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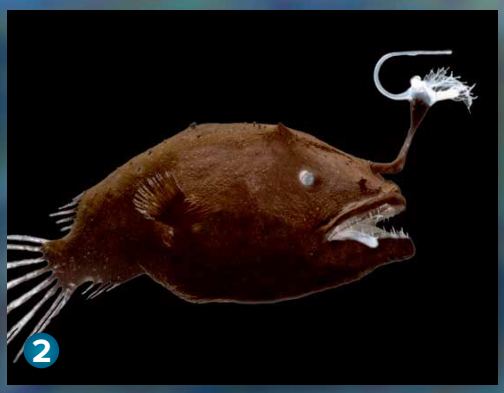


Introduction to the Special Issue

An Overview of the Gulf of Mexico Research Initiative

By John Shepherd, Debra S. Benoit, Kenneth M. Halanych, Michael Carron, Rick Shaw, and Chuck Wilson

INTRODUCTION

Prior to the Deepwater Horizon (DWH) incident on April 20, 2010, in the Gulf of Mexico, the state of knowledge concerning oil in the sea was well summarized by the third National Research Council report (National Research Council, 2003). Since that report was published, several ongoing studies have examined spills in cold and shallow waters, for example, Peterson et al. (2003) and Wiens (2013) on the legacies and lessons of the 1989 *Exxon Valdez* oil spill. Oil exploration and production has moved further offshore and into much deeper water in recent decades. The DWH/Macondo blowout occurred in water over 1,000 m deep, in a relatively warm near-surface water environment, and in a region where naturally occurring seeps of oil are also common. Despite ongoing general oceanographic research in the Gulf of Mexico, establishment of ocean observing systems, and several programs funded by the US Bureau of Ocean Energy Management (BOEM[1], formerly Minerals Management Service), prior knowledge of oceanography in the Gulf proved to be inadequate, and not fully appropriate, for this unprecedented event, as observations in the vicinity of the spill rapidly demonstrated (see Overton et al. and Passow and Hetland in this issue). Major environmental events like the DWH spill trigger a legal process called Natural Resource Damage Assessment (NRDA[2]) that brings together federal agencies, states, and Native American tribes to evaluate the impacts of the event on natural resources, in this case, along the nation's coast. Because there were legal and procedural constraints on resulting field programs, data collection, and other research by US federal government agencies and their contractors as well as on BP investigations, a major program of independent scientific investigations was urgently needed. Fortunately, BP quickly established the Gulf of Mexico Research Initiative (GoMRI) to address this knowledge deficit, and GoMRI has been able to support unfettered and independent research (see Colwell). This article provides an overview of the science undertaken by the GoMRI program and its management.

SCOPE AND STRUCTURE OF GOMRI SCIENCE

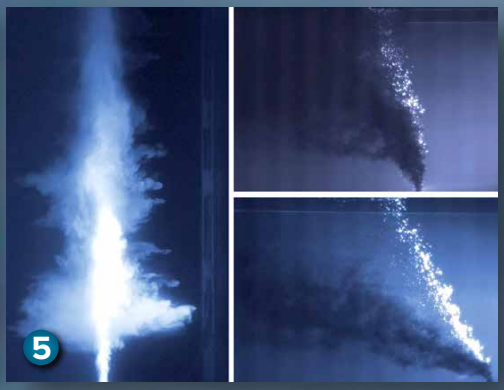
Research Themes and Disciplines

GoMRI's five research themes[3] are:

THEME 1. Physical distribution, dispersion, and dilution of petroleum (oil and gas), its constituents, and associated contaminants (e.g., dispersants) under the action of physical oceanographic processes, air–sea interactions, and tropical storms

THEME 2. Chemical evolution and biological degradation of the petroleum/dispersant systems and subsequent interaction with coastal, open-ocean, and deepwater ecosystems

[1] http://www.boem.gov/BOEM-Newsroom/Library/Publications/Gulf-of-Mexico-OCS-Region-Publications.aspx
[2] http://oceanservice.noaa.gov/facts/nrda.html
[3] Additional information about the structure and organization of the research program can be found on the GoMRI website, http://gulfresearchinitiative.org.



