Coordinating Monitoring Programs to Design for Holistic Ecosystem Restoration

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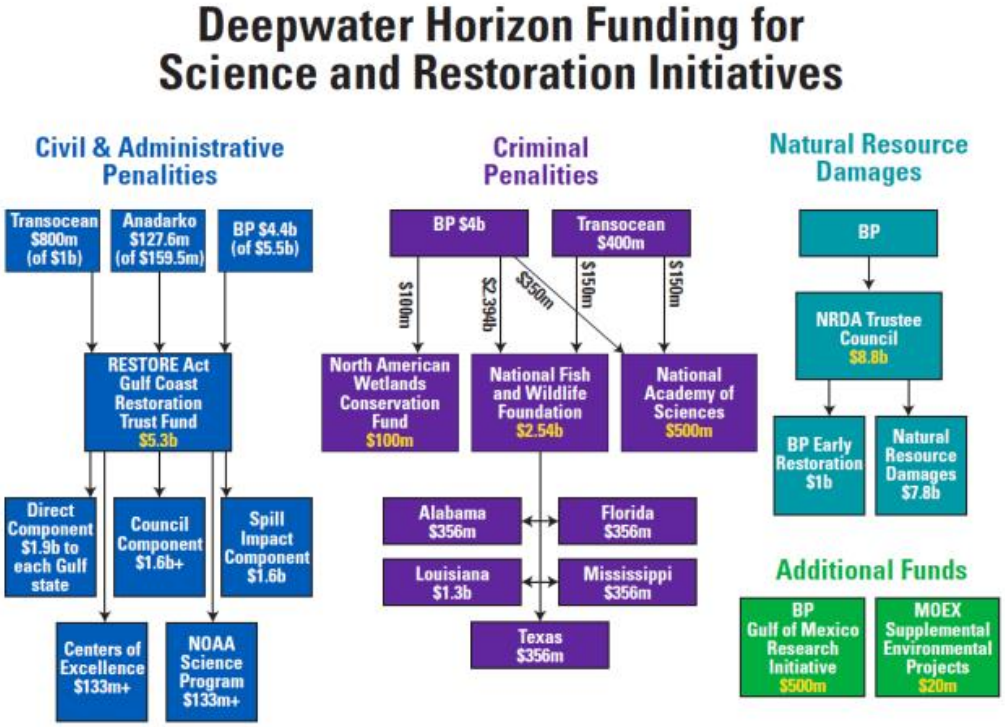
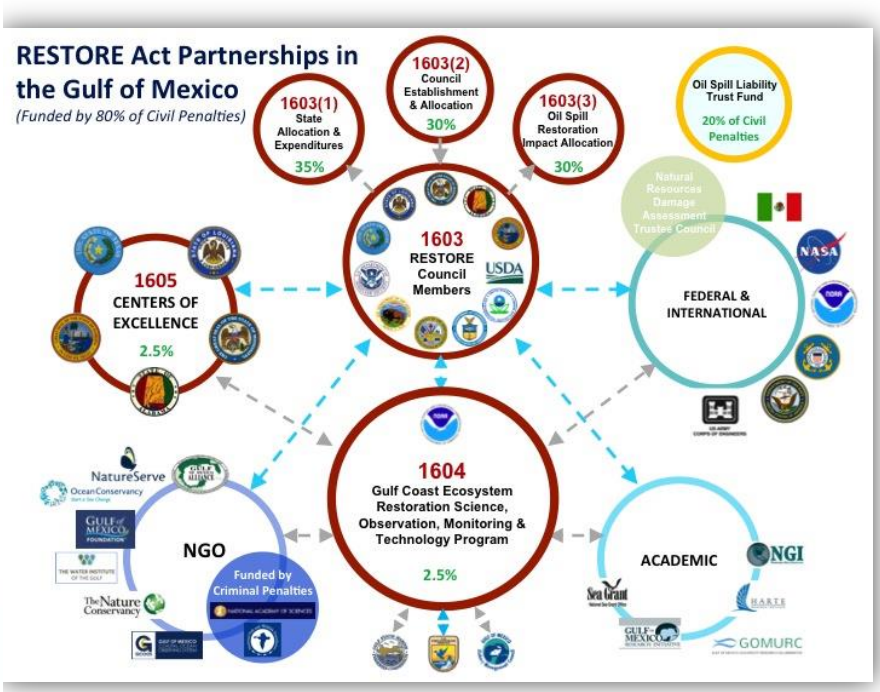
Jessica Henkel, RESTORE Council
Melissa Carle, NOAA

Restoration in the Gulf of Mexico

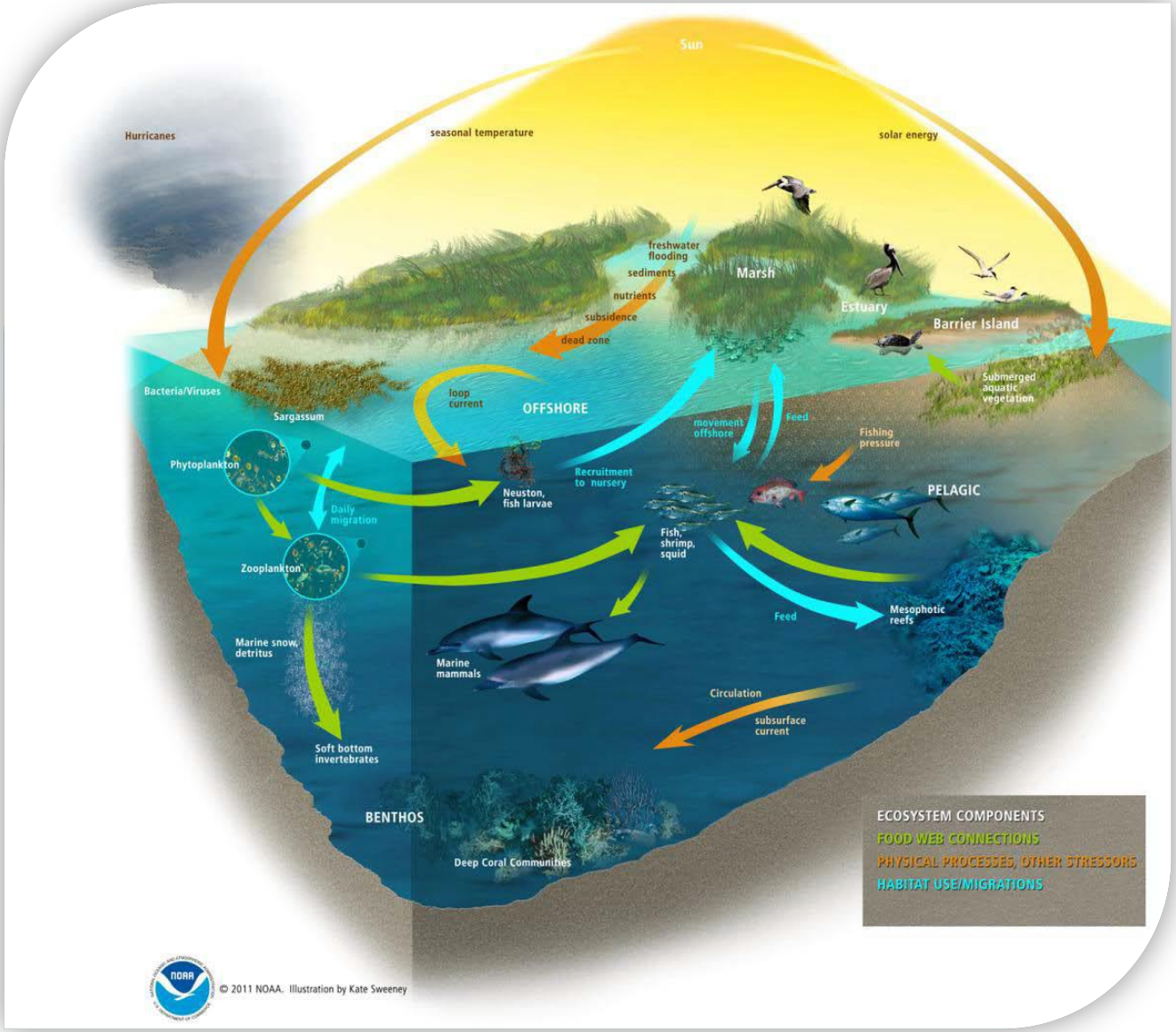




Can any single program independently achieve holistic Gulf restoration?

Holistic Ecosystem Restoration Assessment

- Highly interactive and interdependent network of organisms and their chemical, biological, and physical environment.
- Restoring specific resources, habitats, processes and/or services in Gulf of Mexico
- Can we monitor specific ecological and socio-economic components of the ecosystem and cobble together to understand holistic ecosystem restoration efforts?



