Deepwater Horizon Open Ocean Trustee Implementation Group

MONITORING AND ADAPTIVE MANAGEMENT ACTIVITIES IMPLEMENTATION PLAN: EVALUATING THE CUMULATIVE IMPACTS OF MULTIPLE STRESSORS ON CETACEANS

August 2019

1 Introduction

The Deepwater Horizon (DWH) oil spill settlement in 2016 provides the 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. As described in the DWH oil spill Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement (PDARP/PEIS; DWH NRDA Trustees. 2016a), the Trustees selected a comprehensive, integrated ecosystem approach to restoration. The Final PDARP/PEIS considers programmatic alternatives, composed of Restoration Types, to restore natural resources, ecological services, and recreational use services injured or lost as a result of the DWH oil spill incident. As shown in the PDARP/PEIS, the injuries caused by the DWH oil spill affected such a wide array of linked resources over such an enormous area that the effects must be described as constituting an ecosystem-level injury. The PDARP/PEIS and information on the settlement with British Petroleum Exploration and Production Inc. (called the Consent Decree) are available at the Gulf Spill Restoration website.

Given the unprecedented temporal, spatial, and funding scales associated with the DWH oil spill 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 (Appendix 5.E of the PDARP/PEIS). This framework allows the Trustees to evaluate restoration effectiveness, address potential uncertainties related to restoration planning and implementation, and provide feedback to inform future restoration decisions.

The Trustees also established a governance structure that assigned a Trustee Implementation Group (TIG) to each of the eight designated Restoration Areas, including the Open Ocean Restoration Area. Each TIG makes restoration decisions for the funding allocated to its Restoration Area and is also responsible for identifying MAM priorities for its respective TIG. The Open Ocean TIG includes the four federal Trustee agencies: U.S. Department of Commerce, represented by the National Oceanic and Atmospheric Administration (NOAA); U.S. Department of the Interior (DOI); U.S. Department of Agriculture (USDA); and U.S. Environmental Protection Agency (EPA). It is responsible for restoring the natural resources and services within the Open Ocean Restoration Area that were injured by the DWH oil spill and associated spill response efforts.

The DWH Trustees opened a publicly available Administrative Record for the NRDA of the DWH oil spill, including restoration planning activities, concurrently with publication of the 2010 Notice of Intent (pursuant to 15 CFR § 990.45). DOI is the lead federal Trustee for maintaining the Administrative Record, which can be found at http://www.doi.gov/deepwaterhorizon/adminrecord. This administrative record is used by the Open Ocean TIG to provide the public with information about DWH restoration planning, including MAM activities. Additional information is also provided at http://www.gulfspillrestoration.noaa.gov. Information about restoration projects and MAM activities, including any data and/or analyses produced and annual reports, are made publicly available via the Data Integration Visualization Exploration and Reporting portal (DIVER), available at https://www.diver.orr.noaa.gov/web/guest/home.

2 Document Purpose

The Open Ocean TIG MAM Strategy (see http://www.gulfspillrestoration.noaa.gov), released in May 2019, describes the TIG's approach to MAM, responsibilities, and goals for the use of the Open Ocean Restoration Area MAM allocation. It also describes the TIG's process to develop and release MAM Activities. MAM activities are projects or other MAM efforts (e.g., monitoring, modeling, data collection, research) developed to address identified MAM priorities. MAM priorities are the knowledge gaps or information needs that, if addressed, would help the Trustees successfully implement Gulf restoration.

This MAM Activities Implementation Plan (MAIP) describes the MAM activity, "*Evaluating the Cumulative Impacts of Multiple Stressors on Cetaceans*" to begin to address MAM priorities preliminarily identified by the Open Ocean TIG for the Marine Mammals Restoration Type. This MAM activity is intended to support evaluation of restoration outcomes within the Open Ocean Restoration Area; perform data synthesis and analysis; and resolve critical information gaps and uncertainties for restoration planning and informing restoration decision-making. This document provides information about the activities to be implemented and the data gaps and uncertainties they will address. It also describes its applicability to the Open Ocean MAM Strategy and consistency with the programmatic alternative selected by the Trustees in the PDARP/PEIS.

3 MAM Activity Overview: Evaluating the Cumulative Impacts of Multiple Stressors on Cetaceans

The Open Ocean TIG initiated the process of identifying potential MAM needs while developing its first and second restoration plans (see Gulf Spill Restoration Open Ocean Restoration Area) and while developing the Open Ocean MAM Strategy. Public input was solicited during the 2017 call for restoration project ideas. In addition, the Trustees solicited input from stakeholders and experts from the Trustee agencies, academia, conservation groups, and related industries. Based on this input, the Open Ocean TIG developed this MAIP to begin addressing MAM priorities for the Marine Mammals Restoration Type to inform restoration planning, evaluation, and adaptive management.

