Open Ocean Trustee Implementation Group

Monitoring and Adaptive Management Strategy

Updated June 2020

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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Acronyms and Abbreviations

DIVER	Data Integration, Visualization, Exploration, and Reporting
DWH	*Deepwater Horizon*
GoMOSES	Gulf of Mexico Oil Spill & Ecosystem Science
MAM	Monitoring and Adaptive Management
MAM Manual	Monitoring and Adaptive Management Procedures and Guidelines Manual
NEPA	National Environmental Policy Act
NRDA	Natural Resource Damage Assessment
PDARP	Programmatic Damage Assessment and Restoration Plan
PEIS	Programmatic Environmental Impact Statement
RESTORE	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States
SOP	Standard Operating Procedure
TIG	Trustee Implementation Group

Key Terms and Definitions

This document describes Monitoring and Adaptive Management (MAM)-related processes, procedures, and guidelines that are relevant to the Open Ocean *Deepwater Horizon* (DWH) oil spill Natural Resource Damage Assessment (NRDA) restoration effort. To provide clarity and avoid confusion, definitions are provided below for key terms that are used throughout the document. Where possible, these definitions were drawn from the DWH NRDA Trustees' MAM Procedures and Guidelines Manual (MAM Manual; DWH NRDA Trustees, 2017) and/or the Programmatic Damage Assessment and Restoration Plan and Programmatic Environmental Impact Statement (PDARP/PEIS; DWH NRDA Trustees, 2016a).

Cross-TIG MAM work group – The Cross-Trustee Implementation Group (TIG) MAM work group was established by the Trustee Council to serve as a forum for the TIGs to collectively address MAM topics relevant to multiple TIGs. The Cross-TIG MAM work group has no independent authority to act except when directed by the Trustee Council. See the Trustee Council's Standard Operating Procedures for more information (DWH NRDA Trustees, 2016b).

Implementing Trustee – The Implementing Trustee is the Trustee Agency designated by the TIG that is responsible for carrying out a specific restoration project or MAM activity.

MAM activities – MAM activities are actions taken (e.g., monitoring, modeling, data collection, targeted investigations) to reduce uncertainty or otherwise fulfill MAM needs and priorities. MAM activities may be funded using either Restoration Type or MAM allocation, as appropriate. The Open Ocean TIG may allocate MAM funds for MAM-related operational activities of the TIG.

MAM Activities Implementation Plan – A MAM Activities Implementation Plan is a document that details the actions to be taken to obtain information identified as MAM priorities.

MAM framework – The MAM framework is the iterative process the Trustees outlined in Chapter 5 of the PDARP/PEIS (DWH NRDA Trustees, 2016a) to measure the effectiveness of restoration and support restoration decision-making. The steps of this iterative process are described in Section 2.1 of this document.

MAM Manual – The MAM Manual is a document developed by the Cross-TIG MAM work group that presents details on MAM procedures and guidelines applicable to all TIGs.

MAM needs – MAM needs are knowledge gaps or information needs that, if addressed, may help the Trustees successfully plan, implement, and evaluate Gulf restoration. MAM needs may be identified at any scale or at any time, including at a project concept or restoration-technique level, a single Restoration Area or multiple Restoration Areas, a single Restoration Type or multiple Restoration Types ("cross-resource"), and/or at the ecosystem level.

MAM priorities – MAM priorities are the subset of knowledge gaps or information needs identified by the Open Ocean TIG for near-term action. MAM priorities may be identified at any scale or at any time, including at a project concept or restoration-technique level, a single Restoration Area or multiple Restoration Areas, a single Restoration Type or multiple Restoration Types ("cross-resource"), and/or at the ecosystem level.

Open Ocean Restoration Area – The Open Ocean Restoration Area includes all geographic areas where restoration projects may be implemented to restore Open Ocean resources, including restoring these species throughout their life stages and geographic ranges.

Open Ocean Trustee Implementation Group – The Open Ocean TIG is comprised of four federal Trustees that are responsible for planning, implementing, and evaluating restoration for Open Ocean Restoration Types. These federal Trustees include the National Oceanic and Atmospheric Administration, the U.S. Department of the Interior, the U.S. Department of Agriculture, and the U.S. Environmental Protection Agency.

Project MAM Plan – A Project MAM Plan is a project-specific plan developed by the Implementing Trustee(s) that outlines MAM for a specific restoration project. Project MAM Plans are designed to evaluate the effectiveness of the proposed restoration projects in meeting the restoration objectives and to assist, where feasible, in determining the need for adaptive management, including corrective actions.

Restoration Areas – Restoration Areas are geographic areas identified in the Consent Decree[1] for the 2016 DWH oil spill settlement to which the NRDA funding is allocated. There are seven Restoration Areas, including each of the five Gulf States, Region-wide, and Open Ocean (Sections 5.10.2 and 7.2 of PDARP/PEIS; DWH NRDA Trustees, 2016a). An eighth Restoration Area focused on Unknown Conditions and Adaptive Management will be established by the Trustees 10–15 years following the 2016 settlement (Sections 5.10.2 and 7.2 of PDARP/PEIS; DWH NRDA Trustees, 2016a).

Restoration Types – Restoration Types are the broad restoration categories the Trustees identified pertaining to the programmatic goals described in the PDARP/PEIS (DWH NRDA Trustees, 2016a). Within the Open Ocean Restoration Area, the Trustees identified six Restoration Types, including Fish and Water Column Invertebrates, Sturgeon, Sea Turtles, Marine Mammals, Birds, and Mesophotic and Deep Benthic Communities (Chapter 5 of PDARP/PEIS; DWH NRDA Trustees, 2016a).

Trustee Implementation Groups – TIGs are the decision-making bodies the Trustees established for the purposes of planning, administering, implementing, and evaluating restoration within their Restoration Area. There are currently seven active TIGs, one for each Restoration Area, as follows: Alabama, Florida, Louisiana, Mississippi, Texas, Region-wide, and Open Ocean. An eighth TIG, the Unknown Conditions and Adaptive Management TIG, will be established by the Trustees 10–15 years following the 2016 settlement.