Monitoring and Adaptive Management is Foundational to Gulf Restoration

- Dynamic, changing environment
- Unprecedented scale of the impacts, injury and required restoration
- Lengthy timeline of restoration implementation
- Matrix of restoration efforts in the Gulf of Mexico
- Currently unknown conditions may influence restoration outcomes

Build Out Foundational Monitoring Elements

Monitoring Program & Data Inventory

Monitoring & Adaptive Management Guidance

Standards, Protocols, QA/QC

Product Synthesis & Delivery

Program Coordination & Strategic Leveraging

Information Acquisition from Existing & Historic Programs

Outcomes & Reporting

Data Mgmt. & Accessibility

Uncertainties & Gap Analysis

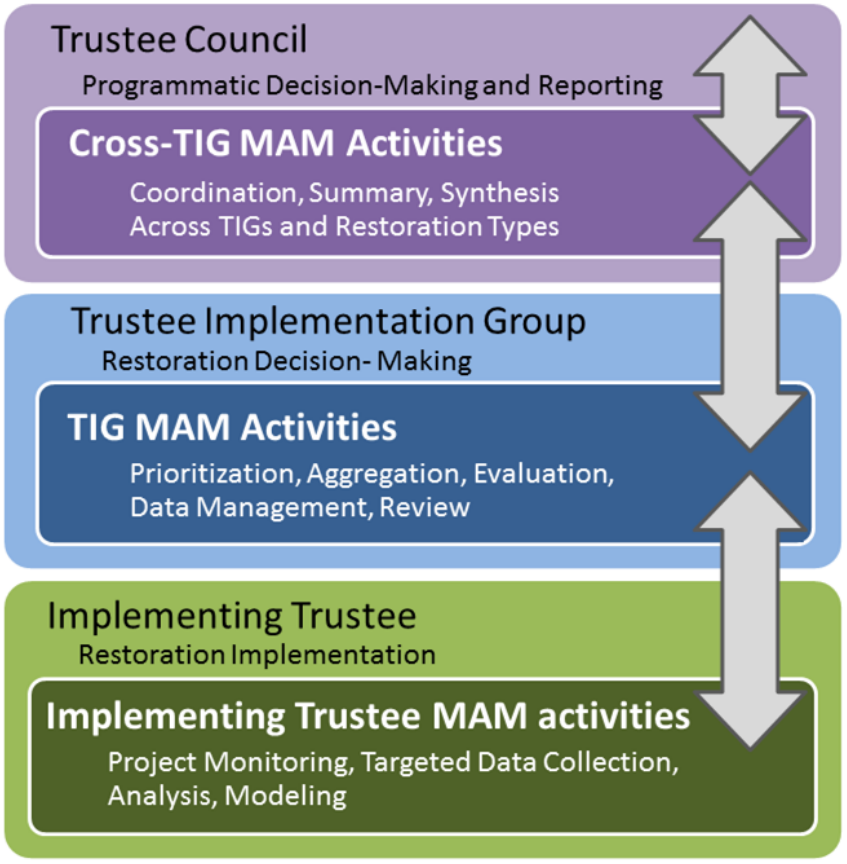
Data Analytics & Assessments

Internal/External Coordination Structures

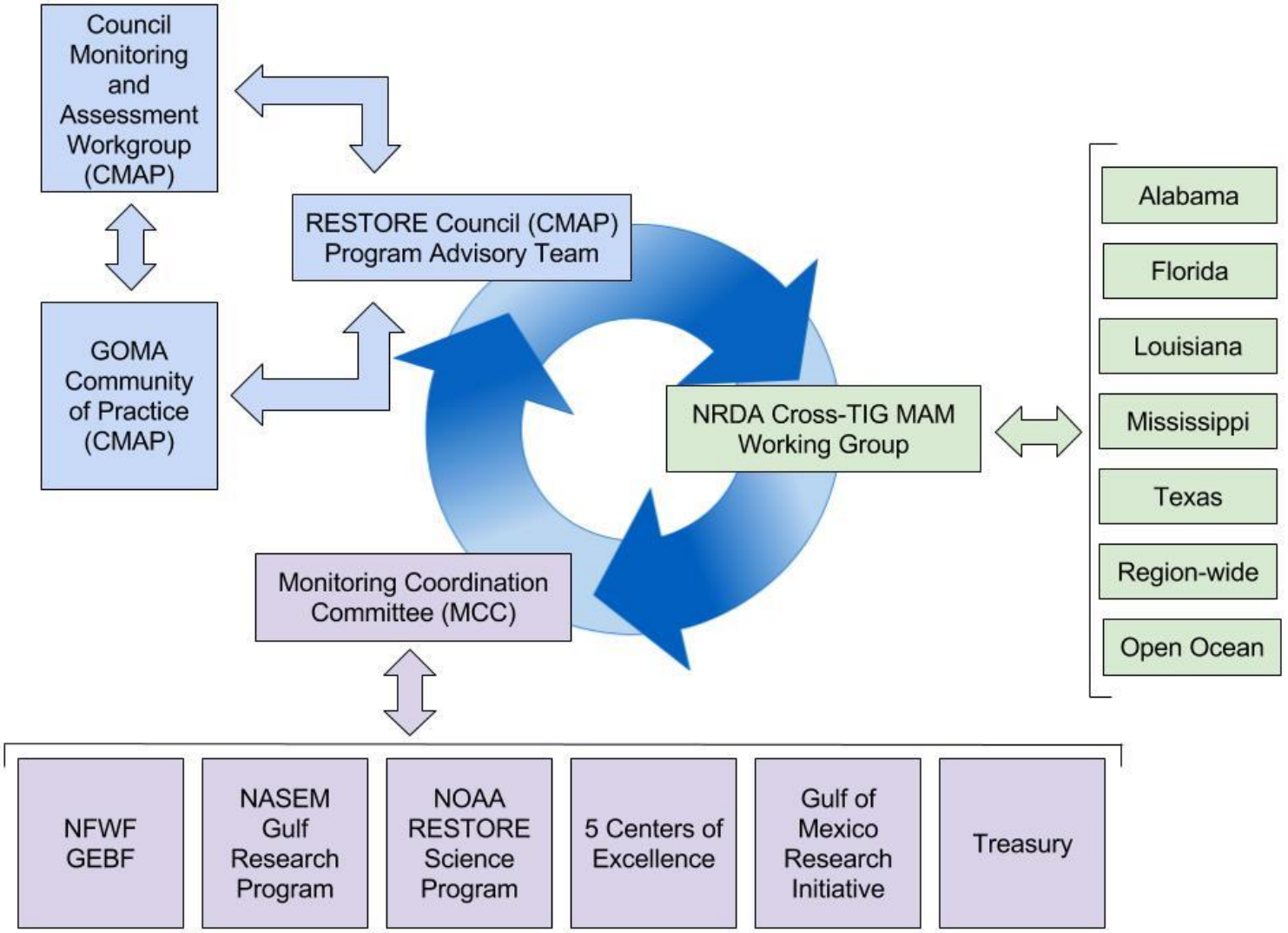
RESTORE

- Council Monitoring & Assessment Work Group (CMAWG)
- Monitoring Coordination Committee (MCC)
  NRDA, NFWF, COEs, DWH Science “pots”
- Monitoring Community of Practice (CoP)

