively, largest U.S. ports by tonnage.[42] Across the five Gulf Coast states, more than 800,000 people are employed by the "ocean economy," which includes natural resource extraction, marine construction, ship building, marine transportation, tourism, and recreation; and the gross domestic product associated with these industries is estimated $117 billion (McKinney et al., 2022).

Across the Gulf states, commercial fish landings and recreational angling trips together added more than $11 billion to the economy (McKinney et al., 2021). By comparison, the South Atlantic's commercial fishing industry is smaller than the Gulf's; however, it is still a significant component of the economy. In 2017, NOAA estimates that landings of commercial fish generated over $200 million in the South Atlantic, compared to more than $800 million in Gulf (NMFS, 2018a). For recreational fishing, NOAA estimates that more than 2.5 million residents participated in recreational fishing along the coast of the South Atlantic in 2017, and the overwhelming majority of those were on the east coast of Florida (NMFS, 2018a). Similarly, 2.6 million residents participated in recreational fishing in the Gulf in 2017 (NMFS, 2018a).

Commercial fishery resources are managed by regional fishery management councils – the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council and by NMFS, depending on the species. The Fishery Management Councils prepare FMPs that are designed to manage fishery resources such as crabs, shrimp, and grouper. HMS including tuna, billfish, sharks, and swordfish are managed domestically by the NMFS under the Magnuson-Stevens Fishery Conservation and Management Act and the Atlantic Tunas Convention Act. The Consolidated Atlantic Highly Migratory Species FMP covers HMS in the Gulf. International management of tuna and tuna-like species is conducted by the International Commission for the Conservation of Atlantic Tunas.

The 2017 *Stock Assessment and Fishery Evaluation Report for Atlantic Highly Migratory Species*, which describes the PLL fishery, is incorporated here by reference (NMFS, 2018c). The Atlantic Highly Migratory Species PLL fishery primarily targets yellowfin tuna, swordfish, and big-eye tuna (*Thunnus obesus*), but can also target dolphinfish (*Coryphaena* sp.), albacore tuna (*Thunnus alalunga*), and sharks. The PLL fishery is typically considered a multi-species fishery and can inadvertently catch non-target species such as seabirds, bluefin tuna (*Thunnus thynnus*), sharks, sea turtles, and marine mammals. Many of the species caught as bycatch are released alive, however some are released dead. The PLL main line

[42] See www.bts.gov/ports.

can vary in length from 5 to 40 miles (8 to 64 kilometers). There are typically 20 to 30 baited hooks per mile. PLL lines are set near the surface via floats.

4.4.7.2 Environmental Consequences

This project does not propose a change in fishing behavior in terms of fishing effort, location, or the gear types used. Seabird bycatch reduction practice pilot studies would be conducted in waters where commercial fishing vessels would be permitted and already operating in U.S. waters for the PLL fishery. Pilot studies would be conducted on fishing vessels that would already be operating.

As noted above, the consolidated FMP/EIS for Atlantic Highly Migratory Species (NMFS, 2006), amendments (NMFS, 2018b), existing ESA consultation (NMFS, 2004), the PDARP/PEIS (DWH Trustees, 2016), and the Open Ocean TIG RP2/EA (Open Ocean TIG, 2019b) are incorporated by reference herein.

Potential impacts from the project are largely beneficial. Benefits to biological and human uses and socioeconomics are anticipated. BMPs identified in required permits, consultations, or environmental reviews, including those described in Appendix 6.A of the PDARP/PEIS that are relevant to this project would be applied. Through technical assistance with regulatory agencies, additional BMPs may be identified for implementation and would be catalogued in compliance documents.

Implementation of seabird bycatch reduction measures proposed under this project are similar or identical in nature to the activities that would occur during implementation of the *Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries (preferred)* project. It is anticipated that the environmental consequences to physical, biological, and socioeconomic resources from those activities would also be very similar. To reduce redundancy, the following discussion of environmental consequences is limited to those activities, techniques, and anticipated impacts that are unique to this project. Table 4-7 indicates the locations within this RP/EA where the reader can find detailed analyses of this project's impacts on physical, biological, and socioeconomic resources.

Table 4-7 NEPA Analysis by Resource for *Seabird Bycatch Risk Reduction in the Gulf of Mexico and Southeast Atlantic Pelagic Longline Fisheries (non-preferred)*

Resource	Location of Analysis in Chapter 4
Physical Resources	
Geology and Substrates	Analyzed in Sections 4.4.6.2.1 (*Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries (preferred)*) and 4.4.7.2.1
Hydrology and Water Quality	Hydrology: Analyzed in Section 4.3.1 (Resources with Similar Impacts Common to All Alternatives) Water Quality: Analyzed in Sections 4.4.6.2.1 and 4.4.7.2.1
Air Quality	Analyzed in Section 4.3.1
Noise	Analyzed in Section 4.3.1
Biological Resources	
Habitats	Analyzed in Sections 4.4.6.2.2 and 4.4.7.2.2
Wildlife Species	Analyzed in Sections 4.4.6.2.2 and 4.4.7.2.2
Marine and Estuarine Fauna	Analyzed in Sections 4.4.6.2.2 and 4.4.7.2.2
Protected Species	Analyzed in Sections 4.4.6.2.2 and 4.4.7.2.2

Resource	Location of Analysis in Chapter 4
Socioeconomic Resources	
Socioeconomics and Environmental Justice	Socioeconomics: Analyzed in Sections 4.4.6.2.3 and 4.4.7.2.3 Environmental Justice: Analyzed in Section 4.3.1
Cultural Resources	Analyzed in Section 4.3.1
Infrastructure	Analyzed in Section 4.3.1
Land and Marine Management	Analyzed in Section 4.3.1
Tourism and Recreational Use	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
Public Health and Safety	Analyzed in Sections 4.4.6.2.3

4.4.7.2.1 Physical Resources

Pilot Testing of Seabird Bycatch Reduction Measures and Field Studies

This project does not propose a change in fishing behavior in terms of fishing effort. Pilot studies would take place during existing fishing efforts. Normal PLL fishing practices involve deploying and hauling of gear. Seabird bycatch reduction pilot studies would not result in increased fishing effort or increased impacts from gear type utilized and are not anticipated to result in changes in number of vessels in the Gulf or southeast Atlantic. HMS are pelagic and the PLL fishery operates in open water. No contact with geology or substrates is anticipated; therefore, no impacts are anticipated.

Summary

In summary, no impacts to physical resources are anticipated.

4.4.7.2.2 Biological Resources

Pilot Testing of Seabird Bycatch Reduction Measures and Field Studies

This approach involves bycatch reduction practice field studies to observe seabird-fishery interaction, and pilot studies to test seabird bycatch reduction strategies, including weighted branchlines, blue-dyed bait, strategic offal discards, voluntary night-setting of longlines, specific bait species best practices (e.g., live versus dead bait), streamer lines, seabird handling best practices, and bycatch hotspot communication networks that could allow vessels to avoid areas of high seabird interactions. This project would take place on existing vessels during regular fishing efforts. Long-term benefits are expected due to the reduction of seabird bycatch from better fishing practices. There are no anticipated impacts to habitats associated with this offshore project. This project would not increase or change current effort in the existing PLL fishery analyzed in NMFS ESA consultations (2004).

Summary

The Open Ocean TIG would coordinate and complete consultation with relevant regulatory agencies as necessary on this project regarding potential adverse impacts to protected species and habitats prior to project implementation. In summary, implementation of this bycatch reduction project could have minor, short-term adverse impacts and is anticipated to have long-term benefits to biological resources.

4.4.7.2.3 Socioeconomic Resources

Summary

As analyzed in Section 4.4.6.2.3, implementation of this seabird bycatch reduction project is anticipated to have no impacts to socioeconomic resources.

4.5 Environmental Assessment for Projects in Locations Not Under the Jurisdiction of the United States

4.5.1 Projects Within Canada

Several projects in the reasonable range of alternatives evaluated in this RP/EA include activities that would be wholly or partially implemented in Canada (*Common Tern Nesting Colony Restoration in the Great Lakes Region, Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries (preferred), Northern Gannet Nesting Colony Restoration in Eastern Canada (preferred), Common Tern Nesting Colony Restoration in Manitoba (preferred)*). The *Common Tern Nesting Colony Restoration in the Great Lakes Region (non-preferred)* and *Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries (preferred)* alternatives are evaluated in Section 4.4 since these projects also occur within the U.S. The *Northern Gannet Nesting Colony Restoration in Eastern Canada (preferred)* and *Common Tern Nesting Colony Restoration in Manitoba (preferred)* alternatives are evaluated below. Where project activities would be conducted outside the U.S., project activities have been developed in coordination with project partners who will participate in project implementation. Implementing Trustees and project partners would coordinate as needed with Canadian federal and provincial agencies to ensure compliance with all relevant laws, regulations, and requirements. Compliance would be completed prior to project implementation.

4.5.1.1 Northern Gannet Nesting Colony Restoration in Eastern Canada (preferred)

This project would increase nesting success, survival, and productivity of northern gannets at nesting colonies in eastern Canada through stewardship, habitat enhancement at existing colony locations, and establishment of new nesting colonies using social attraction. Project activities most relevant to the assessment of environmental consequences include:

- **Land-based removal of marine debris.** Netting, rope, and plastic would be trimmed and/or removed from northern gannet nests and nest sites at Funk, Baccalieu, and Bonaventure Islands and Cape St. Mary’s. All debris removal would occur by hand during the non-nesting period (i.e., when northern gannets are not present), and no in-water debris removal would occur. Beach clean-ups would also occur near nesting sites to prevent the debris from entering the marine environment. All debris would be taken to local refuse collection sites and recycled if possible. On occasion, boats would be used to haul hand-collected debris from islands to mainland disposal sites.
- **Predator removal**. Mammalian predators (invasive coyotes [*Canis latrans*], arctic foxes [*Vulpes lagopus*], and red foxes) would be removed from Baccalieu, Funk, Cape St. Mary’s, and Bonaventure Islands. Arctic and red foxes would be trapped and relocated beyond average home range travel distances and released in suitable habitat. In limited cases, trap-shy foxes may be lethally hunted. Coyotes, which are less common, would be lethally hunted. When used, traps would be checked for any captured animals approximately daily (either directly by project personnel or though remote monitoring tools such as radio telemetry transmitters or cameras). Predator removal activities would occur during nesting season, whenever these predators are present. All work would be conducted by licensed trappers or licensed hunters using rifles and project personnel would use the most humane

approaches possible. For all hunting activities, hunters would only use non-toxic (i.e., non-lead) shot, and as such, adverse impacts are not anticipated. Lethally-removed animals would be turned into pelts by local hunters, trappers, and sheep farmers where possible, or otherwise buried on the mainland.

- **Human disturbance management**. Reserve managers would be hired at Cape St. Mary's, Baccalieu Island Ecological Reserve, and Bonaventure Island Reserve to conduct outreach with reserve visitors, assist with active tourist management, and monitor northern gannet disturbance, predation, and reproductive success.
- **Social attraction**. Bird and egg decoys and sound systems would be installed during nesting season to attract northern gannets to historical nesting areas and existing nesting areas to expand nesting colonies. Colony expansion would occur at Baccalieu, Funk, and Bonaventure Islands, and Cape St. Mary's, in areas adjacent to but outside of colony perimeters. New colony establishment would be targeted at up to eight locations across New Brunswick (Grand Manan Island, Gannet Rock, Sea Island, Whitehorse Island), Nova Scotia (Gannet Rock), the north shore of Gulf of St. Lawrence in Québec (Perroquet Island), and/or Newfoundland (Little Fogo Islands, Offer Gooseberry Island) where gannets historically nested; these areas are owned and managed by Canadian provinces. All social attraction materials would be installed manually. Decoys (made of recycled, high-density polyethylene and painted to look like northern gannets) would be installed using high strength anchoring epoxy. Sound systems (amplifier, charge controller, MP3 player, speakers, solar panels, and marine batteries) would be bolted to rocks using hand tools. Social attraction materials would be removed after each nesting season, if possible, and would be removed after project completion.
- **GPS tracking of nesting adults.** To identify key foraging and roosting sites and assist in the selection of target colony reestablishment areas, adult northern gannets would be captured at nesting colonies and equipped with GPS satellite tracking devices. Approximately 20 adult northern gannets would be tagged each year for 5 years (100 total). An additional 25 gannets per year for 5 years may be tagged with global location sensors to identify additional threats that could be addressed through future restoration projects.

4.5.1.1.1 Affected Environment

Project activities could occur at all six North American northern gannet nesting locations in Canada: Anticosti Island, Baccalieu Island, Bird Rocks, Bonaventure Island, Cape St. Mary's, and Funk Island. The three colonies in Newfoundland and Labrador (Baccalieu, Cape St. Mary's, and Funk Island) are protected as Seabird Ecological Reserves under the Newfoundland and Labrador Wilderness and Ecological Reserves Act. Reserves, administered by the Parks and Natural Areas Division of the Department of Environment and Conservation, offer almost complete protection from most land-based activities. The Canadian Wildlife Service has management responsibility for the seabirds within the reserves under the Migratory Birds Convention Act of 1914. In Québec, Bonaventure Island is a Provincial Park and a Federal Migratory Bird Sanctuary, Bird Rocks in the Magdalen Islands is a Federal Migratory Bird Sanctuary, and the northeastern tip of Anticosti Island is part of a Provincial Ecological Reserve.

At these six sites, northern gannets nest along rocky shorelines and cliffs with occasional nesting on flat, gently-sloped ground. Northern gannets are present in the area from May to October, with chicks fledging in September and October. They exhibit site fidelity, returning each year to their nests which are constructed of vegetation, mud, feathers, excrement, and objects found at sea (e.g., derelict fishing line).

4.5.1.1.1.1 Physical Resources

Anticosti Island

Anticosti Island lies south of Newfoundland and is part of the Municipality of Île-d'Anticosti in Québec. It is bounded by the Gulf of St. Lawrence to the east and south, the St. Lawrence River to the west, and mainland Canada to the north. The island is approximately 4,935 square miles (7,942 square kilometers), with a maximum elevation of about 400 feet (122 meters). The island's topography consists of sinkholes, enlarged joints, small caves, and incised valleys and canyons in the interior, and beaches, rocky coasts, and cliffs along the shoreline. Cliffs along the northern edge of the island (near nesting locations of northern gannets) are often over 300 feet high (Government of Québec, 2020).

Anticosti is composed almost entirely of limestone soil and organic sediments. The sediment throughout the island is sequenced rocky, sedimentary, and igneous layers. At higher elevations, soils and sediments include basal tills, peat bogs, or wetlands. At lower altitudes, the island is covered by coastal marine and fluvial sediments. Anticosti Island has a well-developed riverine network that runs mainly through the eastern and western areas of the island. The island's climate is heavily influenced by maritime conditions, which result in milder extremes during the summer and winter months.

Baccalieu Island

Baccalieu Island lies between the coastal and shelf waters of Newfoundland and Labrador and is located about 4 miles (6 kilometers) off the northern tip of the Avalon Peninsula, Newfoundland. The island is approximately 2 square miles (3 square kilometers) in size but supports the largest seabird rookery in Newfoundland and Labrador. Since the island falls within the eastern hyper-oceanic barrens eco-region, the surrounding ocean is characterized by cold, sub-arctic waters from the Labrador Current, and the weather and climate are influenced by maritime conditions.

The topography of Baccalieu Island is comprised of valleys and hills that form a wave pattern, with a maximum elevation of 450 feet (137 meters). Steep cliffs are present along the coast, with an average height of about 30 feet (9 meters). The island is made of a Precambrian basement of acidic to mafic rock. Sediments below the initial soil layer are made up of Pleistocene glacial till and organic rich, orthic ferro-humic, podzolic soils. The valleys are composed of dark, organic soil (Government of Newfoundland and Labrador, 1995).

Bird Rocks

Bird Rocks is composed of two small, rocky islets: Les Rocher aux Oiseaux and les Rochers aux Margaulx. The islands are in the middle of the Gulf of St. Lawrence, just over 18 miles (29 kilometers) northeast of the Magdalen Islands (Government of Québec, 2012). Les Rocher aux Oiseaux is about 11 acres in size with a maximum elevation of 98 feet (30 meters). Les Rochers aux Margaulx lies less than 1 mile (1.6 kilometers) to the northwest of les Rocher aux Oiseaux and is a 65-foot-high (20 meter) flat-topped outcrop (Government of Québec, 2012). Les Rochers aux Margaulx was broken into two parts over a century ago and has been eroded such that only a small plateau remains. Both rocks are composed of red sandstone (Bird Life International, 2001; Government of Québec, 2012).

Bonaventure Island

Bonaventure Island and Perce Rock Provincial Park were established in the 1970s and are located approximately 2 miles (3 kilometers) from the eastern end of Québec's Gaspé Peninsula in the Gulf of St. Lawrence (Birds Canada, 2022a; Boorstein, 2002). Bonaventure Island is about 12 square miles (19 square kilometers), with the highest elevation sitting at approximately 440 feet (134 meters) (Birds Canada, 2022a). Seabirds nest along the steep cliffs bordering the northern and eastern portions of the island; these cliffs reach a maximum height of 230 feet (70 meters). Soils and sediments on the island are composed mainly of conglomerate rocks as well as some sandstone and siltstone (Boorstein, 2002).

Cape St. Mary's

Cape St. Mary's Ecological Reserve is located approximately 12 miles (19 kilometers) off the southwestern tip of the Avalon Peninsula in Newfoundland. Cape St. Mary's is composed of rocky headlands, hill tops, coastal barrens, and coastal cliffs up to 410 feet high (125 meters). The geology of the area is dominated by grey-green tuffaceous siltstone and arkose with interbedded red sandstone and siltstone spread through the rocks. Variable erosion has resulted in the formation of sea stacks throughout the Reserve. Surface soils are dominated by humoferric podzol, which is a sandy loam till (Government of Newfoundland and Labrador, 1994). The Reserve falls within the eastern hyper-oceanic barrens ecoregion, with a climate highly influenced by maritime conditions. There is a high volume of precipitation year-round, including fog due to the onshore winds from the southeast. The summer season is cool and especially foggy.

Funk Island

Funk Island is a provincial ecological reserve located approximately 37 miles (60 kilometers) northeast of Cape Freels, off the northeastern coast of Newfoundland. The island is formed of flat granite with some low cliffs and boulder-covered areas. On the coast, some areas are solely smooth rock that are washed over by the ocean in the fall and winter (Birds Canada, 2022b). The southwestern and northeastern coastlines have steep slopes that drop between 20 feet (6 meters) and 32 feet (10 meters) into the water. Minimal soils exist in the center of the island that have been enriched by organic matter. The surrounding marine waters are cold from the flow from the Labrador Current, which highly influences the climate of the island.

4.5.1.1.1.2 Biological Resources

Anticosti Island

Habitats on Anticosti Island are primarily comprised of coniferous forests dominated by white spruce. Old forests are prominent and cover nearly 40 percent of the island. Along the coastlines and rocky cliffs, lichen and moss barrens are prominent. Five plant species grow almost exclusively on Anticosti Island: Rolland's bulrush (*Trichophorum pumilum*), the laurentian dandelion (*Taraxacum officinale*), the Alaskan bog orchid (*Platanthera stricta*), the low braya (N*eotorularia humilis*), and the Arctic bladderpod (*Physaria arctica*). According to the Centre de Donné sur le Patrimoine Naturel du Québec, there are known threatened or vulnerable plant species on Anticosti Island. There are Canadian federal provincial and municipal protected species on the island. For example, under the provincial *Act Respecting Threatened or Vulnerable Species (*chapter E-12.01), two species have an endangered or threatened status: the endangered Anticosti aster (*Symphyotrichum anticostense*) and the vulnerable ram's head lady's-slipper (*Cypripedium arietinum*) (Government of Québec, 2020).

The island supports over 245 wildlife species (Government of Québec, 2020), including amphibians, mammals, birds, and freshwater fish. Five terrestrial mammal species are native: river otter (*Lontra canadensis*), red fox, deer mouse (*Peromyscus maniculatus*), and two bat species. Seventeen different waterfowl concentrated areas are spread around the island. The eastern area of the island has the densest and most diverse seabird colonies, composed of the black guillemot (*Cepphus grille*), the thick-billed murre (*Uria lomvia*), the Atlantic puffin (*Fratercula arctica*), the razorbill (*Alca torda*), the black-legged kittiwake (*Rissa tridactyla*), the northern gannet, the double-crested cormorant, and the great cormorant (*Phalacrocorax carbo*). More than 10 freshwater fish species inhabit the lakes and rivers of Anticosti Island, including the Atlantic salmon, the brook trout (*Salvelinus fontinalis*), the American eel (*Anguilla rostrata*), the three-spined stickleback (*Gasterosteus aculeatus*), the banded killifish (*Fundulus diaphanous*), the rainbow smelt (*Osmerus mordax*), the alewife (*Alosa pseudoharengus*), the American shad (*Alosa sapidissima*), the nine-spined stickleback (*Pungitius pungitius*), and the rainbow trout (*Oncorhynchus mykiss*). Over 15 new species have been introduced to the island, 11 of which are still present. The white-tailed deer was introduced to the island over 100 years ago and has caused a decrease in balsam fir and other native plant populations due to foraging.

At least 15 marine species have been recorded in the waters around Anticosti Island. Grey (*Halichoerus grypus*) and harbor seals (*Phoca vitulina*) use the marine and coastal environments to rest and feed. Numerous marine fish species have been documented, including capelin (*Mallotus villosus*), Atlantic cod, Atlantic whiting (*Merlangius merlangus*), Atlantic killifish (*Fundulus heteroclitus*), redfish, shorthorn sculpin (*Myoxocephalus Scorpius*), lumpfish (*Cyclopterus lumpus*), gulf snailfish (*Liparis coheni*), Vahl's eelpout (*Lycodes vahlii*), Atlantic warbonnet (*Chirolophis ascanii*), snake prickleback (*Lumpenus sagitta*), rock gunnel (*Pholis gunnellus*), Atlantic wolffish (*Anarhichas lupus*), Atlantic mackerel, bluefin tuna, winter flounder, and Greenland halibut (*Reinhardtius hippoglossoides*).

Baccalieu Island

Baccalieu Island lies within the eastern hyper-oceanic barrens eco-region, which is characterized by the absence of true forests. Extensive stands of black (*Picea mariana*) and white spruce and balsam fir occur in the island's sheltered valleys. Stunted balsam fir grows in wind-swept portions of the island. Coastal barrens contain blanket bogs, lichen-covered rocks, and shrubs (Government of Newfoundland and Labrador, 1995). Only two mammal species live on Baccalieu Island: red fox and sea otter (*Enhydra lutris*). Red fox prey on ground-nesting birds.

The coastal waters around Baccalieu Island are highly productive waters with nutrient-rich currents that support vast quantities and diversity of marine wildlife (Government of Newfoundland and Labrador, 1995). As such, Baccalieu Island hosts the largest seabird rookery in Newfoundland and Labrador and is home to more types of nesting seabirds than any other island in the province (Government of Newfoundland and Labrador, 2006). At least 75 bird species migrate, overwinter, or live on the island. The near-coastal waters of Baccalieu Island are an important overwintering site for common eiders (*Somateria mollissima*), and other surrounding waters as well as the lakes and ponds on the island support American black ducks (*Anas rubripes*), green-winged teal (*Anas carolinensis*), whimbrel (*Numenius phaeopus*), solitary sandpiper (*Tringa solitaria*), and greater yellowlegs (*Tringa melanoleuca*). Nesting land birds include horned lark (*Eremophila alpestris*), common ravens (*Corvus corax*), warblers, and bald eagles (Baccalieu Island Ecological Reserve, 1995). Eleven seabird species breed on Baccalieu Island, arriving at different times throughout the spring and summer. Besides northern gannets, Leach's storm-petrel (*Hydrobates leucorhous*), thick-billed murre, black-legged kittiwake, and herring and great black-backed (*Larus marinus*) gulls all nest on the island. Northern gannets arrive on the island in late March and depart the island after chicks have fledged in late September or October. They nest on cliffs around the island at Gannet Head, near the central eastern coast.

The nutrient-rich waters surrounding Baccalieu Island also provide food for several marine mammals. Humpback, minke (*Balaenoptera acutorostrata*), short-finned pilot, and fin whales, white-beaked (*Lagenorhynchus albirostris*) and white-sided (*Lagenorhynchus acutus*) dolphins, and harbor porpoise (*Phocoena phocoena*) have all been documented around the island. Harp (*Pagophilus groenlandicus erxleben*) and hooded (*Cystophora cristata erxleben*) seals can be found from mid-February to March along the pack ice front (Government of Newfoundland and Labrador, 1995).

Bird Rocks

Bird Rocks contains minimal vegetative habitat. About 70 percent of the outcrops are covered in groundcover, with the remainder comprising bare rock. The only known wildlife are nesting seabirds, including northern gannets, black-legged kittiwakes, razorbills, common murres (*Uria aalge*), thick-billed murres, and Atlantic puffins. Black guillemots, herring and great black-backed gulls, and Leach's storm-petrels also nest on Bird Rocks on occasion (Bird Life International, 2001).

Bonaventure Island

Bonaventure Island has coniferous forests composed of mainly balsam fir and spruce (Birds Canada, 2022a; Boorstein, 2002). Over 570 vascular plant species have been documented on the island, eight of which are rare and five of which are vulnerable or threatened (Boorstein, 2002). The microclimate along the coastal cliffs and shoreline results in sparse vegetation containing arctic and alpine species (Birds Canada, 2022a).

Habitats on Bonaventure Island support at least 11 seabird species, including the double-crested cormorant, the great cormorant, the great black-backed and herring gulls, the black guillemot, the razorbill, the black-legged kittiwake, the common murre, and the northern gannet. Together, the black-legged kittiwake, the common murre, and the northern gannet comprise 70 percent of the seabird population on the island (Birds Canada, 2022a; Boorstein, 2002). Bonaventure Island is also home to the largest colony of northern gannets in North America. In 2012, 51,700 nesting pairs of Northern Gannets were counted. Harlequin duck *(Histrionicus histrionicus)*, a nationally endangered species, utilize adjacent waters in the summer and early fall (Birds Canada, 2022a).

Barachois (coastal lagoons), eelgrass beds, and the island's many estuaries are key habitats for many species of shellfish and fish such as the soft-shell clam (*Mya arenaria*), sticklebacks, and the winter flounder. Nearshore waters support many recreationally- and commercially-important species such as scallop *(Pectinidae*), snow crab (*Chionoecetes opilio*), American lobster *(Homarus americanus)*, Atlantic mackerel, Atlantic herring *(Clupea harengus)*, and rainbow smelt. At the beginning of the summer, capelin, a common prey of seabirds, spawns in estuaries around the island.

Cape St. Mary's

Cape St. Mary's falls within the eastern hyper-oceanic barrens eco-region. In this cold area, tree growth is stunted, and coastal barrens vegetation is common, especially heath moss and arctic-alpine plants. A small, forested area comprised of balsam fir and black and white spruce is present within one of the bays on the reserve. Crowberry (*Empetrum nigrum*) grows in open barrens, while beach head iris (*Iris setosa*) and cinnamon fern (*Osmundastrum cinnamomeum*) are most prominent in gullies and at the base of hills. Where there has been extensive grazing by sheep, herbaceous flowers and grass species have replaced the ericaceous shrubs that sheep like to eat.

Ten seabird species breed at Cape St. Mary's: the northern gannet, the black-legged kittiwake, the common murre, the black guillemot, the razorbill, great and double-crested cormorants, herring and great black-backed gulls, and the thick-billed murre. Cape St. Mary's is also an important overwintering site for thick-billed murres, dovekies *(Alle alle)*, common murres, and sea ducks. The coastal rock outcrops provide shelter for nesting seabird, and the shallow waters by the headlands provide highly productive feeding grounds. The cliffs are typically inaccessible to seabird predators. In addition to seabirds, many land birds nest and migrate through Cape St. Mary's, including the horned lark, common raven, and whimbrels.

Terrestrial mammals present around Cape St. Mary's Ecological Reserve include moose *(Alces alces*), red fox, arctic fox, ermine *(Mustela erminea)*, meadow vole *(Microtus pennsylvanicus)*, masked shrew *(Sorex cinereus)*, mink, and snowshoe hare *(Lepus americanus)* (Government of Newfoundland and Labrador, 1994; Montevecchi et al., 2019). The red fox and the arctic fox are the most common canine predators that can access the seabird colonies; however, it is still hard for them to reach the sea cliffs where northern gannets nest (Montevecchi et al., 2019). Coyotes are thought to have reached Newfoundland and Cape St. Mary's over sea ice in the 1980s and have increasingly preyed on northern gannets (Montevecchi et al., 2019).

Marine mammals frequent the waters surrounding the reserve, including humpback, fin, short-finned pilot, and minke whales, white-sided and white-beaked dolphins, harbor porpoise, and grey and harbor seals (Government of Newfoundland and Labrador, 1994).

Funk Island

Funk Island lies at the southernmost point of the eastern hyper-oceanic barrens eco-region, with sparse vegetation on the island. Limited areas contain grassy turf, lichens, and mosses, comprising about 15 different species (Birds Canada, 2022b; Kirkham and Montevecchi, 1982).

Many seabirds nest and breed on Funk Island. During the nesting season, the island supports approximately 396,000 pairs of common murres, which is the largest colony in Canada. The island also supports five other species of seabirds: northern gannets, northern fulmars (*Fulmarus glacialis*), black-legged kittiwakes, razorbills, and Atlantic puffins. Northern gannets nest near grassy knolls on the island. Funk Island historically supported a large nesting population of great auks (*Pinguinus impennis*), but they were hunted to extinction in 1844. Due to the cold temperature of the ocean from the Labrador Current, primary productivity in the area is high. In addition to supporting foraging seabirds, the cold water also supports several marine species, such as zooplankton, and a variety of fish, seal, and whale species (Kirkham and Montevecchi, 1982).

4.5.1.1.1.3 Socioeconomic Resources

Anticosti Island

In 1974, the Government of Québec purchased Anticosti Island and placed it under management by the Ministry of Recreation, Hunting, and Fishing. Currently, approximately 60 percent of the island is under management by Sépaq (the agency of the Government of Québec that manages parks and wildlife reserves) and the northeastern tip is a Provincial Ecological Reserve. The island can only be reached by boat or plane; logging roads and offroad vehicle trails provide access to the reserve (Government of Québec, 2020). The area is subject to indigenous claims, especially by the Innu communities of Nutashkuan and Ekuanitshit (Government of Québec, 2020).

The island has extensive paleontological resources, known for its abundance and diversity of marine invertebrate fossils compared to other sites from the same era (Government of Québec, 2020). Most of the 14 archeological sites recorded by the Ministère de la Culture et des Communications on the island are in the reserve. The archeological history and the island's rich fossil reserve, which are the best record of Earth's first global mass animal extinction at the end of the Ordovician, make it popular for scientific research (Government of Québec, 2020). In addition to attracting scientists, the island is a tourist destination for anglers and hunters, particularly from the U.S. and Canada due to its numerous rivers and streams with trout and salmon. It is also a popular site for bird watchers and hikers (Government of Québec, 2020).

There are several buildings, mostly camps, in the reserve as well as 13 oil and gas exploration wells that are plugged or being plugged (Government of Québec, 2020).

Baccalieu Island

Baccalieu Island, a Seabird Ecological Reserve, is an uninhabited island at the northern tip of Conception Bay near Red Head Cove, Newfoundland and Labrador. As an important nesting ground for seabirds, activities on the island are limited during nesting season (April 1 to October 30). For instance, seabird nesting areas are only accessible by scientists with valid access permits and all other activities are restricted to other portions of the island during nesting season. Aircraft are also prohibited from landing in the reserve or flying lower than 980 feet (300 meters) during the nesting season. Finally, no tankers or vessels longer than 65 feet (20 meters) are allowed in the marine portion of the reserve (Government of Newfoundland and Labrador, 1995).

Commercial and recreational fishing occurs in the waters of the reserve. All provincial and federal regulations apply when fishing in the reserve to minimize disturbance to seabirds. Motorized boats are not permitted within 328 feet (100 meters) of the cliffs containing nesting birds during the nesting season, except at designated landing sites. Non-motorized boats can approach up to 65 feet (20 meters) (Government of Newfoundland and Labrador Municipal and Provincial Affairs, n.d.). The *Baccalieu Island Ecological Reserve Management Plan* (Government of Newfoundland and Labrador, 1995) noted that new efforts will be made to reduce the level of bycatch through experimentation with alternate gear types.

Bird Rocks

The Bird Rocks islets are accessible by boat and helicopter from the Grosse-Île sea-harbor, but access is restricted. There is a lighthouse and three associated buildings on the plateau at Les Rocher aux Oiseaux (Birds Canada, 2022a). Approximately 70 percent of this island is vegetated, and the rest is bare rock.

Bird Rock, and the neighboring island known as Rocher aux Margaulx, are together considered ‘Bird Rocks’ and were declared a federal Migratory Bird Sanctuary by the Canadian Government in 1919 (the oldest bird sanctuary in Canada), and as such, the area is well protected from anthropogenic threats. However, erosion is a constant threat to the islands and the main rock, Rocher aux Oiseaux, has lost just under half of its area over the last century. Oil pollution is also a concern due to the proximity of the islands to the main shipping route that leads to the St. Lawrence seaway (Birds Canada, 2022a).

Bonaventure Island

The two cliffs of Bonaventure Island were declared bird migratory sanctuaries in 1919. The Government of Québec purchased the island in 1971 and turned it into a Provincial Park, Parc de l'Île-Bonaventure-et-du-Rocher-Percé, in 1985 to conserve its natural resources. The island is home to the largest migratory bird refuge in North America, with over 200,000 birds including 50,000 nesting pairs of northern gannets (Birds Canada, 2022b).

The park contains numerous hiking trails and conservation zones where access is restricted, particularly in areas with seabird colonies. The park is a popular tourist destination, with approximately 60,000 people visiting each year and most coming to see the seabirds. Disturbances to the seabirds are minimized through the use of fencing, observation platforms, and educational programs (Birds Canada, 2022b).

Cape St. Mary’s

As noted above, Cape St. Mary’s Island is a Seabird Ecological Reserve. As the fourth largest concentration of northern gannets in North America and home to several other seabirds, the island experiences numerous visitors coming for the unique opportunity to witness seabirds (Government of Newfoundland and Labrador, 1994). The island is also one of the most accessible sites in the world to see nesting seabirds (Government of Newfoundland and Labrador, 2006).

The island includes a lighthouse, access road, parking area, and interpretation center outside the reserve area. The interpretive center’s displays and programs provide educational information on the life cycle of the seabirds and terrestrial and marine environments (Government of Newfoundland and Labrador, 2006).

Funk Island

Funk Island is the smallest seabird ecological reserve in Newfoundland and Labrador. However, as one of the most important seabird reserves, the island is protected from human activity with only scientific research activities allowed on the island (Government of Newfoundland and Labrador, 2006). Despite the lack of human disturbance on the island, wildlife in the area experience threats such as from increases in offshore fishing (e.g., potentially causing a shortage of prey for some birds) and offshore oil exploration.

Funk Island was also one of the major nesting areas of the now-extinct Great auk. The name “Funk” came from the odor of rotting guano (bird droppings). It has also been known as “penguin island,” because the auk, a flightless seabird, resembled the penguins of the Southern Hemisphere (Government of Newfoundland and Labrador, 2006).

4.5.1.1.2 Environmental Consequences

The project would occur at four of the six North American northern gannet nesting locations, all within Canada: Baccalieu Island, Bonaventure Island, Cape St. Mary's, and Funk Island (Figure 4-5). Additional project activities could occur at the two other nesting sites (Anticosti Island and Bird Rocks) as needs are identified through nesting colony monitoring. Project activities would enhance existing management and stewardship at these sites. Additionally, the project would establish new nesting colonies at up to eight locations across New Brunswick (Grand Manan Island, Gannet Rock, Sea Island, Whitehorse Island), Nova Scotia (Gannet Rock), the north shore of Gulf of St. Lawrence in Québec (Perroquet Island), and/or Newfoundland (Little Fogo Islands, Offer Gooseberry Island) where gannets historically nested.

The Regionwide TIG previously analyzed manual marine debris removal in the Gulf in its *Final RP/EA 1: Birds, Marine Mammals, Oysters, and Sea Turtles* (herein referred to as RW RP1/EA; RW TIG, 2021). The RW RP1/EA concluded that the removal of marine debris has similar impacts to those associated with the Restoration Approach intended to reduce bycatch mortality through the removal of derelict fishing gear, as described in Section 6.4.5.1 of the PDARP/PEIS. The activities proposed in this project, which include land-based removal of marine debris, fall within the scope of activities and potential environmental consequences analyzed in the PDARP/PEIS and RW RP1/EA, and inform the environmental consequence analysis below. Overall, the impacts in those two plans were expected to be largely beneficial with some short-term, minor adverse impacts to physical and biological resources associated with removal of land-based debris and transportation of debris to disposal sites. The RW RP1/EA is incorporated by reference below.

The Alabama TIG previously analyzed GPS tagging and tracking of nesting adult birds throughout coastal Alabama in its *Final Restoration Plan II and Environmental Assessment: Restoration of Wetlands, Coastal, and Nearshore Habitats; Habitat Projects on Federally Managed Lands; Nutrient Reduction (Nonpoint Source); Sea Turtles; Marine Mammals; Birds; and Oysters* (herein referred to as AL RP2/EA; AL TIG, 2018). Section 12.0 concluded that GPS tagging of birds would have no impact on physical resources, and short-term, minor adverse impacts to tagged birds. The AL TIG RP2/EA is incorporated by reference below.

Predator management and social attraction (specifically, deployments of decoys and sound systems) measures proposed under this project are similar or identical in nature to the activities that would occur during implementation of the *Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)* project. Human disturbance management proposed under this project is similar in nature to the activities that would occur during implementation of the *Common Tern Nesting Colony Restoration in the Great Lakes Region (non-preferred)* project. It is anticipated that the environmental consequences to physical, biological, and socioeconomic resources from the activities proposed in this project would also be very similar. To reduce redundancy, the following discussion of environmental consequences is limited to those activities, techniques, and anticipated impacts that are unique to this project. Table 4-8 indicates the locations within this RP/EA where the reader can find detailed analyses of this project's impacts on physical, biological, and socioeconomic resources.

