Deepwater Horizon

Open Ocean Trustee Implementation Group

MONITORING AND ADAPTIVE MANAGEMENT ACTIVITY IMPLEMENTATION PLAN:
VESSEL SURVEYS FOR ABUNDANCE AND DISTRIBUTION OF MARINE MAMMALS AND SEABIRDS

August 2022

Introduction

Marine mammals and seabirds incurred significant injuries throughout the Gulf of Mexico (GOM) as a result of the *Deepwater Horizon* oil spill. In order to effectively monitor the outcomes of marine mammal and seabird restoration in the Gulf, we need reliable abundance and distribution reference points. One of the principal means by which Trustees document population trajectories of offshore marine mammals is through offshore vessel surveys, such as those conducted through the Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS). In the case of sperm whales, pantropical spotted dolphins, and other focal species (see the Strategic Framework for Marine Mammal Restoration Activities for details), there is a need for additional information to determine if the declines detected in previous GoMMAPPS surveys are continuing, establish reference abundance estimates, and better understand the spatial distribution of these animals to inform future restoration activities (DWH NRDA Trustees 2017a). For example, if the sperm whale population has moved further west as indicated by previous surveys, the Trustees might prioritize vessel strike reduction efforts in the western Gulf.

For many species of injured birds, seabirds in particular, there are limited monitoring options available to evaluate restoration efficacy across *Deepwater Horizon* Trustee Implementation Groups (TIGs) and restoration projects. At the same time, for many species of injured seabirds using the northern Gulf of Mexico, we do not know the colony of origin (Jodice et al. 2019) because we lack species-specific data. As such, capitalizing on National Oceanic and Atmospheric Administration (NOAA) vessels of opportunity and leveraging GoMMAPPS seabird vessel survey protocols, analytical methods, and the experienced pool of seabird observers would be a cost-effective monitoring strategy. From GoMMAPPS seabird vessel surveys in 2017-2019, we tallied 9,347 detections of 44,029 seabirds representing 44 species. Though there were some spatial and temporal gaps in survey coverage (e.g., no surveys in Nov-Dec), GoMMAPPS is arguably the single largest seabird survey effort in the northern Gulf of Mexico with effort extending from the shallow shelf waters out to the Exclusive Economic Zone. By way of comparison, during post-spill injury assessment Bird Study #6 (2010-2011) much of the effort was focused in shallower waters inland from the Continental Shelf Break (Haney et al. 2019). Additional data is needed for seabirds due to the relative paucity of data available for this taxonomic group and because many injured seabird species are not easily monitored by project-level efforts.

The D*eepwater Horizon* oil spill settlement (2016) provides Natural Resource Damage Assessment (NRDA) Trustees (Trustees) up to $8.8 billion, distributed over 15 years, to restore natural resources and services injured by the Spill[1]. As described in the Programmatic Damage Assessment and Restoration Plan/Programmatic Environmental Impact Statement (PDARP/PEIS), the Trustees identified a comprehensive, integrated ecosystem restoration approach as the most effective and representative means to address the broad and geographically expansive resource injuries associated with the Spill (DWH NRDA Trustees 2016a). Given the unprecedented temporal, spatial, and funding scales associated with the DWH NRDA restoration effort, the Trustees recognized the need for robust Monitoring and Adaptive Management (MAM) to support restoration planning and implementation. As such, one of the programmatic goals established in the PDARP/PEIS is to "Provide for Monitoring, Adaptive Management, and Administrative Oversight to Support Restoration Implementation" to ensure that the portfolio of restoration projects provides long-term benefits to natural resources and services injured by the spill

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[1] PDARP/PEIS and information on the settlement with BP Exploration and Production Inc. and other BP entities (called the Consent Decree) are available at the Gulf Spill Restoration website.

(Section 5.3.1 of the PDARP/PEIS). The MAM framework, Appendix 5.E of the PDARP/PEIS, was developed to allow the Trustees to evaluate restoration effectiveness, address potential uncertainties related to restoration planning and implementation, and provide feedback to inform future restoration decisions.

For marine mammals, guidance documents (e.g., Strategic Framework for Marine Mammal Restoration Activities (DWH NRDA Trustees 2017a)) describe potential restoration approaches and techniques, identify potential restoration benefits, and highlight the importance of monitoring and adaptive management considerations. For injured birds, guidance documents (e.g., Strategic Framework for Bird Restoration Activities) describe strategies to achieve overarching goals as described in the PDARP/PEIS, provide a range of potential restoration approaches and techniques (with examples), identify potential restoration benefits, as well as provide information on project- and resource-level monitoring. Though separate from the Strategic Framework for Bird Restoration Activities (DWH NRDA Trustees 2017c), the Gulf of Mexico Avian Monitoring Network (GoMAMN) Strategic Bird Monitoring Guidelines for the Northern Gulf of Mexico aligns well with the Strategic Framework and provides monitoring priorities to reduce uncertainties associated with management actions/restoration projects, as well as ecological processes (Wilson et al. 2019).