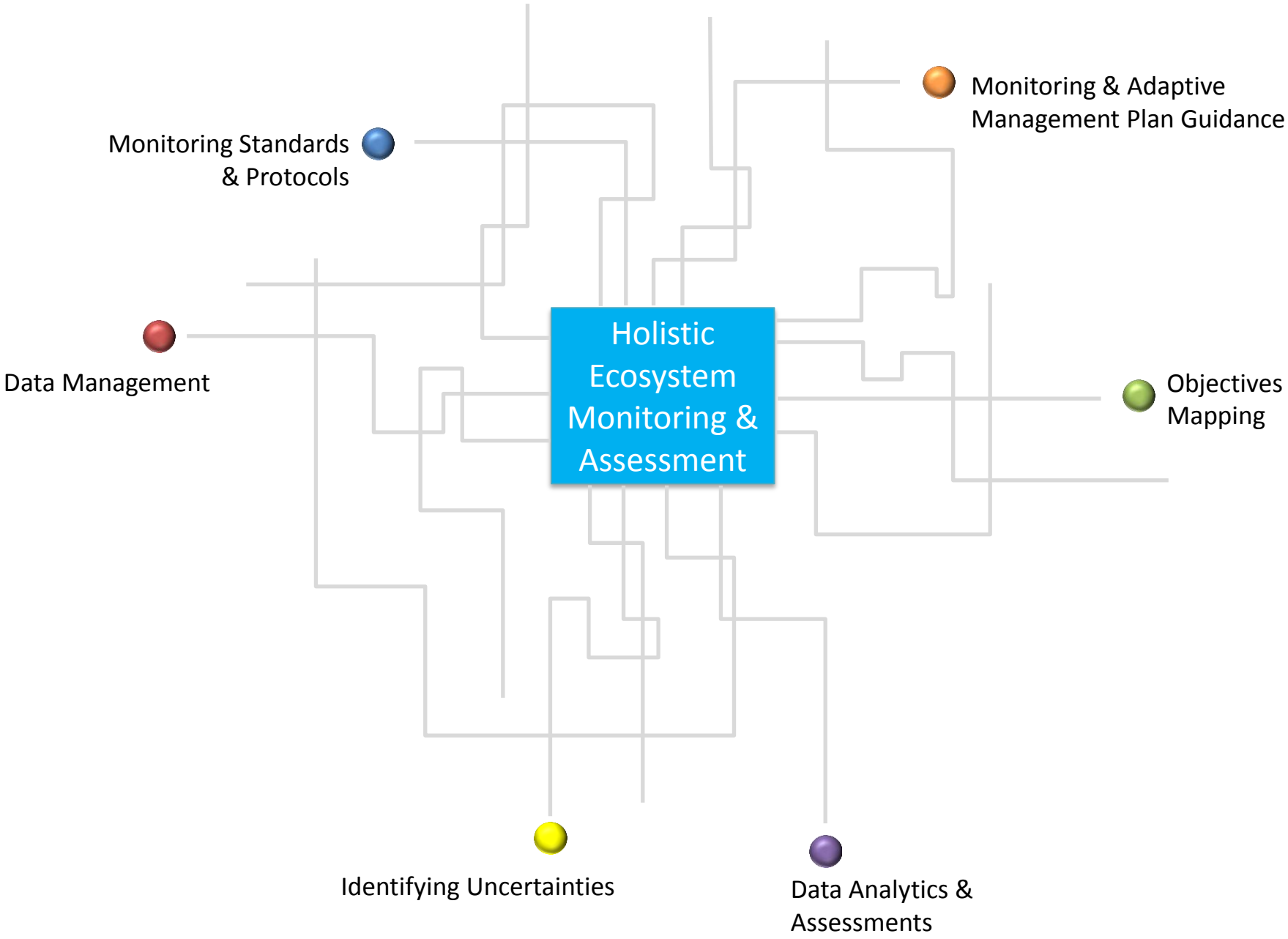
NRDAR



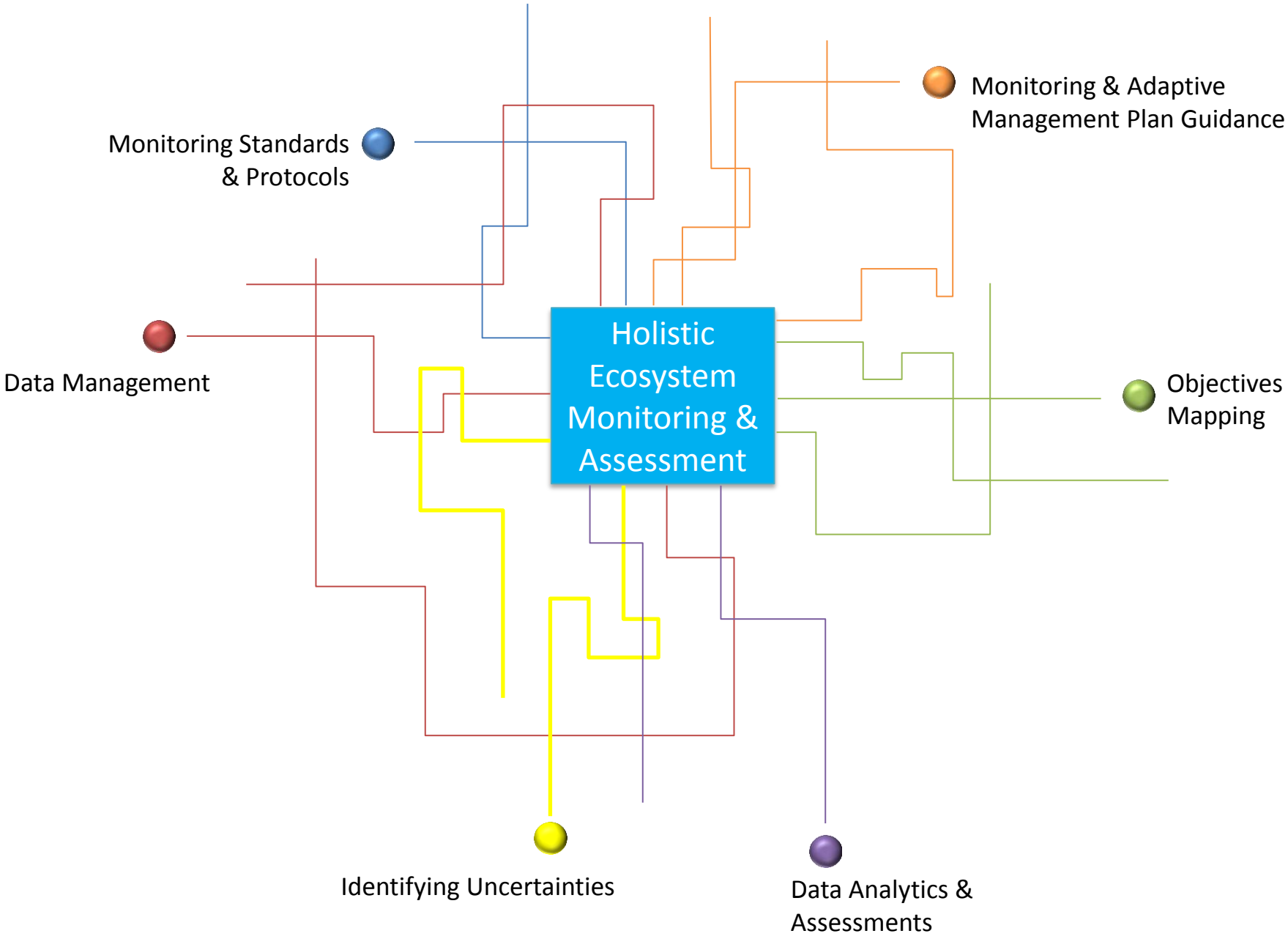
Monitoring and Data Coordination

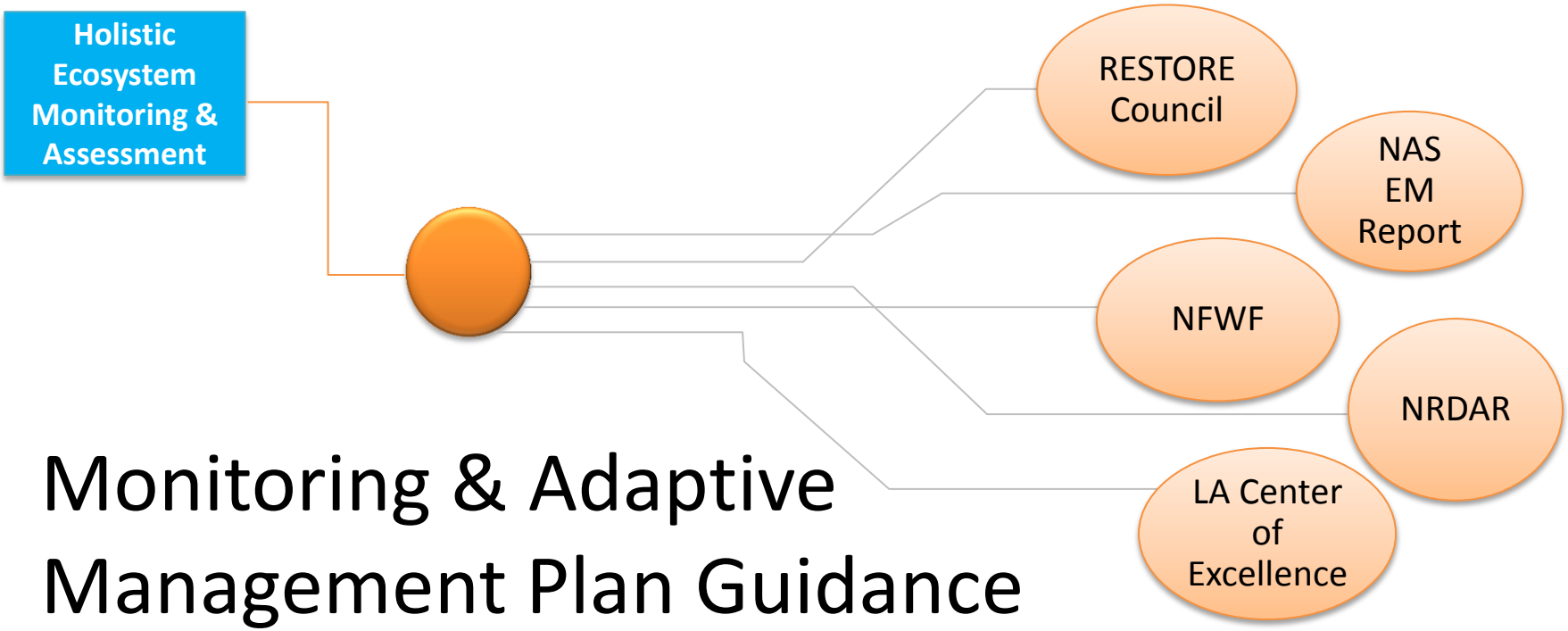


Developing the Knowledge Base Network



Developing the Knowledge Base Network





Monitoring & Adaptive Management Plan Guidance

Accomplishments & Ongoing Activities

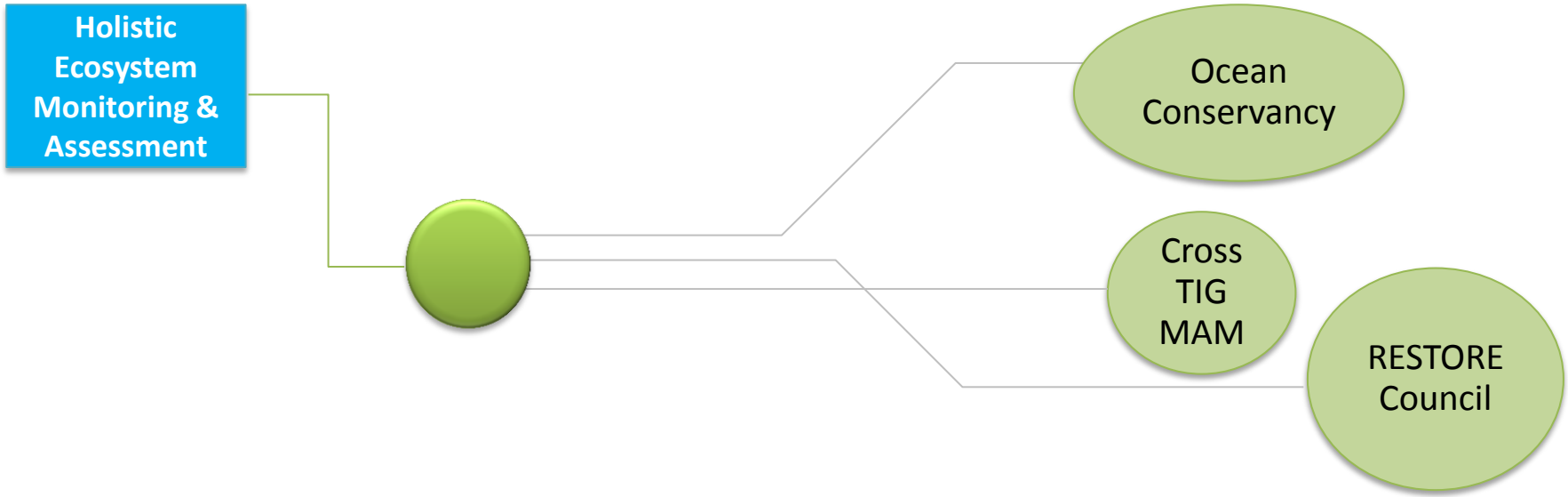
- Establishing Restoration Objectives
- Describing Conceptual Setting
- Identifying Sources of Uncertainty
- Developing Monitoring Designs
- Selection of Monitoring Parameters
- Developing Rationale for Adaptive Management

Needs (Programmatic-level)

- Evaluating Project Effects
- Describing Approach to Corrective Actions/AM
- Describing Data Management Strategy
- Describing Reporting Strategy
- Developing MAM Budget

Monitoring and Adaptive Management Manual

- Roles & Responsibilities
- External Engagement
- MAM Principles
- MAM Plan Development Guidance
- Monitoring Standards & Protocols
- Project/Program Evaluation & Learning
- Data Management
- Reporting Standards



Objectives Mapping

Accomplishments & Ongoing Activities

- Overarching Framework of GoM Restoration Objectives
- Restoration Type Project Objectives