Figure 4-5 Project Activities Proposed at Existing Northern Gannet Colonies

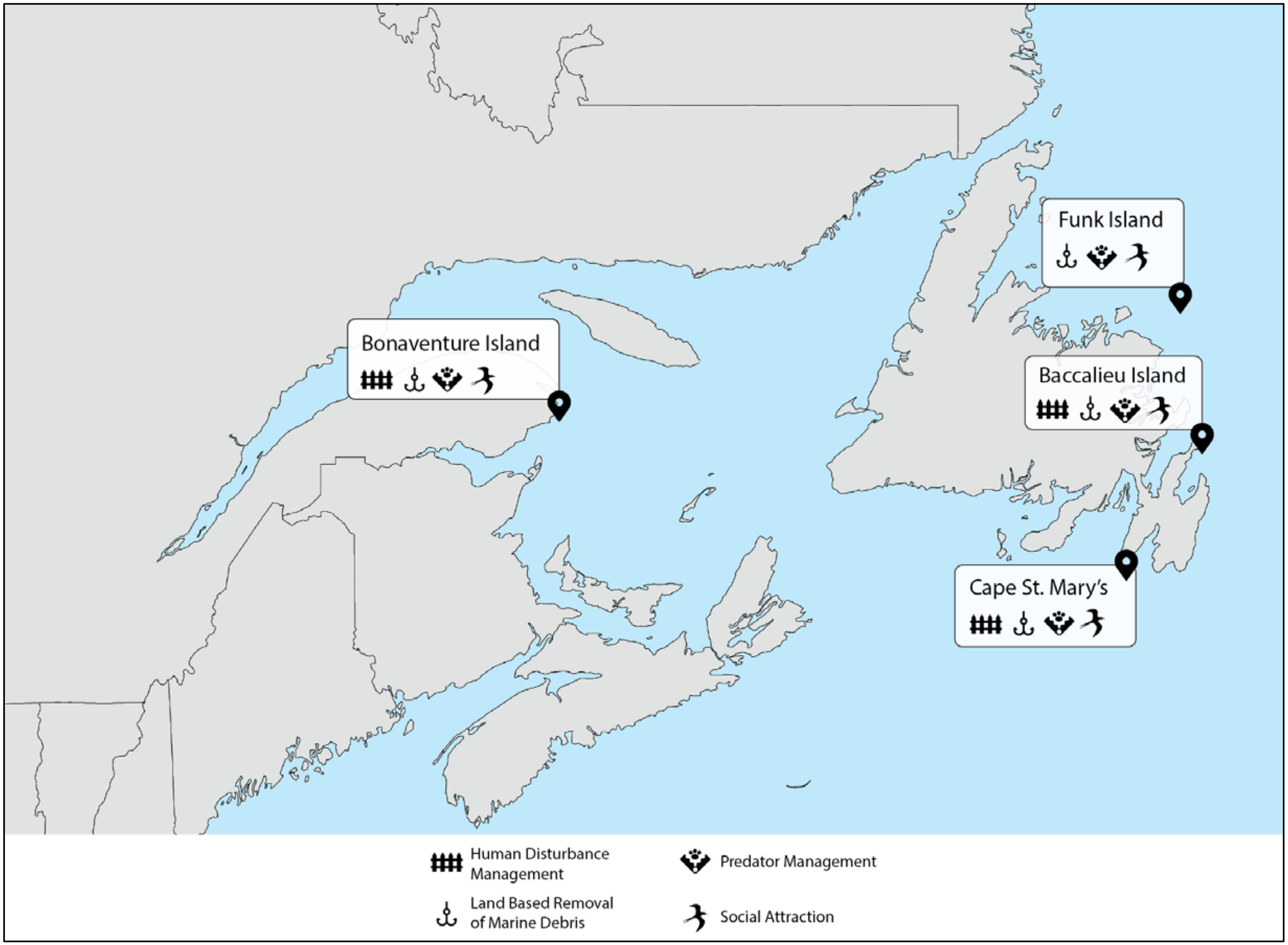


Table 4-8 NEPA Analysis by Resource for *Northern Gannet Nesting Colony Restoration in Eastern Canada (preferred)*

Resource	Location of Analysis in Chapter 4
Physical Resources	
Geology and Substrates	Analyzed in Sections 4.4.1.2.1 (*Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)*) and 4.5.1.2.1
Hydrology and Water Quality	Hydrology: Analyzed in Section 4.3.1 (Resources with Similar Impacts Common to All Alternatives) Water Quality: Does not require additional analysis. Only very minor in-water work may be required to haul hand-collected debris from the island to mainland disposal sites via boat, but boat use would not be appreciably greater than typical.
Air Quality	Analyzed in Section 4.3.1
Noise	Analyzed in Section 4.3.1
Biological Resources	
Habitats	Analyzed in Sections 4.4.1.2.2 and 4.5.1.2.2
Wildlife Species	Analyzed in Sections 4.4.1.2.2 and 4.4.5.2.2
Marine and Estuarine Fauna	Does not require additional analysis. Only very minor in-water work may be required to haul hand-collected debris from the island to mainland disposal sites via boat, but boat use would not be appreciably greater than typical.
Protected Species	Analyzed in Sections 4.4.1.2.2 and 4.4.5.2.2
Socioeconomic Resources	
Socioeconomics and Environmental Justice	Socioeconomics: Analyzed in Sections 4.4.1.2.3, 4.4.5.2.3 (*Common Tern Nesting Colony Restoration in the Great Lakes Region [non-preferred]*), and 4.5.1.2.3 Environmental Justice: Analyzed in Section 4.3.1
Cultural Resources	Analyzed in Section 4.3.1
Infrastructure	Analyzed in Section 4.3.1
Land and Marine Management	Analyzed in Section 4.3.1
Tourism and Recreational Use	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
Public Health and Safety	Analyzed in Sections 4.4.1.2.3, 4.4.5.2.3, and 4.5.1.2.3

4.5.1.1.2.1 Physical Resources

The management of human disturbance would not result in any impacts to physical resources because it would not involve any ground-disturbing activities.

Debris Removal

RW RP1/EA determined that land-based removal of marine debris could result in minor, short-term adverse impacts to geology, substrates, and water quality due to disturbance of soils and sediments from manual cleanup activities. While all proposed debris removal activities would occur by land, boats may be used to haul hand-collected debris from island nesting sites to mainland disposal sites. BMPs would be implemented to reduce the risk of inadvertent spills that could impact water quality. In addition to debris removal from nesting sites, beach cleanups and the removal of land-based debris may be conducted to reduce the risk of debris entering the marine environment, which may result in minor, short-term adverse impacts to geology and substrates. However, geology and substrates would experience long-term benefits from the removal of debris, including a reduction in persistent synthetics in the environment (DWH Trustees, 2016).

Predator Management by Trapping or Hunting
Some predator carcasses may be buried at mainland Canada sites, which would result in minor, short-term, localized adverse impacts to soils and sediments. No chemical euthanasia would occur that could result in water contamination.

Operations, Staging, and Monitoring
The AL RP2/EA determined that GPS tagging of birds would have no impact on physical resources. No ground-disturbing activities nor construction would occur. Project personnel may use boats to access nesting sites and nesting birds, as currently occurs for management of northern gannet nesting sites. BMPs would be implemented to reduce the risk of inadvertent spills that could impact water quality.

Summary
In summary, this project would have minor, short-term adverse impacts and long-term benefits to physical resources.

4.5.1.1.2.2 Biological Resources

The management of human disturbance would not result in any impacts to biological resources and would instead benefit biological resources due to decreased disturbance of habitats and wildlife, including protected species.

Debris Removal
Section 4.3.2.2.1.2 of the RW RP1/EA concluded that the land-based removal of marine debris from coastal habitats would result in minor, short-term adverse impacts to habitats and wildlife. These impacts include potential disturbance of vegetation and wildlife from human activity in the area during the cleanup period. Northern gannets inadvertently incorporate fishing line and other marine debris into their nest structures, which can lead to entanglement and ingestion by adults and chicks. Northern gannets exhibit nest fidelity, which can increase the year-to-year risk of interactions with marine debris that have been incorporated into nest structures. Debris removal would happen when northern gannets are not present and would be done manually (e.g., trimming loose fishing line) to avoid damaging nest structures. All debris removal would occur by hand, which lessens the potential for disturbance to biological resources from machinery and vessels. All debris removal would also occur outside of northern gannet and seabirds nesting periods, to reduce the potential for disturbance. Vessels may be used to transport debris from island nesting sites to the mainland for removal; vessels would implement BMPs to reduce potential interactions with marine species and sensitive habitats. Biological resources would experience long-term benefits from land-based marine debris removal due to the increase in quality of the terrestrial habitats that birds use for nesting, nesting, and hunting and the decrease in the risk of entanglement, entrapment, or ingestion of marine debris.

Predator Management by Trapping or Hunting
Native red and arctic foxes and invasive coyotes would be targeted for trapping (foxes) and hunting (coyotes) based on observed predation pressure at each northern gannet nesting colony. Foxes often travel over sea ice to Baccalieu and Funk Islands, and coyotes are thought to have reached Newfoundland and Cape St. Mary's over sea ice in the 1980s (Montevecchi et al., 2019). Predators would be adaptively managed based on predation pressure at each colony and the presence of nuisance animals. Any lethal removal would follow all applicable

statues and regulations. For all hunting activities, hunters would only use non-toxic (i.e., non-lead) shot. If traps are used, traps would be checked for any captured animals approximately daily. Predator removal would have moderate, short-term adverse impacts to target species (red and arctic foxes, coyotes), but would not impact these species on a population level. Seabirds and other terrestrial wildlife would experience long-term benefits from reduced predation pressure.

Operations, Staging, and Monitoring
Section 12.1.2.2 of the AL RP2/EA found that GPS tracking of nesting birds would result in minor, short-term adverse impacts on vegetation and wildlife due to human disturbance during tagging of northern gannets. Almost all wildlife behavior is anticipated to return to baseline when the project staff leave the area. All staff tagging northern gannets would be appropriately trained and permitted; however, capturing, handling, and banding northern gannets may always have some unintended minor, short-term adverse impacts. The GPS tagging and tracking of nesting adult northern gannets would be conducted under all required permits. This activity would provide long-term benefits to northern gannets by providing critical life history data and helping identify areas important to the birds for nesting and foraging as potential areas for restoration and protection.

Summary
In summary, this project would have minor-to-moderate, short-term adverse impacts and long-term benefits to biological resources.

4.5.1.1.2.3 Socioeconomic Resources

Debris Removal
Marine debris removal activities at the various islands would occur by hand, and on occasion boats may be used to haul debris to mainland disposal sites. These activities are not anticipated to adversely impact any businesses, the local economy, or public health and safety. These activities would result in long-term benefits by hiring local contractors to haul and dispose of debris and removing debris that could impact public health and safety.

Human Disturbance Management, and Operations, Staging, and Monitoring
Human disturbance management is unlikely to adversely impact socioeconomic resources. Outreach to reserve visitors would lead to benefits overall by increasing visitor awareness and enjoyment of the natural resources in the area. This project would also include GPS tracking of nesting adults to inform colony establishment areas to visitors, but again, this is unlikely to impact socioeconomic resources. Seabird colony protection areas on the islands and shoreline restrictions during nesting season would limit interaction between restoration activities and visitors. Additionally, specific actions (e.g., trapping and hunting of predators/competitors) would only be conducted by licensed and/or permitted individuals. Local nature-based tourism businesses would benefit from restored seabird nesting colonies.

Summary
In summary, this project would have negligible short-term adverse impacts and long-term benefits to socioeconomic resources.

4.5.1.2 Common Tern Nesting Colony Restoration in Manitoba (preferred)

This project would restore seabirds injured by the DWH oil spill by increasing nesting success, survival, and productivity of the common tern at nesting locations in Manitoba, Canada through stewardship and establishment of new colonies in protected locations using social attraction techniques. Project activities most relevant to the assessment of environmental consequences include:

- **Management of predator or competitor disturbance.** Predators (including mammals, birds, and reptiles) and nesting site competitors would be managed at locations where predation/competition is observed or has historically occurred. Activities would be implemented on a case-by-case approach using adaptive management principles. Passive deterrence measures would be pursued as the first option; measures would include installation of fencing, overhead wire or monofilament grids, and/or nest or chick shelter boxes/enclosures (e.g., for gull predation). Predator/competitor deterrent activities such as hazing using bird deterrent lasers, noise, or owl decoys could be employed where necessary and effective. Where extreme impacts to nesting terns may potentially occur (i.e., complete colony failure or abandonment), live capture and relocation or lethal removal (targeted at nuisance individuals) would be considered as a last resort, in partnership with state/provincial and federal management agencies, Tribes, and other partners. If used, traps would be checked for any captured animals approximately daily (either directly by project personnel or though remote monitoring tools such as radio telemetry transmitters or cameras). A network of acoustic sensors and game cameras would be deployed to document and respond to predator disturbance events.

- **Human disturbance management.** Human disturbances would be managed at existing nesting colonies through post-and-rope fencing, temporary closures of nesting areas, signage, and/or outreach and education.
- **Land-based removal of marine debris.** Debris already present on land, or other washed-up debris, would be manually removed from nesting beaches to prevent entrapment, entanglement, and the entering of debris into lacustrine environments. All debris would be taken to local refuse collection sites and recycled if possible.
- **Vegetation management.** Non-native, invasive vegetation would be manually removed from nesting sites. Vegetation density would be managed by installing biodegradable matting across nesting areas to improve nesting habitat conditions for the common tern. Additionally, native flora would be planted to improve nesting habitat conditions.
- **Substrate enhancements.** Fine gravel or sand would be added to nesting sites to enhance substrate conditions for the common tern. Each of the enhanced areas would be less than 1,000 square feet (93 square meters) in size and there are unlikely to be more than six enhanced areas.
- **Social attraction.** Common tern bird and egg decoys, sound systems, and artificial nests would be installed during nesting season in former nesting areas or areas with limited human and/or predator conflict. Site identification would be informed by indigenous traditional knowledge through discussions with the Indigenous Guardians. All materials would be installed manually. Decoys (made of recycled, high-density polyethylene and painted to look like target species) would be installed using high strength anchoring epoxy or drilled into soils. Sound systems (amplifier, charge controller, MP3 player, speakers, solar panels, and marine batteries) would be bolted to rocks or drilled into soils using hand tools. Nesting boxes, nest rafts, and nesting platforms would be placed in suitable nesting areas to enhance nesting site conditions. Social attraction materials would be removed after each nesting season, if possible, and would be removed after project completion.
- **Nesting colony monitoring**. In addition to data gathering activities described and analyzed in Section 4.2.1, common tern adults and chicks may be banded to support longitudinal tracking, and drones may be used to monitor colonies. The implementing Trustee and project partners would only use drones if the use is consistent with all laws, regulations, and policies applicable in the project implementation location at the time of use. Drones would not fly higher than 400 feet above sea level, and more commonly would be operated between 150 and 250 feet above sea level.

4.5.1.2.1 Affected Environment

This project would occur at current or historical common tern nesting locations across Manitoba, Canada. Figure 4-6 displays anticipated project locations. Refer to Figure 2-12 for a map of locations in Manitoba where common terns nest.[43] Following training of the Indigenous Guardians, common tern colony monitoring, and prioritization of restoration needs, the exact locations for project implementation will be refined.

Within Manitoba, the common tern primarily nests on sandy or cobble beaches along freshwater shorelines and lakes, or on artificial sites such as dredge spoils and navigational buoys. Optimal nesting sites are isolated (e.g., lacustrine islands or peninsulas) to minimize exposure to predator and human disturbance. The following sections provide a summary of the physical, biological, and socioeconomic resources in the boreal forests of Manitoba where the common tern nests.

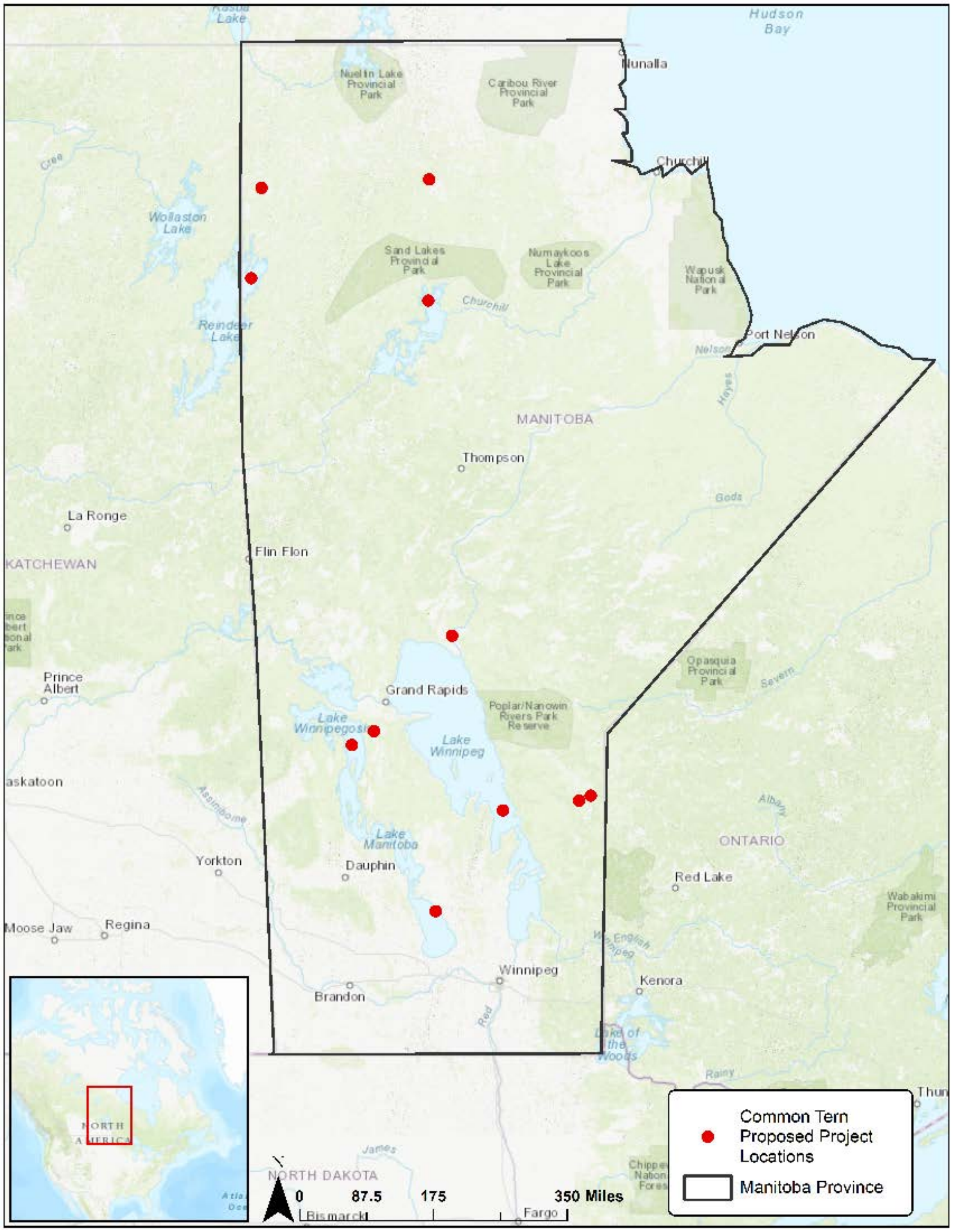
4.5.1.2.1.1 Physical Resources

The common tern nests along the mainland shorelines and islands of the thousands of inland lakes within Manitoba, the most notable of which include Lakes Winnipeg and Winnipegosis. Lakes Winnipeg, Winnipegosis, and Manitoba alone account for thousands of miles of shoreline in the province (Hatch, 1972). However, shorelines for these inland lakes are subject to extreme flooding events and severe water level fluctuations. Lake Winnipeg and Lake Manitoba typically drain to the north but are expanding southward as glaciers melt and water levels rise. The larger lakes, particularly Lake Winnipeg, have been increasingly subject to harmful algal blooms since the 1990s due to increased anthropogenic influence around the lakes. In addition to its abundant lakes, numerous aquifers hold vast amounts of water. Contaminated groundwater exposed to the surface has implications for crops, livestock, wildlife, and people.

The geology and topography of Manitoba is highly influenced by glacial retreat from the last ice age. Southern and mid-latitude portions of Manitoba comprise gently rolling topography with low-lying valleys and other natural depressions that accumulate water, forming lakes, ponds, and bogs. Soils and sediments are dominated by poorly drained glacial tills, lacustrine deposits, and peaty organic soils, with scrape, sands, and gravel more common along shorelines where the common tern nests. Northern latitudes of Manitoba comprise largely flat topography of the Hudson Bay plains. Soils in these locations are primarily organic in nature, with granite bedrock substrate. The high latitude location of Manitoba contributes to a climate dominated by long, cold winters and short, warm summers. The common tern nests during the Manitoba summer, typically May through July.

[43] Common tern nesting sites can vary annually as site conditions change. For the purposes of this NEPA analysis, the Open Ocean TIG has identified a suite of restoration actions that could be implemented at common tern nesting sites throughout Manitoba. At the time of writing this RP/EA, the TIG anticipates that project activities are likely to be implemented at Lake Winnipeg (McLeod's Island, Egg Island, Long Point, and other small, unnamed islands), Kaweenakumik Lake, Lake Winnipegosis (on small, unnamed islands), Reindeer Lake, South Indian Lake (Sand Island), Tadoule Lake, Lake Brochet, Fishing Lake, and Family Lake. Additional locations may be identified during implementation.

Figure 4-6 Anticipated Project Locations for *Common Tern Nesting Colony Restoration in Manitoba (preferred)*



4.5.1.2.1.2 Biological Resources

The common tern nests along freshwater shorelines in Manitoba across three eco-regions: boreal taiga plains, boreal softwood shield, and Hudson Bay plains. The boreal taiga plains comprise the southern latitudes of Manitoba, surrounding Lakes Winnipeg and Winnipegosis. They are characterized by closed-canopy forests with transitional habitat to open woodlands and grasslands that have been modified for agriculture. Dominant vegetation includes white or black spruce, with some deciduous stands of quaking aspen and balsam poplar (*Populus balsamifera*). Freshwater wetlands, marshes, swamps, bogs, and lacustrine bodies are interspersed throughout the forest habitat. Mid-latitude regions of Manitoba comprise the boreal softwood shield, which is characterized by forested vegetation such as coniferous (white and black spruce, tamarack [*Larix laricina*], balsam fir, jack pine [*Pinus banksiana*]) and deciduous trees (balsam poplar, quaking aspen, and white birch [*Betula papyrifera*]). Similar to the boreal taiga plains, the boreal softwood shield contains numerous interspersed freshwater wetlands and water bodies. The northern-most latitudes of Manitoba lie within the Hudson Bay plains ecoregion, with marshland habitats dominated by salt-tolerant plant species and shorelines dominated by willow and birch. Habitats within the Hudson Bay plains are largely intact due to limited development and extractive activities. Across the eco-regions, the common tern typically nests within sandy and/or gravelly beach habitat with sparse grass and shrub cover that the terns use to build nests and for protection from predators. Occasionally, the common tern has been documented nesting in estuaries, bays, and marshes on matted vegetation.

Wetlands and freshwater lakes across Manitoba provide important nesting, roosting, and foraging habitat for hundreds of migratory and resident bird species. About half of these species include shorebirds, waterbirds, and waterfowl (Environment Canada, 2013a, 2013b, 2014). Waterbird and waterfowl species of particular importance across the three eco-regions include the Caspian (*Hydroprogne caspia*) and common terns, common loon, surf scoter (*Melanitta perspicillata*), and bufflehead *(Bucephala albeola*). Manitoba's lakes maintain the highest densities of the common tern of all surveyed boreal areas. Surveys between 1979 and 1999 estimated between 15,140 and 19,997 nesting pairs (Morris et al., 2012; Nisbet, 2002), two to three times greater than the Great Lakes population of the common tern (Arnold et al., 2022; Morris et al., 2012; Nisbet, 2002). In addition to the common tern, inland lakes also support ring-billed and herring gulls, Caspian terns, double-crested cormorants, and American white pelicans (*Pelecanus erythrorhynchos*), which can all compete with the common tern for nesting space.

A variety of mammals and other birds prey on eggs and chicks of the common tern, including gray wolves, river otters, bald eagles, great horned owl, black-crowned night heron, gulls, crows, rodents, and feral cats and dogs. Common tern nesting colonies located near populated areas are at higher risk of anthropogenically-driven predation from feral or stray animals.

Manitoba's inland lakes contain a variety of freshwater fish and crustaceans that support recreational and commercial fisheries and wildlife in the region. Twenty-five species are known to inhabit Lake Winnipegosis, alone, including walleye (*Sander vitreus*), lake whitefish (*Coregonus clupeaformis*), white sucker (*Catostomus commersonii*), and northern pike (*Esox lucius*) (Government of Manitoba, n.d.).

4.5.1.2.1.3 Socioeconomic Resources

In 2021, Manitoba's population exceeded 1.3 million residents, with a majority of the population located in Winnipeg (approximately 750,000 residents) (Statistics Canada, 2021). First Nations and Indigenous peoples have inhabited Manitoba dating back to the last glacial retreat approximately 10,000 years ago, and, today, over 400 First Nation reserves hold land in trust for these peoples (Natural Resources Canada, 2017). The common tern is known to inhabit shorelines that are located on First Nation reserves, and First Nation peoples implement stewardship and conservation activities within their jurisdiction.

4.5.1.2.2 Environmental Consequences

This project would take a phased approach to common tern restoration, beginning with the training of Indigenous Guardians to conduct common tern nesting colony surveys. Environmental consequences from these data gathering and education and outreach activities are analyzed in Section 4.2. Restoration activities (predator/competitor management, human disturbance management, land-based removal of marine debris, vegetation management, substrate enhancements, social attraction, and/or nesting colony surveys) could be implemented at a variety of common tern nesting sites depending on identified restoration needs. As noted in the project description in Chapter 2 and Section 4.3.5.1, specific sites for these activities have not yet been identified. Once specific sites are identified, any additional environmental review would occur during implementation planning. The Implementing Trustee would review and affirm that the site-specific conditions are consistent with those described in this RP/EA. If the site-specific conditions indicate that the impacts would not be consistent with those described in this RP/EA, the Implementing Trustee, in coordination with project partners and Canadian regulatory agencies (as needed), would determine whether to undertake additional site-specific environmental review, consistent with NEPA and other environmental compliance requirements, or forego implementation at that location.

Predator/competitor management, human disturbance management, vegetation management, social attraction measures, and the potential use of drones proposed under this project are similar or identical in nature to the activities that would occur during implementation of the *Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)* and *Common Tern Nesting Colony Restoration in the Great Lakes Region (non-preferred)* projects. Debris removal activities proposed under this project are similar in nature to the activities that would occur during implementation of the *Northern Gannet Nesting Colony Restoration in Eastern Canada (preferred)* project. It is anticipated that the environmental consequences to physical, biological, and socioeconomic resources from the activities proposed in this project would also be very similar. To reduce redundancy, the following discussion of environmental consequences is limited to those activities, techniques, and anticipated impacts that are unique to this project. Table 4-9 indicates the locations within this RP/EA where the reader can find detailed analyses of this project’s impacts on physical, biological, and socioeconomic resources.

Table 4-9 NEPA Analysis by Resource for *Common Tern Nesting Colony Restoration in Manitoba (preferred)*

Resource	Location of Analysis in Chapter 4
Physical Resources	
Geology and Substrates	Analyzed in Sections 4.4.1.2.1 (*Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)*), 4.4.5.2.1 (*Common Tern Nesting Colony Restoration in the Great Lakes Region [non-preferred]*), 4.5.1.2.1 (*Northern Gannet Nesting Colony Restoration in Eastern Canada (preferred)*), and 4.5.1.2.2.1.
Hydrology and Water Quality	Hydrology: Analyzed in Section 4.3.1 (Resources with Similar Impacts Common to All Alternatives) Water Quality: Analyzed in Sections 4.4.1.2.1, 4.4.5.2.1, 4.5.1.2.1, and 4.5.1.2.2.1.
Air Quality	Analyzed in Section 4.3.1
Noise	Analyzed in Section 4.3.1
Biological Resources	
Habitats	Analyzed in Sections 4.4.1.2.2, 4.4.5.2.2, 4.5.1.2.2, and 4.5.1.2.2.2.
Wildlife Species	Analyzed in Sections 4.4.1.2.2, 4.4.5.2.2, 4.5.1.2.2, and 4.5.1.2.2.2.
Marine and Estuarine Fauna	Does not require additional analysis. All project work would occur from land and would not impact marine or estuarine fauna (including freshwater fish).
Protected Species	Analyzed in Sections 4.4.1.2.2, 4.4.5.2.2, 4.5.1.2.2, and 4.5.1.2.2.2.
Socioeconomic Resources	

Resource	Location of Analysis in Chapter 4
Socioeconomics and Environmental Justice	Socioeconomics: Analyzed in Sections 4.4.1.2.3, 4.4.5.2.3, 4.5.1.2.3, and 4.5.1.2.2.3. Environmental Justice: Analyzed in Section 4.3.1
Cultural Resources	Analyzed in Section 4.3.1
Infrastructure	Analyzed in Section 4.3.1
Land and Marine Management	Analyzed in Section 4.3.1
Tourism and Recreational Use	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
Public Health and Safety	Analyzed in Sections 4.4.1.2.3, 4.4.5.2.3, 4.5.1.2.3, and 4.5.1.2.2.3.

4.5.1.2.2.1 Physical Resources

Substrate Enhancements

Fine gravel and/or sand would be trucked to nesting sites using existing roads, then placed manually with wheelbarrows, all-terrain vehicles, and shovels to achieve optimal substrate conditions at common tern nesting sites. Substrate improvements would occur prior to the arrival of the common tern and other colonially-nesting seabirds to avoid disturbing nesting birds. All gravel and/or sand would be locally sourced to match sediment conditions at target sites. Substrate enhancements would result in minor, short- to long-term adverse impacts from implementation and localized changes in substrate type. Implementation could have negligible to minor, short-term adverse impacts to water quality from localized turbidity; however, conditions would return to baseline shortly after implementation has concluded. Physical resources would experience long-term benefits from substrate enhancements, which addresses localized erosion at common tern nesting sites.

Operations, Staging, and Monitoring

Common tern nesting colony monitoring would require foot traffic that may disrupt soils and sediments near nesting sites; however, foot traffic is not expected to occur at a greater level than currently occurs for management and stewardship activities. As such, this activity would result in negligible to minor, short-term adverse impacts to soils and sediments, and would have no effect on water quality.

Summary

In summary, this project would have minor-to-moderate, short-term and minor, long-term adverse impacts and long-term benefits to physical resources.

4.5.1.2.2.2 Biological Resources

Predator/Competitor Management by Trapping or Hunting

Lethal methods of predator/competitor control would only be applied when other nonlethal methods are ineffective. Lethal removal would follow the Animal Care Act of Manitoba (1996) and the Government of Manitoba Trapping Guide (2022), and local populations would be closely monitored to avoid reducing predator populations to an extent that a species would be extirpated. For any hunting activities, hunters would only use non-toxic (i.e., non-lead) shot. If traps are used, traps would be checked for any captured animals approximately daily. Consistent with the analysis of predator/competitor management activities for the *Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)* and *Common Tern Nesting Colony Restoration* *in the Great Lakes Region (non-preferred)* projects, these activities would have minor to moderate, short-term adverse impacts to terrestrial habitats and wildlife and long-term benefits to common terns.

Substrate Enhancements
Substrate enhancements would not change the habitat type present in nesting areas. However, soil and sediment-dwelling organisms such as insects would experience moderate, short-term adverse impacts from burial under new substrate. These organisms are anticipated to re-colonize the added substrate within days to weeks, and impacts would be localized to the areas where gravel and/or sand is placed. Since all placement would occur on land, no marine or estuarine fauna or habitats would be impacted. Proposed sites would be surveyed for protected species and sensitive habitats and sited to avoid impacts to these species and habitats. Substrate enhancements would provide long-term benefits to the common tern and other shore-nesting birds by improving nesting habitat conditions and addressing localized erosion.

Operations, Staging, and Monitoring
Implementation of nesting colony monitoring and surveys would require foot traffic that may disturb coastal habitats and associated wildlife near common tern nesting sites; however, foot traffic is not expected to occur at a greater level than currently occurs for management and stewardship activities. Almost all wildlife behavior is anticipated to return to baseline when the project staff leave the area. As such, it is expected to have a negligible adverse impact on biological resources in the project area. Common tern chicks and adults may be captured and banded to support longitudinal studies of nesting site use. Project staff would be trained in banding best practices, and the work would be conducted under all required permits. However, capturing, handling, and banding of the common tern may always have some unintended level of consequences that would result in minor, short-term adverse impacts to individual birds. This activity would provide long-term benefits to the common tern by providing critical life history data and helping identify areas important to the birds for nesting and foraging as potential areas for restoration and protection.

Summary
In summary, this project would have minor to moderate, short-term adverse impacts and long-term benefits to biological resources.

4.5.1.2.2.3 Socioeconomic Resources

Substrate Enhancements and Operations, Staging, and Monitoring
This project would partner with Canadian First Nations through the Indigenous Guardians program to train indigenous youth and community members in seabird conservation management. The Indigenous Guardians would conduct much of the restoration actions (management of predator/competitor disturbance, management of human disturbance, vegetation management, social attraction, substrate enhancements, land-based removal of marine debris, colony monitoring) on their Reserve lands. All partnerships would be formed on a voluntary basis, and appropriate training would be given to protect the health and safety of Indigenous Guardian participants. Additionally, specific actions (e.g., trapping and hunting of predators/competitors, chick banding) would only be conducted by licensed and/or permitted individuals. Because all partnerships would be formed on a voluntary basis, this project would have no adverse impacts on socioeconomics. No impacts to public health and safety are anticipated to occur during substrate enhancements or operations and staging activities. This project would provide long-term benefits to socioeconomics by building long-term capacity for Indigenous Guardians and conservation work by First Nations peoples, by potentially hiring local contractors to implement substrate enhancements, and by enhancing nature-based tourism business opportunities.

Summary
In summary, this project would have minor, short-term adverse impacts and long-term benefits to socioeconomic resources.

4.5.2 Seabird Nesting Habitat Restoration and Colony Reestablishment in the Bahamas (non-preferred)

The Department of Marine Resources (DMR) is primarily responsible for the administration, management, and development of fisheries in the Bahamas. The Department of Environmental Planning and Protection (DEPP) maintains multilateral agreements and develops and manages the implementation of policies for the effective management and conservation of the physical environment within the Bahamas. DEPP regularly coordinates with DMR, the Bahamas Protected Areas Fund, the Bahamas National Trust, the Nature Conservancy, and the Bahamas Reef Environmental Education Foundation to oversee wild bird research, animal removal, and other conservation management projects.

This project would help restore seabird populations by increasing nesting success, survival, and productivity at nesting colonies in the Bahamas. Project activities most relevant to the assessment of environmental consequences include:

- **Vegetation management.** Invasive vegetation would be removed from priority areas identified during management plan development. Target species would primarily be manually removed, but, as a last resort, herbicide treatment would be considered where necessary (e.g., rhizomatous grasses and other species that cannot be exterminated by mechanical removal) and where targeted treatment can be conducted without risk to surrounding aquatic resources. Native plants may be planted to improve nesting conditions.
- **Predator removal**. Predators, including feral invasive cats, pigs, dogs, and rodents, would be humanely removed from priority areas identified during management plan development. Specific removal techniques include leg-hold and cage traps as well as hunting. Trapping would take place year-round. Leg-hold traps would be placed above-ground (e.g., attached to trees) to the greatest extent possible to avoid trapping non-target species. Trapped cats would be humanely euthanized on site (likely using an air rifle, but possibly using chemical euthanasia or carbon dioxide asphyxiation) and carcasses would be left in place or moved out of obvious sight to decompose (which would occur within days). Traps would be checked for any captured animals approximately daily (either directly by project personnel or though remote monitoring tools such as radio telemetry transmitters or cameras). Hunting would occur year-round by land. For all hunting activities, hunters would only use non-toxic (i.e., non-lead) shot, and as such, adverse impacts are not anticipated. Rodents would be removed using rodenticide. While most rodents are anticipated to die in their burrows and be left in place, any encountered carcasses would be removed and properly disposed of to reduce risk to scavengers. Rodenticide activities may include the use of brodifacoum through hand broadcast and bait stations. Mitigation measures would be employed to minimize impacts to habitats and species.
- **Social attraction**. Bird and egg decoys, mirrors, and sound systems would be installed during nesting season in suitable nesting habitat for target species to attract seabirds to expand existing colonies and create new nesting colonies. All materials would be installed manually. Decoys (made of recycled, high-density polyethylene and painted to look like target species) would be installed using high strength anchoring epoxy. Mirrors (approximately 12 inches by 6 inches [30 by 15 centimeters]) and sound systems (amplifier, charge controller, MP3 player, speakers, solar panels, and marine batteries) would be bolted to rocks or substrates using hand tools. Social attraction materials would be removed after each nesting season, if possible, and would be removed after project completion.
- **Biosecurity measures.** To prevent the (re)introduction of invasive species (including, but not limited to, plants, mammals, herpetofauna, and invertebrates), a biosecurity plan would be developed and implemented. Measures may include vessel inspections, education and outreach, use of network surveillance cameras near landing areas, baiting cameras with non-toxic bait to lure species and increase detection rates, deployment of

chew tags in high-use areas to detect rodents, and deployment of traps (e.g., snap traps) and rodent bait stations if evidence of rodents is found.

- Use of drones for project monitoring. The implementing Trustee and project partners would only use drones if the use is consistent with all laws, regulations, and policies applicable in the project implementation location at the time of use. Drones would not fly higher than 400 feet above sea level, and more commonly would be operated between 150 and 250 feet above sea level.

4.5.2.1 Affected Environment

Based on Mackin's (2016) survey, current nesting colonies for Audubon's shearwaters represent one percent of their historical nesting area, with many active colonies located on remote islands that are difficult to survey and manage. As many as 3,000 pairs may nest in the Bahamas at three of the most numerous remaining colonies (Trimm and Hayes, 2005). However, colonies across the Bahamas are threatened by sea level rise and lack of management that results in increased levels of predation from invasive mammals such as rodents.

Restoration activities would be targeted at established parks in the Bahamas that have been identified as important sites for seabird conservation, including Cay Sal Marine Protected Area, Conception Island and San Salvador National Parks, and Exuma Land and Sea Park. These locations are primarily isolated island groups with either very small settlements or no settlements at all.

4.5.2.1.1 Physical Resources

Cay Sal Marine Protected Area

Cay Sal Marine Protected Area (MPA) is comprised of 117 islands in the approximately 1.3 million-acre (519,000 hectare) Cay Sal Bank. Cay Sal Bank is formed by a shallow detached carbonate oceanic platform, and the islands' soils are sands eroded from carbonate parent materials. Located within the Straits of Florida, Cay Sal MPA is bounded by the Straits of Florida and the Florida Peninsula to the north, the Santaren Channel and Bahamas to the east, the Nicholas Channel and Cuba to the south, and the Gulf to the west.

Cay Sal is the largest island in the MPA, measuring approximately 1 mile (1.6 kilometers) long by 0.6 miles (0.9 kilometers) wide. Most of the island is at, or just slightly above, sea level, with a maximum elevation of 15 feet (4.5 meters). A brackish lake sits in a depression in the middle of the island (Goldberg, 1983; Reynolds et al., 2018). Sediment coverage is low, ranging from 0.8 to 2 inches (2 to 5 centimeters). A 32-to-55-foot-long (10 to 17 meter) sand dune runs northwest to southeast across the island. The winds on the island come from the northeast.

Conception Island National Park

Conception Island National Park comprises the 30,080 acres (12,173 hectares) of Conception Island and surrounding waters. Conception Island is composed of three islets: the main island, Booby Cay, and the south rocks. Conception Island sits directly to the west of the Exuma group of islands in the Bahamas, within the Exuma Trough. Other islands in the vicinity include Cat Island to the north, San Salvador to the east, Rum Cay to the southeast, and Long Island to the southwest.

Conception Island is approximately 2,880 acres (1,165 hectares) in size. Geology and substrates are largely composed of calcareous and sedimentary parent materials and sandy soils. Within its location in the tropics, Conception Island is subject to high winds from the trade winds, which can cause large swells on the eastern coast.

San Salvador Island National Parks

Located in the southwestern portion of the Bahamas, San Salvador Island is an isolated cay that is 7 miles (11 kilometers) wide by 13 miles (21 kilometers) long and has a surface area approximately of 12 square miles (19 square kilometers). It sits atop a narrow underwater ridge along the edge of the Bahamas Escarpment that steeply slopes into the abyssal plains of the Atlantic Ocean. Due to its location on the edge of the Escarpment, waters surrounding San Salvador Island deepen quickly to thousands of feet in depth.

The topography of San Salvador Island is characterized by a series of ridges and troughs that form hyper-saline lakes and steep limestone cliffs and rocky shorelines along the southern shoreline (Bahamas National Trust, 2017). The beaches are almost exclusively fine white sand. Pigeon Creek, on the east side of San Salvador, is the island's only tidal creek. Due to the low development on the island, coastal waters are of high quality with high visibility.

Exuma Land and Sea Park

Exuma Cays Land and Sea Park comprises over 112,500 acres (45,530 hectares) of hundreds of cays and islets and their surrounding waters in the Exuma Islands of the Bahamas. The Exumas sit along the eastern edge of the White and Great Bahamas Bank, with water depths dropping off sharply to the east of the Exumas into the Exuma Sound.