The Open Ocean TIG selected this MAM Activity "Vessel Surveys for Abundance and Distribution of Marine Mammals and Seabirds" to resolve critical information gaps and uncertainties for restoration planning, inform restoration decision-making, and support evaluation of restoration outcomes within the Open Ocean Restoration Area. This Activity will address the following MAM priorities outlined in Section 8 of the Open Ocean TIG MAM Strategy: 1) Evaluate Restoration Progress with secondary benefits of helping to Identify Stressors and 2) Assess Focal Resources and Important Habitats (DWH NRDA Trustees 2020). See Section 5.1 of the Open Ocean MAM Strategy for more information about the TIG's selection process including factors considered in evaluating MAM activities. The Open Ocean TIG also considered the DWH Trustee Council's Standard Operating Procedures (SOP) during its selection process, specifically Section 10.5 MAM Funding, which identifies the activities that may be funded within the MAM allocation.

This Monitoring and Adaptive Management Activity Implementation Plan (MAIP) is intended to detail activities, identify specific methods and metrics, and identify Trustee roles and responsibilities. The MAIP also describes the Activity's consistency with the programmatic alternative selected by the Trustees in the PDARP/PEIS and reviews compliance with the National Environmental Policy Act and other environmental laws and regulations.

MAM Activity Overview

Background
The Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS) is a partnership between Bureau of Ocean Energy Management, National Oceanic and Atmospheric Administration (NOAA), US Geological Survey, and US Fish and Wildlife Service that conducted multi-year field surveys (vessel surveys, aerial surveys, and satellite tagging) and analyses to provide information on abundance, distribution, habitat use, and behavior of protected species (marine mammals, sea turtles, and seabirds) in the Gulf of Mexico from 2017 to 2021. The GOMMAPPS marine mammal objectives included collecting broad-scale information on distribution and abundance of marine mammals and developing

seasonally and spatially explicit maps of species density and uncertainty. The GoMMAPPS seabird objectives included characterizing the distribution, abundance, and diversity of seabirds and interpreting the influence of natural and anthropogenic variables on avian species. The GoMMAPPS project provides the best and most updated understanding of density, abundance, distribution, and habitat usage of key (focal) cetacean stocks in the Gulf and the largest pelagic seabird dataset ever collected in the Gulf of Mexico.

Recent analyses of GoMMAPPS vessel survey data show significant declines in the abundance of offshore dolphins (specifically, pantropical spotted dolphins) between 2003-2004 and 2017-2018 and shifts in the spatial distribution of endangered sperm whales. Preliminary results from NOAA's Southeast Fisheries Science Center (SEFSC) GoMMAPPS analyses show several important patterns emerging:

First, comparisons of survey results from 2017-2018 to those collected during 2003-2009 suggest possible changes in the abundance and occurrence of some species. Overall, there appear to be decreases in both the number of species and number of individuals of small whale and oceanic delphinids in recent years. Most notably, the estimated abundances of pantropical spotted dolphins in the northern Gulf of Mexico decreased by approximately 50% between 2003-2004 and 2017-2018, along with declines in the other Stenellid dolphins (such as clymene and spinner dolphins), which were relatively common in earlier surveys. Data suggests there was a general decline in abundance estimates for the "blackfish" species (false killer whales, pygmy killer whales, and melon-headed whales combined). The interpretation of these potential trends is complicated by the high uncertainty and long time between estimates, the potential for shifts in animal distribution, and changes in survey methods. Additional surveys are required to determine if these results reflect true decreases in marine mammal populations in the GOM.

Second, the development of spatial density models and exploration of the relationships between marine mammal density and oceanographic features highlight important dynamics. The shift in the recent distribution of sperm whales was particularly evident and may be linked to findings that in the recent survey years, the GOM was found to be dominated by waters more heavily influenced by the loop current and loop current eddies. These findings highlight the importance of understanding the underlying dynamics in oceanographic conditions and their impacts on marine mammal spatial distribution and abundance in order to inform restoration planning. Importantly, by updating these models, restoration planners will be able to better interpret the potential trends in cetacean density and distribution and further understand the linkages between marine mammal distribution and oceanographic features.

The last vessel survey conducted under GoMMAPPS ended in October 2018 and there are currently no large whale vessel surveys planned in the GOM. With just over a single year of data documenting the decline and shift, results are difficult to interpret without additional data to evaluate potential trends versus interannual variability. Updated data will help to verify and validate spatial models and will indicate whether or not the recently observed spatial distribution shifts persist through time. For restoration, confirming whether these declines are real will assist in establishing reference points and updating our understanding of spatial distribution, which will impact adaptive management of existing Open Ocean projects and planning for future restoration projects. For example, if the sperm whale population has moved further west than expected, we might prioritize vessel strike reduction efforts in the western Gulf. Also, given that the Open Ocean marine mammal projects approved in 2019

(Cumulative Impact of Multiple Stressors, CETACEAN, Vessel Strike Reduction, and Noise Reduction) all require information on the spatial distribution of injured oceanic marine mammal stocks, the collected survey data and associated analyses would support adaptive management of these projects and directly inform planning of future projects.

For seabirds, other than the 2 years of data (2010 and 2011) collected under Bird Study #6 (Haney et al. 2019) and the 3 years of data (2017-2019) collected by GoMMAPPS, there is a paucity of data to inform restoration planning and restoration evaluation for this diverse taxonomic group. GoMMAPPS vessel surveys detected 44 species of seabirds, many of which were affected by the oil spill. Of the seabirds affected by the spill, only a fraction breed along the northern GOM coast where targeted restoration projects and associated project-level monitoring is occurring through other TIGs.