As summarized in PDARP/PEIS Section 5.5.11, the DWH oil spill resulted in the contamination of prime marine mammal habitat in the nearshore and offshore waters of the northern Gulf of Mexico. After inhaling, ingesting, aspirating, and potentially absorbing oil components, animals suffered from physical damage and toxic effects to a variety of organs and tissues, including lung disease, adrenal disease, poor body condition, immunosuppression, and a suite of other adverse health effects. Animals that succumbed to these adverse health effects contributed to the largest and longest marine mammal unusual mortality event on record in the northern Gulf of Mexico. Nearly all of the marine mammal stocks that overlap with the DWH oil spill footprint have demonstrable, quantifiable injuries. The remaining stocks were also likely injured, but there was not enough information to make a determination at the time of the Settlement. The diverse number of species and geographic range of marine mammals affected by the spill was unprecedented. These species are long-lived, reproduce slowly, and have an important role in the food web as apex predators. All of these factors affect the recovery of marine mammals and necessitate a portfolio of restoration approaches that collectively

address all stocks, species, and geographic areas injured by the spill. This restoration portfolio includes ecological benefits achieved through habitat restoration in addition to addressing direct sources of mortality and morbidity; spatial planning; and robust monitoring of populations, health statuses, and trends. This MAIP will contribute to the identification of key stressors and effective restoration activities to support resilient populations.

3.1 Activity Description

3.1.1 Background

Cetaceans in oceanic waters (>200m bottom depth) of the Northern Gulf of Mexico are exposed to stressors such as noise, shipping traffic, and interactions with commercial fisheries. Quantifying the cumulative impact of these stressors on cetacean population stocks (stocks) is essential for effectively implementing and adaptively managing restoration efforts. The quantification of multiple stressor impact is complicated by the likely interaction of some stressor effects, and assuming simple additive effects may lead to an under- or over-estimation of cumulative impact (NAS 2017). One promising conceptual model for evaluating these effects is the Population Consequences of Multiple Stressors (PCoMS) framework (Figure 3.4-1). The PCoMS framework includes transfer functions that relate exposure to given stressor(s), subsequent behavioral or physiological responses, associated changes to an individual's allostatic load or health, and changes in vital rates. However, information to parameterize these transfer functions and an understanding of potential stressor interactions is lacking for Gulf of Mexico cetaceans. One of the most important contemporary questions in marine ecology is how to assess the cumulative effects of multiple stressors (Rudd 2014). Quantifying the cumulative impact of stressors on cetacean stocks is essential for effectively implementing and adaptively managing anthropogenic activities in a way that minimizes effects on cetaceans.

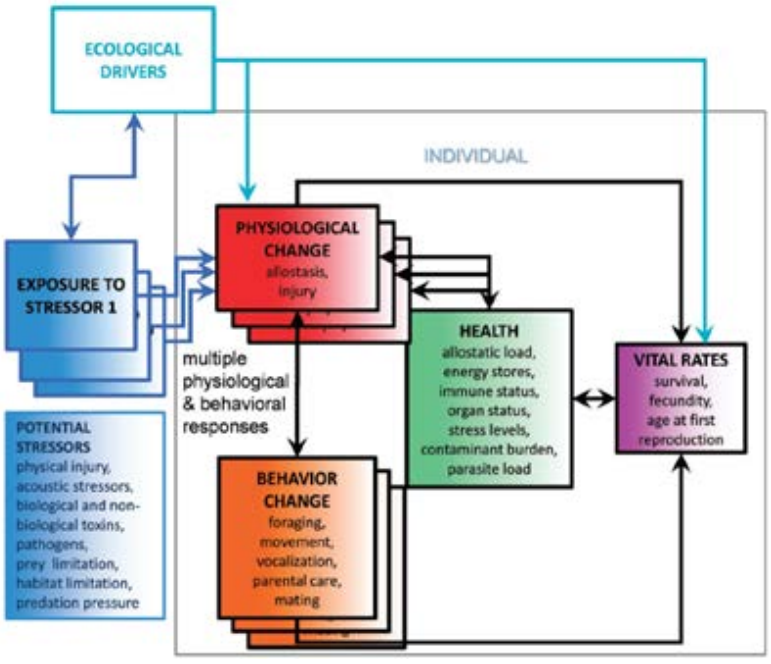

Figure 3.4-1. The PCoMS framework for a single individual exposed to multiple stressors. Each box in the framework represents one or more variables that evolve over time. For each individual, changes in physiology may result in changes in behavior (such as movement away from a sound source and cessation of feeding), which may in turn affect physiology. Source: Approaches to Understanding the Cumulative Effects of Stressors on Marine Mammals. National Academy of Sciences, Engineering, and Math (2017).

