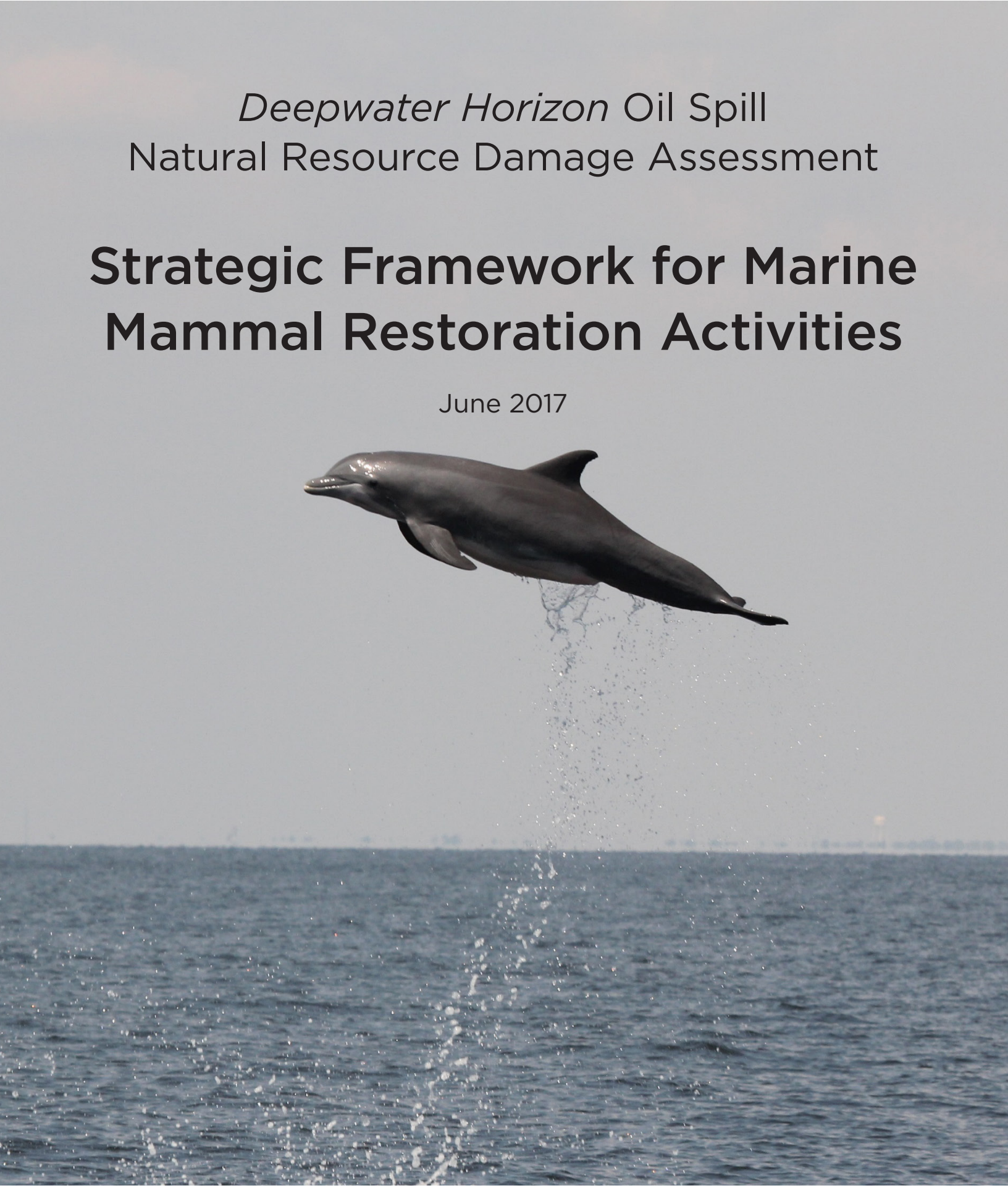
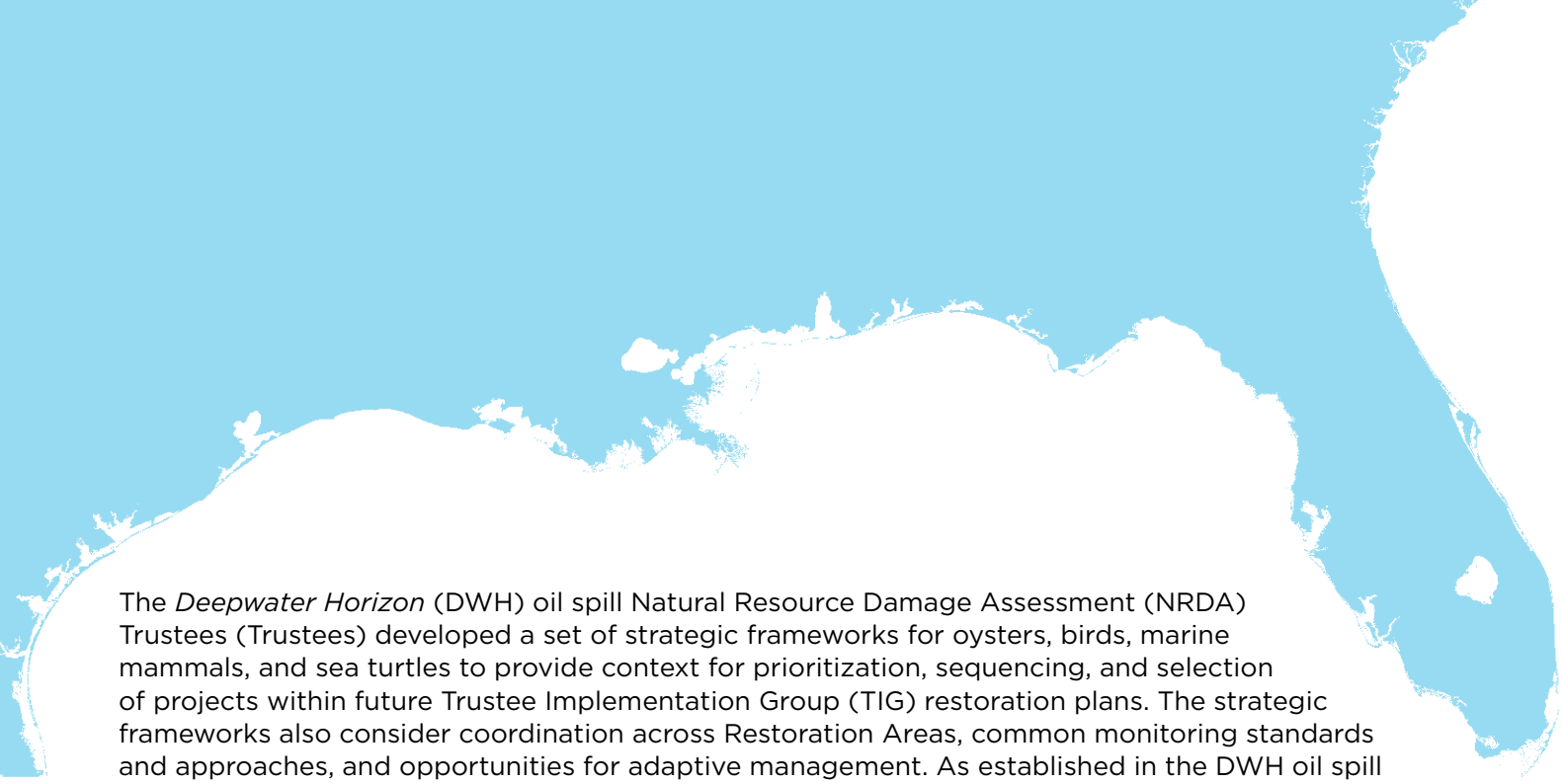
*Deepwater Horizon* Oil Spill
Natural Resource Damage Assessment

# Strategic Framework for Marine Mammal Restoration Activities

June 2017





The *Deepwater Horizon* (DWH) oil spill Natural Resource Damage Assessment (NRDA) Trustees (Trustees) developed a set of strategic frameworks for oysters, birds, marine mammals, and sea turtles to provide context for prioritization, sequencing, and selection of projects within future Trustee Implementation Group (TIG) restoration plans. The strategic frameworks also consider coordination across Restoration Areas, common monitoring standards and approaches, and opportunities for adaptive management. As established in the DWH oil spill Programmatic Damage Assessment and Restoration Plan and Programmatic Environmental Impact Statement (PDARP/PEIS), these frameworks will help the Trustees consider each resource at the ecosystem level, while implementing restoration at the local level.

The Regionwide TIG authorized the creation of these strategic frameworks to promote information sharing and coordination across TIGs for the four resources (oysters, birds, marine mammals, and sea turtles) that will receive restoration funding allocated to the Regionwide TIG. The Trustees also anticipate that the strategic frameworks will be useful for restoration planning and implementation by all TIGs. Developed by teams of Trustee scientists and resource experts, each framework includes four modules with information for the TIGs to consider for planning, implementing, and monitoring restoration activities:

Module 1: A brief summary of the information in the PDARP/PEIS related to each resource, including an overview of the injury, restoration goals, restoration approaches and techniques, and monitoring considerations

Module 2: Biological and ecological information on each resource, including geographic distribution, life history, and key threats

Module 3: An overview of other recent and ongoing conservation, restoration, management, and monitoring activities related to each resource in the northern Gulf of Mexico

Module 4: Considerations for the prioritization, sequencing, and selection of restoration projects to benefit the resource, including additional information on restoration approaches and techniques, potential project concepts, and monitoring needs.

Citations and references are included throughout the modules, so that the reader can easily investigate each topic in more detail. The strategic frameworks may be updated based on new knowledge obtained by Trustee efforts or the broader science community, and updates to relevant species recovery or management plans prepared under other statutes.

Strategic frameworks are not intended to exhaustively present all possible restoration techniques and project concepts, nor to prescriptively describe the complete restoration plan for the resource across all TIGs. Readers are encouraged to submit restoration projects to the Trustee Project Portal (http://www.gulfspillrestoration.noaa.gov/restoration/give-us-your-ideas) or to state-specific project portals, as available.

Please visit www.gulfspillrestoration.noaa.gov for the latest version of this document.

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# Module 1

## Summary of Information from the PDARP – Marine Mammals

### KEY ASPECTS OF MARINE MAMMAL INJURY THAT INFORMED RESTORATION PLANNING

- The DWH oil spill contaminated habitats in the nearshore and offshore waters of the northern GOM where marine mammals occur. Animals suffered from physical damage and toxic effects to a variety of organs and tissues.
- Animals that succumbed to these adverse health effects contributed to the largest and longest marine mammal unusual mortality event on record in the northern GOM.
- At least 22 stocks (representing at least 15 species) of marine mammals overlap with the DWH oil spill footprint and have demonstrable, quantifiable injuries.
- Bay, sound, and estuarine bottlenose dolphin stocks, coastal and shelf dolphin stocks, and oceanic whale and dolphin stocks were all injured by some combination of increased mortality, increased reproductive failure, and adverse health effects.
- The Barataria Bay and Mississippi Sound bottlenose dolphin stocks were two of the most severely injured populations.
- Because cetaceans are long-lived animals and slow to reproduce, it will take many decades for these stocks to recover without any active restoration.

*For additional information, see Section 4.9 in the Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement (PDARP/PEIS).*

**Marine mammals in the Gulf of Mexico (GOM)** inhabit a broad range of habitats, from offshore (including the continental shelf) to coastal waters and bays, sounds, and estuaries. All marine mammals are federally protected under the Marine Mammal Protection Act (MMPA) of 1972, through which Congress declared marine mammals to be resources of great international significance and, therefore, should be protected to the greatest extent feasible. In addition, sperm whales, the only endangered cetacean species that inhabits the GOM, has additional protection under the Endangered Species Act (ESA). There are less than 100 Bryde's whales in the GOM. In December 2016, NOAA published a proposed rule to list the Gulf of Mexico Bryde's whales as endangered under the ESA.

The diverse number of species and geographic range of marine mammals affected by the *Deepwater Horizon* (DWH) oil spill is unprecedented (see text box to the left). These species are long-lived and slow to reproduce and play an important role in the food web as apex predators. All these factors affect the recovery of marine mammals and necessitate a portfolio of restoration approaches that collectively address all stocks, species, and geographic areas that were injured by the DWH oil spill. This portfolio includes ecological benefits achieved through habitat restoration; reducing direct sources of mortality; increasing survival by improving stranding response; spatial planning; and robust monitoring of populations, health statuses, and trends.

**Settlement funding allocation for marine mammal restoration (millions $)**

| | Marine Mammals |
|---|---|
| Regionwide TIG | 19 |
| Open Ocean TIG | 55 |
| Texas TIG | – |
| Louisiana TIG | 50 |
| Mississippi TIG | 10 |
| Alabama TIG | 5 |
| Florida TIG | 5 |
| **Total funding** | **144** |

**Marine mammal funds have been allocated** to the Florida, Alabama, Mississippi, Louisiana, Open Ocean, and Regionwide Trustee Implementation Groups (TIGs), with particular emphasis on the Louisiana, to reflect the diversity of species injured and the geographic distribution of the injury. For marine mammals, Trustees may use funds for restoration outside of the GOM as ecologically appropriate, and these funds may be used for activities such as resource-level planning, prioritization, implementation, and monitoring for resource recovery, among others.

Trustees are using a nested framework of programmatic restoration goals, restoration types, and restoration approaches and techniques to guide and direct the subsequent phases of restoration:

**Trustees' Programmatic Restoration Goal:**

Replenish and protect living coastal and marine resources

**Restoration Type: Marine Mammals**

The goals of the marine mammal restoration type include:

- Implement an integrated portfolio of restoration approaches to restore injured Bay, Sound, and Estuary (BSE); coastal; shelf; and oceanic marine mammals across the diverse habitats and geographic ranges they occupy.
- Identify and implement restoration activities that mitigate key stressors to support resilient populations. Collect and use monitoring information, such as population and health assessments and spatiotemporal distribution information.
- Identify and implement actions that support ecological needs of the stocks; improve resilience to natural stressors; and address direct human-caused threats such as bycatch in commercial fisheries, vessel collisions, noise, industrial activities, illegal feeding and harassment, and hook-and-line fishery interactions.

*For additional information on marine mammal restoration goals, see Section 5.5.11.1 in the Final PDARP/PEIS.*

**Strategy to Achieve Goals**

This Restoration Type will address stressors that cause mortality (death) and morbidity (illness that reduces fitness) to marine mammal stocks. Gulf of Mexico cetaceans are subject to many stressors, such as pollution, physical hazards resulting from interaction with humans, industrialization, habitat loss and degradation, and fishery bycatch. Considering all the injured stocks of marine mammals throughout their geographic ranges will be important for restoration. Restoration should also target offshore and shelf species, especially given the endangered status of the sperm whale. Therefore, the Trustees propose that restoration will take place in four Gulf states (Florida, Alabama, Mississippi, and Louisiana) and in coastal and offshore waters to provide benefits for all injured species. Thus, restoration projects will be focused to support resilient marine mammal populations, reduce further harm or impacts, and complement existing management priorities.

To most effectively address the extent of injury to marine mammals across their diverse geographic ranges, a portfolio of several approaches will need to be implemented that collectively will allow populations to recover more quickly or will reduce further harm from acute and chronic injuries sustained by the DWH incident. The portfolio will enable early detection of and intervention in anthropogenic and natural threats, such as disease outbreaks or harmful algal blooms (e.g., Litz et al. 2014). The restoration approaches that address mortality and morbidity are based on existing management activities established under the MMPA, ESA, and priorities for marine mammal conservation.

The restoration portfolio for marine mammals will also include robust monitoring and scientific support for an adaptive management approach to restoration planning and implementation. Adaptive management is necessary because of limited experience implementing restoration for marine mammals at this scale and limited scientific data on impacts for these species. A strong emphasis on data collection and monitoring for marine mammals will inform the public and Trustees on the state of the resource and iteratively drive restoration toward effective projects and subsequent recovery from injuries associated with the DWH incident.

**Restoration Approaches and Techniques**

The restoration approaches and potential restoration techniques associated with marine mammal restoration include:

**1. Reduce commercial fishery bycatch through collaborative partnerships**

This restoration approach focuses on reducing direct interactions between bottlenose dolphins and fisheries through partnerships to identify, test, and implement solutions. Potential techniques include:

- Developing collaborative partnerships and convening workshops with the commercial fishing industry, gear experts, observer programs, academic institutions and researchers, and state and federal agencies to determine actions that would help reduce bycatch in each fishery or for specific gear types (e.g., research regarding potential gear modifications)
- Testing, implementing, and evaluating potential bycatch reduction actions including gear modifications, fishery best-practice modifications, and outreach programs to promote effective strategies
- Monitoring and adaptively managing bycatch reduction solutions by expanding and enhancing both the fishery observer and Marine Mammal Stranding Network (MMSN) programs.

**2. Reduce injury and mortality of bottlenose dolphins from hook-and-line fishing gear**

This restoration approach focuses on reducing the harmful impacts of hook-and-line fishing gear on bottlenose dolphins. Hook-and-line gear is used by recreational anglers and for-hire fishing vessels (e.g., charter boats and headboats). Potential techniques include:

- Conducting systematic surveys of fishers and evaluating stranding data to understand the scale, scope, and frequency of hook-and-line fishing interactions with dolphins
- Developing collaborative partnerships and convening workshops with stakeholders to identify, test, and implement ways to reduce interactions
- Systematically repeating surveys and stranding data evaluations to measure success.

**3. Increase marine mammal survival through better understanding of causes of illness and death as well as early detection and intervention of anthropogenic and natural threats**

This restoration approach focuses on increasing marine mammal survival through improving understanding of key causes of morbidity and mortality, and also on the early detection and mitigation of anthropogenic or natural threats. Potential techniques include:

- Expanding the MMSN's capabilities along the GOM coast
- Enhancing capabilities to rapidly diagnose causes of marine mammal morbidity and mortality to identify threats and mitigate impacts (e.g., conservation medicine)
- Improving the ability to detect and rescue free-swimming dolphins that are entangled, entrapped, or out of their habitat
- Developing and increasing the technical and infrastructure capabilities to respond to major stranding events or disasters.

**4. Measure noise to improve knowledge and reduce impacts of anthropogenic noise on marine mammals**

This approach uses passive acoustics and other technologies to evaluate and address noise impacts on marine mammals. Potential techniques include:

- Collecting and using data from calibrated passive acoustic and complementary marine mammal survey techniques to characterize the spectral, temporal, and spatial qualities of noise throughout the GOM and determine areas of overlap between high noise levels and marine mammal stocks
- Prioritizing noise reduction in areas where high noise levels and high densities of marine mammals overlap
- Developing collaborative partnerships to identify, test, and implement strategies and technologies to reduce noise impacts on marine mammals using outcomes from the characterization and prioritization steps.

**5. Reduce injury, harm, and mortality to bottlenose dolphins by reducing illegal feeding and harassment activities**

This restoration approach focuses on reducing harmful impacts on marine mammals from illegal feeding and harassment activities by people. Potential techniques include:

- Conducting social science studies – such as surveys, focus groups, and interviews – to identify and characterize the attitudes, knowledge, perceptions, and motivations of user groups interacting with dolphins to design outreach tools
- Developing educational campaigns (such as public service announcements, social media campaigns, print products and advertisements) for specific target audiences
- Partnering with stakeholders to widely distribute and communicate tools to effectively reach targeted user groups throughout the GOM.

**6. Reduce marine mammal takes through enhanced state enforcement related to the MMPA**

This restoration approach builds capacity and training for state enforcement agencies to implement the MMPA in their state waters. Potential techniques include:

- Working with Gulf states to identify training needs and the most appropriate venue and format for the delivery of MMPA-related training
- Developing and distributing outreach products or techniques targeted specifically to enforcement officers (e.g., fact sheets or stickers that summarize why enforcing key MMPA provisions is important)
- Increasing funding to state enforcement agencies to increase the percentage of time that officers and equipment (e.g., vessels) are dedicated to MMPA enforcement activities.

**7. Reduce injury and mortality of marine mammals from vessel collisions**

This restoration approach focuses on reducing vessel collisions with marine mammal species in the GOM by developing and implementing a comprehensive mitigation strategy. Potential techniques include:

- Adjusting time/area-sensitive vessel routes and speeds, mariner training, and mariner and recreational boater outreach and education
- Collecting and analyzing data from passive acoustics, tagging, and predictive modeling to help inform effective mitigation to reduce vessel collisions with marine mammals in the GOM.

**8. Protect and conserve marine, coastal, estuarine, and riparian habitats**

This restoration approach supports, protects, and restores a wide variety of marine, coastal, estuarine, and riparian habitats and the ecosystem services they provide, through the identification, protection, management, and restoration of important marine habitat areas or land parcels. Potential techniques include:

- Acquire lands for conservation
- Develop and implement management actions in conservation areas and/or restoration projects
- Establish or expand protections for marine areas.

*For additional information on marine mammal restoration approaches and techniques, see Section 5.5.11.2 and Appendix 5.D in the Final PDARP/PEIS.*

**Monitoring**

A monitoring and adaptive management framework will be used to support restoration implementation and provide the DWH Trustees with a flexible, science-based decision-making approach to ensure that the restoration portfolio provides long-term benefits to the natural resources and services injured by the spill.

**Project-level monitoring**. Performance monitoring and tracking at the scale of the individual project will be used for evaluating and determining the need for any corrective actions to maximize benefits for marine mammals. Performance monitoring may measure parameters such as participation in and compliance with incentive-based programs and state laws, public perception and effectiveness of outreach and education materials, size and response times for stranding programs, stranding rates and locations, and indications of fishery interactions on stranded animals, among others.

Data may be collated and aggregated from existing and/or enhanced fishery observer programs, state enforcement programs, stranding programs, or project-specific data collection (e.g., social science surveys). The use of enhanced observer coverage and project-specific data collection would be coordinated with appropriate state and federal agencies. Additional monitoring and scientific support beyond individual project performance monitoring may be needed to address uncertainties of the restoration projects, individually and together, and aid in adaptive management at the project and resource level for restoration planning, implementation, and evaluation.

**Resource-level monitoring**. Monitoring and scientific support for adaptive management of restoration approaches would include population and health assessments, such as live capture-and-release and stranding data, development of spatial planning information management tools [e.g., geographic information systems (GIS) maps, databases, and statistical models] and identification of stressors.

*For additional information on marine mammal restoration monitoring, see Section 5.5.11.4 in the Final PDARP/PEIS.*

PHOTO CREDITS.