PHOTOS. (1) An injection sled is equipped and ready for deployment from R/V *Brooks McCall*. The white bumpers provide buoyancy for recovery. The gray horizontal tubes, next to engineer Brian Guest, sample salinity. *Photo Credit: Texas A&M University Gulf Integrated Spill Response Consortium* (2) *Oneirodes eschrichtii* (bulbous dreamer, bathypelagic). *Photo courtesy of Danté Fenolio, Deep-Pelagic Nekton Dynamics Consortium* (3) Stefan Bourgoin and Don Deis sampling fiddler crabs and periwinkles at a study site in Barataria Bay, Louisiana. *Photo credit: Don Deis* (4) Consortium for Advanced Research on Transport of Hydrocarbon in the Environment (CARTHE) researchers launched drifters from a fleet of small boats, like the one used in this test run, operated by David Nadeau, to study the complex and elusive surface ocean currents that transport pollutants. *Photo Credit: Josefina Olascoaga, CARTHE Consortium* (5) Dye visualizations of stratified bubble plume flows. *Image courtesy of Scott Socolofsky* (6) Deploying a rosette sampler during a Deep-C geochemistry cruise aboard R/V *Weatherbird II* in May 2012. *Photo Credit: Deep-C Consortium* (background photo) Oil sampling location during research cruise off Louisiana coast on May 26, 2010. *SkyTruth photo, public access by NOAA*

THEME 3. Environmental effects of the petroleum/dispersant system on the seafloor, water column, coastal waters, beach sediments, wetlands, marshes, and organisms, and the science of ecosystem recovery

THEME 4. Technology developments for improved response, mitigation, detection, characterization, and remediation associated with oil spills and gas releases

THEME 5. Impact of oil spills on public health, including behavioral, socioeconomic, environmental risk assessment, community capacity, and other population health considerations and issues[4]

These themes are disciplinary in character, and are intended to cover the full range of processes involved, from the release of oil and gas to the impacts on humans and the ecosystem. They also cover a very wide range of spatial and temporal scales; types of processes, environments, and ecotypes; and/or technological, social, and economic aspects. Thus, the program has sought to encourage and fund interdisciplinary studies and modeling activities wherever appropriate, as discussed further below. GoMRI has also co-hosted a major Oil Spill and Ecosystem Science Conference in one of the Gulf States each year since 2013 to encourage intercommunication among all of the disciplinary specialties involved in understanding the impacts of oil spills.

Science Integrity and Investigator Expectations

In accordance with the requirements of the Master Research Agreement (MRA)[5], the GoMRI program aims to promote and maintain the highest possible standards of scientific integrity in the process of program operations, in the selection of proposals for funding, and in the execution of the research itself. To this end:

- Upon appointment to the GoMRI Research Board (RB), each board member must sign Appendix 2 of the MRA "Research Board Conflict of Interest Policy and Confidentiality Statement" and complete the Conflict of Interest Disclosure Form to identify institutional, professional, and personal/financial conflicts. The Research Board Grants Unit maintains all forms, and the forms are updated by the RB every three years.
- In accordance with the MRA, the RB developed Bylaws and a Code of Conduct for the operations of the board, drawn from the experience and practices of the National Academy of Sciences, the National Science Foundation (NSF), and the National Institutes of Health.
- GoMRI uses the National Science Foundation peer evaluation protocols set by the National Science Board to select research for funding.
- Independent reviews are carried out by scientific peers who meet stringent conflict of interest criteria.

[4] Theme 5 was formally modified from an earlier version following a workshop on public health aspects in 2013. Further information is available at http://gulfresearchinitiative.org/taking-oil-spill-research-future-public-health.