The PCoMS framework was developed by a National Academies of Sciences Ocean Sciences Board (2017) as a conceptual approach to understand the cumulative effects of stressors on cetaceans. The PCoMS framework is an extension of the Population Consequences of Disturbance (PCoD) framework, which was initially formulated to examine the impacts of acoustic disturbance on the energetics and population dynamics of marine mammals (e.g., Harwood et al. 2014; King et al. 2015). These models are characterized by a functional relationship between a disturbance, such as anthropogenic noise, and a behavioral response in the target organism. This behavioral response drives an energetic cost such as reduced feeding, which then leads to an individual physiological effect and ultimately may lead to a change in population vital rates and dynamics (Figure 1; King et al. 2015). An example of this type of model has recently been developed for the Northern Gulf of Mexico sperm whale associated with exposure to noise sources from oil and gas exploration (Farmer et al. 2018a). As with many prior studies, the Farmer et al. model found that there was potential for long term negative population-level effects due to increased sound exposure; however, the key uncertainty was the anticipated degree of the behavioral response due to sound exposure. Under the range of behavioral responses tested, the Gulf of Mexico sperm whale was expected to experience a range of effects from no impact to significant reductions in population growth. Identifying key sources of uncertainty and conducting field studies to improve estimation of these parameters is thus a key step in the development and use of models of this type. The PCoMS framework extends the PCoD approach by including multiple stressors (e.g., physical injury, acoustic stressors, pathogens, etc.) that may have direct physiological effects (e.g., disease processes, decreased body condition) or behavioral effects that indirectly lead to impacts on health.

3.1.2 Objectives

The overall goal of this activity is to develop and implement a PCoMS framework to evaluate the cumulative impact of multiple anthropogenic stressors and quantify the relative benefit of restoration efforts aimed at reducing those stressors on key stocks of Gulf of Mexico cetaceans. This activity will integrate the information gathered during restoration projects, such as those currently proposed under the Open Ocean TIG Draft Restoration Plan 2 and Environmental Assessment (RP2/EA) (e.g. reducing vessel strikes, reducing impacts of anthropogenic noise, improving disaster response) into a quantitative framework to evaluate their effectiveness at improving survival and reproduction of target cetaceans. This activity will target sperm whale and oceanic dolphin stocks that were injured by the DWH spill. Both sperm whales (listed as Endangered under the Endangered Species Act) and oceanic dolphins (e.g., pantropical spotted dolphins) are widely distributed in the Gulf and may be sensitive to environmental changes and anthropogenic stressors. In addition, this activity will provide a useful framework for integrating data collected during ongoing monitoring programs and characterizing trends in population parameters such as abundance, survival, and reproductive rates. As such, it is a useful framework for conducting quantitative evaluation of management and restoration strategies and assessing progress towards restoration goals.

3.1.3 Tasks

This MAM activity will develop PCoMS models for oceanic cetacean stocks that were injured during the DWH oil spill relying on a comprehensive literature search combined with an expert elicitation approach to develop initial parameter estimates (and associated uncertainty) for the impacts of various stressors

and the relationships among them. The initial estimates of parameter values and their uncertainties will identify potentially important knowledge gaps. Sensitivity analyses of the PCoMS models will then be used to identify those parameters with the largest impact on model outcomes.

The MAM activity will proceed in two phases. Phase 1 tasks will develop interim PCoMS models for sperm whales and oceanic dolphins. After the development of the interim PCoMS models, a steering committee (see Section 3.2.5 below) will evaluate model requirements for monitoring the effectiveness of restoration projects and a refined Phase 2 work plan and budget will be developed for approval by the Open Ocean TIG prior to proceeding with Phase 2 of the activity. Following identification and ranking of data gaps, Phase 2 tasks would target field work to quantify dose-response relationships between levels of a given stressor and physiological and behavioral changes, and further literature screening would be used to improve parameter estimates and reduce model uncertainty. The PCoMS models would then be updated by integrating additional data collected during directed field studies, implemented restoration projects, and ongoing monitoring programs.