Page 1 (*top*). After being illegally fed, this bottlenose dolphin patrols a fishing pier for opportunities to take bait and/or catch directly off fishing hooks. *Sarasota Dolphin Research Program.*

Page 1 (*bottom*). Example of outreach tool and communication strategies: educational billboards. *NOAA, Texas Marine Mammal Stranding Network, and www.dontfeedwilddolphins.org.*

*Page 2.* Bottlenose dolphins in Mississippi Sound feeding on and around a shrimp trawl. *NOAA.*

# Module 2
## Biological and Ecological Information – Marine Mammals

# 1. Introduction

At least 15 of the 21 cetacean species[1] in the northern Gulf of Mexico (GOM) had quantifiable injuries (related to mortality, reproductive failure, and adverse health effects) from the *Deepwater Horizon* (DWH) oil spill. These whales and dolphins have adapted to a wide variety of habitats and can be found throughout the northern GOM. This module provides biological and ecological information about select focal species, which we believe is relevant to designing restoration projects for the DWH oil spill (whether for marine mammals, or any other resource). Most of the information in this module is adapted from Rosel and Mullin (2015), Dias and Garrison (2015), and the National Marine Fisheries Service (NMFS) Stock Assessment Reports and website (NOAA Fisheries, 2016b, 2016c). For additional information and citations, please reference those documents.

This module presents information by marine mammal stock, starting with stocks in inshore waters and moving to offshore waters. The Marine Mammal Protection Act (MMPA) defines a "population stock" or "stock" as "a group of marine mammals of the same species or smaller taxa in a common spatial arrangement, that interbreed when mature" [Marine Mammal Commission and National Oceanic and Atmospheric Administration (NOAA) NMFS, 2007, Section 3(11)]. Bottlenose dolphins in the northern GOM have almost 40 stocks; the first part of this module focuses on the various bottlenose dolphin stocks. The module then provides information on shelf and oceanic stocks other than bottlenose dolphins. The other species of cetaceans in the GOM are each considered a single stock. For consistency, in this module we default to using "stock" rather than "species" when referring to animals in the GOM, and "species" when referring to information that is not specific to a given stock.

## 1.1 Focal Stocks

It is infeasible to design restoration projects for every stock of marine mammals in the GOM. For the purposes of efficient restoration planning, we organize our discussion of oceanic marine mammals around a number of "focal" stocks that offer good opportunities as targets for successful restoration activities. Focal stocks were selected for the following reasons:

- Information (existing or to be gathered) from these stocks can reasonably be applied to other stocks that inhabit similar habitats and exhibit similar behaviors
- They can be identified visually and/or acoustically
- They were all injured by the DWH oil spill
- They collectively represent the range of habitats and depths in the northern GOM
- They collectively represent the range of hearing sensitivities/frequency ranges
- They are accessible for field studies and are good candidates for tagging
- Projects designed to benefit these stocks will likely benefit other stocks.

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1. While the distribution of West Indian manatees overlaps with the DWH oil footprint, none were sighted in oil, and they are not considered in the DWH injury assessment nor this document. Thus, throughout this document, references to marine mammals are limited to cetaceans. However, manatees may benefit from the activities associated with the comprehensive marine mammal strandings responses and as a part of unusual mortality event (UME) investigations, which may impact multiple species.

For example, a restoration project designed to monitor and reduce the impacts of noise and vessel traffic would be more logistically feasible for Risso's dolphins compared to species that are difficult to observe (e.g., pygmy killer whale, melon-headed whale), but because they share geographic ranges and behavioral traits, the project may benefit all three species.

In the sections to follow, we propose four[2] oceanic cetacean focal stocks. We emphasize that stocks without a "focal" designation are no less important for restoration, and we encourage the reader to investigate and consider these other stocks when designing restoration projects. For more information on the oceanic stocks not described here, see Dias and Garrison (2015), Rosel and Mullin (2015), the NMFS websites (NOAA Fisheries, 2016b), and the most recent Stock Assessment Reports (NOAA Fisheries, 2016c).

## 1.2 Resource Management

"The Marine Mammal Protection Act of 1972 was enacted in response to increasing concerns among scientists and the public that significant declines in some species of marine mammals were caused by human activities. The Act established a national policy to prevent marine mammal species and population stocks from declining beyond the point where they ceased to be significant functioning elements of the ecosystems of which they are a part. … The Department of Commerce through the National Marine Fisheries Service is charged with protecting whales, dolphins, porpoises, seals, and sea lions."

As part of the MMPA (Marine Mammal Commission and NOAA NMFS, 2007), Congress found that:

- Species and population stocks of marine mammals are, or may be, in danger of extinction or depletion as a result of man's activities
- Such species and population stocks should not be permitted to diminish beyond the point at which they cease to be a significant functioning element in the ecosystem of which they are a part, and consistent with this major objective, they should not be permitted to diminish beyond their optimum sustainable population
- Measures should be immediately taken to replenish any species or population stock which has already diminished below that population
- There is inadequate knowledge of the ecology and population dynamics of such marine mammals
- Negotiations should be undertaken immediately to encourage the development of international arrangements for research on, and conservation of, all marine mammals
- Marine mammals have proven themselves to be resources of great international significance, esthetic and recreational as well as economic, … they should be protected and encouraged to develop to the greatest extent feasible commensurate with sound policies of resource management
- It should be the goal to obtain an optimum sustainable population keeping in mind the carrying capacity of the habitat.

Source: NOAA Fisheries (Undated).

A "strategic stock"[3] is defined in the MMPA as a marine mammal stock (1) for which the level of direct human-caused mortality exceeds the potential biological removal level; (2) based on the best available scientific information, is declining and is likely to be listed as a threatened species under the Endangered Species Act of 1973 (ESA) [16 U.S.C. 1531 et seq.] within the foreseeable future; or (3) which is listed as a threatened or endangered species under the ESA or is designated as depleted under the MMPA.

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2. As explained in Section 2.4.2, from the perspective of designing restoration projects, there is little to differentiate the beaked whale species in the GOM. Thus, we use the general term "beaked whales focal stock" to reference the three GOM beaked whale species collectively.
3. When abundance or human-related mortality levels are truly unknown, current NMFS Guidelines for Assessing Marine Mammal Stocks (GAMMS) as of 2016 state that a stock could be considered strategic if human-caused mortality is likely to be significant relative to stock size (NOAA, 2016e).

## 1.3 Threats to Marine Mammals in the GOM

"Although there are substantial gaps in our understanding, several threats to marine mammals in the Gulf of Mexico are well-known and documented, including human threats such as bycatch in fishing gear (both from commercial fisheries and recreational hook and line gear), illegal feeding and harassment, intentional harm, vessel collisions, and noise; and natural stressors such as disease outbreaks, habitat degradation, and harmful algal blooms."

"Because scientific data are lacking on many species of cetaceans in the Gulf, restoration implementation will require a phased approach that includes data collection and monitoring. Data collected on marine mammals varies by stock and topic. The current federal resources to support these data collection needs are inconsistent, especially to support evaluation of the impacts of multiple threats and of cumulative impacts, or the study of stranded marine mammals. … In some cases, enough information exists to identify the threat (e.g., bycatch, illegal feeding, noise, or natural stressors), but specific mitigation measures needed to reduce that threat are less understood. Using a phased approach will enable the data collected to inform restoration decision-making and allow the Trustees to assess the effectiveness of restoration."

Source: DWH NRDA Trustees, 2016, 5.5.11.3 and 5.5.11.4.

The GOM is a heavily utilized and industrialized basin, supporting increasing levels of oil and gas exploration and development, commercial and recreational fishing, shipping, military operations, and tourism. Many of these activities take place in areas that are known habitat for marine mammals. These and other human activities may, individually and cumulatively, have impacts on marine mammals. In addition, natural events, such as extreme weather events (e.g., hurricanes) and coastal inundation and erosion, can pose risks to marine mammals.

It is also unclear how the effects of climate change may exacerbate existing threats or add new threats that affect marine mammals in the GOM. Climate change impacts such as increased ocean temperature, changes in precipitation, and increased coastal eutrophication may affect marine mammal populations. Some effects on marine mammals may include increased growth and spread of diseases, changes in prey abundance and distribution, changes in spatiotemporal distribution, increased strandings, reduced breeding success, reduced adult survival rates, and changes in recruitment.

For additional information about the threats associated with each stock, reference:

- The NMFS stock assessment reports: http://www.nmfs.noaa.gov/pr/sars/species.htm (NOAA Fisheries, 2016c)
- Phillips and Rosel (2014)
- Vollmer and Rosel (2013).

# 2. Species Distributions, Life History, and Habitat Information

The following sections discuss species- and stock-specific life history and habitat information for marine mammals that occur in the northern GOM. For each species, there is a short discussion of biological characteristics, stock information, ecological considerations, and other relevant information that may help with restoration efforts.

## 2.1 Bay, Sound, and Estuarine Bottlenose Dolphins

| | |
|---|---|
| Latin name | *Tursiops truncatus* |
| Average adult length | 1.9–2.7 m |
| Average adult weight | 135–635 kg |
| Average lifespan | 40–50 years |
| Hearing frequency range[4] | 0.15–160 kHz |

The common bottlenose dolphin (often referred to simply as "bottlenose dolphin") is distributed throughout the northern GOM in estuarine waters, nearshore coastal waters, and deep oceanic waters (although few have been observed beyond the upper continental slope). Of the 36 stocks of bottlenose dolphins in the northern GOM,[5] 13 overlapped with the DWH oil spill footprint [9 bay, sound, and estuary (BSE) stocks; 2 coastal stocks; the shelf stock; and the oceanic stock]. In this section, we provide general physical, behavioral, and life history species information, as well as information specific to the northern GOM BSE and coastal stocks. Further information specific to the continental shelf and oceanic stocks can be found in Sections 2.3 and 2.4 (DWH NRDA Trustees, 2016).

Bottlenose dolphins have a fairly large and robust body with a short, thick beak that is distinct from the melon. Their color can range from light gray to black, but is typically steel gray on the back and sides with a lighter-colored belly and a darker-colored dorsal cape. Bottlenose dolphins often travel in groups of 2 to 15 individuals, but offshore herds can grow as large as several hundred individuals. In offshore waters, they are sometimes associated with pilot whales and other cetacean species. Bottlenose dolphins develop complex social structures. Life history parameters may vary by region, but generally females reach sexual maturity between 5 and 13 years of age and males between 9 and 14 years of age. Calving intervals range from 3 to 6 years (NOAA Fisheries, 2015a; Rosel and Mullin, 2015). In the wild, female bottlenose dolphins typically live into their 50s and may live into their 60s, while males typically live into their 40s and 50s (Wells and Scott, 2009; NOAA Fisheries, 2016b).

Bottlenose dolphin prey preferences are highly variable and dependent on their habitat. Like other dolphins, they rely on high-frequency echolocation to find and catch prey. Dolphins in nearshore waters typically eat fish (e.g., drum, mullet, tuna), crab, and shrimp, including many benthic species. Offshore bottlenose dolphins tend to focus on pelagic fish and squid (Rosel and Mullin, 2015).

### 2.1.1 BSE Stocks

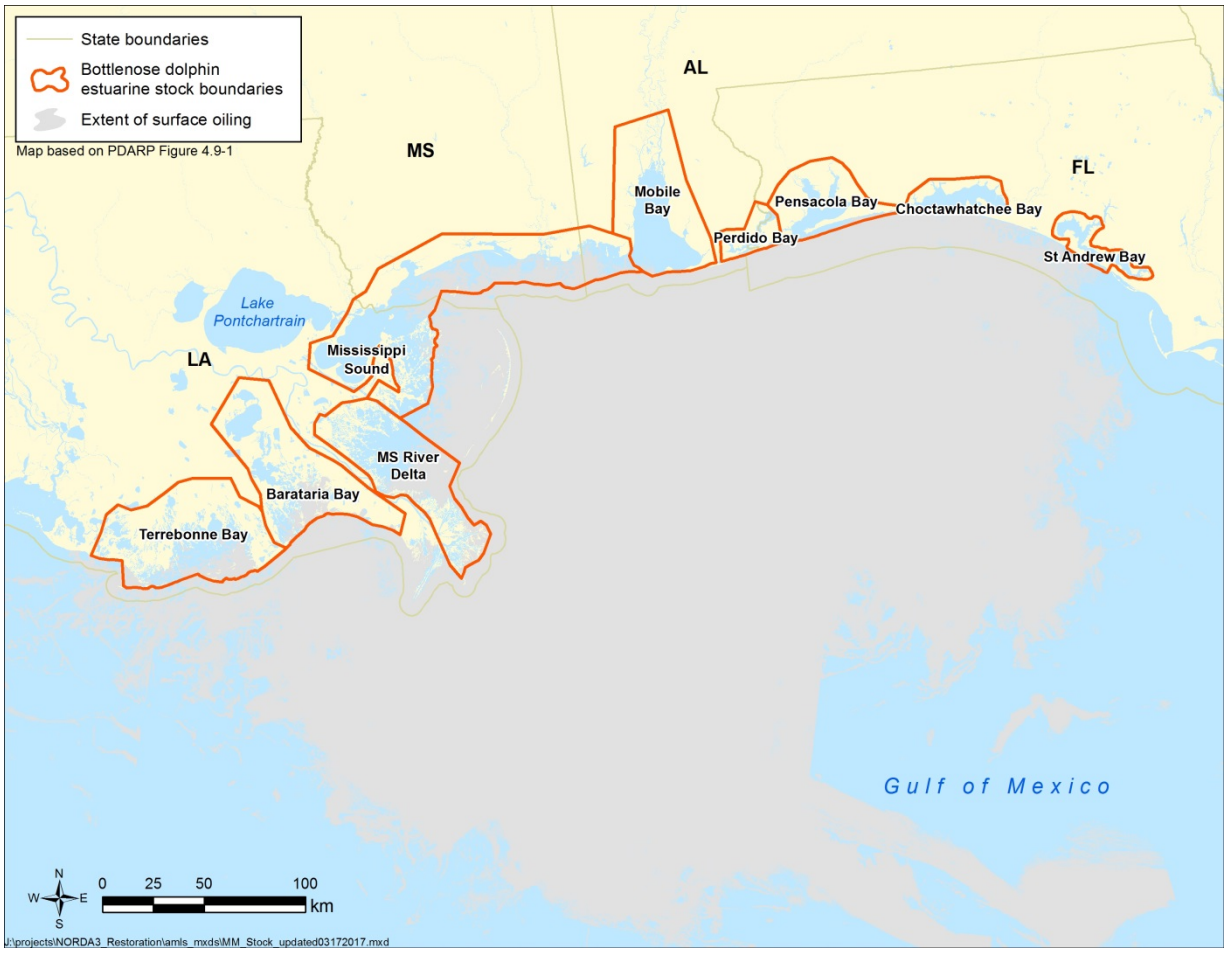
In the northern GOM, NOAA has identified 31 BSE bottlenose dolphin stocks in the inshore waters from Texas to Florida. There are no other species of cetaceans in northern GOM BSEs. Although BSE dolphins do occasionally move out into nearshore waters, they are thought to spend most of their time within their home BSEs. All of the BSE bottlenose dolphin stocks are considered "strategic" under the MMPA.[6] Nine of these stocks overlapped with the DWH oil spill footprint (DWH NRDA Trustees, 2016; NOAA, 2016c; Figure 1):

4. See NOAA's Marine Mammal Acoustic Technical Guidance (NOAA Fisheries, 2016a) for more information about hearing frequencies: www.nmfs.noaa.gov/pr/acoustics/guidelines.htm.

5. At the time of the DWH oil spill, there were 37 stocks of bottlenose dolphins in the northern GOM, which included 32 BSE stocks. In the 2014 marine mammal stock assessments, the Sarasota Bay and Little Sarasota Bay stocks were combined into one stock, resulting in a total of 31 BSE stocks and 36 stocks total.

6 These stocks are considered strategic pursuant to the GAMMS provision because abundance and human-mortality levels are unknown and human-caused mortality is likely to be significant relative to stock size (NOAA, 2016e).

**Figure 1. Bottlenose dolphin estuarine stock boundaries in the northern GOM.**




- The Terrebonne Bay and Timbalier Bay Stock (LA) was the furthest west stock to overlap with the DWH oil spill footprint. Little is known about this group of animals, but NOAA completed a field study of the stock in 2016 and is analyzing the data for an abundance estimate.
- The Barataria Bay Estuarine System Stock (LA; NOAA, 2016g) was one of the stocks most severely affected by the DWH oil spill. It is one of the best-studied stocks in the northern GOM, due to the attention it received during and after the spill. Live health assessments were carried out in 2011, 2013, and 2014; and are scheduled for 2017 and 2018. Scientists also conducted mark-recapture assessments using photo-identification (photo-ID) surveys, and they collected satellite tagging and genetic data. These studies demonstrated that individual animals typically have preferences for either the west side or the east side of the bay, and that the highest density of animals tends to be around the barrier islands.

Bottlenose dolphins.
Photograph taken under NOAA-SEFSC MMPA permit No. 779-1633.

- The Mississippi River Delta Stock (LA) inhabits the nearshore waters directly east of the Mississippi River. Little is known about this group of animals, although NOAA has conducted some aerial surveys.
- The Mississippi Sound, Lake Borgne, and Bay Boudreau Stock (LA, MS, AL, respectively; NOAA, 2016h) covers the inshore waters behind the barrier islands between New Orleans, Louisiana, and Dauphin Island, Alabama. Like Barataria Bay, this stock was one of the most severely affected stocks after the DWH oil spill and one of the best studied during/after the spill. Live health assessments were carried out in 2013, and will be conducted in 2018 and 2019. Scientists also conducted mark-recapture assessments using photo-ID surveys. A subset of this stock was the focus of a UME investigation prior to the DWH oil spill (see Lake Pontchartrain box).
- The Mobile Bay and Bon Secour Bay Stock (AL) inhabits the waters of Mobile and Bon Secour bays (AL) out to the barrier islands near Dauphin Island and Fort Morgan.
- The Perdido Bay Stock of common bottlenose dolphins inhabits estuarine waters of Perdido and Wolf bays along the Alabama-Florida border.
- The Pensacola Bay Stock of common bottlenose dolphins inhabits estuarine waters of Pensacola Bay (FL), including Escambia Bay, East Bay, and part of Santa Rosa Sound.
- The Choctawhatchee Bay Stock of common bottlenose dolphins inhabits the waters of Choctawhatchee Bay from Point Washington and Jolly Bay in the east to Fort Walton Beach in the west (NOAA, 2016f).
- The St. Andrew Bay Stock of common bottlenose dolphins inhabits the waters of the St. Andrew Bay estuarine system, including the West, North, and East bays.

Lake Pontchartrain

From February through April 2010, there was an increase in the number of bottlenose dolphin strandings along the northern GOM coastline, 114 strandings, whereas the historical average for this area during the same time period was 37 (http://www.nmfs.noaa.gov/pr/health/mmume/cetacean_gulfofmexico.htm), particularly within Lake Pontchartrain (LA), which had 26 strandings. In March 2010, NMFS consulted the UME Working Group to investigate increased strandings in the northern GOM, largely motivated by the bottlenose dolphin mortalities in Lake Pontchartrain. The UME Working Group requested that NMFS reevaluate all cetacean strandings and resubmit its request for consultation.

This consultation with the UME Working Group was subsequently put on hold when the DWH well exploded on April 20, 2010, causing NMFS staff and the stranding network to focus on the crisis at hand and support marine mammal response efforts. After the DWH response phase for cetaceans ended, the consultation was reinitiated. On December 13, 2010, the UME Working Group concluded that the high number of cetacean mortalities in the northern GOM in 2010 met the criteria for a UME, or perhaps multiple UMEs. The UME lasted from March 2010 to July 2014 and included 1,141 cetaceans, of which 85% were bottlenose dolphins. The UME included all cetaceans stranded in Louisiana, Mississippi, and Alabama and only offshore species (excludes bottlenose dolphins) in the Florida Panhandle. Most of the cetaceans stranded dead (95%).

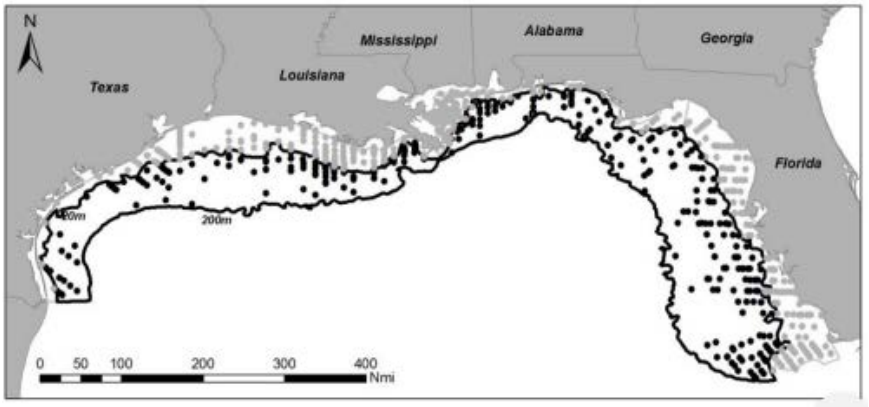
Although the UME started prior to the DWH incident, most of the strandings (above the historical average) prior to the incident occurred from March to May 2010; and were limited to Lake Pontchartrain, Louisiana, and western Mississippi, and were most likely caused by prolonged exposure to cold temperatures and low salinity. Most strandings outside of this March to May 2010 cluster occurred after the DWH blowout, were focused in areas exposed to DWH oil, and could not be attributed to prolonged cold temperatures or low salinity (Litz et al., 2014; Mullin et al., 2015; Venn-Watson et al., 2015).

## 2.2 Coastal Stocks

In the northern GOM, NOAA has identified three coastal bottlenose dolphin stocks from Texas to Florida. Coastal dolphins inhabit both state and federal waters, and typically occur from the shoreline out to the 20-m isobaths (Figure 2). It can be difficult to identify from which stock (BSE or coastal) a stranded bottlenose dolphin originated without genetic and/or stable isotope data (DWHMMIQT, 2015). The three coastal stocks include:

- The Western Coastal Stock includes dolphins in nearshore waters of Texas and Louisiana from the Texas/Mexico border to the Mississippi River outlet. The DWH oil spill footprint overlapped with this stock's boundaries as far west as the waters outside of Vermilion Bay (LA; NOAA, 2016d).
- The Northern Coastal Stock includes dolphins in the nearshore waters east of the Mississippi River outlet to 84° west (approximately Tallahassee, FL). The DWH oil spill footprint overlapped with this stock's boundaries as far east as the waters off Panama City. This stock was one of the most severely injured by the DWH oil spill (DWH NRDA Trustees, 2016; NOAA, 2016b).
- The Eastern Coastal Stock includes dolphins in the nearshore waters of Florida east of the 84th meridian. The DWH oil spill footprint did not overlap with this stock's boundaries and the DWH NRDA did not attempt to identify injuries to this stock (NOAA, 2016a).

**Figure 2. Locations (circles) of common bottlenose dolphin groups sighted in coastal and continental shelf waters during aerial surveys conducted in spring, summer, and fall of 2011; and in winter of 2012.** Dark circles indicate groups within the boundaries of the continental shelf stock. The 20-m and 200-m isobaths are shown.




Source: NOAA, 2016i.

