GULF OF MEXICO RESEARCH INITIATIVE
FEBRUARY ISSUE 2013
NEWSLETTER

About the Gulf of Mexico Research Initiative

The Gulf of Mexico Research Initiative is a 10-year, $500 million independent research program established by an agreement between BP and the Gulf of Mexico Alliance to study the effects of the Deepwater Horizon incident and the potential associated impact of this and similar incidents on the environment and public health.

Would you like to know more about the GoMRI-funded research?

Check out our Research page on the website:

http://research.gulfresearchinitiative.org/research-awards/

Recent Events

Gulf of Mexico Oil Spill & Ecosystem Science Conference
January 21-23, 2013
New Orleans, LA

Gulf of Mexico Research Initiative All Program Meeting
January 24, 2013
New Orleans, LA

Upcoming Events

Deep-C Workshop: How to Bring Your Science to the Policy Arena
February 26, 2013
Tallahassee, FL

Deep-C Annual Progress Meeting
February 27-28, 2013
Tallahassee, FL

ASLO Aquatic Sciences Meeting (stop by the GoMRI exhibition booth!)
February 17-22, 2013
New Orleans, LA

American Chemical Society Meeting (stop by the GoMRI exhibition booth!)
April 7-11, 2013
New Orleans, Louisiana

Gulf of Mexico Fun Facts!

- The Gulf of Mexico yields more finfish, shrimp, and shellfish annually than the south and mid-Atlantic, Chesapeake, and New England areas combined.
- More than 400 species of shells can be found in the Gulf of Mexico. Gulf beaches are considered the best shelling beaches in North America.
- The Gulf of Mexico is the ninth largest body of water in the world.

http://www.epa.gov/gmpo/about/facts.html.

In preparation for the live deployment experiment, research teams field test the process to accurately release drifters – a critical component for the success of this project. Top left to right: Marine Operator David Nadeau, GLAD Cruise Chief Scientist Dr. Brian Haus, and CARTHE Director Dr. Tamay Özgökmen. Credit: Josefina Olascoaga (UM)

CARTHE Drifters Provide Unprecedented Amounts of Data for Gulf of Mexico Science

With a Gulf of Mexico Research Initiative (GoMRI) award, the Consortium for Advanced Research on Transport of Hydrocarbon in the Environment (CARTHE), led by Dr. Tamay Özgökmen at the University of Miami (UM), is conducting the largest-scale experiment of its kind in the Gulf. This past summer, over the course of a week, Dr. Brian Haus (UM) and his research team deployed 300 custom-made drifters near the Deepwater Horizon site and Louisiana coast.

The release of drifters, known as the Grand Lagrangian Deployment (GLAD), is an essential first step to understanding the complex and elusive surface ocean currents that transport pollutants.

> *"In light of the Deepwater Horizon oil spill, it became clear that understanding the multi-scale interactions among small, large, and sub-mesoscale oceanic flows lies at the very heart of being able to improve our understanding and prediction of oil spills"* – T. Özgökmen

Using GPS satellite positioning, the specially designed drifters reported their positions every five minutes – a rate not achieved before in an experiment of this magnitude. The Naval Research Laboratory supplied 32 realizations of Navy Coastal Ocean Model (NCOM), running at one and three kilometer resolution to provide 72 hour forecasts. CARTHE investigators used a fully coupled ocean-wave-atmosphere modeling system for real-time data processing. These detailed data were essential

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in determining more precisely where the drifters were launched according to ocean features.

Data from the drifters will help scientists understand the role of near-surface ocean flows in spreading and dispersing oil. Researchers are studying interactions among ocean flows, the levels of influence on transport that large and small flows have, the size of oil spread at which large flows dominate, and the length of time that large flows control the direction oil will travel.

For a perspective from the field, check out the CARTHE GLAD blog, featuring graduate student Nathan Laxague as he chronicled the 17-day research expedition aboard UM's *RV Walton Smith*. As part of this GLAD experiment, scientists and students deployed more than 300 drifters in the Gulf to collect ocean current data.

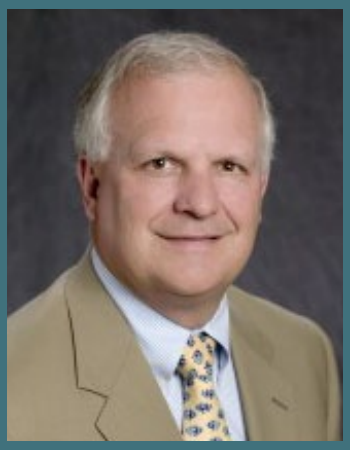
The CARTHE program includes 26 Principal Investigators from 12 research institutions in eight states. Together, these scientists are embarking in a novel research direction, developing a suite of integrated models and state-of-the-art data assimilation that bridge the scale gap between existing models and natural processes. For the first time, CARTHE's field work at sea, combined with laboratory experiments and development of interconnected modeling systems, will produce a comprehensive modeling hierarchy that provides a four dimensional description of oil/dispersant fate and transport in the Gulf of Mexico and coastal environments across all relevant time and space scales.

To see an animation of the CARTHE drifters, take a look at the Video Clip of the Quarter on page 6 of this newsletter!

For more information on this exciting program, please see the GoMRI website or the CARTHE website.