Geology through the Exumas is characterized by a mix of bioclastic and oolithic sediments and limestone. The limestone deposits around the islands are capped with lowstand clayey terra rosa paleosols, red-stained micritic limestone, calcrete, or karst surfaces (Hearty and Backstrom, 2021).

4.5.2.1.2 Biological Resources

Cay Sal Marine Protected Area

Terrestrial habitats on Cay Sal are characterized by sandy beaches with minimal vegetation, shrubby vegetation, and a brackish lagoon ringed by mangroves. Silver (*Coccothrinix spp.*) and coconut (*Cocos spp.*) palms, grasses, and shrubs are dispersed sparsely but evenly across the island. Seagrass and brown algae are also present within the island's lagoon (Goldberg, 1983). Terrestrial wildlife is sparse; only two reptiles are known to inhabit the island, *Anolis fairchildi* and *Anolis sagrei sagrei*. The island supports major brown noddy and Audubon's shearwater nesting colonies. Loggerhead sea turtles are also abundant and use the beaches of Cay Sal for nesting (Reynolds et al., 1983).

Conception Island National Park

Terrestrial habitats on Conception Island are composed of grass flats and a system of mangrove flats and creeks. These habitats provide an important sanctuary for migratory birds and a nesting site for a variety of seabirds. Reddish egret *(Egretta rufescens*), white-tailed tropicbirds, sooty terns (*Onychoprion fuscatus)*, American oystercatchers (*Haematopus palliatus*), and osprey (*Pandion haliaetus)* all inhabit the island. The island's system of creeks and mangroves serve as a nursery for fish, sharks, conch, crawfish, and green sea turtles. Green sea turtles forage in the creek, off the southwestern shore, and in the northern bay (Bahamas National Trust, 2022a).

San Salvador Island National Parks

Terrestrial habitats on San Salvador Island are comprised of saline and freshwater wetlands (primarily around the brackish lakes), woodlands, and mangroves. Nearshore vegetation is located inland where it is protected from salt spray. Upland vegetation is often characterized by silver thatch palm (*Coccothrinaz argentata*) and broadleaf evergreen species that can grow up to 13 feet (4 meters) high. Orchids and bromeliads can be found within inland wooded areas (Bahamas National Trust, 2022b). Mangroves stands often grow around the brackish lakes and can grow as tall as 13 feet (4 meters).

Seabird nesting and roosting sites are protected by the island's national parks. Over 14 species of seabirds breed on the island, and the national parks on San Salvador are some of the largest and most diverse seabird colonies in the Bahamas. Notable seabirds that migrate to and nest on San Salvador include frigatebirds, boobies, multiple tern species, white-tailed tropicbirds, and Audubon's shearwaters. In addition to seabirds, San Salvador is home to the critically endangered West Indian woodpecker (*Melanerpes superciliaris*) (Bahamas National Trust, 2017).

Various reptile species also inhabit San Salvador Island. The San Salvador rock iguana (*Cyclura rileyi*) is an endangered species that is only found on San Salvador Island on islets in the lakes and the surrounding cays. They are the largest terrestrial vertebrates in the Bahamas and are primarily (Bahamas National Trust, 2017). Five other reptile species also live on the island, including the worm snake (*Carphophis spp.*) (Bahamas National Trust, 2017). Hawksbill sea turtles nest on the southwest point of the island.

Pigeon Creek in the southeast section of the island forms a unique, tidal ecosystem fringed by mangroves and unvegetated flats, with seagrasses, sponges, and corals in the tidal channel. These waters, and shallow coastal waters around the island, are an important nursery for spiny lobster, some species of reef fish, Nassau grouper, sea urchin, and species of conchs (Bahamas National Trust, 2022c).

Marine habitats surrounding the water comprise highly diver coral reefs. Elkhorn coral is found in numerous locations around San Salvador (Bahamas National Trust, 2017). Numerous megafauna migrate and inhabit the deep waters surrounding the island, including hawksbill sea turtle, humpback whales, hammerhead shark (*Sphyrnidae spp.*), and spotted eagle rays (*Aetobatus narinari*).

Exuma Cays Land and Sea Park

Most of the area of Exuma Cays Land and Sea Park is marine habitats and shallow waters. The cays contain various shrubby or grassy vegetation, mangroves, and unvegetated beaches. Terrestrial wildlife includes various reptiles (iguanas, turtles) and birds (most notably, Audubon’s shearwater).

Exuma Cays Land and Sea Park is renowned for its system of offshore and patch reefs, seagrass beds, and sand bars. The most abundant coral species amongst the reef communities in the park are mustard hill coral (*Porites astreoides*), boulder star coral, and mountain star coral (*Montastraea faveolate*). These reefs support a variety of commercially- and recreationally-important fish species, such as Nassau grouper, Caribbean spiny lobster, and queen conch. Other fish species in the area include wahoo (*Acanthocybium solandri*), large and small parrotfish species, large and small grouper species, and multiple snapper species. There are also lionfish (*Pterois spp.*), an invasive species. Dolphins also frequent the area (Dahlgren, 2009).

4.5.2.1.3 Socioeconomic Resources

Cay Sal Marine Protected Area

Cay Sal is an uninhabited, highly isolated island. The public can only access the island by boat, and illegal fishers and poachers are known to camp on the island (Reynolds et al., 2018). No infrastructure exists to support public use.

Conception Island National Park

Conception Island is an uninhabited island established as a national park in 1964. In 1969, the Bahamas National Trust excavated and cemented a well to provide a source of water for birds and fishers.

The island is only accessible by boat and attracts a variety of research and recreation vessels. There are three moorings off the northwestern shore for larger boats to moor. Snorkeling and SCUBA diving are popular recreational activities in the area. Other recreation activities are hiking on island trails and taking small motorized or un-motorized vessels into Conception Creek during high tide.

San Salvador Island National Parks

San Salvador Island has a small population of 940 people spread across eight different settlements and towns (Bahamian Department of Statistics, 2012). The island is only accessible by boat via a breach in the fringe reefs near Cockburn Town on the west coast.

San Salvador contains five national parks, all established in 2015. Graham’s Harbour Iguana & Seabird National Park (GHISNP) is about 9 square miles (14 square kilometers) in northern San Salvador and protects marine and terrestrial habitats; Green’s Bay National Park is less than 1 square mile (1.6 square kilometers) in northwest San Salvador and protects marine and terrestrial habitats; Pigeon Creek & Snow Bay National Park is about 8 square miles (13 square kilometers) in southern San Salvador and protects marine habitats; Southern Great Lake National Park is 6.3 square miles (10 square kilometers) in southern San Salvador and protects terrestrial and freshwater habitats; and West Coast Marine Park is about 16 square miles (26 square kilometers) in western San Salvador and protects marine habitats (Bahamas National Trust, 2022d). Several of the national parks offer recreational and commercial fishing. There are many popular locations for snorkeling and SCUBA diving. Other recreational activities such as jet skiing or kayaking are popular.

Exuma Cays Land and Sea Park
The Exuma Cays have a population of 6,928 people, spread across 36 different settlements, cays, and towns (Bahamian Department of Statistics, 2012).

Exuma Cays Land and Sea Park first became a park through the Bahamas National Trust Act in 1959. In 1986, the park was declared a no-take marine reserve. Boats are present in the park for transportation between islands, recreational fishing, recreational boating and sightseeing, guided tours, snorkeling, and SCUBA diving. Big Major Cay is one of the uninhabited islands in the Exuma Cays, also known as “Pig Beach.” It is home to approximately 20 feral pigs that have become a popular tourist attraction to photograph and interact with the swimming pigs.

4.5.2.2 Environmental Consequences

As noted in the project description in Chapter 2 and Section 4.5.2.1, specific sites for these activities have not yet been identified. Once specific sites are identified, any additional environmental review would occur during implementation planning. The Implementing Trustee, in coordination with project partners and local regulatory agencies (as needed), would affirm consistency with the project evaluation presented in this RP/EA and determine whether to undertake additional site-specific environmental review, consistent with NEPA and other environmental compliance requirements, or forego implementation at that location.

Vegetation management (specifically, mechanical removal of invasive plants), predator management, social attraction, biosecurity measures, and the potential use of drones proposed under this project are similar or identical in nature to the activities that would occur during implementation of the *Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)* project. Vegetation management (specifically, chemical removal of invasive plants) activities proposed under this project are similar or identical in nature to the activities that would occur during implementation of the *Common Tern Nesting Colony Restoration in the Great Lakes Region (non-preferred)* project. It is anticipated that the environmental consequences to physical, biological, and socioeconomic resources from the activities proposed in this project would also be very similar. To reduce redundancy, the following discussion of environmental consequences is limited to those activities, techniques, and anticipated impacts that are unique to this project. Table 4-10 indicates the locations within this RP/EA where the reader can find detailed analyses of this project’s impacts on physical, biological, and socioeconomic resources.

Table 4-10 NEPA Analysis by Resource for *Seabird Nesting Habitat Restoration and Colony Reestablishment in the Bahamas (non-preferred)*

Resource	Location of Analysis in Chapter 4
Physical Resources	
Geology and Substrates	Analyzed in Sections 4.4.1.2.1 (*Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)*), 4.4.5.2.1 (*Common Tern Nesting Colony Restoration in the Great Lakes Region [non-preferred]*), and 4.5.2.2.1.
Hydrology and Water Quality	Hydrology: Analyzed in Section 4.3.1 (Resources with Similar Impacts Common to All Alternatives)

Resource	Location of Analysis in Chapter 4
	Water Quality: Analyzed in Sections 4.4.1.2.1, 4.4.5.2.1, and 4.5.2.2.1
Air Quality	Analyzed in Section 4.3.1
Noise	Analyzed in Section 4.3.1
Biological Resources	
Habitats	Analyzed in Sections 4.4.1.2.2, 4.4.5.2.2, and 4.5.2.2.2.
Wildlife Species	Analyzed in Sections 4.4.1.2.2, 4.4.5.2.2, and 4.5.2.2.2.
Marine and Estuarine Fauna	Analyzed in Sections 4.4.1.2.2, 4.4.5.2.2, and 4.5.2.2.2.
Protected Species	Analyzed in Sections 4.4.1.2.2, 4.4.5.2.2, and 4.5.2.2.2.
Socioeconomic Resources	
Socioeconomics and Environmental Justice	Socioeconomics: Analyzed in Sections 4.4.1.2.3, 4.4.5.2.3, and 4.5.2.2.3. Environmental Justice: Analyzed in Section 4.3.1
Cultural Resources	Analyzed in Section 4.3.1
Infrastructure	Analyzed in Section 4.3.1
Land and Marine Management	Analyzed in Section 4.3.1
Tourism and Recreational Use	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
Public Health and Safety	Analyzed in Sections 4.4.1.2.3, 4.4.5.2.3, and 4.5.2.2.3.

4.5.2.2.1 Physical Resources

Predator Management by Trapping or Hunting, and Predator Management using Rodenticide

Impacts to physical resources would be consistent with those described for other predator management activities described above (see Section 4.4.1.2.1). Minimal disturbance of soils and sediments from foot traffic could result from implementation of traps, hunting, and deployment of rodenticide. Predator management would result in negligible to minor, short-term adverse impacts to physical resources with overall long-term benefits.

Summary

In summary, this project is anticipated to result in negligible to minor-to-moderate, short-term adverse impacts and long-term benefits to physical resources.

4.5.2.2.2 Biological Resources

Predator Management by Trapping or Hunting, and Predator Management using Rodenticide

Impacts to biological resources would be consistent with those described for other predator management activities described above (see Section 4.4.1.2.2). Project staff would implement BMPs when working, such as moving slowly and deliberately to avoid frightening birds and other animals, traveling carefully on foot, and avoiding sensitive areas when possible. Technicians would apply humane removal techniques and adhere to the guidelines set forth in the Statute Laws of the Bahamas, Ch.240-3(1958), the Wild Animal Protection Act (1968), and the Animal Protection and Control Act (2010).

Summary
In summary, this project is anticipated to result in minor-to-moderate, short- to long-term adverse impacts and long-term benefits to biological resources.

4.5.2.2.3 Socioeconomic Resources

Operations, Staging, and Monitoring
Cay Sal is uninhabited and rarely visited by tourists, so there would be no effect from the projects on socioeconomic resources. Conception Island, Exuma Island Land and Sea Park, and San Salvador Island National Parks are all popular tourist destinations, and project activities would likely result in minor, short-term adverse effects to nature-based tourism companies and potentially public health and safety during implementation due to disturbances from project personnel and potential short-term closures in certain areas. Pigs would be removed from most islands except Big Major Cay (Pig Beach), due to the tourist attraction the pigs have become on this island. As such, additional socioeconomic impacts from pig removal are not anticipated. The project is expected to benefit the islands' natural environment and further enhance aesthetics, wildlife viewing, and tourism, resulting in long-term benefits to nature-based tourism companies.

Summary
In summary, this project is anticipated to result in minor, short-term adverse impacts and long-term benefits to socioeconomic resources.

4.5.3 Invasive Goat Removal to Restore Seabird Nesting Habitat in St. Vincent and the Grenadines (preferred)

Seabird protection in Saint Vincent and the Grenadines falls primarily under the authority of the Forestry Department, while other departments are guided by legislation such as the Wildlife Protection Act (1987, seabirds and their chicks, eggs, and nests are protected under Section 13, which imposes fines up to $4,000 and a year imprisonment for violators), the National Parks Act (2002, amended 2010, which establishes the National Parks, Rivers, and Beaches Authority to protect endangered and endemic species and habitats and provide conservation education to the public), the Marine Parks Act (1997, established Marine Parks and associated governing board), the Forest Resource Conservation Act (1992, contains a provision for maintenance of biological diversity), the Fisheries Act (1986, allows for establishment of marine reserves), the Saint Vincent and the Grenadines National Trust Act (1969, establishes a body to acquire land and restore marine and terrestrial flora and fauna), and the Mustique Company Limited Act (2002, establishes a conservation zone around the Island of Mustique).

The St. Vincent Departments are limited by staff and resources, and thus monitoring and protection of seabirds from poaching or overgrazing does not occur with any regularity. For example, goats are severely overgrazing Battowia, which has been declared a protected area by the Department of Forestry. Due to the private ownership of many islands in both nations, best strategies to protect seabirds could incorporate landholders, residents, and NGOs such as the Grenadines Network of Marine Protected Areas.

This project would restore seabird nesting habitat by removing invasive goats. Project activities most relevant to the assessment of environmental consequences include:

- **Goat eradication.** Goats would be removed from Battowia and Pillories Islands using humane eradication practices.[44] Some of these goats are privately owned and free-ranged on the islands; the public would be

[44] For example, predator removal practices would be conducted in compliance with applicable regulations, such as the Wildlife Protection Act (1987).

informed of the eradication effort and would be given the opportunity to collect their goats prior to eradication efforts. Any unclaimed goats would either be hunted by a hired harvester or live captured and provided to community members to raise as livestock, as determined through community engagement. For all hunting activities, hunters would only use non-toxic (i.e., non-lead) shot, and as such, adverse impacts are not anticipated. All meat from the hunted goats would be provided to local communities.

- **Monitoring.** To determine if rodents are present on Battowia and the Pillories, passive monitoring measures would be implemented, including but not limited to installing a network of surveillance cameras, baiting cameras with non-toxic bait to lure rodents and increase detection rates, and deploying chew tags in high-use areas to detect rodents. Additionally, drones could be used to monitor nesting colonies. The implementing Trustee and project partners would only use drones if the use is consistent with all laws, regulations, and policies applicable in the project implementation location at the time of use. Drones would not fly higher than 400 feet above sea level, and more commonly would be operated between 150 and 250 feet above sea level.

4.5.3.1 Affected Environment

Battowia and the Pillories islands are remote, uninhabited Caribbean islands in St. Vincent and the Grenadines. This project would remove free-roaming, feral goats from Battowia and the Pillories to improve nesting habitat and reproductive success for Caribbean nesting seabirds injured by the DWH oil spill. Goats have negative impacts on seabird nesting by eliminating vegetation, causing erosion and disturbance, and potentially trampling nests.

4.5.3.1.1 Physical Resources

Battowia and the Pillories are islands within St. Vincent and the Grenadines, a nation comprised of a series of volcanic basalt islands situated within the Lesser Antilles between the Caribbean Sea and the Atlantic Ocean. These islands are within the larger St. Vincent and the Grenadines archipelago, a bank that consists of more than 80 volcanic-origin islands, islets, rocks, and cays (Coffey and Collier, 2020).

Battowia is a 156-acre (63 hectare) island and is a state-designated Wildlife Reserve managed by the Forestry Department of St. Vincent and the Grenadines. The island has steep slopes and a peak elevation of 670 feet (210 meters) (Freid and Glasgow, 2015). The Pillories consists of three islets, covering a total land area of 0.37 acres (0.15 hectares). These islands' volcanic origins have been altered over time by erosion and sea level change. Substrates are primarily igneous rock with alluvial deposits and beach sands. There are no sources of freshwater on the islands.

Goats on the island directly disturb island substrates, and by overgrazing vegetation, indirectly contribute to erosion of soils and sediments. Freid and Glasgow (2015) documented extensive erosion on Battowia. Erosion and runoff of sediments may also impact water quality in the nearshore marine environment.

4.5.3.1.2 Biological Resources

Across the Grenadines archipelago, the islands' terrestrial and marine systems form an interconnected complex of upland and in-water habitats, including upland salt ponds, mangroves, intertidal and subtidal seagrass, and extensive coral reefs. Abundant habitat and high primary productivity support diverse assemblages of marine invertebrates, fishes, sea turtles, marine mammals, and seabirds. However, because the bank is remote and many islands are uninhabited, the inventories of biological resources on Battowia and the Pillories are limited.

The islands' upland plant communities are not well characterized (Coffee and Collier, 2020). Freid and Glasgow (2015) characterize the archipelago's vegetation as seasonally dry tropical forests dominated by broadleaf evergreens, deciduous, and succulent taxa. During a 2015 survey, 38 vascular plant species were observed on Battowia. Forested areas were dominated by ratapple (*Morisonia americana*), Cuban pink trumpet tree

(*Tabebuia pallida*), coclette (*Pisonia fragrans*), and Jamaica caper tree (*Capparis cynophallophora*); and shrublands were dominated by croton (*Croton niveus*), devil pepper (*Rauwolfia viridis*), and plumbago (*Plumbago scandens*). The plant communities, in particular, are highly impacted by goats' grazing. Freid and Glasgow (2015) observed that goats had heavily grazed all vegetation less than 6 feet (2 meters) in height, resulting in low plant species diversity.

The islands' invertebrate communities are similarly not well characterized. Esteves and Fisher (2019) characterized ant communities across the northern portion of the archipelago and found Battowia had the most diverse native ant assemblage of the islands surveyed.

Across the Grenadines, upland habitats support a diverse assemblage of reptiles and amphibians. Approximately 25 species of reptiles and amphibians may be found in the Grenadines, including endemic geckos *(Gekkonidae spp.)*, green anoles *(Anolis carolinensis)*, and snake species; however, records on uninhabited islands are limited (Coffee and Collier, 2020). The red-footed tortoise (*Geochelone carbonaria*), an introduced species, occurs on uninhabited islands in the Grenadines. Four species of sea turtles (green, loggerhead, leatherback, and hawksbill) occur in the region and may nest on Grenadine island beaches.

Bats may be the only native mammals on the islands. There are at least five species found in the Grenadines (Coffee and Collier, 2020). Introduced mammals include mongoose (*Herpestes spp.*), guinea pigs (*Cavia spp.*), armadillos (*Dasypus spp.*), peccaries (*Tayassu/Pecari spp.*), opossums (*Didelphis spp.*), and agoutis (*Dasyprocta spp.*), in addition to feral goats. A lack of natural predators has resulted in an expanded population of feral goats on Battowia and the Pillories. As noted above, the abundance of feral goats has led to overgrazing of the islands' natural vegetation. The St Vincent and the Grenadines Forestry Department, which manages the Wildlife Reserve on Battowia, supports the full eradication of goats from the island to restore ecological function.

More than 120 species of birds utilize islands across the Grenadines archipelago (Coffey and Collier, 2020). St. Vincent and the Grenadines is the only nation in the Lesser Antilles to support two globally significant populations, the red-footed booby on Battowia and the red-billed tropicbird (*Phaethon aethereus*) on Battowia and Pillories. Battowia is an important seabird colony, supporting one of the highest densities of red-footed boobies in the entire Caribbean (Lowrie et al., 2009), and the only recently confirmed magnificent frigatebird colony south of Antigua (Coffey and Collier, 2020). BirdLife International has designated both Battowia and Pillories islands as Important Bird Areas.

As described in Coffee and Collier (2020), more than 54,000 pairs of 12 species of seabirds nest in St. Vincent and the Grenadines, ten of which have colonies on Battowia, the Pillories, or both. The Pillories host Audubon's shearwater, bridled tern, roseate tern, and the sooty tern, whose eggs are intensively harvested. Brown boobies also nest on Battowia. Colonies of red-billed tropicbird, laughing gull, and brown noddy are found on both Battowia and the Pillories.

4.5.3.1.3 Socioeconomic Resources

Only nine of the approximately 80 islands, islets, rocks, and cays within the Grenadines archipelago are currently inhabited (Coffey and Collier, 2020). Neither Battowia nor the Pillories are currently inhabited; however, fishers from nearby inhabited islands temporarily visit Battowia and the Pillories and harvest seabirds and their eggs and/or the feral goats.

Battowia is a privately-owned island, designated by the government and managed as a Wildlife Reserve. Goats on Battowia exist as a feral population and are not actively managed or tended to by any individual(s). The Pillories are also privately-owned and are not subject to land use designations. Residents of St. Vincent and the Grenadines frequently graze their domestic animals on private landowners' property, and goats on the Pillories could have owners who live on nearby islands (e.g., Mustique).

4.5.3.2 Environmental Consequences

The environmental consequences of predator removal and potential use of drones are evaluated and described for alternatives in this RP/EA, including *Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)*, *Predator Removal and Seabird Nesting Colony Restoration in the Culebra Archipelago (non-preferred)*, and *Northern Gannet Nesting Colony Restoration in Eastern Canada (preferred)*. Although these analyses evaluate the environmental consequences of removing rodents, pigs, and cats, the impacts of the removal methods for goats in this proposed project are likely to be similar to those for pigs and cats. These analyses concluded that predator removal activities would have negligible impacts on physical resources, minor short-term adverse impacts on biological resources, and long-term benefits to biological resources. Table 4-11 indicates the locations within this RP/EA where the reader can find detailed analyses of this project's impacts on physical, biological, and socioeconomic resources.

Table 4-11 NEPA Analysis by Resource for *Invasive Goat Removal to Restore Seabird Nesting Habitat in St. Vincent and the Grenadines (preferred)*

Resource	Location of Analysis in Chapter 4
Physical Resources	
Geology and Substrates	Analyzed in Section 4.5.3.2.1.
Hydrology and Water Quality	Hydrology: Analyzed in Section 4.3.1 (Resources with Similar Impacts Common to All Alternatives) Water Quality: Does not require additional analysis. Only very minor in-water work may be required to transport goats and carcasses via boat, but boat use would not be appreciably greater than typical.
Air Quality	Analyzed in Section 4.3.1
Noise	Analyzed in Section 4.3.1
Biological Resources	
Habitats	Analyzed in Section 4.5.3.2.2.
Wildlife Species	Analyzed in Section 4.5.3.2.2.
Marine and Estuarine Fauna	Does not require additional analysis. Only very minor in-water work may be required to transport goats and carcasses via boat, but boat use would not be appreciably greater than typical.
Protected Species	Analyzed in Section 4.5.3.2.2.
Socioeconomic Resources	
Socioeconomics and Environmental Justice	Socioeconomics: Analyzed in Section 4.5.3.2.3. Environmental Justice: Analyzed in Section 4.3.1
Cultural Resources	Analyzed in Section 4.3.1
Infrastructure	Analyzed in Section 4.3.1
Land and Marine Management	Analyzed in Section 4.3.1
Tourism and Recreational Use	Analyzed in Section 4.3.
Fisheries and Aquaculture	Analyzed in Section 4.3.1
Marine Transportation	Analyzed in Section 4.3.1

Resource	Location of Analysis in Chapter 4
Aesthetics and Visual Resources	Analyzed in Section 4.3.1
Public Health and Safety	Analyzed in Section 4.5.3.2.3.

4.5.3.2.1 Physical Resources

Goat Eradication

Goat eradication would occur during the dry season (approximately December through May) to improve detection ability (when vegetation cover is lower) and to provide feed and water to attract goats to centralized locations. This would minimize the need for human presence across the islands and reduce disturbance to geology and substrates and erosion from foot traffic. As needed and determined through community engagement, permitted harvesters may be hired to hunt goats on the island, which may require a higher human presence. The presence of hired hunters on the island could result in minor, short-term adverse impacts to soils and substrates; however, these impacts would be temporary and less severe than the long-term disturbance of soils and substrates that would be associated with goats' ongoing presence. Goat eradication on Battowia and the Pillories would have long-term benefits for decreased soil erosion, and by proxy, water quality in the surrounding waters (Coffey and Collier, 2021).

Monitoring

The presence of humans and increased foot traffic associated with conducting monitoring to determine if rodents are present on Battowia and the Pillories may result in minor, short-term adverse impacts to physical resources; however, monitoring would have long-term benefits on geology and substrates.

Summary

In summary, this project is anticipated to result in negligible to minor, short-term adverse impacts and long-term benefits to physical resources.

4.5.3.2.2 Biological Resources

Goat Eradication

Goat eradication would occur during the dry season (approximately December through May) to improve detection ability (when vegetation cover is lower) and to provide feed and water to attract goats to centralized locations. Additionally, operations would avoid peak annual seabird nesting, which typically begins in May. The method of goat removal (live-capture and lethal removal) would employ humane techniques where possible and would be closely coordinated with local communities who have historically harvested feral goats and used Battowia and the Pillories. Live capture would entail corralling goats in a central area on each island and removing them from the island via boats. Removed, live goats would be offered to the local communities. Lethally-removed goats would either be humanely corralled and killed via gunshot or hunted across the island. For all hunting activities, hunters would only use non-toxic (i.e., non-lead) shot. All carcasses would be removed from the islands and the meat provided to the local communities.

The presence of hired hunters and project personnel may result in minor, short-term adverse impacts to vegetation and existing wildlife due to disturbance and trampling. Implementation would occur during the day to avoid disturbing wildlife. Sensitive seabird nesting colonies exist around Battowia and the Pillories, and seabirds can flush and abandon their nests if disturbed. Project activities would not be implemented during peak seabird nesting season. Additionally, the project implementers would avoid nesting colonies by avoiding trees (where magnificent frigatebirds and red-footed boobies nest) and taking alternative routes to the island. Additionally, project staff and hired harvesters would be trained on BMPs for identifying and avoiding sensitive vegetation/seabird colonies.

The ongoing presence of goats has resulted in extensive over-grazing of native vegetation at both Battowia and the Pillories, eroding nesting habitat, reducing suitable vegetative conditions, and causing seabird nests to become exposed to predators and the elements. Goat eradication would have far-reaching and long-term benefits to these islands' biological resources. Decreasing grazing pressure would result in increased plant abundance, density, and species diversity. Benefits to local plant communities are expected to have cascading benefits to the islands' faunal communities. Terrestrial invertebrates, reptiles, amphibians, native mammals, and birds would benefit from improved habitat condition and decreased pressure from goat predation. Additional benefits are anticipated to reef-dependent marine communities surrounding the islands due to decreased erosion and associated benefits to water quality. The humane eradication of goats and implementation of long-term biosecurity measures would increase abundance of seabird species previously documented on the islands and may provide additional nesting for colonies of red-billed tropicbird and masked booby found elsewhere in the Grenadines.

Monitoring

The presence of humans and increased foot traffic associated with conducting monitoring to determine if rodents are present on Battowia and the Pillories may result in minor, short-term adverse impacts to biological resources due to increased human disturbances and minor trampling of vegetation; however, monitoring would have long-term beneficial effects on habitat and wildlife.

Summary

In summary, this project is anticipated to result in minor, short-term adverse impacts and long-term benefits to biological resources.

4.5.3.2.3 Socioeconomic Resources

Goat Eradication

Residents of the Grenadines frequently graze their domestic animals on private lands. All goats on Battowia are feral, with no person or entity owning or minding the goats. The introduction of livestock or domesticated animals to Battowia is illegal per the island's designation as a Wildlife Reserve. Goats on the Pillories may have actual or perceived owners, who are likely to live on the nearby island of Mustique.

Project activities would employ humane removal techniques and be closely coordinated with communities neighboring Battowia and the Pillories which have historically harvested feral goats and used the islands. Project implementors would first work with local communities to identify and return goats to their owners. The local communities would then provide input on the method and disposition of unclaimed goats; goats would either be live-captured and offered to communities to raise as livestock or harvest or lethally-removed, with harvested meat offered to the communities. Goat capturing and transport and/or hunting would be conducted by trained personnel, and, as such, would have no impact to public health and safety.

While best efforts would be made to identify all potential goat owners, some individuals' goats may be removed from the island and harvested or given to another community member. These individuals may experience up to moderate, long-term adverse impacts, depending on the number of goats they lose. Additionally, biosecurity measures would be implemented at the islands to prevent the re-introduction of goats by community members who seek to graze their goats on Battowia or the Pillories. These individuals may experience up to moderate, long-term adverse impacts from needing to find alternative grazing locations. Community members would be engaged from the project outset to clarify public perceptions of the project and minimize potential adverse impacts to community members.

Individuals and the broader community would benefit from new livestock or meat provided by the goat eradication effort. Additionally, restored seabird populations would benefit these communities traditional fishing activities. Incorporating local citizens into harvesting efforts and informing them about the globally important bird populations that rely on these islands has long-term positive effects on nesting seabirds in terms of project support and local ecological knowledge.

Monitoring
Monitoring efforts to determine if rodents are present on Battowia and the Pillories is not anticipated to result in adverse impacts to socioeconomics or public health and safety. Monitoring would be conducted by trained project personnel and would be passive in nature (e.g., observational surveys), without any ground-disturbances or other activities that have the potential to impact public health and safety. Monitoring would have long-term beneficial effects on wildlife-related tourism.

Summary
In summary, this project is anticipated to result in minor to moderate, long-term adverse impacts as well as benefits to socioeconomic resources.

4.6 No Action Alternative

Under the No Action Alternative, none of the proposed restoration alternatives would be pursued by the TIG. The affected resources identified in the prior sections would remain in their current conditions, including deteriorating conditions described in the affected environment and below. If the proposed restoration actions are not taken, local population-level declines and/or extirpations would likely contribute to moderate to major adverse impacts locally and minor to moderate, long-term adverse impacts to regional or global populations. The following subsections address the likely impacts to physical, biological, and socioeconomic resources for each of the activities analyzed in this RP/EA if none were to be implemented.

Data Gathering, Outreach, Education, and Training
If the projects involving data gathering are not implemented, information gaps would persist for seabird species that are the target of restoration in this RP/EA (northern gannets, common terns, and Caribbean-nesting seabirds). These information gaps would continue to hinder effective restoration decision-making on both project-level and regional scales, resulting in moderate, long-term adverse impacts to these species.

If education and outreach activities are not conducted, over the long term there would be an increased risk of anthropogenic disturbances (e.g., human disturbance, introduction of invasive and/or non-native species, bycatch) to seabirds that could result in minor to moderate, long-term adverse impacts to seabirds, habitats, and other wildlife.

Under the No Action Alternative, training and capacity building would not occur, which would leave certain areas without the capability needed for seabird conservation and management. Seabirds and associated nesting habitat may not receive necessary stewardship, resulting in minor to moderate, long-term adverse impacts to nesting habitat and local seabird populations.

Vegetation Management
Under the No Action Alternative, vegetation management, including the removal of invasive plant species, planting of native plants, and removal of dense plant mats, would not occur. Invasive species would continue to expand within project areas, outcompeting native vegetative communities over time, moving the areas farther away from optimal plant coverage. This would adversely impact the long-term reproductive success of seabirds and other wildlife that rely on native vegetation. Overall lack of vegetation management in these affected environments would have minor to moderate, long-term adverse impacts on habitat quality and biodiversity as

invasive species overtake native species. This degradation could also result in long-term adverse impacts to aesthetic resources and nature-based tourism and recreation as the habitats tend toward monocultures.

Under No Action, the short-term minor to moderate adverse impacts from vegetation management activities would not occur, but the long-term beneficial impacts far outweigh any short-term benefits of no action.

Predator Management by Trapping or Hunting
Under the No Action Alternative, lethal and non-lethal predator management would not occur at project sites. Localized populations of predators, including foxes, coyotes, mink, and owls, could increase, resulting in increased predation pressure on seabirds and other sensitive wildlife. Over the long-term, unmanaged predation pressure could have moderate to major adverse impacts to local seabird and wildlife populations, up to local extirpation. Overall habitat quality and biodiversity would experience minor to moderate, long-term adverse impacts as seabirds and other wildlife populations decline. This degradation could result in long-term adverse impacts to aesthetic resources and nature-based tourism and recreation as the habitats and wildlife species enjoyed by tourists decline in quality.

Predator Management using Rodenticide
Under the No Action Alternative, rodent eradications would not occur at Mona Island and the Culebra Archipelago. Local rodent populations would continue to persist, preying on seabirds and protected species (e.g., USFWS, 2016), and adversely impacting local biodiversity over the long-term. Unmanaged rodent populations could have moderate to major adverse impacts to local seabird and wildlife populations, up to total collapse of local populations. Overall habitat quality and biodiversity would have minor to moderate, long-term adverse impacts. This degradation could result in long-term adverse impacts to aesthetic resources and nature-based tourism and recreation as the habitats and wildlife species enjoyed by tourists decline in quality.

If these activities are not conducted, non-target wildlife and human health and safety would not be at risk of exposure to rodenticide.

Social Attraction
Under the No Action Alternative, social attraction would not occur across project sites. Some recolonization or new colony formation may occur without the aid of social attraction tools, but these may not be as successful as nesting colonies that are protected or actively managed areas. Nesting site competition would likely continue to occur at colony locations, having minor to moderate, long-term adverse impacts on the reproductive success of seabird species.

Biosecurity Measures
Under the No Action Alternative, no or only limited biosecurity would occur at project areas. Invasive species (plants, animals) may be (re)introduced in the project areas, which could result in a range of minor to moderate, short- to long-term adverse impacts to physical and biological resources depending on the species (re)-introduced that would be similar to those impacts described in the Vegetation Management and Predation Management by Trapping and Hunting sections above. Overall, invasive species harm native habitats and wildlife, reducing local biodiversity, which, in turn, can adversely impact aesthetic resources and nature-based tourism and recreation.

Debris Removal
Under the No Action Alternative, marine debris would not be removed from project areas, increasing the likelihood that it could wash out to sea and risk entanglement or ingestion by seabirds, fish, and/or marine mammals and sea turtles. Northern gannets, in particular, would continue to be at high risk of entanglement or ingestion from debris that is incorporated into their nest structures, resulting in minor to moderate, long-term adverse impacts. Debris could continue to have minor to moderate, long-term adverse impacts to local habitat quality and aesthetic resources. Additional, debris could pose a threat to human health and safety depending on the debris type.

Human Disturbance Management, including Outreach and Education
Under the No Action Alternative, human disturbance would not be managed at project sites beyond current capacity. Where uncontrolled disturbance occurs, nesting seabirds could flush from their nesting sites, causing long-term reproductive failure and resulting in up to moderate, long-term adverse impacts to seabird populations and other wildlife.

Construction of New Nesting islands and Substrate Enhancements
Under the No Action Alternative, new common tern nesting islands would not be constructed, and substrates would not be enhanced in nesting areas. Nesting sites within the project area would continue to degrade over time and would be less resilient to rising water levels, potentially causing long-term reproductive failure and resulting in up to moderate, long-term adverse impacts to local common tern populations.

Goat Eradication
Under the No Action Alternative, goats would continue to persist on Battowia and the Pillories Islands in St. Vincent and the Grenadines and contribute to habitat degradation through trampling and uncontrolled foraging. This would result in poor seabird nesting conditions over the long-term, and moderate to major, long-term adverse impacts from colony decline or extirpation.

Seabird Bycatch Reduction Field Studies, Strategy Implementation
Under the No Action Alternative, fisheries would continue operating using current fishing methods, which are known to result in seabird bycatch. Key information gaps regarding bycatch hotspots and most impactful fishing methods would continue to persist, hindering effective decision-making to reduce seabird bycatch. Due to uncertainties regarding bycatch rates and population-level impacts, adverse impacts may range from minor to moderate over the long-term.

Summary
If the proposed alternatives are not implemented, local wildlife, protected species populations including seabirds, and habitats would experience minor to moderate (and in some instances, major), short- and long-term adverse impacts from nest disturbance, predation, and destruction. Impacts include poor nesting habitat quality and reduced ecosystem function and bird mortality and disturbance from predators and humans. Cumulatively, the local population-level declines and/or extirpations could result in minor to moderate, long-term adverse impacts to regional or global populations. Benefits to birds, or other resources that would also benefit from the alternatives (such as habitat quality improvements from removal of invasive plant species), would not be realized from the proposed projects.

Under the No Action Alternative, project-specific adverse impacts to socioeconomic resources would not occur. However, local organizations would not receive contracts and/or funding to implement the projects, which could have minor, long-term adverse impacts to socioeconomics. Aesthetic resources, nature-based tourism and recreation would not realize the benefits of improved habitat and wildlife watching opportunities that would occur with project implementation.

4.7 NEPA Cumulative Impacts Analysis

CEQ regulations for implementing NEPA require the assessment of cumulative impacts in the decision-making process. CEQ defines cumulative impacts 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 CFR §1508.7). As stated in the CEQ handbook, *Considering Cumulative Effects* (CEQ, 1997), cumulative impacts need to be analyzed in terms of the specific resource, ecosystem, and human community being affected and should focus on impacts that are truly meaningful. Cumulative impacts should be considered for all alternatives, including the No Action alternative.

The PDARP/PEIS (Section 6.17.2) states that consideration of cumulative impacts of proposed alternatives in RP/EAs should build on the programmatic analyses and focus on site-specific issues (DWH Trustees, 2016). This is consistent with CEQ guidance regarding effective use of programmatic NEPA analysis. Section 6.6 and Appendix 6.B of the PDARP/PEIS are incorporated by reference into the cumulative impacts analysis, including the methodologies for assessing cumulative impacts, identification of affected resources, and the cumulative impacts scenario. The PDARP/PEIS found that implementation of restoration projects under the Birds Restoration Type would be consistent with its Restoration Goals and would not be expected to contribute substantially to short- or long-term adverse cumulative impacts on physical, biological, or socioeconomic resources when analyzed in combination with other past, present, and reasonably foreseeable future actions.

Section 6.6.2 of the PDARP/PEIS outlines the following steps involved in a cumulative impact analysis: (1) identify the resources affected, (2) establish the boundaries of analysis, (3) identify the cumulative impacts scenario, and (4) conduct a cumulative impacts analysis.

Regarding identification of the resources affected, the CEQ handbook states that the analysis must first determine the realistic potential for the resource to sustain itself in the future and whether the proposed action would affect this potential; therefore, the baseline condition of the resource should include a description of how conditions have changed over time and how they are likely to change in the future if the proposed action is not implemented. The baseline condition should also include other ongoing actions, as discussed in Section 6.6.4 of the PDARP/PEIS (DWH Trustees, 2016). To properly bound the cumulative impacts analysis, the CEQ handbook recommends determining appropriate spatial and temporal impact boundaries. The alternatives analyzed in this RP/EA would have local and minor or moderate adverse impacts, most of which would be short-term in duration (i.e., during implementation). Therefore, the Open Ocean TIG considered these short-term adverse impacts in concert with other present actions (i.e., actions with impacts that would overlap with the implementation stage of the alternatives), thus limiting the temporal boundary of the analysis to the construction/implementation phases. In determining the spatial boundary, the Open Ocean TIG considered the programmatic analysis of cumulative impacts in the PDARP/PEIS, which analyzed impacts on a regional, ecosystem scale (DWH Trustees, 2016). The spatial boundary of the cumulative impacts analysis in this RP/EA is a local scale. In summary, the analysis boundaries for this RP/EA include the Gulf of Mexico and the southeast Atlantic coast of the U.S.; the northeast Atlantic Coast of the U.S.; the Great Lakes and Manitoba; and the Caribbean; including coastal uplands and nearshore waters, over one to ten years of implementation of the alternatives.