[5] http://gulfresearchinitiative.org/about-gomri/master-research-agreement

- All reviewers sign conflict of interest and nondisclosure statements.
- Individual researchers must comply with the highest professional standards as defined by the National Academies.
- All GoMRI-funded researchers conduct independent and objective work, without any influence from BP or direction from the RB.
- Researchers are required to publish their results independently in peer-reviewed scientific journals with no requirement for approval from either BP or the Research Board.

In addition, the GoMRI Research Board has adopted procedures that require the recusal of Board members having potential conflicts of interest from evaluation and ranking of proposals. Further information on these issues is available on the GoMRI website.

In accordance with emerging standards of best practice, and requirements of the MRA, GoMRI also supports maximum openness and accessibility of all data generated. A research database, the GoMRI Information and Data Cooperative (GRIIDC), has, therefore, been established, and GoMRI requires that "all data shall be fully accessible and posted thereto with minimum time delay." The GRIIDC mission is:

- To ensure a data and information legacy that promotes continual scientific discovery and public awareness of the Gulf of Mexico ecosystem
- To maintain the scientific data sets resulting from GoMRI-funded research and assist researchers with data archiving and data interoperability among GoMRI and other data sets

More information on GRIIDC is provided in an overview paper by Gibeaut and is also available on the GRIIDC website.[6]

GoMRI Management Team

The GoMRI Management Team (GMT) administers the GoMRI program, with oversight and guidance from the RB. The GMT operates under distributed management and involves personnel at various organizations that together provide leadership, Research Board support, request for proposal (RFP) development, proposal review, grants management, outreach, data management, and reporting.

Leadership activities are led by a program director who is responsible for overall program budgetary oversight and planning and MRA compliance, and a chief scientific officer (CSO) who oversees GoMRI-funded science and communication between the funded research community, the GoMRI management team, and the Research Board. The CSO is also liaison to BP, the funding organization. The program manager is responsible for the daily conduct of the Administrative Unit established by the MRA and coordinates weekly GMT communication and oversees GoMRI program contracts, compliance, and reporting. One of the most critical components in an organization such as GoMRI is open, transparent, and regular communication between all involved parties. Regular communication between the Leadership Team and the RB leadership (chair and co-chair) facilitates open and timely discussion of all pressing issues and ensures that the board leadership is fully informed of all relevant activities.

Given the nature of such a program, RB support has proven to be critical. The administrative entity (AE), the American Institute of Biological Sciences (AIBS), provides the support in accordance with the MRA. The AE is separate from the other organizations involved in management but coordinates by being a member of the GMT. The AE is responsible for compliance with board-related MRA matters, logistics, and travel for all meetings and calls, and associated summaries for archival and reporting purposes.

The GMT has been responsible for the execution of five RFPs (78 research grants) under the direction of the RB. The GMT assists the RB's RFP committee in developing sequential requests for proposal solicitations and organizing reviews of those proposals. A subset of the GMT works with an RFP committee that vets final RFPs that are later approved by the RB and submitted to BP for MRA compliance. RFPs are posted on GoMRI website and distributed through a variety of email listserves, including Sea Grant, Consortium for Ocean Leadership, Gulf of Mexico Alliance, AIBS, and the Northern Gulf Institute. All of the past RFPs are available on the GoMRI website. As specified in the MRA, NSF protocols are used as a guidepost for managing proposal solicitation and review. Proposal review consists of an administrative review process to verify compliance of required items as specified in the RFP, e-mail reviews, and then panel reviews. Proposal competition has been intense, and success has ranged from 4% to 8% to date.

Grants management is an important, yet complex responsibility of the GMT. The respective host organizations of the grants management unit (GU) execute a contract with the primary award recipient. All GoMRI contracts generally follow NSF awards policy, with the additional stipulation that award recipients will also accept and comply with the MRA. These conditions also carry forward to any subawards, but they are the responsibility of the primary award recipient. Awardees are required to submit quarterly financial and activity reports and annual reports. Grant close out is managed and completed through verification of financial expenditures, reporting, and data compliance.