More than 30 of the 93 injured bird species from the DWH spill were seabirds. Of the top 20 bird species injured by the spill, 15 were seabirds. Of the total estimated injury for birds, these 15 species of seabirds account for over 80% of the cumulative estimated bird injury. To obtain quality data on offshore seabird species like shearwaters, storm-petrels, and boobies, there is no cost-effective alternative to vessel-based surveys. Further, such surveys may be the only substantial source of data for 8-10 of the injured seabird species that are only found in the open waters of the Gulf. Available data is limited on both the spatial distribution and abundance of many of these seabird species in the GOM, as well as seasonal and annual variation in their distribution and abundance. Many of the seabird species injured by the spill breed outside of the Gulf of Mexico, and as such, data for assessing restoration progress are limited.

Although we do not yet know what restoration work will occur for seabirds in the Gulf, options that have been considered include bycatch reduction in commercial fisheries and lighting modifications to reduce interactions/collisions with energy infrastructure. More complete data on the spatiotemporal distribution of seabirds would be extremely useful in future planning efforts for this kind of restoration work. Data collected through this MAM Activity will help refine the analysis products that will be most useful for planning future restoration. In particular, including an integrated summary/analysis of the new survey data along with the previous data would be valuable for assessing trends in relative abundance over time.

Lastly, there were fewer than 10 individual birds of some seabird species injured by the spill, such as Manx and Sooty Shearwaters, and Parasitic Jaeger. Direct restoration efforts for these species, such as activities at breeding areas, may be costly relative to the injury. Survey data from vessels could help determine whether these species have benefitted indirectly from other restoration efforts to an extent that accounts for their injury.

This MAM Activity utilizes established methods and protocols that have been successfully implemented in the GOM. The MAM Activity will conduct two summer vessel surveys in 2023 and 2024. The surveys will follow the previous GoMMAPPS vessel tracklines, collecting data through marine mammal and seabird visual observers, passive acoustic surveys, in situ environmental data, and opportunistic biopsy sampling. Using the same data collection methods will allow for easier comparisons and interpretation of the results from surveys in the future with those from 2017 and 2018 during GoMMAPPS. Surveying across two consecutive years in the same season allows for the accounting of interannual variability and controlling for seasonal variability. Products will include publicly available and updated spatial density models and updated abundance estimates for oceanic stocks of cetaceans in the GOM. The data could

be checked for Quality Assurance/Quality Control (QA/QC) relatively quickly and incorporated into the marine mammal spatial density models already developed in GoMMAPPS (~ 6 months following survey), allowing for evaluation of potential trends. For seabirds, data products would include: QA/QC'd data on the location, number, and identification of seabirds from the 2023-2024 surveys; a combined and QA/QC'd dataset including the 2010-2011 data (DWH Bird Study #6 seabird vessel surveys), 2017-2019 data (GoMMAPPS seabird vessel surveys), and 2023-2024 data; geospatial map products (either relative abundance or density-based, accounting for effort and potentially detection probability); predictive habitat-based models and associated code; species-specific annual estimates of abundance; and a Final Report.

Objectives

For marine mammals, the objective of this MAIP is to collect information on the distribution, density, and abundance of oceanic cetacean stocks and develop seasonally and spatially explicit maps of species density to incorporate into existing spatial density models. Outcomes to measure success will include development of updated seasonal/spatial density maps, updated spatial density models, and a summary report and recommendations for utilizing data to inform restoration.

For seabirds, the objective is to collect broad-scale information on the distribution and abundance of seabirds in the GOM to inform seasonally- and spatially-explicit density estimates for a suite of injured seabird species. Using GoMMAPPS standardized seabird monitoring protocols (Ballance and Force 2016), new and existing data will be QA/QC'd and merged and incorporated into existing (or new) model structures developed under GoMMAPPS.

Tasks

Overview: This Activity involves two summer vessel surveys following the previous GoMMAPPS vessel tracklines, collection of new data on distribution and abundance of marine mammals and seabirds, analysis of the newly collected data, updated model runs using the GoMMAPPS model structures, the development of products including publicly available and updated spatial density models and updated abundance estimates for oceanic stocks of cetaceans in the northern Gulf of Mexico, and report writing including Trustee review of reports and analyses developed as a result of this activity.

Marine mammals:
This activity will provide updated population information (abundance estimates, distribution, seasonal spatial density, and habitat use) for Open Ocean marine mammal focal species, including but not limited to sperm whales, Rice's whales, Risso's dolphins, beaked whales, *Kogia* sp., and pantropical spotted dolphins by:
- Conducting a dual-team visual line transect survey to estimate the abundance and spatial distribution of cetacean stocks in U.S. Gulf of Mexico waters;
- Conducting passive acoustic surveys simultaneous with visual surveys to provide supplemental information on cetacean abundance and spatial distribution;
- Collecting echosounder data (EK60) to quantify acoustic backscatter from small fish and zooplankton;

- Collecting vertical profiles of hydrographic parameters (e.g., temperature, salinity, oxygen concentration) using conductivity, temperature and depth (CTD) and Expendable BathyThermograph (XBT) probes; and
- Opportunistically collecting remote biopsy samples of priority cetacean species including, but not limited to, Rice's whales and sperm whales.