1. On April 4, 2016, a federal court in New Orleans entered a Consent Decree in matters related to the DWH oil spill*: United States v. BPXP et al., Civ. No. 10-4536, centralized in MDL 2179, In re: Oil Spill by the Oil Rig "Deepwater Horizon" in the Gulf of Mexico, on April 20, 2010 (E.D. La.)*. This Consent Decree resolved civil claims against BP arising from the April 20, 2010 Macondo well blowout and oil spill in the Gulf of Mexico. For more information, see: https://www.justice.gov/enrd/deepwater-horizon.

1 Introduction

1.1 Background

The *Deepwater Horizon* (DWH) oil spill settlement in 2016 provides the Natural Resource Damage Assessment (NRDA) Trustees (the Trustees) up to $8.8 billion to restore natural resources and services injured by the spill. The funds will be distributed over 15 years. 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.

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. Therefore, the Trustees committed to conduct monitoring and scientific support activities within an adaptive management framework (Appendix 5.E of the PDARP/PEIS; DWH NRDA Trustees, 2016a). This framework will allow 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' Standard Operating Procedures (SOPs) and MAM Procedures and Guidelines Manual (the MAM Manual) provides guidance to the Trustees regarding the implementation of MAM for the DWH oil spill restoration effort (DWH NRDA Trustees, 2016b, 2017). Version 1.0 of the MAM Manual is focused on MAM at the project level, and subsequent versions will include more information on MAM at the Restoration Type and programmatic levels. Building off of the MAM Manual, this document focuses on the development of a strategy for implementing MAM specifically for the Open Ocean Trustee Implementation Group (TIG; the "Open Ocean TIG MAM Strategy"). Consistent with the PDARP/PEIS and SOPs, the TIG is responsible for identifying MAM needs and priorities for its Restoration Area (Section 7.5.1.2 of the PDARP/PEIS, DWH NRDA Trustees, 2016a; Section 10.4.1.2(a) of SOP, DWH NRDA Trustees, 2016b).

1.2 Open Ocean TIG

The Consent Decree[2] for the 2016 DWH oil spill settlement allocated funds for NRDA restoration by Restoration Type and Restoration Area. The Trustees also established a governance structure that assigned a 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 (DWH

2. On April 4, 2016, a federal court in New Orleans entered a Consent Decree in matters related to the DWH oil spill: *United States v. BPXP et al., Civ. No. 10-4536, centralized in MDL 2179, In re: Oil Spill by the Oil Rig "Deepwater Horizon" in the Gulf of Mexico, on April 20, 2010 (E.D. La.)*. This Consent Decree resolved civil claims against BP arising from the April 20, 2010 Macondo well blowout and oil spill in the Gulf of Mexico. For more information, see: https://www.justice.gov/enrd/deepwater-horizon.

NRDA Trustees, 2016a) and is also responsible for identifying MAM priorities for its respective TIG (DWH NRDA Trustees, 2016b).

The Open Ocean Restoration Area has restoration funds allocated to six Restoration Types: fish and water column invertebrates, sturgeon, sea turtles, marine mammals, birds, and mesophotic and deep benthic communities (Figure 1). Additional funds were also allocated for MAM, Administrative Oversight and Comprehensive Planning, and Early Restoration Recreational Opportunities on Federal Lands (Figure 1). The Open Ocean TIG will address restoration for the species throughout their life history stages and geographic ranges, potentially undertaking restoration activity in offshore, coastal, and inland areas; and in some cases outside of the Gulf of Mexico (if/as restoration needs require). The Trustees for the Open Ocean Restoration Area are the National Oceanic and Atmospheric Administration, the U.S. Department of the Interior, the U.S. Department of Agriculture, and the U.S. Environmental Protection Agency.

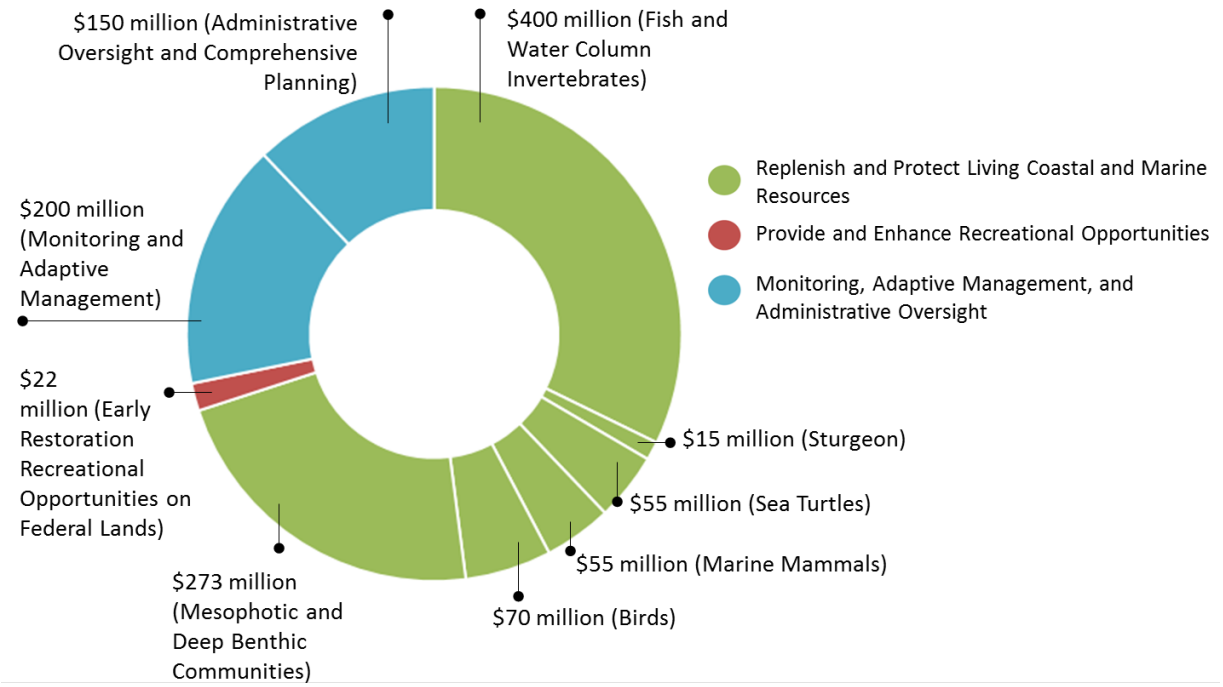

Figure 1. The allocation of Open Ocean restoration funds by programmatic goal and Restoration Type.