The GMT has grown to serve a central role in the overall GoMRI outreach program. A primary goal was to keep the public informed of GoMRI activities and scientific findings. Benoit et al. provide a detailed overview of GoMRI outreach activities, including those managed by the GMT.

[6] https://data.gulfresearchinitiative.org/about-griidc and https://data.gulfresearchinitiative.org/RB-data-compliance

The GRIIDC participates as a member of GMT (see Gibeaut). Because data compliance is an important element of grant performance and required under the MRA, it is actively tracked and reported to the Board. The RB considers data policy compliance as part of annual funding increments, no-cost extensions, and proposal review processes.

GoMRI Funding Programs

GoMRI has distributed its available funds through a series of funding rounds, initiated by RFPs. In addition to the five RFPs issued through mid-2016, BP made an initial round of block grants directly to Florida, Mississippi, Alabama, Louisiana, and Texas institutions, and the National Institutes of Health (NIH) before GoMRI was formally established. A final round of RFPs (RFP-VI) is planned for 2016/2017 (see http://gulfresearchinitiative.org/request-for-proposals/rfp-vi). The RFPs have been of various types and sizes for research both by major multi-institution consortia and by individual investigators, as described below.

- **Year-One Block Grants (June 2010)**
  BP directly provided $45 million in funding to Gulf State institutions and NIH to establish critical baseline data to be used for subsequent research and to support studies of the health of oil spill workers and volunteers.

- **RFP-I – Consortia Grants (Years 2–4, August 2011)**
  Grants of $110 million were awarded to eight research consortia composed of experts from over 139 research institutions in 32 US states and nine other countries. Proposals involved a principal investigator (PI) and co-principal investigators (co-PIs) at three or more additional institutions.

- **RFP-II – Investigator Grants (Years 3–5, August 2012)**
  Grants of $18.5 million were awarded to 19 individuals or collaborative efforts composed of experts from over 61 research institutions in 26 US states and four other countries. Proposals involved a PI and up to three co-PIs from no more than three additional institutions.

- **RFP III – Bridge Grants (July 2011)**
  Grants of $1.5 million were awarded to 17 projects to support the continuity of observations and sampling while the peer-review process was underway for Years 2–4 consortia (RFP-I).

- **RFP-IV – Consortia Grants (Years 5–7, January 2015)**
  Grants of $140 million were awarded to 12 research consortia composed of experts from over 125 research institutions in 27 US states and 10 other countries.

- **RFP-V – Investigator Grants (Years 6–8, January 2016)**
  Grants of $38 million were awarded to individuals and teams composed of experts from over 46 research institutions in 21 US states and one other country to study the effects of oil on the Gulf of Mexico ecosystem and public health. A total of 22 research proposals are being funded under this most recent GoMRI program.

Figure 1 shows the number of people supported by GoMRI funding (note that RFP-I and RFP-IV are the major consortium rounds). In addition, as of May 2016, GoMRI-funded research has already contributed to more than 758 scientific peer-reviewed publications and book chapters (Figure 2), more than 2,869 scientific presentations and posters, training of approximately 900 graduate students, and mentoring of approximately 250 postdocs, and it has involved approximately 700 undergraduates.

Substantial funds have been allocated across all five themes: 66 for Transport, 75 for Biochemistry, 132 for Ecosystem Impact, 46 for Technology, and 15 for Health (see Figure 3 for percentages).