All other things being equal, because of the large amount of data collected and analyzed during the NRDA, we propose that the Northern Coastal Stock serve as the focal stock for coastal bottlenose dolphins.

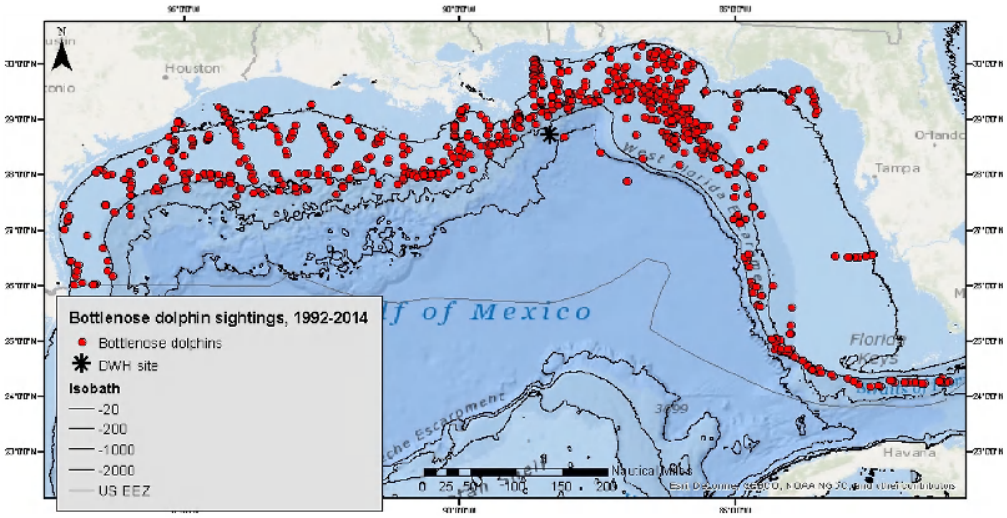
## 2.3 Continental Shelf Dolphins

Two species of dolphins inhabit the waters over the continental shelf (between the 20-m and 200-m isobaths and from Texas to Florida): the common bottlenose dolphin and the Atlantic spotted dolphin. The abundance estimates from NOAA in these areas are based on aerial surveys. However, it is difficult to reliably differentiate the two species from an airplane in these surveys. Thus, the DWH NRDA injury estimate estimated a combined number for these species; in terms of absolute lost cetacean years, this combined number was the second largest injury estimate (DWH NRDA Trustees, 2016).

### 2.3.1 Bottlenose Dolphins

Bottlenose dolphins inhabiting waters over the continental shelf have the same morphologic and genetic makeups similar to coastal and BSE bottlenose dolphins (although there is some overlap with dolphins of the offshore morphotype). Thus, the physical, behavioral, and life history parameters described in Section 2.1 are applicable to shelf bottlenose dolphins. There is a fairly uniform distribution throughout the northern GOM, but there is a slight concentration of shelf bottlenose dolphins on the shelf break at the Mississippi River delta and the shelf break/upper slope off the Florida Panhandle (Figure 3; Dias and Garrison, 2015).

**Figure 3. Sightings distribution of Bottlenose dolphins, 1992–2014.**




Source: Dias and Garrison, 2015.

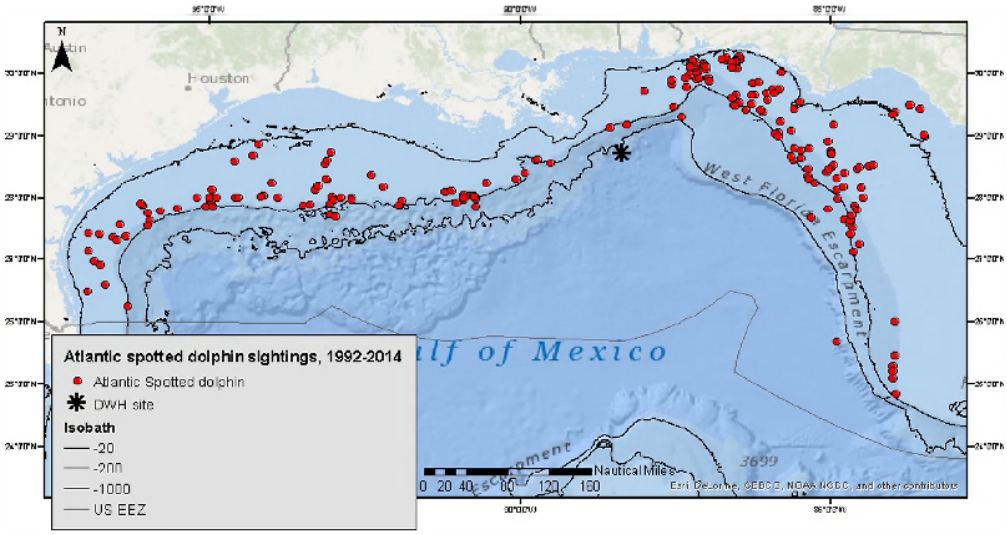
### 2.3.2 Atlantic Spotted Dolphins

| | |
|---|---|
| Latin name | *Stenella frontalis* |
| Average adult length | 1.6–2.3 m |
| Average adult weight | 100–143 kg |
| Average lifespan | < 23 years |
| Hearing frequency range[4] | 0.15–160 kHz |

Atlantic spotted dolphins are found year-round in the northern GOM, primarily over the continental shelf (Figure 4). They travel in groups averaging 18–23 animals. Most are born with a dark gray cape, lighter flanks, and a pale white underside without any spots, but become dark gray and heavily spotted by their first year. Atlantic spotted dolphins are relatively small and stocky compared to other dolphins. Generally, females reach sexual maturity between 8 and 15 years of age. Calving intervals range from 1 to 5 years. Atlantic spotted dolphins have a maximum age of about 23 years. They will eat a variety of prey, including squid and epipelagic/mesopelagic fishes. They often approach vessels to bowride. Atlantic spotted dolphins prefer tropical to warm waters found along the continental shelf of the Atlantic Ocean, and are typically found in waters 65–820 feet deep.

Atlantic spotted dolphin. Photograph taken under NOAA-SEFSC MMPA permit No. 779-1633.

**Figure 4. Sightings distribution of Atlantic spotted dolphins, 1992–2014.**




Source: Dias and Garrison, 2015.

## 2.4 Oceanic Stocks

There are 20 species of marine mammals in the northern GOM inhabiting oceanic waters (waters from beyond the 200-m isobaths to the extent of the U.S. Exclusive Economic Zone), from Texas to Florida (although many of these animals likely range beyond U.S. waters of the GOM). NOAA manages each of these species as a unique stock. For the purposes of this module, we describe four focal stocks: Risso's dolphins, beaked whales, sperm whales, and GOM Bryde's whales. For more information on the oceanic stocks not described here, see Dias and Garrison (2015), Rosel and Mullin (2015), the NMFS websites, and the Stock Assessment Reports.

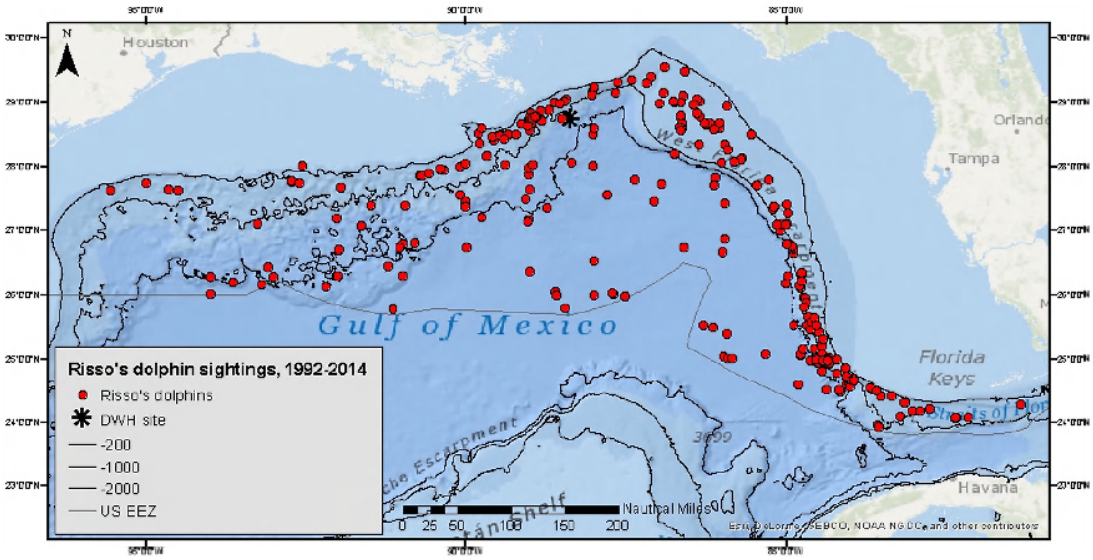
### 2.4.1 Risso's Dolphins

Risso's dolphins can be found throughout the northern GOM oceanic waters in all seasons, but tend to concentrate along the continental slope, especially near Mississippi Canyon and the Florida escarpment (Figure 5). In the northern GOM, they typically travel in groups up to 40 individuals.

| | |
|---|---|
| Latin name | *Grampus griseus* |
| Average adult length | 3.8–4 m |
| Average adult weight | 300–500 kg |
| Average lifespan | 35 years |
| Hearing frequency range[4] | 0.15–160 kHz |
| Mean bottom depth[7] | 714 m |

7. The mean bottom depth represents the average depth at each sighting location, but excludes sightings in water depths less than 100 m.

**Figure 5. Sightings distribution of Risso's dolphins, 1992–2014.**




Source: Dias and Garrison, 2015.

Risso's dolphins are the fifth largest member of the Delphinidae family of dolphins, with adults reaching up to 3.8–4 m in length. They have stocky, robust bodies tapering to a relatively narrow tailstock with a relatively small dorsal fin. They also have a blunt head without a pronounced beak. The coloration of Risso's dolphins changes as they age. They are generally dark gray on the back with whitish bellies, but as they age, their face, head, and the back in front of the dorsal fin fade to light gray. Even more strikingly, they tend to accumulate many light-colored scars, resulting in older adults that are much whiter in appearance than younger individuals (NOAA Fisheries, 2015e).

Risso's dolphins.
Photograph taken under NOAA-SEFSC MMPA permit No. 779-1633.

Although there is limited information available on their life history parameters, Risso's dolphins are believed to be sexually mature at 8–10 years of age for females and 10–12 years of age for males. Calving intervals are about 2.24 years, and they may live from 17 to 40 years. They feed almost exclusively on squid, likely at night (Rosel and Mullin, 2015).

### 2.4.2 Beaked Whales

Four species of beaked whales can be found in the GOM, including Cuvier's beaked whale (*Ziphius cavirostris*), Blainville's beaked whale (*Mesoplodon densirostris*), Gervais' beaked whale (*M. europaeus*), and Sowerby's beaked whale (*M. bidens*). However, NMFS considers Sowerby's beaked whales to be extralimital to the GOM because there is only one known stranding of the species (Bonde and O'Shea, 1989), and because they are normally found in northern temperate waters of the North Atlantic (Mead, 1989). For each of the beaked whale species, the GOM populations are provisionally being considered separate stocks for management purposes, although there is currently no information to differentiate each stock from the Atlantic Ocean stocks. Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

Gervais' beaked whale.
Photograph taken under
NOAA-SEFSC MMPA permit No. 779-1633.

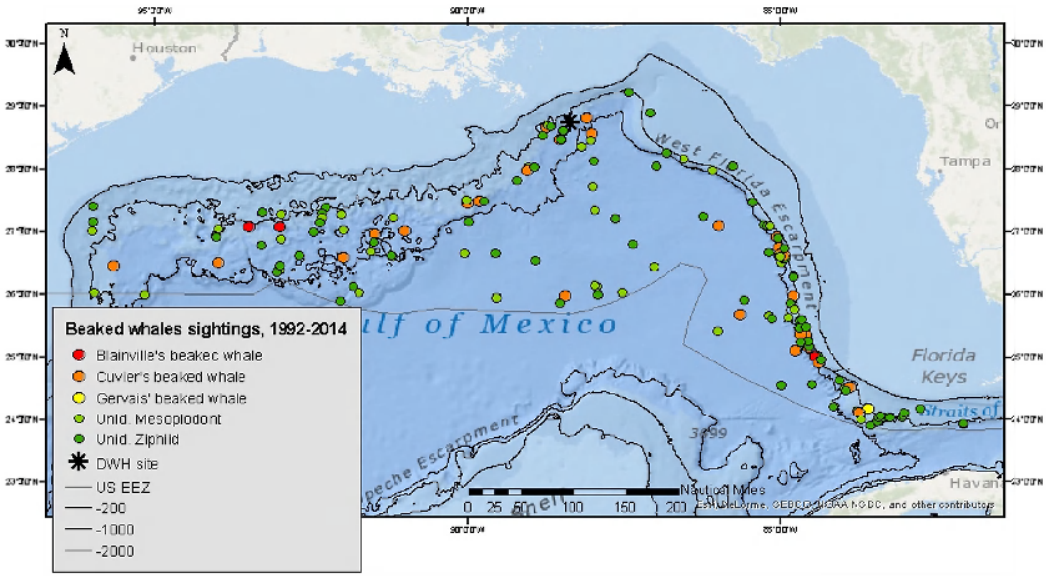
Beaked whales are the least well-known of all cetaceans. Many species of beaked whales (especially in the genus Mesoplodon) are difficult to distinguish from one another. At sea, they are both challenging to observe and difficult to identify to the species level due to their cryptic, skittish behavior; low profile; and small, inconspicuous blow at the water's surface. Therefore, much of the available knowledge about beaked whales is limited to the genus level. Because of these logistical difficulties, for the purposes of restoration planning (and consistent with the quantification of injury to beaked whales), we propose the more general label "beaked whales" as a "focal stock." Here, we provide information about beaked whales in general, then describe what is known about each species.

Beaked whales generally live in deep water far from land and are rarely seen. However, beaked whales were seen in all seasons during GulfCet aerial surveys of the northern GOM from 1992 to 1998 (Hansen et al., 1996; Mullin and Hoggard, 2000). Beaked whale sightings made during spring and summer vessel surveys have been widely distributed in waters > 500-m deep (Maze-Foley and Mullin, 2006; Figure 6).

| | Blainville's beaked whales | Cuvier's beaked whales | Gervais' beaked whales |
|---|---|---|---|
| Latin name | *Mesoplodon densirostris* | *Ziphius cavirostris* | *Mesoplodon europaeus* |
| Average adult length | 4.5–6 m | 4.5–7 m | 4.6–5.2 m |
| Average adult weight | 820–1,030 kg | 1,845–3,090 kg | 1,200 kg |
| Average lifespan | Unknown | 60 years | 27–48 years |
| Hearing frequency range[4] | 0.15–160 kHz | 0.15–160 kHz | 0.15–160 kHz |
| Mean bottom depth[7] | ~ 1,200 m | ~ 1,200 m | ~ 1,200 m |

Beaked whales in the GOM are deep divers. Regular dives range from 20 to 45 minutes, and commonly reach depths of at least 500–1,000 m, but dives of over 54 minutes and up to 1,400 m have been recorded (Jefferson et al., 2008). While diving, they use suction to feed on small fish, mysid shrimp, and cephalopods in deep water. Male beaked whales have large teeth that protrude from their mouths, which are believed to play a role in mating competition.

**Figure 6. Sightings distribution of beaked whales, 1992–2014.**




Source: Dias and Garrison, 2015.

### *2.4.2.1 Blainville's Beaked Whales*

Blainville's beaked whales occur in tropical to temperate waters worldwide. They are generally found in deep, offshore waters of the continental shelf. This species is often associated with steep underwater geologic structures such as banks, submarine canyons, seamounts, and continental slopes. Blainville's beaked whales have a relatively medium-sized, round body with a small, wide-based, slightly "falcate" dorsal fin located far down (about two-thirds) the animal's back. The whale's head has a low, sloping forehead and indistinct melon. Their coloration varies from dark gray to brownish and bluish. Individuals, especially mature males, accumulate scars and scratches with age. Blainville's beaked whales are usually found individually or in small social groups averaging between 3 and 7 individuals, but have been occasionally seen in larger groups of up to 12 animals. Blainville's beaked whales may reach sexual maturity at about 9 years of age (NOAA, 2012a; NOAA Fisheries, 2015b).

### *2.4.2.2 Cuvier's Beaked Whales*

Cuvier's beaked whales are distributed throughout the world's oceans except for the polar regions (Leatherwood and Reeves, 1983; Heyning, 1989). They prefer deep "pelagic" waters (usually greater than 1,000 m) of the continental slope and edge, as well as around steep underwater geologic features like banks, seamounts, and submarine canyons. Recent surveys suggest that beaked whales may favor oceanographic features such as currents, current boundaries, and core ring features. Cuvier's beaked whales have a robust, cigar-shaped body with a small falcate dorsal fin set about two-thirds back; the small flippers fit into a slight depression in the side of the body as with other beaked whales (Heyning and Mead, 2009). There is little definition between the head and the body, and the rostrum is very short and poorly defined (Heyning and Mead, 2009). Coloration is somewhat variable, but they are generally brownish to gray and have a white forehead and rostrum. These whales are typically found individually or in small groups of less than 5 animals, but groups of up to 25 animals have been reported (NOAA, 2012b; NOAA Fisheries, 2015c).

#### *2.4.2.3 Gervais' Beaked Whales*

Gervais' beaked whales appear to be widely but sparsely distributed in temperate and tropical waters of the world's oceans (Leatherwood et al., 1976; Leatherwood and Reeves, 1983). Gervais' beaked whales have a relatively small to medium-size body, with a moderately long beak and an indistinct sloping melon. They have a small, triangular, wide-based, slightly falcate, dorsal fin located far down (about two-thirds) the animal's back. The coloration of the body is dark gray or bluish to black with a paler ventral side. Gervais' beaked whales are usually found individually or in small closely associated social groups. Females may become sexually mature at 4.5 m (NOAA, 2012c; NOAA Fisheries, 2015d).

### 2.4.3 Sperm Whales

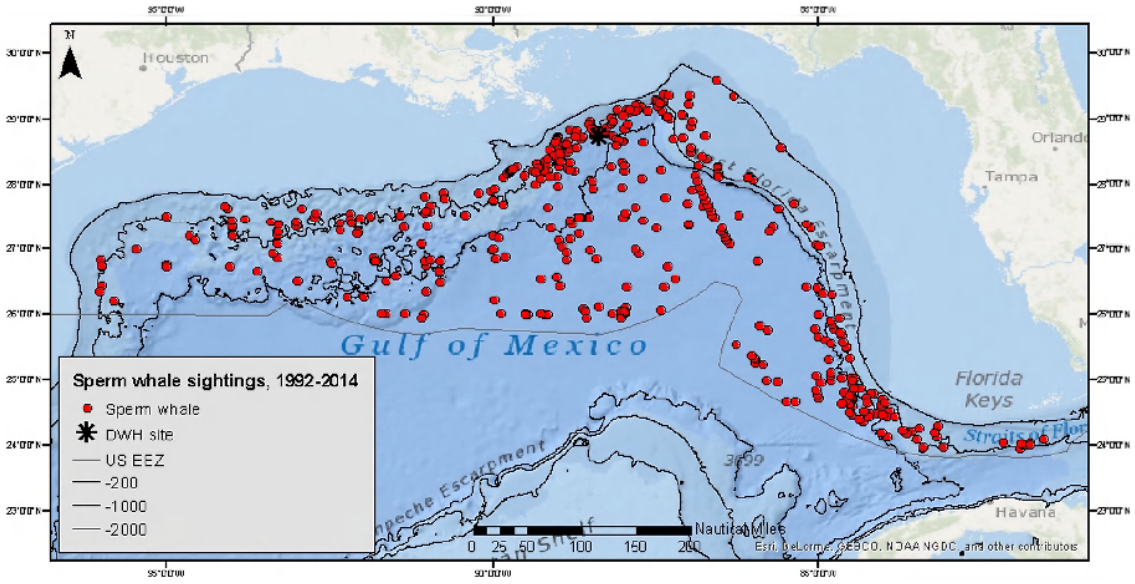
| | |
|---|---|
| Latin name | *Physeter macrocephalus* |
| Average adult length | 11–16 m |
| Average adult weight | 13,607–40,823 kg |
| Average lifespan | Unknown, mature at 30 (female) to 50 (male) years old |
| Hearing frequency range[4] | Low frequency |
| Mean bottom depth[7] | 1,000 m |

Sperm whales are found throughout the world's oceans in deep waters from the tropics to the edge of the ice at both poles, and are widely distributed in continental slope and oceanic waters of the GOM (Figure 7). The sperm whale was listed as endangered throughout its range on June 2, 1970 under the ESA of 1969 (35 FR 8495). Most females will form lasting bonds with other females of their family and, on average, 12 females and their young will form a family unit. Females generally stay with the same unit all their lives in and around tropical waters. Young males will leave their family units when they are between 4 and 21 years old and can be found in "bachelor schools," comprised of other males that are about the same age and size (NOAA Fisheries, 2017).

The sperm whale is distinguished by its extremely large head, which takes up to 25-35% of its total body length. GOM sperm whales are 1.5–2.0 m smaller, on average, compared to whales measured in other areas. Sperm whales are mostly dark gray, with paddle-shaped flippers that are small compared to the size of the body, and their flukes are very triangular in shape. They have small dorsal fins that are low, thick, and usually rounded (NOAA Fisheries, 2017).

Sperm whales.
Photograph taken under NOAA-SEFSC MMPA permit No. 779-1633.

**Figure 7. Sightings distribution of sperm whales, 1992–2014.**




Source: Dias and Garrison, 2015.