Seabirds:

Data collection will focus on more than 30 species of seabirds:
- Collecting data on the distribution and abundance of seabirds and other marine life using experienced observers and standardized seabird methodologies, with data input directly into a laptop using SEEBIRD (Vers. 4.3.7; Ballance and Force 2016) connected to the vessel GPS. Seabird observers also collect observational data on flying fish distribution and abundance, Sargassum distribution and patch size, as well as sea turtles and marine mammals as contextual information. For sea turtles and marine mammals, all data would be provided to NOAA. Marine mammal observations are only collected when marine mammal observers are not present on the flying bridge, e.g., when transiting away from and to port, and times when winds exceed Beaufort sea-state 5.
- Data from the 2023 and 2024 surveys would be used to generate spatially-explicit abundance maps or habitat suitability maps, both taking into account effort and important environmental covariates such as Sea-Surface Height (SSH), Sea-Surface Salinity (SSS), Sea-Surface Temperature (SST), and chlorophyll-a.
- Conduct QA/QC and requisite database management techniques to pool the 3 disparate seabird vessel survey databases (Bird Study #6, GoMMAPPS, and 2023-2024 surveys) into a single, comprehensive seabird database to be housed in NOAA's National Centers for Environmental Information (NCEI), USFWS Migratory Bird Data Center, MarineCadastre.
- Using all available seabird data from vessel surveys 2010-2024, generate species-specific annual point estimates of relative abundance, density, or population size with associated confidence intervals, in an effort to evaluate restoration progress.

Methods

For the activities identified in this MAIP, NOAA and DOI will utilize the same methods and tracklines (Figure 1) used in the GoMMAPPS 2017 - 2018 vessel surveys. The surveys will be conducted in oceanic waters (>100 m) of the Gulf of Mexico out to the U.S. Exclusive Economic Zone. Activities will include:

1. Vessel surveys: Two vessel surveys (~60-days each) will be conducted in two consecutive summers using the same methods and tracklines employed during the GoMMAPPs vessel surveys for consistency, including using two teams of visual marine mammal observers that operate independently of one another (Figure 1). Distance sampling, a commonly used methodology, will be used to estimate the detection probabilities for marine mammal sightings which is used to estimate density. Observers will record other species of interest, such as sea

turtles, manta rays, and sharks, but it is often difficult to see these species from a large vessel, particularly at a distance.

Observers will be considered "on effort" whenever the ship is on a prescribed trackline or transit line, at survey speed, and the visual team is actively searching for cetaceans. Visual surveys are conducted during daylight hours (approximately from 0700 to 1900). During the independent observer approach, one survey team will be stationed on the vessel's flying bridge. The second team will be stationed on the bridge deck and located on the bridge wings. Both visual survey teams will utilize pedestal mounted, 25x150 mm "bigeye" binoculars located on the port and starboard sides of the ship and a 3rd observer searching closer to the ship with only handheld binoculars. The survey will primarily be conducted in "passing mode" whereby the ship maintains a steady course and speed while the visual teams identify the sighting to species level if possible and count the number of individuals in a sighting. Under certain circumstances, a "closing mode" technique will be employed, which entails maneuvering the ship to more closely approach a sighting. This survey mode is used sparingly and restricted to sightings of special interest. Data will be recorded by the centralized data recorder using a custom written visual data acquisition program (VisSurvey) installed on a networked laptop. For each encounter, the data to be recorded will include time, position, bearing and reticle, species, group size, behavior, bottom depth, sea surface temperature, and associated animals (e.g., seabirds, fish). An attempt will be made to photograph animals that closely approach the ship.

In addition, passive acoustic surveys will be conducted simultaneously with visual surveys to provide supplemental information on cetacean abundance and spatial distribution. Passive acoustic monitoring for odontocetes will be conducted using a modular towed hydrophone array deployed approximately 300 m behind the ship and hydrophone depth will vary depending on survey speed, ship turns, and current. Acoustic signals will be monitored by a team of two acoustic technicians that rotate through a primary and on-call secondary position every 1 to 2.5 hours while the array is deployed. Acoustic localizations will be mapped and compared with visual sighting locations using a custom-written acoustic version of VisSurvey.

Directional sonobuoys will be used for acoustic detection, localization, and recording of low-frequency sounds produced by baleen whales which are too low in frequency to be detected by the towed array system. Sonobuoys will be deployed during daylight hours concurrent with visual surveys. The sonobuoy deployment strategy will be to 1) deploy a single sonobuoy at predetermined stations where the trackline intersected the 250 m isobath and 2) opportunistically deploy at least two sonobuoys as drifters, spaced 5 km apart within 2 km of all visually-sighted baleen whales. The sonobuoys scuttle themselves and settle to the seafloor at a pre-set time or are recovered while floating if time permits. The two acoustic field technicians will only cursorily monitor the recordings for data quality and received radio signal strength in real time while focusing their effort on towed array monitoring.