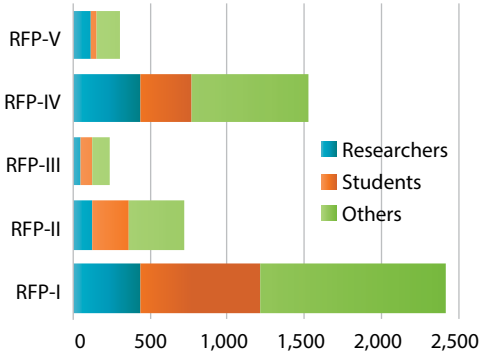


FIGURE 1. Number of researchers, students, and other (staff) supported by the Gulf of Mexico Research Initiative (GoMRI) request for proposal (RFP) program.

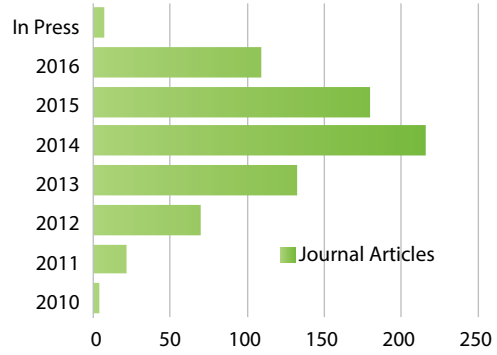


FIGURE 2. GoMRI publications, 2010 through June 2016.

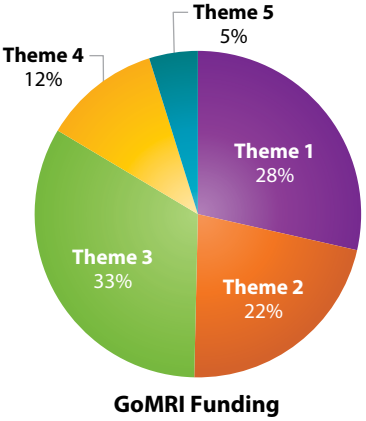


FIGURE 3. Estimate of percentage funding by GoMRI theme for 2011–2016.

Research Institutions/ Organizations Involved in GoMRI

In addition to providing funds for improving knowledge of the impacts of oil spills in the Gulf, the GoMRI program was also designed to promote capacity building in relevant scientific institutions, especially those located in the states most affected by the spill. Thus, the MRA requires that "funds…are to be distributed to governmental or nonprofit academic and research institutions…primarily in Alabama, Florida, Louisiana, Mississippi and Texas…which have formed or may form partnerships with Research Institutions based outside of the Gulf Coast States, as appropriate…" All but one of the major consortia funded under RFP-I and RFP-IV are, therefore, led by Gulf State institutions, but are otherwise as diverse as appropriate, because the MRA also provides that "partnerships and collaboration by the Research Consortia with Research Institutions or individual researchers…beyond the Gulf Coast States will be welcomed." Figure 4 shows the locations of institutions to which funds have been allocated as of mid-2016.

Interdisciplinary Aspects

As stated above, GoMRI aims to encourage and fund interdisciplinary studies wherever appropriate. The extent of these collaborations is difficult to describe and to quantify, as many research groups (and of course some individuals) are inherently already interdisciplinary. However, GoMRI has fostered and supported many collaborations between groups and institutions that otherwise may not have occurred. Evidence of such collaboration and capacity building can be found, for example, in some of the "stories" about GoMRI activities on the program website.

