Final Report – GoMRI Session 10 (January, 2014, Mobile)

Current and Future Ecosystem-Monitoring Strategies in the Gulf of Mexico:

Spanning Disciplines, Platforms, and Affiliations

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Background and Participation

In light of developing RESTORE Act programs and other sources of funding post-*Deepwater Horizon*, the overarching impetus for this session was to advance ongoing discussions for expanded and coordinated environmental monitoring in the Gulf of Mexico (Gulf). Under this umbrella, session goals were three-fold as follows: (1) to begin to synthesize current monitoring projects and assets in the Gulf, (2) to determine the community's observing priorities in a variety of disciplines, and (3) to elicit participant recommendations for an optimized, integrated observing system. A base definition for "ecosystem monitoring" was identified before the session as *a continuing program of measurement, analysis, and synthesis to identify and quantify ecosystem conditions and trends to provide a technical basis for decision-making*. This definition was purposely all-inclusive with regards to sampling location, discipline, platforms, and affiliations of participants and programs represented. The session agenda was a full day and was multi-faceted including a traditional science approach with invited speakers and a series of oral and poster presentations, as well as facilitated discussions incorporating a Federal Government Agency panel, online polling, and interactive flip chart activities. Invited talks were provided by Dr. Rick Spinrad (Oregon State University) on "What's the Right Observing Network?" and Mr. Ben Scaggs (Deputy Director of the RESTORE Council; for Justin

Ehrenwerth, the RESTORE Council Executive Director) on "Update on Gulf Coast Ecosystem Restoration Council Activities".

Approximately half of the conference participants (almost 1000 conference participants total) expressed interest in the session at the time of registration. Of the 59 total abstracts submitted to the session, 16 were allotted to oral presentations and 43 to poster presentations. Approximately 100 people were in attendance during the session throughout the day. Online polling provided a sample distribution of the disciplines, affiliations, and primary regions of interest of session participants. The majority of participants were from the natural sciences (~60% of total from biological, ~20% from physical, and 9% from chemical), with some participation also from the social sciences and human/environmental health. Academia and federal government were most heavily represented, followed by participation from non-governmental organizations (NGOs) and State/Local governments. The vast majority of participants indicated their primary region of interest as Gulf wide, with more regional focuses and international waters also represented.

Audience Participant Recommendations

A series of questions was asked of the audience to determine the current state of understanding and coordination regarding a Gulf integrated monitoring system, as well as to elicit recommendations and identify the most immediate information needs in each discipline. Based on poll results, general consensus amongst respondents indicated the need for an improved Gulf monitoring system, composed approximately equally of both current approaches and new technologies, with significantly more coordination and identification of lead roles required to achieve an expanded observing system for the Gulf of Mexico.

Potential Contributions from Academia, Government, and NGOs to a Gulf Observing System

More than twenty different ideas were gathered on flip charts regarding what individual groups could contribute to an integrated observing system, with responses in this report aggregated by the group's broader affiliation (academia, government, or NGO). All three affiliations provided ideas on how they could contribute broadly to coordination and planning of an integrated observing system. Ideas included providing stakeholder buy-in, facilitating coordination and connecting programs, and hosting a coordination team. Both academic and government entities indicated that they could contribute aspects of data management, collection, and processing – a topic of especial importance since data management garnered much discussion during the conference, including its own session. As well, both academic and government entities identified contributions of existing regional observing assets and long-term datasets, including for example, time series of living marine resources, coastal wetland monitoring systems, and multi-decadal environmental studies programs. Synthesis of existing information, as well as providing innovative and diverse ideas, were common contributions of NGOs and academia. NGOs uniquely said they could contribute objective peer review, providing "catalyst" money, identifying gaps, and alerts of industry spills. Unique contributions from academia included hosting a coordination team to centralize academic needs, creating an inventory of research interests/contact information/expertise, and a socio-economic observing system. Finally, government participants uniquely said they could contribute decision-making perspectives, such as related to oil spill response planning, offshore energy development, and evaluation of restoration program effectiveness.

Coordination

Numerous participant recommendations were gathered regarding how groups can better coordinate to develop an integrated system. One recommendation suggested that an Intergroup Monitoring Advisory Committee be developed with representatives from Federal/State government, NGOs, academia, and local communities with significant practice/experience in developing regional programs. Several recommendations focused around the guidelines by which any coordinating body should operate, including stakeholder engagement, the need for buy-in from the various monitoring programs, carefully defining the requirements/needs of the system to fill-in research and monitoring gaps, identifying all existing “sustainable” resources/assets to form a monitoring system backbone, and engagement of the private sector for communications, marketing, and operations and maintenance (O&M) services. As well, it was recommended that a monitoring “Community of Practice” be developed and that key variables be identified for sampling and standards (QA/QC) development. Several participant recommendations focused on the need for improved funding requirements that would encourage better coordination, essentially “incentivizing” coordination, such as data sharing requirements and adequate funding to include development of end-uses.

Building on Existing Assets: What can we do with what we already have?