Phase 1 Tasks (Years 1-3):

- Review available information on population dynamics, bioenergetics, and physiological and behavioral responses to anthropogenic stressors for sperm whales and oceanic dolphins;
- Integrate the outcomes of information gathering activities conducted by marine mammal restoration projects and other related activities in the Gulf of Mexico;
- Based on the above, identify priority stressors to be included in PCoMS frameworks;
- Through expert elicitation, develop interim PCoMS models to identify and prioritize critical data gaps
- Plan field studies and provide Phase 2 work plan for approval by the Open Ocean TIG.

Phase 2 Tasks (Years 3-5):

- Conduct field studies to collect data required to address identified data gaps, examples of field projects may include: 1) deployment of telemetry tags to measure dive profiles and estimate body composition, swimming energetics, and feeding rates; 2) remote biopsy, photo-monitoring, and health assessment studies to compare survival, reproduction, or health under varying stressor exposures; and 3) controlled behavioral response studies.
- Integrate the results of field studies to refine parameter estimates and/or model structure to reduce uncertainty in PCoMS outputs for iterative monitoring and adaptive management throughout the DWH NRDA restoration program.

3.2 Activity Implementation Description

3.2.1 Phase 1: Expert Elicitation and Interim PCoMS model development

Phase 1 will develop interim PCoMS models (Figure 2). Interim models rely on the use of expert elicitation to develop initial parameter estimates and uncertainty.

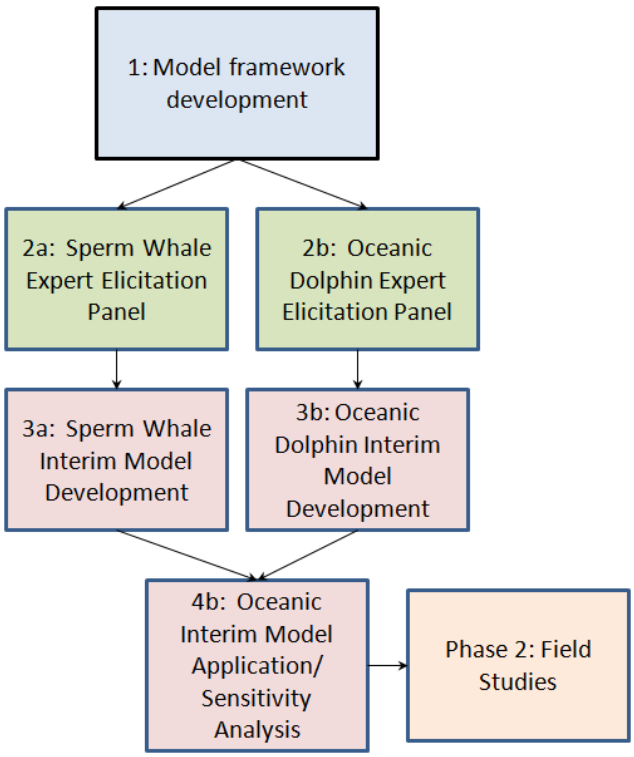

Figure 3.4-2. Flow diagram describing development of interim PCoMS models. A steering committee will inform the initial model scope and identification of key parameters to be addressed through expert elicitation (Step 1). Two distinct expert panels will be convened (Step 2), and resulting parameters will be incorporated into initial PCoMS models (Step 3). Sensitivity analyses conducted with the interim model will be used to identify key parameters to refine through field studies, evaluate the utility of the model for addressing MAM objectives, and assess the benefits of field projects, again with the input of the steering committee. Field projects would then be implemented during Phase 2.

3.2.1.1 Model Framework Development

The first, data-based task will gather data from literature sources and ongoing field studies to develop a portfolio of background information and to identify model parameters that need to be estimated. This step will incorporate information from other marine mammal focused restoration projects such as those aimed at reducing ship strikes and anthropogenic noise exposure for large whales and other oceanic stocks. Existing data will be drawn from DWH injury assessment studies, health assessment studies conducted during subsequent Gulf of Mexico Research Initiative (GOMRI) projects, and ongoing restoration studies conducted by state or regional TIGs. In addition, a recent PCoD effort has been completed for Gulf of Mexico sperm whale focusing on behavioral and energetic responses to disturbance by anthropogenic noise (Farmer et al. 2018a). The approach by Farmer et al. incorporates a shifted baseline condition that considers the long-term effects of DWH oil exposure, and also includes the development of a bioenergetic model for sperm whales that integrates the energetic costs of disturbance into sperm whale population dynamics (Farmer et al. 2018b).