### 2.4.4 GOM Bryde's Whales

| | |
|---|---|
| Latin name | *Balaenoptera edeni* |
| Average adult length | 13–16.5 m |
| Average adult weight | 40,000 kg |
| Average lifespan | Unknown, mature at 8–13 years |
| Hearing frequency range[4] | 0.007–35 kHz |
| Mean bottom depth[7] | 226 m |

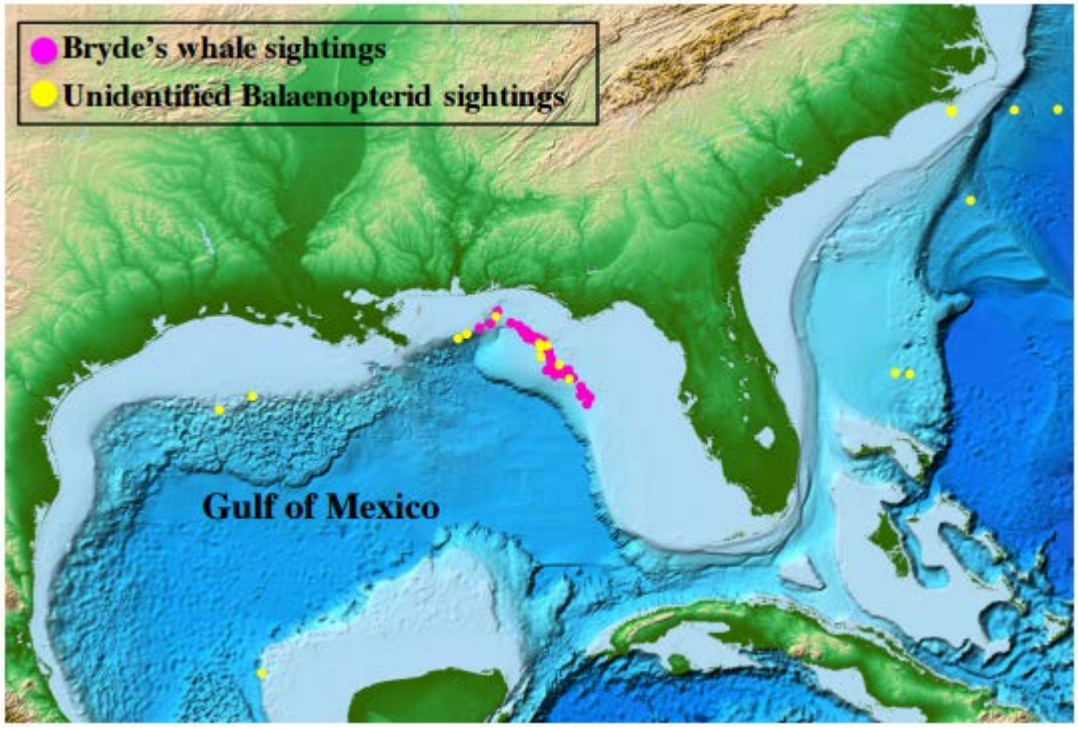
The Bryde's whale is a large baleen whale distributed worldwide in tropical and sub-tropical waters (Figure 8). The GOM Bryde's whale is genetically distinct from all other species of Bryde's whale worldwide, and they are considered a separate subspecies (Rosel et al., 2016). These whales inhabit a very narrow depth corridor along the De Soto Canyon shelf break in the northern GOM. Bryde's whales are designated as strategic under the MMPA, and NMFS recently issued a proposed rule to list this subspecies as endangered under the ESA (see 81 FR 88639, 2016).

GOM Bryde's whales are the only year-round resident baleen whale in the northern GOM. Although little is known about the GOM Bryde's whale, in general, Bryde's whale diets consist of plankton (e.g., krill, copepods), crustaceans (e.g., pelagic red crabs, shrimp), as well as schooling fish (e.g., anchovies, herring, mackerel, pilchards, sardines); and they feed by skimming the surface, lunging, or creating bubble nets and regularly dive for 5–15 minutes, reaching depths up to 300 m (Rosel and Mullin, 2015; NOAA, 2016a).

GOM Bryde's whale.
Photograph taken under NOAA-SEFSC MMPA permit No. 779-1633.

By some metrics, Bryde's whales were the oceanic stock most affected by the DWH oil spill: 48% of the population was impacted by DWH oil, resulting in an estimated 22% maximum decline in population size that will require 69 years to recover (DWH NRDA Trustees, 2016).

**Figure 8. Sightings of Bryde's whales and unidentified balaenopterid whales during NMFS shipboard and aerial surveys between 1989 and 2015 in the northern GOM and western North Atlantic, and one sighting in the southwestern GOM from Ortega-Ortiz (2002).** Basemap from NOAA National Centers for Environmental Information (NCEI).




Source: Rosel et al., 2016.

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# Module 3

**Overview of Related Activities – Marine Mammals**

# 1. Background

This module is intended to summarize available information on existing acts, programs, *Deepwater Horizon* (DWH*)* Natural Resource Damage Assessment (NRDA) early restoration projects, and other funding mechanisms related to the conservation, management, and/or restoration of northern Gulf of Mexico (GOM) marine mammals.[1] This module can be used to identify and leverage existing opportunities; incorporate inherent efficiencies; and evaluate potential cumulative benefits and project synergies. Further, it has the potential to limit project selection redundancy, promote wise stewardship of available resources, and promote the sharing of monitoring data among programs (DWH NRDA Trustees, 2016, pp. 5-379, and 7-16 to 7-17).

# 2. DWH NRDA Early Restoration

On the first anniversary of the DWH explosion, April 20, 2011, BP and the DWH Trustees signed a "Framework Agreement" for early restoration under the NRDA. The agreement provided a $1 billion down payment on restoration and required BP and the Trustees to work together to identify early restoration projects that would provide "meaningful benefits to accelerate restoration in the Gulf as quickly as practicable." The agreement also set out criteria for project design and selection.

As of January 2016, approximately $866 million and 68 projects were identified for early restoration in five phases. Although none of the early restoration projects focused specifically on restoration of marine mammals impacted by the oil spill, future activities under the comprehensive restoration planning, as described in the Programmatic Damage Assessment and Restoration Plan (PDARP), will address those impacts.

Source: http://www.gulfspillrestoration.noaa.gov/restoration/early-restoration/.

# 3. Existing Conservation, Management, and Monitoring Acts and Programs

## 3.1 Marine Mammal Protection Act

All marine mammals are protected under the Marine Mammal Protection Act of 1972 (MMPA). The MMPA was enacted in response to increasing concerns among scientists and the public that significant declines in some species of marine mammals were caused by human activities. The MMPA established a national policy to prevent marine mammal species and population stocks from declining beyond the point where they ceased to be significant functioning elements of the ecosystems of which they are a part. The MMPA

1. While the distribution of West Indian manatees overlaps with the DWH oil spill footprint, none were sighted in oil, and they are not considered in the DWH injury assessment nor this document. Thus, throughout this document, references to marine mammals are limited to cetaceans. However, manatees may benefit from the activities associated with the comprehensive marine mammal strandings responses and as part of unusual mortality event (UME) investigations, which may impact multiple species.

established a moratorium on the taking of marine mammals in U.S. waters. It defines “take” to mean “to hunt, harass, capture, molest, or kill” any marine mammal or attempt to do so. The MMPA prohibits, with certain exceptions, the “take” of marine mammals in U.S. waters and by U.S. citizens on the high seas. It defines “take” as “to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal” (16 U.S.C. 1362) and, as further defined by regulation (50 CFR 216.3), “to harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect, or kill any marine mammal.”

The Department of Commerce through the National Marine Fisheries Service (NMFS) is charged with protecting whales, dolphins, porpoises, seals, and sea lions in state and federal waters. Walrus, manatees, otters, and polar bears are protected by the Department of the Interior through the U.S. Fish and Wildlife Service (USFWS). The Animal and Plant Health Inspection Service, a part of the Department of Agriculture, is responsible for regulations managing marine mammals in captivity.

More information can be found at: http://www.nmfs.noaa.gov/pr/laws/mmpa/.

### 3.1.1 NMFS – Southeast Regional Office

The NMFS Southeast Regional Office (SERO), Protected Resources Division (PRD), is responsible for the conservation, protection, restoration, and recovery of marine mammals and endangered and threatened species in the Southeast United States. The PRD implements the MMPA and Endangered Species Act (ESA). Through policy, management, and outreach, the PRD strives to ensure the recovery, survival, and protection of marine mammals. PRD works in collaboration with the NMFS Science Centers and Office of Protected Resources, and other partners to implement these programs in the Southeast United States.

More information can be found at: http://sero.nmfs.noaa.gov/protected_resources/index.html.

### 3.1.2 NMFS – Southeast Fisheries Science Center

The Southeast Fisheries Science Center (SEFSC) Marine Mammal Program conducts research on marine mammals primarily in the western North Atlantic, the GOM, and the Caribbean. Major areas of study include abundance estimation, mortality estimation, genetics research, and health and stranding response. The SEFSC also works with SERO to implement the Marine Mammal Health and Stranding Response Program (MMHSRP) in the Southeast United States. Laboratory-based research focuses on molecular genetics to investigate population structure, species identification and health, passive acoustics, and stable isotope analysis. Field and laboratory studies are integrated to provide marine mammal stock assessments.

More information can be found at: https://www.sefsc.noaa.gov/species/mammals/ and https://www.sefsc.noaa.gov/labs/galveston.htm.

#### National Marine Fisheries Service Marine Mammal Stock Assessments

The MMPA requires that the NMFS and the USFWS develop Stock Assessment Reports for all marine mammal stocks that occur regularly in U.S. waters. These reports are based upon the best available scientific information and include information on the distribution, abundance, population trends, human-caused mortality, and the potential biological removal of each stock. Stock assessment reports are reviewed annually for strategic stocks and for stocks for which new information is available, and at least once every three years for all other stocks.

Source: http://www.nmfs.noaa.gov/pr/sars/.

#### Most Recent Marine Mammal Stock Assessments

- 2015 US Atlantic and GOM Marine Mammal Stock Assessments: http://www.nmfs.noaa.gov/pr/sars/pdf/atlantic2015_final.pdf

- 2015 Stock Assessment Summary Table: http://www.nmfs.noaa.gov/pr/sars/pdf/atl2015_summary_final.pdf.

**All Past Stock Assessments**

- http://www.nmfs.noaa.gov/pr/sars/region.htm.

### 3.1.3 Office of Protected Resources Permitted Research

The NMFS Office of Protected Resources authorizes take under the MMPA for certain activities. Among these are take (1) from directed, scientific research; (2) incidental to specified activities other than commercial fishing; and (3) incidental to commercial fisheries. A Scientific Research and/or Enhancement permit is required for any proposed research activity that involves "take," except for those activities covered by the General Authorization for activities involving only "Level B Harassment."[2] Any research involving an ESA-listed species also requires a permit.

A list of Scientific Research permits and General Authorizations issued to scientists for marine mammal-related research within the GOM may be found by searching the National Oceanic and Atmospheric Administration (NOAA) Fisheries Authorizations and Permits for Protected Species website at: https://apps.nmfs.noaa.gov/search/search.cfm.

A list of pending and completed incidental take authorizations (other than commercial fishing) can be found at: http://www.nmfs.noaa.gov/pr/permits/incidental/index.htm#review.

## 3.2 NOAA MMHSRP

The MMHSRP was formalized by amendments to the MMPA in 1992. The NOAA NMFS was designated as the lead agency to coordinate related activities. The MMHSRP's goals are to facilitate collection and dissemination of data; assess health trends in marine mammals; correlate health with available data on physical, chemical, environmental, and biological parameters; and coordinate effective responses to UMEs. "The program has the following components: stranding networks, responses/investigations of mortality events, biomonitoring, tissue/serum banking, and analytical quality assurance."

Source: http://www.nmfs.noaa.gov/pr/health/MMHSRP.html.

2. Level B Harassment has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering, but which does not have the potential to injure a marine mammal or marine mammal stock in the wild.

**Programs authorized to conduct strandings response in the GOM**

| Alabama | Florida | Florida (continued) |
|---|---|---|
| AL Marine Mammal Stranding Network | FL Fish and Wildlife Conservation Commission (FWC) Wildlife Alert Hotline | FWC Tallahassee |
| **Louisiana** | Central Panhandle Aquatic Preserve Office | Gulf Islands National Seashore |
| LA Department of Wildlife and Fisheries | Clearwater Marine Aquarium | Gulf World Marine Park |
| Audubon Aquarium of the Americas | Dolphin Conservation Field Station at Marineland | Harbor Branch Oceanographic Institute – FL Atlantic University |
| **Mississippi** | Emerald Coast Wildlife Refuge, Inc. | Hubbs-SeaWorld Research Institute |
| MS Marine Mammal Stranding Hotline | FL Aquarium | Marine Animal Rescue Society |
| Institute for Marine Mammal Studies | FL Marine Mammal Stranding Network – Southwest Region | Marine Mammal Conservancy, Inc. |
| Gulf Islands National Seashore | FWC, Florida Fish and Wildlife Research Institute (FWRI) Marine Mammal Pathobiology Laboratory (MMPL) | Mote Marine Laboratory |
| NMFS SEFSC Pascagoula Laboratory | FWC Northeast Field Laboratory | NMFS SEFSC Miami Laboratory |
| **Texas** | | NMFS SEFSC Panama City Laboratory |
| TX Marine Mammal Stranding Network Hotline | | Northwest FL Aquatic Preserves Office, FL Department of Environmental Protection (FDEP) |
| Aransas National Wildlife Refuge | | SeaWorld Orlando |
| TX State Aquarium | | Volusia County Stranding Network |

Source: http://www.nmfs.noaa.gov/pr/health/report.htm#southeast.

## 3.3 NMFS National Observer Program

The NMFS coordinates observer program management through its Office of Science and Technology/National Observer Program (NOP). NMFS deploys observers to collect catch and bycatch data from U.S. commercial fishing and processing vessels and annually monitor 47 different fisheries. NMFS has been utilizing observers to collect fisheries data from 1972 to the present and observers have monitored fishing activities on all U.S. Coasts collecting data for a range of conservation and management issues. Improvements in data collection, observer training, and the integration of observer data with other research are among the important issues that the NOP works to achieve on a national level.

Source: http://www.st.nmfs.noaa.gov/observer-home/#.

### Current Southeast Fisheries Observer Programs

- Pelagic Observer Program: http://www.sefsc.noaa.gov/fisheries/observers/pelagic.htm
- Shark Bottom Longline Observer Program: http://www.sefsc.noaa.gov/labs/panama/ob/bottomlineobserver.htm
- Southeast Gillnet Observer Program: http://www.sefsc.noaa.gov/labs/panama/ob/gillnet.htm
- GOM Reef and Shrimp Observer Program: http://www.galvestonlab.sefsc.noaa.gov/forms/observer/index.html
- Platform Removal Observer Program: http://www.galvestonlab.sefsc.noaa.gov/platforms/.

## 3.4 NOAA Animal Telemetry Network

“Animal telemetry is the science of elucidating the movements and behavior of animals as they move through the world’s oceans, coastal rivers, estuaries and great lakes. Animal telemetry devices (“tags”) yield detailed data regarding animal responses to the coupled ocean-atmosphere and physical environment through which they are moving. … Animals are particularly adept at helping scientists identify critical habitats, spawning locations, and important oceanographic features (e.g., fronts, eddies and upwelling areas). They also provide important insights into regions of the oceans that are difficult and expensive to monitor (e.g., offshore environments, Arctic).”

Source: https://ioos.noaa.gov/project/atn/.

#### Relevant Recently Funded Work

- GOM-wide Acoustic Array Network (GAAN).

Source: https://ioos.noaa.gov/project/atn/.

## 3.5 Bureau of Ocean Energy Management GOM Marine Assessment Program for Protected Species

"The GoMMAPPS study is a partnership program to improve information about protected species and provide a comprehensive assessment of marine mammal, marine turtle, and seabird abundance and spatial distribution in Gulf offshore waters. The program will conduct repeated, broad-scale surveys over multiple years and seasons using various methods, including aerial surveys, ship-based surveys, and tag telemetry work. GoMMAPPS will be moving from its first planning year in 2016 to the start of its field campaign during 2017–2019, as guided by a well-considered science framework required to collect this comprehensive dataset. Outreach and coordination are important aspects of GoMMAPPS."

Source: Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS) – Informational Meeting (http://www.cvent.com/events/2016-oil-spill-and-ecosystem-science-conference/custom-21-52ad0b225ba54cf0960090070e6f8073.aspx).

#### Other Relevant Information

- The Bureau of Ocean Energy Management (BOEM) Environmental Studies Plan, Studies Development Plan FYs 2017–2019 (https://www.boem.gov/SDP-2017-2019/).

## 3.6 BOEM Passive Acoustic Monitoring

"A high priority right now in the GOM is measurement of the ambient noise environment to understand potential impacts of noise-producing oil and gas activities on protected species. Thus, the following study is proposed for FY2016: Passive Acoustic Monitoring (PAM) Program for the northern Gulf of Mexico. This project will establish a long-term PAM program using moored acoustic recorders at permanent stations throughout the GOM. The program will establish a "baseline" for ambient noise in the GOM against which to judge potential future noise impacts from BOEM/BSEE (Bureau of Safety and Environmental Enforcement) activities as well as characterize the sound budget from other kinds of noise already occurring in the GOM (e.g., shipping). In addition, acoustic recorders will be able to detect vocalizing marine mammals, providing both spatial and temporal information about cetacean species in the GOM. A new study also proposed for FY2016 will continue to test the effectiveness of BOEM mitigations: Seismic Survey Mitigation Measures and Marine Mammal Observer Reports. This study will provide an update to a previous study which analyzed seismic survey observer reports from 2002 to 2008 and, based on the results of the analysis, will make recommendations as to the effectiveness of specific mitigation measures."

Source: BOEM Environmental Studies Plan, Studies Development Plan FYs 2017–2019 (https://www.boem.gov/FY-2016-2018-SDP/).

BOEM has awarded this proposal as of 2017.

## 3.7 U.S. Navy Marine Species Monitoring

"The Navy is responsible for compliance with a suite of Federal environmental laws and regulations that apply to marine mammals and other marine protected species, including the Endangered Species Act and the Marine Mammal Protection Act. As part of the regulatory compliance process associated with these Acts, the Navy is responsible for meeting specific requirements for monitoring and reporting on military

readiness activities involving active sonar and underwater detonations from explosives and explosive munitions."

Source: http://www.navymarinespeciesmonitoring.us/about/.

#### Relevant Recently Funded Work

- Bottlenose Dolphin Occurrence in Estuarine and Coastal Waters Near Panama City, Florida – "The goals of the proposed study are to determine abundance, habitat use, and distribution patterns of bottlenose dolphins in St. Andrew Bay and adjacent coastal waters in the Naval Surface Warfare Center, Panama City Division, over two seasons."

Source: http://www.navymarinespeciesmonitoring.us/reading-room/project-profiles/bottlenose-dolphin-occurrence-estuarine-and-coastal-waters-near-panama-city-florida/.

# 4. State Programs

## 4.1 Florida

The Florida FWC is responsible and has the authority for conserving and protecting Florida's wildlife and habitats, including conserving resident wildlife species that are endangered or threatened. FWC, NMFS, and USFWS operate under ESA cooperative agreements. FWC's division of habitat and species conservation collaborates extensively with local, state, and federal agencies to maintain diverse and healthy fish and wildlife populations, and to support their mission to ensure healthy populations of all native wildlife and their habitats on a statewide basis. FWC's research division (FWRI) is responsible for acquiring and distributing biological and ecological information critical for science-based management, conservation, and restoration. FWRI's Marine Mammal Research Program has diverse expertise. Program goals for cetaceans include carcass recovery, necropsy, and rescues. While most research staff are centrally located at FWRI headquarters and at the MMPL in St. Petersburg, there are field biologists located around the state in four regional field stations.

## 4.2 Louisiana

The Louisiana Department of Wildlife and Fisheries (LDWF) is the state agency responsible for management of the state's renewable natural resources, including all wildlife and all aquatic life. LDWF's Marine Mammal and Sea Turtle Stranding and Rescue Program was established in 2010. LDWF is the lead marine mammal and sea turtle stranding and rescue response organization in Louisiana, and is the first to respond to all live/dead marine mammal strandings in cooperation with the Southeast Regional Office Staff of NOAA, NMFS, and USFWS. LDWF has collaborative partnerships with other members of the Southeast stranding network as well as the National Marine Mammal Health and Stranding Response Program. Staff have worked with NOAA and other marine mammal experts to perform live dolphin health assessments, photo-identification surveys, reproductive outcomes surveys, and follow-up monitoring/tagging monitoring surveys. Response and rescue efforts are carried out by extensively trained core LDWF staff located across the coast of Louisiana.

## 4.3 Mississippi

The Mississippi Marine Mammal Stranding network is cooperatively operated by the Mississippi Department of Marine Resources (DMR) as well as the Institute of Marine Mammal Studies (IMMS), in coordination with NOAA's NMFS. Both organizations work in a coordinated fashion with NOAA in responding to any marine mammal stranding-related activities. The goal of the partnership is to enhance the state's ability to appropriately respond to any marine mammal strandings. IMMS, DMR, and Mississippi State University – College of Veterinary Medicine are currently funded through a grant from the National

Fish and Wildlife Foundation (NFWF) to enhance stranding network capacity, as well as the quality and quantity of data acquisition associated with strandings. The core mission of this partnership is to enhance our response to marine mammal strandings, capture higher quality data to understand causes of mortality, and to establish a strong state and federal partnership concerning marine mammal health in designated state waters.

### 4.4 Alabama

The Alabama Marine Mammal Stranding Network (ALMMSN) is a cooperative regional stranding network partner, which works with NOAA's NMFS to respond to dolphin and whale strandings in Alabama. The mission of the ALMMSN is to enhance stranding reporting and response; collect consistent, high quality stranding data; provide long-term data sharing, storage and retrieval capacity; and expand community awareness and public education about marine mammals in Alabama. ALMMSN provides aid to the Florida Fish and Wildlife Conservation Commission in the Florida Panhandle when needed. ALMMSN is a nonprofit organization currently funded by a grant from the NFWF to establish and enhance a regional stranding collaboration among the Dauphin Island Sea Lab's Manatee Sighting Network, the Alabama Department of Conservation and Natural Resources (ADCNR), NMFS, USFWS, and other local regional partners. The ALMMSN plays a critical role in understanding key causes of marine mammal morbidity and mortality, and in the early detection and mitigation of anthropogenic or natural threats to marine mammals.

## 5. Funding Opportunities Related to the DWH Oil Spill

### 5.1 John H. Prescott Marine Mammal Rescue Assistance Grant Program

The John H. Prescott Marine Mammal Rescue Assistance Grant Program is administered by NOAA to provide federal assistance to eligible members of the National Marine Mammal Stranding Network to (1) support basic needs of organizations for response, treatment, and data collection from living and dead stranded marine mammals; (2) fund scientific research objectives designed to answer questions about marine mammal strandings, health, or rehabilitation techniques utilizing data from living and dead stranded marine mammals; and (3) support facility operations directly related to the recovery, treatment, and data collection from living and dead stranded marine mammals.

Source: http://www.nmfs.noaa.gov/pr/health/prescott/.

#### 2017 GOM Proposals under Consideration

- MESC/Dauphin Island Sea Lab – Personnel Support for the Alabama Marine Mammal Stranding Network
- Florida Fish & Wildlife Conservation Commission – Level 1 and Level 2 Necropsy Training for Increasing Quality of Level A, B, and C Data Collection by the Southeast Cetacean Stranding Network
- Florida Fish & Wildlife Conservation Commission – Florida Marine Mammal Stranding Network Coordination, Response, and Sample Analyses in Southwest Florida
- Mote Marine Laboratory – Enhanced Capacity for Ultrasound Imaging and Continued High-Level Response, Recovery, and Analyses of Stranded Cetaceans in Southwest Florida
- The Florida Institute of Technology – Multi-Regional HAB Toxin Diagnostics for the Marine Mammal Stranding Network
- Audubon Nature Institute, Inc. – Coastal Wildlife Network: Enhancement of Rehabilitation Facility and Continuation of the Stranding and Rescue Program
- Louisiana Department of Wildlife and Fisheries – Marine Mammal Stranding Response, Rescue and Recovery; Maintaining and Enhancing Efforts Along Louisiana's Coast

- Institute for Marine Mammal Studies, Inc. – Stranding Response and Data and Tissue Collection in Mississippi to Support the Unusual Mortality Event and DWH Oil Spill Investigations in the Northern Gulf of Mexico
- Texas Marine Mammal Stranding Network (TMMSN) – Support for Live and Dead Marine Mammal Response, Rehabilitation and Data Collection along the Texas Coast.