To identify the cumulative impacts scenario, the PDARP/PEIS describes the affected environment and evaluates the impacts of restoration as well as programmatic development activities by considering cumulative impacts from implementation of DWH Early Restoration. The PDARP/PEIS analysis is incorporated by reference, where applicable (DWH Trustees, 2016). No significant cumulative impacts were concluded in this analysis. Where applicable, each RP/EA's cumulative impacts analysis should build on previous plans, incorporating only impacts not considered in previous analyses.

For past, present, and reasonably foreseeable future actions, past activities that have contributed to the current condition of resources are described and analyzed in Chapter 6 of the PDARP/PEIS and are not repeated in this analysis. The Open Ocean TIG identified relevant present and reasonably foreseeable future actions not analyzed in the previous documents and considered their potential impacts in the analysis (Table 4-12).

Applicable to the Birds Restoration Type, these include restoration related to the DWH oil spill such as habitat restoration and restoration for other natural resources (e.g., fish, sea turtles), which could benefit birds and other ongoing activities such as military operations, marine transportation, energy activities, dredged material disposal, marine mineral mining, fisheries and aquaculture, tourism and recreation, and coastal development and land use. Where these actions are planned and/or ongoing, they may apply as present and reasonably foreseeable future actions.

Sections 4.4-4.5 of this chapter analyze the environmental consequences for each of the alternatives evaluated in this RP/EA. The alternatives evaluated in this RP/EA are designed to improve environmental quality. Adverse effects would not be anticipated to extend beyond the implementation period for most projects. Some resource areas would be affected over the long-term, some beneficially and some adversely. Adverse effects would not be anticipated to extend beyond the implementation period for most projects, which in some cases is considered long-term. None of the projects included in this RP/EA would result in any long-term adverse effects that rise above a moderate-adverse effect. For example, most of the projects would result in only minor, short-term adverse impacts to geology and substrates, air quality, and hydrology and water quality during construction activities, and possibly moderate short-term and minor long-term adverse impacts on habitat and wildlife. Biological resources would primarily experience minor short-term adverse impacts from human disturbance associated with project implementation. Socioeconomic resources would also experience only none to minor, short-term adverse impacts. Very few moderate adverse impacts would result to tourism and recreation use, aesthetics and visual resources, and public health and safety. Additionally, for many of the resources, projects are anticipated to result in no long-term adverse effects and long-term benefits.

As such, the Open Ocean TIG concluded that although some of the projects may have an incremental contribution to adverse cumulative impacts, the contribution would not be substantial over the long-term. Many of the alternatives have the potential to provide long-term beneficial cumulative impacts to physical, biological, and socioeconomic resources. Thus, the TIG concludes that the Birds Restoration Type alternatives in this RP/EA would not contribute substantially to adverse cumulative impacts when added to other past, present, or reasonably foreseeable future actions.

Table 4-12 Summary of the Past, Present, and Reasonably Foreseeable Future Actions Considered in the Cumulative Impacts Analysis

Action Description	Key Resource Areas and Potential for Adverse Cumulative Impacts
Restoration Related to the DWH Oil Spill (funded by NRDA, North American Wetlands Conservation [NAWCA], NFWF-GEBF, RESTORE, Gulf of Mexico Research Initiative [GOMRI])	
Caribbean: Restoring Allen Cay for Shearwaters (NFWF)	Geology and substrates; Hydrology and water quality; Habitats; Marine and estuarine fauna; Terrestrial wildlife; Protected species; EFH; Land and marine management; Fisheries and aquaculture.
Great Lakes and Manitoba: Restoration of Black Terns in North and South Dakota (NRDA); Loyalist - St. Lawrence Wetland Restoration Initiative; Long Point and Lake St. Clair Marsh Restoration; Manitoba Prairie Parkland Macondo Oil Spill Mitigation Project; Prairie Pothole Region Landscapes Phase I and II; Parkland Bird Production Project Phase I, II, and IV; Killarney Landscape (NAWCA); Conservation of Shorebirds in Gulf Region (NFWF) Gulf of Mexico and southeast Atlantic coast of the U.S.: Enhanced Management of Avian Breeding Habitat Injured by Response Activities in the Florida Panhandle, Alabama, and Mississippi; Improving Habitat Injured by Spill Response: Restoring the Night Sky; Louisiana Outer Coast Restoration; Osprey Restoration in Coastal Alabama; Texas Rookery Islands; Queen Bess Island Restoration Project; Rabbit Island Restoration Project; Graveline Bay Land Acquisition and Management; Grand Bay Land Acquisition and Habitat Management; Colonial Nesting Wading Bird Tracking and Habitat Use Assessment—Two Species; Southwestern Coffee Island Habitat Restoration Project—Phase I (E&D); Stewardship of Coastal Alabama Beach Nesting Bird Habitat; Dauphin Island West End Acquisition; Isle au Pitre Restoration; Terrebonne HNC Island Restoration; Egmont Key National Wildlife Refuge Vegetation Management and Dune Retention; Gomez Key Oyster Reef Expansion and Breakwaters for American Oystercatchers; Northeast Florida Coastal Predation Management; Florida Shorebird and Seabird Stewardship and Habitat Management – 5 Years; Conservation and Enhancement of Nesting and Foraging Habitat for Birds; Reducing Marine Debris Impacts on Birds and Sea Turtles; Bird Nesting and Foraging Area Stewardship; Bird Stewardship and Enhanced Monitoring in Mississippi (NRDA); Bayou L'Ours Marsh Terracing; Island Road Marsh Terracing; Mississippi Wetlands Conservation Initiative I; Mississippi Wetlands Conservation Initiative II; Glaciated Wetlands and Prairies of North Dakota and Minnesota - Phase IV; Tom's Bayou; Long Term Conservation of Key Wetlands in the Alvarado Lagoon System 1A; Establishment of the Gulf of Mexico Private Wetlands Conservation Network - Phase I; Glaciated Wetlands and Prairies of North Dakota and Minnesota – V; Golden Meadow Marsh; Enhancement of Habitat for Waterfowl in Northern Yucatan Peninsula; Allan/Dana Hills Landscape; Nicolet Marsh Restoration; Massettes Marsh Enhancement; Touchwood Hills/Conjuring Creek Landscape; Virden/Lightning Landscape; NCC Missouri Coteau, SK: Protecting Wetland and Upland Habitat; Atchafalaya River Basin I; Bayou Monnaie Marsh; Creole Marsh; MAV Wetlands Conservation I; Mid-Barataria Wetlands I; Lower Mississippi Delta Wetlands; Pine Pasture Wetlands Enhancement; White Acquisition - Salvador WMA; Rockefeller Refuge Unit 4 Wetlands Enhancement; Hydrological Restoration Of Key Wetland Habitats For Aquatic Migratory Birds; Atchafalaya River Basin II; Deep Lake Unit Marsh Enhancement; Phil's Cut Marsh Enhancement; Freshwater Bayou II; Live Oak Farm Bayou Sauvage Protection; Restoration & Enhancement of Freshwater Wetlands on the Coastal Plain of Tamaulipas: Rancho El Mezquite; Protection & Restoration in the Rio Bravo (Grande) Delta: Laguna Madre - Phase III; Enhancement of Wetlands for Habitat for Migratory Waterfowl on the Coastal Plain of Tamaulipas; Texas Gulf Coast XIII; Coastal Texas I; Restoration Of Freshwater Wetlands As	

Action Description	Key Resource Areas and Potential for Adverse Cumulative Impacts
Waterfowl Habitat: La Mezquitoza Ranch; Coastal Texas II; Follets Island; Enhancement of Freshwater Wetlands as Wintering Habitat for Waterfowl, Laguna Madre; Coastal Texas III; Central Flyway Migration Corridor; Texas Gulf Coast XI (NAWCA); Private Lands Moist Soil Initiative; Bird Habitat Creation; Alafia Bank Shoreline Restoration and Management; Coastal Wetland Restoration on Private Lands; Delta Plantation Wetland Habitat Expansion; Lanark Reef Shorebird Protection; Migratory Bird Habitat Development in Coastal Alabama Counties; Perdido Bay/Pass Islands Acquisition-Restoration; Providing Critical Habitat for Birds in the Gulf of Mexico; Restoration Benefits to Wading Bird Habitat In Florida Bay; Wetland Enhancement and Early Flood Up; Coastal Bird Habitat Stewardship in Florida; Migratory Bird Habitat Development in Coastal Florida; Louisiana Deltaic Wetland Habitat Restoration and Enhancement; U.S. Gulf Shorebird Assessment and Management Plan; Migratory Bird Habitat Initiative; Coastal Bird Stewardship Program in Mississippi; Comprehensive Panhandle Coastal Bird Conservation; Gulf Coast Migratory Waterfowl Habitat Enhancement; Restoration of Florida's Coastal Dune Lakes; Florida Shorebird Conservation Initiative; Nueces Bay Rookery Islands Restoration; Cow Trap Lake Bird Nesting Island Improvements; Smith Oaks Bird Sanctuary Rookery Island Restoration and Enhancement; Restoring Florida's Shorebird & Seabird Populations Phase I Gulf Highlands Conservation Acquisition; Sabine Ranch Acquisition; Coastal Bird Stewardship in Mississippi Phase II; Dauphin Island Conservation Acquisition; Alabama Coastal Bird Stewardship Program; Restoring Colonial Waterbirds on the Texas Coast; Beach-nesting and Wintering Bird Protection and Habitat Stewardship; Bahia Grande Coastal Corridor - Holly Beach Tract Acquisition; Pascagoula River Corridor Acquisitions; Follets Island Land Acquisition and Conservation Phase II; Dauphin Island Bird Habitat Acquisition and Enhancement Program; Restoration of JD Murphree WMA Water Management Infrastructure; Repair ARK Wildlife Rescue Facility; Galveston Island State Park Marsh Restoration & Protection - Phase III; Southwest Florida Wading Bird Nesting Island Enhancement; Restoration of Florida's Coastal Dune Lakes - Phase II; Wulfert Bayous Bird Nesting Habitat Restoration; Restoring Florida's Shorebird and Seabird Populations - Phase II; Migratory Bird Habitat Creation in the Lower Mississippi River Valley (NFWF); A multiscale approach to understanding migratory land bird habitat use of functional stopover habitat types and management efforts; Fire Effects in Gulf of Mexico Marshes: Historical Perspectives, Management, and Monitoring of Mottled Ducks and Black and Yellow Rails; Assessment of coastal island restoration practices for the creation of brown pelican nesting habitat; Bahia Grande Coastal Corridor (BGCC) (Implementation); Gulf of Mexico Conservation Enhancement Grant Program; Restoration of Gulf of Mexico islands and beaches for wildlife: Reducing the uncertainty; Restoring coastal wetlands for shorebirds: Leveraging lessons learned to identify research priorities and strategies to maximize future success; Designing effective stewardship and post-restoration management plans through co-production to protect vulnerable Gulf of Mexico coastal birds (RESTORE); Food Web Impacts of Deepwater Horizon Oil Spill on Coastal Alabama Waterfowl (GOMRI)	
Northeast Atlantic coast of the U.S.: Conservation of Shorebirds in the Gulf Region (NFWF)	
Land and Marine Management	
MPAs, Sanctuaries, National Estuarine Research Reserves (NERRs), NWRs. Mona Island Natural Reserve, Mona Marine Protected Area, Desecheo National Wildlife Refuge, Culebra National Wildlife Refuge, St. Vincent National Wildlife Refuge, Battowia Island Wildlife Reserve, Exuma Cays Land and Sea Park Marine Reserve, Cay Sal Marine Protected Area, Cape St. Mary's Ecological Reserve, Baccalieu Island Ecological Reserve, Bonaventure Island Reserve, Bonaventure Island Federal Migratory Bird Sanctuary, Bird Rocks (Magdalen Islands) Federal Migratory Bird Sanctuary, Anticosti Island Provincial Ecological Reserve	Hydrology and water quality; Habitats; Marine and estuarine fauna; EFH; Land and marine management; Fisheries and aquaculture.

Action Description	Key Resource Areas and Potential for Adverse Cumulative Impacts
Military Operations	
The U.S. Air Force and U.S. Navy conduct military operations within federally designated areas for the purposes of personnel training, research, design, testing, and evaluation.	Geology and substrates; Hydrology and water quality; Habitats; Marine and estuarine fauna; EFH; Land and marine management; Fisheries and aquaculture.
Marine Transportation	
Marine Highway Corridors are used for port development; shipping and maritime services; and associated navigation, channel construction, and maintenance. Future actions are likely to occur along corridors or at ports as maritime traffic is expected to increase.	Hydrology and water quality; Habitats; Marine and estuarine fauna; EFH; Land and marine management; Fisheries and aquaculture.
Dredged Material Disposal	
Navigational channels, 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; Hydrology and water quality; Habitats; Marine and estuarine fauna; Protected species; EFH; Land and marine management; Fisheries and aquaculture.
Marine Mineral Mining, Including Sand and Gravel Mining	
Oil and gas exploration and production and mining of minerals, gravel, and sand occurs on submerged marine lands offshore. Mining and extraction of these resources involves survey work, vessel operations, and other infrastructure in coastal and offshore areas.	Geology and substrates; Hydrology and water quality; Habitats; Marine and estuarine fauna; Protected species; EFH; Land and marine management; Fisheries and aquaculture.
Fisheries and Aquaculture	
Federal and state agencies are responsible for regulating recreational and commercial fishing as well as aquaculture activities within state and U.S. waters. Agencies provides licenses and permits; lease coastal submerged land for aquaculture; set catch limits, quotas, and seasons; regulate harvest and processing; and provide technical assistance.	Geology and substrates; Hydrology and water quality; Habitats; Marine and estuarine fauna; Protected species; EFH; Land and marine management; Fisheries and aquaculture.
Tourism and Recreation	
Examples include park upgrades to walking and biking paths.	Geology and substrates; Habitats; Terrestrial wildlife; Protected species; EFH; Land and marine management.
Coastal Development and Land Use	
Examples of coastal development activities include commercial, residential, and other development; roadway maintenance and improvement; structural and nonstructural risk reduction projects; marsh creation; sediment diversions; and hydrologic and ridge restoration.	Geology and substrates; Hydrology and water quality; Habitats; Marine and estuarine fauna; Terrestrial wildlife; Protected species; EFH; Land and marine management; Fisheries and aquaculture.

4.8 Comparison of Alternatives

The environmental analysis demonstrated that there would be primarily minor, but also some moderate short- and long-term adverse impacts, as well as benefits from implementation of the alternatives evaluated in this plan.

In general, implementation of the proposed alternatives would result in negligible to minor, short-term adverse impacts to physical resources. Minor to moderate, long-term adverse impacts are anticipated on geology and substrates and hydrology from the *Common Tern Nesting Colony Restoration in the Great Lakes Region (non-preferred)* project due to the geomorphological change from subtidal to island habitat area when the nesting islands are constructed and from prescribed burns for vegetation management. For the *Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)* alternative, minor, long-term adverse impacts are also anticipated from operations, staging, and monitoring activities that would be implemented over several years. Most alternatives would result in minor to moderate, short- and long-term, localized adverse impacts to ambient noise. However, ambient noise would benefit from restored seabird nesting colonies, which contribute to the natural soundscape. Several of the alternatives would also result in benefits to geology and substrates from vegetation management and predator removal activities.

Biological resources would primarily experience minor, short-term adverse impacts from human disturbance (e.g., foot traffic, human presence, increased noise) during implementation activities such as vegetation management, predator removal, social attraction, biosecurity measures, and operations, staging, and monitoring. However, some alternatives would result in moderate, short- and long-term adverse impacts, for example, from rodenticide application and trapping of non-target species during predator removal actions for the *Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)* alternative and during the construction of nesting islands for the *Common Tern Nesting Colony Restoration in the Great Lakes Region (non-preferred)* project. Overall, biological resources would experience long-term benefits from all the proposed projects given the benefits to seabirds from reductions in risk of bycatch, vegetation management, predator removal, and overall enhancements to seabird colonies.

Lastly, for socioeconomic resources, most alternatives would result in negligible to minor, short-term adverse impacts. One alternative *Invasive Goat Removal to Restore Seabird Nesting Habitat in St. Vincent and the Grenadines (preferred)* could have up to moderate, short- and long-term adverse impacts on socioeconomic resources. All projects would have long-term benefits to socioeconomic resources.

The No Action alternative is anticipated to result in minor to major, long-term adverse impacts. A summary of impacts for each restoration alternative and the No Action alternative is provided in Table 4-13.

Alternatives that include data-gathering and educational activities would also have limited adverse impacts, and at most, would cause minor, short-term localized impacts. Adverse impacts to the biological and physical environment could include short-term disturbance of habitats and species, minor emissions from vehicles, and minor disturbance to terrestrial, estuarine, and marine environments. Implementing Trustees would conduct due diligence to ensure that no unanticipated effects to listed species and habitats would occur. Adverse impacts would be minimized by following mitigation measures, BMPs, and other guidance developed during the permitting process, environmental reviews, consultation process, and other relevant regulatory requirements. The Open Ocean TIG would also consider best practices referenced in Section 6.15 and Appendix 6.A of the PDARP/PEIS (DWH Trustees, 2016).

Table 4-13 Summary of the Direct and Indirect Impacts of the Reasonable Range of Restoration Alternatives

Project	Geology and Substrates	Hydrology and Water Quality	Air Quality	Noise	Habitats	Wildlife Species	Marine and Estuarine Fauna	Protected Species	Socioeconomics and Environmental Justice	Cultural Resources	Infrastructure	Land and Marine Management	Tourism and Recreational Use	Fisheries and Aquaculture	Marine Transportation	Aesthetics and Visual Resources	Public Health and Safety
No Action	l	NE	NE	NE	L	L	l	L	NE	NE	NE	NE	l	NE	NE	l	l
Predator Removal and Seabird Nesting Colony Restoration at Mona Island	s,l,+	s,+	s	S,L,+	S,L,+	S,L,+	NE	S,L,+	s,+	NE	NE	s,+	s,l,+	NE	NE	s,+	s
Predator Removal and Seabird Nesting Colony Restoration in the Culebra Archipelago	s,+	s,+	s	S,+	s,+	S,l,+	NE	S,l,+	s,+	NE	NE	+	s,+	NE	NE	s,l,+	s
Seabird Nesting Colony Reestablishment and Protection at Desecheo NWR	NE	NE	s	+	s,+	s,+	NE	s,+	+	NE	NE	+	+	NE	NE	+	NE
Seabird Nesting Colony Protection and Enhancement at Dry Tortugas National Park	s,+	s,+	s	+	s,+	s,+	NE	s,+	+	NE	NE	+	+	NE	NE	+	NE
Common Tern Nesting Colony Restoration in the Great Lakes Region	S,L,+	S,L,+	s	S,+	S,L,+	S,+	S,L,+	S,+	s,+	NE	NE	s,l,+	s,l,+	NE	NE	s,+	s
Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries	NE	NE	s	+	NE	s,+	s,+	s,+	NE	NE	NE	NE	+	+	NE	NE	NE
Seabird Bycatch Risk Reduction in Gulf of Mexico and Southeast U.S. Pelagic Longline Fisheries	NE	NE	s	+	NE	s,+	s,+	s,+	NE	NE	NE	NE	+	+	NE	NE	NE
Northern Gannet Nesting Colony Restoration in Eastern Canada	s,+	NE	s	s,+	s,+	S,+	NE	s,+	+	NE	NE	+	+	NE	NE	s,+	+
Common Tern Nesting Colony Restoration in Manitoba	S,l,+	s,+	s	s,+	S,+	S,+	+	S,+	s,+	NE	NE	s,l,+	s,l,+	NE	NE	s,+	s,+
Seabird Nesting Habitat Restoration and Colony Reestablishment in the Bahamas	S,+	s,+	s	s,+	S,L,+	S,L,+	NE	S,L,+	s,+	NE	NE	+	+	NE	NE	s,+	s
Invasive Goat Removal to Restore Seabird Nesting Habitat in St. Vincent and the Grenadines	s,+	+	s	+	s,+	s,+	+	s,+	S,+	NE	NE	L	+	NE	NE	s,+	s

+ Beneficial effect
NE No effect
s Short-term minor adverse effect
S Short-term moderate adverse effect
S Short-term major adverse effect
l Long-term minor adverse effect
L Long-term moderate adverse effect
L Long-term major adverse effect

4.9 Compliance with Environmental Laws and Regulations

The Open Ocean TIG would ensure compliance with all applicable state/provincial and local laws and other applicable federal laws and regulations relevant to any project selected in the final RP/EA. At the time of this draft RP/EA, the TIG has completed or is nearing completion of technical assistance reviews with relevant agencies for protected species and their habitats under the U.S. ESA, Magnuson-Stevens Fishery Conservation and Management Act, Marine Mammal Protection Act (MMPA), consistency with the Coastal Zone Management Act (CZMA) for the preferred alternatives, and other federal statutes, where appropriate. Additionally, technical assistance reviews for cultural resources under the NHPA are in progress for the preferred alternatives. The current compliance status by project at the time of this draft RP/EA is provided below in Table 4-14. This table will be updated at the time of the final RP/EA to reflect current statuses. All compliance for any projects selected in the final RP/EA will be completed prior to implementation of regulated project activites. Further, as discussed in Section 4.4.1.2.2, compliance with Section 7 of the ESA for the rodenticide portion of the *Predator Removal and Seabird Nesting Colony Restoration at Mona Island* project may be conducted in stages to allow the Implementing Trustees to consult with the USFWS Caribbean Ecological Services Office regarding initial planning efforts and to refine the project design, as needed, to avoid and minimize impacts to non-target species. Finally, if any project changes are recommended during planning and implementation efforts, the Open Ocean TIG would determine whether additional consultation or other environmental compliance is needed.

Projects involving in-water work may require authorization pursuant to the Clean Water Act (CWA) Section 404 and/or Rivers and Harbors Act (RHA). Any work in waters of the U.S., including wetlands, associated with selected projects would be coordinated with the U.S. Army Corps of Engineers (USACE) pursuant to CWA Section 404 and the RHA. Coordination with USACE and final authorization pursuant to CWA and RHA where applicable would be completed prior to final design and construction.

Wherever existing consultations or permits are present, they will be reviewed to determine if the consultations/permits are still valid or if re-initiation of any consultations or permits are necessary. Implementing Trustees are required to implement alternative-specific mitigation measures (including BMPs) identified in the RP/EA, Biological Evaluation forms, and completed consultations/permits. Oversight, provided by the Implementing Trustees, would include due diligence to ensure that no unanticipated effects to listed species and habitats occur, including ensuring that BMPs are implemented and continue to function as intended. As noted above, pursuant to the CZMA, federal activities must be consistent to the maximum extent practicable with the federally approved coastal management programs for states where the activities would affect a coastal use or resource. Federal Trustees are submitting consistency determinations for state review coincident with public review of this document.

Federal environmental compliance responsibilities and procedures will follow the Trustee Council's SOPs, which are laid out in Section 9.4.6 of that document (DWH Trustees, 2021a). Following these SOPs, the Implementing Trustees for each alternative would ensure that the status of environmental compliance (e.g., completed, in progress) is tracked through the DIVER Restoration Portal. The Implementing Trustees will keep a record of compliance documents (e.g., ESA letters, permits) and ensure that they are submitted for inclusion in the Administrative Record. Additional information specific to each preferred alternative regarding the environmental compliance requirements and their status is provided in the project-specific descriptions earlier in this chapter.

Table 4-14 Current Status of U.S. Federal Regulatory Compliance Reviews and Approvals of Preferred Alternatives at Release of the Draft RP/EA

Preferred Alternatives	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)	Bald and Golden Eagle Protection Act	Migratory Bird Treaty Act (MBTA)	Coastal Barrier Resources Act
Predator Removal and Seabird Nesting Colony Restoration at Mona Island	IP	C-NE	IP	N/A	N/A	N/A	IP	N/A	N/A	IP	N/A
Seabird Nesting Colony Reestablishment and Protection at Desecheo National Wildlife Refuge	IP	IP	C-EC	N/A	N/A	N/A	IP	N/A	N/A	C-EC	N/A
Seabird Nesting Colony Protection and Enhancement at Dry Tortugas National Park	IP	N/A	IP-NLAA	N/A	N/A	N/A	IP	N/A	N/A	IP-NLAA	N/A
Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries	IP	C-NLAA	IP-NE	C	C	N/A	IP	N/A	N/A	IP-NE	N/A
Northern Gannet Nesting Colony Restoration in Eastern Canada	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Common Tern Nesting Colony Restoration in Manitoba	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Invasive Goat Removal to Restore Seabird Nesting Habitat in St. Vincent and the Grenadines	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

C: Complete
C-EC: Complete, covered by existing compliance
C-NE: Complete, no effect
C-NLAA: Complete, not likely to adversely affect
IP: In progress
IP-NE: In progress, no effect
IP-NLAA: In progress, not likely to adversely affect
IP-LAA: In progress, likely to adversely affect
N/A: Not applicable

4.9.1 Additional U.S. Laws

Examples of applicable laws or EOs include, but are not necessarily limited to, those listed below. Additional detail on each of these laws or EOs can be found in Chapter 6 of the PDARP/PEIS.

Additional federal laws may apply to the alternatives considered in this RP/EA. U.S. legal authorities applicable to restoration alternative development were fully described in the context of the DWH restoration planning in the PDARP/PEIS Section 6.9, Compliance with Other Applicable Authorities and Appendix 6.D, Other Laws and Executive Orders (DWH Trustees, 2016). That material is incorporated by reference here.

Additional U.S. federal laws, regulations, and executive orders that may be applicable include but are not limited to:

- Endangered Species Act (16 U.S.C. § 1531 *et seq*.)
- Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended (16 U.S.C. § 1801 *et seq*.)
- Marine Mammal Protection Act (16 U.S.C. § 1361 *et seq*.)
- Coastal Zone Management Act (16 U.S.C. § 1451 *et seq*.)
- National Historic Preservation Act (16 U.S.C. § 470 *et seq*.)
- Coastal Barrier Resources Act (16 U.S.C. § 3501 *et seq*.)
- Migratory Bird Treaty Act (16 U.S.C. § 703 *et seq*.)
- Bald and Golden Eagle Protection Act (16 U.S.C. § 668 *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*.) and/or Rivers and Harbors Act (33 U.S.C. § 401 *et seq*.)
- Marine Protection, Research, and Sanctuaries Act (16 U.S.C. § 1431 *et seq*. and 33 U.S.C. § 1401 *et seq*.)
- Estuary Protection Act (16 U.S.C. §§ 1221–1226)
- Archaeological Resource Protection Act (16 U.S.C. §§ 470aa–470mm)
- National Marine Sanctuaries Act (16 U.S.C. § 1431 *et seq*.)
- Farmland Protection Policy Act (7 U.S.C. §§ 4201–4209)
- EO 11988: Floodplain Management (May 24, 1977), as amended
- EO 11990: Protection of Wetlands (May 24, 1977), as amended
- EO 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (Feb. 11, 1994), as amended
- EO 12962: Recreational Fisheries (June 7, 1995), as amended
- EO 13007: Indian Sacred Sites
- EO 13045: Protection of Children from Environmental Health Risks and Safety Risks (Apr. 23, 1997), as amended

- EO 13112: Safeguarding the Nation from the Impacts of Invasive Species (Feb. 3, 1999), as amended
- EO 13175: Consultation and Coordination with Indian Tribal Governments (Nov. 6, 2000)
- EO 13186: Responsibilities of Federal Agencies to Protect Migratory Birds (Jan. 10, 2001)
- EO 13693: Planning for Federal Sustainability in the Next Decade
- EO 13985: Advancing Racial Equity and Support for Underserved Communities Through the Federal Government (Jan. 20, 2021)
- EO 13990: Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis (Jan. 20, 2021)
- EO 14008: Tackling the Climate Crisis at Home and Abroad (Jan. 27, 2021)
- EO 14072: Strengthening the Nation's Forests, Communities, and Local Economies (Apr. 22, 2022)

5 Monitoring and Adaptive Management Plans

MAM supports all restoration activities under the PDARP/PEIS by tracking and evaluating restoration progress toward goals, determining the need for corrective actions, addressing key uncertainties, and ensuring compliance with appropriate regulations (see PDARP/PEIS Appendix 5.E, Monitoring and Adaptive Management Framework, for additional details). Through MAM, decisions are informed by evolving restoration information. The adaptive management process incorporates monitoring of restoration progress, consideration of uncertainties, and opportunities for the Trustees to adapt activities to ensure restoration success.

Monitoring for projects considered in this RP/EA may include pre-implementation monitoring, as-built monitoring (e.g., to document successful completion of construction of nesting islands), performance monitoring, and/or post-implementation monitoring. Pre-implementation monitoring can include monitoring to support project compliance, project planning, design, location, or implementation such as to identify environmental factors that may influence project success; or monitoring to document initial conditions. Post-implementation monitoring can help gauge restoration progress and success and/or provide data to better understand ecological functions and benefits that would be used to inform decisions related to current or future DWH restoration projects. The bulk of project monitoring activities may fall under performance monitoring, which is intended to document whether projects have met their established performance criteria and determine the need for interim corrective actions or other adaptive management actions.

Adaptive management is an iterative process that integrates monitoring and evaluation of management actions, where adjustments are made to management approaches based on observed outcomes (NRC, 2004) and science-based approaches are linked to restoration decision-making (Steyer and Llewellyn, 2000; Thom et al., 2005). Within the context of DWH NRDA restoration, adaptive management includes implementing corrective actions, when necessary, to projects that are not trending toward established performance criteria; making adjustments over time to projects that require recurrent or ongoing decision-making; and informing the selection, design, and implementation of restoration projects. The emphasis of adaptive management for DWH NRDA restoration projects is learning from the results of strategic implementation and targeted monitoring to reduce uncertainties concerning restoration decisions.

Adaptive management at the project level includes activities that occur during project planning, implementation, and evaluation. The level of adaptive management needed for a given project (and in turn described in the project-specific MAM Plan) will vary by project depending on the level of uncertainty regarding the project techniques (e.g., restoration of resources with limited scientific understanding, the use of novel approaches and/or techniques, and restoration at large spatial scales and/or longer time scales may require a more robust approach to adaptive management).

Consistent with Section 10 of the Trustee Council SOPs (revised August 2, 2021), the Implementing Trustee will develop MAM plans for all projects other than those proposed only for engineering and design. In addition, for a Draft RP/EA, MAM Plans are only developed for preferred projects. To the extent the Trustees selected different preferred projects in a final RP/EA, MAM plans will be developed for those projects, consistent with the requirements and guidelines set forth in the Final PDARP/PEIS, the Trustee Council SOPs (Section 10) and the MAM Manual.

This RP/EA includes seven preferred project alternatives. MAM Plans for each of these preferred restoration alternatives are provided in Appendix C.

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Industrial Economics, Incorporated (IEc) and Herndon Solutions Group (HSG)	
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Appendix B. Impact Intensity Definitions

The intensity definitions used in the evaluation of potential environmental impacts from the reasonable range of alternatives considered in this RP/EA are provided below. These definitions are also provided in Table 6.3-2 in the PDARP/PEIS.

Resource	Impact Duration	Minor Intensity	Moderate Intensity	Major Intensity
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 on 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 on 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 groundwater 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 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	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 groundwater flows. Water quality: Impacts on 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. 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.	Hydrology: The effect on hydrology could be measurable and widespread. The effect could permanently alter hydrologic patterns including surface and groundwater 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 waterbody. Floodplains: Impacts could result in a change to natural and beneficial floodplain values that could have substantial consequences over a 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.

Resource	Impact Duration	Minor Intensity	Moderate Intensity	Major Intensity
		and natural restoration could occur if left alone.		
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 USEPA's *de minimis* criteria for a general conformity determination under the Clean Air Act (40 CFR 93.153).	The impact on air quality could be measurable and limited to local and adjacent areas. Emissions of criteria pollutants could be at USEPA's *de minimis* criteria levels for general conformity determination.	The impact on air quality could be measurable over a widespread area. Emissions would be high, such that they could exceed USEPA's *de minimis* criteria for a general conformity determination.
Noise	Short-term: During construction period. Long-term: Over the life of the project.	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.
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 adversely affect local populations 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 adverse impacts on both local and regional population levels. These disturbances could adversely affect range-wide population stability. Some impacts might occur in key habitats, and habitat impacts could adversely affect the viability of the species both locally and throughout its range. Actions could result in the widespread increase of non-native species and result 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.	Impacts on 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,	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 adverse impacts on feeding, reproduction, resting, migrating, or other factors affecting local population levels. Some impacts might	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 adverse impacts on feeding, reproduction, migrating, or other factors resulting in a decrease in both local and range-wide population levels and habitat type.

Resource	Impact Duration	Minor Intensity	Moderate Intensity	Major Intensity
	Long-term: Lasting more than two breeding seasons.	reproduction, resting, 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.	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.	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 and result 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 and result in broad and permanent changes to native species populations and distributions.
Protected Species	Short-term: Lasting up to one breeding/growing season. Long-term: 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	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.

Resource	Impact Duration	Minor Intensity	Moderate Intensity	Major Intensity
			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.	
Socioeconomics and Environmental Justice	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. Actions could not disproportionately affect minority and low-income populations.	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. Actions could disproportionately affect minority and low-income populations. However, the impact could be temporary and localized.	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. 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	Minor Intensity	Moderate Intensity	Major Intensity
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: Lasting up to two spawning seasons, depending on length of season. Long-term: Lasting more than two spawning seasons.	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. 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 marine traffic volumes, resulting in perceived inconvenience to operators but no actual disruptions to transportation.	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 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).	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 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.	There could be a change in the viewshed 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 viewshed 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.

Resource	Impact Duration	Minor Intensity	Moderate Intensity	Major Intensity
	Long-term: Over the life of the project or longer.			
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, groundwater, 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, groundwater, 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.	Actions could result in (1) exposure, mobilization and/or migration of existing contaminated soil, groundwater, or surface water to an extent that requires mitigation; and/or (2) could introduce detectable levels of contaminants to soil, groundwater, and/or surface water in localized areas within the project boundaries such that mitigation/remediation is required to restore the affected area to the pre-construction 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 avoidance in local and adjacent areas.	Actions could result in (1) soil, groundwater, and/or surface water contamination at levels exceeding federal, state, or local hazardous waste criteria, including those established by 40 CFR 261; (2) mobilization of contaminants currently in the soil, groundwater, 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, groundwater, 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 federal OSHA in 29 CFR 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.

Appendix C. Project Monitoring and Adaptive Management Plans

MAM plans for each of the preferred alternatives are provided below.

Predator Removal and Seabird Nesting Colony Restoration at Mona Island: Monitoring and Adaptive Management Plan

Prepared by: U.S. Department of the Interior (DOI)

Draft Version Date: 1/2/2023

1. Introduction

This monitoring and adaptive management (MAM) plan follows guidance provided in the Programmatic Damage Assessment and Restoration Plan and Programmatic Environmental Impact Statement (PDARP/PEIS; *Deepwater Horizon* [DWH] Natural Resource Damage Assessment [NRDA] Trustees, 2016) and the Strategic Framework for Bird Restoration Activities (DWH NRDA Trustees, 2017), and identifies the monitoring needed to evaluate progress toward meeting project objectives and to support any necessary adaptive management of the project. Where applicable, it identifies key sources of uncertainty and incorporates monitoring data and decision points that address these uncertainties. As not all projects would have the same sources and degrees of uncertainty, this project-specific MAM plan is scaled according to the level of uncertainty, scope, scale, and Restoration Type associated with this project.

This plan is a living document and may be updated as needed to reflect changing conditions and/or new information. Any future revisions to this MAM plan would be made publicly available through the Data Integration Visualization Exploration and Reporting (DIVER) Explorer (www.diver.orr.noaa.gov) and accessible through the Trustees' website (www.gulfspillrestoration.noaa.gov).

Project Overview

This project would be implemented as restoration for the DWH oil spill NRDA, consistent with the PDARP/PEIS.

- Programmatic Goal: Replenish and Protect Living Coastal and Marine Resources
- Restoration Type: Birds
- Restoration Approaches: Restore and conserve bird nesting and foraging habitat; Establish or reestablish breeding colonies (PDARP/PEIS Section 5.5.12.2)
- Restoration Techniques: Enhance habitat through vegetation management; nesting and foraging area stewardship (i.e., predator management); use acoustic vocalization playbacks and decoys to attract breeding adults to restoration sites (PDARP/PEIS Appendix 5.D.6.1 and 5.D.6.2)

This restoration project would be implemented on Mona Island, a 21-square-mile uninhabited tropical island approximately 41 miles west of Puerto Rico. Invasive, feral mammals (rodents, cats, and pigs) have caused local extirpations and reduced remnant populations of native plants and wildlife on Mona Island, including seabirds and Endangered Species Act-listed species. This project would restore seabirds by reducing predator disturbance, enhancing nesting habitat, establishing new breeding colonies, and enhancing reproductive success.

This project includes restoration actions such as vegetation management (removal of invasive species and planting of native plants), predator management (eradication of rodents, cats, and pigs), development and implementation of biosecurity measures to prevent the (re)introduction of invasive and/or non-native species, and expansion of existing or creation of new seabird colonies through social attraction techniques.[45] The removal of rodents, mice, cats, and pigs on Mona Island could increase the number of birds and restore a portion of the injury from the DWH oil spill for Audubon's shearwater (*Puffinus lherminieri*), sooty tern (*Onychoprion fuscatus*), magnificent frigatebird (*Fregata magnificens*), bridled tern (*Onychoprion anaethetus*), masked booby (*Sula dactylatra*), brown noddy (*Anous stolidus*), white-tailed tropicbird (*Phaethon lepturus*), and brown booby (*Sula leucogaster*).

The implementing trustee is DOI. Project partners may include non-governmental organizations (Island Conservation) and U.S. federal and Puerto Rican government agencies (USDA-APHIS, USFWS Caribbean Ecological Services Field Office, Puerto Rico Department of Natural and Environmental Resources).

Restoration Type Goals and Project Restoration Objectives

The Restoration Type goals relevant to this project, as identified in the PDARP/PEIS, are:

- 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 restoration objective for this project is:

- Restore seabirds by implementing a suite of restoration and conservation techniques (including predator management, vegetation management, social attraction, and biosecurity measures).

Performance criteria would be used to determine restoration success or the need for corrective action in accordance with 15 Code of Federal Regulations 900.55(b)(1)(vii). Specific, measurable performance criteria are defined, as applicable, for monitoring parameters associated with the restoration objective in Section 3.0.

Conceptual Setting

The project would protect and enhance nesting habitats and reestablish nesting colonies for birds on Mona Island, Puerto Rico. The restoration techniques proposed would directly address habitat 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 ongoing efforts of projects partners to address habitat degradation of nesting habitats in individual sites. Habitat restoration activities are expected to provide ancillary benefits to other species and improve overall habitat quality.

External drivers that could affect achievement of project objectives include frequency and severity of storms and prevailing abiotic conditions that influence vegetation growth, which could negatively affect habitat creation, predator removal, and restoration efforts. 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 areas from which

[45] For the purposes of this MAM Plan, biosecurity measures refer to actions taken, such as the placement of rodenticide bait stations, to reduce the risk of (re)introduction of invasive species (e.g., rodents, cats, pigs, or other invasive species) that harm seabirds and seabird habitat.

birds might colonize the new habitats, and connectivity with foraging areas and migratory routes (where applicable).