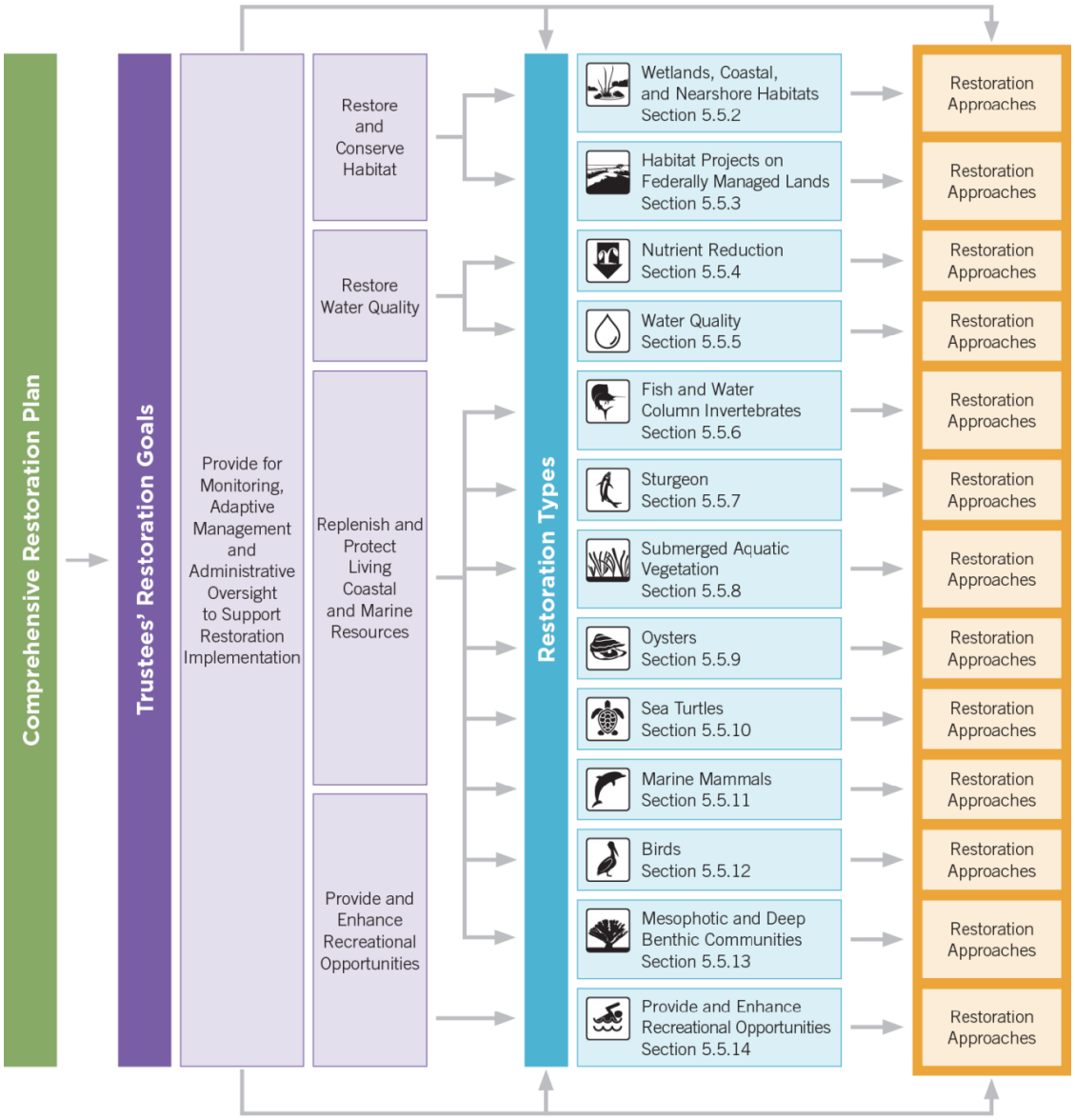
Needs

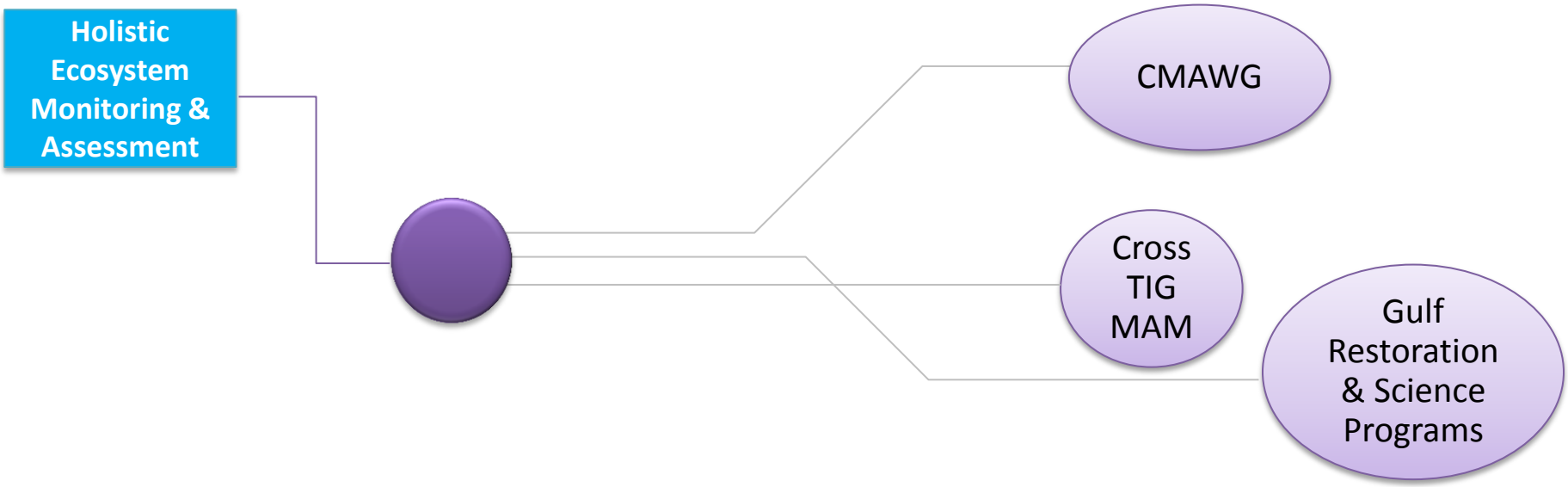
- Network of Shared Objectives

Alignment of Restoration Goals/Objectives

Restore Comprehensive Plan Goal	Restore Goal Description	NRDA Restoration Plan Goal	Comments
1. Restore and Conserve Habitat	Restore and conserve the health, diversity, and resilience of key coastal, estuarine, and marine habitats.	1. Restore and Conserve Habitat	Restore and NRDA goals are equivalent at the highest level
2. Restore Water Quality	Restore and protect water quality of the Gulf Coast region's fresh, estuarine, and marine waters.	2. Restore Water Quality	Restore and NRDA goals are equivalent at the highest level
3. Replenish and Protect Living Coastal and Marine Resources	Restore and protect healthy, diverse, and sustainable living coastal and marine resources.	3. Replenish and Protect Living Coastal and Marine Resources	Restore and NRDA goals are equivalent at the highest level
4. Enhance Community Resilience	Build upon and sustain communities with capacity to adapt to short- and long-term changes.	(No equivalent goal)	Enhancing community resilience is likely outside the NRDA regulatory requirement for a nexus between the injury and the restoration
5. Restore and Revitalize the Gulf Economy	Enhance the sustainability and resiliency of the Gulf economy.	4. Provide and Enhance Recreational Opportunities	The NRDA goal is a subset of RESTORE goal and is more narrowly focused to offsetting lost use
(No equivalent goal; however, Objective 7 (Improve science-based decision-making processes) is similar to NRDA Restoration Plan Goal)	Objective 7: Improve science-based decision-making processes used by the Council	5. Provide for Monitoring, Adaptive Management, and Administrative Oversight to Support Restoration Implementation	Restore Objective 7 and NRDA Goal 5 are largely process orientated regarding how other goals will be approached and achieved rather than establishing new goals for environmental change

Map Objectives across Restoration Types





Data Analytics & Assessments

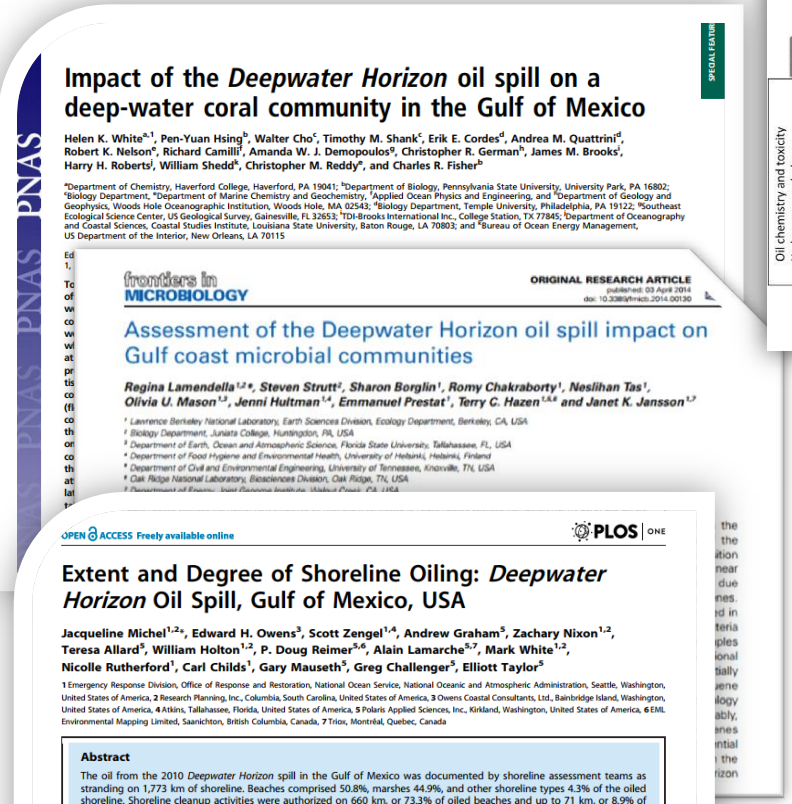
Accomplishments & Ongoing Activities

- Project level assessments
- Community or species level examples – GOMRI
- NRDA Assessment Examples

Needs

- Establish Baseline
  - Habitat & WQ Inventory
- Establish Reference
- Wetland, Coastal, Nearshore Pilot
- Synthesis Center(s)

Data Analytics & Assessments



Impact of the *Deepwater Horizon* oil spill on a deep-water coral community in the Gulf of Mexico

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frontiers in MICROBIOLOGY

ORIGINAL RESEARCH ARTICLE

Assessment of the Deepwater Horizon oil spill impact on Gulf coast microbial communities

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[5] Department of Civil and Environmental Engineering, University of Tennessee, Knoxville, TN, USA
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PLOS ONE

Extent and Degree of Shoreline Oiling: *Deepwater Horizon* Oil Spill, Gulf of Mexico, USA

Jacqueline Michel[1,2]*, Edward H. Owens[3], Scott Zengel[1,4], Andrew Graham[5], Zachary Nixon[1,2], Teresa Allard[5], William Holton[1,2], P. Doug Reimer[5,6], Alain Lamarche[5,7], Mark White[1,2], Nicole Rutherford[1], Carl Childs[1], Gary Mauseth[5], Greg Challenger[5], Elliott Taylor[5]

1 Emergency Response Division, Office of Response and Restoration, National Ocean Service, National Oceanic and Atmospheric Administration, Seattle, Washington, United States of America, **2** Research Planning, Inc., Columbia, South Carolina, United States of America, **3** Owens Coastal Consultants, Ltd., Bainbridge Island, Washington, United States of America, **4** Atkins, Tallahassee, Florida, United States of America, **5** Polaris Applied Sciences, Inc., Kirkland, Washington, United States of America, **6** EML Environmental Mapping Limited, Saanichton, British Columbia, Canada, **7** Trios, Montréal, Quebec, Canada

Abstract

The oil from the 2010 *Deepwater Horizon* spill in the Gulf of Mexico was documented by shoreline assessment teams as stranding on 1,773 km of shoreline. Beaches comprised 50.8%, marshes 44.9%, and other shoreline types 4.3% of the oiled shoreline. Shoreline cleanup activities were authorized on 660 km, or 73.3% of oiled beaches and up to 71 km, or 8.9% of oiled marshes and associated habitats. One year after the spill began, oil remained on 847 km; two years later, oil remained on 687 km, though at much lesser degrees of oiling. For example, shorelines characterized as heavily oiled went from a maximum of 360 km, to 22.4 km one year later, and to 6.4 km two years later. Shoreline cleanup has been conducted to meet habitat-specific cleanup endpoints and will continue until all oiled shoreline segments meet endpoints. The entire shoreline cleanup program has been managed under the Shoreline Cleanup Assessment Technique (SCAT) Program, which is a systematic, objective, and inclusive process to collect data on shoreline oiling conditions and support decision making on appropriate cleanup methods and endpoints. It was a particularly valuable and effective process during such a complex spill.