The most appropriate approaches for evaluating and analyzing effects of the multiple, potentially interacting, stressors will be selected using a decision tree developed by the National Academies of Sciences, Engineering, and Medicine Committee on Cumulative Effects of Stressors on Marine Mammals (NAS 2017). A steering committee will be formed, consisting of about 12 members representing the Marine Mammal Commission (MMC), National Marine Fisheries Service (NMFS), and other stakeholders (e.g., Bureau of Ocean Energy Management [BOEM], U.S. Navy) that will be invited to participate. The steering committee will help to guide the scope of models, as well as the identification of key parameters to be addressed through expert elicitation.

3.2.1.2 Expert Elicitation

The expert elicitation process is a quantitative structured decision making process with well-defined steps and expected outcomes (Harwood et al. 2014). Two interim PCoMS models will be developed: one for sperm whales and a second for oceanic dolphins. After gathering and summarizing available information and identifying a small set of key parameters (likely 3-5 per model), a group of experts is assembled, and each expert is asked to develop a probability distribution for the parameters based upon the information presented in the evidence dossier and their expert opinion. There are several tools available to assist in this process and convert expert opinion into quantitative metrics that represent the best consensus of the expert group (e.g., SHELF, http://www.tonyohagan.co.uk/shelf/). An expert elicitation process focusing on the health impacts of oil-associated chemicals on cetaceans is currently planned through the Consortium for Advanced Research on Marine Mammal Health Assessment (CARMMHA) project funded through GOMRI during 2018-2020 (https://www.carmmha.org/ or http://research.gulfresearchinitiative.org/research-awards/projects/?pid=295). The CARMMHA project will use the expert elicitation for the development of population models for several target species, including sperm whales and oceanic dolphins in the Gulf of Mexico, and it is expected that the outcome of that process will also inform the development of parameter estimates and probability distributions for survival rates and reproductive rates relevant for this MAM activity. For this MAM activity, the interim PCoMS models will include expert elicitation for refining dose-response parameters for specific stressors, along with associated uncertainty. In addition, the interim PCoMS model development will extend existing PCoD models by considering a larger suite of dose-response processes beyond behavioral disturbance, and by considering potential interaction among responses for multiple stressors. For example, the model may consider the effects of localized and/or transient prey depletion associated with coastal pollution/habitat loss or the possible benefits associated with the restoration of these resources. While the complete list of potential stressors to be considered is unknown at this time, upon the formation of the steering committee, the suite of potential stressors, and how they will be changed during restoration projects, will be reviewed and evaluated for inclusion in the model framework.

3.2.1.3 Interim Model Development and Sensitivity Analysis

Phase 1 will result in interim PCoMS models and identify critical data and information gaps. The models provide a quantitative framework with which to identify potential impacts of individual stressors on the population dynamics of target species and will help to quantify the benefits of restoration projects.

3.2.1.4 Outcomes

The outcomes of Phase 1 will be the interim PCoMS model outputs and sensitivity analysis results, which will guide next steps for the activity and set broader marine mammal restoration goals. For example, the PCoMS could be used to set targets for the reduction of anthropogenic noise sources that would be expected to result in a significant reduction in behavioral disturbance and thereby increase the population growth rate for target species. The interim models, and the expert elicitation process, will also help to identify key parameters and their associated uncertainty and thereby inform the data gathering process for other restoration projects and identify key field activities that need to be conducted during Phase 2 to address those uncertainties.

3.2.2 Phase 2: Field studies to address critical information gaps

There are likely to be several key parameters with a high degree of uncertainty identified in the interim PCoMS models. For example, while data are available from other geographic areas to help bound the uncertainty in life-history and behavioral parameters, there are unique aspects of the biology of sperm whales and oceanic dolphins in the northern Gulf of Mexico. Therefore, to improve the utility of the model for restoration, field studies would be conducted during Phase 2 of this project to address critical information gaps identified during Phase 1. The information gaps are most likely to include behavioral responses to various disturbances, the bioenergetic status of affected populations, and trophic interactions.

3.2.2.1 Field Study Methods

The field studies would require vessel based studies in sperm whale or oceanic dolphin habitats in the northern Gulf of Mexico. The exact survey effort and data collection plans would be determined by the key uncertainties identified by sensitivity analysis of the PCoMS models. We anticipate that these studies would total approximately 60 days at sea. The configuration (e.g., cruise length, staffing, and timing) of these studies would be driven by the requirements determined during Phase 1 planning and evaluation. The studies would likely be focused primarily on the collection of data on individual animals, rather than large scale surveys for abundance or spatial distribution. Information on abundance at the population level has been collected during the BOEM funded Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS) project and associated spatial density modeling efforts. Examples of possible field efforts include animal borne telemetry tag studies, studies of animal health and condition, and studies of behavioral responses to stressors.