1.3 Purpose of the Open Ocean TIG MAM Strategy

The purpose of this document is to articulate an agile and responsive approach to MAM for the Open Ocean TIG to promote effective and efficient restoration of Open Ocean resources. Specific objectives for this document include (1) developing processes for the Open Ocean TIG to implement MAM, including the identification and prioritization of MAM needs and the development, selection, and approval of MAM activities; (2) facilitating collaboration and coordination among TIGs and with science and other restoration programs; and (3) providing information to support public participation in Open Ocean restoration planning. These processes apply to implementing MAM under the MAM allocation (Figure 1). However, there may be circumstances when these processes will apply to implementing MAM using the Restoration Type allocations consistent with the PDARP/PEIS (DWH NRDA Trustees, 2016a).

The Open Ocean TIG anticipates releasing the Open Ocean TIG MAM Strategy in stages. This document is focused on describing the Open Ocean TIG's MAM-related planning processes and the identification of MAM priorities.

The Open Ocean TIG MAM Strategy is a living document that may be updated periodically as the TIG evaluates its MAM priorities through adaptive management. Table 1 provides a history of the versions of the Strategy that have been developed to date.

Table 1. Version history of the Open Ocean TIG MAM Strategy.

Version	Date	Changes Since Previous Version
Version 1	April 2019	N/A
Version 2	June 2020	Updates regarding MAM needs and prioritization included in Sections 7, 8, and 9; minor edits for clarity were also incorporated.

1.4 Contents

This Open Ocean TIG MAM Strategy includes information on the Open Ocean TIG's approach to MAM. The document is organized as follows:

- Section 1, this section, provides an introduction to the document and describes its purpose
- Section 2 provides an overview of MAM for the DWH oil spill NRDA, including the MAM framework and roles and responsibilities
- Section 3 articulates the goals for the DWH oil spill NRDA Open Ocean restoration effort and the Open Ocean MAM more specifically
- Section 4 describes the process that is used to identify, prioritize, and refine Open Ocean MAM needs at the Restoration Type, cross-resource, and ecosystem levels
- Section 5 describes the process through which specific MAM activities will be developed and released to address MAM priorities
- Section 6 describes the Open Ocean TIG's MAM coordination with other TIGs, as well as science programs and other restoration programs
- Section 7 discusses the status of MAM priority development
- Section 8 describes the initial MAM priorities that have been identified by the Open Ocean TIG
- Section 9 discusses next steps.

2 DWH NRDA MAM Overview

2.1 MAM Overview

As noted by the Trustees in the PDARP/PEIS, the unprecedented temporal, spatial, and funding scales associated with the DWH oil spill NRDA restoration effort warrant a robust MAM framework to support restoration decisions (DWH NRDA Trustees, 2016a). To increase the likelihood of successful restoration, the Trustees committed to monitor and evaluate restoration outcomes, which can provide feedback to inform decision-making for current projects and refine the selection, design, and implementation of future restoration actions (DWH NRDA Trustees, 2016a).

> *Adaptive management is a form of structured decision-making applied to the management of natural resources in the face of uncertainty (Pastorok et al., 1997; Williams, 2011). It is an iterative process that integrates monitoring and evaluation of management actions with flexible decision-making, where adjustments are made to management approaches based on observed outcomes (NRC, 2004).*

The Trustees presented a general MAM framework in the PDARP/PEIS to guide restoration efforts, as illustrated in Figure 2. The steps of this iterative process include restoration planning (including the development of MAM plans for restoration projects), implementation of the initial restoration plan, monitoring of restoration actions, evaluation of restoration effectiveness, feedback of information to restoration planning and implementation, refinements to restoration implementation, and reporting on progress toward meeting restoration goals and objectives. This MAM framework may be more robust for some elements of the restoration effort with higher degrees of uncertainty, or where large amounts of restoration are planned within a given geographic area and/or for the benefit of a particular resource (DWH NRDA Trustees, 2016a). Importantly, this adaptive management feedback loop provides the Trustees with the opportunity to adjust restoration actions, as needed, based on monitoring and evaluation of restoration outcomes (Williams et al., 2009; Williams, 2011). Once a project is completed, data obtained can be used to inform the next set of restoration project decisions.

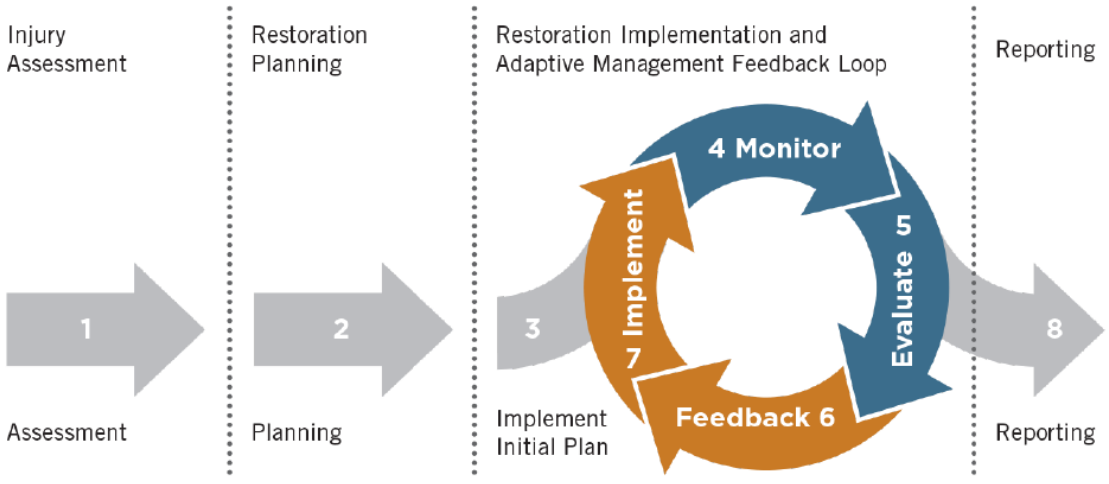

Figure 2. The MAM framework presented by the Trustees in the PDARP/PEIS.