Source: http://www.nmfs.noaa.gov/pr/health/prescott/received2017.html.

#### 2016 Funded GOM Grant Proposals

- Mote Marine Laboratory – Enhanced Capacity for Live Animal Response and Transport, and Continued High-Level Response, Recovery, and Analyses of Stranded Cetaceans in Southwest Florida
- The Florida Institute of Technology – Multi-Regional HAB Toxin Diagnostics for the Marine Mammal Stranding Network
- Louisiana Department of Wildlife and Fisheries – Maintaining and Enhancing Marine Mammal Stranding Response, Rescue and Recovery Along the Louisiana Coast
- Institute for Marine Mammal Studies, Inc. – Conduct Marine Mammal Stranding Response in Mississippi to Continue Data and Tissue Collection, Live Animal Rehabilitation, and Coverage of the Coastline and Barrier Islands
- TMMSN – Provision for Heightened Response and Analysis of Stranding Events Conducted by the TMMSN Rehabilitation and Research Program along the Texas Coast.

Source: http://www.nmfs.noaa.gov/pr/health/prescott/2016funded.html.

#### 2015 Funded GOM Grant Proposals

- Florida Fish & Wildlife Conservation Commission – Level 1 and Level 2 Necropsy Training for Increasing Quality of Level A, B, and C Data Collection by the Southeast Cetacean Stranding Network
- Mote Marine Laboratory – Mass Stranding Capacity Building for Equipment and Training, and Rapid Detection, Response and Recovery of Stranded Cetaceans in Southwest Florida
- The Florida Institute of Technology – Multi-Regional HAB Toxin Diagnostics for the Marine Mammal Stranding Network
- Louisiana Department of Wildlife and Fisheries – Marine Mammal Stranding Response, Rescue and Recovery; Enhancing Operations, Rapid Response, and Sample Collection Along the Louisiana Coast
- TMMSN – Support of the TMMSN Rehabilitation and Research Program for Enhanced Investigation of Stranding Events along the Texas Coast.

Source: http://www.nmfs.noaa.gov/pr/health/prescott/2015funded.html.

#### 2014 Funded GOM Grant Proposals

- Florida Fish & Wildlife Conservation Commission – Northeast Florida Marine Mammal Stranding Network Response Enhancement
- Florida FWC – Florida Marine Mammal Stranding Network Coordination and Response in Southwest Florida
- Mote Marine Laboratory – Rapid Detection, Response, Upgraded Radiograph Capabilities, and Disentanglement Efforts for Stranded Cetaceans in Central West Florida
- Audubon Nature Institute, Inc./Audubon Commission – Louisiana Marine Mammal and Sea Turtle Rescue Program (LMMSTRP): Continued Operations and Response for Live and Dead Marine Mammal Strandings
- Louisiana Department of Wildlife and Fisheries – Enhanced Operations and Rapid Response for Marine Mammal Strandings and Rescues along the Louisiana Coast

- TMMSN – Support for Basic Operational Needs of the TMMSN for the Recovery and Investigation of Live and Deceased Marine Mammal Strandings.

Source: http://www.nmfs.noaa.gov/pr/health/prescott/2014funded.html.

#### 2013 Funded GOM Grant Proposals

- TMMSN – Support for Operational and Enhancement Needs of the TMMSN for the Recovery and Investigation of Live and Decease Marine Mammal Strandings.

Source: http://www.nmfs.noaa.gov/pr/health/prescott/2013funded.html.

## 5.2 Marine Mammal Commission

In 1972, the MMPA established the Marine Mammal Commission to provide independent oversight of the marine mammal conservation policies and programs being carried out by federal regulatory agencies. The commission carries out a small grant program that supports projects aimed at meeting the conservation and protection goals of the MMPA. The Commission's Research Program includes all relevant activities, including basic and applied research, workshops, literature reviews, compilations of expert opinion, and drafting manuscripts or reports. The Research Program is administered by the Commission's Scientific Program staff in consultation with the Commissioners and the Committee of Scientific Advisors on Marine Mammals.

Source: https://www.mmc.gov/about-the-commission/.

#### Relevant Recently Funded Work

- Investigating Factors for Unusual Dolphin Mortalities on the U.S. Atlantic Coast: Focus on the Immune System. Year funded: 2015.
- Assessment of the Cumulative Effects of Anthropogenic Stressors on Marine Mammals. Year funded: 2015.
- Fifteen Years Later – An Updated Evaluation of the Impacts and Evolution of Marine Mammal Tourism with a Focus on Human-Dolphin Interactions in Panama City, Florida. Year funded: 2014.
- "Whale Alert" App on Android Platform and Shipping Industry Stewardship. Year funded: 2013.

Source: https://www.mmc.gov/grants-and-research-survey/grant-awards/.

## 5.3 The National Academies of Science Gulf Research Program

"Over its 30-year duration, the Gulf Research Program works to enhance oil system safety and the protection of human health and the environment in the Gulf of Mexico and other U.S. outer continental shelf areas by seeking to improve understanding of the region's interconnecting human, environmental, and energy systems; and fostering application of these insights to benefit Gulf communities, ecosystems, and the Nation."

Source: http://www.nationalacademies.org/gulf/index.html.

#### Published Reports

The National Academies of Science also published two reports that are relevant to northern GOM marine mammals:

- Approaches to Understanding the Cumulative Effects of Stressors on Marine Mammals (https://www.nap.edu/catalog/23479/approaches-to-understanding-the-cumulative-effects-of-stressors-on-marine-mammals)

- Effective Monitoring to Evaluate Ecological Restoration in the Gulf of Mexico (https://www.nap.edu/catalog/23476/effective-monitoring-to-evaluate-ecological-restoration-in-the-gulf-of-mexico).

**Relevant Recently Funded Work**

- Integrating Visual and Acoustic Data on Cetacean Abundance and Habitat in Gulf of Mexico Deep Water – led by J. Hildebrand, Scripps Institution of Oceanography. "Protected species in the deep ocean, such as dolphins and whales, require monitoring for management and conservation purposes. In response to the need for improved monitoring, the project team will integrate temporally rich acoustic survey data and spatially rich visual survey data of whales and dolphins from the Gulf of Mexico and develop habitat models. These models could inform the development of new conservation and management strategies – particularly after events such as the *Deepwater Horizon* oil spill." Funding level: $451,000. Years funded: 2015–2017.

Source: http://www.nationalacademies.org/gulf/grants/index.html.

## 5.4 NFWF Gulf Environmental Benefit Fund

"In early 2013, a U.S. District Court approved two plea agreements resolving certain criminal cases against BP and Transocean that arose from the 2010 Deepwater Horizon explosion and oil spill. The agreements direct a total of $2.544 billion to the National Fish and Wildlife Foundation (NFWF) to fund projects benefiting the natural resources of the Gulf Coast that were impacted by the spill. Between 2013 and 2018, NFWF's newly established Gulf Environmental Benefit Fund (GEBF) will receive a total of $1.272 billion for barrier island and river diversion projects in Louisiana; $356 million each for natural resource projects in Alabama, Florida, and Mississippi; and $203 million for similar projects in Texas. Now in its third year, the GEBF has supported 75 projects worth nearly $500 million. In making the awards, NFWF has worked closely with key state and federal resource agencies to select projects that remedy harm and eliminate or reduce the risk of future harm to Gulf Coast natural resources."

Source: http://www.nfwf.org/gulf/Pages/home.aspx.

**Relevant Recently Funded Work**

- Alabama Marine Mammal Conservation and Recovery Program – led by R. Carmichael, Dauphin Island Sea Lab. "This project seeks to increase the response and research capacity within the Alabama Marine Mammal Stranding Network (ALMMSN)." Funding level: $1,281,600. Years funded: 2014–2019.
- Increased Capacity for Marine Mammal Response and Analysis: Florida – led by J. Litz, NMFS SEFSC. "This project will improve capacity and data collection efforts for the Florida Fish and Wildlife Conservation Commission's marine mammal field stations as well as 8 marine mammal stranding response and research organizations working in the Gulf." Funding level: $4,400,000. Years funded: 2015–2020.
- Increased Capacity for Marine Mammal Response and Analysis: Gulf of Mexico Marine Mammal Stranding Database – Data Diplomat – led by J. Litz, NMFS SEFSC. "The Gulf of Mexico data diplomat hired through this grant will work closely with NOAA's MMHSRP and stranding network participants, particularly Gulf Environmental Benefit Fund (GEBF) grantees, to ensure consistency and accuracy of data collected from stranded marine mammals in the Gulf of Mexico." Funding level: $200,000. Years funded: 2015–2017.
- Marine Mammal and Sea Turtle Conservation, Recovery, and Monitoring Program – Phase I – Mississippi Department of Environmental Quality. "This five-year project will engage state and federal agencies, academic institutions and conservation organizations to bolster the capacity of Mississippi's

marine mammal and sea turtle stranding network." Funding level: $9,933,900. Years funded: 2016–2020.

Source: http://www.nfwf.org/gulf/Pages/gulf-projects.aspx.

## 5.5 NFWF Gulf Response Grants

"From 2010 to 2012, NFWF invested $22.9 million in conservation actions in the Gulf of Mexico to minimize the effects of the *Deepwater Horizon* oil spill on key fish and wildlife species. Our projects focused on the species most at risk, including shorebirds, waterfowl and marsh birds; seabirds; sea turtles; marine mammals, oysters, and others. They are designed to boost these populations outside the direct spill zone and promote their long-term survival. Strategic investments were funded through the Recovered Oil Fund for Wildlife and other sources."

Source: http://www.nfwf.org/gulf/Pages/projectlist.aspx.

#### Relevant Recently Funded Work

- **Cooperative Marine Mammal Stranding Network for Alabama – Dauphin Island Sea Lab.** "To increase capacity for improved stranding response for marine mammals" Funding Source: NFWF Recovered Oil Fund for Wildlife. Funding level: $148,563. Years funded: 2010–2012.
- **Enhancing Necropsy Capacity for Unusual Mortality Events (LA): Coastal Estuaries, Bays, and Beaches – Audubon Nature Institute, Inc.** "This project will enhance capabilities to respond to Unusual Mortality Events through increased staff time for necropsies and related efforts." Funding source: NOAA. Funding level: $19,500. Years funded: 2010–2012.

Source: http://www.nfwf.org/gulf/Pages/projectlist.aspx.

## 5.6 Mississippi-Alabama Sea Grant Consortium and the NMFS

"The National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries Service) in partnership with the Mississippi-Alabama Sea Grant Consortium (MASGC) has awarded two grants in support of bottlenose dolphin conservation and marine mammal stranding response in the Gulf of Mexico and Southern Atlantic regions."

Source: http://masgc.org/news/article/noaa-fisheries-service-masgc-award-grants-for-marine-mammal-research-app-de.

#### Relevant Recently Funded Work

- Development of Marine Mammal Stranding and Identification/Viewing Smartphone Apps for the Southeast Region – Geo-Marine, Inc. and Applied Research Associates. "The GMI/ARA team will strive to promote protected species conservation by developing and disseminating smartphone apps to enhance accurate and timely reporting of strandings and encourage responsible viewing of marine mammals in the Southeast U.S." The apps are now complete and can be found here: http://sero.nmfs.noaa.gov/protected_resources/outreach_and_education/mm_apps/. Funding level: $39,979. Years funded: 2012–2014.
- Determining the Factors Contributing to Human-Dolphin Interactions in a Long-Term Resident Inshore Bottlenose Dolphin Community – Chicago Zoological Society. "We propose to utilize the long-term 'natural laboratory' in Sarasota Bay, Florida, to conduct a pilot research project on HI within a multi-generational resident inshore bottlenose dolphin community." Funding level: $110,988. Years funded: 2012–2015.
- Testing Tackle Modifications and Fish Descender Tools for Reducing Dolphin Depredation and Scavenging of Sport Fish – Emerald Coast Wildlife Refuge and Mote Marine Lab. The project team

"will test mitigation devices to see if they deter dolphins from depredating on rod and reel fishing gear or from scavenging discarded fish." Funding level: $67,000. Years funded: 2014–2016.

Source: http://seagrant.noaa.gov/whatwedo/regionalinitiatives/regionalprojects.aspx.

## 5.7 RESTORE Council

"The RESTORE Act establishes the Council as an independent entity in the federal government. The council is charged with helping to restore the ecosystem and economy of the Gulf Coast region by developing and overseeing implementation of a comprehensive plan and carrying out other responsibilities. The council is chaired by the Secretary of the U.S. Department of Commerce and includes the Governors of the States of Alabama, Florida, Louisiana, Mississippi, and Texas; the Secretaries of the U.S. Departments of Agriculture, Army, Homeland Security, and the Interior; and the Administrator of the U.S. Environmental Protection Agency.

The council has responsibilities with respect to 60 percent of the funds made available from the Gulf Restoration Trust Fund. Thirty percent of the Trust Fund, plus interest, will be administered for ecosystem restoration and protection by the council (known as the Council-Selected Restoration Component). The other 30 percent of the Trust Fund will be allocated to the Gulf Coast States under a formula described in the RESTORE Act and spent according to individual State Expenditure Plans (Spill Impact Component). The state Expenditure Plans must be consistent with the goals and objectives of the Initial Comprehensive Plan and are subject to the Council's approval."

Source: https://www.restorethegulf.gov/our-work.

#### Other Relevant Information

- The RESTORE Council funds a broad range of projects. Individual project details are provided in the Final Funded Priorities List (FPL), available online (https://restorethegulf.gov/council-selected-restoration-component/funded-priorities-list). None of the projects listed on the Final FPL to date have directly focused on restoration of marine mammals impacted by the oil spill.
- One of the RESTORE Council's primary responsibilities is to develop a Comprehensive Plan to restore the ecosystem and the economy of the Gulf Coast region. The council approved the Initial Comprehensive Plan in August 2013, and a Comprehensive Plan Update in December 2016.

## 5.8 NOAA RESTORE Act Science Program

"The research portfolio for the NOAA RESTORE Act Science Program currently contains seven projects funded through the Science Program's first Federal Funding Opportunity (FFO-2015). These projects were selected following a rigorous and highly competitive process which included a review by a panel of outside experts. In total, approximately $2.7 million has been awarded to seven research teams. Each of the research teams will be addressing one or more of the Science Program's short-term priorities which focus on assessing ecosystem modeling, evaluating indicators for ecosystem conditions, and assessing and developing recommendations for monitoring and observing in the Gulf of Mexico. These projects will synthesize current scientific understanding and management needs and inform the future direction of the NOAA RESTORE Act Science Program as well as the other science and restoration initiatives in the region. The results from these projects will also inform the development of management strategies to support the sustainability of the Gulf of Mexico ecosystem, including its fisheries."

Source: https://restoreactscienceprogram.noaa.gov/research.

## 5.9 GOM Research Initiative

In May 2010, BP committed $500 million over a 10-year period to investigate the impacts of the spill on the Gulf ecosystem and affected states. The funds were used to create the Gulf of Mexico Research Initiative (GOMRI) – a broadly focused, independent research program to be conducted primarily by Gulf research institutions. GOMRI is overseen by a board of scientists selected by BP and the governors of the five Gulf states. Funding is awarded on a competitive basis and all data collected by grant recipients are to be made publicly available on the Gulf of Mexico Research Initiative Information and Data Cooperative (GRIIDC) website.

Source: https://www.mmc.gov/priority-topics/offshore-energy-development-and-marine-mammals/gulf-of-mexico-deepwater-horizon-oil-spill-and-marine-mammals/.

The GOMRI investigates the impacts of oil, dispersed oil, and dispersant on the ecosystems of the GOM and affected coastal states in a broad context of improving fundamental understanding of the dynamics of such events and their environmental stresses and public health implications. GOMRI also has the objective to develop improved spill mitigation, oil and gas detection, characterization, and remediation technologies.

The ultimate goal of GOMRI will be to improve society's ability to understand, respond to, and mitigate the impacts of petroleum pollution and related stressors of marine and coastal ecosystems, with an emphasis on conditions found in the GOM. Knowledge accrued will be applied to restoration and to improving the long-term environmental health of the GOM.

Source: http://gulfresearchinitiative.org/.

#### Relevant Recently Funded Work

- Center for Integrated Modeling and Analysis of Gulf Ecosystems (C-IMAGE I and C-IMAGE II), Task 4: Environmental Impacts on Marine Mammals (as identified by PAM) – led by S. Murawski, University of South Florida, in collaboration with J. Hildebrand and K. Frasier, Scripps Institution of Oceanography. "The overarching objective of C-IMAGE II is: to advance understanding of the processes and mechanisms involved in marine blowouts and their environmental consequences. … C-IMAGE researchers will conduct studies in six Tasks: (1) near-to-far field modeling, (2) high-pressure experimentation, (3) sedimentation of oil and its impacts, (4) impacts on the abundance, contamination and population dynamics of fishes and marine mammals, (5) toxicology studies, and (6) ecosystem modeling." Funding level: $31,249,000. Years funded: 2011–2017.
- Impacts of the 2010 *Deepwater Horizon* Oil Spill on Estuarine Bottlenose Dolphin Populations in the West Florida Panhandle – led by G. Worthy, University of Central Florida. "We have initiated a comprehensive assessment of the current status of bottlenose dolphin communities in Pensacola Bay, Santa Rosa Sound and Choctawhatchee Bay and have begun to assess the potential impact of the DWH oil spill on their distribution, habitat use, and feeding habits." Funding level: $204,386. Years funded: 2010–2012.
- The Littoral Acoustic Demonstration Center – Gulf Ecological Monitoring and Modeling – led by N. Sidorovskaia, University of Louisiana. "This multidisciplinary consortium effort, which uses expertise from marine acoustics, biology, physics, engineering, mathematics, and computational predictive modeling, will equip scientists with an understanding of how the regional marine mammal population in the Northern Gulf of Mexico (GoM) has been affected by the 2010 *Deepwater Horizon* (DWH) oil spill." Funding level: $5,238,170. Years funded: 2015–2017.
- Investigation of Mechanisms for Reproductive Failure in the Aftermath of the *Deepwater Horizon* Oil Spill to Understand Population Recovery Scenarios for Cetaceans – led by C.R. Smith, National Marine Mammal Foundation. "The overall goal of this project will be to investigate direct and indirect factors involved in the reproductive impairment observed in bottlenose dolphins following the DWH oil spill in

order to better understand the process for population recovery." Funding level: $2,460,920. Years funded: 2016–2018.

- Using Embryonic Stem Cell (ESC) Fate to Determine Potential Adverse Effects of Petroleum/Dispersant Exposure – led by Demetri D. Spyropoulos, Medical University of South Carolina, Marine Biomedicine and Environmental Sciences. "This project will establish an in vitro test for the influences of oil/dispersed oil and breakdown products on long-term health; guiding safer, more effective oil spill contingency plans. For this, the research team has developed novel pig and phylogenetically linked pygmy sperm whale (PSW) iPSCs and mouse ESCs that can serve as high-throughput models to complement conventional in vivo animal models to test oil/dispersant exposure during development." Funding level: $1,148,710. Years funded: 2013–2015.

Source: http://research.gulfresearchinitiative.org/research-search/research-searchtool.php.

## 5.10 GOM Alliance

"The Gulf of Mexico Alliance was established in 2004 by the Gulf State Governors in response to the President's Ocean Action Plan. It was a State-led network of partners working together on projects related to the priority issues identified by the Governors in early discussions. Strongly supported by the White House's Council on Environmental Quality, 13 Federal agencies led by EPA and NOAA, were identified to work with and support the young effort."

"Today, the Gulf of Mexico Alliance is actively addressing the region's Priority Issues as well as managing a large-scale oil spill research program [GOMRI]."

Source: http://www.gulfofmexicoalliance.org/about-us/goma-history/.

#### Other Relevant Information

- The Gulf of Mexico Alliance (GOMA) has developed the *Deepwater Horizon* Project Tracker as a tool to track restoration, research, and recovery projects resulting from the DWH oil spill. We have included any directly marine mammal-related project found in the Project Tracker in the other sections of this module.

# References

DWH NRDA Trustees. 2016. *Deepwater Horizon* Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. *Deepwater Horizon* Natural Resource Damage Assessment Trustees. Available: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan.

# Module 4
## Considerations for Restoration – Marine Mammals

# 1. Introduction

The purpose of Module 4 is to discuss how the proposed restoration techniques would address key threats to marine mammals. The Trustee Implementation Groups (TIGs) can use this information in their consideration and selection of specific projects based on an appropriate technical, sequencing, and coordinated context across the larger Gulf of Mexico (GOM) *Deepwater Horizon* (DWH) restoration planning efforts. Where applicable, the planning included in this strategic framework for marine mammals would be coordinated with existing entities charged with protecting whales and dolphins, such as the appropriate National Oceanic and Atmospheric Administration (NOAA) Fisheries offices.

This strategic framework may be updated based on additional knowledge obtained by the DWH Natural Resource Damage Assessment (NRDA) Trustee efforts or the broader science community, and based on any updates to relevant species recovery or management plans prepared under other statutes.

## 1.1 How to Use this Module

For the purposes of considering restoration activities to benefit GOM marine mammals, we arranged this module by the restoration approaches outlined in the Programmatic Damage Assessment and Restoration Plan and Programmatic Environmental Impact Statement (PDARP/PEIS) and presented in Module 1. Under each restoration approach in Section 2, we describe potential restoration techniques with unique objectives. For each technique, we describe a set of suggested phases that could be used to design a generic project concept to meet each objective. Not all project concepts need to start at Phase 1 of the general strategy if there is sufficient existing information to inform later phases. To complement the general strategy, we provide examples of potential project concepts that could be pursued by the TIGs. It is critical for each restoration project to include carefully chosen project-specific monitoring metrics. We have provided examples of potential project-level monitoring metrics under each technique, but a more general discussion on the selection and integration of appropriate metrics into projects is included in Section 3. Section 3 also provides information on resource-level monitoring that will inform restoration planning, implementation, and evaluation.

This module is not intended to exhaustively present all possible restoration techniques and project concepts, nor to prescriptively describe the complete restoration plan for marine mammals across all TIGs. This module provides relevant information for the Trustees and other stakeholders, including the public, to consider when evaluating and planning marine mammal restoration projects. Readers are encouraged to submit restoration projects to the Trustee Project Portal or to state-specific project portals, as available.

Bottlenose dolphin. Photograph taken under NOAA-SEFSC MMPA permit No. 779-1633.