3.2.2.2 Outcomes

The data collected during field studies would reduce uncertainties in key parameters identified in the interim PCoMS models. As a result, the predictions generated by these models would also have reduced biases and uncertainty. While it is unlikely that all critical information gaps can be filled, the iterative process of identifying information gaps that are essential to model parameterization and designing field studies to address those gaps would help ensure that the data collected provide the most direct benefit for restoration. The end product of these efforts would be improved estimates for key parameters of the PCoMS models that would be integrated into updated models.

Following the completion of field studies and associated data analysis, the PCoMS model framework would be updated with newly estimated parameters (e.g., bioenergetic parameters, dose-response curves, etc.). The updated framework can then be incorporated into the restoration planning and evaluation process for a broad suite of potential restoration actions. It is anticipated that these analyses would take the form of quantitative evaluations to predict which restoration actions are expected to have the greatest benefits to cetaceans and to identify mechanisms to assess changes in population status in response to restoration projects. It is also anticipated that this framework would be helpful in identifying additional data gaps and key metrics to monitor as restoration projects continue.

The critical task for managing risk of cumulative effects is to determine which combination of stressors could be reduced in order to bring the population (or ecosystem) into a more favorable state (NAS

2017). Although it may be challenging to parameterize the models to the extent that definitive statements can be made regarding the population effects of single stressors, the PCoMS models should allow reliable relative comparisons between proposed restoration actions. The final product of this activity would be updated PCoMS models that provide the information necessary to support restoration planning and evaluation. The PCoMS models would provide input to restoration projects on the potential impacts of environmental stressors on population dynamics, and integrate the available information on the effects of changes in anthropogenic stressors during the implementation of restoration projects. As part of the implementation of updated models resulting from this activity, we will evaluate the effects of the reduction in bias and uncertainty in stressor parameters on the resulting bias and uncertainties in model outputs to continue to refine the use of these models for restoration planning and evaluation. In addition, the completion of these models will support the development of similar models for a larger suite of species if needed. Finally, we anticipate the identification of additional key parameters that are important data gaps for cetacean restoration.

The primary environmental impacts would be from field studies that may be conducted in Phase 2 that include nonlethal takes[1] of endangered and/or protected marine mammals. These studies would focus on Gulf of Mexico Sperm Whales, which are listed as endangered under the Endangered Species Act (ESA) and protected under the Marine Mammal Protection Act (MMPA) and possibly oceanic dolphins which are protected by the MMPA. Annual takes of these species for these studies would likely be on the order of 10-30 individuals and could include close approaches by small boat and drone, biopsy sample collection, tag telemetry application, and exposure to sound sources during proposed behavioral response studies. Incidental take of other marine mammal species and of sea turtles could also occur in the course of conducting the field studies. These studies would likely be conducted under existing MMPA and ESA research permits held by the Southeast Fisheries Science Center. Modifications may be required to the existing permits to increase the number and types of marine mammal takes. However, behavioral response studies are not currently included under the existing permits. If behavioral response studies are needed, environmental assessments relevant to the proposed data collection activities would be conducted as required under NEPA. All necessary permits would be obtained prior to conducting any field studies.

3.2.3 Budget

The estimated budget for Phase 1 of this activity is approximately $1,182,230. The estimated budget for Phase 2 is approximately $2,544,460, and would be approved by the Open Ocean TIG, contingent on the outcome of Phase 1. The total, combined cost, if both phases are implemented would be approximately $3,726,690.

[1] The Endangered Species Act defines Take as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct” (16 USC § 1532). Take as defined under the Marine Mammal Protection Act means "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal" (16 USC § 1362).

3.2.4 Timeline

This MAM activity is anticipated to take five years to complete. Phase 1 will occur in Years 1-3 (October 2019 – September 2022). Phase 2 would be initiated during Year 3 (October 2021 – September 2022), pending review of initial Phase 1 outcomes and refinement of requirements for field activities, and would continue through Years 4-5 (October 2022 – September 2023).