Oceanographic and environmental data will be collected by utilizing scientific echosounders (EK60) to quantify acoustic backscatter from small fish and zooplankton. EK60 data will be collected beginning at sunset and until the commencement of acoustic survey effort the following day. Vertical profiles of hydrographic parameters (e.g., temperature, salinity, oxygen concentration) will be collected using a conductivity, temperature and depth sensor (CTD) unit

and expendable bathythermographs (XBT). Environmental data including water temperature, salinity, and weather conditions (e.g., wind speed, wind direction) will be continuously collected in situ via the ship's Scientific Computer System (SCS) and recorded in the visual marine mammal sighting database.

Remote biopsy samples may be opportunistically collected from priority species if encountered. Tissue samples will be collected from the small boat with a crossbow fitted with a custom designed sampling dart and head to extract a small core of skin and blubber. All sampling will be conducted by personnel with training and experience to collect biopsy samples from wild cetaceans and as authorized by the MMPA permit issued by the Office of Protected Resources to the NOAA SEFSC (Permit No. 21938-03).

Data on the distribution and abundance of seabirds and other marine life will be collected by two seabird observers. The seabird observers will use binoculars to conduct counts of birds from the bridge within a 300-m strip transect (see Tasker et al. 2004) while the ship is underway. Data will be entered directly into the SEEBIRD (Vers. 4.3.7) software system (Ballance and Force 2016) on a laptop connected directly to the vessel GPS, and the laptop will be synced each morning to the clock on the bridge. At the end of each day, the primary seabird observer will review the data to address any ID discrepancies, download the .csv file, and convert the file to .xls format ensuring column headings, column widths, cell labels, text, are all standardized. Each day's data will then be appended to the master dataset. No biopsies or other samples will be taken from seabirds. Survey time will be approximately 9-12 hours per day depending on weather. Start time for seabird observers usually coincides with marine mammal observers. However, there will be times when seabird observers will continue visual surveys when marine mammal observers are not conducting surveys, e.g., when Beaufort sea-state >= 5 (Chapman 1977), or when heading out from or into port.

2. Post-survey data processing and product development:

Following each vessel survey, all resulting marine mammal and environmental data files (Access databases, photographs, scanned data sheets, photographic logs, etc.) are transferred from an external hard drive to NOAA's Southeast Fisheries Science Center (SEFSC) Miami lab network server for extensive auditing of the visual data. Data auditing consists of making corrections based on error log notes from the field, plotting trackline points to identify errors made when recording effort status, and verifying sighting data based on data sheets from the field. Detailed steps of the visual data auditing process are available upon request. Once the data auditing is complete, R scripts are run to extract data and prepare the data for distance sampling analysis. The final data sets are archived to NCEI (see example here: https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0241032) and a final cruise report is prepared (see example: https://repository.library.noaa.gov/view/noaa/32749). The cruise report will be submitted to the Restoration Center after each cruise as an interim product.

After both surveys are completed, the marine mammal data will be analyzed using a Distance Sampling framework with an independent observer approach for estimating detection probability. The data from these surveys will be used to test the predictive ability of habitat models developed with GoMMAPPS data. This will be done by comparing new sighting data

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with predicted surface densities from the existing models. After the comparison, we will incorporate the new data to fit updated habitat models. The new models will benefit from additional data to obtain better fits for probability of detection functions in Distance Sampling. Additional data are particularly important for rare species with few sightings and to further evaluate changes in distribution and abundance of cetaceans. The overall result will be improved surface density models for cetaceans in the oceanic Gulf of Mexico. The improved spatial density models will be made publicly available through the GoMMAPPS model viewer website (currently under development) and a final report for the project will be generated and submitted 6 months after the completion of the second survey.

For seabirds, following completion of each vessel survey, all resulting data files (daily and Master bird sightings files, daily and Master all species observations files, and daily and Master flyingfish observations files) are transferred via thumbdrive to the principal investigator (PI). Original .csv files are never manipulated and are retained for reference. After a QA/QC process based on efforts developed during GoMMAPPS, all data will be transferred to the PI and/or quantitative ecologist for further inspection. After both surveys are completed, the survey data will be merged with Bird Study #6 and GoMMAPPS vessel survey seabird data using common column headings. The combined final QA/QC'd comprehensive vessel survey seabird database will be housed in NOAA NCEI, USFWS Migratory Bird Data Center, and MarineCadastre. The combined dataset may be analyzed using Program DISTANCE (Buckland et al. 2001, 2008, 2015). Analysis may include estimation of species-specific detection probabilities, followed by generalized linear models using a negative binomial distribution with associated habitat variables and environmental covariates (GoMMAPPS Final Report: seabirds, Table 4.2) to generate spatially-explicit distribution models from transect segments (see Kinlan et al. 2012, 2016). In addition, for species with sufficient numbers of detections, analysis may include the generation of seasonal relative abundances or predicted seasonal population estimates with associated confidence intervals.
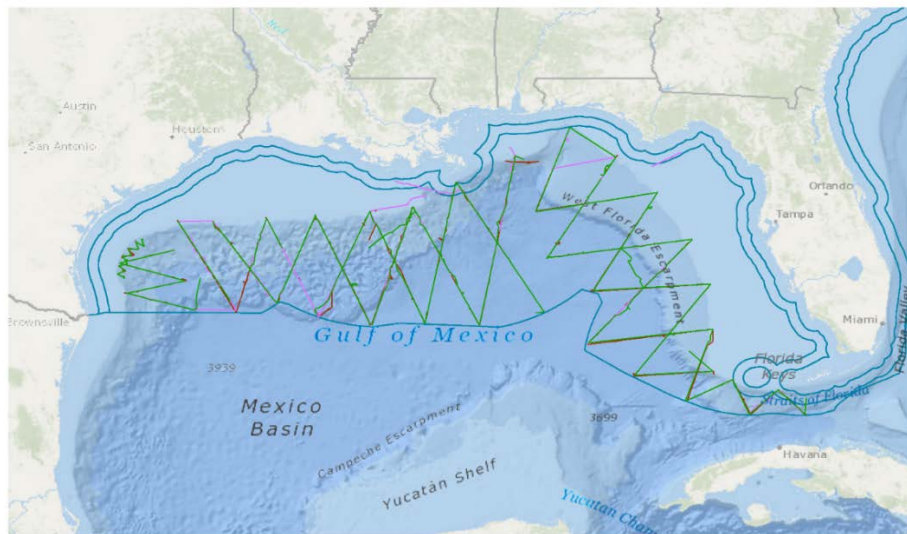