Potential Sources of Uncertainty

Potential uncertainties may affect the likelihood that this project would be successful in achieving the project objective in a timely manner. Corrective actions may be necessary to address uncertainties and maximize project benefits. Table 1-1 addresses some uncertainties that were considered during project planning. This list should not be considered exhaustive; additional uncertainties could be identified as the project is implemented and monitored.

Table 1-1 Potential Uncertainties

Uncertainty	Summary of Resolution Strategy
Seabirds may not respond immediately to social attraction tools and may take more than a year to respond and populate the desired area.	Bird monitoring would provide useful information on nesting colonies and individuals in the area. Areas with birds could serve as a guide for corrective actions to help ensure the desired area is populated.
Nesting seabirds may not use the restored and enhanced habitat right away due to natural variability.	The number of nesting seabirds on the island fluctuates from year to year for reasons unrelated to habitat availability. The use of restored habitat may lag following predator removal and vegetation management efforts. Bird monitoring conducted during the nesting season would provide needed information on potential corrective actions, such as timing and placement of social attraction materials. Areas of restored habitat that are being used can serve as a guide for social attraction in areas not showing evidence of bird use.
Rodents, cats, and pigs may not be fully eradicated from the island or may be reintroduced following eradication.	Predator monitoring would occur throughout the eradication and following eradication via biosecurity measures. Eradication efforts would be adaptively managed to alter implementation methods if the eradications appear unsuccessful. Biosecurity measures would be developed and implemented following the eradications to minimize the risk of (re)introductions of invasive species.
Climate variability, such as extreme weather events, sea level rise, changes in freshwater inflows, etc. may impact bird survival and reproductive success.	Eradication efforts would be adaptively managed to account for inclement weather.
Planted native vegetation may not establish.	Native plantings may need irrigation or fertilization to assist in establishment. Replacement of dead plants may be required and should consider better suited species depending on site conditions and cause of mortality.

2. Adaptive Management

While this project includes the use of standard restoration techniques, the island's scale and the desired outcome of predator management (i.e., full eradication) warrant the use of adaptive management. Throughout project implementation, corrective actions would be identified as necessary. This MAM Plan may be updated in the future to include additional details on adaptive management of this project.

As noted above, there is some uncertainty related to the short-term effectiveness of project activities (e.g., social attraction) as well as the likelihood that stewarded and managed areas are used and leads to additional production of injured bird species. To adaptively manage this project, and increase the likelihood of achieving the project objective, DOI project personnel would conduct targeted monitoring and use the monitoring data to refine future management actions.

For this project, the principles of adaptive management would be applied in several areas and ways.

- Pre-implementation field trials would be conducted to identify the most effective eradication techniques that minimize impacts to non-target species.
- Coordination with resource management agencies who have conducted eradications on other similar tropical islands would inform implementation.
- Monitoring would be conducted during eradication efforts to identify and mitigate potential impacts to non-target species.
- Monitoring would be conducted during and following eradication efforts to determine efficacy of eradication efforts.

3. Project Monitoring, Performance Criteria, and Potential Corrective Actions

Performance monitoring is designed to determine if a project is meeting its restoration objective(s). Performance monitoring would also assist in determining the need for corrective actions and adaptive management. The proposed monitoring plan for this restoration project was developed to evaluate project performance, key uncertainties, and potential corrective actions if needed. In addition to the performance monitoring parameters listed in Table 3-1, additional monitoring parameters/information may be reported on to document project implementation progress. Examples of this type of additional information can be found in Section 7.

Information on each monitoring parameter is provided below. The list of corrective actions provided below is not exhaustive; rather, it includes a list of potential actions to be considered if the project is not performing as expected once implemented. Other corrective actions may be identified post-implementation, as appropriate.

Table 3-1 Monitoring Parameters

Monitoring Parameter[46]	Purpose	Method(s)	Timing, Frequency, Duration of Data Collection	Sample Size and Sites	Performance Criteria[47]	Potential Corrective Action(s)
Abundance/Density, Birds (Count of nesting adults/pairs by species)	Monitor progress towards meeting the restoration objective	Document abundance of nesting adults in the project area. Ground survey, game camera, or Uncrewed Aircraft System (UAS or "drone"); follow appropriate protocols for most appropriate counting method depending on nesting location	Once every 10-14 days, where feasible; increase effort during peak nesting. Follow appropriate protocols for details on the timing of nest initiation	All sites in the project area. Estimates will account for asynchronous nesting	An increase in abundance and/or density in the project area	Adapt ongoing or implement new stewardship activities focused on key stressors; adjust attraction techniques with decoys, audio, or placement sites as appropriate
Reproduction, Birds (Nest occupancy by species)	Monitor progress towards meeting the restoration objective	Determine potential productivity (number of nests) and identify threats to nest and/or chick success. Ground survey, game camera, or Uncrewed Aircraft System (UAS or "drone"); follow appropriate protocols for most appropriate counting method depending on nesting location	Once every 10-14 days, where feasible. Follow appropriate protocols for details on the timing of nest initiation, conclude counts when all hatch-year birds have left the nesting/ brood-rearing area	All sites in the project area. Estimates will account for asynchronous nesting	An increase in abundance and/or density in the project area	Adapt ongoing or implement new stewardship activities focused on key stressors; adjust attraction techniques with decoys, audio, or placement sites as appropriate
Abundance/Density, Birds (Fledgling count by species)	Monitor progress towards meeting the restoration objective	Determine average productivity (number of flight-capable young per number of breeding pairs) and identify threats to nest and/or chick success. Ground survey, game camera, or Uncrewed Aircraft System (UAS	At least once every 10-14 days where feasible; follow appropriate protocols for details on the timing of nest initiation conclude counts when all hatch-year	All sites or a representative subset of sites in the project area. Estimates will account for	Production of fledgling birds from nests in project area	Determine cause of nest failure and adapt ongoing or implement new stewardship activities focused on key stressors

[46] These monitoring parameters are identified as core performance parameters under the Restore and Conserve Bird Nesting and Foraging Habitat and Establish or Reestablish Breeding Colonies Restoration Approaches in the Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0 (2021).

[47] Performance criteria may be revised as pre-implementation monitoring is conducted and a seabird population and nesting baseline is established.

Monitoring Parameter[46]	Purpose	Method(s)	Timing, Frequency, Duration of Data Collection	Sample Size and Sites	Performance Criteria[47]	Potential Corrective Action(s)
		or "drone"); follow appropriate protocols for most appropriate counting method depending on nesting location	birds have left the nesting/brood-rearing area	asynchronous nesting		

4. Monitoring Schedule

The schedule for project monitoring is shown in Table 4-1 by monitoring parameter.

Table 4-1 Monitoring Schedule

Monitoring Parameters	Pre-Implementation (Years 1-2)	Implementation (Years 3-8)	Post-Implementation (Years 8-10)
Abundance/Density, Birds (Count of nesting adults/pairs by species)	x	x	x
Reproduction, Birds (Nest occupancy)	x	x	x
Abundance/Density, Birds (Fledgling count by species)	x	x	x

5. Evaluation

Pre-implementation monitoring data would be collected to develop a seabird population and nesting baseline on Mona Island. The OO TIG anticipates conducting an evaluation of implementation and post-implementation project monitoring data against baseline data to help answer the following questions:

- Did the project increase seabird abundance/density and productivity? If not, why?
- Did the project produce unanticipated results?
- Were there unanticipated events related to the project that potentially affected the monitoring results (e.g., hurricanes)?
- Were any of the uncertainties identified prior to project implementation resolved?
- Were any new uncertainties identified?

6. Data Management

Data Description

Data would be compiled within 12 months after collection. To the extent practicable, all environmental and biological data generated during monitoring activities would be documented using standardized electronic or paper field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, then project-specific datasheets would be drafted prior to conducting any project monitoring activities. Original hardcopy datasheets and notebooks and photographs would be retained by DOI.

Relevant project data that are handwritten on hardcopy datasheets or notebooks would be transcribed (entered) into standard digital format as per protocols. All field datasheets and notebook entries would be scanned to PDF files. Electronic data files should be named with the date on which the file was created and should include a ReadMe file that describes when the file was created and by whom, and any explanatory notes on the file contents. If a data file is revised, a new copy should be made and the original preserved.

All data would have properly documented Federal Geographic Data Committee/International Organization for Standardization (FGDC/ISO) metadata, a data dictionary (defines codes and fields used in the dataset), and/or a Readme file as appropriate (e.g., how data was collected, quality assurance/quality control [QA/QC] procedures, other information about data such as meaning, relationships to other data, origin, usage, and format).

Data Review and Clearance

After relevant project data is transcribed (entered) into standard digital format, electronic data sheets would be verified against the original hardcopy datasheets and/or notebooks and any corrections for transcription errors would be made as appropriate before data are used for any analyses or distributed. Implementing Trustees would verify and validate MAM data and information and would ensure that all data are: i) entered or converted into agreed upon/commonly used digital format; ii) labeled with metadata following FGDC/ISO standards to the extent practicable and in accordance with DOI requirements.

After all identified errors are addressed, data are considered to be QA/QC'ed. DOI would give the other TIG members time to review the data before making such information publicly available (as described below). Before submitting the monitoring data and information package, co-Implementing Trustees shall confirm with one another that the package is approved for submission.

Data Storage and Accessibility

Once all data has been QA/QC'ed it would be submitted to the DIVER Restoration Portal. Trustees would provide DWH NRDA MAM data and information to the Restoration Portal as soon as possible and no more than 1 year from when data are collected.

Data Sharing

The monitoring data and annual report would be made publicly available, in accordance with the Open, Public, Electronic and Necessary Government Data Act of 2019, through the DIVER Restoration Portal within 6 months of the end of each calendar year through project close-out.

7. Reporting

All reporting would occur after field surveys are completed annually. Reports would summarize the findings for the sampling period including all worksheets transferred into digital format and presented in tabular and graphical formats. The data would be summarized in such a way that it is meaningful to readers. Additionally, an annual report would be completed that includes:

A summary of project activities for the year, such as progress of eradication efforts (e.g., number and type of invasive species removed) and details on social attraction activities that were implemented (e.g., number of decoys and sound systems deployed).

- Summarized monitoring data – synthesized data for all efforts during the year.
- Graphics, if applicable, and associated interpretations of the data.
- Comparisons of pre- and post-implementation conditions, as applicable.
- Any uncertainties with management actions.
- Potential data collection issues.
- Reporting on general MAM activities in the DIVER Restoration Portal on an annual basis.
- Developing a Final MAM Report before the project is closed out.

8. Roles and Responsibilities

Monitoring data associated with this MAM plan would be collected, reviewed, and reported by DOI.

9. References

DWH NRDA Trustees. 2016. *Deepwater Horizon* Oil Spill: Final Programmatic Damage Assessment and Restoration Plan (PDARP) and Final Programmatic Environmental Impact Statement (PEIS). Available: www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.

DWH NRDA Trustees. 2017. *Deepwater Horizon* Oil Spill Natural Resource Damage Assessment: Strategic Framework for Bird Restoration Activities Version 1. June. Available: www.gulfspillrestoration.noaa.gov/2017/06/trustees-release-strategic-frameworks-restoration.

DWH NRDA Trustees. 2021. Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0. Appendix to the Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the DWH Oil Spill. December. Available: https://www.gulfspillrestoration.noaa.gov/monitoring-and-adaptive-management

Seabird Nesting Colony Reestablishment and Protection at Desecheo National Wildlife Refuge: Monitoring and Adaptive Management Plan

Prepared by: U.S. Department of the Interior (DOI)

Draft Version Date: 1/2/2023

1. Introduction

This monitoring and adaptive management (MAM) plan follows guidance provided in the Programmatic Damage Assessment and Restoration Plan and Programmatic Environmental Impact Statement (PDARP/PEIS; *Deepwater Horizon* [DWH] Natural Resource Damage Assessment [NRDA] Trustees, 2016) and the Strategic Framework for Bird Restoration Activities (DWH NRDA Trustees, 2017), and identifies the monitoring needed to evaluate progress toward meeting project objectives and to support any necessary adaptive management of the project. Where applicable, it identifies key sources of uncertainty and incorporates monitoring data and decision points that address these uncertainties. As not all projects would have the same sources and degrees of uncertainty, this project-specific MAM plan is scaled according to the level of uncertainty, scope, scale, and Restoration Type associated with this project.

This plan is a living document and may be updated as needed to reflect changing conditions and/or new information. Any future revisions to this MAM plan would be made publicly available through the Data Integration Visualization Exploration and Reporting (DIVER) Explorer (www.diver.orr.noaa.gov) and accessible through the Trustees' website (www.gulfspillrestoration.noaa.gov).

Project Overview

This project would be implemented as restoration for the DWH oil spill NRDA, consistent with the PDARP/PEIS.

- Programmatic Goal: Replenish and Protect Living Coastal and Marine Resources
- Restoration Type: Birds
- Restoration Approaches: Restore and conserve bird nesting and foraging habitat; Establish or reestablish breeding colonies (PDARP/PEIS Section 5.5.12.2)
- Restoration Techniques: Develop and implement management actions in conservation areas and/or restoration projects; use acoustic vocalization playbacks and decoys to attract nesting adults to restoration sites (PDARP/PEIS Appendix 5.D.6.1 and 5.D.6.2)

This restoration project would be implemented on Desecheo Island, a 300-acre, uninhabited tropical island approximately 13 miles west of Puerto Rico. The island is designated and managed as a National Wildlife Refuge (NWR) by the U.S. Fish and Wildlife Service (USFWS). Invasive mammals (rodents, goats, macaques) caused a near-total collapse of the seabird colonies on Desecheo NWR. These invasive mammals were recently eradicated through a collaborative project with USFWS, Island Conservation, U.S. Department of Agriculture, and Puerto Rico Department of Natural and Environmental Resources (PRDNER). After declines caused by anthropogenic factors, seabirds often fail to reestablish because of fidelity to their place of origin or a continued perceived predation risk. In the absence of active management, re-colonization by the target seabird species is less likely to occur. This project would help reestablish seabird breeding colonies, and, in turn, maximize the return on investment from the previous invasive mammal eradication.

This project would implement social attraction methods (e.g., species-specific decoys, mirrors, acoustic playbacks) to expand existing or create new seabird nesting colonies. Additionally, the project would enhance existing biosecurity measures to prevent the (re)introduction of invasive or non-native species that harm seabirds or seabird habitat.[48] Target species include bridled tern (*Onychoprion anaethetus*), brown booby (*Sula leucogaster*), magnificent frigatebird (*Fregata magnificens*), sooty tern (*Onychoprion fuscatus*), and brown noddy (*Anous stolidus*).

The implementing trustee is DOI. Project partners may include non-governmental organizations (Island Conservation, Effective Environmental Restoration) and U.S. federal and Puerto Rican government agencies (USFWS Caribbean Islands NWR Complex, PRDNER).

*Restoration Type **Goals and Project Restoration Objectives***

The Restoration Type goals relevant to this project, as identified in the PDARP/PEIS, are:

- 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 restoration objective for this project is:

- Restore seabirds by reestablishing nesting colonies for five primary seabird species using techniques such as social attraction, biosecurity, and monitoring.

Performance criteria would be used to determine restoration success or the need for corrective action in accordance with 15 Code of Federal Regulations 900.55(b)(1)(vii). Specific, measurable performance criteria are defined, as applicable, for monitoring parameters associated with the restoration objective in Section 3.0.

Conceptual Setting

The project would reestablish nesting colonies for birds in Desecheo NWR, Puerto Rico. The restoration techniques proposed would directly restore seabird colonies and have been implemented successfully on Desecheo Island. This restoration project would complement and enhance ongoing efforts of projects partners to restore seabirds. Biosecurity efforts are expected to provide ancillary benefits to other species and improve habitat quality.

External drivers that could affect achievement of project objectives include frequency and severity of storms and prevailing abiotic conditions that influence seabird nesting. Ecosystem linkages and factors that could influence this project include the suitability and quality of available habitat to support ecological needs of bird species, proximity of other nesting areas from which birds might colonize the new habitats, and connectivity with foraging areas and migratory routes (where applicable).

[48] For the purposes of this MAM Plan, biosecurity measures refer to actions taken, such as the placement of rodenticide bait stations, to reduce the risk of (re)introduction of invasive species (e.g., rodents, cats, pigs, or other invasive species) that harm seabirds and seabird habitat.

Potential Sources of Uncertainty

Potential uncertainties may affect the likelihood that this project would be successful in achieving the goals and objectives in a timely manner. Corrective actions may be necessary to address uncertainties and maximize project benefits. Table 1-1 addresses some uncertainties that were considered during project planning. This list should not be considered exhaustive; additional uncertainties could be identified as the project is implemented and monitored.

Table 1-1 Potential Uncertainties

Uncertainty	Summary of Resolution Strategy
Seabirds may not respond immediately to social attraction tools and may take more than a year to respond and populate the desired area.	Bird monitoring would provide useful information on nesting colonies and individuals in the area. Areas with birds could serve as a guide for corrective actions to help ensure the desired area is populated.
Nesting seabirds may not use the restored and enhanced habitat right away due to natural variability.	The number of nesting seabirds on the island fluctuates from year to year for reasons unrelated to habitat availability. Bird monitoring conducted during the breeding season would provide needed information on potential corrective actions, such as timing and placement of social attraction materials. Characteristics of existing seabird nesting sites can serve as a guide placement of social attraction materials and similar areas.

2. Adaptive Management

The Open Ocean Trustee Implementation Group (Open Ocean TIG or “the TIG”) anticipates utilizing adaptive management principles for this project to ensure project objectives are being met and allow for course adjustments if necessary to achieve project success. The TIG would identify corrective actions as necessary. This MAM Plan may be updated in the future to include additional details on adaptive management of this project.

As noted in Table 1-1, there is uncertainty regarding seabird response to social attraction materials. Project implementors would monitor seabird response to social attraction materials and compare targeted new nesting sites to conditions at existing sites to determine optimal placement locations.

Biosecurity enhancement would employ adaptive management principles by developing targeted response plans when incursions of invasive species are identified through habitat monitoring. Response plans would consider (1) the type of species that is introduced, (2) the introduction location, and (3) the probability of the invasive establishing and impacting native species.

3. Project Monitoring, Performance Criteria, and Potential Corrective Actions

Performance monitoring is designed to determine if a project is meeting its restoration objective(s). Performance monitoring would also assist in determining the need for corrective actions and adaptive management. The proposed monitoring plan for this restoration project was developed to evaluate project performance, key uncertainties, and potential corrective actions, if needed. In addition to the performance monitoring parameters listed in Table 3-1, additional monitoring parameters/information may be reported on to document project implementation progress. Examples of this type of additional information can be found in Section 7.

Information on each monitoring parameter is provided below. The list of corrective actions provided below is not exhaustive; rather, it includes a list of potential actions to be considered if the project is not performing as expected once implemented. Other corrective actions may be identified post-implementation, as appropriate.

Table 3-1 Monitoring Parameters

Monitoring Parameter[49]	Purpose	Method(s)	Timing, Frequency, Duration of Data Collection	Sample Size and Sites	Performance Criteria[50]	Potential Corrective Action(s)
Abundance/Density, Birds (Count of nesting adults/pairs by species)	Monitor progress towards meeting the restoration objective	Document abundance of nesting adults in the project area. Ground survey, game camera, or Uncrewed Aircraft System (UAS or "drone"); follow appropriate protocols for most appropriate counting method depending on nesting location	Once every 10-14 days, where feasible; increase effort during peak nesting. Follow appropriate protocols for details on the timing of nest initiation	All sites in the project area. Estimates will account for asynchronous nesting	An increase in abundance and/or density in the project area	Adapt ongoing or implement new stewardship activities focused on key stressors; adjust attraction techniques with decoys, audio, or placement sites as appropriate
Reproduction, Birds (Nest occupancy by species)	Monitor progress towards meeting the restoration objective	Determine potential productivity (number of nests) and identify threats to nest and/or chick success. Ground survey, game camera, or Uncrewed Aircraft System (UAS or "drone"); follow appropriate protocols for most appropriate counting method depending on nesting location	Once every 10-14 days, where feasible. Follow appropriate protocols for details on the timing of nest initiation, conclude counts when all hatch-year birds have left the nesting/ brood-rearing area	All sites in the project area. Estimates will account for asynchronous nesting	An increase in abundance and/or density in the project area	Adapt ongoing or implement new stewardship activities focused on key stressors; adjust attraction techniques with decoys, audio, or placement sites as appropriate
Abundance/Density, Birds (Fledgling count by species)	Monitor progress towards meeting the restoration objective	Determine average productivity (number of flight-capable young per number of breeding pairs) and identify threats to nest and/or chick success. Ground survey, game camera, or Uncrewed Aircraft System (UAS	At least once every 10-14 days where feasible; follow appropriate protocols for details on the timing of nest initiation conclude counts when all hatch-year	All sites or a representative subset of sites in the project area. Estimates will account for	Production of fledgling birds from nests in project area	Determine cause of nest failure and adapt ongoing or implement new stewardship activities focused on key stressors

[49] These monitoring parameters are identified as core performance parameters under the Restore and Conserve Bird Nesting and Foraging Habitat and Establish or Reestablish Breeding Colonies Restoration Approaches in the Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0 (2021).

[50] Performance criteria may be revised as pre-implementation monitoring is conducted and a seabird population and nesting baseline is established.

Monitoring Parameter[49]	Purpose	Method(s)	Timing, Frequency, Duration of Data Collection	Sample Size and Sites	Performance Criteria[50]	Potential Corrective Action(s)
		or "drone"); follow appropriate protocols for most appropriate counting method depending on nesting location	birds have left the nesting/ brood-rearing area	asynchronous nesting		

4. Monitoring Schedule

All monitoring parameters listed in Table 3-1 would be measured in each year of project implementation, plus an additional 3 years of post-implementation monitoring.

5. Evaluation

Project monitoring data would be evaluated against baseline monitoring data collected by project partners. The Open Ocean Trustee Implementation Group anticipates conducting an evaluation of the project monitoring data collected (as described above) to help answer the following questions:

- Did the project reestablish seabird nesting colonies and increase abundance/density and/or productivity? If not, why?
- Did the project produce unanticipated results?
- Were there unanticipated events related to the project that potentially affected the monitoring results (e.g., hurricanes)?
- Were any of the uncertainties identified prior to project implementation resolved?
- Were any new uncertainties identified?

6. Data Management

Data Description

Data collected would be compiled within 12 months after collection. To the extent practicable, all environmental and biological data generated during monitoring activities would be documented using standardized field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, then project-specific datasheets would be drafted prior to conducting any project monitoring activities. Original hardcopy datasheets and notebooks and photographs would be retained by DOI.

Relevant project data that are handwritten on hardcopy datasheets or notebooks would be transcribed (entered) into standard digital format as per protocols. All field datasheets and notebook entries would be scanned to PDF files. Electronic data files should be named with the date on which the file was created and should include a ReadMe file that describes when the file was created and by whom, and any explanatory notes on the file contents. If a data file is revised, a new copy should be made and the original preserved.

All data would have properly documented Federal Geographic Data Committee/International Organization for Standardization (FGDC/ISO) metadata, a data dictionary (defines codes and fields used in the dataset), and/or a Readme file as appropriate (e.g., how data was collected, quality assurance/quality control [QA/QC] procedures, other information about data such as meaning, relationships to other data, origin, usage, and format).

Data Review and Clearance

After relevant project data is transcribed (entered) into standard digital format, electronic data sheets would be verified against the original hardcopy datasheets and/or notebooks and any corrections for transcription errors would be made as appropriate before data are used for any analyses or distributed. Implementing Trustees would verify and validate MAM data and information and would ensure that all data are: i) entered or converted into agreed upon/commonly used digital format; ii) labeled with metadata following FGDC/ISO standards to the extent practicable and in accordance with DOI requirements.

After all identified errors are addressed, data are considered to be QA/QC'ed. DOI would give the other TIG members time to review the data before making such information publicly available (as described below). Before submitting the monitoring data and information package, co-Implementing Trustees shall confirm with one another that the package is approved for submission.

Data Storage and Accessibility

Once all data has been QA/QC'ed it would be submitted to the DIVER Restoration Portal. Trustees would provide DWH NRDA MAM data and information to the Restoration Portal as soon as possible and no more than 1 year from when data are collected.

Data Sharing

The monitoring data and annual report would be made publicly available, in accordance with the Open, Public, Electronic and Necessary Government Data Act of 2019, through the DIVER Restoration Portal within 6 months of the end of each calendar year through project close-out.

7. Reporting

All reporting would occur after field surveys are completed annually. This report would summarize the findings for the sampling period including all worksheets transferred into digital format and presented in tabular and graphical formats. The data should be summarized in such a way that it is meaningful to the reader. Additionally, an annual report would be completed that includes:

A summary of project activities for the year, such as social attraction activities that were implemented and details on those activities (e.g., number of decoys and sound systems deployed).

- Summarized monitoring data –synthesized data for all efforts during the year.
- Graphics, if applicable, and associated interpretations of the data.
- Comparisons of pre- and post-implementations conditions, as applicable.
- Any uncertainties with management actions.
- Potential data collection issues.
- Reporting on general MAM activities in the DIVER Restoration Portal on an annual basis.
- Developing a Final MAM Report before a project is closed out.

8. Roles and Responsibilities

Monitoring data associated with this MAM plan would be collected, reviewed, and reported by DOI.

9. References

DWH NRDA Trustees. 2016. *Deepwater Horizon* Oil Spill: Final Programmatic Damage Assessment and Restoration Plan (PDARP) and Final Programmatic Environmental Impact Statement (PEIS). Available: www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.

DWH NRDA Trustees. 2017. *Deepwater Horizon* Oil Spill Natural Resource Damage Assessment: Strategic Framework for Bird Restoration Activities Version 1. June. Available: www.gulfspillrestoration.noaa.gov/2017/06/trustees-release-strategic-frameworks-restoration.

DWH NRDA Trustees. 2021. Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0. Appendix to the Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the DWH Oil Spill. December. Available: https://www.gulfspillrestoration.noaa.gov/monitoring-and-adaptive-management

Seabird Nesting Colony Protection and Enhancement at Dry Tortugas National Park: Monitoring and Adaptive Management Plan

Prepared by: U.S. Department of the Interior (DOI)

Draft Version Date: 1/2/2023

1. Introduction

This monitoring and adaptive management (MAM) plan follows guidance provided in the Programmatic Damage Assessment and Restoration Plan and Programmatic Environmental Impact Statement (PDARP/PEIS; *Deepwater Horizon* [DWH] Natural Resource Damage Assessment [NRDA] Trustees, 2016) and the Strategic Framework for Bird Restoration Activities (DWH NRDA Trustees, 2017), and identifies the monitoring needed to evaluate progress toward meeting project objectives and to support any necessary adaptive management of the project. Where applicable, it identifies key sources of uncertainty and incorporates monitoring data and decision points that address these uncertainties. As not all projects would have the same sources and degrees of uncertainty, this project-specific MAM plan is scaled according to the level of uncertainty, scope, scale, and Restoration Type associated with this project.

This plan is a living document and may be updated as needed to reflect changing conditions and/or new information. Any future revisions to this MAM plan would be made publicly available through the Data Integration Visualization Exploration and Reporting (DIVER) Explorer (www.diver.orr.noaa.gov) and accessible through the Trustees' website (www.gulfspillrestoration.noaa.gov).

Project Overview

This project would be implemented as restoration for the DWH oil spill NRDA, consistent with the PDARP/PEIS.

- Programmatic Goal: Replenish and Protect Living Coastal and Marine Resources
- Restoration Type: Birds
- Restoration Approaches: Restore and conserve bird nesting and foraging habitat; Establish or reestablish breeding colonies (PDARP/PEIS Section 5.5.12.2)
- Restoration Techniques: Enhance habitat through vegetation management; Develop and implement management actions in conservation areas and/or restoration projects; Use acoustic vocalization playbacks and decoys to attract breeding adults to restoration sites (PDARP/PEIS Appendix 5.D.6.1 and 5.D.6.2)

This restoration project would be implemented at keys within Dry Tortugas National Park (DRTO) in Florida. DRTO, in partnership with USDA Animal and Plant Health Inspection Service (USDA-APHIS), recently completed a black rat (*Rattus rattus*) eradication from Garden, Long, Bush, and Loggerhead Keys. This project would be implemented in a phased approach. Phase I would include compilation of existing monitoring data and seabird monitoring via overflights or uncrewed aircraft systems (UAS or "drones") to establish a seabird population baseline following the rat eradication and inform subsequent restoration actions. Phase II would include habitat enhancements through vegetation management and social attraction to reestablish seabird nesting colonies. Additionally, the project would enhance existing biosecurity measures to prevent the (re)introduction of black rats or other harmful species.[51] Targeted seabird species include the sooty tern (*Onychoprion fuscatus*), bridled tern (*Onychoprion anaethetus*), brown noddy (*Anous stolidus*), masked booby (*Sula dactylatra*), and magnificent frigatebird (*Fregata magnificens*).

The implementing trustee is DOI. Project partners may include the National Park Service (NPS) and USDA-APHIS.

Restoration Type Goals and Project Restoration Objectives

The Restoration Type goals relevant to this project, as identified in the PDARP/PEIS, are:

- 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 restoration objective for this project is:

- Contribute to seabird restoration by establishing a monitoring baseline to inform restoration decisions and to reestablish nesting colonies through vegetation management and social attraction.

Performance criteria would be used to determine restoration success or the need for corrective action in accordance with 15 Code of Federal Regulations 900.55(b)(1)(vii). Specific, measurable performance criteria are defined, as applicable, for monitoring parameters associated with the restoration objective in Section 3.0.

Conceptual Setting

The restoration techniques proposed would directly restore seabird nesting colonies at DRTO. After declines caused by anthropogenic factors, seabirds often fail to reestablish because of fidelity to their place of origin or a continued perceived predation risk. In the absence of active management, recolonization by the target seabird species is less likely to occur. This project would help reestablish seabird nesting colonies, and, in turn, maximize the return on investment from the recent invasive mammal eradication. This restoration project would complement and enhance ongoing efforts of projects partners to restore seabirds. Biosecurity efforts are expected to provide ancillary benefits to other species and improve habitat quality.

External drivers that could affect achievement of project objectives include frequency and severity of storms and prevailing abiotic conditions that influence seabird nesting. Ecosystem linkages and factors that could influence this project include the suitability and quality of available habitat to support ecological needs of bird species, proximity of other nesting areas from which birds might colonize the new habitats, and connectivity with foraging areas and migratory routes (where applicable).

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[51] For the purposes of this MAM Plan, biosecurity measures refer to actions taken, such as the placement of rodenticide bait stations, to reduce the risk of (re)introduction of invasive species (e.g., rodents, cats, pigs, or other invasive species) that harm seabirds and seabird habitat.

Potential Sources of Uncertainty

Potential uncertainties may affect the likelihood that this project would be successful in achieving the goals and objectives in a timely manner. Corrective actions may be necessary to address uncertainties and maximize project benefits. Table 1-1 addresses some uncertainties that were considered during project planning. This list should not be considered exhaustive; additional uncertainties could be identified as the project is implemented and monitored.

Table 1-1 Potential Uncertainties

Uncertainty	Summary of Resolution Strategy
Seabirds may not respond immediately to social attraction tools and may take more than a year to respond and populate the desired area.	Bird monitoring would provide useful information on nesting colonies and individuals in the area. Areas with birds could serve as a guide for corrective actions to help ensure the desired area is populated.
Nesting seabirds may not use the restored and enhanced habitat right away due to natural variability.	The number of nesting seabirds on the keys fluctuates from year to year for reasons unrelated to habitat availability. The use of restored habitat may lag predator removal and vegetation management efforts. Bird monitoring conducted in Phase I would provide needed information on potential restoration actions, such as timing and placement of social attraction materials. Areas of restored habitat that are being used can serve as a guide for social attraction in areas not showing evidence of bird use.

2. Adaptive Management

The Open Ocean Trustee Implementation Group (Open Ocean TIG or "the TIG") anticipates utilizing adaptive management principles for this project to ensure project objectives are being met and allow for course adjustments if necessary to achieve project success. The TIG would identify corrective actions as necessary. This MAM Plan may be updated in the future to include additional details on adaptive management of this project.

As noted in Table 1-1, there is uncertainty regarding seabird response to social attraction materials. Project implementors would monitor seabird response to social attraction materials and compare targeted new nesting sites to conditions at existing sites to determine optimal placement locations.

Biosecurity enhancement would employ adaptive management principles by developing targeted response plans when incursions of invasive species are identified through habitat monitoring. Response plans would consider (1) the type of species that is introduced, (2) the introduction location, and (3) the probability of the invasive establishing and impacting native species.

3. Project Monitoring, Performance Criteria, and Potential Corrective Actions

Performance monitoring is designed to determine if a project is meeting its restoration objective(s). Performance monitoring would also assist in determining the need for corrective actions and adaptive management. The proposed monitoring plan for this restoration project was developed to evaluate project performance, key uncertainties, and potential corrective actions, if needed. In addition to the performance monitoring parameters listed in Table 3-1, additional monitoring parameters/information may be reported on to document project implementation progress. Examples of this type of additional information can be found in Section 7.

Information on each monitoring parameter is provided below. The list of corrective actions provided below is not exhaustive; rather, it includes a list of potential actions to be considered if the project is not performing as expected once implemented. Other corrective actions may be identified post-implementation, as appropriate.

Table 3-1 Monitoring Parameters

Monitoring Parameter[52]	Purpose	Method(s)	Timing, Frequency,[53] **Duration of Data Collection**	Sample Size and Sites	Performance Criteria[54]	Potential Corrective Action(s)
Abundance/ Density, Birds (Count of nesting adults/pairs by species)	Monitor progress towards meeting the restoration objective	Document abundance of nesting adults in the project area using aerial imagery. Aerial surveys; follow protocols for most appropriate counting method depending on nesting location and species type	Approximately once per month or as frequent as every 7-10 days, when possible, from February to September each year (when nesting seabirds are present)	All sites in the project area. Estimates will account for asynchronous nesting	An increase in abundance and/or density in the project area	Adapt ongoing or implement new stewardship activities focused on key stressors; adjust attraction techniques with decoys, audio, or placement sites as appropriate
Reproduction, Birds (Nest occupancy by species)	Monitor progress towards meeting the restoration objective	Determine potential productivity (number of nests) and identify threats to nest and/or chick success. Aerial surveys; follow protocols for most appropriate counting method depending on nesting location and species type	Approximately once per month or as frequent as every 7-10 days, when possible, from February to September each year (when nesting seabirds are present); follow appropriate protocols for details on the timing of nest initiation, conclude counts when all hatch-year birds have left the nesting/ brood-rearing area	All sites in the project area. Estimates will account for asynchronous nesting	An increase in abundance and/or density in the project area	Adapt ongoing or implement new stewardship activities focused on key stressors; adjust attraction techniques with decoys, audio, or placement sites as appropriate

[52] These monitoring parameters are identified as core performance parameters under the Restore and Conserve Bird Nesting and Foraging Habitat and Establish or Reestablish Breeding Colonies Restoration Approaches in the Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0 (2021).

[53] The monitoring parameters would be collected in both phases of the project. Monitoring frequency would increase for performance monitoring, beginning in Year 3 (see Section 4.

[54] Performance criteria may be revised as pre-implementation monitoring is conducted and a seabird population and nesting baseline is established.

Monitoring Parameter[52]	Purpose	Method(s)	Timing, Frequency,[53] **Duration of Data Collection**	Sample Size and Sites	Performance Criteria[54]	Potential Corrective Action(s)
Abundance/ Density, Birds (Fledgling count by species)	Monitor progress towards meeting the restoration objective	Determine average productivity (number of flight-capable young per number of breeding pairs) and identify threats to nest and/or chick success. Aerial surveys; follow appropriate protocols for most appropriate counting method depending on nesting location	Approximately once per month or as frequent as every 7-10 days, when possible, from February to September each year (when nesting seabirds are present); follow appropriate protocols for details on the timing of nest initiation conclude counts when all hatch-year birds have left the nesting/ brood-rearing area	All sites or a representative subset of sites in the project area. Estimates will account for asynchronous nesting	Production of juvenile birds from nests in project area	Determine cause of nest failure and adapt ongoing or implement new stewardship activities focused on key stressors

4. Monitoring Schedule

The schedule for project monitoring is shown in Table 4-1 by monitoring parameter and project phase.

Table 4-1 Monitoring Schedule

Monitoring Parameters	Phase I (Pre-Implementation, Years 1-5)	Phase II Implementation (Years 3-5)	Phase II Post-Implementation (Years 5-7)
Abundance/Density, Birds (Count of nesting adults/pairs by species)	x	x	x
Reproduction, Birds (Nest occupancy)	x	x	x
Abundance/Density, Birds (Fledgling count by species)	x	x	x

5. Evaluation

Pre-implementation monitoring data would be collected to develop a seabird population and nesting baseline at Dry Tortugas. The Open Ocean TIG anticipates conducting an evaluation of implementation and post-implementation project monitoring data against baseline data to help answer the following questions:

- Did the project reestablish seabird nesting colonies and increase abundance/density and productivity? If not, why?
- Did the project establish a monitoring baseline?
- Did the project produce unanticipated results?
- Were there unanticipated events related to the project that potentially affected the monitoring results (e.g., hurricanes)?
- Were any of the uncertainties identified prior to project implementation resolved?
- Were any new uncertainties identified?

6. Data Management

Data Description

Data collected would be compiled within 12 months after collection. To the extent practicable, all environmental and biological data generated during monitoring activities would be documented using standardized electronic or paper field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, then project-specific datasheets would be drafted prior to conducting any project monitoring activities. Original hardcopy datasheets and notebooks and photographs would be retained by DOI.

Relevant project data that are handwritten on hardcopy datasheets or notebooks would be transcribed (entered) into standard digital format as per protocols. All field datasheets and notebook entries would be scanned to PDF files. Electronic data files should be named with the date on which the file was created and should include a ReadMe file that describes when the file was created and by whom, and any explanatory notes on the file contents. If a data file is revised, a new copy should be made and the original preserved.

All data would have properly documented Federal Geographic Data Committee/International Organization for Standardization (FGDC/ISO) metadata, a data dictionary (defines codes and fields used in the dataset), and/or a Readme file as appropriate (e.g., how data was collected, quality assurance/quality control [QA/QC] procedures, other information about data such as meaning, relationships to other data, origin, usage, and format).

Data Review and Clearance

After relevant project data is transcribed (entered) into standard digital format, electronic data sheets would be verified against the original hardcopy datasheets and/or notebooks and any corrections for transcription errors would be made as appropriate before data are used for any analyses or distributed. Implementing Trustees would verify and validate MAM data and information and would ensure that all data are: i) entered or converted into agreed upon/commonly used digital format; ii) labeled with metadata following FGDC/ISO standards to the extent practicable and in accordance with DOI requirements.

After all identified errors are addressed, data are considered to be QA/QC'ed. DOI would give the other TIG members time to review the data before making such information publicly available (as described below). Before submitting the monitoring data and information package, co-Implementing Trustees shall confirm with one another that the package is approved for submission.

Data Storage and Accessibility

Once all data has been QA/QC'ed it would be submitted to the DIVER Restoration Portal. Trustees would provide DWH NRDA MAM data and information to the Restoration Portal as soon as possible and no more than 1 year from when data are collected.

Data Sharing

The monitoring data and annual report would be made publicly available, in accordance with the Open, Public, Electronic and Necessary Government Data Act of 2019, through the DIVER Restoration Portal within 6 months of the end of each calendar year through project close-out.

7. Reporting

All reporting would occur after field surveys are completed annually. This report would summarize the findings for the sampling period including all worksheets transferred into digital format and presented in tabular and graphical formats. The data would be summarized in such a way that it is meaningful to readers. Additionally, an annual report would be completed that includes:

- A summary of project activities for the year, such as social attraction activities that were implemented and details on those activities (e.g., number of decoys and sound systems deployed).
- Summarized monitoring data – synthesized data for all efforts during the year.
- Graphics, if applicable, and associated interpretations of the data.
- Comparisons of pre- and post-implementation conditions, as applicable.
- Any uncertainties with management actions.
- Potential data collection issues.
- Reporting on general MAM activities in the DIVER Restoration Portal on an annual basis.
- Developing a Final MAM Report before a project is closed out.