OVERVIEW OF THIS SPECIAL ISSUE

This special issue is intended to provide a broad overview of the scientific work that has been done under the GoMRI program, up to June 2016. GoMRI research funding will continue until 2020, so there is still much more to come, and additional time will be needed before the knowledge produced by this exceptional initiative can be summarized and fully evaluated. Nevertheless, some aspects of the research are already clear. One pervasive message is that technological developments in the past decade or two have enabled investigations that would have been impossible after past large spills. In Theme 1 (physical distribution, dispersion, and dilution), the availability of satellite remote sensing, operational ocean circulation models, global positioning, and real-time telemetry of location data have revolutionized studies of large-scale movements and mesoscale surface movement; microstructure and small-scale turbulence sensors have transformed studies of mixing and dispersion; and advances in computer technology (both hardware and software, such as Large Eddy Simulation methods for near-field turbulent flows) have enabled unprecedented advances over what was possible before (Özgökmen et al.). Similarly, in Theme 2 (chemical evolution and biological degradation), tools such as two-dimensional, high-resolution gas chromatography and Fourier transform cyclotron resonance mass spectrometry have transformed our ability to characterize the composition of chemical residues, and molecular microbiological methods have enabled study of degradation and weathering processes and determine their rates; such processes could previously have only been crudely described (see White et al. and Tarr et al.). Theme 3 (environmental effects) studies have elucidated mechanisms of impacts, including the effects on individual organisms, rather than just using modeling to study the consequences of the DWH spill on population dynamics. Laboratory and field research has been conducted to correlate possible causes with effects in novel ways as well as to project long-term impacts and recovery in areas from coastal wetlands and beaches to the deep ocean (Joye et al., Rabalais and Turner, Murawski et al., Buskey et al., Fisher et al.). This trend in innovative science is less prominent in Themes 4 and 5. In the case of Theme 4 (technology developments), the revolution will likely be in the future application of operational tools that will depend on the fundamental results obtained; there has been major progress in the study of dispersants (see John et al.), and evaluating the results will be a major task for the next five years. For Theme 5 (impacts on public health), a primary concern during the DWH oil spill was the safety of Gulf of Mexico seafood and beaches (see Dickey and Huettel). Although

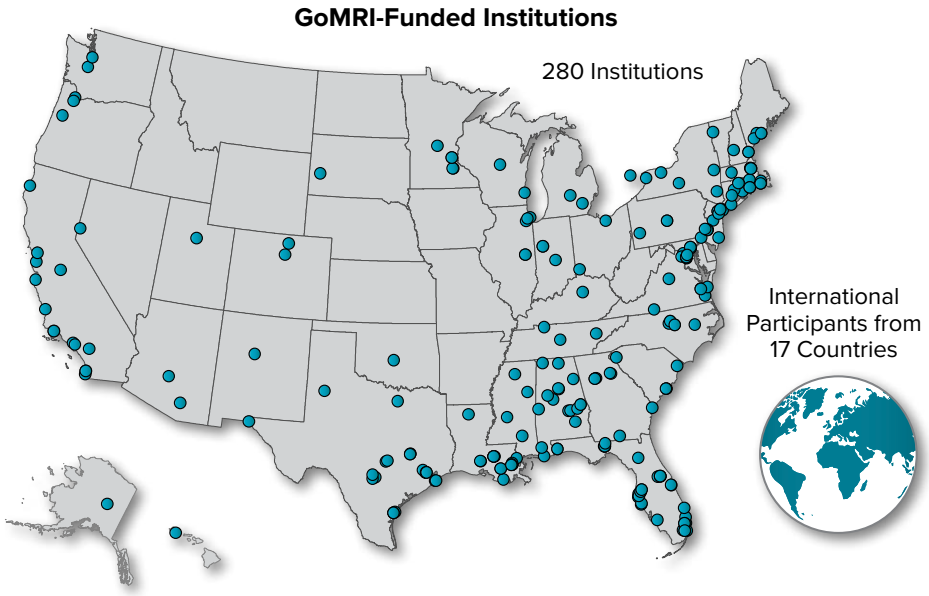


FIGURE 4. Location of research institutions funded by GoMRI, 2010–2016.

somewhat resolved, our tools for studying consequences for people, particularly behavioral and socioeconomic, are still not fully adequate for the task, and predicting anything having to do with human behavior is difficult. Singer and Sempier discuss this issue further.

The articles in this special issue of *Oceanography* have been structured to address a series of general questions that we believe will be of interest to a nonspecialist audience, running all the way from "What was released?" to "Are beaches and seafood safe?" Not all of these questions can be answered definitively yet, and there is still much to be learned, so the articles are, in essence, a mid-term progress report. However, we hope that they will provide easily accessible entry points into the now voluminous literature that GoMRI and other investigations have produced. Everything that GoMRI has produced is (or soon will be) freely accessible online, and our aim is to make it simple for those interested to find needed information. In addition, GoMRI has maintained a substantial program of outreach and educational activities (Benoit et al.).