Figure 1. *Planned track lines for vessel surveys shown outside of state waters. State water boundaries are indicated by the inner blue line closest to shore. The track lines are consistent with those used during the GoMMAPPS surveys.*

Budget

Marine Mammal Budget	
Budget Category	**Total Cost**
Vessel surveys (includes ship time, staffing, travel)	$960,000
Analysis (data QA/QC, incorporation of data into models)	$50,000
Project Management	$124,800
MAM Activity Management, Oversight, and Reporting	$100,000
TOTAL	**$1,234,800**
Contribution of NOAA ship time (120 days total)	*~$1,600,000*

Seabird Budget	
Budget Category	**Total Cost**
Seabird Vessel surveys (includes PI supervision and oversight and planning of logistics, staffing, travel, lodging, car rentals, etc.)	$300,000
Analyses, Modeling, and Data Management (includes PI time, hiring PhD-level quantitative ecologist, data QA/QC, species-specific detection probabilities, habitat variables, environmental covariates and scaling, building and testing models, model outputs, combining 3 disparate datasets, data management, etc.)	$425,000
MAM Activity Management, Oversight, and Reporting	$100,000
TOTAL	**$825,000**

TOTAL	
Marine Mammal Costs	$1,234,800
Seabird Costs	$825,000
Subtotal	$2,059,800
Contingency (15%)	$308,970
TOTAL	$2,368,770

Schedule

This MAM Activity will be completed within a 3-year timeframe with the bulk of the work being completed between March 2023 - March 2025.

	Jan - May 2023	**June - Aug 2023**	**Sept-Dec 2023**	**Jan - May 2024**	**June - Aug 2024**	**Sept - Dec 2024**	**Jan – March 2025**
Pre-cruise and data management planning	■			■			
60-day vessel survey		■			■		
Data QA/QC/Interim products			■			■	
Update spatial density models						■	■
Final products							■

Roles of the Implementation Team

NOAA and DOI are responsible for implementing the tasks associated with each of the major elements in accordance with this MAIP, the associated Open Ocean TIG resolution, and the DWH Trustee Council SOP. This section describes the activities associated with the major elements and the specific entities responsible for each activity.

Management, Administration, and Oversight

Roles: NOAA, DOI

Description: Activity planning and coordination will be conducted prior to its launch and during implementation. This work will involve NOAA with input from DOI, and will be conducted via teleconferences and webinars. NOAA will oversee implementation during the entire duration of the activity via regular teleconferences to ensure that the deliverables are met on schedule and in a timely fashion. NOAA and DOI will submit information to the DWH DIVER Portal for annual reporting. All participating trustees will review the draft and final annual report for submission in DIVER.

Implementation

Roles: NOAA; DOI

Description: NOAA will coordinate implementation of the surveys according to the data collection methods described above. DOI will coordinate the activities of the seabird observers and any data collection related tasks.

Data Analyses

Roles: NOAA, DOI

Description: The NOAA implementation team will oversee the data analyses of marine mammal data according to the methods described above. DOI will oversee the data analysis associated with seabirds. Contextual observations (e.g. flying fish, sea turtles, sargassum) will be made public through NCEI at the end of the Activity, but will not be formally analyzed by the implementation teams.

Data Management and Reporting

A data management plan will be developed that documents data standards, quality assurance and quality control, and long-term maintenance and data archiving policies that is consistent with previous GOMMAPPS efforts and the guidance provided in the Monitoring and Adaptive Management Procedures and Guidelines Manual (DWH NRDA Trustees 2017b) and the Trustee Standard Operating Procedures (DWH NRDA Trustees 2016b).