8. Roles and Responsibilities

Monitoring data associated with this MAM plan would be collected, reviewed, and reported by DOI.

9. References

DWH NRDA Trustees. 2016. *Deepwater Horizon* Oil Spill: Final Programmatic Damage Assessment and Restoration Plan (PDARP) and Final Programmatic Environmental Impact Statement (PEIS). Available: www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.

DWH NRDA Trustees. 2017. *Deepwater Horizon* Oil Spill Natural Resource Damage Assessment: Strategic Framework for Bird Restoration Activities Version 1. June. Available: www.gulfspillrestoration.noaa.gov/2017/06/trustees-release-strategic-frameworks-restoration.

DWH NRDA Trustees. 2021. Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0. Appendix to the Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the DWH Oil Spill. December. Available: https://www.gulfspillrestoration.noaa.gov/monitoring-and-adaptive-management

Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries: Monitoring and Adaptive Management Plan

Prepared by: U.S. Department of the Interior (DOI) and the National Oceanic and Atmospheric Administration (NOAA)

Draft Version Date: 1/2/2023

1. Introduction

This monitoring and adaptive management (MAM) plan follows guidance provided in the Programmatic Damage Assessment and Restoration Plan and Programmatic Environmental Impact Statement (PDARP/PEIS; *Deepwater Horizon* [DWH] Natural Resource Damage Assessment [NRDA] Trustees, 2016) and the Strategic Framework for Bird Restoration Activities (DWH NRDA Trustees, 2017), and identifies the monitoring needed to evaluate progress toward meeting project objectives and to support any necessary adaptive management of the project. Where applicable, it identifies key sources of uncertainty and incorporates monitoring data and decision points that address these uncertainties. As not all projects would have the same sources and degrees of uncertainty, this project-specific MAM plan is scaled according to the level of uncertainty, scope, scale, and Restoration Type associated with this project.

This plan is a living document and may be updated as needed to reflect changing conditions and/or new information. Any future revisions to this MAM plan would be made publicly available through the Data Integration Visualization Exploration and Reporting (DIVER) Explorer (www.diver.orr.noaa.gov) and accessible through the Trustees' website (www.gulfspillrestoration.noaa.gov).

Project Overview

This project would be implemented as restoration for the DWH oil spill NRDA, consistent with the PDARP/PEIS.

- Programmatic Goal: Replenish and Protect Living Coastal and Marine Resources
- Restoration Type: Birds
- Restoration Approach: Prevent incidental bird mortality (PDARP/PEIS Section 5.5.12.2)
- Restoration Technique: Reduce seabird bycatch through voluntary fishing gear and/or technique modification (PDARP/PEIS Appendix 5.D.6.3)

This restoration project seeks to reduce the risk of mortality from bycatch for northern gannets (*Morus bassanus*), great shearwaters (*Ardenna gravis*), and other seabirds in marine waters off the northeastern United States and Atlantic Canada. During migration and wintering periods northern gannets and great shearwaters utilize offshore waters of the northern U.S. and Canadian Atlantic coastlines for foraging and resting. Great shearwaters are most numerous in waters off New England and Atlantic Canada, with some migrating through the Gulf of Mexico (Carboneras et al., 2020). All the western hemisphere's northern gannets nest in Atlantic Canada, including many that winter in the Gulf of Mexico, and they are abundant in New England and Atlantic Canada during both fall and spring migration (Nisbet et al., 2013). However, restoration options to benefit these species, which spend most of their lives in the marine environment and nest at a small number of remote locations for short durations, are limited. Bycatch of northern gannets and great shearwaters has been observed in pelagic and nearshore gillnet, trawl, pelagic longline (PLL), and other fisheries. As such, reducing incidental mortality experienced from commercial fisheries bycatch can help restore these injured species.

This project would take a phased approach to improving understanding of seabird bycatch and implementing bycatch reduction strategies. Phase I includes pilot testing preliminary bycatch reduction strategies in Cape Cod-based groundfish and Newfoundland-based cod and herring gillnet fisheries; establishing and expanding partnerships with commercial fisheries to gather local knowledge regarding interactions with birds during fishing operations to inform bycatch reduction strategies to test in Phase II; and modeling to identify environmental factors influencing bycatch and inform geographic priorities for development of bycatch reduction strategies and partnerships for Phase II. Phase II includes pilot testing additional bycatch reduction strategies; conducting field studies to gather more information regarding fishery interactions with birds; and expanding the awareness and voluntary use of the most effective strategies. This project would directly benefit bird species injured by the DWH spill by reducing the risk of bycatch of seabirds in northeastern U.S. and Atlantic Canadian commercial fisheries through cooperative work with fishers and other partners.

The implementing trustees are DOI and NOAA. Project partners may include non-governmental organizations, universities, and Canadian provincial fish and wildlife agencies.

Restoration Type Goals and Project Restoration Objectives

The Restoration Type goals relevant to this project, as identified in the PDARP/PEIS, are:

- Restore lost birds by facilitating additional production and/or reduced mortality of injured bird species.
- Restore injured birds by species where actions would provide the greatest benefits within geographic ranges that include the Gulf of Mexico.

The restoration objectives for this project are:

- Improve understanding of seabird bycatch by conducting data analysis efforts and developing partnerships with commercial fisheries to improve understanding of and collect data regarding seabird interactions during fishing operations.
- Pilot test initial efforts to identify successful strategies to reduce seabird bycatch while maintaining target catch retention.
- Encourage adoption of effective bycatch reduction strategies within targeted fisheries.

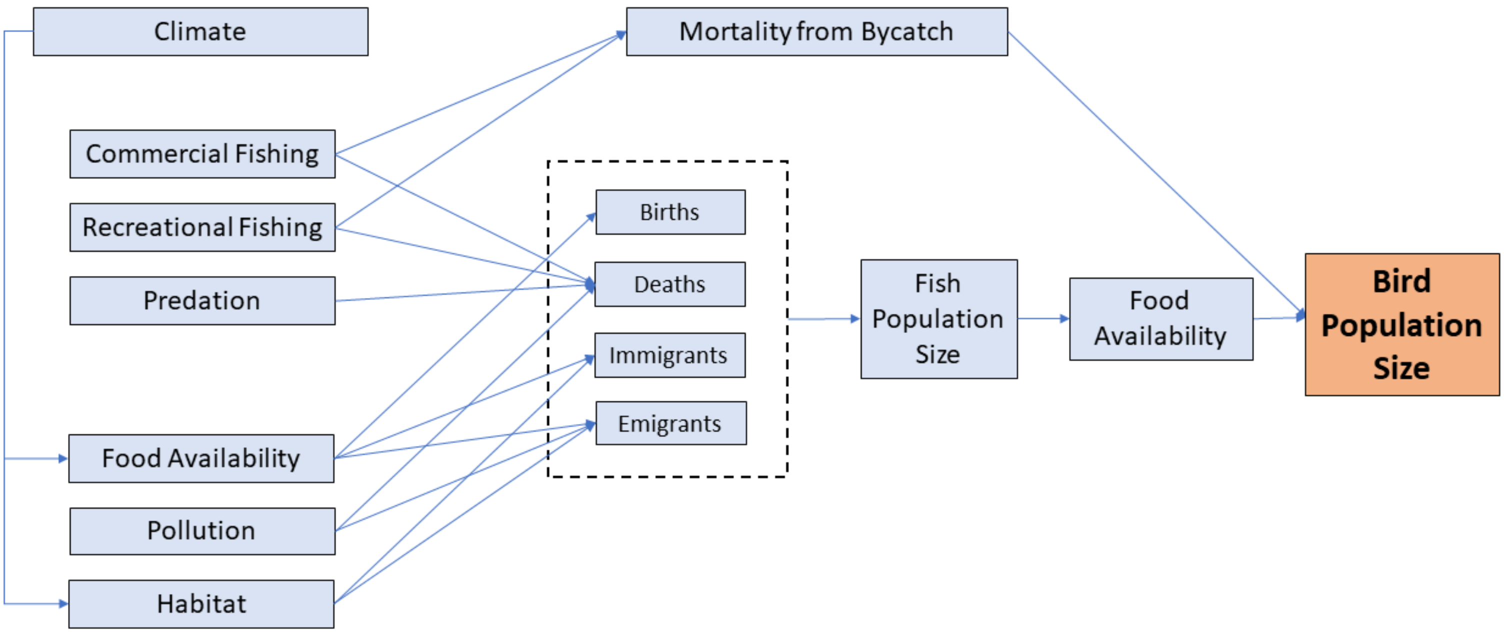
Performance criteria would be used to determine restoration success or the need for corrective action in accordance with 15 Code of Federal Regulations 900.55(b)(1)(vii). Specific, measurable performance criteria are defined, as applicable, for monitoring parameters associated with restoration objectives 2 and 3 in Section 3.0.

Conceptual Setting

The conceptual setting identifies factors and interactions that may influence the project outcomes. This may include factors affecting whether the project is implemented as planned (e.g., the expected number of samples were obtained), cofactors that may have a significant effect on variance in the data, and factors that may alter the expected outcome of the restoration effort. Understanding the conceptual setting aids in adaptive management of the project, as well as future projects of a similar type by identifying some of these factors and providing the opportunity to anticipate their effects and plan for contingencies.

The influence diagram below (Figure 1-1) shows that bycatch reduction strategies may affect seabird populations through mortality rates. Usage of bycatch reduction strategies would depend upon training, cost effectiveness, efficiency, and ease of use. Besides fish (prey) population sizes, there are many factors influencing seabird populations, including fish food availability, fishery catch, habitat, and predation. Large scale environmental drivers such as climate may affect all variables and must be considered when assessing project performance.

Figure 1-1 Project Influence Diagram



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.

As this project relies on voluntary participation in studies and voluntary adoption of new technology, there are a number of potential sources of uncertainty that could affect project performance and success. Potential sources of uncertainty include:

- Can we engage the appropriate people/entities to voluntarily participate in project activities including testing and adoption of seabird bycatch reduction strategies?
- Can we develop accurate models of the factors that lead to seabird bycatch and environmental factors that affect seabird- fisheries interactions on an interannual basis?
- Can we attract enough eligible fishermen to voluntarily test/adopt seabird bycatch reduction strategies?
- Can we develop seabird bycatch reduction strategies that industry will want to adopt without incentives?
- Can we develop cost-effective bycatch reduction strategies that maintain target catch while reducing sebird bycatch?

2. Adaptive Management

An adaptive management approach would be applied to all aspects of the project but would be most robust during the identification and pilot testing of seabird bycatch reduction strategies in Phase I. For example, data analysis and partnership development in Phase I would inform bycatch reduction strategies that could be pilot tested. During Phase I pilot testing, seabird interactions, including bycatch, and fisheries target yield would be monitored during testing to evaluate the effectiveness of each strategy. If pilot strategies in Phase I do not reduce seabird bycatch, or if they significantly impact fisheries target yields or operational efficiencies, other strategies would be identified and implemented. Only strategies that effectively reduce seabird bycatch while maintaining fishery efficiencies would be expanded upon in Phase II.

3. Project Monitoring, Performance Criteria, and Potential Corrective Actions

Performance monitoring is designed to determine if projects are meeting overall restoration objectives. Performance monitoring would also assist in determining the need for corrective actions and adaptive management. The proposed monitoring plan for this restoration project was developed to evaluate project performance, key uncertainties, and potential corrective actions, if needed. In addition to the performance monitoring parameters listed in Table 3-1, additional monitoring parameters/information may be reported on to document project implementation progress. Examples of this type of additional information can be found in Section 7.

Information on each monitoring parameter is provided below. The list of corrective actions provided below is not exhaustive; rather, it includes a list of potential actions to be considered if the project is not performing as expected once implemented. Other corrective actions may be identified post-implementation, as appropriate.

Restoration Objective 1, “Improve understanding of seabird bycatch by conducting data analysis efforts and developing partnerships with commercial fisheries to improve understanding of and collect data regarding seabird interactions during fishing operations”, would be reported on during project implementation. For example, MAM reports may document the number and type of partnerships developed; the type of data that is collected and analyzed; and the utility of that data for improving understanding of temporal and geographic bycatch hotspots for each fishery. Additional information about project reporting can be found in Section 7.

Table 3-1 Monitoring Parameters

Objective 2: Pilot test initial efforts to identify successful strategies to reduce seabird bycatch while maintaining target catch retention.

Monitoring Parameter[55]	Purpose	Method(s)	Timing, Frequency, Duration of Data Collection	Sample Size and Sites	Performance Criteria	Potential Corrective Action(s)
Equipment Enhancements, Birds (Number developed by type; Number used by type) *or*[56] **Conservation Improvements, Birds** (Number of Improvements Developed and/or Evaluated by Activity)	Monitor progress towards meeting the restoration objective	Record the number and type of bycatch reduction strategies identified and pilot tested	Annually compiled during project implementation following initiation of relevant project activities	At locations where project activities have been implemented in the project area (number and specific location to be determined)	At least two bycatch reduction strategies pilot tested in each fishery	Further engage fishery partners or collect additional data/information to identify additional bycatch reduction strategies
Bycatch, Birds (Number bycaught by taxon)	Monitor progress towards meeting the restoration objective	Record the number of birds with fishery interactions and their species and disposition	Annually compiled during project implementation following initiation of relevant project activities	At locations where project activities have been implemented in the project area (number and specific location to be determined)	Lower number of bycaught birds by boats testing bycatch reduction strategies	Adjust the bycatch reduction strategy or identify new strategies

[55] Bold font denotes core performance monitoring parameters identified in the Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0 (2021) under the Prevent Incidental Bird Mortality Restoration Approach.

[56] Bycatch reduction strategies may include fishing gear modifications (“Equipment Enhancements”) or changes in fishing practices such as baiting (“Conservation Improvements”). Monitoring parameters would be further refined as preliminary bycatch reduction strategies are identified in Phase I.

Monitoring Parameter[55]	Purpose	Method(s)	Timing, Frequency, Duration of Data Collection	Sample Size and Sites	Performance Criteria	Potential Corrective Action(s)
Abundance, Fish and Water Column Invertebrates (Catch per unit effort [CPUE])	Evaluate performance of seabird bycatch reduction strategies	Conduct paired tests by comparing the target yield (as a measure of CPUE) from vessels testing seabird bycatch reduction strategies and with target yield from vessels not testing the strategies	Calculated following each pilot test	To be determined depending on level of fishery involvement with pilot testing	Vessels testing seabird bycatch reduction measures have the same or higher target catch than those not implementing bycatch reduction strategies	Adjust the strategy to improve CPUE or identify a new strategy for testing

Objective 3: Encourage adoption of effective bycatch reduction strategies within targeted fisheries.

Monitoring Parameter[57]	Purpose	Method(s)	Timing, **Frequency, Duration of Data Collection**	Sample Size **and Sites**	Performance Criteria	Potential Corrective Action(s)
Equipment Enhancements, Birds (Number of Trips with Enhancements; Number Used by Type) *or*[58] **Conservation Improvements, Birds** (Number Implemented by Activity)	Monitor progress towards meeting the restoration objective	Record the number of vessels implementing seabird bycatch reduction strategies by type	Annually compiled during project implementation following initiation of relevant project activities	At locations where project activities have been implemented in the project area (number and specific location to be determined)	To be determined following identification of effective seabird bycatch reduction strategies in Phase I (Objective 2)	Further engage project partners to identify why seabird bycatch reduction strategies have not been adopted and identify if changes can be made to improve adoption.

[57] Bold font denotes core performance monitoring parameters identified in the Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0 (2021) under the Prevent Incidental Bird Mortality Restoration Approach.

[58] Bycatch reduction strategies may include fishing gear modifications ("Equipment Enhancements") or changes in fishing practices ("Conservation Improvements"). Monitoring parameters would be further refined as preliminary bycatch reduction strategies are identified in Phase I.

4. Monitoring Schedule

The schedule for project monitoring is shown in Table 4-1 by monitoring parameter.

Table 4-1 Monitoring Schedule

Restoration Objectives / Monitoring Parameters	Phase I (Years 1-2)	Phase II (Years 2-6)
Objective 2	-	-
Equipment Enhancements, Birds or Conservation Improvements, Birds	x (U.S. gillnet and Canadian fisheries)	x (Additional U.S. fisheries)
Bycatch, Birds	x (U.S. gillnet and Canadian fisheries)	x (Additional U.S. fisheries)
Abundance, Fish and Water Column Invertebrates	x (U.S. gillnet and Canadian fisheries)	x (Additional U.S. fisheries)
Objective 3	-	-
Equipment Enhancements, Birds or Conservation Improvements, Birds	N/A	x (U.S. gillnet fishery)

5. Evaluation

The Open Ocean TIG anticipates conducting an evaluation of the project monitoring data collected (as described above) to help answer the following questions:

- Were piloted strategies successful in reducing seabird bycatch while maintaining target catch and fishing efficiencies (e.g., not increasing operational costs)? If not, why?
- Did Phase 1 seabird bycatch modeling adequately identify factors influencing bycatch including temporal and environmental conditions? Was this information useful in the development of Phase II seabird bycatch reduction strategies?
- What characteristics of seabird bycatch reduction strategies and outreach efforts led to the successful rates of adoption by fishermen?
- Did the project produce unanticipated results?
- Were there unanticipated events related to the project that potentially affected the monitoring results (e.g., storms)?
- Were any of the uncertainties identified prior to project implementation resolved?
- Were any new uncertainties identified?

Project monitoring data would be evaluated against existing seabird bycatch data available in the National Bycatch Report, peer reviewed papers (e.g., Hatch, 2017), and Fishery One Stop Shop (www.fisheries.noaa.gov/inport/item/10422).

6. Data Management

Data Description

Data collected would be compiled within 12 months after collection. To the extent practicable, all environmental and biological data generated during monitoring activities would be documented using standardized field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, then project-specific datasheets would be drafted prior to conducting any project monitoring activities. Original hardcopy datasheets and notebooks and photographs would be retained by DOI.

Relevant project data that are handwritten on hardcopy datasheets or notebooks would be transcribed (entered) into standard digital format as per protocols. All field datasheets and notebook entries would be scanned to PDF files. Electronic data files should be named with the date on which the file was created and should include a ReadMe file that describes when the file was created and by whom, and any explanatory notes on the file contents. If a data file is revised, a new copy should be made and the original preserved.

All data would have properly documented Federal Geographic Data Committee/International Organization for Standardization (FGDC/ISO) metadata, a data dictionary (defines codes and fields used in the dataset), and/or a Readme file as appropriate (e.g., how data was collected, quality assurance/quality control [QA/QC] procedures, other information about data such as meaning, relationships to other data, origin, usage, and format).

Data Review and Clearance

After relevant project data is transcribed (entered) into standard digital format, electronic data sheets would be verified against the original hardcopy datasheets and/or notebooks and any corrections for transcription errors would be made as appropriate before data are used for any analyses or distributed. Implementing Trustees would verify and validate MAM data and information and would ensure that all data are: i) entered or converted into agreed upon/commonly used digital format; ii) labeled with metadata following FGDC/ISO standards to the extent practicable and in accordance with DOI requirements.

After all identified errors are addressed, data are considered to be QA/QC'ed. DOI would give the other TIG members time to review the data before making such information publicly available (as described below). Before submitting the monitoring data and information package, co-Implementing Trustees shall confirm with one another that the package is approved for submission.

Data Storage and Accessibility

Once all data has been QA/QC'ed it would be submitted to the DIVER Restoration Portal. Trustees would provide DWH NRDA MAM data and information to the Restoration Portal as soon as possible and no more than 1 year from when data are collected.

Data Sharing

The monitoring data (if the data are not confidential or proprietary) and an annual report would be made publicly available, in accordance with the Open, Public, Electronic and Necessary Government Data Act of 2019, through the DIVER Restoration Portal within 6 months of the end of each calendar year through project close-out.

7. Reporting

All reporting would occur after field surveys are completed annually. This report would summarize the findings for the sampling period including all worksheets transferred into digital format and presented in tabular and graphical formats. The data should be summarized in such a way that it is meaningful to the reader. Additionally, an annual report would be completed that includes:

- A summary of project activities for the year, such as seabird bycatch reduction strategies that were tested and/or implemented (e.g., types, locations, and fisheries), outreach conducted with commercial fisheries, and hotspot model analyses that were conducted (e.g., fisheries that were analyzed, results from the analysis).
- Summarized monitoring data –synthesized data for all efforts during the year.
- Graphics, if applicable, and associated interpretations of the data.
- Comparisons of pre- and post-project conditions, as applicable.

- Any uncertainties with management actions.
- Potential data collection issues.
- Reporting on general MAM activities in the DIVER Restoration Portal on an annual basis.
- Developing a Final MAM Report before the project is closed out.

8. Roles and Responsibilities

Monitoring data associated with this MAM plan would be collected, reviewed, and reported by DOI and NOAA.

9. References

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Northern Gannet Nesting Colony Restoration in Eastern Canada: Monitoring and Adaptive Management Plan

Prepared by: U.S. Department of the Interior (DOI)

Draft Version Date: 1/2/2023

1. Introduction

This monitoring and adaptive management (MAM) plan follows guidance provided in the Programmatic Damage Assessment and Restoration Plan and Programmatic Environmental Impact Statement (PDARP/PEIS; *Deepwater Horizon* [DWH] Natural Resource Damage Assessment [NRDA] Trustees, 2016) and the Strategic Framework for Bird Restoration Activities (DWH NRDA Trustees, 2017), and identifies the monitoring needed to evaluate progress toward meeting project objectives and to support any necessary adaptive management of the project. Where applicable, it identifies key sources of uncertainty and incorporates monitoring data and decision points that address these uncertainties. As not all projects would have the same sources and degrees of uncertainty, this project-specific MAM plan is scaled according to the level of uncertainty, scope, scale, and Restoration Type associated with this project.

This plan is a living document and may be updated as needed to reflect changing conditions and/or new information. Any future revisions to this MAM plan would be made publicly available through the Data Integration Visualization Exploration and Reporting (DIVER) Explorer (www.diver.orr.noaa.gov) and accessible through the Trustees' website (www.gulfspillrestoration.noaa.gov).

Project Overview

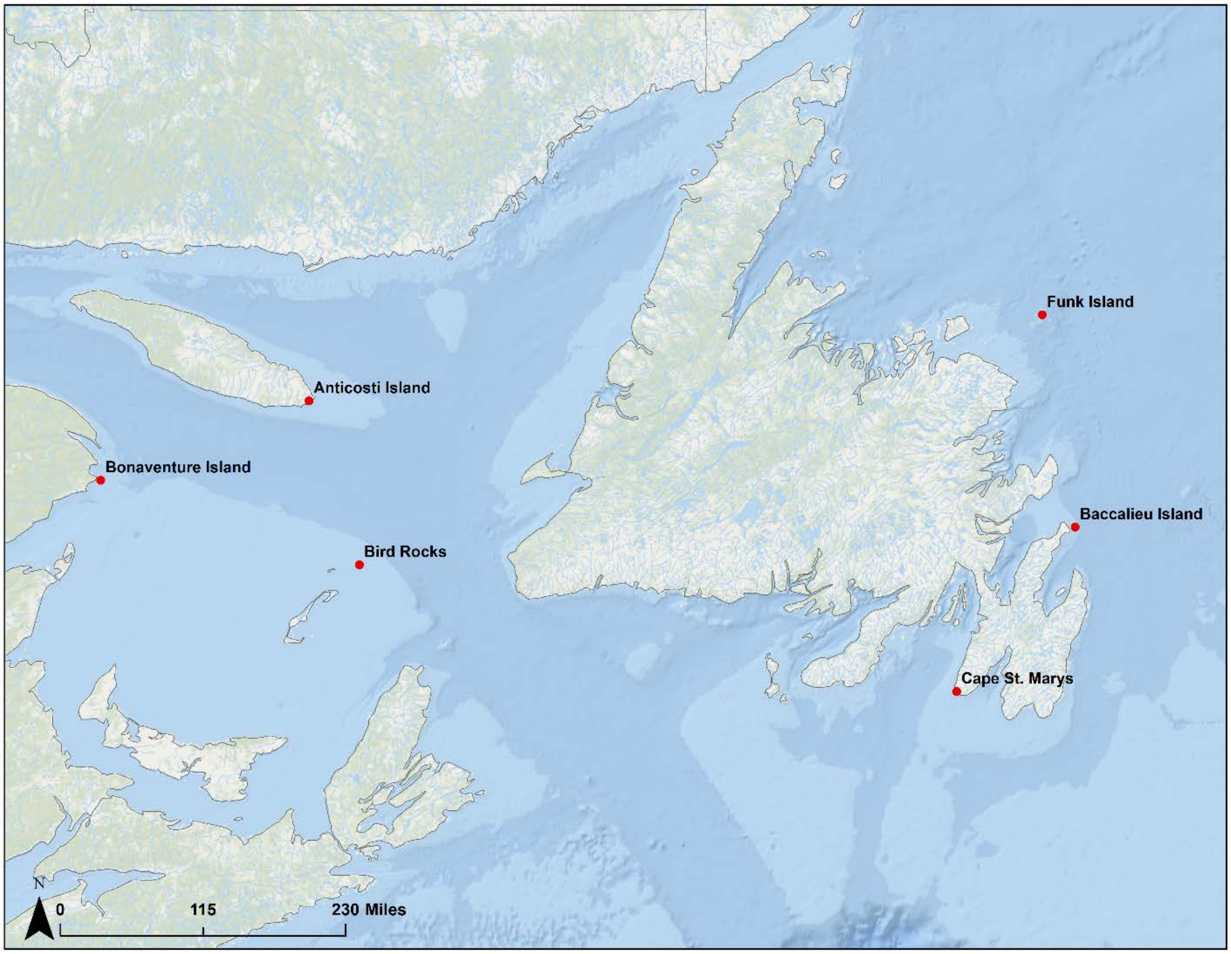
This project would be implemented as restoration for the DWH oil spill NRDA, consistent with the PDARP/PEIS.

- Programmatic Goal: Replenish and Protect Living Coastal and Marine Resources
- Restoration Type: Birds
- Restoration Approaches: Restore and conserve bird nesting and foraging habitat; Establish or reestablish breeding colonies; Prevent incidental bird mortality (PDARP/PEIS Section 5.5.12.2)
- Restoration Techniques: Nesting and foraging area stewardship; develop and implement management actions in conservation areas and/or restoration projects; use acoustic vocalization playbacks and decoys to attract breeding adults to restoration sites; remove derelict fishing gear (PDARP/PEIS Appendix 5.D.6.1 and 5.D.6.2)

This restoration project would be implemented at northern gannet (*Morus bassanus*) nesting sites in Nova Scotia, Québec, and Newfoundland, Canada. This project includes restoration actions to remove marine debris from nests and nest sites, manage predators, minimize human disturbance, expand existing breeding colonies, establish new colonies, and conduct GPS tracking of breeding adults. This project would directly benefit birds by increasing nesting success, survival, and productivity of northern gannets at nesting locations in eastern Canada through the implementation of stewardship activities and establishment of new nesting colonies.

All northern gannets in North America nest at six nesting colonies in eastern Canada (Figure 1-1) and spend the non-nesting period in the Gulf of Mexico and along the U.S. Atlantic coast. Threats at the colonies include predators that kill adults and chicks, such as coyotes, arctic foxes, and red foxes, as well as marine debris such as discarded fishing gear that reduces nesting habitat and entangles and kills adults and chicks. This project would implement conservation activities at nesting colonies, which is the most direct and reliable way to restore for the injury to the species. In addition, the creation of new nesting colonies would ensure long-term population sustainability in case of unpredictable events that may affect existing colonies.

Figure 1-1 Map of Northern Gannet Nesting Colonies in Northeastern Canada



This project would involve various activities at the nesting locations across northeastern Canada to conserve and enhance nesting habitat for northern gannets. The activities proposed would directly address anthropogenic stressors, habitat degradation, and other stressors that impact northern gannets at nesting sites. Stewardship may be implemented in several ways, depending on the location, and could include:

- Land-based removal of marine debris from nests and nesting sites
- Predator management
- Stewardship of nesting areas to reduce human disturbance (e.g., hiring staff to manage disturbance, installing deterrents, closing nesting areas to human use, and/or developing and distributing educational materials)
- Social attraction to expand existing and establish new nesting colonies
- Nesting colony monitoring and GPS tracking of breeding adults

The implementing trustee is DOI. Project partners may include the U.S. Geological Survey's South Carolina Cooperative Fish and Wildlife Research Unit, non-governmental organizations, academic institutions, and Canadian provincial wildlife services.

Restoration Type Goals and Project Restoration Objectives

The Restoration Type goals relevant to this project, as identified in the PDARP/PEIS, are:

- 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 restoration objective for this project is:

- Restore northern gannets by implementing a suite of restoration and conservation techniques (including predator management, social attraction, land-based removal of marine debris, and human disturbance management).

Performance criteria would be used to determine restoration success or the need for corrective action in accordance with 15 Code of Federal Regulations 900.55(b)(1)(vii). Specific, measurable performance criteria are defined, as applicable, for monitoring parameters associated with the restoration objective in Section 3.0.

Conceptual Setting

The project would protect and enhance nesting habitats, reestablish nesting colonies, and prevent incidental bird mortality for northern gannets across northeastern Canada. The restoration techniques proposed would directly address habitat stressors that impact these birds. Habitat enhancement projects based on the anticipated restoration techniques have been widely implemented. This restoration project would complement and enhance ongoing efforts of project partners to address nesting habitat degradation at individual sites. Habitat restoration activities are expected to provide ancillary benefits to other species and improve overall habitat quality.

External drivers that could affect achievement of project objectives include frequency and severity of storms and prevailing abiotic conditions that influence nesting success. Ecosystem linkages and factors that could influence this habitat restoration project include the suitability and quality of created or restored habitat to support ecological needs of bird species, proximity of other nesting areas from which birds might colonize the new habitats, and connectivity with foraging areas and migratory routes (where applicable).

Potential Sources of Uncertainty

Potential uncertainties may affect the likelihood that this project would be successful in fully achieving the project objective in a timely manner. Corrective actions may be necessary to address uncertainties and maximize project benefits. Table 1-1 addresses some uncertainties that were considered during project planning. This list should not be considered exhaustive; additional uncertainties could be identified as the project is implemented and monitored.

Table 1-1 Potential Uncertainties

Uncertainty	Summary of Resolution Strategy
Northern gannets may not respond immediately to social attraction tools or may take more than a year to respond and populate the desired area.	Bird monitoring would provide useful information on nesting colonies and individuals in the area. Areas with birds could serve as a guide for corrective actions to help ensure the desired area is populated.

Uncertainty	Summary of Resolution Strategy
Nesting northern gannets may not use the restored and enhanced habitat right away due to natural variability.	The number of nesting northern gannets fluctuates from year to year for reasons unrelated to habitat availability, and the use of the newly available habitat may lag habitat restoration efforts. Bird monitoring conducted during the nesting season would provide needed information to inform social attraction efforts. Areas of restored habitat that are being used can serve as a guide for future treatments or re-treatments in areas not showing evidence of bird use.
Predators may not respond to management actions or new predators may occur a project sites.	Predator management efforts would be adaptively managed to alter implementation methods if non-lethal methods (e.g., hazing, trapping) are unsuccessful.
Human disturbance may continue following education and outreach efforts.	Proposed project locations are used for recreational purposes and disturbance may occur to nesting seabirds. Project partners would monitor restoration areas for disturbance and implement disturbance control measures as needed.
Marine debris may continue to impact northern gannets and their nest structures.	Nesting sites would be monitored prior to the arrival of northern gannets each year to determine where debris need to be removed from nest structures. Nesting colony monitoring would help inform the extent to which marine debris impacts northern gannets and their nests and potential future management actions.

2. Adaptive Management

The Open Ocean Trustee Implementation Group (Open Ocean TIG or "the TIG") anticipates utilizing adaptive management principles for this project to ensure project objectives are being met and allow for course adjustments if necessary to achieve project success. The TIG would identify corrective actions as necessary. This MAM Plan may be updated in the future to include additional details on adaptive management of this project.

The project would take an adaptive management approach to restoration by using existing baseline data to inform restoration actions at each nesting site. Nesting colonies would be frequently monitored when northern gannets are present to identify stressors that require restoration actions.

As noted above, there is some uncertainty related to the short-term effectiveness of project activities, such as social attraction, as well as the likelihood that stewarded and managed areas are used and results in additional production of injured bird species. To adaptively manage this project, and increase the likelihood of achieving the project objective, DOI project personnel would conduct targeted monitoring and use monitoring data to refine future restoration actions.

3. Project Monitoring, Performance Criteria, and Potential Corrective Actions

Performance monitoring is designed to determine if a project is meeting its restoration objective(s). Performance monitoring would also assist in determining the need for corrective actions and adaptive management. The proposed monitoring plan for this restoration project was developed to evaluate project performance, key uncertainties, and potential corrective actions, if needed. In addition to the performance monitoring parameters listed in Table 3-1, additional monitoring parameters/information may be reported on to document project implementation progress. Examples of this type of additional information can be found in Section 7.

Information on each monitoring parameter is provided below. The list of corrective actions provided below is not exhaustive; rather, it includes a list of potential actions to be considered if the project is not performing as expected once implemented. Other corrective actions may be identified post-implementation, as appropriate.

Table 3-1 Monitoring Parameters

Monitoring Parameter[59]	Purpose	Method(s)	Timing, Frequency, Duration of Data Collection	Sample Size and Sites	Performance Criteria	Potential Corrective Action(s)
Abundance/Density, Birds (Count of nesting adults/pairs)	Monitor progress towards meeting the restoration objective	Document abundance of nesting adults in the project area. Ground survey, game camera, or Uncrewed Aircraft System (UAS or “drone”); follow protocols for most appropriate counting method depending on nesting location	Once every 7-10 days, where feasible; increase effort during peak nesting. Follow appropriate protocols for details on the timing of nest initiation	All sites in the project area. Abundance/density estimates will account for asynchronous nesting	An increase in abundance and/or density in the project area	Adapt ongoing or implement new stewardship activities focused on key stressors; adjust attraction techniques with decoys and/or audio as appropriate
Reproduction, Birds (Nest occupancy)	Monitor progress towards meeting the restoration objective	Determine potential productivity (number of nests). Ground survey, game camera, or Uncrewed Aircraft System (UAS or “drone”); follow appropriate protocols for most appropriate counting method depending on nesting location	Once every 7-10 days, where feasible. Follow appropriate protocols for details on the timing of nest initiation, conclude counts when all hatch-year birds have left the nesting/ brood-rearing area	All sites in the project area. Estimates will account for asynchronous nesting	An increase in abundance and/or density in the project area	Adapt ongoing or implement new stewardship activities focused on key stressors; adjust attraction techniques with decoys and/or audio as appropriate
Abundance/Density, Birds (Fledgling count)	Monitor progress towards meeting the restoration objective	Determine average productivity (number of flight-capable young per number of breeding pairs) and identify threats to nest and/or chick success. Ground survey, game camera, or Uncrewed Aircraft System (UAS or “drone”); follow appropriate protocols for most	At least once every 7-10 days where feasible; follow appropriate protocols for details on the timing of nest initiation conclude counts when all hatch-year birds have left the nesting/ brood-rearing area	All sites or a representative subset of sites in the project area. Estimates will account for asynchronous nesting	Production of fledgling birds from nests in project area	Determine cause of nest failure and adapt ongoing or implement new stewardship activities focused on key stressors

59 These monitoring parameters are identified as core performance parameters under the Restore and Conserve Bird Nesting and Foraging Habitat and Establish or Reestablish Breeding Colonies Restoration Approaches in the Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0 (2021).

Monitoring Parameter[59]	Purpose	Method(s)	Timing, Frequency, Duration of Data Collection	Sample Size and Sites	Performance Criteria	Potential Corrective Action(s)
		appropriate counting method depending on nesting location				

4. Monitoring Schedule

The schedule for project monitoring is shown in Table 4-1 by monitoring parameter.

Table 4-1 Monitoring Scheduled

Monitoring Parameters	Pre-Implementation (Year 1)	Implementation (Years 1-5)	Post-Implementation (Years 5-7)
Abundance/Density, Birds (Count of nesting adults/pairs)	x	x	x
Reproduction, Birds (Nest occupancy)	x	x	x
Abundance/Density, Birds (Fledgling count)	x	x	x

5. Evaluation

The Open Ocean TIG anticipates conducting an evaluation of implementation and post-implementation project monitoring data against existing northern gannet baseline monitoring data to help answer the following questions:

- Did the project restore northern gannets nesting colonies and increase abundance/density and/or productivity? If not, why?
- Did the project establish new northern gannet nesting colonies? If not, why?
- Did the project produce unanticipated results?
- Were there unanticipated events related to the project that potentially affected the monitoring results (e.g., hurricanes)?
- Were any of the uncertainties identified prior to project implementation resolved?
- Were any new uncertainties identified?

6. Data Management

Data Description

Data collected would be compiled within 12 months after collection. To the extent practicable, all environmental and biological data generated during monitoring activities would be documented using standardized field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, then project-specific datasheets would be drafted prior to conducting any project monitoring activities. Original hardcopy datasheets and notebooks and photographs would be retained by DOI.

Relevant project data that are handwritten on hardcopy datasheets or notebooks would be transcribed (entered) into standard digital format as per protocols. All field datasheets and notebook entries would be scanned to PDF files. Electronic data files should be named with the date on which the file was created and should include a ReadMe file that describes when the file was created and by whom, and any explanatory notes on the file contents. If a data file is revised, a new copy should be made and the original preserved.

All data would have properly documented Federal Geographic Data Committee/International Organization for Standardization (FGDC/ISO) metadata, a data dictionary (defines codes and fields used in the dataset), and/or a Readme file as appropriate (e.g., how data was collected, quality assurance/quality control [QA/QC] procedures, other information about data such as meaning, relationships to other data, origin, usage, and format).

Data Review and Clearance

After relevant project data is transcribed (entered) into standard digital format, electronic data sheets would be verified against the original hardcopy datasheets and/or notebooks and any corrections for transcription errors would be made as appropriate before data are used for any analyses or distributed. Implementing Trustees would verify and validate MAM data and information and would ensure that all data are: i) entered or converted into agreed upon/commonly used digital format; ii) labeled with metadata following FGDC/ISO standards to the extent practicable and in accordance with DOI requirements.

After all identified errors are addressed, data are considered to be QA/QC'ed. DOI would give the other TIG members time to review the data before making such information publicly available (as described below). Before submitting the monitoring data and information package, co-Implementing Trustees shall confirm with one another that the package is approved for submission.

Data Storage and Accessibility

Once all data has been QA/QC'ed it would be submitted to the DIVER Restoration Portal. Trustees would provide DWH NRDA MAM data and information to the Restoration Portal as soon as possible and no more than 1 year from when data are collected.

Data Sharing

The monitoring data and annual report would be made publicly available, in accordance with the Open, Public, Electronic and Necessary Government Data Act of 2019, through the DIVER Restoration Portal within 6 months of the end of each calendar year through project close-out.

7. Reporting

All reporting would occur after field surveys are completed annually. This report would summarize the findings for the sampling period including all worksheets transferred into digital format and presented in tabular and graphical formats. The data should be summarized in such a way that it is meaningful to the reader. Additionally, an annual report would be completed that includes:

- A summary of project activities for the year, such as locations where stewardship activities were implemented and details on those activities (e.g., land-based marine debris removal, types and numbers of predators managed; number and location of social attraction decoys deployed).
- Summarized monitoring data –synthesized data for all efforts during the year.
- Graphics, if applicable, and associated interpretations of the data.
- Comparisons of pre- and post-project conditions, as applicable.
- Any uncertainties with management actions.
- Potential data collection issues.
- Reporting on general MAM activities in the DIVER Restoration Portal on an annual basis.
- Developing a Final MAM Report before a project is closed out.

8. Roles and Responsibilities

Monitoring data associated with this MAM plan would be collected, reviewed, and reported by DOI.