MAM may be applied at multiple scales, including project, Restoration Type, and programmatic levels (Appendix 5.E.3 of PDARP/PEIS; DWH NRDA Trustees, 2016a). Project-level MAM includes the monitoring and scientific support needed for planning, implementing, and evaluating individual restoration projects. Restoration Type MAM includes the monitoring and scientific support needed to inform planning and implementation at the resource level and to evaluate the collective benefits provided to a resource across projects. Programmatic MAM includes any monitoring and scientific support more broadly needed to support restoration and evaluate benefits for multiple injured resources.

2.2 TIG Responsibilities for MAM

As outlined in the Trustee Council's SOP for the implementation of natural resource restoration for the DWH oil spill, TIGs are responsible for addressing MAM objectives that pertain to their restoration activities and for communicating information to the Trustee Council or Cross-TIG MAM work group (Section 10.3.2 of SOP; DWH NRDA Trustees, 2016b). Each TIG will address the following MAM responsibilities, as appropriate to its restoration activities:

- Review and approve Project MAM Plans for compatibility with the Trustee Council's SOPs and MAM Manual for compliance with regulatory requirements, and determine the MAM Plans' readiness for inclusion in restoration plans (Sections 2.3.4 and 10.3.2 of SOP; DWH NRDA Trustees, 2016b)
- Identify MAM priorities for the TIG's Restoration Area and communicate priorities to the Cross-TIG MAM work group (Sections 2.3.4 and 10.3.2 of SOP; DWH NRDA Trustees, 2016b)
- Ensure project monitoring data, monitoring reports, and other monitoring information are compatible with the MAM Manual and are submitted to the Restoration Portal (Sections 2.3.4 and 10.3.2 of SOP; DWH NRDA Trustees, 2016b)
- Provide TIG-related aggregated and quality-controlled MAM data, information, and evaluations to the Trustee Council and Implementing Trustee(s) (Sections 2.3.4 and 10.3.2 of SOP; DWH NRDA Trustees, 2016b)
- Provide the Trustee Council an annual status update of project monitoring information and data (Section 10.3.2 of SOP; DWH NRDA Trustees, 2016b).

2.3 Uses of Open Ocean MAM Allocation

The Open Ocean TIG has been allocated $200 million for the purposes of conducting MAM activities in support of restoration of Open Ocean resources. Consistent with the Trustee Council's SOP (Section 10.5.1(b) of SOP; DWH NRDA Trustees, 2016b), MAM activities that may be funded by the Open Ocean MAM allocation include, but are not limited to, the following:

1. Performing cross-resource science and monitoring activities
2. Evaluating regional restoration outcomes (beyond individual project footprints) within the Open Ocean TIG's Restoration Area
3. Performing programmatic or operational MAM activities such as data aggregation, summary, and synthesis; report development; and data management activities
4. Resolving critical information gaps/uncertainties for restoration planning and informing restoration decision-making
5. Supplementing Restoration Type monitoring activities, where needed

6. Responsively re-examining Open Ocean TIG MAM priorities following a disturbance (e.g., a hurricane, oil spill)
7. Performing monitoring to inform the design and implementation of future restoration projects, including better characterization of ecological function.

The Open Ocean TIG will emphasize activities 1–3 above as these most directly contribute to the evaluation of the Open Ocean restoration effort, but will maintain the flexibility to conduct any of the above activities. The Trustee Council SOP also authorizes the use of Restoration Type funds for some of these activities (Section 10.5.2(b)(4) of SOP; DWH NRDA Trustees, 2016b).

3 Open Ocean TIG MAM

3.1 Restoration of Open Ocean Resources

As part of the DWH NRDA, the Open Ocean TIG is addressing restoration for fish and water column invertebrates, sea turtles, marine mammals, birds, sturgeon, and mesophotic and deep benthic communities. This effort includes addressing species throughout their life stages and geographic ranges, including inland, coastal, and offshore areas. Because many of these species spend part of their lives in the Gulf of Mexico but also migrate to other places – as far away as Mexico and the Mediterranean Sea – some funds may be used for restoration outside of the Gulf of Mexico. Open Ocean restoration, in conjunction with the restoration efforts of the other TIGs, is intended to accomplish the Trustees' goal of comprehensive integrated ecosystem restoration.

3.2 Goals of Open Ocean MAM

In the PDARP/PEIS, the Trustees committed to conduct monitoring and scientific support in an adaptive management framework to evaluate restoration effectiveness, address uncertainties related to the planning and implementation of projects and portfolios of projects, and provide feedback to inform future restoration decisions (DWH NRDA Trustees, 2016a). Aligned with the MAM framework, the Open Ocean TIG has the following goals for MAM:

- Evaluate the outcomes of the Open Ocean restoration effort across the portfolio of Open Ocean projects, including evaluating benefits to Restoration Types as well as across Restoration Types (i.e., cross-resource).
- Identify and fill data gaps that affect the Open Ocean TIG's ability to meet and/or evaluate progress toward restoration goals for Open Ocean resources. The Open Ocean TIG would coordinate efforts to meet this goal with the other TIGs and the Cross-TIG MAM work group to achieve effective and efficient use of MAM resources.
- Identify the benefits and outcomes from Open Ocean restoration activities to resource, cross-resource, and ecosystem restoration across the northern Gulf of Mexico.

4 Process for Identification and Prioritization of MAM Needs

The Trustee Council SOP recommends that TIGs identify MAM priorities for the use of their designated MAM funds (Section 10.4.1.2 of SOP; DWH NRDA Trustees, 2016b). MAM priorities refer to key knowledge gaps or information needs relevant to planning, implementing, and/or evaluating restoration that would help the Trustees achieve the restoration goals established in the PDARP/PEIS (DWH NRDA

Trustees, 2017). MAM priorities can represent information gaps that are relevant to different spatial and temporal scales. For example, MAM priorities may apply to project concepts or restoration techniques, an individual Restoration Area or multiple Restoration Areas, an individual Restoration Type or multiple Restoration Types, and/or at the ecosystem level. These knowledge gaps or information needs can change over time, and will be evaluated periodically.