NOAA and DOI will submit annual reports to the publicly available DWH DIVER Portal available at https://www.gulfspillrestoration.noaa.gov/restoration-areas/open-ocean. NOAA and DOI Implementation Team will prepare a final summary report synthesizing the findings of the Activity, including inferences and considerations for marine mammal and seabird restoration. All data will be archived with the National Center for Environmental Information (NCEI) and a link to the datasets will be provided in the DIVER Restoration Portal.

Consistency of MAM Activity with the PDARP/PEIS

The PDARP/PEIS establishes goals to identify and implement restoration activities that mitigate key stressors to support resilient populations, and collect and use monitoring information, such as population and health assessments and spatiotemporal distribution information. Information of this kind is meant to help implement an integrated portfolio of marine mammal and seabird restoration approaches across their diverse GOM habitats. This MAM Activity is intended to address significant informational needs for open ocean cetaceans (e.g., abundance, distribution, density, and habitat use) and seabirds to facilitate future restoration planning and implementation activities. Information gained from this MAM Activity will directly benefit the Trustees' ability to effectively restore marine mammals and seabirds. This MAM activity is consistent with the PDARP/PEIS, including the Monitoring and Adaptive Management Framework, as described in Section 5.5.11.4 (Restoration Type: Marine Mammals: Monitoring), and the *Strategic Framework for Marine Mammal Restoration Activities*, Module 1 which includes considerations for monitoring. For seabirds, this MAM activity is consistent with the PDARP/PEIS, including the Monitoring and Adaptive Management Framework, as described in Section 5.5.12.4 (Restoration Type: Birds: Monitoring), as well as the *Strategic Framework for Bird Restoration Activities.*

National Environmental Policy Act (NEPA) Review

Introduction

Section 6.4.14 of the PDARP/PEIS considers the environmental consequences associated with activities including, but not limited to planning, feasibility studies, design, engineering, and permitting of conceptual projects. These activities can include a mixture of data collection, modeling of ecological response to projects, conducting surveys, and creating maps and scale drawings of potential project sites. These activities may also include minimally intrusive field activities. The MAM activities described in this MAIP fall within the scope described in the PDARP/PEIS. Upon review, the federal trustees of the OO TIG find the environmental conditions and NEPA analysis in the PDARP/PEIS current and valid. Therefore, this review relies on the analysis in Section 6.4.14 of the PDARP/PEIS, which is incorporated herein by reference and summarized below. In addition, the field activities identified in this plan are a continuation of prior NOAA actions fully evaluated as part of GoMMAPPS, and as such this MAIP relies upon previous environmental review of GoMMAPPS, summarizing and incorporating by reference that material below. Further, some components of this MAIP are permitted activities under NMFS ESA and MMPA permit #21938-03, and as such the actions have been previously evaluated in the issuance of that permit.

Summary NEPA Review

For purposes of this NEPA review, activities to be performed can be categorized as data-based actions and field-based actions. In this review, visual data auditing, distance sampling analysis, development of improved surface density models and a final report are considered data-based actions. These activities are consistent with the previous evaluation in the PDARP/PEIS Section 6.4.14 and would not cause adverse impacts to any resource area, and require no additional environmental review.

For field-based actions, the PDARP/PEIS states that temporary adverse impacts on the biological and physical environment could include short-term, temporary disturbance of habitats and species, minor emissions from equipment and vehicles, and minor disturbance to terrestrial, estuarine, and marine environments. Field work in this MAIP consists of visual and acoustic surveys, collecting environmental data, and conducting remote biopsy sampling conducted by an experienced crew aboard a NOAA research vessel. Visual survey and environmental data collection activities are non-invasive and have been previously determined to have no effects on physical, biological or socioeconomic resources. Acoustic survey and biopsy sampling activities may have minor adverse effects on resources and require permitting and authorization under Endangered Species Act and the Marine Mammal Protection Act. Those activities are authorized under existing permits issued to the SEFSC (NMFS 2021).

Visual Surveys

The visual surveys include observers utilizing binoculars to record cetacean and bird sightings. The survey will primarily be conducted in "passing mode" whereby the ship maintains a steady course and speed while the visual teams identify the sighting to species level if possible and count the number of individuals in a sighting. Under certain circumstances, a "closing mode" technique will be employed, which entails maneuvering the ship to more closely approach a sighting. This survey mode is used sparingly and restricted to sightings of special interest. As summarized in the previous NMFS environmental review for issuance of scientific research permit (NMFS 2019), during vessel approaches cetaceans may exhibit signs of temporary disturbance, such as diving or moving away from the vessel, but these behaviors would dissipate within minutes after the encounter. Visual surveys could include short-term, temporary disturbance of protected species if they are approached, otherwise visual surveys from a distance are not expected to have adverse impacts.

Acoustic Surveys

For acoustic surveys, a modular towed hydrophone array will be deployed and directional sonobuoys will be used for acoustic detection, localization, and recording of low-frequency sounds produced by baleen whales that are too low in frequency to be detected by the towed array system. The sonobuoys are deployed as drifters which then scuttle themselves and settle to the seafloor at a pre-set time (max 8 hours, but likely less, maybe 1 - 2 hours, depending on the amount of time the vessel expects to be within range). Oceanographic and environmental data will be collected using scientific echosounders (EK60), a conductivity, temperature and depth sensor (CTD) unit, and expendable bathythermographs (XBT). Use of echosounders has been previously evaluated for potential impacts to resources; those evaluations are incorporated by reference here. NMFS (2020) found that echosounders including EK60, CD, and XBTs have nothing more than minor, short-term adverse impacts on biological resources; therefore, no additional evaluation is necessary for this proposed action.