# 2. Restoration Activities for Marine Mammals

The restoration activities described in this module will support resilient marine mammal populations,[1] reduce further harm or impacts, and complement existing management priorities. To most effectively address the extent of injuries to marine mammals, the Trustees plan to implement a portfolio of several approaches to allow populations to recover more quickly and reduce further harm from acute and chronic injuries sustained by the DWH incident. The restoration approaches described here are based on existing management activities established under the Marine Mammal Protection Act (MMPA), Endangered Species Act (ESA), and priorities for marine mammal conservation. These approaches are also consistent with the goals (see box) and approaches described in the PDARP/PEIS.

DWH marine mammal restoration goals

- Implement an integrated portfolio of restoration approaches to restore injured bay, sound, and estuarine (BSE); coastal; shelf; and oceanic marine mammals across the diverse habitats and geographic ranges they occupy.
- Identify and implement restoration activities that mitigate key stressors in order to support resilient populations.
- Collect and use monitoring information, such as population and health assessments, and spatiotemporal distribution information.
- Identify and implement actions that support ecological needs of the stocks; improve resilience to natural stressors; and address direct human-caused threats such as bycatch in commercial fisheries, vessel collisions, noise, industrial activities, illegal feeding and harassment, and hook-and-line fishery interactions.

The restoration portfolio for marine mammals will also include robust monitoring and scientific support for an adaptive management approach to restoration planning and implementation. Monitoring and adaptive management (MAM) are important for the restoration of marine mammals because of limited experience implementing restoration at this scale and the limited scientific data on impacts for these species. As demonstrated in the early phases of each general strategy, a strong emphasis on data collection and monitoring for marine mammals will inform the public and Trustees on the state of the resource for planning purposes, and will iteratively drive restoration toward effective projects and subsequent recovery from injuries associated with the DWH incident. The Trustees continue to develop protocols and techniques to ensure that MAM are incorporated effectively throughout all restoration activities.

## 2.1 Restoration Approaches

There are currently eight restoration approaches for marine mammals, which are described fully in the PDARP/PEIS (Appendix 5.D) and briefly summarized below:

- **Reduce commercial fishery bycatch through collaborative partnerships**

Bycatch in commercial fishing gear is a leading source of mortality among marine mammals worldwide and one of the main human-caused threats identified for bottlenose dolphins in the GOM. There are several data limitations and potential biases based on inadequate knowledge of both the fishery and marine mammal stocks, particularly in inshore waters. To reduce bycatch, collaborative partnerships should characterize the nature of fishery interactions and identify, test, and implement strategies to reduce bottlenose dolphin bycatch in shrimp trawl, menhaden, gillnet, and trap/pot fishing gear. Expanding and enhancing both the Fishery

1. While the distribution of West Indian manatees overlaps with the DWH oil footprint, none were sighted in oil, and they are not considered in the DWH injury assessment nor this module. Thus, throughout this module, references to marine mammals are limited to cetaceans. However, manatees may benefit from the activities associated with the comprehensive marine mammal strandings responses and as part of unusual mortality event (UME) investigations, which may impact multiple species.

Observer and Marine Mammal Stranding Network (MMSN) programs is also important to directly monitor and adaptively manage bycatch reduction solutions.

- **Reduce injury and mortality to bottlenose dolphins from hook-and-line fishing gear**

Fishing interactions between hook-and-line (i.e., rod and reel) anglers and bottlenose dolphins occur throughout the southeastern United States, including the GOM, and are increasing. This restoration approach focuses on reducing direct and indirect injuries and mortalities associated with hook-and-line fishery interactions by better understanding the scope, scale, and frequency of these interactions and by working collaboratively to identify, test, and implement strategies to reduce them.

- **Increase marine mammal survival through better understanding of causes of illness and death, as well as early detection and intervention of anthropogenic and natural threats**

The objective of this approach is to improve the survival of many marine mammal species in the GOM, especially BSE and coastal stocks of bottlenose dolphins, as well as offshore species that are subject to mass strandings. Potential restoration techniques include expanding the MMSN's capabilities to diagnose illness and cause of death; improving live-animal response success rates; and enhancing response to entangled, entrapped, or out-of-habitat dolphins and major strandings events/disasters.

- **Measure noise to improve knowledge and reduce impacts of anthropogenic noise on marine mammals**

Noise from anthropogenic sources, including commercial shipping, oil and gas exploration and extraction, and military activities, can have short- and long-term impacts on marine life. Measurements of cumulative noise would serve as a predictor variable (among others) that could be used to assess possible correlations with broad-scale and long-term marine mammal movement patterns, and provide data necessary to ground-truth models built to predict noise patterns in the GOM. Outcomes from these efforts can help inform management actions for marine mammal restoration.

- **Reduce injury, harm, and mortality to bottlenose dolphins by reducing illegal feeding and harassment activities**

Incidences of people feeding, attempting to feed, and harassing wild dolphins are increasing throughout the GOM despite being illegal under the MMPA. Reducing these illegal activities and associated negative impacts to dolphins requires effectively changing human behaviors by implementing innovative and targeted outreach and education tools.

- **Reduce marine mammal takes through enhanced state enforcement related to the MMPA**

Enforcement is an important tool for reducing illegal activities known to cause harm to marine mammals. MMPA provisions prohibit the illegal feeding, harassment, intentional harm (e.g., shooting), and other illegal "take" of marine mammals. This restoration approach builds capacity and training for state enforcement agencies to enhance enforcement of the MMPA.

Bottlenose dolphin.
Photograph taken under NOAA-SEFSC MMPA permit No. 779-1633.

- **Reduce injury and mortality of marine mammals from vessel collisions**

Vessel collisions to marine mammals can result in serious injury or mortality due to either injuries from propeller cuts or blunt force

trauma from collisions with vessel hulls. The highest risk of vessel collisions occurs in areas where high vessel traffic overlaps spatially and temporally with high marine mammal densities. Therefore, this restoration approach focuses on identifying vessel collision hotspots, characterizing the nature of the trauma, and collaboratively developing and implementing mitigation methods to reduce the risk of vessel collisions.

- **Protect and conserve marine, coastal, estuarine, and riparian habitats**

This restoration approach supports, protects, and restores a wide variety of marine, coastal, estuarine, and riparian habitats and the ecosystem services they provide, through the identification, protection, management, and restoration of important habitat areas or land parcels that may benefit marine mammals.

The following sections describe potential techniques within restoration approaches, including technique phases, examples of potential project concepts, examples of potential project-level monitoring metrics, and how activities associated with a potential technique could be coordinated with other restoration activities in the GOM (Table 1).

**Table 1. Marine mammal restoration approaches and techniques at a glance**

## 2.2 Approach: Reduce Commercial Fishery Bycatch through Collaborative Partnerships

### 2.2.1 Technique: Evaluate, Develop, and Implement Conservation Measures in the Shrimp Trawl Fishery (otter and skimmer trawls)

The GOM shrimp trawl fishery operates throughout the U.S. waters of the GOM, including coastal, shelf, and inshore estuarine waters. Dolphins are known to become entangled in shrimp trawl gear; current bycatch estimates from otter trawls suggest that annual dolphin mortalities include hundreds of animals per year. These estimates may exceed sustainable levels for some coastal and estuarine stocks of bottlenose dolphins.

**General strategy for the restoration technique**

**PHASE 1** Enhance and expand the shrimp trawl fishery observer program for both otter and skimmer trawls, especially within state waters, to characterize patterns between marine mammal interactions, fishery distribution and gear type usage, as well as the magnitude of bycatch.

**PHASE 2** Develop collaborative partnerships to identify actions/needs to reduce bycatch of dolphins in shrimp trawl fishing gear by reviewing existing information and soliciting expert elicitation to understand shrimp trawl gear interactions with marine mammals.

**PHASE 3** Work with stakeholders to test and evaluate actions (e.g. gear modifications or best fishing practices) to reduce dolphin bycatch in shrimp trawls, while maintaining trawl operational feasibility and catch efficiency.

**PHASE 4** Partner with stakeholders to implement actions by widely distributing and communicating effective strategies to reduce dolphin bycatch in shrimp trawl gear.

**Potential project concepts**

- Increase observer coverage in inshore state waters, including non-federally permitted vessels and skimmer trawls, to provide information on bycatch rates and estimate distribution of the fishery effort. Data collected by observers can be used for both planning projects and monitoring/evaluating the efficacy of projects.
- Explore alternative ways to better understand the inshore fishery effort distribution as it relates to estuarine stocks of bottlenose dolphins (e.g., collaborative studies with state fishery agencies to determine fishery effort distribution and their relationship to federal fishery effort levels in estuarine waters; use of electronic logbooks; vessel monitoring systems).
- Enhance observer data collection protocols to improve understanding of (1) species identification of observed takes (e.g., genetic and photographic sampling, carcass retrieval for necropsy), and (2) gear materials and configurations that may contribute to interactions (e.g., lazy line descriptions, turtle exclusion devices).
- Convene technical workshops with stakeholders to determine actions, needs, and feasibility analyses that would help reduce bycatch caused by otter and skimmer trawls.
- Conduct research to better understand the risk factors and causes of dolphin entanglement and interaction in skimmer and otter trawls (e.g., using DIDSON for underwater observations), and explore ways to reduce these.
- Conduct gear research to examine the feasibility and potential effectiveness of (1) using different materials and configurations of lazy lines to reduce the potential for entanglement (e.g., stiffer/thicker line, more vertical deployment); and (2) modifications to the shrimp trawl net to prevent dolphin interactions, such as nets made from stronger materials (e.g., high-density polyethylene), net covers (e.g., webbing socks), and other designs to reduce fish gilling.
- Develop and expand Sea Turtle Gear Monitoring Teams to include marine mammals experts.
- Develop forensic techniques and training for MMSNs to detect, characterize, and document external and internal evidence of commercial fishery interactions (e.g., fishing line markings) and provide descriptive information on any gear associated with the stranding.

**Potential project-level monitoring metrics**

- % observer coverage
- # of observer sea days
- # of fishermen voluntarily adopting modified gear
- # of fishermen educated about strategies and actions to reduce bycatch
- # of MMSN responders trained to investigate signs of human interactions

**Coordination considerations**

We expect the activities developed under this restoration technique will be coordinated with other marine mammal restoration approaches (e.g., threat identification and rapid intervention) and other GOM resources with shrimp trawl considerations (e.g., sea turtles and fish). Many of the resource-level monitoring activities (e.g., developing and documenting forensic analysis of stranded animals or filling critical data gaps in bottlenose dolphin stock assessments) are also important to consider for this technique.

## 2.2 Approach: Reduce Commercial Fishery Bycatch through Collaborative Partnerships (cont.)

### 2.2.2 Technique: Evaluate, Develop, and Implement Conservation Measures in the Menhaden Purse Seine Fishery

The commercial menhaden fishery primarily operates in coastal and state waters of the GOM, with the majority of fishing activities occurring off Louisiana. Although there is currently no systematic observer coverage of the fishery, there are several documented bycatch events from fishermen reports and pilot observer programs. These bycatch events may be of concern to some stocks of bottlenose dolphins.

**General strategy for the restoration technique**

**PHASE 1** Develop a systematic fishery observer program of menhaden purse seines to characterize patterns among marine mammal interactions, fishery distribution, gear type usage, and the magnitude of bycatch.

**PHASE 2** Develop collaborative partnerships to identify actions and needs to reduce bycatch of dolphins in menhaden purse seine fishing gear by reviewing existing information and soliciting expert elicitation to understand gear interactions with marine mammals.

**PHASE 3** Work with stakeholders to test and evaluate actions (e.g., gear modifications and best fishing practices) to reduce dolphin bycatch in menhaden purse seines, while maintaining operational feasibility and catch efficiency.

**PHASE 4** Partner with stakeholders to implement actions by widely distributing and communicating effective strategies to reduce dolphin bycatch in menhaden purse seines.

**Potential project concepts**

- Conduct and implement systematic observer coverage of the menhaden purse seine fishery in a manner that overcomes the challenges with traditional observer coverage (e.g., alternative platform observer coverage) and allows for statistical estimation of mortality and serious injury.
- Explore the use of innovative technologies (e.g., drones, aerial observer in spotter planes) to enhance systematic observer coverage efforts.
- Convene technical workshops with stakeholders to determine actions and needs that would help reduce bycatch in menhaden purse seines.
- Develop forensic techniques and training for MMSNs to detect, characterize, and document external and internal evidence of commercial fishery interactions (e.g., fishing line markings by type); and provide descriptive information on any gear associated with the strandings.

**Potential project-level monitoring metrics**

- % observer coverage
- # of observer sea days
- # of fishermen educated about strategies and actions to reduce bycatch
- # of MMSN responders trained to investigate signs of human interactions

**Coordination considerations**

We expect the activities developed under this restoration technique will be coordinated with other marine mammal restoration approaches (e.g., threat identification and rapid intervention) and other GOM resources with purse seine considerations (e.g., sea turtles and fish). Many of the resource-level monitoring activities (e.g., developing and documenting forensic analysis of stranded animals or filling critical data gaps in bottlenose dolphin stock assessments) are also important to consider for this technique.

## 2.2 Reduce Commercial Fishery Bycatch through Collaborative Partnerships (cont.)

### 2.2.3 Technique: Evaluate, Develop, and Implement Conservation Measures in the Gillnet Fishery

Bottlenose dolphins can become entangled in gillnet gear resulting in mortality and serious injury. Dolphins commonly take catch from gillnet gear and use nets as a foraging strategy, which leads to an increased risk of lethal entanglement. Use of commercial gillnet gear to harvest catch is prohibited in Texas and Florida state waters but is permitted in Alabama, Mississippi, and Louisiana[2] state waters. To date, the observer program has not documented any takes of bottlenose dolphins in gillnet gear operating within state waters; however, interactions with the gear have been documented. There have also been several documented cases of bottlenose dolphin mortalities in fishery research gillnets.

**General strategy for the restoration technique**

**PHASE 1** Conduct field studies and enhance and expand observer and MMSN coverage to better understand the extent and nature of dolphin interactions with gillnets, fishery distribution, gear type use, and magnitude of bycatch in gillnets.

**PHASE 2** Develop collaborative partnerships to identify actions and needs to reduce bycatch of dolphins in gillnet fishing gear by reviewing existing information and soliciting expert elicitation to understand gear interactions with marine mammals.

**PHASE 3** Work with stakeholders to test and evaluate actions (e.g., developing and researching potential gear or fishing practice modifications, developing best fishing practices) to reduce dolphin bycatch in gillnets, while maintaining operational feasibly and catch efficiency.

**PHASE 4** Partner with stakeholders to implement actions by widely distributing and communicating effective strategies and actions to reduce dolphin bycatch in gillnets.

**Potential project concepts**

- Enhance representative observer coverage on commercial gillnets fishing in nearshore waters (e.g., conduct alternative observer coverage, electronic monitoring).
- Conduct fine-scale behavioral observations of dolphins in areas where interactions are known to occur to further characterize the nature of their interactions with gillnets.
- Better understand inshore fishery effort distribution as it relates to estuarine stocks of bottlenose dolphins.
- Develop forensic techniques and training for MMSNs to detect, characterize, and document external and internal evidence of commercial fishery interactions (e.g., fishing line markings); and provide descriptive information on any gear associated with the strandings.
- Convene technical workshops with stakeholders to determine actions and needs that would help reduce bycatch in gillnets.

**Potential project-level monitoring metrics**

- % observer coverage
- # of observer sea days
- # of fishermen educated about strategies and actions to reduce bycatch
- # of MMSN responders trained to investigate signs of human interactions
- # of fishermen voluntarily adopting recommended gear modifications

**Coordination considerations**

We expect the activities developed under this restoration technique will be coordinated with other marine mammal restoration approaches (e.g., threat identification and rapid intervention) and other GOM resources with gillnet considerations (e.g., sea turtles and fish). Many of the resource-level monitoring activities (e.g., developing and documenting forensic analysis of stranded animals or filling critical data gaps in bottlenose dolphin stock assessments) are also important to consider for this technique.

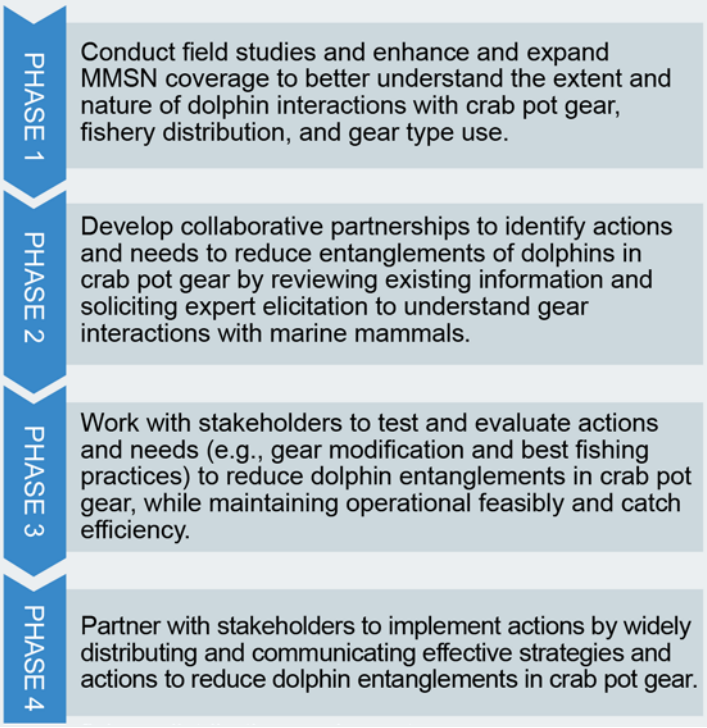
2. In Louisiana, strike nets are allowed during certain times of the year.

## 2.2 Approach: Reduce Commercial Fishery Bycatch through Collaborative Partnerships (cont.)

### 2.2.4 Technique: Evaluate, Develop, and Implement Conservation Measures in the Crab Pot Fishery

Fishing with crab pot gear is ubiquitous throughout the coastal state waters of the GOM. Bottlenose dolphins can become entangled in the buoy line of crab pot gear when foraging in and around the pots, rubbing on the buoy line, or swimming in close proximity to them. There is no observer program for crab pot fisheries to document the magnitude and extent of bycatch events; however, strandings data document several cases of dolphin entanglements in gear. These entanglements may be a conservation concern for some stocks. Derelict crab pots can also be a source of dolphin entanglements if the buoy lines are still attached.

**General strategy for the restoration technique**




**Potential project concepts**

- Explore alternative observer methods for systematically documenting dolphin interactions with crab pot gear, and estimating fishing effort levels and spatial distribution of effort to allow for statistical estimation on the magnitude of crab pot gear interactions.
- Conduct gear characterization to better understand crab pot gear use, modifications, and performance in different geographic regions and states of the northern GOM and examine the feasibility and potential effectiveness of crab pot gear modifications to reduce bottlenose dolphin interactions and entanglements (e.g., stiffer buoy line, minimizing buoy line lengths, modifying bait wells and type of bait used).
- Develop forensic techniques and training for MMSNs to detect, characterize, and document external and internal evidence of commercial fishery interactions (e.g., fishing line markings by type); and provide descriptive information on any gear associated with the strandings.
- Convene technical workshops with stakeholders to determine actions and needs that would help reduce entanglements in crab pot gear.
- Enhance derelict crab pot removal programs, and document how many pots were recovered with buoy lines and how much line was recovered (entangling risk for dolphins).

**Potential project-level monitoring metrics**

- % observer coverage
- # of observer sea days
- # of fishermen educated about strategies and actions to reduce bycatch
- # of fishermen voluntarily adopting recommended gear modifications
- % of pots with modified gear
- Amount of buoy line associated with the removal of derelict pots
- % change in number of strandings with evidence of crab pot gear interactions
- # of MMSN responders trained to investigate signs of human interactions

**Coordination considerations**

We expect the activities developed under this restoration technique will be coordinated with other marine mammal restoration approaches (e.g., threat identification and rapid intervention) and other GOM resources with crab pot bycatch and entanglement considerations (e.g., sea turtles and fish). Many of the resource-level monitoring activities (e.g., developing and documenting forensic analysis of stranded animals or filling critical data gaps in bottlenose dolphin stock assessments) are also important to consider for this technique.

## 2.3 Approach: Reduce Injury and Mortality to Bottlenose Dolphins from Hook-and-Line Fishing Gear

### 2.3.1 Technique: Reduce Lethal and Harmful Impacts on Dolphins from Hook-and-Line Fishing Activities and Related Mortalities from Retaliation

Hook-and-line gear is used by recreational anglers and by clients onboard for-hire fishing vessels (e.g., charter boats and headboats). Dolphin entanglements and ingestions with hook-and-line gear largely result from dolphins taking the bait or eating discarded fish, as well as from illegal feeding that causes dolphins to associate anglers with food. These interactions cause lethal injuries to dolphins from fishing gear entanglements and ingestions, and related mortalities (e.g., in extreme cases, fisher retaliation by shooting); and may be affecting the long-term sustainability of some bottlenose dolphin stocks.

**General strategy for the restoration technique**

**PHASE 1**
Conduct systematic fishery surveys and human dimension studies (e.g., surveys, focus groups, interviews), and evaluate existing information to characterize the fishery; nature and extent of interactions with dolphins; and anglers' observations, attitudes, and perceptions toward dolphins and fishing gear interactions.

**PHASE 2**
Develop collaborative partnerships to identify, test, and evaluate actions (e.g., research potential gear or fishing practice modifications and safe and effective deterrence techniques) for reducing dolphin interactions with hook-and-line gear and related mortalities from entanglements, ingestions, or retaliation.

**PHASE 3**
Implement actions by partnering with stakeholders to widely distribute and communicate effective strategies and measures for how to reduce dolphin and hook-and-line gear interactions.

**Potential project-level monitoring metrics**

- % change in number of hook-and-line gear-related strandings
- Success rate of disentanglements
- # of survey responses
- % change in survey responses on attitudes, perceptions, and motivations
- # of fishermen voluntarily adopting recommended gear modifications and best practices
- # of animals observed with scarring and entanglements
- # of monofilament recycling containers established
- Amount of fishing line recycled

**Potential project concepts**

- Conduct systematic fishery surveys of hook-and-line anglers fishing from piers and vessels (both recreational and for-hire), or add to existing creel surveys, to characterize the fishery and determine the frequency and geographic extent of dolphin interactions.
- Conduct human dimension social science studies (e.g., focus groups, interviews) to characterize anglers' attitudes towards dolphins and dolphin interactions with their gear, and identify ways to reduce interactions.
- Develop and disseminate standardized data collection protocols to document scarring and entanglements in photo identification (photo-ID) and health assessment surveys to determine the frequency of hook-and-line interactions and entanglements.
- Implement monofilament fishing gear recycling programs to help prevent entanglement of dolphins in discarded fishing line.
- Conduct a pilot observer program to employ onboard observers on for-hire fishing vessels (i.e., charter and head boats) and use vessel monitoring systems to directly characterize hook-and-line gear interactions with dolphins, estimate interaction rates and the factors influencing them, and understand fishery effort distribution.
- Characterize and evaluate hook-and-line fishing gear found on or in stranded bottlenose dolphins and associated injuries to determine gear factors, types, and characteristics that increase the risk of interactions resulting in death or serious injury (e.g., hook-and-line gear risk matrix).
- Examine the feasibility and potential long-term effectiveness of gear modifications and deterrence measures to safely prevent dolphin depredation of gear and scavenging on discarded bycatch.
- Improve rescue response capabilities for entangled marine mammals by training response personnel, providing equipment for disentanglements, and standardizing tools and techniques for boat-based disentanglements.