The sequence of events following a deepwater blowout, and the likely consequences, including the formation of deepwater plumes, were already understood in a general way by specialists before the Deepwater Horizon incident, but were arguably not as widely understood as would have been desirable. The National Research Council (2003; see pages 107–108, especially Figures 4–6) report describes the state of knowledge at the time. Research on the DWH event has led to a number of surprises, and GoMRI research has enabled their investigation in appropriate detail. Particular highlights include the following.

- Prior to the DWH event, the modeling tools available for deepwater spills were still relatively undeveloped (Reed et al., 1999; Beegle-Krause 2001). GoMRI funding has enabled great advances. However, comparisons of observations and model results show that it is still hard to predict the spatial distributions of oil accurately, in part because of small-scale (submesoscale) processes in the ocean that are still not well understood and that are hard to reproduce (Socolofsky et al. and Özgökmen et al.).
- The extent of interactions between microbiota, oil, and suspended particulate material, and the consequences for the formation of aggregates that sink to the bottom (or are transported laterally and deposited as a "bathtub ring" on the continental slope) were not previously fully appreciated. The emergence of a community of scientists studying these marine oil snow sedimentation and flocculent accumulation (MOSSFA) processes has been a notable feature of GoMRI and has resulted in a synthesis symposium and a dedicated journal volume (Joye, 2016). For more detail, see Passow and Ziervogel.
- The DWH spill was the first occasion when dispersants were directly injected into a subsurface plume in order to reduce the amount of oil reaching the surface in the vicinity of the blowout. The effects of this scheme on subsurface dissolution and transport, and the consequences for biota, have been controversial, and the overall advantages and disadvantages of this practice are still being evaluated (see John et al. and Farrington et al.)

The articles that follow describe these and other significant achievements in more detail, and Farrington et al. synthesize them.

FUTURE OUTLOOK

The GoMRI program is still under way, and much more research will be conducted and reported in the next five to 10 years. Nevertheless, this is already the most studied oil spill ever, and in its final phase, GoMRI will seek to cover any issues of concern that have not yet been adequately studied. In so doing, the RB will be guided by Gap Analyses that have been carried out by Sea Grant (Sempier et al., 2015)

The need for many agencies and organizations to undertake scientific research as a consequence of the DWH spill has enhanced many existing collaborative relationships among governmental, academic, and industrial partners, including the Gulf of Mexico Alliance, RESTORE (the Gulf Coast Ecosystem Restoration Council and state Centers of Excellence), National Science Foundation, National Academy of Sciences Gulf Research Program, National Fish and Wildlife Foundation, American Petroleum Institute, Bureau of Ocean Energy Management, National Oceanic and Atmospheric Administration, and Environmental Protection Agency. Regrettably, these collaborations have at times been impeded by legal constraints. Regardless, much progress has been made, and it is hoped that these collaborations can now be consolidated and strengthened.

GoMRI is concerned that its research should leave a substantial and valuable legacy, which of course includes its data repository and its publication archive. But, beyond these usual scientific research products, it is important that GoMRI-supported work should inform and influence operational response to future oil spills. This can only be achieved by GoMRI working collaboratively with the operators and other organizations responsible for such response, and this will be a priority for the latter part of the program. Beyond these valuable collaborations, outreach to the public and wider dissemination of knowledge about oil spills has been a consistent activity throughout the program (Benoit et al.). This important work will continue. Finally, workshops, proposals for future funding, and discussions on the need for advances in future Gulf of Mexico ocean observing systems are important contributions to building both intellectual and physical capacity that will be of lasting benefit.