Environmental Data Collection

Collecting environmental data such as temperature, salinity, oxygen concentration, conductivity is done via small, deployed sensors and the ship's Scientific Computer System (SCS). Collection of environmental

data has been previously evaluated for potential impacts to resources; those evaluations are incorporated by reference here. NMFS 2020 found that such data collection has no impact on the resources; therefore, no additional evaluation is necessary for this proposed action.

Remote Biopsy Sampling

Remote biopsy samples may be opportunistically collected from priority marine mammal species if encountered. Tissue samples would be collected from the small boat with a crossbow fitted with a custom designed sampling dart and head to extract a small core of skin and blubber. Biopsy sampling involves piercing the skin and would result in minor injury at the wound site with wounds healing within days to weeks of the event. Interactions with other protected species while sampling, such as ESA-listed fishes and sea turtles, are not expected because the permit includes mitigation measures to avoid or minimize effects to all protected species that may occur in the study area. The proposed remote biopsy sampling research activities are expected to result in effects ranging from minor, short-term (recoverable) adverse behavioral effects, to moderate adverse effects on the individual animals sampled. Such impacts fall within the range of activities permitted and authorized under existing ESA Section 10(a)(1)(A) scientific research permits (NMFS 2021) and MMPA take authorizations (NMFS 2021) held by the NMFS Southeast Fisheries Science Center, and as such, have been previously evaluated per the NEPA analyses associated with permits and authorizations (NMFS 2019). That evaluation considered routine methods of implementation; reasonably foreseeable direct, indirect, and cumulative effects; and mitigation activities required.

NEPA Conclusion

No long-term moderate adverse impacts would occur as a result of performing these MAM activities. Short-term, negligible to moderate adverse impacts could occur to cetaceans from disturbance due to the presence of the vessel, the towed passive acoustic receiver, and the biopsy sampling. Beneficial impacts would result from increased understanding about the distribution of open ocean cetaceans to help ensure maximum restoration benefits during restoration planning in the GOM. The impacts fall within the analysis provided in Section 6.4.14 of the Final PDARP/PEIS which states that some planning activities would cause minor, direct, short-term impacts through associated fieldwork, and the Permit to Take Protected Species for Scientific Purposes (No. 21938-03), which allows for effects ranging from minor, short-term (recoverable) adverse behavioral effects, to moderate adverse effects on the individual animals that are the subject of the permit. Therefore, no further NEPA analysis for these MAM activities is required.

Compliance with Other Environmental Laws and Regulations

The Open Ocean TIG will ensure compliance with all applicable state and local laws and other applicable federal laws and regulations relevant to this MAM Activity. We anticipate there will be minimal impacts to threatened or endangered species. Marine mammal surveys and sampling will be performed under the existing ESA and MMPA Permit issued to the SEFSC (NMFS 2021). No specific permits or

authorizations are anticipated to be required for visual surveys of seabirds. The compliance status by statute at the time of this MAIP is shown below in Table 1. All necessary compliance will be complete prior to the implementation of field work.

Federal environmental compliance responsibilities and procedures follow the Trustee Council Standard Operating Procedures (SOP), which are laid out in Section 9.4.6 of that document. Following the SOP, the Implementing Trustees will ensure that the status of environmental compliance (e.g., completed vs. in progress) is tracked through the Restoration Portal.

Documentation of regulatory compliance will be available in the Administrative Record that can be found at the DOI's Online Administrative Record repository for the DWH NRDA (https://www.doi.gov/deepwaterhorizon/adminrecord). The current status of environmental compliance can be viewed at any time on the Trustee Council's website: http://www.gulfspillrestoration.noaa.gov/environmental-compliance/.

Table 1. Status of federal regulatory compliance reviews and approvals.

Federal Statute	Compliance Status
Bald and Golden Eagle Protection Act (USFWS)	N/A
Coastal Barrier Resources Act (USFWS)	N/A
Coastal Zone Management Act	N/A
Endangered Species Act (NMFS)	Complete based on existing compliance. The NOAA SEFSC holds an existing MMPA and ESA permit (No. 21938-03), which authorizes take from the proposed survey and sampling techniques described above. Additional BMPs may be required by NMFS for operations in the Rice's whale core distribution area.
Endangered Species Act (USFWS)	In progress
Essential Fish Habitat (NMFS)	N/A
Marine Mammal Protection Act (NMFS)	Complete based on existing compliance. The NOAA SEFSC holds an existing MMPA and ESA permit (No. 21938-03) which authorizes take from the proposed survey and sampling techniques described above.
Marine Mammal Protection Act (USFWS)	In progress

Federal Statute	Compliance Status
Migratory Bird Treaty Act (USFWS)	N/A
National Historic Preservation Act	N/A
Rivers and Harbors Act/Clean Water Act	N/A
National Environmental Policy Act	Complete, based Section 6.4.14 of the Final PDARP/PEIS and above in the Summary NEPA Review section

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