Below, information is presented on how the Open Ocean TIG identifies MAM needs and prioritizes MAM needs (becoming MAM priorities).

4.1 Identification of MAM Needs

Consistent with the Trustee Council SOP, the Open Ocean TIG develops MAM priorities for its Restoration Area. To accomplish this, the Open Ocean TIG first identifies MAM needs for each of its Restoration Types, as well as considers MAM needs across multiple Restoration Types (cross-resource) and at the ecosystem level. While the Restoration Type MAM needs will likely address information needed to support successful planning, implementation, and evaluation of DWH restoration, MAM needs at the cross-resource and ecosystem levels will focus on information needed to evaluate progress toward meeting programmatic goals and achieving comprehensive integrated ecosystem restoration.

To support the development of MAM needs, the Open Ocean TIG may do one or more of the following:

- Consult with subject matter experts and/or stakeholders
- Conduct targeted outreach and engagement with other restoration or science programs
- Hold workshops or webinars to gain input from resource experts, stakeholders, and/or the public
- Review existing management plans and science gap analyses
- Review existing or TIG-developed conceptual models, such as influence diagrams and logic models.

The Open Ocean TIG reviews the MAM needs identified to identify potential efficiencies in addressing multiple MAM needs together and avoid duplication of effort.

4.2 Prioritization of MAM Needs

Once identified, the Open Ocean TIG prioritizes MAM needs. The overarching consideration for prioritizing MAM needs is their importance to achieving the restoration goals established in the PDARP/PEIS, including evaluation of restoration success. Therefore, the Open Ocean TIG prioritizes MAM needs based on the following criteria (in no particular order):

- Relevance to Open Ocean resources and the Open Ocean ecosystem
- Importance for restoration planning and implementation
- Importance for programmatic evaluation
- Importance for multiple Restoration Types
- Importance at the ecosystem level
- Feasibility of obtaining data of sufficient quality and timeliness to meet objectives
- Urgency of the MAM need
- Likelihood of success in meeting the MAM need.

Following prioritization, the Open Ocean TIG developed an initial list of MAM priorities (see Section 8). These MAM priorities will be evaluated and updated periodically as needed.

5 Process for Development and Release of MAM Activities to Address MAM Priorities

5.1 Development of MAM Activities

The Open Ocean TIG will identify and develop MAM activities to address MAM priorities, and evaluate the extent to which potential activities would address these priorities. MAM activities may include, but are not limited to, monitoring, modeling, data collection, and/or targeted investigations (DWH NRDA Trustees, 2017). While MAM activities can be funded to address MAM priorities through the TIGs, it is also possible that activities addressing MAM priorities may be supported by other programs or funding mechanisms (e.g., projects funded by other science or restoration programs).

To support the development of the MAM activities, the Open Ocean TIG may do one or more of the following:

- Hold workshops or webinars to gain additional expert, stakeholder, and/or public input on MAM activities
- Refine ideas and/or develop new activities, as needed, to specifically address MAM priorities
- Review activity ideas submitted to the DWH NRDA project portal (https://www.gulfspillrestoration.noaa.gov/restoration/give-us-your-ideas/view-submitted-projects) and, as needed, request additional ideas to be submitted to the project portal for specific Open Ocean TIG MAM priorities.

Factors the Open Ocean TIG may consider when evaluating MAM activities include, but are not limited to, whether the activities:

- Address one or more Open Ocean MAM priorities
- Involve one or more Open Ocean Restoration Types
- Address MAM priorities at the ecosystem level
- Inform multiple restoration decisions or evaluations of restoration progress
- Address MAM priorities across life stages and geographic ranges
- Provide data in a timely manner to make restoration planning or evaluation decisions
- Take advantage of existing monitoring or evaluation efforts from other TIGs, or Gulf restoration or monitoring programs
- Do not duplicate existing efforts
- Are technically sound
- Are cost-effective.

Based on this evaluation, the Open Ocean TIG will approve MAM activities for funding. This approval process will be based on the timing and urgency of MAM needs. This will allow the Open Ocean TIG to maintain agility in obtaining MAM information when needed.

5.2 Methods for Releasing MAM Activities

Once the Open Ocean TIG has selected MAM activities, information on the approved activities will be released to the public. The types of information to be provided will include, as appropriate, a description of the MAM activity (e.g., objectives, tasks, methods, anticipated information to be acquired, timeline, and summary budget information), an overview of the approach to data management and reporting, any environmental compliance considerations, and other relevant information. This information may be released to the public through a variety of mechanisms, such as:

1. A MAM Activities Implementation Plan
2. A draft Restoration Plan.

In determining which mechanism is more appropriate, the Open Ocean TIG may consider a number of factors including, but not limited to, whether the MAM activities:

- Are consistent with Restoration Type goals described in the PDARP/PEIS
- Address monitoring and information gaps identified in the PDARP/PEIS and/or priorities identified in future versions of the Open Ocean TIG MAM Strategy
- Are related to specific project(s) included in a restoration plan
- Are covered under existing National Environmental Policy Act (NEPA) analysis
- Require new/additional NEPA analysis.

As appropriate, the Open Ocean TIG may release draft documents with MAM-related information (e.g., a component of a draft restoration plan) and consider public comments when developing the final TIG document.

5.3 Informing the Public about MAM Activity Progress

The Open Ocean TIG will inform the public about MAM activities being implemented. Potential methods of communication include, but are not limited to:

- Providing updates at the Trustee Council annual meeting
- Providing updates during the Open Ocean TIG annual meeting
- Providing project information in the Data Integration, Visualization, Exploration, and Reporting (DIVER) platform
- Providing updates in the Trustee Council annual report
- Highlighting accomplishments in a webstory and/or e-mail blast (e.g., when a MAM activity is approved)
- Posting MAM-related documents (e.g., MAM Activities Implementation Plan, restoration plans) to the Gulf Spill Restoration website (https://www.gulfspillrestoration.noaa.gov/) and Administrative Record (https://www.doi.gov/deepwaterhorizon/adminrecord).