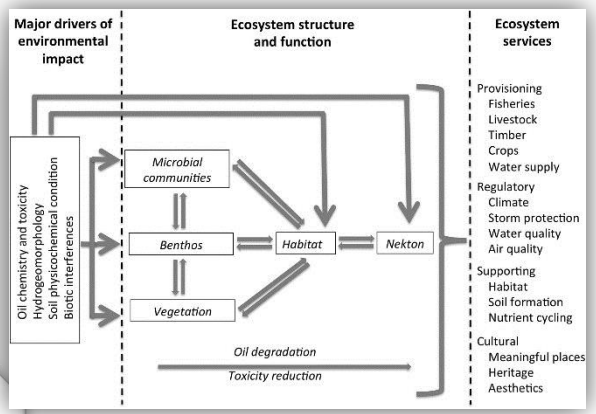
Citation: Michel J, Owens EH, Zengel S, Graham A, Nixon Z, et al. (2013) Extent and Degree of Shoreline Oiling: *Deepwater Horizon* Oil Spill, Gulf of Mexico, USA. PLoS ONE 8(6): e65087. doi:10.1371/journal.pone.0065087

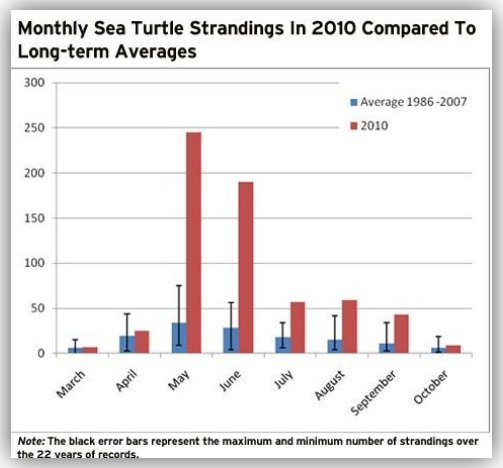
Editor: Wei-Chun Chin, University of California, Merced, United States of America

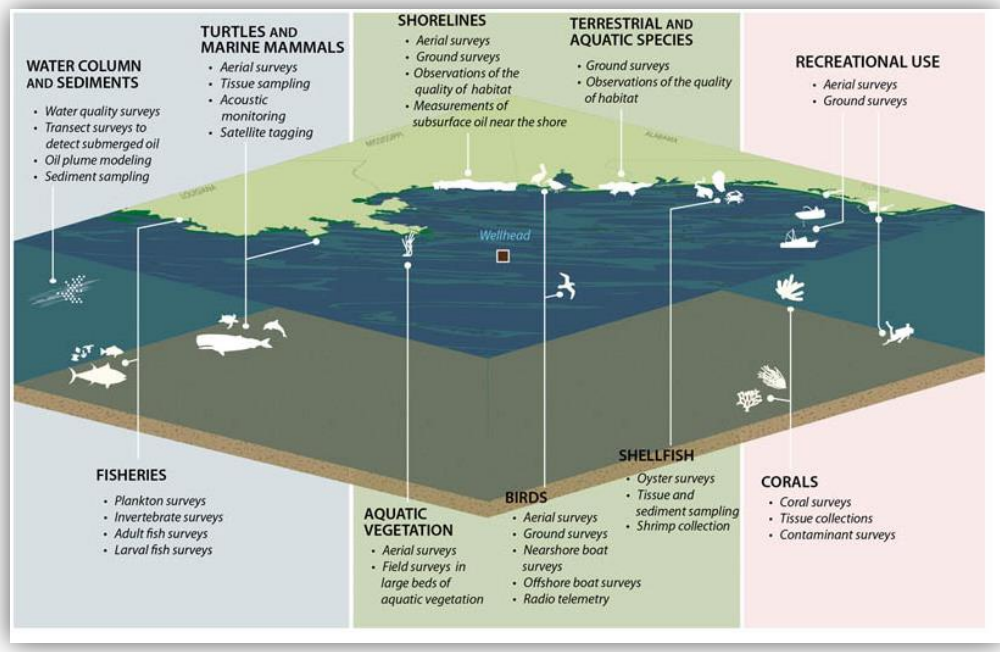
Received November 15, 2012; **Accepted** April 21, 2013; **Published** June 12, 2013

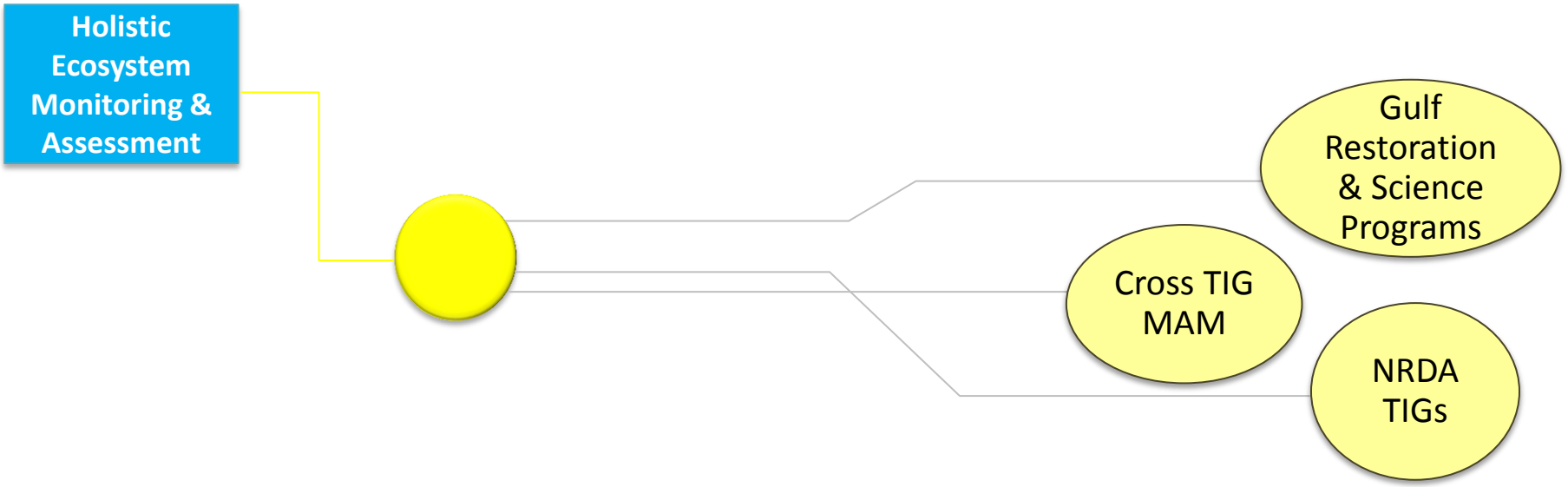
Funding: This work was conducted under the Deepwater Horizon oil spill Unified Command. Funding was provided by BP, as the Responsible Party. However, the NOAA, RPI, and Atkins authors were funded through NOAA, who is the Scientific Support Coordinator to the US Coast Guard. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests: Authors JM, ZN, MW and WH are employed by Research Planning, Inc. Author SZ is employed by Atkins. Author EHO is employed by Owens Coastal Consultants, Ltd., and was contracted to Polaris Applied Sciences, Inc. Author PDR is employed by EML Environmental Mapping Limited and is contracted to Polaris Applied Sciences, Inc. Author AL is employed by Trios and is contracted to Polaris Applied Sciences, Inc. Authors AG, TA, GC, ET and









Identifying Uncertainties

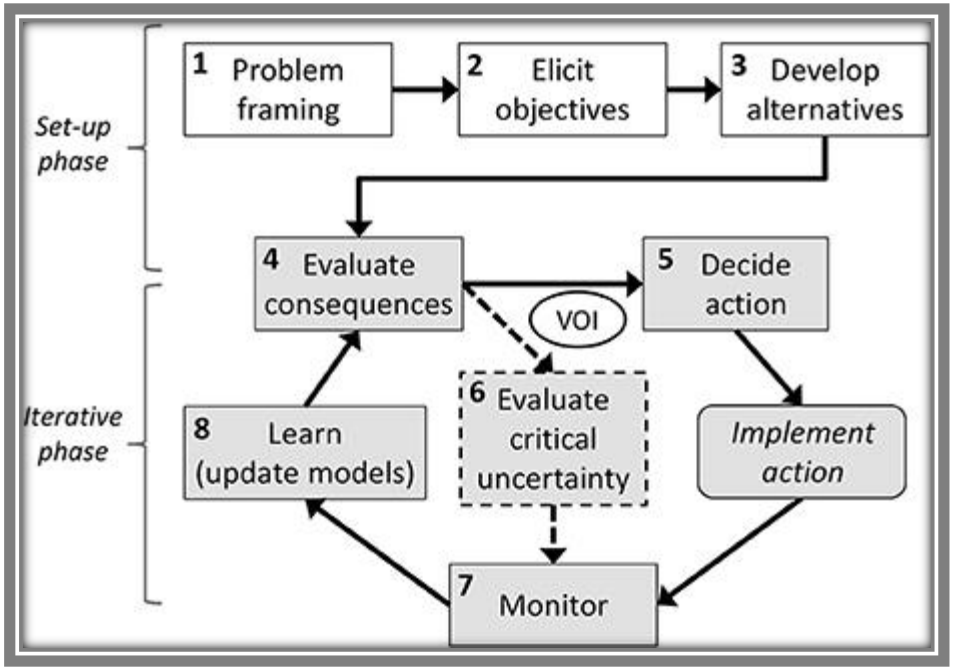
Accomplishments & Ongoing Activities

- Project level
- Strategic Frameworks
- MAM Priorities

Needs

- Gulf Science Strategy
- Investigation of Unknown Conditions
- Addressing uncertainties in iterative feedback loop

Identifying Uncertainties



Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the *Deepwater Horizon* (DWH) Oil Spill

10.4.2.3 Identification and Investigation of Unknown Conditions

The Cross-TIG MAM work group will establish a process to evaluate all monitoring results across TIGs and Restoration Types along with other relevant scientific information (e.g., scientific

literature, monitoring data from other programs) to identify any trends and/or unanticipated results that may signal the existence of emerging unknown conditions. Procedures for reviewing existing information to identify emerging unknown conditions will be described in the MAM Manual. In the event that emerging unknown conditions are discovered, the Cross-TIG MAM work group may make recommendations to the Trustee Council on the prioritization of MAM activities to better document and characterize those conditions to inform future Trustee Council decisions related to the timing and purpose of establishing the Adaptive Management and Unknown Conditions TIG.