Session participants were also queried as to how existing assets (e.g., technologies, expertise, historical datasets, data management capabilities, etc.) can best be utilized to inform an optimized observing system. One recommended approach was to engage practitioners with long histories of developing and implementing observing systems, in order to develop lessons learned. A second recommended approach was to take data management requirements, as well as monitoring standards, from the existing Federal/State/Local/Industry systems and to form a sustainable framework, which could be built out with the requirements. As well, it was suggested to conduct an inventory of existing assets and how they can be shared with others. Numerous participant recommendations centered around best use of existing assets through data management-related topics, such as provisions for centralized data management, greater focus on synthesis and data integration, use of data processing and analytics to do more with less staff time, asset discovery and mining, and posting available data more widely. It was suggested that these approaches should all help facilitate better sharing across academic, government, and industry datasets. Again, participants emphasized that funding groups need to provide sufficient funding for appropriate comprehensive and integrated data management. More specific recommendations for better utilizing existing assets included determining the relevant scales (i.e., space and time) of observable phenomena in order to design a more effective system and application of modeling to system design, such as via Observation System Simulation Experiments (OSSEs).

Discipline-Specific Observing Priorities

Discipline-specific observing priorities were solicited from attendees to determine the most immediate needs in their respective disciplines. In some cases, voting was also employed within discipline breakout groups to help rank top priorities. Common themes across disciplines and overlaps included the need to coordinate observations with modeling and the coupling of biology into the physicochemical models to inform, for example, habitat characterization (including for fish) and habitat response to anthropogenic activities. The Social Science group identified the need for a "translational lens" to incorporate human needs with biogeochemical environmental monitoring. The results for each discipline are summarized below.

***Biological Sciences*:** The top three monitoring priorities based on participant input were *benthic habitat mapping, habitat utilization, and bio-indicators of environmental health*. Other identified observing needs included primary to secondary productivity (nearshore to blue water), higher trophic level observations (marine mammals, fish, etc.), microbial processes and productivity, deepwater biodiversity, soil development and wetlands, fisheries recruitment, bird status and trends, and abundance of pelagic *Sargassum*.

Chemical Sciences: The top three monitoring priorities based on participant input were *nutrient processes, ocean acidification, and chemical loading*. Other identified observing needs included ecotoxicology, sediment quality guidelines for offshore deepwater applications, carbon flow pathways, natural toxins/harmful algal blooms (HABs), and metals.

***Physical Sciences*:** The ability to capture full 3-D ocean circulation offshore was identified as the highest priority. Related monitoring tools from coastal areas to deep waters to capture this would include moorings, high-frequency radar, gliders, and floats, which would be able to capture variables such as salinity, temperature, nutrients, surface meteorological data, waves, dissolved oxygen, and passive acoustics. For coastal areas, the highest priorities were quantifying sediment discharge rates and improved bathymetric maps for coastal restoration needs.

***Social Sciences*:** One of the top monitoring priorities identified by this group was answering the question: What are we monitoring "for" (in terms of what people want/need)? Other top priorities included human health and environmental connections, cultural/archaeological resources (monitor status/oil-spill impacts), longitudinal data for non-traditional economic variables (e.g., subsistence fisheries, communities, ecosystem services), and offshore observations to valuate ecosystem benefits (e.g., dive sites, recreational fishing, etc.). The group also acknowledged that individual versus community requirements can differ, and further identified the observation needs related to community resilience ("key indicators", such as linking health to environment) and fishing industry surveys "before" crisis (baselines). Related technology needs were also identified as requirements for achieving the above monitoring goals. Recommendations included for development of a socio-economic observing system are quick tool kits/best practices and a set of indicators that can be measured to reflect provisioning of services.

***Human and Environmental Health*:** Immediate needs identified in this discipline included observation of long-term biomarkers of human health in relation to contaminant exposure and psycho-social surveying to understand impacts of events on human well-being. Also identified were cross-sectional studies (long-term) in relation to occupation-based stress and long-term monitoring of seafood safety for sub-populations (subsistence fishing).

***Industry*:** Immediate observation needs related to industry identified by participants included produced-water monitoring in real-time from rigs, accidental spill reporting, high-resolution bathymetry for charting purposes, vessel traffic (which could be overlaid with ecosystem services and goods), and determining acoustic sensitivity of animals (whales) related to anthropogenic activities.

Overarching Recommendations from Presentations and Posters

While there were many excellent oral presentations and posters, here are some overarching highlights provided during the session. The speakers suggested the following could significantly help advance development of an expanded, right-sized Gulf observing network.

Developing an Effective Business Model – It was recommended that a more disciplined and defensible business model needs to be built for integrated ocean observing systems, including by defining markets, prioritizing requirements, selling products, and exploiting aggressively a more realistic funding portfolio. The importance of developing public-private partnerships was stressed to help fill the current gap in product service providers/developers, as well as to strengthen and tighten operational capabilities.

Highlighted Role for Advanced Technologies – Advances in technology represent an important avenue for reducing observing system costs and providing sustained observations, as recommended in numerous session posters. What were previously experimental technologies (like gliders) may now substitute for expensive research vessels to provide continuous monitoring of physical, chemical, and biological parameters. It was recommended that operationalizing of some of these new and advanced technologies should be a priority for a future Gulf observing system.