6 Coordination on MAM Needs with Other Restoration Programs

6.1 Coordination with Other TIGs

Many Open Ocean Restoration Types are shared with other TIGs. In addition, MAM efforts are being coordinated by each TIG as well as across TIGs by the Trustees and through the Cross-TIG MAM work

group. Thus, the Open Ocean TIG will coordinate with the other TIGs and the Cross-TIG MAM work group on MAM needs and activities as applicable. This may include coordinating on:

- Monitoring efforts for Open Ocean Restoration Types that cross TIG boundaries
- Opportunities to fill data gaps for shared Restoration Types that would improve the Trustees' collective efforts to prioritize restoration and evaluate progress toward restoration goals
- Monitoring and other activities to support the identification of outcomes from Open Ocean TIG restoration projects that contribute to resource, cross-resource, and ecosystem benefits across Restoration Areas
- Monitoring and other activities to support the identification of outcomes of other TIG projects that affect Open Ocean resources.

6.2 Coordination with Science Programs and Other Restoration Programs

As the Trustees noted in the PDARP/PEIS, the DWH NRDA restoration effort is being conducted within a matrix of other restoration and science efforts and programs across the Gulf of Mexico, both originating from and unrelated to the DWH incident (Appendix 5.E of PDARP/PEIS; DWH NRDA Trustees, 2016a). In addition, many relevant science and other technical datasets, research results, models, and decision support tools are available to support restoration planning, implementation, and/or evaluation. Recognizing this, the Trustees committed to leverage existing work, when possible, to address priority uncertainties and conduct monitoring and scientific support activities efficiently (Appendix 5.E of PDARP/PEIS; DWH NRDA Trustees, 2016a). The Trustees are also committed to maintain coordination with the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States (RESTORE) Council and other appropriate programs and/or partners in the Gulf of Mexico (e.g., National Oceanic and Atmospheric Administration's RESTORE Science Program, RESTORE Centers of Excellence, National Academies of Sciences' Gulf Research Program) throughout the restoration process in order to identify synergies across programs and ensure efficiencies are realized (Appendix 5.E of PDARP/PEIS; DWH NRDA Trustees, 2016a).

Consistent with the PDARP/PEIS, the Open Ocean TIG will coordinate with other restoration and science efforts and programs that could include, but are not limited to:

- Communicating Open Ocean MAM priorities and identifying critical information gaps to applicable science programs
- Engaging with other restoration programs participating in research, restoration, and/or management of Open Ocean resources to determine whether they are collecting or plan to conduct activities that may meet Open Ocean MAM needs or priorities
- Exploring opportunities to coordinate or partner with existing programs to obtain data needed to support restoration of Open Ocean resources and/or evaluation of Open Ocean restoration.

The Open Ocean TIG also recognizes that the best available science for planning restoration activities will evolve as the amount of information from the DWH NRDA restoration effort, as well as other science, monitoring, and restoration programs in the Gulf of Mexico, continues to grow. Thus, the Open Ocean TIG will seek to leverage newly available science in the identification of MAM priorities and activities. The Open Ocean TIG may engage with subject matter experts for specific Restoration Types,

as well as for cross-resource- and ecosystem-level issues as appropriate, to obtain relevant information regarding MAM priorities or activities. This could include coordinating with subject matter experts to:

- Help identify MAM needs and provide input on Open Ocean MAM priorities
- Provide technical input on potential MAM activities
- Provide input on the best approaches for collecting data to address MAM priorities.

7 Status of MAM Priority Development

Using the processes described above in Section 4, the Open Ocean TIG identified three initial MAM priorities to promote effective and efficient use of the MAM allocation to guide restoration of Open Ocean resources. These priorities, described in detail in the next section, are meant to support the evaluation of restoration efforts by the TIG, but they may also inform restoration planning and implementation. The priorities are focused on meeting cross-resource- and ecosystem-level MAM needs; however, MAM needs for individual Open Ocean restoration types may also be addressed by the TIG. To identify these priorities, the TIG consulted with subject matter experts and stakeholders; reviewed existing management plans, data gap analyses, and relevant conceptual models; and held two public outreach events [a workshop at the 2019 Gulf of Mexico Oil Spill & Ecosystem Science (GoMOSES) conference and a public meeting on June 4, 2019]. Priorities were evaluated according to the criteria detailed in Section 4.2 above.

8 Identified MAM Priorities

8.1 Open Ocean MAM Priority: Evaluate Restoration Progress

Under this priority, the Open Ocean TIG is focused on analyzing and evaluating a wide range of data to help effectively target future restoration and to assess the combined effect of restoration activities in restoring Open Ocean resources. As noted above in Section 3.2, the Open Ocean TIG's goals for MAM include evaluating restoration outcomes across the portfolio of Open Ocean projects and identifying restoration benefits provided to injured resources and the northern Gulf of Mexico ecosystem. This priority is central to understanding whether and how the Open Ocean TIG is meeting its restoration goals. In turn, this information can be used by the Open Ocean TIG to adaptively manage restoration activities over time to maximize restoration benefits.

The Open Ocean TIG has identified the following information needs that may be addressed individually or in combination with MAM activities:

1. *Assessing appropriate indicators of progress toward Open Ocean restoration goals and objectives.* The Open Ocean TIG recognizes that not all species and habitats in the Gulf of Mexico can be monitored to evaluate restoration progress. Therefore, the Open Ocean TIG may decide to select specific indicators that are sensitive to restoration actions and could provide insights regarding progress toward meeting restoration objectives, the status and trends of key resources or habitats, and ecosystem restoration progress. Examples may include ecosystem characteristics and dynamics (e.g. focal species, metrics of productivity, habitat quality), and the trends in key indicators over various spatial and temporal scales. To that end, the TIG may

compile existing data for selected ecological indicators, assess key data gaps, or conduct monitoring activities to address data gaps.