**Coordination considerations**

We expect the activities developed under this restoration technique will be coordinated with other marine mammal restoration approaches (e.g., reducing illegal feeding and harassment, threat identification and rapid intervention, enhancing MMPA-related enforcement) and other GOM resources with hook-and-line recreational fishing considerations. For example, surveys and their resulting education and outreach activities would be coordinated with sea turtle activities; and marine debris removal programs would be coordinated with sea turtle, fish, bird, and coastal restoration activities. Many of the resource-level monitoring activities (e.g., developing and documenting forensic analysis of stranded animals or filling critical data gaps in bottlenose dolphin stock assessments) are also important to consider for this technique.

## 2.4 Approach: Increase Marine Mammal Survival through Better Understanding of Causes of Illness and Death, as Well as Early Detection and Intervention of Anthropogenic and Natural Threats

### 2.4.1 Technique: Address Gaps and Enhance Capacity in the Current Capabilities of the MMSN throughout the Northern GOM to Improve Timeliness of Response, and Diagnosis of Illness and Cause of Death

The MMSN, formalized by the Marine Mammal Health and Stranding Response Act of 1992, amended the MMPA. Volunteer and agency partner MMSNs have been established in some coastal states to respond to strandings of many marine mammal species. For cetaceans in the GOM, there are currently 16 MMSN organizations and facilities administered by NOAA's National Marine Fisheries Service Southeast Regional Office that are authorized under the MMPA to respond to live or dead stranded marine mammals, and to rehabilitate animals. However, due to disparate levels of training, funding, and resources, MMSN organizations have different capabilities (especially in their ability to diagnose causes of illness and death in stranded marine mammals and use that information to better understand population health). Increasing existing capacity and expanding networks would fill gaps in capabilities and spatial coverage along the GOM coastline.

**General strategy for the restoration technique**

**PHASE 1**
Coordinate with federal and state agencies to identify what standardized protocols, training, support, data collection and analysis, equipment, and other resources are necessary for each state to improve existing MMSN coverage and capabilities (i.e., conduct a gap analysis).

**PHASE 2**
Develop new partnerships, improve existing partnerships, and support additional resources and personnel to address gaps and expand coverage.

**PHASE 3**
Establish regular training sessions and workshops to maintain the MMSN partners' capabilities over time and through personnel turnover, and share information across the network about new threats and the efficacy of various response actions to those threats.

**Potential project-level monitoring metrics**

- # of MMSN personnel trained
- Average reporting time and response time
- # of established index areas for active surveillance

**Potential project concepts**

- Develop and distribute regionwide standards and protocols for how MMSN partners can support restoration efforts and develop an infrastructure to support the partners.
- Improve the capabilities and capacity for MMSN partners to conduct their "routine" activities, as well as respond to unusual or emergency events (e.g., mass strandings and UMEs, strandings response in remote locations) by supporting personnel, equipment, resources, necropsy facility improvements, and training.
- Enhance mortality examinations by improving the timeliness, efficiency, expertise, and capacity to perform necropsies and collect data on illness and cause of death – including signs of human interaction – by applying refined forensic techniques and sample analysis.
- Increase access to data collected by the MMSN from stranded marine mammals by supporting national, federally led and maintained databases (e.g., HealthMAP); and hire personnel to enter data, ensure the quality of data, and maintain databases to link strandings records and sample analysis results.
- Develop education and outreach programs and materials for the public, states, industries, and local communities with the goal of increasing timely reporting of stranded marine mammals.
- Identify and develop federal, state, and local partnerships to facilitate access to resources (e.g., landing sites for dead floating whales, disposal of carcasses), and to respond to and investigate stranded animals (e.g., partnerships with academic institutions and vet schools).
- Increase triage capabilities for live strandings response (including mass strandings). Provide funding support for beachside triage assessment including diagnostic equipment for veterinarian and MMSN members, and live animal triage training for MMSN members.
- Improve the capabilities and capacity for MMSN partners to conduct active surveillance to enhance detection of live and dead stranded, injured, or entangled marine mammals; and for improved mortality estimates (e.g., boat surveys, beach surveys).

**Coordination considerations**

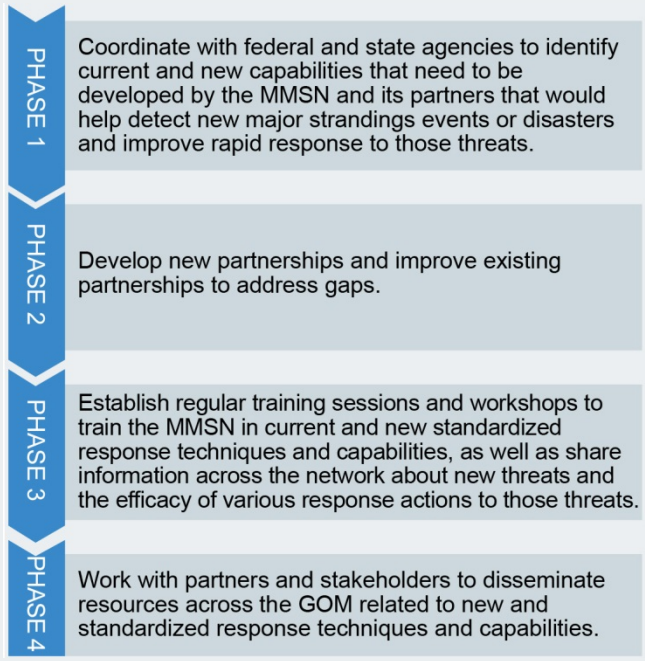
We expect the activities developed under this restoration technique will be coordinated with most other marine mammal restoration approaches and other GOM resources with strandings network considerations (e.g., sea turtles). Many of the resource-level monitoring activities (e.g., integrating strandings network data into monitoring activities) are also important to consider for this technique.

## 2.4 Approach: Increase Marine Mammal Survival through Better Understanding of Causes of Illness and Death as Well as Early Detection and Intervention of Anthropogenic and Natural Threats (cont.)

### 2.4.2 Technique: Develop and Increase the Technical and Infrastructure Capabilities to Respond to Major Strandings Events or Disasters

Natural and anthropogenic disasters can negatively impact marine mammal health and survival. Enhancing preparedness to respond to these events will improve capabilities to manage and mitigate their impacts on marine mammals. This technique will provide and improve training for the MMSN and its partners to respond to major strandings events and disasters to mitigate impacts on marine mammals or inform potential management actions. It will develop response plans, provide supplies and equipment for responding to marine mammals in various strandings and disaster scenarios, train and test capabilities through drills, and integrate strandings response into other federal and state disaster response plans.

**General strategy for the restoration technique**




**Potential project concepts**

- Develop a disaster response program focused on improving responses to marine mammal strandings and health events or disasters (e.g., oil spills, harmful algal blooms, freshwater inundation events, hurricanes), including an assessment of response needs and risks associated with response activities for the various events, incorporate cetacean responses into existing plans, and share with appropriate response agencies.
- Develop equipment caches with emergency response kits in strategic locations around the GOM to be used when responding to unique threats to marine mammals as needs are identified in response plans for mid- to long-term responses.
- Develop regional exercise plan(s) with multiple scales and types of exercises (e.g., trainings, tabletop, field deployment).
- Support required and recommended trainings for the MMSN and other marine mammal responders [e.g., Hazardous Waste Operations and Emergency Response (HAZWOPER)].
- Conduct appropriate training, drills, and exercises, including participation in MMSN-specific opportunities and identification of and participation in non-MMSN drills and exercise opportunities. Review the lessons learned after each training or real event, and update plans and operating procedures as needed.

**Potential project-level monitoring metrics**

- # of equipment caches developed
- # of MMSN personnel with HAZWOPER training
- % of MMSN and other agency personnel participating in training events and tabletop exercises

**Coordination considerations**

We expect the activities developed under this restoration technique will be coordinated with other GOM resources with strandings network and disaster response considerations (e.g., sea turtles). Many of the resource-level monitoring activities (e.g., integrating standardized protocols into monitoring activities) are also important to consider for this technique.

## 2.4 Approach: Increase Marine Mammal Survival through Better Understanding of Causes of Illness and Death as Well as Early Detection and Intervention of Anthropogenic and Natural Threats (cont.)

### 2.4.3 Technique: Develop and Implement a Regionwide Marine Mammal Health Assessment and Conservation Medicine Program to Identify Risks for Illness and Death, and Mitigate Potential Impacts

Physical examinations on BSE and coastal bottlenose dolphins conducted through live animal capture and release health assessments or other remote health assessments can identify health threats to dolphins and links to possible environmental and anthropogenic stressors. Health data collected from wild dolphins will help shape environmental policies, inform decision-making, and identify conservation medicine techniques, such as vaccination programs, to more effectively conserve and protect marine mammals.

**General strategy for the restoration technique**

**PHASE 1**
Coordinate with federal and state agencies to identify current and new capabilities that need to be developed by the MMSN and its partners that would help detect new major strandings events or disasters and improve rapid response to those threats.

**PHASE 2**
Develop new partnerships and improve existing partnerships to address gaps.

**PHASE 3**
Establish regular training sessions and workshops to train the MMSN in current and new standardized response techniques and capabilities, and share information across the network about new threats and the efficacy of various response actions to those threats.

**PHASE 4**
Work with partners and stakeholders to disseminate resources across the GOM related to new and standardized response techniques and capabilities.

**Potential project concepts**

- Develop and implement a regionwide conservation medicine program to identify illness and mortality risks, including impacts from natural and man-made threats (e.g., Brucella, toxoplasmosis, leptospirosis, freshwater disease); enhance the capabilities of MMSN partners and live capture-release health assessment teams to rapidly diagnose causes of marine mammal illness, mortality, and types of threats; and implement treatment or prevention if possible.
- Develop a working group to identify and develop future health intervention tools and techniques (e.g., morbillivirus vaccination, improved diagnosis of freshwater disease, development of rapid point-of-care tools, improved real-time diagnostic capabilities) and implement those techniques as appropriate through MMSN partners and other marine mammal researchers.

**Potential project-level monitoring metrics**

- # of MMSN and other appropriate personnel trained to support conservation medicine activities
- # of techniques and protocols developed by the working group and adopted by MMSN partners and marine mammal researchers

**Coordination considerations**

We expect the activities developed under this restoration technique will be coordinated with other GOM resources with anthropogenic and natural threat considerations (e.g., sea turtles). Many of the resource-level monitoring activities (e.g., integrating health data collection into monitoring activities) are also important to consider for this technique.

## 2.4 Approach: Increase Marine Mammal Survival through Better Understanding of Causes of Illness and Death as Well as Early Detection and Intervention of Anthropogenic and Natural Threats (cont.)

### 2.4.4 Technique: Improve the Ability of Strandings Network Partners to Detect and Rescue Free-Swimming Marine Mammals that Are Entangled, Entrapped, or out of Habitat

Small cetaceans, in particular coastal and BSE bottlenose dolphins, frequently become entangled in fishing gear or marine debris. Small dolphins and whales also may be displaced by hurricanes into inland waters, canals, and ditches; or end up entrapped or out of habitat due to tidal fluctuations or construction activities. Animals in these situations may be rescued by the MMSN if logistics and resources allow. This technique will improve the ability of the MMSN to rescue free-swimming marine mammals that are entangled, entrapped, or out of habitat.

**General strategy for the restoration technique**

**PHASE 1** Coordinate with federal, state, and MMSN agencies to identify standardized protocols, training, support, equipment, and other resources that are necessary to establish rapid response protocols, teams, and equipment around the GOM for interventions on entangled, entrapped, or out of habitat marine mammals.

**PHASE 2** Develop new partnerships and improve existing partnerships to address gaps in coverage and response capabilities.

**PHASE 3** Establish rapid response teams and equipment caches to respond to entangled, entrapped, or out of habitat marine mammals.

**PHASE 4** Establish regular training sessions and workshops to maintain the capabilities of the rapid response team and MMSN.

**Potential project concepts**

- Develop standard operating procedures and protocols for entangled, entrapped, or out-of-habitat animals to disseminate to the MMSN partners. Implement protocols when activated, hold an after-action review when the response is completed, and update protocols and training as indicated by the response assessment.
- Identify, train, and support rapid response team members for entangled, entrapped, or out-of-habitat animals to ensure timely response and enhance survival. This would include a rapid response team training workshop that covers all aspects of a live animal intervention (e.g., net handling, animal handling, boat maneuvering around nets, tagging, tracking tagged animals); and travel support for MMSN partners to attend dolphin health assessments for training in live animal capture, handling, and release techniques. Additionally, the program could provide support for team members to travel to other locations to assist local response and rescue efforts.
- Purchase equipment (e.g., a catch boat and nets) to be staged strategically throughout the GOM (two – three locations).
- Funding, including vessel and personnel support, and training for pre-capture visual monitoring and assessment of entangled, entrapped, or out-of-habitat animals to monitor animal condition, determine extent of injury and entanglement, and ensure animals can be located both on the day of rescue and for follow-up monitoring of released animals.

**Potential project-level monitoring metrics**

- # of rapid response team members trained
- # of equipment caches established
- # of successful responses to entangled, entrapped, or out-of-habitat animals requiring assessment or intervention

**Coordination considerations**

We expect the activities developed under this restoration technique will be coordinated with other marine mammal restoration approaches (e.g., reducing hook-and-line interactions) and other GOM resources with strandings network considerations (e.g., sea turtles). Many of the resource-level monitoring activities (e.g., integrating standardized protocols into monitoring activities) are also important to consider for this technique.

## 2.4 Approach: Increase Marine Mammal Survival through Better Understanding of Causes of Illness and Death as Well as Early Detection and Intervention of Anthropogenic and Natural Threats (cont.)

### 2.4.5 Technique: Develop and Implement Tools and Techniques to Identify Possible Mass Strandings Situations before They Occur, and to Avert Animals from Mass Strandings

Some pelagic cetacean species commonly mass strand along the GOM coast. These animals must travel across the continental shelf for a period of time before reaching the coastline where they strand or become disoriented and die. In some parts of the country, mass strandings have been averted by hazing groups of animals (i.e., using NMFS-approved methods such as acoustic devices or vessel chasing) to encourage them to return offshore. This approach will develop and implement tools and techniques to identify, in real-time, animals that may be out of habitat (e.g., groups of whales over the continental shelf) and potentially avert those animals from mass strandings.

**General strategy for the restoration technique**

**PHASE 1**
Coordinate with federal and state agencies to identify what standardized protocols, training, support, data collection and analysis, equipment, and other resources are necessary for each region to improve existing mass strandings network coverage and capabilities (i.e., conduct a gap analysis).

**PHASE 2**
Develop partnerships to increase monitoring of off-shore species on the continental shelf or in-shore prior to mass strandings.

**PHASE 3**
Develop rapid response and intervention techniques.

**Potential project concepts**

- Develop real-time warnings of presence of off-shore species that are out of habitat by working with the Bureau of Ocean and Energy Management (BOEM) and other funding agencies on a Passive Acoustic Monitoring (PAM) network in areas where historical mass strandings have occurred.
- Develop hazing techniques to deter or herd off-shore species that are prone to mass strand in the GOM to prevent or mitigate the strandings.
- Develop rapid-response capabilities (e.g., training, equipment, point-of-care diagnostics) and enhance the assessment of individuals, including safely moving them to deeper waters.
- Identify priority areas, develop and support partnerships, provide resources, and stage equipment caches to support rapid-response efforts for mass strandings events (including assessment, mitigation, intervention, and response activities).

**Potential project-level monitoring metrics**

- # of individuals and agencies trained in hot-spot areas
- # of hazing techniques developed and evaluated for commonly mass-stranded species
- # of PAM arrays deployed

**Coordination considerations**

We expect the activities developed under this restoration technique will be coordinated with other GOM resources with strandings network considerations (e.g., sea turtles). Many of the resource-level monitoring activities (e.g., integrating standardized protocols into monitoring activities) are also important to consider for this technique. In addition, collaboration with the PAM network is critical to this technique.

## 2.5 Approach: Measure Noise to Improve Knowledge and Reduce Impacts of Anthropogenic Noise on Marine Mammals

### 2.5.1 Technique: Reduce Noise Impacts on Marine Mammals

Noise from anthropogenic sources, including commercial shipping, oil and gas exploration and extraction, and military activities can have short- and long-term impacts on marine life, including behavioral changes, habitat modification, and serious injury or mortality. Long-term calibrated measurements of ambient noise throughout the GOM are needed to assess the impacts of anthropogenic noise sources and the overlap of noise sources with priority marine mammal habitats, to ground-truth models built to predict noise patterns in the GOM, and to monitor the effectiveness of noise-reduction mitigation actions. Reducing chronic noise from anthropogenic sources in priority habitats in the GOM will improve habitat quality and reduce negative impacts on marine mammals.

**General strategy for the restoration technique**

**PHASE 1**
Collect and use data from calibrated passive acoustic and complementary marine mammal survey techniques to characterize the spectral, temporal, and spatial qualities of noise throughout the GOM; and determine areas of overlap between high noise levels and marine mammal stocks.

**PHASE 2**
Identify and target noise reduction opportunities in areas where high noise levels and high densities of marine mammals overlap, and promote activities to keep noise levels low in areas with already low noise levels.

**PHASE 3**
Partner with stakeholders to identify, test, and implement strategies and technologies to reduce noise impacts on marine mammals.

**Potential project-level monitoring metrics**

- % of live stranded cetaceans or cetaceans handled during capture release programs that have hearing testing completed
- % of specific industries that are using noise-reducing technologies in the Gulf
- # of PAM arrays deployed

**Potential project concepts**

- Establish a region-wide noise reduction task force to develop and disseminate a soundscape monitoring guidance document to report on priority species and habitats for noise reduction. Activities would include assessing current PAM data availability and determining data gaps, establishing a data management plan for acoustic data, enhancing collaboration and coordination across taxa and research groups with ongoing PAM projects, determining hearing ranges of priority species of concern, and identifying mechanisms for monitoring cumulative impacts from multiple sources.
- Establish a long-term, standardized, and calibrated acoustic monitoring network that fills current gaps and monitors priority areas utilized by priority species, including collecting baseline data and conducting long-term monitoring to measure the effectiveness of noise-reduction mitigation.
- Develop industry-specific geological and geophysical noise mitigation task forces to investigate, develop, and incentivize noise-reducing technologies (e.g., marine vibroseis and implementing Green Marine noise indicators at Gulf ports).
- Enhance strandings network capabilities by providing equipment, training, and protocols to conduct hearing tests when responding to live strandings, in order to provide hearing curves for species for which we have none and to increase our understanding of acoustic impairments in cetaceans in the wild.

**Coordination considerations**

We expect the activities developed under this restoration technique will be coordinated with other marine mammal restoration approaches (e.g., threat identification and rapid intervention) and other GOM resources with noise reduction considerations (e.g., sea turtles and fish). Many of the resource-level monitoring activities (e.g., integrating PAM data into monitoring activities) are also important to consider for this technique.

## 2.6 Approach: Reduce Injury, Harm, and Mortality to Bottlenose Dolphins by Reducing Illegal Feeding and Harassment Activities

### 2.6.1 Technique: Reduce Lethal and Harmful Impacts on Dolphins from Illegal Feeding Activities by Effectively Changing Human Behaviors

There is extensive documentation that feeding wild dolphins is harmful to both dolphins and people. It alters dolphins' natural foraging behavior and causes them to associate people, boats, and fishing gear with a food source. This increases their risk of getting hit by a propeller or entangled in fishing gear, and harms them by providing contaminated or inappropriate food and nonfood items. Because dolphins are also social learners, these altered behaviors can be passed to calves and other dolphins, increasing the prevalence of the problem for generations.

**General strategy for the restoration technique**

**PHASE 1**
Use existing information (e.g., literature, social media, anecdotal reports, enforcement cases, strandings data) and expert elicitation to determine and verify known hot-spots for illegal feeding activities and the nature and extent of these activities.

**PHASE 2**
Characterize the attitudes, knowledge, perceptions, and motivations of user groups feeding dolphins and determine where and how they get their information by conducting social science studies (e.g., surveys, focus groups, interviews).

**PHASE 3**
Develop outreach and educational messages, tools, pilot projects, and campaigns that match each target audience's motivations and needs (e.g., public service announcements, social media campaigns, print products, advertisements).

**PHASE 4**
Partner with stakeholders to widely distribute and communicate developed outreach and educational tools to reach targeted user groups effectively.

**Potential project concepts**

- Determine the magnitude and extent of illegal feeding activities by user group and location, and develop and implement targeted outreach and educational campaigns and tools. Data from longitudinal surveys can be used for both planning projects and monitoring/evaluating the efficacy of projects.
- Conduct pier and vessel-based observational surveys where fish cleaning stations are present to observe the public's behavior (e.g., intentional vs. unintentional feeding of fish remains) and the resulting behavior of the dolphins; develop and implement targeted outreach to reduce unintentional and intentional feeding activities.
- Reduce unintentional and intentional feeding by commercial bait boats by developing and implementing targeted outreach.
- Reduce unintentional and intentional feeding of dolphins by commercial vessels when discarding throw backs by developing and implementing targeted outreach.
- Determine the most appropriate educational messages and campaigns (e.g., print advertisements, targeted Facebook advertisements) to educate Alabama waterway users illegally feeding dolphins and identify a distribution strategy.
- Evaluate existing social science studies from Florida and Corpus Christi, Texas, to inform targeted outreach and educational messages.
- Develop and disseminate education and outreach materials to promote public awareness on the importance of reporting violations of the MMPA to law enforcement.