9. References

DWH NRDA Trustees. 2016. *Deepwater Horizon* Oil Spill: Final Programmatic Damage Assessment and Restoration Plan (PDARP) and Final Programmatic Environmental Impact Statement (PEIS). Available: www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.

DWH NRDA Trustees. 2017. *Deepwater Horizon* Oil Spill Natural Resource Damage Assessment: Strategic Framework for Bird Restoration Activities Version 1. June. Available: www.gulfspillrestoration.noaa.gov/2017/06/trustees-release-strategic-frameworks-restoration.

DWH NRDA Trustees. 2021. Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0. Appendix to the Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the DWH Oil Spill. December. Available: https://www.gulfspillrestoration.noaa.gov/monitoring-and-adaptive-management

Common Tern Nesting Colony Restoration in Manitoba: Monitoring and Adaptive Management Plan

Prepared by: U.S. Department of the Interior (DOI)

Draft Version Date: 1/2/2023

1. Introduction

This monitoring and adaptive management (MAM) plan follows guidance provided in the Programmatic Damage Assessment and Restoration Plan and Programmatic Environmental Impact Statement (PDARP/PEIS; *Deepwater Horizon* [DWH] Natural Resource Damage Assessment [NRDA] Trustees, 2016) and the Strategic Framework for Bird Restoration Activities (DWH NRDA Trustees, 2017), and identifies the monitoring needed to evaluate progress toward meeting project objectives and to support any necessary adaptive management of the project. Where applicable, it identifies key sources of uncertainty and incorporates monitoring data and decision points that address these uncertainties. As not all projects would have the same sources and degrees of uncertainty, this project-specific MAM plan is scaled according to the level of uncertainty, scope, scale, and Restoration Type associated with this project.

This plan is a living document and may be updated as needed to reflect changing conditions and/or new information. Any future revisions to this MAM plan would be made publicly available through the Data Integration Visualization Exploration and Reporting (DIVER) Explorer (www.diver.orr.noaa.gov) and accessible through the Trustees' website (www.gulfspillrestoration.noaa.gov).

Project Overview

This project would be implemented as restoration for the DWH oil spill NRDA, consistent with the PDARP/PEIS.

- Programmatic Goal: Replenish and Protect Living Coastal and Marine Resources
- Restoration Type: Birds
- Restoration Approaches: Restore and conserve bird nesting and foraging habitat; Establish or reestablish breeding colonies (PDARP/PEIS Section 5.5.12.2)
- Restoration Techniques: Nesting and foraging area stewardship; develop and implement management actions in conservation areas and/or restoration projects; use acoustic vocalization playbacks and decoys to attract nesting adults to restoration sites (PDARP/PEIS Appendix 5.D.6.1 and 5.D.6.2)

This restoration project would be implemented at common tern (*Sterna hirundo*) nesting sites in Manitoba, Canada. Freshwater lakes throughout the boreal forest biome of Manitoba support thousands of nesting pairs of common terns each year (e.g., Wilson, 2013), with an estimated 8,000 nesting pairs occurring in colonies on Manitoba's three largest lakes (Winnipeg, Manitoba, and Winnipegosis) (Wilson et al., 2014). Nesting colonies typically form on sandy or cobble beaches along Manitoba's freshwater shorelines and lakes, or on artificial sites such as dredge spoils and navigational buoys. This project would steward and monitor common terns by reducing human and predator disturbance, enhancing nesting habitat, and establishing new nesting colonies, which could help increase bird productivity and survival.

This project would involve various activities at multiple nesting locations in Manitoba to conserve and enhance nesting and foraging habitat for birds. The activities proposed would directly address anthropogenic stressors, habitat degradation, and other stressors that impact birds. Stewardship may be implemented in several ways, depending on the location, and could include:

- Management of human disturbance (e.g., installing deterrents, closing nesting areas to human use when seabirds are present, and/or developing and distributing educational materials).
- Lethal and non-lethal predator and nesting site competitor control.
- Vegetation management (e.g., removal of invasive vegetation, planting native plants, and installing biodegradable matting to manage vegetation density).
- Substrate enhancements (e.g., adding fine gravel or sand to nesting areas).
- Land-based removal of marine debris.
- Social attraction to establish new nesting colonies.
- Nesting colony monitoring and bird banding.

Specific activities and target locations may vary from year to year based on several factors including where nesting occurs, the stewardship needs at each nesting area, and where project implementers are supported by project partners. Project partners, including Canadian First Nation youth and community members, would be trained in the above stewardship practices. The Open Ocean Trustee Implementation Group (Open Ocean TIG or “the TIG”) anticipates that project activities are likely to be implemented at Lake Winnipeg (McLeod’s Island, Egg Island, Long Point, and other small, unnamed islands), Kaweenakumik Lake, Lake Winnipegosis (on small, unnamed islands), Reindeer Lake, South Indian Lake (Sand Island), Tadoule Lake, Lake Brochet, Fishing Lake, and Family Lake. Additional or alternative locations may be identified during project implementation.

The implementing trustee is DOI. Project partners include multiple non-governmental organizations and Canadian First Nations.

Restoration Type Goals and Project Restoration Objectives

The Restoration Type goals relevant to this project, as identified in the PDARP/PEIS, are:

- 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 restoration objective for this project is:

- Restore common terns in Manitoba by implementing a suite of restoration and conservation techniques (including predator management, vegetation management, social attraction, and human disturbance management).

Performance criteria would be used to determine restoration success or the need for corrective action in accordance with 15 Code of Federal Regulations 900.55(b)(1)(vii). Specific, measurable performance criteria are defined, as applicable, for monitoring parameters associated with the restoration objective in Section 3.0.

Conceptual Setting

The project would protect and enhance nesting habitat and reestablish breeding colonies for common terns in Manitoba, Canada. The restoration techniques proposed would directly address habitat loss and stressors that impact birds. Habitat enhancement projects based on the anticipated restoration techniques have been widely implemented. This restoration project would complement and enhance ongoing efforts of project partners to address habitat loss and degradation of nesting habitats at individual sites. Habitat restoration activities are expected to provide ancillary benefits to other species and improve habitat quality.

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 suitability and quality of created or restored habitat to support ecological needs of bird species, proximity of other nesting areas from which birds might colonize the new habitats, and connectivity with foraging areas and migratory routes (where applicable).

Potential Sources of Uncertainty

Potential uncertainties may affect the likelihood that this project would be successful in fully achieving the project objective in a timely manner. Corrective actions may be necessary to address uncertainties and maximize project benefits. Table 1-1 addresses some uncertainties that were considered during project planning. This list should not be considered exhaustive; additional uncertainties could be identified as the project is implemented and monitored.

Table 1-1 Potential Uncertainties

Uncertainty	Summary of Resolution Strategy
The common tern may not respond immediately to social attraction tools or may take more than a year to respond and populate the desired area.	Bird monitoring would provide useful information on nesting colonies and individuals in the area. Areas with birds could serve as a guide for corrective actions to help ensure the desired area is populated.
Common terns may not use the restored and enhanced habitat for nesting right away due to natural variability.	The number of nesting common terns fluctuates from year to year for reasons unrelated to habitat availability, and the use of the newly available habitat may lag following habitat restoration efforts. Monitoring conducted during the nesting season would provide needed information to inform social attraction efforts. Areas of restored habitat that are being used can serve as a guide for future treatments or re-treatments in areas not showing evidence of bird use.
Predators may not respond to management actions or new predators may occur a project sites.	Predator management efforts would be adaptively managed to alter implementation methods if non-lethal methods (e.g., hazing) are unsuccessful.
Climate variability, such as extreme weather events, sea level rise, changes in freshwater inflows, etc. may impact bird survival and reproductive success.	Habitat enhancements (e.g., vegetation management, substrate enhancements) would be employed to improve nesting conditions at targeted sites.
Planted native vegetation may not establish.	Native plantings may need irrigation or fertilization to assist in establishment. Replacement of dead plants may be required and should consider better suited species depending on site conditions and cause of mortality.
Human disturbance may continue following education and outreach efforts.	Proposed project locations are used for recreational purposes and disturbance may occur to nesting or breeding birds. Project partners would monitor restoration areas for disturbance and implement disturbance control measures as needed.
Substrate enhancements may not improve nesting habitat conditions.	Visual inspection of substrate enhancements at least twice a year would verify the integrity of the added

Uncertainty	Summary of Resolution Strategy
	substrates and determine changes in the environment. If erosion continues, modification of the technique and placement would be considered. Beach re-nourishment or other shoreline hardening may be needed in the future if enhancement proves to be ineffective.

2. Adaptive Management

The Open Ocean OO TIG anticipates utilizing adaptive management principles for this project to ensure project objectives are being met and allow for course adjustments if necessary to achieve project success. The TIG would identify corrective actions as necessary. This MAM Plan may be updated in the future to include additional details on adaptive management of this project.

The project would take an adaptive management approach to restoration by first conducting pre-implementation monitoring to establish common tern nesting baselines and identify restoration needs at nesting colonies. This pre-implementation monitoring would inform the location and restoration actions implemented.

As noted above, there is some uncertainty related to the short-term effectiveness of project activities, such as social attraction, as well as the likelihood that stewarded and managed areas are used and results in additional production of injured bird species. To adaptively manage this project, and increase the likelihood of achieving the project objective, DOI project personnel would conduct targeted monitoring and use monitoring data to refine future restoration actions.

3. Project Monitoring, Performance Criteria, and Potential Corrective Actions

Performance monitoring is designed to determine if a project is meeting its restoration objective(s). Performance monitoring would also assist in determining the need for corrective actions and adaptive management. The proposed monitoring plan for this restoration project was developed to evaluate project performance, key uncertainties, and potential corrective actions, if needed. In addition to the performance monitoring parameters listed in Table 3-1, additional monitoring parameters/information may be reported on to document project implementation progress. Examples of this type of additional information can be found in Section 7.

Information on each monitoring parameter is provided below. The list of corrective actions provided below is not exhaustive; rather, it includes a list of potential actions to be considered if the project is not performing as expected once implemented. Other corrective actions may be identified post-implementation, as appropriate.

Table 3-1 Monitoring Parameters

Monitoring Parameter[60]	Purpose	Method(s)	Timing, Frequency, Duration of Data Collection	Sample Size and Sites	Performance Criteria[61]	Potential Corrective Action(s)
Abundance/Density, Birds (Count of nesting adults/pairs)	Monitor progress towards meeting the restoration objective	Document abundance of nesting adults in the project area. Ground survey, game camera, or Uncrewed Aircraft System (UAS or "drone"); follow appropriate protocols for most appropriate counting method depending on nesting location	Once every 10-14 days, where feasible; increase effort during peak nesting. Follow appropriate protocols for details on the timing of nest initiation	All sites in the project area. Estimates will account for asynchronous nesting	An increase in abundance and/or density in the project area	Adapt ongoing or implement new stewardship activities focused on key stressors; adjust attraction techniques with decoys, audio, and/or placement sites as appropriate
Reproduction, Birds (Nest occupancy)	Monitor progress towards meeting the restoration objective	Determine potential productivity (number of nests) and identify threats to nest and/or chick success. Ground survey, game camera, or Uncrewed Aircraft System (UAS or "drone"); follow appropriate protocols for most appropriate counting method depending on nesting location	Once every 10-14 days, where feasible. Follow appropriate protocols for details on the timing of nest initiation, conclude counts when all hatch-year birds have left the nesting/ brood-rearing area	All sites in the project area. Estimates will account for asynchronous nesting	An increase in abundance and/or density in the project area	Adapt ongoing or implement new stewardship activities focused on key stressors; adjust attraction techniques with decoys, audio, and/or placement sites as appropriate
Abundance/Density, Birds (Fledgling count)	Monitor progress towards meeting the restoration objective	Determine average productivity (number of flight-capable young per number of breeding pairs) and identify threats to nest and/or chick success. Ground survey, game camera, or Uncrewed Aircraft System (UAS	At least once every 10-14 days where feasible; follow appropriate protocols for details on the timing of nest initiation conclude counts when all hatch-year	All sites or a representative subset of sites in the project area. Estimates will account for	Production of juvenile birds from nests in project area	Determine cause of nest failure and adapt ongoing or implement new stewardship activities focused on key stressors

[60] These monitoring parameters are identified as core performance parameters under the Restore and Conserve Bird Nesting and Foraging Habitat and Establish or Reestablish Breeding Colonies Restoration Approaches in the Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0 (2021).

[61] Performance criteria may be revised as pre-implementation monitoring is conducted and a seabird population and nesting baseline is established.

Monitoring Parameter[60]	Purpose	Method(s)	Timing, Frequency, Duration of Data Collection	Sample Size and Sites	Performance Criteria[61]	Potential Corrective Action(s)
		or “drone”); follow appropriate protocols for most appropriate counting method depending on nesting location	birds have left the nesting/ brood-rearing area	asynchronous nesting		

4. Monitoring Schedule

The schedule for project monitoring is shown in Table 4-1 by monitoring parameter.

Table 4-1 Monitoring Schedule

Monitoring Parameters	Pre-Implementation (Years 1-2)	Implementation (Years 2-5)	Post-Implementation (Years 5-7)
Abundance/Density, Birds (Count of breeding adults/pairs by species)	x	x	x
Reproduction, Birds (Nest occupancy)	x	x	x
Abundance/Density, Birds (Fledgling count by species)	x	x	x

5. Evaluation

Pre-implementation monitoring data would be collected to develop a common tern population and nesting baseline at sites throughout Manitoba. The Open Ocean TIG anticipates conducting an evaluation of implementation and post-implementation project monitoring data against baseline data to help answer the following questions:

- Did the project restore common tern nesting colonies and increase abundance/density and/or productivity? If not, why?
- Did the project produce unanticipated results?
- Were there unanticipated events related to the project that potentially affected the monitoring results?
- Were any of the uncertainties identified prior to project implementation resolved?
- Were any new uncertainties identified?

6. Data Management

Data Description

Data collected would be compiled within 12 months after collection. To the extent practicable, all environmental and biological data generated during monitoring activities would be documented using standardized electronic or paper field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, then project-specific datasheets would be drafted prior to conducting any project monitoring activities. Original hardcopy datasheets and notebooks and photographs would be retained by DOI.

Relevant project data that are handwritten on hardcopy datasheets or notebooks would be transcribed (entered) into standard digital format as per protocols. All field datasheets and notebook entries would be scanned to PDF files. Electronic data files should be named with the date on which the file was created and should include a ReadMe file that describes when the file was created and by whom, and any explanatory notes on the file contents. If a data file is revised, a new copy should be made and the original preserved.

All data would have properly documented Federal Geographic Data Committee/International Organization for Standardization (FGDC/ISO) metadata, a data dictionary (defines codes and fields used in the dataset), and/or a Readme file as appropriate (e.g., how data was collected, quality assurance/quality control [QA/QC] procedures, other information about data such as meaning, relationships to other data, origin, usage, and format).

Data Review and Clearance

After relevant project data is transcribed (entered) into standard digital format, electronic data sheets would be verified against the original hardcopy datasheets and/or notebooks and any corrections for transcription errors would be made as appropriate before data are used for any analyses or distributed. Implementing Trustees would verify and validate MAM data and information and would ensure that all data are: i) entered or converted into agreed upon/commonly used digital format; ii) labeled with metadata following FGDC/ISO standards to the extent practicable and in accordance with DOI requirements.

After all identified errors are addressed, data are considered to be QA/QC'ed. DOI would give the other TIG members time to review the data before making such information publicly available (as described below). Before submitting the monitoring data and information package, co-Implementing Trustees shall confirm with one another that the package is approved for submission.

Data Storage and Accessibility

Once all data has been QA/QC'ed it would be submitted to the DIVER Restoration Portal. Trustees would provide DWH NRDA MAM data and information to the Restoration Portal as soon as possible and no more than 1 year from when data are collected.

Data Sharing

The monitoring data and annual report would be made publicly available, in accordance with the Open, Public, Electronic and Necessary Government Data Act of 2019, through the DIVER Restoration Portal within 6 months of the end of each calendar year through project close-out.

7. Reporting

All reporting would occur after field surveys are completed annually. This report would summarize the findings for the sampling period including all worksheets transferred into digital format and presented in tabular and graphical formats. The data should be summarized in such a way that it is meaningful to the reader. Additionally, an annual report would be completed that includes:

- A summary of project activities for the year, such as stewardship activities were implemented and details on those activities (e.g., numbers/types of predators managed, number of decoys and sound systems deployed for social attraction).
- Summarized monitoring data –synthesized data for all efforts during the year.
- Graphics, if applicable, and associated interpretations of the data.
- Comparisons of pre- and post-implementation conditions, as applicable.
- Any uncertainties with management actions.
- Potential data collection issues.
- Reporting on general MAM activities in the DIVER Restoration Portal on an annual basis.
- Developing a Final MAM Report before a project is closed out.

8. Roles and Responsibilities

Monitoring data associated with this MAM plan would be collected, reviewed, and reported by DOI.

9. References

DWH NRDA Trustees. 2016. *Deepwater Horizon* Oil Spill: Final Programmatic Damage Assessment and Restoration Plan (PDARP) and Final Programmatic Environmental Impact Statement (PEIS). Available: www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.

DWH NRDA Trustees. 2017. *Deepwater Horizon* Oil Spill Natural Resource Damage Assessment: Strategic Framework for Bird Restoration Activities Version 1. June. Available: www.gulfspillrestoration.noaa.gov/2017/06/trustees-release-strategic-frameworks-restoration.

DWH NRDA Trustees. 2021. Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0. Appendix to the Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the DWH Oil Spill. December. Available: https://www.gulfspillrestoration.noaa.gov/monitoring-and-adaptive-management

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Wilson, S., Bazin, R., Calvert, W., Doyle, T.J., Earsom, S.D., Oswald, S.A., and Arnold, J.M. 2014. Abundance and trends of colonial waterbirds on large lakes of southern Manitoba. *Waterbirds, Journal of the Waterbird Society* 37(3): 233-244.

Invasive Goat Removal to Restore Seabird Nesting Habitat in St. Vincent and the Grenadines: Monitoring and Adaptive Management Plan

Prepared by: U.S. Department of the Interior (DOI)

Draft Version Date: 1/2/2023

1. Introduction

This monitoring and adaptive management (MAM) plan follows guidance provided in the Programmatic Damage Assessment and Restoration Plan and Programmatic Environmental Impact Statement (PDARP/PEIS; *Deepwater Horizon* [DWH] Natural Resource Damage Assessment [NRDA] Trustees, 2016) and the Strategic Framework for Bird Restoration Activities (DWH NRDA Trustees, 2017), and identifies the monitoring needed to evaluate progress toward meeting project objectives and to support any necessary adaptive management of the project. Where applicable, it identifies key sources of uncertainty and incorporates monitoring data and decision points that address these uncertainties. As not all projects would have the same sources and degrees of uncertainty, this project-specific MAM plan is scaled according to the level of uncertainty, scope, scale, and Restoration Type associated with this project.

This plan is a living document and may be updated as needed to reflect changing conditions and/or new information. Any future revisions to this MAM plan would be made publicly available through the Data Integration Visualization Exploration and Reporting (DIVER) Explorer (www.diver.orr.noaa.gov) and accessible through the Trustees' website (www.gulfspillrestoration.noaa.gov).

Project Overview

This project would be implemented as restoration for the DWH oil spill NRDA, consistent with the PDARP/PEIS.

- Programmatic Goal: Replenish and Protect Living Coastal and Marine Resources
- Restoration Type: Birds
- Restoration Approach: Restore and conserve bird nesting and foraging habitat (PDARP/PEIS Section 5.5.12.2)
- Restoration Technique: Nesting and foraging area stewardship (i.e., predator management – eradicating invasive goats) (PDARP/PEIS Appendix 5.D.6.1)

This restoration project would be implemented on Battowia and the Pillories Islands in St. Vincent and the Grenadines, comprising four small (less than 200 acres each) islets. Feral goats have eliminated much of the vegetation on Battowia and the Pillories, negatively impacting seabird nesting by altering habitat conditions, causing erosion and disturbance, and potentially trampling nests. Project activities would focus on eradicating goats from the islands to increase nesting success and productivity of seabird species injured by the DWH oil spill, such as magnificent frigatebird (*Fregata magnificens*), bridled (*Onychoprion anaethetus*) and sooty (*Onychoprion fuscatus*) terns, brown noddy (*Anous stolidus*), brown booby (*Sula leucogaster*), and red-billed tropicbird (*Phaethon aethereus*).

This project would eradicate free-ranging, feral goats from Battowia and the Pillories, monitor for rodent presence, and conduct public outreach to encourage stewardship and communicate project outcomes.

The implementing trustee is DOI. Project partners may include non-governmental organizations (Environmental Protection in the Caribbean), the Mustique Company, and the Forestry Department of St. Vincent and the Grenadines.

Restoration Type Goals and Project Restoration Objectives

The Restoration Type goals relevant to this project, as identified in the PDARP/PEIS, are:

- 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 restoration objective for this project is:

- Restore seabird nesting habitat at Battowia and the Pillories by removing invasive goats.

Performance criteria would be used to determine restoration success or the need for corrective action in accordance with 15 Code of Federal Regulations 900.55(b)(1)(vii). Specific, measurable performance criteria are defined, as applicable, for monitoring parameters associated with each of the restoration objectives in Section 3.0.

Conceptual Setting

The project would protect and enhance nesting habitats for seabirds on Battowia and the Pillories Islands in St Vincent and the Grenadines. The restoration techniques proposed would directly address habitat loss and stressors that impact seabirds. This restoration project would complement and enhance ongoing efforts of project partners to address seabird nesting habitat loss and degradation. Habitat restoration activities are expected to provide ancillary benefits to other species and improve overall habitat quality.

External drivers that could affect achievement of project objectives include frequency and severity of storms and prevailing abiotic conditions that influence seabird nesting success. 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 areas from which birds might colonize the new habitats, and connectivity with foraging areas and migratory routes (where applicable).

Potential Sources of Uncertainty

Potential uncertainties may affect the likelihood that this project would be successful in fully achieving the goals and objectives in a timely manner. Corrective actions may be necessary to address uncertainties and maximize project benefits. Table 1-1 addresses some uncertainties that were considered during project planning. This list should not be considered exhaustive; additional uncertainties could be identified as the project is implemented and monitored.

Table 1-1 Potential Uncertainties

Uncertainty	Summary of Resolution Strategy
Nesting seabirds may not use the restored and enhanced habitat right away due to natural variability.	The number of nesting seabirds fluctuates from year to year for reasons unrelated to habitat availability, and the use of the newly available habitat may lag habitat restoration efforts. Bird monitoring conducted during the nesting season would provide needed information to inform social attraction efforts. Areas of restored habitat that are being used can serve as a guide for future treatments or re-treatments in areas not showing evidence of bird use.

Uncertainty	Summary of Resolution Strategy
Local communities may not support goat removal, or the preferred removal method may alter the project costs or timeline.	The proposed project partners have extensive outreach experience with local communities. Public educational campaigns could be altered to address concerns.

2. Adaptive Management

The Open Ocean Trustee Implementation Group (OO TIG or "the TIG") anticipates utilizing adaptive management principles for this project to ensure project objectives are being met and allow for course adjustments if necessary to achieve project success. The TIG would identify corrective actions as necessary. This MAM Plan may be updated in the future to include additional details on adaptive management of this project.

This project would take an adaptive approach to managing and eradicating feral goats from Battowia and the Pillories. Local communities would be engaged to help inform the method of goat eradication and final disposition of the removed goats (e.g., offered to local communities to raise as livestock, meat offered to local communities).

3. Project Monitoring, Performance Criteria, and Potential Corrective Actions

Performance monitoring is designed to determine if a project is meeting its restoration objective(s). Performance monitoring would also assist in determining the need for corrective actions and adaptive management. The proposed monitoring plan for this restoration project was developed to evaluate project performance, key uncertainties, and potential corrective actions, if needed. In addition to the performance monitoring parameters listed in Table 3-1, additional monitoring parameters/information may be reported on to document project implementation progress. Examples of this type of additional information can be found in Section 7.

Information on each monitoring parameter is provided below. The list of corrective actions provided below is not exhaustive; rather, it includes a list of potential actions to be considered if the project is not performing as expected once implemented. Other corrective actions may be identified post-implementation, as appropriate.

Table 3-1 Monitoring Parameters

Monitoring Parameter[62]	Purpose	Method(s)	Timing, Frequency, Duration of Data Collection	Sample Size and Sites	Performance Criteria[63]	Potential Corrective Action(s)
Abundance/Density, Birds (Count of nesting adults/pairs by species)	Monitor progress towards meeting the restoration objective	Document abundance of nesting adults in the project area. Ground survey, game camera, Uncrewed Aircraft System (UAS or "drone"), or acoustic monitor; follow protocols for most appropriate counting method depending on nesting location	Once every 10-14 days, where feasible; increase effort during peak nesting. Follow appropriate protocols for details on the timing of nest initiation	All sites in the project area. Estimates will account for asynchronous nesting	An increase in abundance and/or density in the project area	Determine additional stressors that could be targeted for future restoration activities
Reproduction, Birds (Nest occupancy by species)	Monitor progress towards meeting the restoration objective	Determine potential productivity (number of nests) and identify threats to nest and/or chick success. Ground survey, game camera, Uncrewed Aircraft System (UAS or "drone"), or acoustic monitor; follow appropriate protocols for most appropriate counting method depending on nesting location	Once every 10-14 days, where feasible. Follow appropriate protocols for details on the timing of nest initiation, conclude counts when all hatch-year birds have left the nesting/ brood-rearing area	All sites in the project area. Estimates will account for asynchronous nesting	An increase in abundance and/or density in the project area	Determine additional stressors that could be targeted for future restoration activities
Abundance/Density, Birds (Fledgling count by species)	Monitor progress towards meeting the	Determine average productivity (number of flight-capable young per number of breeding pairs) and identify threats to nest and/or chick success. Ground	Once every 10-14 days, where feasible. Follow appropriate protocols for details on the timing of nest initiation conclude	All sites or a representative subset of sites in the project area.	Production of fledgling birds from nests in project area	Determine cause of nest failure that could be targeted for future restoration activities

[62] These monitoring parameters are identified as core performance parameters under the Restore and Conserve Bird Nesting and Foraging Habitat Restoration Approach in the Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0 (2021).

[63] Performance criteria may be revised as pre-implementation monitoring is conducted and a seabird population and nesting baseline is established.

Monitoring Parameter[62]	Purpose	Method(s)	Timing, Frequency, Duration of Data Collection	Sample Size and Sites	Performance Criteria[63]	Potential Corrective Action(s)
	restoration objective	survey, game camera, Uncrewed Aircraft System (UAS or "drone"), or acoustic monitor; follow appropriate protocols for most appropriate counting method depending on nesting location	counts when all hatch-year birds have left the nesting/ brood-rearing area	Estimates will account for asynchronous nesting		

4. Monitoring Schedule

The schedule for project monitoring is shown in Table 4-1 by monitoring parameter.

Table 4-1 Monitoring Schedule

Monitoring Parameters	Pre-Implementation (Years 1-2)	Implementation (Years 2-5)	Post-Implementation (Years 5-7)
Abundance/Density, Birds (Count of nesting adults/pairs by species)	x	x	x
Reproduction, Birds (Nest occupancy)	x	x	x
Abundance/Density, Birds (Fledgling count by species)	x	x	x

5. Evaluation

Pre-implementation monitoring data would be collected to develop a seabird population and nesting baseline on Battowia and the Pillories. The Open Ocean TIG anticipates conducting an evaluation of implementation and post-implementation project monitoring data against baseline data to help answer the following questions:

- Did the project restore seabirds and increase abundance/density and/or productivity? If not, why?
- Are there other stressors (e.g., rodents) that may affect seabird nesting colonies?
- Did the project produce unanticipated results?
- Were there unanticipated events related to the project that potentially affected the monitoring results (e.g., hurricanes)?
- Were any of the uncertainties identified prior to project implementation resolved?
- Were any new uncertainties identified?

6. Data Management

Data Description

Data collected would be compiled within 12 months after collection. To the extent practicable, all environmental and biological data generated during monitoring activities would be documented using standardized field datasheets. If standardized datasheets are unavailable or not readily amendable to record project-specific data, then project-specific datasheets would be drafted prior to conducting any project monitoring activities. Original hardcopy datasheets and notebooks and photographs would be retained by DOI.

Relevant project data that are handwritten on hardcopy datasheets or notebooks would be transcribed (entered) into standard digital format as per protocols. All field datasheets and notebook entries would be scanned to PDF files. Electronic data files should be named with the date on which the file was created and should include a ReadMe file that describes when the file was created and by whom, and any explanatory notes on the file contents. If a data file is revised, a new copy should be made and the original preserved.

All data would have properly documented Federal Geographic Data Committee/International Organization for Standardization (FGDC/ISO) metadata, a data dictionary (defines codes and fields used in the dataset), and/or a Readme file as appropriate (e.g., how data was collected, quality assurance/quality control [QA/QC] procedures, other information about data such as meaning, relationships to other data, origin, usage, and format).

Data Review and Clearance

After relevant project data is transcribed (entered) into standard digital format, electronic data sheets would be verified against the original hardcopy datasheets and/or notebooks and any corrections for transcription errors would be made as appropriate before data are used for any analyses or distributed. Implementing Trustees would verify and validate MAM data and information and would ensure that all data are: i) entered or converted into agreed upon/commonly used digital format; ii) labeled with metadata following FGDC/ISO standards to the extent practicable and in accordance with DOI requirements.

After all identified errors are addressed, data are considered to be QA/QC'ed. DOI would give the other TIG members time to review the data before making such information publicly available (as described below). Before submitting the monitoring data and information package, co-Implementing Trustees shall confirm with one another that the package is approved for submission.

Data Storage and Accessibility

Once all data has been QA/QC'ed it would be submitted to the DIVER Restoration Portal. Trustees would provide DWH NRDA MAM data and information to the Restoration Portal as soon as possible and no more than 1 year from when data are collected.

Data Sharing

The monitoring data and annual report would be made publicly available, in accordance with the Open, Public, Electronic and Necessary Government Data Act of 2019, through the DIVER Restoration Portal within 6 months of the end of each calendar year through project close-out.

7. Reporting

All reporting would occur after field surveys are completed annually. This report would summarize the findings for the sampling period including all worksheets transferred into digital format and presented in tabular and graphical formats. The data should be summarized in such a way that it is meaningful to the reader. Additionally, an annual report would be completed that includes:

- A summary of project activities for the year, such as progress of eradication and outreach efforts.
- Summarized monitoring data –synthesized data for all efforts during the year.
- Graphics, if applicable, and associated interpretations of the data.
- Comparisons of pre- and post-project conditions, as applicable.
- Any uncertainties with management actions.
- Potential data collection issues.
- Reporting on general MAM activities in the DIVER Restoration Portal on an annual basis.
- Developing a Final MAM Report before a project is closed out.

8. Roles and Responsibilities

Monitoring data associated with this MAM plan would be collected, reviewed, and reported by DOI.

9. References

DWH NRDA Trustees. 2016. *Deepwater Horizon* Oil Spill: Final Programmatic Damage Assessment and Restoration Plan (PDARP) and Final Programmatic Environmental Impact Statement (PEIS). Available: www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.

DWH NRDA Trustees. 2017. *Deepwater Horizon* Oil Spill Natural Resource Damage Assessment: Strategic Framework for Bird Restoration Activities Version 1. June. Available: www.gulfspillrestoration.noaa.gov/2017/06/trustees-release-strategic-frameworks-restoration.

DWH NRDA Trustees. 2021. Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0. Appendix to the Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the DWH Oil Spill. December. Available: https://www.gulfspillrestoration.noaa.gov/monitoring-and-adaptive-management

Appendix D. Demographic Information

Environmental justice under the National Environmental Policy Act is assessed as any disproportionately high adverse effects to low income, minority, and/or Tribal populations. To evaluate the effects of the projects considered in this restoration plan and environmental assessment, current demographic data from the U.S. Census Bureau and metrics such as air quality, hazardous waste proximity, and respiratory hazard index, from the U.S. Environmental Protection Agency were analyzed. Analogous information from Canadian, Bahamian, and Grenadine departments of statistics were also reviewed. The results of this analysis are detailed in this Appendix.

The projects and the demographic data for the states/countries in which they are located, are listed in Table D-1. The EPA's Environmental Justice Screening and Mapping Tool (Version 2017) was used to assess impacts from the proposed projects regarding human health, the potential for multiple exposures or cumulative exposures, and historical exposures to environmental hazards. Based on the information in that platform, the project locations are below or similar to the State, Region, and U.S. percentiles for particulate matter (PM 2.5), ozone, National-Scale Air Toxics Assessment (NATA) diesel particulate matter, NATA cancer risk, NATA respiratory hazard index, traffic proximity, lead paint indicator, superfund proximity, RMP proximity, hazardous waste proximity, and waste discharge indicator.

Table D-1 Municipalities, County, State, and National Demographic Information

Location	Project(s) in Associated Location	Percent White Alone (2021)	Percent of population age 25 or older with high school education or higher (2021)	Percent of population age 16 or older in civilian labor force (2021)	Median household income, 2020 dollars (2016-2020)	Percent of persons in poverty (2021)
United States of America[1]	N/A	75.8%	88.5%	63.0%	$64,994	11.6%
Illinois, United States of America[1]	Common Tern Nesting Colony Restoration in the Great Lakes Region	76.3%	89.7%	65.1%	$68,428	12.1%
Indiana, United States of America[1]	Common Tern Nesting Colony Restoration in the Great Lakes Region	84.2%	89.3%	63.7%	$58.235	12.2%
Massachusetts, United States of America[1]	Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries	79.8%	91.1%	67.1%	$84,385	10.4%
Michigan, United States of America[1]	Common Tern Nesting Colony Restoration in the Great Lakes Region	79.0%	91.3%	61.4%	$59,234	13.1%
Minnesota, United States of America[1]	Common Tern Nesting Colony Restoration in the Great Lakes Region	83.0%	93.4%	69.2%	$73,382	9.3%
Monroe County, FL[1]	Seabird Nesting Colony Protection and Enhancement at Dry Tortugas National Park	88.6%	91.9%	62.5%	$72,012	10.2%
New York, United States of America[1]	Common Tern Nesting Colony Restoration in the Great Lakes Region	69.1%	87.2%	62.9%	$71,117	13.9%
Ohio, United States of America[1]	Common Tern Nesting Colony Restoration in the Great Lakes Region	81.2%	90.8%	63.0%	$58,116	13.4%
Pennsylvania, United States of America[1]	Common Tern Nesting Colony Restoration in the Great Lakes Region	81.0%	91.0%	62.7%	$63,627	12.1%

Location	Project(s) in Associated Location	Percent White Alone (2021)	Percent of population age 25 or older with high school education or higher (2021)	Percent of population age 16 or older in civilian labor force (2021)	Median household income, 2020 dollars (2016-2020)	Percent of persons in poverty (2021)
Wisconsin, United States of America[1]	Common Tern Nesting Colony Restoration in the Great Lakes Region	86.6%	92.6%	66.1%	$63,293	10.8%
International						
Commonwealth of The Bahamas (2010)[3]	Seabird Nesting Habitat Restoration and Colony Reestablishment in the Bahamas	5%	1,536	-	-	-
Manitoba Province, Canada[4]	Common Tern Nesting Colony Restoration in Manitoba	-	-	-	$79,500 (2020)	-
Newfoundland and Labrador Province, Canada[4]	Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries Northern Gannet Nesting Colony Restoration in Eastern Canada	-	-	-	$71,500 (2020)	-
Ontario Province, Canada[4]	Common Tern Nesting Colony Restoration in the Great Lakes Region	-	-	-	$91,000 (2020)	-
Saint Vincent and the Grenadines[5]	Invasive Goat Removal to Restore Seabird Nesting Habitat in St. Vincent and the Grenadines	-	-	67.8% (15 or older, 2017)	-	-

Location	Project(s) in Associated Location	Percent White Alone (2021)	Percent of population age 25 or older with high school education or higher (2021)	Percent of population age 16 or older in civilian labor force (2021)	Median household income, 2020 dollars (2016-2020)	Percent of persons in poverty (2021)

Sources:

[1]United States Census Bureau. 2021. QuickFacts. Accessed 11/1/2022. www.census.gov/quickfacts/fact/table/US/PST045217

[2]United States Census Bureau. 2021. QuickFacts. Accessed 11/1/2022. www.census.gov/quickfacts/fact/table/mayaguezmunicipiopuertorico,culebramunicipiopuertorico/PST045221

[3]Bahamian Department of Statistics. 2012. Census of Population and Housing 2010. First Release. www.bahamas.gov.bs/wps/wcm/connect/a6761484-9fa0-421d-a745-34c706049a88/Microsoft+Word+-+2010+CENSUS+FIRST+RELEASE+REPORT.pdf?MOD=AJPERES

[4]Census Profile, 2021 Census of Population. February 9, 2022. Statistics Canada. Accessed 11/1/2022. www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/index.cfm?Lang=E

[5]Economic Planning Division, Ministry of Finance Economic Planning & Information Technology. 2019. Digest of Statistics. www.stats.gov.vc/wp-content/uploads/2022/05/Digest-of-Statistics-2019.pdf

Appendix E. U.S. Federally Protected Species

The tables below provide a list of U.S. federally-listed species potentially occurring within each location for the proposed alternatives within the jurisdiction of the United States. Associated habitat information is also provided for each species.