3.2.5 Implementation Roles

NOAA will be the implementing Trustee, with participation anticipated from DOI, BOEM, the U.S. Navy, and the MMC. The steering committee will include representatives from each of these agencies and several offices within NMFS including Office of Protected Resources, Office of Science and Technology, Southeast Regional Office, and Southeast Fisheries Science Center (SEFSC). The NMFS Southeast Fisheries Science Center will be responsible for the implementation of analyses, model development, and field studies described in Phases 1 and 2 of this project. SEFSC will partner with University researchers and other agencies as needed to accomplish the goals of the activity. Potential partners include the Scripps Institution of Oceanography, Oregon State University, the National Marine Mammal Foundation, the University of St. Andrews, and the University of Miami. The Expert Elicitation Panel of approximately 10 members, will likely be convened through a contracted facilitator and will include participants from a suite of academic and government agencies with experience in marine mammal physiology, behavior, and population dynamics.

3.2.6 Data Management and Reporting

All data collected, compiled, or analyzed as part of this activity will be stored on the Data Integration, Visualization, Exploration, and Reporting (DIVER) Restoration Portal or other data platforms as appropriate for the data type. Data management, including data documentation standards, quality assurance and quality control procedures, and long-term maintenance and data archiving policies, will conform to the guidance provided in the Monitoring and Adaptive Management Procedures and Guidelines Manual (DWH NRDA Trustees 2017) and the Trustee Council Standard Operating Procedures (DWH NRDA Trustees 2016b).

MAM activities will be reported in the DIVER Restoration Portal and updated annually to reflect the status of the MAM activities. Interim monitoring reports will be released annually, and a final monitoring report will be released within one year of monitoring activities being concluded.

4 Open Ocean MAM Strategy Goals Addressed by this MAM Activity

This MAM activity supports the Open Ocean MAM strategy goals to evaluate the outcomes of the Open Ocean restoration efforts across the portfolio of Open Ocean projects, including evaluating benefits to Restoration Types, such as Marine Mammals, and to identify the benefits and outcomes from Open Ocean restoration activities to marine mammals. The sensitivity analyses of the interim models would identify, and the field studies would fill, data gaps that contribute to uncertainty in the modeling framework. These uncertainties currently reduce the Open Ocean TIG's ability to evaluate progress

toward the Restoration Goals for marine mammals. The refined models would support the trustees in identifying, prioritizing, and filling these data gaps. The models would also be used to evaluate the outcomes of the Open Ocean restoration effort across a portfolio of projects. In addition to marine mammal restoration, this may include cross-resource benefits (e.g., restoration of marine mammal prey species may occur as part of restoration within the Fish and Water Column Invertebrates Restoration Type). This activity may also support further development of PCoMS models for other species, including coastal and estuarine dolphins, and thus, could contribute to evaluation of restoration activities across the northern Gulf of Mexico.

5 Consistency of MAM Activity with the PDARP/PEIS

This MAM activity primarily supports the restoration goal for the Marine Mammals Restoration Type of identifying restoration activities that mitigate key stressors in order to support resilient populations (PDARP/PEIS section 5.5.11.1), by providing a platform for prioritizing monitoring and restoration projects related to population health and mitigation or reduction of stressors and threats. Simultaneously evaluating the effects of multiple stressors across the spatiotemporal distribution of each population will enable integrated planning of restoration projects using all of the restoration approaches identified in the PDARP/PEIS (Section 5.5.11.2) to mitigate and reduce those stressors and threats in a way that maximizes benefits to multiple species across their habitats and ranges. Therefore, this MAM activity is consistent with the PDARP/PEIS goals and strategy described in Sections 5.5.11.1 and 5.5.11.2. By providing a platform for evaluation and prioritization of restoration projects, it is also consistent with the Monitoring and Adaptive Management Framework, described in Section 5.5.15.2.

6 National Environmental Policy Act (NEPA) Review

The Trustees' approach to compliance with NEPA summarized in this section is consistent with, and follows where applicable from the PDARP/PEIS Section 6.4.14. Resources considered and impacts definitions (minor, moderate, major) align with the PDARP/PEIS. Relevant analyses from the PDARP/PEIS are incorporated by reference. Such incorporation by reference of information from existing plans, studies or other material is used in this analysis to streamline the NEPA process and to present a concise document that briefly provides sufficient evidence and analysis to address the Open Ocean TIG's compliance with NEPA (40 CFR 1506.3, 40 CFR § 1508.9). All source documents relied upon are available to the public and links are provided in the discussion where applicable.