**Potential project-level monitoring metrics**

- # of survey responses
- # of MMPA-related violations

**Coordination considerations**

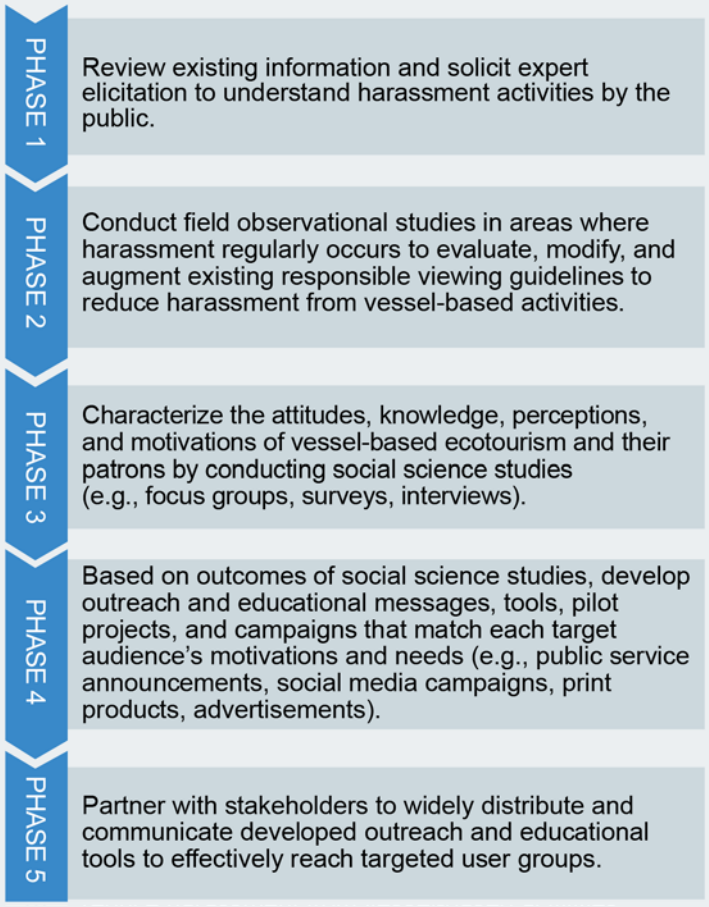
We expect the planning, education, and outreach activities developed under this restoration technique will be coordinated with other marine mammal restoration approaches (e.g., reducing hook-and-line interactions, threat identification and rapid intervention, reducing illegal harassment activities, enhancing MMPA-related enforcement) and other GOM resources with public outreach components (e.g., sea turtles). Many of the resource-level monitoring activities (e.g., integrating survey data into monitoring activities) are also important to consider for this technique.

## 2.6 Approach: Reduce Injury, Harm, and Mortality to Bottlenose Dolphins by Reducing Illegal Feeding and Harassment Activities (cont.)

### 2.6.2 Technique: Reduce Lethal and Harmful Impacts on Dolphins from Illegal Harassment Activities by Effectively Changing Human Behaviors

Dolphins are significantly affected by vessel-based harassment both at an individual and population level. Numerous studies examining the effects of viewing activities show that vessels disturb dolphins' natural behavior patterns, causing several types of short-term behavioral changes as well as increased risk of vessel strikes. These short-term behavioral changes can lead to long-term biological impacts for dolphin populations, such as declines in reproductive health and permanent habitat displacement or abandonment.

**General strategy for the restoration technique**




**Potential project concepts**

- Determine the economic benefit and associated value to dolphin conservation from promoting responsible viewing and stewardship.
- Evaluate and update existing responsible viewing guidelines to ensure they are scientifically based and provide the maximum potential conservation benefit to dolphins. Data from longitudinal surveys can be used for both planning projects and monitoring/evaluating the efficacy of projects.
- Augment existing responsible viewing guidelines to address emerging conservation concerns caused by ecotourism vessels promoting dolphin wake-riding.
- Develop responsible viewing guidelines to reduce harassment to dolphins caused by jet skis.
- Develop and disseminate education and outreach materials to promote public awareness on the importance of reporting violations of the MMPA to law enforcement.

**Potential project-level monitoring metrics**

- # of survey responses
- # of MMPA-related violations

**Coordination considerations**

We expect the planning, education, and outreach activities developed under this restoration technique will be coordinated with other marine mammal restoration approaches (e.g., reducing hook-and-line interactions, threat identification and rapid intervention, illegal feeding activities; enhancing MMPA-related enforcement) and other GOM resources with public outreach components (e.g., sea turtles). Many of the resource-level monitoring activities (e.g., integrating survey data into monitoring activities) are also important to consider for this technique.

## 2.7 Approach: Reduce Marine Mammal Takes through Enhanced State Enforcement Related to the MMPA

### 2.7.1 Technique: Reduce Harmful and Lethal Marine Mammal Takes by Increasing Awareness and Understanding of the MMPA to Assist State Enforcement Efforts

Illegal feeding, attempting to feed, and harassing dolphins are prevalent activities throughout the Gulf Coast. Direct, intentional harm or retaliatory acts by people, such as shooting dolphins, also occurs Gulf-wide. Providing training and associated outreach materials to state law enforcement agency personnel on MMPA-related issues and needs would enhance enforcement efforts, ultimately resulting in improved compliance with the MMPA and potentially reducing numbers of dolphins that are injured, killed, or harassed by illegal activities.

**General strategy for the restoration technique**

**PHASE 1**
Use existing information (e.g., literature, social media, anecdotal reports, enforcement cases, strandings data) and expert elicitation among states and federal agencies (including law enforcement) to determine law enforcement training needs and the most appropriate format for the delivery of MMPA-related training.

**PHASE 2**
Develop specified training materials and outreach products.

**PHASE 3**
Conduct training and distribute outreach products by partnering with stakeholders to widely distribute and communicate developed outreach and educational products to law enforcement personnel.

**PHASE 4**
Establish continued communication plan among state and federal agencies and law enforcement to re-evaluate priority enforcement training and outreach needs to assist with enhanced enforcement efforts.

**Potential project concepts**

- Establish collaborative partnerships to develop and implement a consistent and effective regionwide plan to train enforcement agency personnel on MMPA-related topics (e.g., training materials and annual in-person trainings).
- Conduct standardized trainings for enforcement personnel on recurring and emerging issues with an emphasis on unique local threats and issues.
- Develop readily accessible educational materials for enforcement personnel, such as web-based and smartphone applications.
- Develop an MMPA task force that can travel as needed to provide training for enforcement and other stakeholders across the region to ensure continuity and consistency in awareness of the MMPA and enforcement needs.

**Potential project-level monitoring metrics**

- # of agencies receiving outreach materials
- # of trainings conducted by MMPA task force

**Coordination considerations**

We expect the planning and training activities developed under this restoration technique will be coordinated with other marine mammal restoration approaches (e.g., reducing hook-and-line interactions and reducing illegal feeding and harassment) and other GOM resources with enforcement components (e.g., sea turtles).

## 2.7 Approach: Reduce Marine Mammal Takes through Enhanced State Enforcement Related to the MMPA (cont.)

### 2.7.2 Technique: Reduce Harmful and Lethal Marine Mammal Takes by Increasing Resources for Enforcement Agencies to Dedicate toward MMPA-Related Activities

Illegal feeding, attempting to feed, and harassing dolphins are prevalent activities throughout the Gulf Coast. Direct, intentional harm or retaliatory acts by people, such as shooting dolphins, also occurs Gulf-wide. Providing increased resources for state law enforcement agencies would result in greater compliance with the MMPA and reduce the number of dolphins that are injured, killed, or harassed by illegal activities.

**General strategy for the restoration technique**

**PHASE 1** Use existing information (e.g., literature, social media, anecdotal reports, enforcement cases, strandings data) and expert elicitation among states and federal agencies, including law enforcement, to identify and prioritize hot-spot areas for potential MMPA violations and areas in need of increased and consistent enforcement effort.

**PHASE 2** Work with state and federal agencies to determine resources needed (e.g., equipment, vessels, personnel hours) to increase and sustain enforcement activities in identified hot-spot areas.

**PHASE 3** Conduct increased enforcement efforts in hot-spot areas.

**PHASE 4** Maintain continued communication pathway among state and federal agencies and law enforcement to re-evaluate priority enforcement needs.

**Potential project concepts**

- Establish collaborative partnerships to develop a strategy to ensure enforcement is consistent, effective, and sustained in problematic areas.
- Provide funding for additional state law enforcement personnel hours and related resources (e.g., vessels, supplies) to maintain consistent and sustained enforcement efforts.

**Potential project-level monitoring metrics**

- % change in hours, equipment, and vessels dedicated to MMPA enforcement
- % coverage in hot-spot areas

**Coordination considerations**

We expect the resource dissemination activities developed under this restoration technique will be coordinated with other marine mammal restoration approaches (e.g., reducing hook-and-line interactions, reducing illegal feeding and harassment) and other GOM resources with enforcement components (e.g., sea turtles). Many of the resource-level monitoring activities (e.g., integrating hot-spot data into monitoring activities) are also important to consider for this technique.

## 2.8 Approach: Reduce Injury and Mortality of Marine Mammals from Vessel Collisions

### 2.8.1 Technique: Reduce Vessel Collisions with Marine Mammals

Vessel collisions are a known source of anthropogenic mortality for many large whale species and smaller marine mammals in the GOM. The likelihood of an interaction is dependent on species' behavioral patterns, marine mammal geographic distributions, and areas of high vessel traffic. The severity of injuries can include bone fractures, organ damage, and/or internal hemorrhaging; and is dependent on the species, the individual, location of the cut, and the depth of penetration.

**General strategy for the restoration technique**

PHASE 1: Inventory, assemble, and collect species distribution data from surveys, passive acoustics, and tagging; and incorporate those data into predictive models to help inform risk assessments and support effective mitigation efforts to reduce vessel collisions with marine mammals.

PHASE 2: Partner with stakeholders to adjust time and area-sensitive vessel routes and speeds, conduct mariner training, and conduct mariner and recreational boater outreach and education.

**Potential project concepts**

- Compile available data, and identify and address data gaps to develop a spatial-temporal characterization of vessel traffic overlaid with appropriately scaled marine mammal distribution information and predictive models.
- Conduct a risk assessment using vessel traffic characterizations, marine mammal distributions, and avoidance behaviors to identify vessel interaction hot-spots to target restoration efforts; develop vessel collision risk-reduction measures for hot-spots.
- Analyze strandings, health assessment, and photo-ID data with evidence of boat strikes to identify vessel interaction hot-spots.
- Develop standardized protocols for MMSN partners and photo-ID programs to identify, characterize, and document evidence of vessel collisions.

**Potential project-level monitoring metrics**

- # or % of animals with vessel collision injuries
- # of MMSN and marine mammal researchers trained on vessel strike identification techniques

**Coordination considerations**

We expect the activities developed under this restoration technique will be coordinated with other marine mammal restoration approaches (e.g., threat identification, rapid intervention) and other GOM resources with vessel collision considerations (e.g., sea turtles). Many of the resource-level monitoring activities (e.g., integrating hot-spot data into monitoring activities) are also important to consider for this technique.

## 2.9 Approach: Protect and Conserve Marine, Coastal, Estuarine, and Riparian Habitats

### 2.9.1 Technique: Protect Habitat by Acquiring Lands, Developing/Implementing Management Actions, or Establishing/Expanding Protections for Marine Areas

Protecting coastal and marine habitats can provide secondary benefits to marine mammals by improving water quality, prey base, and mitigating other potential stressors (e.g., pollution). At this time, we have not identified any habitat areas to restore specifically for marine mammals.

**Potential project concepts**

- Acquire lands for conservation.
- Develop and implement management actions in conservation areas and restoration projects.
- Expand protections for existing marine areas (e.g., seasonal protection for areas where dolphins calve or congregate).
- Establish new marine protected area(s).

**Coordination considerations**

We expect that any activities developed under this technique will be coordinated with restoration for other marine resources (e.g., fish, sea turtles, sea birds) to maximize benefits to all resources, as appropriate. In addition, habitat protection and restoration projects proposed under other resource categories should be coordinated with marine mammal restoration activities.

# 3. Monitoring and Adaptive Management Considerations

## 3.1 Project-Level Monitoring and Adaptive Management Considerations

Project-level monitoring is critical for documenting whether projects have met their established performance criteria, and to determine the need for corrective actions and adaptive management. Project-level monitoring activities will also guide adjustments in the design and implementation of future projects to maximize targeted benefits. Examples of potential project-level metrics are listed in Section 2, but the specific suite of appropriate metrics for a given project must be established during project development, and may include metrics other than those mentioned in this module. Each project should also, to the extent practicable, standardize the project-specific data collection methods to facilitate comparisons across projects and enable efficient resource-level monitoring. Monitoring information collected at the project-level can also inform adaptive management of that individual project, as well as similar restoration approaches and/or restoration types, by informing the selection, design, and implementation of future restoration projects. Where gaps in scientific understanding exist, an adaptive management approach to marine mammal restoration may involve additional science support activities such as targeted data collection to reduce key uncertainties and/or other analyses that inform the selection, design, and optimization of restoration projects.

## 3.2 Resource-Level Monitoring and Adaptive Management Considerations

Given the protected status of marine mammals in the GOM, the extent of their injuries, and the limited scientific data available to inform restoration efforts in many areas and for many species, robust MAM will be needed to ensure effective restoration. Resource-level MAM for marine mammals will help inform ongoing decision-making during restoration planning and implementation, and will facilitate aggregating and evaluating the collective benefits of restoration to the injured marine mammal populations or stocks and their habitats.

There are many tools available to monitor marine mammals at a resource-level, but because they can be expensive, logistically challenging, and have the potential to result in a cumulative negative effect on the species being monitored (and therefore require permits), it is important to establish a coordinated monitoring effort with NOAA and local resource stakeholders. In this section, we describe the resource-level monitoring activities that will most benefit restoration planning, implementation, and evaluation across the marine mammal restoration approaches and techniques discussed in Section 2. These concepts may evolve over time as the Trustees gain insight from various restoration activities and their associated outcomes, and from outside research on marine mammal species in the GOM. These resource-level monitoring activities are designed to provide information about one or more of the following data needs (Table 2):

- Abundance
- Stock structure
- Morbidity (illness and injuries)
- Mortality
- Fecundity
- Distribution, habitat use, and movement
- Threat identification and characterization.

Bottlenose dolphin. Photograph taken under NOAA-SEFSC MMPA permit No. 779-1633.

**Table 2. Resource-level monitoring activities are designed to address critical data needs for restoration planning, implementation, and evaluation**

| Activity | Abundance | Stock structure | Morbidity (illness and injury) | Mortality | Fecundity[a] | Distribution, habitat use, and movement | Threat identification and characterization |
|---|---|---|---|---|---|---|---|
| Photo-ID surveys and cataloging | | X | X | | X | X | X |
| Capture-mark-recapture surveys and analyses | X | | | X | | X | |
| Aerial surveys and analyses | X | | | | | X | |
| Satellite tagging and telemetry | | X | | | X | X | X |
| Remote biopsy sampling | | X | | | X | | X |
| Live-capture health assessments | | X | X | | X | | X |
| Live remote health assessments | | X | X | | X | | X |
| Active surveillance of index sites for strandings mortality | | | | X | | | |
| Passive acoustic monitoring | X | | | | | X | X |
| Evaluate potential shifts in prey consumption | | | X | | | X | X |
| Data management and analytical tools | X | X | X | X | X | X | X |

a. The evaluation of fecundity generally involves multiple combined activities (e.g., hormone analysis of remote biopsy samples to determine pregnancy, then photo-ID follow-up surveys to evaluate reproductive outcome).

By gaining a better understanding of each of the above data needs, planning, implementing, and evaluating restoration projects will be more efficient and effective, especially in the context of the overlapping suite of projects over time and space in the GOM.

The resource-level monitoring activities to address the above data needs may be conducted as stand-alone activities to inform planning or evaluation of one or multiple restoration projects, or they may be integrated into the design of individual projects. Discussions and decisions on how these activities are conducted should take place early in the planning process to ensure that all parties are coordinating in an effort to avoid redundancy, encourage efficiencies, and reduce any potential cumulative impacts on animals from the monitoring activities themselves.

It will be necessary to conduct some of these resource-level monitoring activities prior to planning and implementing specific projects, as they will determine the pre-restoration baseline or reference points necessary to inform the determination of success of specific projects and the restoration portfolio as a whole. In addition, pre-restoration, resource-level monitoring activities can provide other requisite information for effective restoration planning and implementation, including information on stock structure, distribution, and movement, as well as habitat use.

Therefore, many of these MAM activities must be conducted in phases. Early phases may include the identification of specific information needs or data gaps, prioritization of localized or regional threats, the standardization of protocols for data collection of that data gap (including spatial and temporal considerations), and the selection of an agreed-upon tool or technology (e.g., a central database repository) for data aggregation and synthesis. Later phases could focus on capacity building and the implementation of the MAM activity (over various temporal or spatial needs and in coordination with other restoration activities).

### 3.2.1 Potential Resource-Level MAM Activities

**Photo-ID surveys and cataloging**

Photo-ID activities involve systematic surveys to photograph dolphins, record their location, identify each individual and their movements based on their unique dorsal fin, and document any health indicators or injuries from boats or fishery gear. Analysis of photo-ID data can provide an understanding of habitat use and identification of specific threats for a given area; and comparison across sites can provide information on distribution and movement, stock structure, and insight into reproductive rates and calving success. For BSE stocks, photo-ID helps in the identification and monitoring of human impacts and can give information on overall condition and health. These surveys and analyses would provide information that could support restoration planning and implementation by informing optimal restoration actions or locations for particular stocks or areas. They could also provide pre-restoration baseline or reference points that would help inform the evaluation of restoration success at a project or resource level.

**Capture-recapture studies**

Capture-recapture studies involve systematic field surveys, usually using photo-ID techniques, and modeling to document the number of animals in a stock or within a defined area (i.e., abundance and density). Analyses of surveys repeated in the same areas over time can also provide estimates of survival rates. These studies can provide estimates of survival and abundance for BSE stocks, and changes in distribution or abundance can inform restoration progress and adaptive management decisions.

**Aerial surveys and analysis**

Aerial surveys are systematic field studies from planes or helicopters to count animals in given shelf and deep ocean waters. These surveys and analyses would provide estimates of abundance and distribution for pre-restoration baseline or reference points. They also would provide data to monitor abundance and distribution for restoration effectiveness and adaptive management decisions.

**Tagging and telemetry**

Tags [usually satellite-linked or with very-high frequency (VHF) radio transmitters] can be attached to animals to remotely track their movements for up to months at a time. Tagging would allow for estimates of ranging patterns and co-occurrence of stocks with potential stressors, as well as stock interactions that may drive disease transmission, providing information that would help determine the optimal actions and locations for restoration actions. Tagging may facilitate the re-acquisition of animals for follow-up observations (e.g., for observing reproductive outcome or survival outcome). In addition, tags that measure depth or other environmental variables may be used to gain insight into feeding behavior and habitat use, and acoustic tags that record animal vocalizations can provide necessary information (e.g., marine mammal sound production in relation to behavior) for interpretation of passive acoustic monitoring (PAM) data (see the section below for more information). D-tag technology also allows the assessment of animal reactions to environmental parameters such as sonar or shipping.

**Remote biopsy sampling**

Remote biopsy sampling is a method to collect skin and blubber samples from free-swimming cetaceans using a modified crossbow or rifle. Laboratories can use these samples for a variety of assays (e.g., contaminant analysis, genomics, transcriptomics, microbiome, pathology, age, lipids, hormone analysis). These sampling events would help provide information on genetic composition, condition, diversity of populations, contaminant exposure, feeding ecology, pregnancy rates, hormone concentrations, and reproductive success. This information would help determine the optimal actions and locations for restoration by providing information that can help identify risks and threats, as well as inform decision-makers whether a restoration project was successful or help inform why particular restoration actions were not as successful as expected.

**Live-capture or remote health assessments**

Health assessments allow veterinarians to examine clinical indicators in wild animals, whether by temporarily capturing the animals or using remote techniques (e.g., observing large oceanic whales from vessels or unmanned aerial systems) These sampling events would help provide information on the morbidity (i.e., illness, injuries), mortality, and the fecundity of stocks by gathering information on the age of an animal, clinical indicators, pathogen exposure, and biotoxin exposure. Monitoring via health assessments could help inform restoration decision-making by helping define optimal locations or approaches for restoration based on the detection of emerging disease; estimates of non-lethal human interaction rates; contaminant, biotoxin, and pathogen exposures; and detection of non-specific health effects (e.g., endocrine disruption, declining body condition).

**Active surveillance of index sites for strandings mortality**

The systematic active surveillance for carcasses at carefully chosen index sites (usually conducted by strandings network partners, volunteer beach surveys, or via aerial surveys) documents how the level of carcass-searching effort influences the number of reported strandings. This activity could improve mortality and strandings estimates, and develop an effort index to help translate carcass recovery to mortality rate. This information would be useful to establishing pre-restoration reference points for mortality and detection rates that could be used to evaluate overall restoration progress.

**Passive acoustic monitoring**

PAM involves the deployment of audio-recording devices throughout areas of the ocean that can document the location of and sounds made by marine mammals, as well as anthropogenic noise from vessels or oil and gas infrastructure development. This activity would inform changes in spatial distribution at fine temporal resolution if a broad array were deployed, and would provide an index of density on a similarly fine resolution that could be helpful for informing restoration progress and adaptive management decisions. This could be useful for interpreting changes more quickly than capture-recapture surveys would, but work would need to be done to determine how to integrate the two datasets. In addition, pre-implementation acoustic tagging and analysis of marine mammal sounds in relation to behavior and environmental variables would facilitate interpretation and thus help to establish relationships between PAM data and density. This activity would also provide information on ambient noise levels and sources for use in noise-reduction techniques, and would be critical in monitoring the effectiveness of overall noise reduction strategies. Coordination across PAM groups should be done to determine historical data collection locations and times to work out data gaps and priority locations for future PAM, and coordination with the BOEM long-term PAM project would be helpful to prevent duplication and prevent data gaps.

**Evaluate potential shifts in prey consumption**

Cetaceans can employ a diverse set of foraging strategies, and a variety of techniques could be used to characterize the available prey (species and abundance) in a given location (e.g., fishery surveys) or dolphins'

prey preferences (e.g., stomach contents analysis). This could help provide information on the potential outside impacts affecting forage fish stocks on bottlenose dolphin population dynamics, which could help inform future restoration projects.

### 3.2.2 Data Management to Support Restoration Planning

There are various MAM activities that can assist with the proper management of data and in the development of proper analytical tools to inform effective decision-making, as well as reporting on the analysis and evaluation. For example, the development of a marine mammal data coordination group could help facilitate communication and information dissemination to restoration project managers and other stakeholders. Some of the activities that this group could undertake include characterizing habitat and stressors that will inform appropriate restoration actions; supporting the standardization of data collection and analysis; developing a comprehensive approach for data management, spatial analysis, and modeling tools for marine mammals; and refining and updating current and under-development databases in the GOM such as the Gulf of Mexico Dolphin Identification System (GOMDIS) database, which provides access for photo-ID catalog matching with collaborators across the GOM. There are numerous databases used in the Gulf that should be considered during marine mammal restoration planning decision-making, including, but not limited to, the Animal Tracking Network; the Marine Mammal Health Monitoring and Analyses Platform; the Gulf of Mexico Research Initiative Information and Data Cooperative (GRIIDC); GOMDIS; the Data Integration, Visualization, Exploration, and Reporting (DIVER) NOAA application; the Gulf of Mexico Coastal Ocean Observing System (GCOOS); and BOEM's Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS) program.

# References

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