2. *Cumulative effects of multiple projects on targeted Open Ocean resources.* The Open Ocean TIG will be making substantial investments in restoration projects over time that may be implemented in many different geographic locations; therefore, it is important to understand the cumulative effects of restoration activities across the full portfolio of TIG projects. In some cases, these effects will simply be additive. In other cases, benefits to Open Ocean resources may be multiplicative if there are synergistic effects among projects. The Open Ocean TIG will use existing information sources and may collect data or conduct modeling to understand these cumulative effects of its projects.
3. *Indirect impacts of restoration actions on non-targeted Open Ocean resources.* With the Gulf of Mexico being a large interconnected ecosystem, direct restoration activities may have broader indirect effects. For example, restoration focused on a specific fish species may have broader effects through food web interactions. Similarly, nearshore habitat restoration targeted at restoring estuarine-dependent species may have indirect effects on the offshore ecosystem via migration and food web connectivity. The Open Ocean TIG will use existing information sources and may collect data and/or utilize models to understand these potential indirect impacts of restoration actions.
4. *Influences of external factors (e.g., changing environmental conditions, extreme weather, policies/management) on the success of restoration actions.* These factors may affect Open Ocean habitats, populations, and stressors. The Open Ocean TIG may use information about these factors to plan more resilient restoration projects. This information could also contribute to the Open Ocean TIG's ability to interpret restoration results and explain variability in restoration outcomes over time or in different geographic areas.

8.2 Open Ocean MAM Priority: Identify Stressors

Open Ocean resources are subject to both anthropogenic (i.e., man-made) and natural stressors that can cause mortality, injury, or other sublethal impacts, many of which present potential opportunities for restoration. Under this priority, the Open Ocean TIG is focused on assessing when and where key stressors of Open Ocean resources occur in the Gulf, including descriptions of the stressors, their intensity, the intensity of their impacts on resources, the degree of potential threat they pose, and the cumulative and indirect effects of combined stressors. The Open Ocean TIG prioritized stressor identification and evaluation due to its relevance to a wide array of Open Ocean restoration activities and resources. Many of the restoration approaches identified in the PDARP and re-emphasized in the first and second Open Ocean restoration plans (DWH NRDA Open Ocean TIG, 2019a, 2019b) are focused on reducing causes of morbidity (ill health) and mortality to birds, fish and water column invertebrates, marine mammals, sea turtles, and mesophotic and deep benthic communities.

Central to effectively reducing the impact of key stressors on Open Ocean resources will be understanding where and when they occur most often and are most intense, and which types of interactions most negatively affect each resource. Identifying which areas of the Gulf of Mexico have the highest concentrations and intensities of stressors and when and where those areas have the greatest overlap with Open Ocean resources would help the Open Ocean TIG focus its restoration efforts where they will have the greatest benefit to resources.

This type of information would be used by the TIG to assess the progress restoration projects have made in reducing or avoiding the impacts of stressors on Open Ocean resources. Compiling and analyzing data related to the location and intensity of stressors in the Gulf of Mexico will also allow the Trustees to assess changes in stressors over the life of the DWH restoration program.

Under this priority, the Open Ocean TIG may focus initially on compiling existing data on the distribution and intensity of stressors, and assessing whether there are significant data gaps. Where additional data collection is needed, the Open Ocean TIG Trustees may assess the urgency of the data need and the feasibility of collecting data in a manner and timeframe that will be effective for informing restoration planning, implementation, and evaluation.

The Open Ocean TIG has identified the following information needs related to stressors that may be addressed individually or in combination with future MAM activities:

1. *The nature and frequency of interactions between Open Ocean resources and fisheries, particularly the recreational, bottom longline, pelagic longline, and shrimp trawl fisheries.* Interactions with commercial and recreational fisheries may lead to bycatch, a cause of serious injury and mortality for marine mammals, sea turtles, and non-target fish and invertebrate species, and may impact pelagic seabirds. The PDARP identified numerous restoration approaches for these Restoration Types that focus on developing voluntary collaborations with commercial and recreational fishermen to reduce unintended bycatch and other fisheries interactions. Developing effective voluntary solutions to reduce fisheries bycatch and interactions is dependent on first characterizing the scope, scale, and frequency of interactions; and then identifying the areas and the times of year when interactions are most likely to occur. The TIG recognizes that data on fisheries interactions already exist in some sectors through observer programs, electronic monitoring, protected resource databases, and other sources, although not always at a scale necessary to adequately assess protected species' rare event interactions or inform specific restoration actions. In some cases, existing data and analyses do not meet the Trustees' MAM needs for restoration, and supplemental data collection or analysis may be needed. These initial four fisheries (recreational, bottom longline, pelagic longline, and shrimp trawl) have been identified by the Open Ocean TIG as potentially having opportunities to implement voluntary restoration activities that may reduce impacts on multiple Open Ocean resources, including fish and water column invertebrates, marine mammals, and/or sea turtles. For each fishery, the Open Ocean TIG may analyze fishing effort, catch, bycatch, and post-release survival as appropriate, and where gaps exist. This can help the TIG understand when and where fishing-related impacts occur most often in the Gulf of Mexico, and which potential restoration approaches may be most effective in helping Open Ocean resources recover from the injuries associated with the DWH oil spill. Fisheries interactions data would also allow the Trustees to evaluate the combined outcomes of projects over the life of the restoration program.
2. *The location, type, and extent of marine debris accumulation and its interactions with Open Ocean resources.* Marine debris is a widespread problem facing ocean and coastal environments, causing a range of negative potential impacts on birds, fish and water column invertebrates, marine mammals, sea turtles, and mesophotic and deep benthic communities. Lost or derelict fishing gear is particularly persistent in the environment and damaging to open ocean resources and habitats. Consumption of marine debris or entanglement/trapping can result in death or injury

to open ocean species and accumulation of marine debris can damage fragile ocean habitats. Effectively planning and evaluating restoration activities would be improved by better understanding where marine debris accumulates and how it impacts Open Ocean resources, and evaluating the reduction in marine debris over time associated with restoration projects.