Quantify the Economic Value of an Observing System – More than one speaker stressed that "selling" the need for an observing system was of utmost importance if additional funding were to be invested in the future. A lack of funding for a Gulf Observing System, something that is seen as pertinent by the scientific community, reveals that the community has not "done its job" in communicating why an integrated monitoring system is necessary. For example, a current study underway aims to quantify both the societal value of and secondary markets ("private re-packaging") for a Gulf ocean observing network. This analysis should help communicate to politicians, decision-makers, and the public the importance of such a system and its economic and societal benefits ("how it would help people", including the public-at-large).

Building Consensus and Vision – The challenge in building consensus for a Gulf monitoring system is to integrate across multiple scales, different priorities, and numerous funding sources. One speaker suggested that increased communication between “the funders”, “the doers”, and “the users” would be a significant step forward.

Gap Assessment and Analysis – Preliminary results were presented of a survey and gap analysis for Gulf of Mexico monitoring programs relevant to *Deepwater Horizon* recovery. Several hundred programs have thus far been catalogued, ranging from human use to deepwater communities, with more work and funding required to finalize. Ultimately, the results of this work will identify major gaps, contributing to and supporting related ecosystem monitoring plans.

Visualizing a Gulf Observing System as a “System of Systems” – Because of the multiple entities engaged in Gulf monitoring from coastal to offshore, with different goals and needs, as well as the various sources of money invested, no one single entity is able to implement a Gulf Observing System on its own with current funding. A Gulf Observing System will need to be seen as a “System of Systems” with different spatial and temporal scales, geographic areas, and entities working together with their individual pieces to create an observing system by coordination and cooperation.

Improved Communication of Monitoring Products – The need was identified to move beyond time series and trends in datasets to visualization and decision-making tools for users, thus making a better connection between researchers collecting data and end users charged with applying the science for societal/environmental benefit. For example, “report cards” were described as an important tool for the user community.

Single Location for Accessing Data – The recommendation was made that coordination of an expanded monitoring effort would benefit from making the various datasets within agencies’ and other entities’ archives more accessible. For example, during the *Deepwater Horizon* oil spill, the ERMA database provided an online mapping tool integrating key environmental response information and baseline data for decision makers. Now post-*Deepwater Horizon*, much of this data is public (e.g., RestoreTheGulf.org), including multiple datasets across agencies that can inform future environmental monitoring programs.

Session Outcomes, Summary, and Next Steps

A significant amount of input aimed at informing current and future plans for Gulf monitoring programs was received during this session. One of the consistent messages, or outcomes, from the day was surrounding challenges related to funding. First, participants seemed to consistently express there is not enough money currently invested for what is needed to support a Gulf Observing System. Second, if more funding is going to be invested in a Gulf-wide monitoring effort, the scientific community has to do a better job of communicating the need and benefit to entities that have the ability to provide funding. Third, there are substantial assets and funding invested in Gulf monitoring; however, for those to be truly beneficial, there is a greater need for coordination among programs, prioritization of data needs, and realistic funding for appropriate comprehensive and integrated data management. For example, some participants emphasized that someone with money and authority needs to bring and keep disparate programs together. It was recommended that an authoritative body also needs to "Prioritize, REALLY prioritize" monitoring requirements and identify the most crucial data needs. This also relates to the relative benefit of any single data set as revealed in "data-denial" experiments - essentially calculating the value of the collection of a dataset, with low value datasets no longer financially supported. Future monitoring prioritization should ask stakeholders to justify why they would spend the next dollar allocated to Gulf monitoring in a particular way, being realistic about what any new observation will get us and why it's important to restoration.

In summary, it appears that all the money flowing to the Gulf post-*Deepwater Horizon* likely cannot, nor will not, be able to support the kind of "wish list" the scientific community has for a Gulf Observing System. However, if the science and monitoring community is working together, leveraging resources, thinking of Gulf observing as a "System of Systems", and communicating/translating information appropriately with funders and decision-makers, movement towards an integrated Gulf Observing System appears within reach. But it will also require tough decisions and prioritization of data needs based on available funding.

The information and recommendations collected during this session are being integrated into other efforts, such as the development of a *logic model* for a Gulf Observing System—starting with: what do we as a Gulf community envision a Gulf Observing System to be? And then: working backwards to map out a path on how to achieve that vision as a Gulf community.

Other next steps include taking the prioritized data needs among the different disciplines, and then cross-walking them in an attempt to see how data collected for one discipline can also meet the needs highlighted in another discipline. For example, in the physical sciences, the highest priority data need identified was for 3-D ocean circulation collecting parameters such as salinity, temperature, nutrients, dissolved oxygen, and passive acoustics. These data can also help meet some biological discipline needs of habitat characterization and response for specific species. There are also examples where tagging of certain biological species includes collection of supporting datasets such as salinity, temperature, and depth, which would help the physical sciences discipline.

The outcomes of this session are only one step, of many, that can help the development of a Gulf Observing System. This kind of creative thinking and brainstorming provides diverse ideas that can inform the structure of an integrated Gulf Observing System that meets the multi-purpose needs of stakeholders across the Gulf of Mexico.