10.4.2.4 Programmatic Review and Feedback

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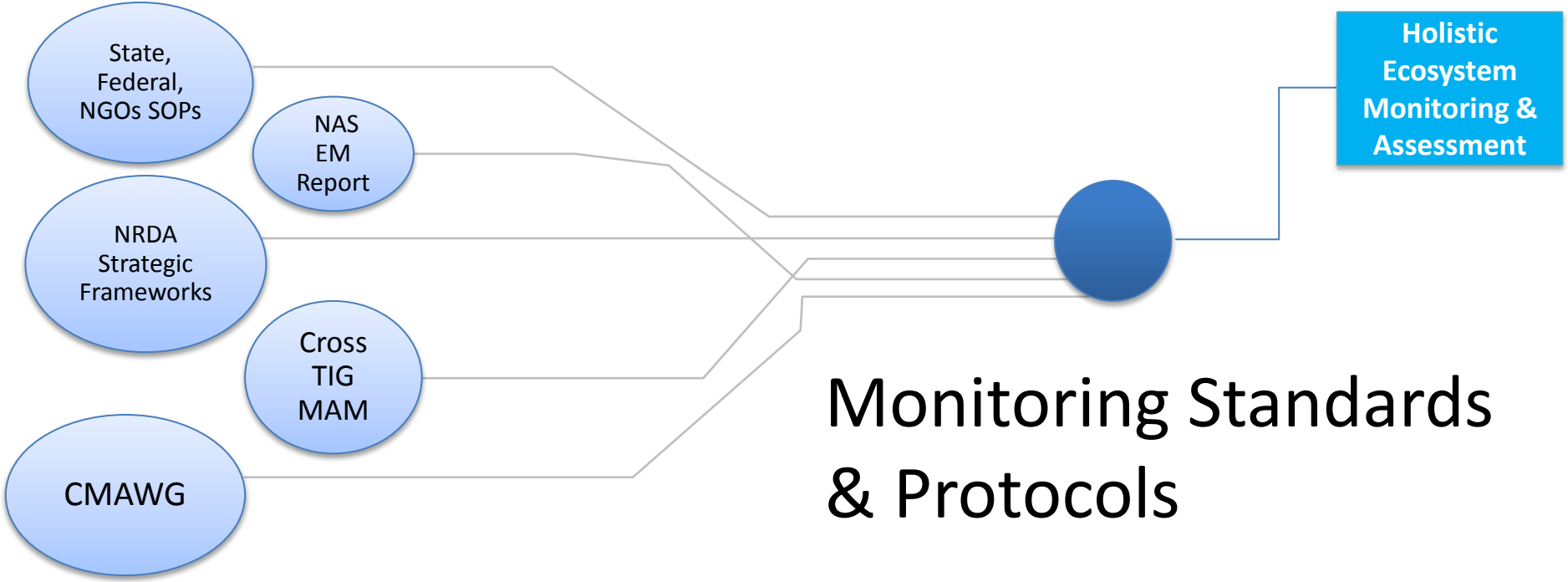
2015 Gulf Research Program Exploratory Grants Recipients

The Gulf Research Program announced the recipients of 12 exploratory grants, totaling more than $1.5 million, for award year 2015.

Developing a decision support tool to evaluate ecosystem services and associated uncertainties using a Bayesian belief network - $124,000
Project Director: *Wei Wu, Ph.D., University of Southern Mississippi*
Project team affiliation(s): *University of Southern Mississippi*
This project proposes to develop a tool which integrates knowledge from both natural and social sciences and quantifies uncertainties to help resource managers in the Gulf of Mexico understand how ecosystems—and the benefits they provide to people—may change as a result of different management decisions (such as developing offshore oil and gas or restoring coastal wetlands). This tool could allow decision makers to evaluate the potential risks and tradeoffs that these types of decisions entail in a dynamic system like the Gulf of Mexico. This tool may also be used by policymakers in other regions who want to maximize the benefits that ecosystems provide to people.



Accomplishments & Ongoing Activities

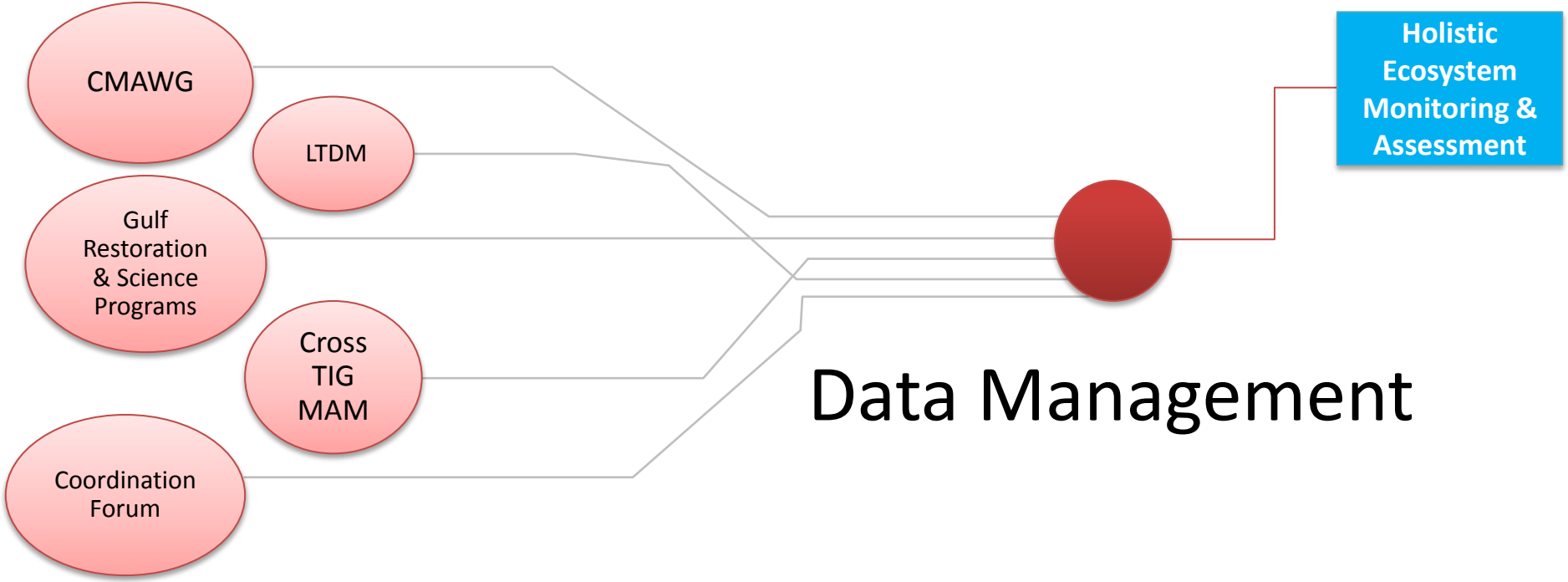
- Inventory & gap analysis
  - (Habitat & WQ)
- Minimum monitoring standards
- Core performance monitoring parameters – project level; few restoration types

Needs

- Inventory & gap analysis
- Compatible data collection methodologies across programs
- Capacity building of implementing entities

Fact Sheets

- Restoration Techniques
- Examples of Project-Level Objectives
- Example Drivers
- Example Uncertainties
- Recommended Parameters for Example Objectives
  - Core Performance Monitoring Parameters
  - Other Parameters for Consideration
- Monitoring Methods for Specific Restoration Techniques