3. *The location, timing, type, and frequency of vessel traffic and interaction with Open Ocean resources.* Marine vessels are a known cause of morbidity and mortality for marine mammals, sea turtles, and sturgeon, and reducing injury and mortality associated with vessel strikes was identified as a restoration approach for both sea turtles and marine mammals in the PDARP. Vessels can directly strike and injure or kill individuals due to propeller cuts or blunt force trauma, and disrupt migratory and breeding behavior. The highest general risk of vessel collisions occurs in areas where high vessel traffic overlaps with high animal densities, although the risk is dependent on vessel size and speed. To better know how to reduce negative impacts, the TIG may compile available data, identify data gaps, and potentially address data gaps to characterize the spatiotemporal distribution of vessel traffic and its overlap with Open Ocean resource distributions. The TIG may then evaluate reductions in vessel strikes over time associated with restoration activities. Other data of interest may include water depth, vessel size, level and frequency of vessel traffic, and vessel speed, which may influence the severity of vessel strikes. This information would also allow the Trustees to monitor changes in vessel traffic associated with restoration activities and assess the impact of restoration activities on the frequency and severity of vessel strikes.
4. *The distribution and intensity of underwater noise, and interactions with Open Ocean resources.* Underwater anthropogenic noise, either from vessels or other marine activities (e.g., drilling, seismic airgun surveying), is known to disrupt marine mammal behavior – it may mask vocalizations from other animals; cause changes to feeding, breathing, and vocalization patterns; and even result in mass strandings. Underwater noise can also cause biophysical trauma in mammals, fish, and invertebrates, including internal injuries, cellular damage, hearing loss, disorientation, physiological effects, and even death. Characterizing the spatiotemporal distribution, intensity, and spectral properties of anthropogenic noise would allow the Open Ocean TIG to identify areas with high noise impacts to Open Ocean resources and/or important Open Ocean habitats. The TIG may support MAM activities that better characterize this source of stress to Open Ocean resources in the Gulf, and identify effective ways to minimize its impacts and evaluate the benefits of noise remediation projects on Open Ocean resources.
5. *The nature, distribution, and frequency of mineral extraction activities and interactions with Open Ocean resources.* Mineral extraction activities often result in high concentrations of vessel traffic and noise, in addition to serving as potential sources of marine contamination. Another key concern is the potential for lethal bird collisions with infrastructure, which is potentially exacerbated by night-time lighting on oil platforms and other infrastructure. Many Open Ocean resources could also be affected by oil rig removal and the unintentional release of toxins from extraction sites or during transport. However, oil rigs may also provide value as artificial habitats. Thus, related MAM activities may identify and quantify the types of stress that mineral extraction activities pose to Open Ocean resources so that effective restoration activities can be planned and implemented, and reductions in stressors associated with mineral extraction activities in the Gulf of Mexico can be evaluated.

6. *Spatiotemporal overlap of Open Ocean stressors and resources.* As noted above, areas identified to be highly impacted by stressors may be targeted for restoration, especially those areas that also have high-quality habitats, high productivity, and/or are important for a species' life history (e.g., recruitment, breeding, foraging, migration). Looking at the spatiotemporal overlap of this combined information can help the Open Ocean TIG identify key areas to focus restoration actions on to maximize benefits to injured resources. The Open Ocean TIG could also use this information to evaluate how restoration is affecting the intensity of stressors over time and whether or not there is a reduction in overlap between stressors and important habitats.

8.3 Open Ocean MAM Priority: Assess Focal Resources and Important Habitats

Under this priority, the Open Ocean TIG is focused on analyzing data to identify where and when particular geographic areas are highly valuable or productive for Open Ocean resources. As with the "Identify Stressors" MAM priority above, the Open Ocean TIG identified this as a MAM priority due to its relevance across Open Ocean restoration activities and resources. The type of information gathered for this and the "Identify Stressors" priority may be used together to identify where and when there is a confluence of stressors and valuable ecological habitats or resources. This may help inform restoration planning and evaluation.

Habitats important to Open Ocean resources are dynamic in nature. Better understanding the spatial and temporal distribution of ecologically valuable areas (e.g., areas of high productivity or diversity) would help the Trustees identify high-value habitat for Open Ocean resources and assess the outcomes of restoration actions that are undertaken to protect resources using those habitats. For example, the Open Ocean TIG may assess whether and how restoration actions have sustained or increased the productivity of specific habitats, where appropriate. These types of evaluations are potentially relevant to all Open Ocean resources that are the focus of Open Ocean TIG restoration activities.

As with the previous MAM priority (Identify Stressors), the urgency of the data needed and the feasibility of the data collection will be specific to the resource and topic. However, the Open Ocean TIG will prioritize the use of existing data and data urgently needed for restoration design, implementation, or evaluation.

The Open Ocean TIG has identified the following information needs that may be addressed individually or in combination with future MAM activities:

1. *Locations and environmental characteristics of important breeding, foraging, nursery, or migratory habitats and areas of high productivity and/or biodiversity, including their variability in space and time.* The Open Ocean TIG may use this information to help plan and evaluate restoration actions intended to benefit multiple Open Ocean resources and the ecosystem.
2. *Distribution, abundance, health, and status of focal species, including their variability in space and time.* These data may be used for two main purposes: first, to understand potential overlaps with stressors, which could inform restoration planning and implementation; and second, to document progress toward resource- or ecosystem-level restoration outcomes. While it is not feasible to track the distribution and abundance of every species injured by the DWH spill, assessing a set of focal species may contribute to understanding overall ecosystem restoration

progress in the Gulf of Mexico. Open Ocean TIG MAM efforts related to this topic would focus initially on compiling existing data for specific injured species, where applicable; and assessing where the most important data gaps exist for key Open Ocean species, and where modeling or other analytical approaches may be appropriate.

9 Next Steps

Now that the initial MAM priorities have been identified, the Open Ocean TIG will identify opportunities to most effectively address them. The TIG will select a subset of focus areas under these priorities for further refinement. As part of this process, the TIG may conduct inventories of existing datasets, models, and ongoing science and monitoring efforts that may be leveraged to help address priorities; review project ideas submitted to the Trustees' project portal; and hold workshops or webinars to obtain further input from stakeholders, technical experts, and other interested members of the public, as described in Section 5. Through this work, the TIG will develop potential activities to address the MAM priorities, which the TIG will then evaluate based on the factors described in Section 5 to determine whether the TIG will implement the activity. The Open Ocean TIG expects to refine the MAM priorities listed in Section 8 over time as needed using the processes described in Section 4 above. If substantial revisions to the MAM priorities are made, the Open Ocean TIG will release a new version of this document to share the updated priorities.

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