Table E-1 Federally Listed Species Potentially Occurring in the *Predator Removal and Seabird Nesting Colony Restoration at Mona Island (preferred)* Project Area

Common Name	Scientific Name	Habitat	Status	Likelihood
Blue whale	*Balaenoptera musculus*	Marine: various	T	Unlikely
Boulder star coral	*Orbicella franksi*	Marine: shallow waters.	T	Unlikely
Elkhorn coral	*Acropora palmata*	Marine: shallow coastal waters in high-energy wave zones.	T	Unlikely
Fin whale	*Balaenoptera physalus*	Marine: various	T	Unlikely
Giant manta ray	*Manta birostris*	Marine: various	T	Unlikely
Green sea turtle	*Chelonia mydas*	Estuarine: near seagrasses; Marine: coastal waters, breeds adjacent to the shoreline; Terrestrial: nest on sandy beaches.	T	Likely
Hawksbill sea turtle	*Eretmochelys imbricata*	Estuarine: bays and estuaries; Marine: forages around coral reefs, breeds adjacent to shoreline; Terrestrial: nests on sandy beaches.	E	Likely
Higo chumbo cactus	*Harrisia portoricensis*	Terrestrial: cactus forest.	T	Likely
Leatherback sea turtle	*Dermochelys coriacea*	Marine: forages in the open ocean waters, breeds in deep waters adjacent to the shoreline; Terrestrial: nests on sandy beaches	E	Unlikely
Lobed star coral	*Orbicella annularis*	Marine: nearshore shallow water.	T	Unlikely
Loggerhead sea turtle	*Caretta caretta*	Marine: forages in the open ocean and shallow coastal waters, breeds adjacent to the shoreline; Terrestrial: nests on sandy beaches.	T	Unlikely
Mona boa	*Epicrates monensis monensis*	Terrestrial: subtropical dry deciduous forest, coastal plains.	T	Likely
Mona ground iguana	*Cyclura stejnegeri*	Terrestrial: semi-open areas of plateau and coastal plains.	T	Likely
Mountainous star coral	*Orbicella faveolata*	Marine: various	T	Unlikely
Nassau grouper	*Epinephelus striatus*	Marine: various	T	Unlikely
Oceanic whitetip shark	*Carcharhinus longimanus*	Marine: open ocean and outer continental shelf.	T	Unlikely
Pillar coral	*Dendrogyra cylindrus*	Marine: various	T	Unlikely
Rough cactus coral	*Mycetophyllia ferox*	Marine: various	T	Unlikely
Sei whale	*Balaenoptera borealis*	Marine: various	E	Unlikely
Sperm whale	*Physeter macrocephalus*	Marine: various	E	Unlikely
Staghorn coral	*Acropora cervicornis*	Marine: various	T	Unlikely
Yellow-shouldered blackbird	*Agelaius xanthomus*	Estuarine: mud flats, salt flats, offshore red mangrove cays, black mangrove forests; Terrestrial: lowland dry coastal pastures, suburban areas, coconut plantations, coastal cliffs.	E	Likely

Note: Species determined to be “unlikely” to be found in the action area are not addressed further in the environmental analysis.
C=Candidate, CH=Critical Habitat, E=Endangered, T=Threatened, SAT=Similarity of Appearance (Threatened), SSC=Species of Special Concern

Table E-2 Federally Listed Species Potentially Occurring in the *Predator Removal and Seabird Nesting Colony Restoration in the Culebra Archipelago (non-preferred)* Project Area

Common Name	Scientific Name	Habitat	Status	Likelihood
Blue whale	*Balaenoptera musculus*	Marine: various	T	Unlikely
Boulder star coral	*Orbicella franksi*	Marine: shallow waters.	T	Unlikely
Culebra Island giant anole	*Anolis roosevelti*	Terrestrial: forest.	E	Potentially
Elkhorn coral	*Acropora palmata*	Marine: shallow coastal waters in high-energy wave zones.	T	Unlikely
Fin whale	*Balaenoptera physalus*	Marine: various	T	Unlikely
Giant manta ray	*Manta birostris*	Marine: various	T	Unlikely
Green sea turtle	*Chelonia mydas*	Estuarine: near seagrasses; Marine: coastal waters, breeds adjacent to the shoreline; Terrestrial: nest on sandy beaches.	T	Potentially
Hawksbill sea turtle	*Eretmochelys imbricata*	Estuarine: bays and estuaries; Marine: forages around coral reefs, breeds adjacent to shoreline; Terrestrial: nests on sandy beaches.	E	Potentially
Kemp's ridley sea turtle	*Lepidochelys kempii*	Marine: forages in sargassum and open waters, breeds adjacent to the shoreline; Terrestrial: nests on sandy beaches.	E	Unlikely
Leatherback sea turtle	*Dermochelys coriacea*	Marine: forages in the open ocean waters, breeds in deep waters adjacent to the shoreline; Terrestrial: nests on sandy beaches	E	Unlikely
n/a	*Leptocereus grantianus*	Terrestrial: rocky shoreline.	E	Likely
Lobed star coral	*Orbicella annularis*	Marine: nearshore shallow water.	T	Unlikely
Loggerhead sea turtle	*Caretta caretta*	Marine: forages in the open ocean and shallow coastal waters, breeds adjacent to the shoreline; Terrestrial: nests on sandy beaches.	T	Potentially
Mountainous star coral	*Orbicella faveolata*	Marine: various	T	Unlikely
Nassau grouper	*Epinephelus striatus*	Marine: various	T	Unlikely
Oceanic whitetip shark	*Carcharhinus longimanus*	Marine: open ocean and outer continental shelf.	T	Unlikely
Pillar coral	*Dendrogyra cylindrus*	Marine: various	T	Unlikely
Roseate tern	*Sterna dougallii dougallii*	Terrestrial: various nesting sites; Marine: various foraging sites.	T	Potentially
Rough cactus coral	*Mycetophyllia ferox*	Marine: various	T	Unlikely
Sei Whale	*Balaenoptera borealis*	Marine: various	E	Unlikely
Shortnose sturgeon	*Acipenser brevirostrum*	Marine: various	E	Unlikely
Sperm Wwale	*Physeter macrocephalus*	Marine: various	E	Unlikely
Staghorn coral	*Acropora cervicornis*	Marine: various	T	Unlikely
Virgin Islands tree boa	*Chilabothrus granti*	Terrestrial: xeric forest, low profile islets.	E	Potentially
West Indian manatee	*Trichechus manatus*	Estuarine: seagrass, open water; Marine: seagrass, open water.	T	Unlikely

Common Name	Scientific Name	Habitat	Status	Likelihood
Note: Species determined to be "unlikely" to be found in the action area are not addressed further in the environmental analysis.				
C=Candidate, CH=Critical Habitat, E=Endangered, T=Threatened, SAT=Similarity of Appearance (Threatened), SSC=Species of Special Concern				

Table E-3 Federally Listed Species Potentially Occurring in the *Seabird Nesting Colony Reestablishment and Protection at Desecheo National Wildlife Refuge (preferred)* Project Area

Common Name	Scientific Name	Habitat	Status	Likelihood
Blue whale	*Balaenoptera musculus*	Marine: various	T	Unlikely
Boulder star coral	*Orbicella franksi*	Marine: shallow waters.	T	Unlikely
Elkhorn coral	*Acropora palmata*	Marine: shallow coastal waters in high-energy wave zones.	T	Unlikely
Fin whale	*Balaenoptera physalus*	Marine: various	T	Unlikely
Giant manta ray	*Manta birostris*	Marine: various	T	Unlikely
Green sea turtle	*Chelonia mydas*	Estuarine: near seagrasses; Marine: coastal waters, breeds adjacent to the shoreline; Terrestrial: nest on sandy beaches.	T	Potentially
Hawksbill sea turtle	*Eretmochelys imbricata*	Estuarine: bays and estuaries; Marine: forages around coral reefs, breeds adjacent to shoreline; Terrestrial: nests on sandy beaches.	E	Potentially
Higo chumbo cactus	*Harrisia portoricensis*	Terrestrial: cactus forest.	T	Potentially
Leatherback sea turtle	*Dermochelys coriacea*	Marine: forages in open ocean waters, breeds in deep waters adjacent to the shoreline; Terrestrial: nests on sandy beaches.	E	Unlikely
Lobed star coral	*Orbicella annularis*	Marine: nearshore shallow water.	T	Unlikely
Loggerhead sea turtle	*Caretta caretta*	Marine: forages in the open ocean and shallow coastal waters, breeds adjacent to the shoreline; Terrestrial: nests on sandy beaches.	T	Potentially
Mountainous star coral	*Orbicella faveolata*	Marine: various	T	Unlikely
Nassau grouper	*Epinephelus striatus*	Marine: various	T	Unlikely
Oceanic whitetip shark	*Carcharhinus longimanus*	Marine: open ocean and outer continental shelf.	T	Unlikely
Pillar coral	*Dendrogyra cylindrus*	Marine: various	T	Unlikely
Rough cactus coral	*Mycetophyllia ferox*	Marine: various	T	Unlikely
Sei whale	*Balaenoptera borealis*	Marine: various	E	Unlikely
Sperm whale	*Physeter macrocephalus*	Marine: various	E	Unlikely
Staghorn coral	*Acropora cervicornis*	Marine: various	T	Unlikely

Note: Species determined to be “unlikely” to be found in the action area are not addressed further in the environmental analysis.
C=Candidate, CH=Critical Habitat, E=Endangered, T=Threatened, SAT=Similarity of Appearance (Threatened), SSC=Species of Special Concern

Table E-4 Federally Listed Species Potentially Occurring in the *Seabird Nesting Colony Protection and Enhancement at Dry Tortugas National Park (preferred)* Project Area

Common Name	Scientific Name	Habitat	Status	Likelihood
American alligator	*Alligator mississippiensis*	Estuarine: herbaceous wetland; Riverine: river, creek, low gradient, medium river, pool, spring/spring brook; Lacustrine: shallow water; Palustrine: forested wetland, herbaceous wetland, riparian, scrub-shrub wetland.	SAT	Potentially
Bachman's warbler (wood)	*Vermivora bachmanii*	Palustrine: forested wetlands containing dense palmetto or cane understory.	E	Unlikely
Bartram's hairstreak butterfly	*Strymon acis bartrami*	Terrestrial: pine rockland, rockland hammock, hydric pine flatwoods.	E	Unlikely
Big Pine partridge pea	*Chamaecrista lineata keyensis*	Terrestrial: pine rocklands and rockland hammocks.	E	Unlikely
Blodgett's silverbush	*Argythamnia blodgettii*	Terrestrial: pine rocklands and rockland hammocks.	T	Unlikely
Blue whale	*Balaenoptera musculus*	Marine: various	T	Unlikely
Boulder star coral	*Orbicella franksi*	Marine: shallow waters.	T	Unlikely
Cape Sable thoroughwort	*Chromolaena frustrata*	Terrestrial: coastal berms, buttonwood forests, coastal hardwood hammocks, rockland hammocks.	E	Unlikely
Eastern black rail	*Laterallus jamaicensis ssp. jamaicensis*	Estuarine: herbaceous wetland with elevated refugia; Palustrine: herbaceous wetland with elevated refugia.	T	Unlikely
Elkhorn coral	*Acropora palmata*	Marine: shallow coastal waters in high-energy wave zones.	T	Unlikely
Everglades bully	*Sideroxylon reclinatum ssp. austrofloridense*	Terrestrial: pine rockland and marl prairie.	T	Unlikely
Fin whale	*Balaenoptera physalus*	Marine: various	T	Unlikely
Florida leafwing butterfly	*Anaea troglodyta floridalis*	Terrestrial: pine rockland, rockland hammock, hydric pine flatwoods.	E	Unlikely
Florida panther	*Puma (=Felis) concolor coryi*	Terrestrial: upland forest containing dense understory vegetation.	E	Unlikely
Florida pineland crabgrass	*Digitaria pauciflora*	Terrestrial: pine rockland and marl prairie.	T	Unlikely
Florida prairie-clover	*Dalea carthagenensis floridana*	Terrestrial: pine rockland, rockland hammock, marl prairie, and coastal berm.	E	Unlikely
Florida semaphore cactus	*Consolea corallicola*	Terrestrial: coastal berms, buttonwood forests, rockland hammocks.	E	Likely
Garber's spurge	*Chamaesyce garberi*	Terrestrial: open areas on dry, sandy soil.	T	Unlikely
Giant manta ray	*Manta birostris*	Marine: various	T	Unlikely
Green sea turtle	*Chelonia mydas*	Estuarine: near seagrasses; Marine: coastal waters, breeds adjacent to the shoreline; Terrestrial: nests on sandy beaches.	T	Likely
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	Estuarine: various; Marine: various habitats; Riverine: alluvial and blackwater streams.	T	Unlikely
Hawksbill sea turtle	*Eretmochelys imbricata*	Estuarine: bays and estuaries; Marine: forages around coral reefs, breeds adjacent to shoreline;	E	Unlikely

Common Name	Scientific Name	Habitat	Status	Likelihood
		Terrestrial: nests on sandy beaches.		
Kemp's ridley sea turtle	*Lepidochelys kempii*	Marine: forages in sargassum and open waters, breeds adjacent to the shoreline; Terrestrial: nests on sandy beaches.	E	Unlikely
Key tree cactus	*Pilosocereus robinii*	Terrestrial: rocky hammocks.	E	Unlikely
Largetooth sawfish	*Pristis pristis*	Marine: various	E	Unlikely
Leatherback sea turtle	*Dermochelys coriacea*	Marine: forages in the open ocean waters, breeds in deep waters adjacent to the shoreline; Terrestrial: nests on sandy beaches	E	Unlikely
Lobed star coral	*Orbicella annularis*	Marine: nearshore shallow water.	T	Unlikely
Loggerhead sea turtle	*Caretta caretta*	Marine: forages in the open ocean and shallow coastal waters, breeds adjacent to the shoreline; Terrestrial: nests on sandy beaches.	T	Likely
Miami blue butterfly	*Cyclargus (=Hemiargus) thomasi bethunebakeri*	Terrestrial: hardwood hammocks, coastal berm hammocks, dunes, and scrub.	E	Unlikely
Mountainous star coral	*Orbicella faveolata*	Marine: various	T	Unlikely
Nassau grouper	*Epinephelus striatus*	Marine: various	T	Unlikely
North Atlantic right whale	*Eubalaena glacialis*	Marine: various	E	Unlikely
Oceanic whitetip shark	*Carcharhinus longimanus*	Marine: open ocean and outer continental shelf.	T	Unlikely
Pillar coral	*Dendrogyra cylindrus*	Marine: various	T	Unlikely
Piping plover	*Charadrius melodus*	Estuarine: exposed unconsolidated substrate; Marine: exposed unconsolidated substrate; Terrestrial: dunes, sandy beaches, and inlet areas; mostly wintering and migrants.	T	Potentially
Puma (mountain lion)	*Puma (=Felis) concolor*	Terrestrial: upland forest containing dense understory vegetation.	SAT	Unlikely
Rice's whale	*Balaenoptera ricei*	Marine: various	E	Unlikely
Rough cactus coral	*Mycetophyllia ferox*	Marine: various	T	Unlikely
Sand flax	*Linum arenicola*	Terrestrial: pine rockland.	E	Unlikely
Sei whale	*Balaenoptera borealis*	Marine: various	E	Unlikely
Shortnose sturgeon	*Acipenser brevirostrum*	Marine: various	E	Unlikely
Smalltooth sawfish	*Pristis pectinata*	Estuarine: shallow habitats such as inshore bars, mangrove edges, and seagrass beds; Marine: shallow coastal waters with muddy or sandy bottoms.	E	Unlikely
Sperm whale	*Physeter macrocephalus*	Marine: various	E	Unlikely
Staghorn coral	*Acropora cervicornis*	Marine: various	T	Unlikely
Wedge spurge	*Chamaesyce deltoidea serpyllum*	Terrestrial: pine rockland.	E	Unlikely
West Indian manatee	*Trichechus manatus*	Estuarine: seagrass, open water; Marine: seagrass, open water.	T	Unlikely
Wood stork	*Mycteria americana*	Estuarine: marshes; Lacustrine: floodplain lakes, marshes (feeding);	T	Unlikely

Common Name	Scientific Name	Habitat	Status	Likelihood
		Palustrine: marshes, swamps, roadside ditches.		

Note: Species determined to be “unlikely” to be found in the action area are not addressed further in the environmental analysis.
C=Candidate, CH=Critical Habitat, E=Endangered, T=Threatened, SAT=Similarity of Appearance (Threatened), SSC=Species of Special Concern

Table E-5 Federally Listed Species Potentially Occurring in the *Common Tern Nesting Colony Restoration in the Great Lakes Region (non-preferred)* Project Area

Common Name	Scientific Name	Habitat	Status	Likelihood
American Hart's-tongue fern	*Asplenium scolopendrium var. americanum*	Terrestrial: cool, moist refugia on dolomitic limestone bedrock under intact deciduous hardwood canopies with shallow soils and an open understory.	T	Unlikely
Bog turtle	*Glyptemys muhlenbergii*	Palustrine: open-canopy, herbaceous sedge meadows and fens bordered by wooded areas.	T	Unlikely
Canada lynx	*Lynx canadensis*	Terrestrial: moist boreal forests.	T	Potentially
Chittenango ovate amber snail	*Novisuccinea chittenangoensis*	Riverine: Chittenango Falls State Park in Madison County, New York.	T	Unlikely
Clubshell	*Pleurobema clava*	Riverine: clean coarse sand and gravel in runs, packed sand and gravel in riffles and runs.	E	Potentially
Copperbelly water snake	*Nerodia erythrogaster neglecta*	Palustrine: isolated wetlands distributed in a forested upland matrix, floodplain wetlands.	T	Potentially
Dwarf lake iris	*Iris lacustris*	Terrestrial: shoreline coniferous forests dominated by northern white cedar and balsam fir.	T	Potentially
Eastern massasauga (rattlesnake)	*Sistrurus catenatus*	Palustrine: wet prairies, marshes, fens, sedge meadows, peatlands, and low areas along lakes; Riverine: low areas along rivers; Terrestrial: shrubland, open woodlands, prairie.	T	Potentially
Eastern prairie fringed orchid	*Platanthera leucophaea*	Terrestrial: tallgrass silt-loam or sand prairies; Palustrine: sedge meadows, fens, sphagnum bogs.	T	Unlikely
Fassett's locoweed	*Oxytropis campestris var. chartacea*	Terrestrial: sandy shorelines of land-locked seepage lakes.	T	Potentially
Gray wolf	*Canis lupus*	Terrestrial: temperate forests, mountains, tundra, taiga, and grasslands.	E	Unlikely
Hine's emerald dragonfly	*Somatochlora hineana*	Palustrine: small to medium-sized streams, with areas of coarse gravel and sand substrate within fast flowing riffles and runs.	E	Potentially
Houghton's goldenrod	*Solidago houghtonii*	Terrestrial: narrow bands of open, calcareous, lakeshore habitat.	T	Potentially
Hungerford's crawling water beetle	*Brychius hungerfordi*	Riverine: clear cool streams with well-aerated riffle segments, a cobble bottom, an underlying sand substrate, and alkaline water conditions.	E	Unlikely
Indiana bat	*Myotis sodalis*	Terrestrial: caves and mines, wooded areas in riparian zones, bottomland and floodplain habitats, wooded wetlands, and upland communities.	E	Potentially
Karner blue butterfly	*Lycaeides melissa samuelis*	Terrestrial: remnants of savanna and barrens habitats typified by dry sandy soils.	E	Unlikely
Lakeside daisy	*Hymenoxys herbacea*	Terrestrial: abandoned quarry areas.	T	Unlikely
Leafy prairie-clover	*Dalea foliosa*	Terrestrial: thin-soiled mesic and wet-mesic dolomite prairie, limestone cedar glades, and limestone barrens.	E	Unlikely
Leedy's roseroot	*Rhodiola integrifolia ssp. leedyi*	Terrestrial: cliffside habitat along the shore of a lake in New York, cool moderate cliffs in Minnesota.	T	Unlikely
Longsolid	*Fusconaia subrotunda*	Riverine: small streams to large rivers, mixture of sand, gravel, and cobble substrates.	PT	Potentially
Mead's milkweed	*Asclepias meadii*	Terrestrial: tallgrass prairies, hay meadows, thin soil glades or barrens.	T	Unlikely
Michigan monkey-flower	*Mimulus michiganensis*	Palustrine: cold, alkaline spring seepages and streams;	E	Unlikely

Common Name	Scientific Name	Habitat	Status	Likelihood
		Terrestrial: northern white cedar swamps.		
Mitchell's satyr butterfly	*Neonympha mitchellii mitchellii*	Palustrine: sedge-dominated fens.	E	Unlikely
Monarch butterfly	*Danaus plexippus*	Terrestrial: temperate climates, various sites.	C	Potentially
Northeastern bulrush	*Scirpus ancistrochaetus*	Palustrine: ponds, wet depressions, or shallow sinkholes within small wetland complexes.	E	Unlikely
Northern long-eared bat	*Myotis septentrionalis*	Terrestrial: caves and mines, forested habitats.	T	Unlikely
Northern riffleshell	*Epioblasma rangiana*	Riverine: small streams to large rivers, mixture of sand, gravel, and cobble substrates.	E	Potentially
Northern wild monkshood	*Aconitum noveboracense*	Terrestrial: partially shaded cliffs and talus slopes; Riverine: semi-shaded seepage springs at high elevation headwaters, stream-side crevices downstream.	T	Unlikely
Piping plover	*Charadrius melodus*	Estuarine: exposed unconsolidated substrate; Marine: exposed unconsolidated substrate; Terrestrial: dunes, sandy beaches, and inlet areas.	E	Likely
Pitcher's thistle	*Cirsium pitcheri*	Terrestrial: unforested dune systems of western Great Lakes.	T	Likely
Poweshiek skipperling	*Oarisma poweshiek*	Palustrine: remnant prairie areas including prairie fens, grassy lake and stream margins, moist meadows, sedge meadows, and wet-to-dry prairie.	E	Unlikely
Rabbitsfoot	*Quadrula cylindrica cylindrica*	Riverine: small to medium sized streams and some larger rivers.	T	Unlikely
Rayed bean	*Villosa fabalis*	Riverine: smaller, headwater creeks near shoal or riffle; Lacustrine: shallow, wave-washed areas.	E	Unlikely
Red knot	*Calidris canutus rufa*	Estuarine: bays, tidal flats, salt marshes; Marine: aerial, near shore; Terrestrial: sandy beaches.	T	Likely
Rusty patched bumble bee	*Bombus affinis*	Terrestrial: prairies, woodlands, agricultural landscapes, and residential parks and gardens; Palustrine: marshes.	E	Unlikely
Sheepnose mussel	*Plethobasus cyphyus*	Riverine: streams.	E	Potentially
Snuffbox mussel	*Epioblasma triquetra*	Riverine: streams.	E	Potentially
White catspaw	*Epioblasma obliquata perobliqua*	Riverine: small to medium-sized streams, with areas of coarse gravel and sand substrate within fast flowing riffles and runs.	E	Potentially

Note: Species determined to be “unlikely” to be found in the action area are not addressed further in the environmental analysis.

C=Candidate, CH=Critical Habitat, E=Endangered, T=Threatened, SAT=Similarity of Appearance (Threatened), SSC=Species of Special Concern

Table E-6 Federally Listed Species Potentially Occurring in the *Seabird Bycatch Reduction in Northeast U.S. and Atlantic Canada Fisheries (preferred)* Project Area

Common Name	Scientific Name	Habitat	Status	Likelihood
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	Marine: various	E	Potentially
Blue whale	*Balaenoptera musculus*	Marine: various	E	Potentially
Fin whale	*Balaenoptera physalus*	Marine: various	E	Potentially
Giant manta ray	*Manta birostris*	Marine: various	T	Potentially
Green sea turtle	*Chelonia mydas*	Estuarine: near seagrasses; Marine: coastal waters, breeds adjacent to the shoreline; Terrestrial: nest on sandy beaches.	T	Potentially
Kemp's ridley sea turtle	*Lepidochelys kempii*	Marine: forages in sargassum and open waters, breeds adjacent to the shoreline; Terrestrial: nests on sandy beaches.	E	Potentially
Leatherback sea turtle	*Dermochelys coriacea*	Marine: forages in open ocean waters, breeds in deep waters adjacent to the shoreline; Terrestrial: nests on sandy beaches.	E	Potentially
Loggerhead sea turtle	*Caretta caretta*	Marine: forages in the open ocean and shallow coastal waters, breeds adjacent to the shoreline; Terrestrial: nests on sandy beaches.	T	Potentially
North Atlantic right whale	*Eubalaena glacialis*	Marine: various	E	Likely
Oceanic whitetip shark	*Carcharhinus longimanus*	Marine: open ocean and outer continental shelf.	T	Likely
Roseate tern	*Sterna dougallii dougallii*	Terrestrial: various nesting sites; Marine: various foraging sites.	E	Unlikely
Sei whale	*Balaenoptera borealis*	Marine: various	E	Potentially
Shortnose sturgeon	*Acipenser brevirostrum*	Marine: various	E	Potentially
Sperm whale	*Physeter macrocephalus*	Marine: various	E	Potentially

Note: Species determined to be “unlikely” to be found in the action area are not addressed further in the environmental analysis.
C=Candidate, CH=Critical Habitat, E=Endangered, T=Threatened, SAT=Similarity of Appearance (Threatened), SSC=Species of Special Concern

Table E-7 Federally Listed Species Potentially Occurring in the *Seabird Bycatch Risk Reduction in Gulf of Mexico and Southeast U.S. Pelagic Longline Fisheries (non-preferred)* Project Area

Common Name	Scientific Name	Habitat	Status	Likelihood
American crocodile	*Crocodylus acutus*	Estuarine: herbaceous wetland; Riverine: river, creek, low gradient, medium river, pool, spring/spring brook; Lacustrine: shallow water; Palustrine: forested wetland, herbaceous wetland, riparian, scrub-shrub wetland.	T	Unlikely
Bachman's warbler	*Vermivora bachmanii*	Palustrine: forested wetlands containing dense palmetto or cane understory.	E	Unlikely
Bartram's hairstreak butterfly	*Strymon acis bartrami*	Terrestrial: pine rockland, rockland hammock, hydric pine flatwoods.	E	Unlikely
Big pine partridge pea	*Chamaecrista lineata keyensis*	Terrestrial: pine rocklands and rockland hammocks.	E	Unlikely
Blodgett's silverbush	*Argythamnia blodgettii*	Terrestrial: pine rocklands and rockland hammocks.	T	Unlikely
Blue whale	*Balaenoptera musculus*	Marine: various	T	Potentially
Boulder star coral	*Orbicella franksi*	Marine: shallow waters.	T	Unlikely
Cape Sable thoroughwort	*Chromolaena frustrata*	Terrestrial: coastal berms, buttonwood forests, coastal hardwood hammocks, rockland hammocks.	E	Unlikely
Eastern black rail	*Laterallus jamaicensis ssp. jamaicensis*	Estuarine: herbaceous wetland with elevated refugia; Palustrine: herbaceous wetland with elevated refugia.	T	Unlikely
Eastern indigo snake	*Drymarchon couperi*	Terrestrial: mesic flatwoods, upland pine forest, sandhills, scrub, scrubby flatwoods, rockland hammock, ruderal.	T	Unlikely
Elkhorn coral	*Acropora palmata*	Marine: shallow coastal waters in high-energy wave zones.	T	Unlikely
Everglades bully	*Sideroxylon reclinatum ssp. austrofloridense*	Terrestrial: pine rockland and marl prairie.	T	Unlikely
Fin whale	*Balaenoptera physalus*	Marine: various	T	Potentially
Florida leafwing butterfly	*Anaea troglodyta floridalis*	Terrestrial: pine rockland, rockland hammock, hydric pine flatwoods.	E	Unlikely
Florida panther	*Puma (=Felis) concolor coryi*	Terrestrial: upland forest containing dense understory vegetation.	E	Unlikely
Florida pineland crabgrass	*Digitaria pauciflora*	Terrestrial: pine rockland and marl prairie.	T	Unlikely
Florida prairie-clover	*Dalea carthagenensis floridana*	Terrestrial: pine rockland, rockland hammock, marl prairie, and coastal berm.	E	Unlikely
Florida semaphore cactus	*Consolea corallicola*	Terrestrial: coastal berms, buttonwood forests, rockland hammocks.	E	Unlikely
Garber's spurge	*Chamaesyce garberi*	Terrestrial: open areas on dry, sandy soil.	T	Unlikely
Giant manta ray	*Manta birostris*	Marine: various	T	Potentially
Green sea turtle	*Chelonia mydas*	Estuarine: near seagrasses; Marine: coastal waters, breeds adjacent to the shoreline; Terrestrial: nests on sandy beaches.	T	Potentially
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	Estuarine: various; Marine: various habitats; Riverine: alluvial and blackwater streams.	T	Potentially

Common Name	Scientific Name	Habitat	Status	Likelihood
Hawksbill sea turtle	*Eretmochelys imbricata*	Estuarine: bays and estuaries; Marine: forages around coral reefs, breeds adjacent to shoreline; Terrestrial: nests on sandy beaches.	E	Potentially
Kemp's ridley sea turtle	*Lepidochelys kempii*	Marine: forages in sargassum and open waters, breeds adjacent to the shoreline; Terrestrial: nests on sandy beaches.	E	Potentially
Key deer	*Odocoileus virginianus clavium*	Terrestrial: upland pine rockland and hardwood hammock	E	Unlikely
Key tree cactus	*Pilosocereus robinii*	Terrestrial: rocky hammocks.	E	Unlikely
Largetooth sawfish	*Pristis pristis*	Marine: various	E	Unlikely
Leatherback sea turtle	*Dermochelys coriacea*	Marine: forages in the open ocean waters, breeds in deep waters adjacent to the shoreline; Terrestrial: nests on sandy beaches	E	Potentially
Lobed star coral	*Orbicella annularis*	Marine: nearshore shallow water.	T	Unlikely
Loggerhead sea turtle	*Caretta caretta*	Marine: forages in the open ocean and shallow coastal waters, breeds adjacent to the shoreline; Terrestrial: nests on sandy beaches.	T	Potentially
Lower Keys marsh rabbit	*Sylvilagus palustris hefneri*	Estuarine: saltmarsh areas of slightly higher elevation such as ridges or islands; Terrestrial: hammocks and flatwoods bordering fresh water.	E	Unlikely
Miami blue butterfly	*Cyclargus (=Hemiargus) thomasi bethunebakeri*	Terrestrial: hardwood hammocks, coastal berm hammocks, dunes, and scrub.	E	Unlikely
Monarch butterfly	*Danaus plexippus*	Terrestrial: temperate climates, various sites.	C	Unlikely
Mountainous star coral	*Orbicella faveolata*	Marine: various	T	Unlikely
Nassau grouper	*Epinephelus striatus*	Marine: various	T	Potentially
North Atlantic right whale	*Eubalaena glacialis*	Marine: various	E	Potentially
Northern long-eared Bat	*Myotis septentrionalis*	Terrestrial: caves and mines, forested habitats.	T	Unlikely
Oceanic whitetip shark	*Carcharhinus longimanus*	Marine: open ocean and outer continental shelf.	T	Likely
Olive ridley sea turtle	*Lepidochelys olivacea*	Marine: various	T	Potentially
Pillar coral	*Dendrogyra cylindrus*	Marine: various	T	Unlikely
Piping Plover	*Charadrius melodus*	Estuarine: exposed unconsolidated substrate; Marine: exposed unconsolidated substrate; Terrestrial: dunes, sandy beaches, and inlet areas; mostly wintering and migrants.	T	Unlikely
Red knot	*Calidris canutus rufa*	Estuarine: bays, tidal flats, salt marshes; Marine: aerial, near shore; Terrestrial: sandy beaches; mostly wintering and migrants.	T	Unlikely
Red-cockaded woodpecker	*Picoides borealis*	Terrestrial: mature pine forests.	E	Unlikely
Rice's whale	*Balaenoptera ricei*	Marine: various	E	Potentially
Roseate tern	*Sterna dougallii dougallii*	Terrestrial: various nesting sites; Marine: various foraging sites.	T	Potentially
Rough cactus coral	*Mycetophyllia ferox*	Marine: various	T	Unlikely

Common Name	Scientific Name	Habitat	Status	Likelihood
Rough-leaved loosestrife	*Lysimachia asperulaefolia*	Terrestrial: areas between longleaf pine or oak savannas and wetter, shrubby plant communities growing on moist sand or peat.	E	Unlikely
Sand flax	*Linum arenicola*	Terrestrial: pine rockland.	E	Unlikely
Schaus swallowtail butterfly	*Heraclides aristodemus ponceanus*	Terrestrial: hardwood hammocks within the Florida Keys.	E	Unlikely
Seabeach amaranth	*Amaranthus pumilus*	Terrestrial: barrier island beaches.	T	Unlikely
Sei whale	*Balaenoptera borealis*	Marine: various	E	Potentially
Shortnose sturgeon	*Acipenser brevirostrum*	Marine: various	E	Potentially
Silver rice rat	*Oryzomys palustris natator*	Estuarine: mangrove swamps, vegetated saltmarsh flats; Palustrine: vegetated marshes.	E	Unlikely
Smalltooth sawfish	*Pristis pectinata*	Estuarine: shallow habitats such as inshore bars, mangrove edges, and seagrass beds; Marine: shallow coastal waters with muddy or sandy bottoms.	E	Unlikely
Sperm whale	*Physeter macrocephalus*	Marine: various	E	Potentially
Staghorn coral	*Acropora cervicornis*	Marine: various	T	Unlikely
Stock Island tree snail	*Orthalicus reses (not incl. nesodryas)*	Terrestrial: tropical hardwood hammock.	T	Unlikely
Wedge spurge	*Chamaesyce deltoidea serpyllum*	Terrestrial: pine rockland.	E	Unlikely
West Indian manatee	*Trichechus manatus*	Estuarine: seagrass, open water; Marine: open water, seagrass.	T	Unlikely
Wood stork	*Mycteria americana*	Estuarine: marshes; Lacustrine: floodplain lakes, marshes (feeding); Palustrine: marshes, swamps, roadside ditches.	T	Unlikely

Note: Species determined to be “unlikely” to be found in the action area are not addressed further in the environmental analysis.
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Appendix F. Additional Information on the Use of Rodenticide

Islands across the world have served as biodiversity hotspots, supporting populations of sensitive wildlife such as seabirds. Global trade and seafaring have introduced invasive species such as rodents on these islands, decimating native biota from rodents consuming young/small wildlife. Rodenticides have been commonly used to conduct island-wide rodent eradications for habitat restoration. This appendix summarizes rodenticide information available from environmental assessments for island rodent eradications. Additional information can be found in the following documents, which are available in the *Deepwater Horizon* Natural Resource Damage Assessment Administrative Record (www.doi.gov/deepwaterhorizon/adminrecord):

- Harper, G.A. and S. Boudjelas. 2017. The Feasibility of Eradicating Pacific Rats from Beautemps-Beaupre Island, New Caledonia. Report prepared by the Pacific Invasives Initiative for the Association pour la Sauvegarde de la Biodiversite d'Ouvea, New Caledonia. 32 pp.
- Harper, G.A. 2020. Environmental Impact Assessment for the Eradication of Black Rats *Rattus rattus* from the Outer Chago Archipelago. Report prepared for the Chagos Conservation Trust, U.K. 49 pp.
- U.S. Fish and Wildlife Service. 2016. Environmental Assessment for Restoration of Habitat on the Desecheo National Wildlife Refuge through the Eradication of Non-Native Rats, Desecheo, Puerto Rico. February.
- U.S. Fish and Wildlife Service. 2019. Midway Seabird Protection Project Final Environmental Assessment, Sand Island, Midway Atoll, Papahanaumokuakea Marine National Monument. January. 358 pp.

Anticoagulant rodenticides are commonly used in the control and/or eradication of small mammals. Rodenticide is typically administered in 1-to-3-gram non-germinating grain pellets via aerial broadcast, hand broadcast, or bait boxes. Within the U.S., two primary rodenticides are used for conservation purposes and approved by the U.S. Environmental Protection Agency (USEPA) for aerial broadcast: diphacinone and brodifacoum. As anticoagulants, both rodenticides interfere with blood clotting, resulting in death by internal hemorrhaging within 3 to 10 days of consumption. Given the high toxicity of these poisons, the USEPA restricts their use to islands and their sale to the U.S. Department of Agriculture-Animal Plant and Health Inspection Service-Wildlife Service, the U.S. Fish and Wildlife Service (USFWS), or the National Park Service.

Diphacinone, a first-generation anticoagulant rodenticide, is typically administered in 50 parts per million concentrations. As a first-generation rodenticide, rodents have developed a genetic resistance to diphacinone, requiring consumption over multiple days to achieve mortality. Studies suggest bait must be available and consumed for 12 days to kill rodents (USFWS, 2016). Diphacinone has been used in over 30 successful eradications (Howald et al., 2007 as cited in USFWS, 2016). It has been infrequently used for aerial applications, as it requires multiple applications; multiple attempts at aerial broadcasts have failed to eradicate rodents (USFWS, 2016). While diphacinone has a lower record of success in eradication attempts compared to brodifacoum, its reduced environmental risk (from its lower toxicity) makes it preferred in certain instances, such as smaller islands where bait boxes can be used. Additionally, diphacinone is less persistent in tissues, which reduces risk of secondary exposure by wildlife that may consume dead rodents.

As a second-generation anticoagulant rodenticide, brodifacoum typically only requires one dose (or "feed") of only a few bait pellets to achieve mortality due to its greater toxic effects. Brodifacoum is administered in 25 parts per million concentrations in either a dry or wet formulation. The dry formulation breaks down quickly when exposed to moisture (e.g., rain, ocean), while the wet formulation contains sorbitol to increase resistance to weathering. In bait degradation trials at Desecheo Island, no difference in degradation rates was found between the two formulations (USFWS, 2016). Brodifacoum has been used in 196 of 277 successful island rodent eradications (Howald et al., 2007 as cited in USFWS, 2016). Its high toxicity reduces need to have bait available in the environment for extended periods of time, making brodifacoum more cost- and effort-efficient because it requires fewer repeated applications.

The decision to use diphacinone versus brodifacoum in rodent eradication requires a balancing of efficacy and requirements for bait availability with potential impacts to non-target species. When applying rodenticide, resource managers must consider:

- Baiting rates and application uniformity to ensure enough bait is available for all rodents to deliver a lethal dose;
- Rodent breeding to ensure bait is available for emerging juveniles;
- Other food sources to ensure rodents eat the bait; and
- Wet/dry formulations to ensure bait remains available for consumption.

Application rates and maximum rodenticide amounts are subject to USEPA approval under the Federal Insecticide, Fungicide, and Rodenticide Act and Supplemental Labels. Bait trials are conducted prior to application to determine optimal coverage to ensure all rodents in the trial area are exposed to a lethal bait dose and to determine how quickly bait degrades at the project site. Multiple applications are typically conducted to ensure bait availability for all rodents. As noted above, the three primary methods for bait application are hand broadcast, aerial broadcast (by drone or helicopter), or bait stations. The application method is dependent on the size of application/eradication area and the landscape. For example, bait boxes are not feasible for large eradication areas, due to the difficulty in making rodenticide available for all rodents. Hand broadcast is common on islands up to 200 hectares (approximately 500 acres) in size (Harper and Boudjelas, 2017). Aerial applications with higher toxicity rodenticide are typically conducted on larger islands because bait is generally not available for as long as bait boxes.

As anti-coagulants, both diphacinone and brodifacoum can negatively impact non-target species when they directly consume bait pellets or they consume poisoned prey. Brodifacoum in particular is highly toxic to non-target mammals and birds. Since rodenticide is typically administered via grain pellets, insectivores and herbivores are more likely to consume bait. Bait pellets are typically dyed blue or green, which has been demonstrated to reduce consumption by some birds and reptiles (e.g., Tershy et al., 1992 as cited in USFWS, 2016). To minimize impacts to non-target species, various mitigation measures can be employed, including but not limited to:

- Using a deflector on aerial broadcast buckets to limit bait spread to the marine environment;
- Captive holding of protected and/or sensitive species;
- Monitoring for non-target species that have consumed bait and providing veterinary services;
- Monitoring and collecting rodent carcasses and excess bait pellets; and
- Timing rodenticide application when sensitive and/or protected species are not present.

Appendix G. List of Repositories

State/Province, Country	Repository	Address	City	ZIP
Florida, USA	Dry Tortugas National Park, Fort Jefferson Visitor Center	Fort Jefferson	Key West	33040
Kingstown, St. Vincent and the Grenadines	National Public Library of St. Vincent and the Grenadines	5Q3H+PHC	Kingstown	
Louisiana, USA	New Orleans Public Library Main Branch	219 Loyola Avenue	New Orleans	700112
Louisiana, USA	Plaquemines Parish Library	8442 Highway 23	Belle Chase	70037
Manitoba, Canada	Band Offices of: • Barren Lands First Nation • Bloodvein River First Nation • Little Grand Rapids First Nation • Misipawistik Cree Nation • Northlands Dene Nation • O-Pipon-Na-Piwin Cree Nation • Pauingassi First Nation • Poplar River First Nations • Sayisi Dene First Nation	Various	Various	
Massachusetts, USA	Eldredge Public Library	564 Main Street	Chatham	02633
Nassau, Bahamas	Nassau Public Library	3MG5+HQX, Shirley St	Nassau	
Newfoundland and Labrador, Canada	A.C. Hunter Public Library	125 Allandale Road	St. John’s	A1B 3A3
Ohio, USA	Cedar Point National Wildlife Refuge Visitor Center	14000 West State Route 2,	Oak Harbor	43449
Ontario, Canada	Presqu’ile Provincial Park Visitor Center	328 Presqu’ile Parkway	Brighton	K0K 1H0
Puerto Rico, USA	Caribbean Islands National Wildlife Refuge Complex Visitor Center	Carr 301, Km 5.1, Bo Corozo	Boqueron	PR00622
Puerto Rico, USA	Department of Natural and Environmental Resources Central Office	1375 Ave. Ponce de Leon,	San Juan	00926
Puerto Rico, USA	Mona Island Camps (Sardinera and Pájaros)	33P5+WX3	Mayagüez	00680
Puerto Rico, USA	San Juan Community Library	2105 Cll Topacio	San Juan	00924

State/Province, Country	Repository	Address	City	ZIP
Kingstown, St. Vincent and the Grenadines	National Public Library of St. Vincent and the Grenadines	5Q3H+PHC	Kingstown	