As discussed in Chapter 6 of the PDARP/PEIS, a TIG may propose funding a planning phase (e.g., initial engineering, design, and compliance) in one plan for a conceptual project, or for studies needed to maximize restoration planning efforts. This would allow the TIG to develop information needed leading to sufficient project information to develop a more detailed analysis in a subsequent restoration plan, or for use in the restoration planning process. Where these conditions apply and activities are consistent with those described in the PDARP/PEIS, NEPA evaluation is complete and no additional evaluation of individual activities is necessary.

6.1.1 NEPA Review of MAM Activity: Evaluating the Cumulative Impacts of Multiple Stressors on Cetaceans

The goal of this activity is to develop and implement a framework to evaluate the cumulative impacts of multiple anthropogenic stressors and quantify the relative benefit of restoration efforts aimed at reducing those stressors on key stocks of Gulf of Mexico cetaceans. This activity will develop PCoMS models for oceanic marine mammal stocks that were injured during the DWH event, relying on a comprehensive literature search combined with an expert elicitation approach to develop initial parameter estimates (and associated uncertainty) for the impacts of various stressors and the relationships among them. Ranges provided for initial parameter estimates will identify critical knowledge gaps, and preliminary sensitivity runs of PCoMS models will be used to identify parameter uncertainty with the largest impact upon model outcomes. Following identification and ranking of data gaps, targeted field work and further literature screening may be conducted to improve parameter estimates and reduce model uncertainty.

Phase 1 actions include expert-elicitation, data review, model development, planning for Phase 2, and reporting, but will not include field studies. Consistent with the impacts considered in the PDARP/PEIS Section 6.4.14, all components of Phase 1 involve data that have already been collected. Therefore, none of the activities will result in impacts to the environment.

Phase 2 actions, if undertaken, would include additional data-based actions to improve the models and would also include field studies to address data gaps. Specific activities would be determined following Phase 1 and may include actions involving live marine animals such as deployment of telemetry tags to measure dive profiles and estimate body composition, swimming energetics, and feeding rates; remote biopsy, photo-monitoring, and health assessment studies; and controlled behavioral response studies.

Certain field activities (e.g., aerial and vessel-based surveys; behavioral observation; remote monitoring; collection of biological samples; capturing, handling, tagging with instrumentation; tissue sampling) require permitting and authorization under ESA and MMPA. We anticipate that potential Phase 2 activities would fall within the range of activities permitted and authorized under existing ESA Section 10(a)(1)(A) scientific research permits and MMPA take authorizations held by the NMFS Southeast Fisheries Science Center, and as such, have been previously evaluated per the NEPA analyses associated with those permits and authorizations (NMFS 2016, NMFS 2019). The prior NEPA analyses in the 2016 draft programmatic environmental assessment for these types of field activities are incorporated here by reference and considered methods of implementation; reasonably foreseeable direct, indirect, and cumulative effects; and mitigation activities required. In addition, the process utilized by NOAA as part of each EA to confirm the lack of environmental impact is also incorporated here by reference (NOAA 2017).

No additional NEPA evaluation would be needed for Phase 2 activities that can be carried out under existing permits and authorizations. The data gathered are expected to lead to beneficial impacts to biological resources through increased understanding of cumulative anthropogenic stressors on cetaceans and the application of this understanding to future restoration activities. Should there be activities that fall outside of current permits or that would require modification of current permits, those actions would be fully evaluated and any requisite NEPA for such permit modification would be completed prior to such actions being taken.

6.1.2 NEPA Conclusion

Based on review of the proposed activities against those actions previously evaluated in the PDARP/PEIS and actions authorized under ESA and MMPA permits, no additional NEPA evaluation is necessary at this time.

7 Compliance with Environmental Laws and Regulations

The Open Ocean TIG has completed technical assistance with the appropriate regulatory agencies for Phase 1 of this project and determined there will be no effects, thus permits and consultations are not required. This is due to the nature of the Phase 1 activity, which consists of data analysis and modeling with no proposed field activities. Once the details, including locations and fieldwork methodologies, are determined for Phase 2, the OO TIG will evaluate the need for future environmental compliance approvals. The OO TIG will also evaluate any existing permits or consultations that may apply to Phase 2 field work. All necessary environmental compliance would be completed prior to the commencement of any fieldwork.

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 this SOP, the Implementing Trustees for each activity will ensure that the status of environmental compliance (e.g., completed vs. in progress) is tracked through the Restoration Portal. The Implementing Trustees will keep a record of compliance documents (e.g., ESA biological opinions, USACE permits) and ensure that they are submitted for inclusion in the Administrative Record. The current status of environmental compliance by project can be viewed at any time on the Trustee Council's website: http://www.gulfspillrestoration.noaa.gov/environmental-compliance/.

8 References

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