The GoMRI model for independent research for the public good, funded

(1) Photograph of marine oil snow aggregates at the water's surface in the Gulf of Mexico, May 2011. *Photo by Andrew Warren* (2) Andrew Worthen, a PhD student at The University of Texas at Austin and a GoMRI Scholar, samples an oil-in-seawater emulsion, stabilized with polymer-coated iron oxide nanoparticles. *Photo Credit: Consortium for the Molecular Engineering of Dispersant Systems* (3) This image incorporates data on Lagrangian coherent structures (LCS, in red) onto a simulation of the oil slick (in green) following the Deepwater Horizon oil spill. Data from the LCS-core analyses forecasted the subsequent formation and movement of the oil slick (in yellow), sometimes referred to as the "tiger tail." Image *by Maria Josefina Olascoaga. Data acknowledgment to Geoffrey Samuels and the Center for Southeastern Tropical Advanced Remote Sensing*

by industry but free from any influence beyond defining the scope of the program, is quite novel (see Colwell). It has already been demonstrated that it can be extremely successful, and it has already been adopted elsewhere, such as for the INSITE program (http://www.insitenorthsea.org) in the North Sea. However, the program is time limited, and unless something further is done, the capacity we have built will decline. Because the research products will benefit all offshore operators in the Gulf of Mexico and elsewhere, perhaps it is possible that there could be a collaborative effort to maintain the research and capitalize on the investment made for the future?

A similar funding model could also be applicable far more widely, as it enables the costs of research into environmental and other impacts of industrial activities to be borne by those responsible, without that casting doubt on the validity of the results. It would allow industry to promote research in areas of interest much more directly than by paying taxes and then lobbying on the way the proceeds are spent, while maintaining the integrity of the "arms-length" relationship generally provided by funding agencies such as NSF. If GoMRI has created a new mechanism for industry-funded but independent scientific research, that would be a most valuable legacy from an otherwise tragic event.

REFERENCES

Beegle-Krause, J. 2001. General NOAA oil modeling environment (GNOME): A new spill trajectory model. Pp. 865–871 in *Proceedings of the 2001 International Oil Spill Conference*, American Petroleum Institute.

National Research Council. 2003. *Oil in the Sea III: Inputs, Fates, and Effects*. National Academies Press, Washington, DC, 280 pp.

Joye, S.B., A. Bracco, T.M. Özgökmen, J.P. Chanton, M. Grosell, I.R. MacDonald, E.E. Cordes, J.P. Montoya, and U. Passow. 2016. The Gulf of Mexico ecosystem, six years after the Macondo oil well blowout. *Deep Sea Research Part II* 129:4–19, http://dx.doi.org/10.1016/j.dsr2.2016.04.018.

Peterson, C.H., S.D. Rice, J.W. Short, D. Esler, J.L. Bodkin, B.E. Ballachey, and D.B. Irons. 2003. Long-term ecosystem response to the Exxon Valdez oil spill. *Science* 302:2,082–2,086, http://dx.doi.org/10.1126/science.1084282.

Reed, M., O. Johansen, P.J. Brandvik, P. Daling, A. Lewis, R. Fiocco, D. Mackay, and R. Prentki. 1999. Oil spill modeling towards the close of the 20th century: Overview of the state of the art. *Spill Science & Technology Bulletin* 5(1):3–16, http://dx.doi.org/10.1016/S1353-2561(98)00029-2.

Sempier, S.H., L. Graham, E. Maung-Douglass, M. Wilson, and C. Hale. 2015. *Summary of Target Audience Input on Oil Spill Science Topics.* MASGP-15-006, Sea Grant, 19 pp., https://gulfseagrant.files.wordpress.com/2015/05/final-target-audience-input-2014-early-2015.pdf.

Wiens, J.A., ed. 2013. *Oil in the Environment: Legacies and Lessons of the Exxon Valdez Oil Spill.* Cambridge, Cambridge University Press, 482 pp.

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