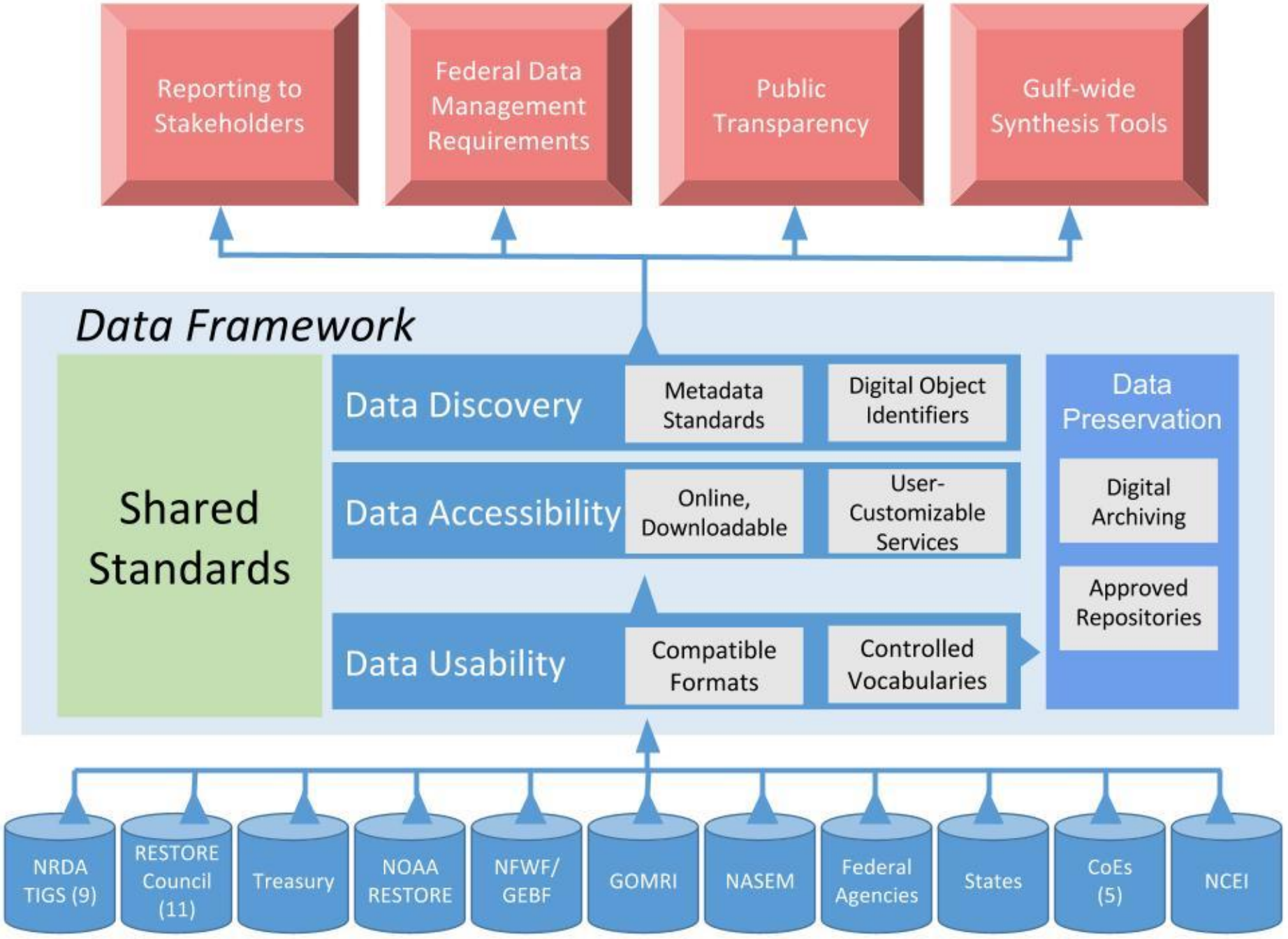
Data Management

Accomplishments & Ongoing Activities

- Project Data Management Plans
- CMAWG recommendation for ISO Metadata standard and Council investment in Metadata records development tool
- Funders Coordination Forum Data Management Workgroup

Needs

- Coordination across programs to aggregate, quality assure, store, disseminate data
- Integrate, standard-based system that will support web-based discovery and access
- Utilize existing capabilities
- Develop common standards for descriptions, formats, services, etc.
- Establish clear and consistent policies


Reporting to Stakeholders
Federal Data Management Requirements
Public Transparency
Gulf-wide Synthesis Tools
Data Framework
Shared Standards
Data Discovery
Metadata Standards
Digital Object Identifiers
Data Accessibility
Online, Downloadable
User-Customizable Services
Data Usability
Compatible Formats
Controlled Vocabularies
Data Preservation
Digital Archiving
Approved Repositories
NRDA TIGS (9)
RESTORE Council (11)
Treasury
NOAA RESTORE
NFWF/ GEBF
GOMRI
NASEM
Federal Agencies
States
CoEs (5)
NCEI

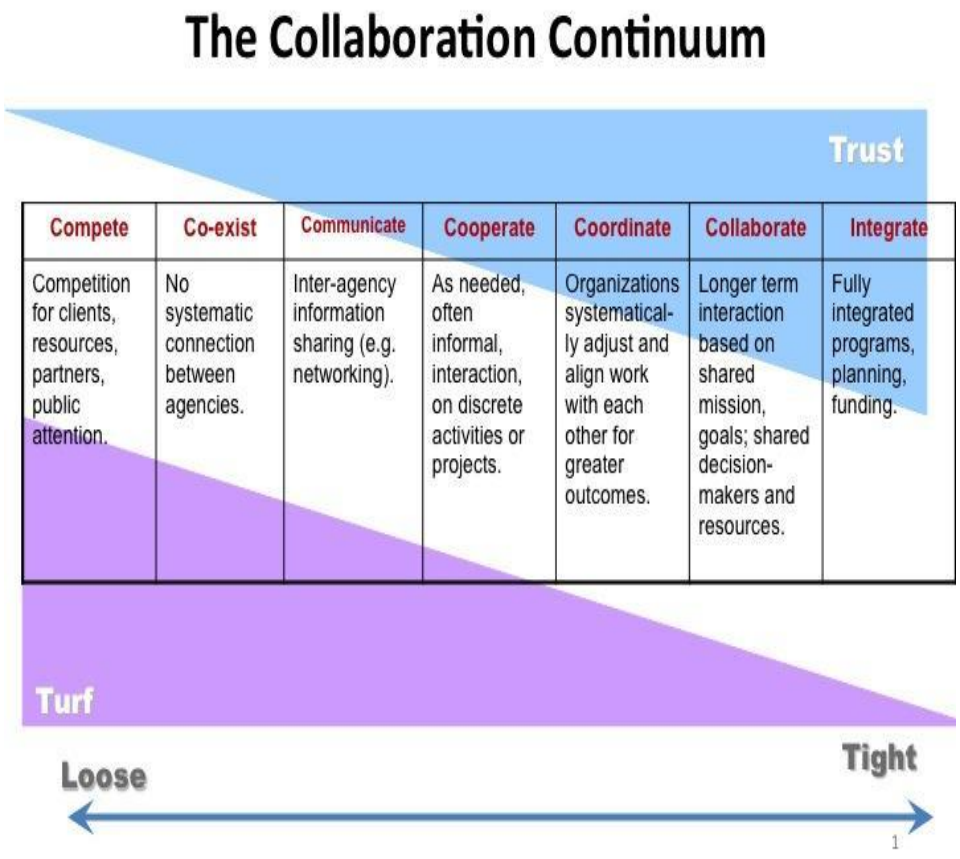
Biggest Challenges

- Monitoring and data management communities working together from inception to develop integrated processes
- Communicating and coordinating across both DWH and non-DWH programs
- Designing to the needs of users while meeting the mandates of agencies
- Clearly articulating measurable objectives from project to programmatic scales and common sets of questions we want the monitoring and data management programs to address
- Adoption of common data standards
- Tweaking designs of long-term monitoring and data management programs
- Responsibilities for following minimum monitoring standards & data requirements
- Governance across programs

Big Challenges…but Achievable

Solutions to Challenges

- Effective partnerships, based on shared goals and resources, facilitate robust evaluations
- Reduced burden on any single entity
- Open source access to all data
- Elevating the monitoring capacities of all partners
- Shared vision



Questions?


Monitoring
Coordination
Data
RESTORE/NRDA
Standards
Deepwater
scales
decisions
Subgroup
language
versus
Identifying
Management
Horizon
objectives
MAM
Forum
adaptive
Process
conditions
programmatic
programs
baseline
Decision
Stakeholders
Management/Corrective
completeness
track
Mechanisms
groups
community
commonalities
Adaptive
Quality
sampling
Recurrent
conceptual
frame/cost
decision
restoration
Reporting
NEWF
accuracy
aggregation
science
Implementing
applicable
Engagement
approach
sharing
vehicle
inform
Methods
Tracking
Generic
monitoring
Report
Establishing
Engaging
coordinate
Communicating
interpretation
repositories)standards
scientific
performance
process
External
makers
discuss
Long-term
metrics
quality
Context
designs
criteria
Scales
broader
RESTORE
entities
representativeness
DWH
among
Minimum
Framework
Manual
analysis
Critical
trusted
Analytics
Measurement
Objectives
project
bias
protocols
identifying
clearance
Project-specific
comparability
opportunities
Activities
spatial
Rolling
level
core
models
Uncertainties
time
work
Responsibilities
authorities
controlled-vocabularies
Plans
link
joint
Actions
pre-restoration
information
processes
precision
Considering
development
evaluation
Tracking
monitoring
Establishing
coordinate