Frequently Asked Questions by Dr. Chuck Wilson

Dr. Chuck Wilson, Senior Scientist for the Gulf of Mexico Research Initiative (GoMRI), answers a few of the most frequently asked questions about the program.



Question 1: What is GoMRI?

GoMRI is an independent research program established by BP in May 2010 to administer the company's 10-year, $500 million commitment to research the effects of the Deepwater Horizon incident. The mission of the GoMRI is to improve society's ability to understand and mitigate the impacts of hydrocarbon pollution and stressors on the marine environment, with an emphasis on conditions found in the Gulf of Mexico, through studying the effects of the Deepwater Horizon incident.

Question 2: Is GoMRI part of the Natural Resource Damage Assessment (NRDA) process?

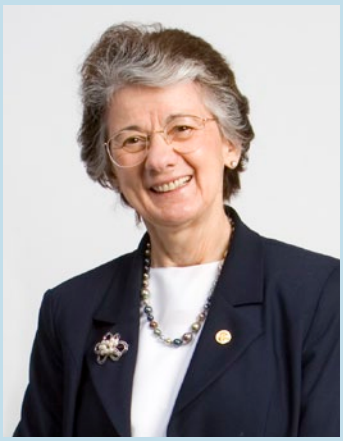
No. GoMRI is completely separate from the Natural Resource Damage Assessment (NRDA) process, which is a legal process, conducted by federal and state trustees to determine injuries to or lost use of the public's natural resources as a result of the oil spill. GoMRI is also separate from the $4 billion fine associated with the November 2012 criminal case settlement with BP; $350 million of the fine was committed to the National Academy of Sciences to establish a program on human health and environmental protection in the Gulf of Mexico. In addition, GoMRI is not associated with the RESTORE Act, which reinvests 80 percent of the Clean Water Act fines resulting from the spill back into the Gulf for restoration.

Question 3: Who makes the funding decisions?

The GoMRI funding decisions are made by a Research Board, an independent and academic board composed of 20 science, public health, and administration experts. Ten of the members are appointed by BP and 10 are appointed by the Gulf of Mexico Alliance (GOMA). The Research Board considers peer reviews, conducted using the National Science Board peer evaluation protocols, to ensure the intellectual quality, effectiveness, and academic independence of all GoMRI research. The members of the Research Board can be found on the GoMRI website.

Note from the Research Board Chair

Dr. Rita Colwell, University of Maryland and Johns Hopkins University



Welcome to the inaugural newsletter of the Gulf of Mexico Research Initiative (GoMRI). This quarterly e-newsletter provides readers with updates from the GoMRI-funded scientific teams and their research results. To date GoMRI has invested more than $175 million in funded proposals that include more than 1400 researchers, students and staff working in 38 states and eight countries, representing 150 institutions.

GoMRI research investments cut across many disciplines and are focused on the *five GoMRI themes*. Illustrative of the newest scientific tools employed in GoMRI research is genomics. Several GoMRI scientists are using DNA sequencing and metagenomics to monitor temporal changes in populations, both in the presence and absence of oil and dispersants. Other GoMRI scientific teams are using genomics to monitor gene expression as an indicator of environmental perturbation.

The use of genomics to identify and quantify populations of novel and less familiar species has been made possible with rapid advances in methods for isolation and amplification of DNA and development of tools for rapid sequencing of DNA. Thus, it is now possible to identify individual species present in environmental samples. Microbial populations can be analyzed before and after a perturbation, such as the Deepwater Horizon oil spill. We can now understand impacts of these kinds of events on biological population structure.

Genomics also affords our scientists the ability to quantify gene expression. DNA microarray technology has given our scientists the ability to measure gene expression by determining relative abundance of specific gene transcripts. They are measuring environmentally triggered gene expression as an indicator of physiological response of cells/organisms to changes in the environment. The scientists are able to use gene expression as an indicator of stress driven by environmental change. By screening large numbers of samples collected over time, it is possible to determine the genetic impact of a stress and follow recovery as well.

The GoMRI Research Board is very pleased with the progress of GoMRI researchers and we anticipate new and exciting results from their work that will aid in recovery of Gulf of Mexico waters and its biota.

Science Corner

Published science highlights from the GoMRI program.

Radiocarbon evidence that carbon from the Deepwater Horizon spill entered the planktonic food web of the Gulf of Mexico

Environmental Research Letters: November 2012

The study reports that the distinct radiocarbon isotopic composition of Macondo oil provided a sensitive tracer to estimate petro-carbon contributions from the Deepwater Horizon spill to the planktonic food web.

http://gulfresearchinitiative.org/2012/study-finds-carbon-from-deepwater-horizon-entered-food-web/

J P Chanton et al 2012 Environ. Res. Lett. 7 045303

Oil weathering after the Deepwater Horizon disaster led to the formation of oxygenated residues

Environmental Science and Technology: 2012

The authors identify a compound of oxygen combined with oil hydrocarbons (oxyhydrocarbons) which make up a significant amount of the chemical composition of weathered oil. This finding expands the analytical window, or the range of compounds, that scientists can study in determining the fate and effect of petroleum hydrocarbons after an oil spill.

http://gulfresearchinitiative.org/2012/study-finds-oxygenated-compounds-formed-in-weathered-oil-samples/

Aeppli et al Environ. Sci. Technol., 2012, 46 (16), pp 8799–8807

Education Corner

by Sherryl Gilbert

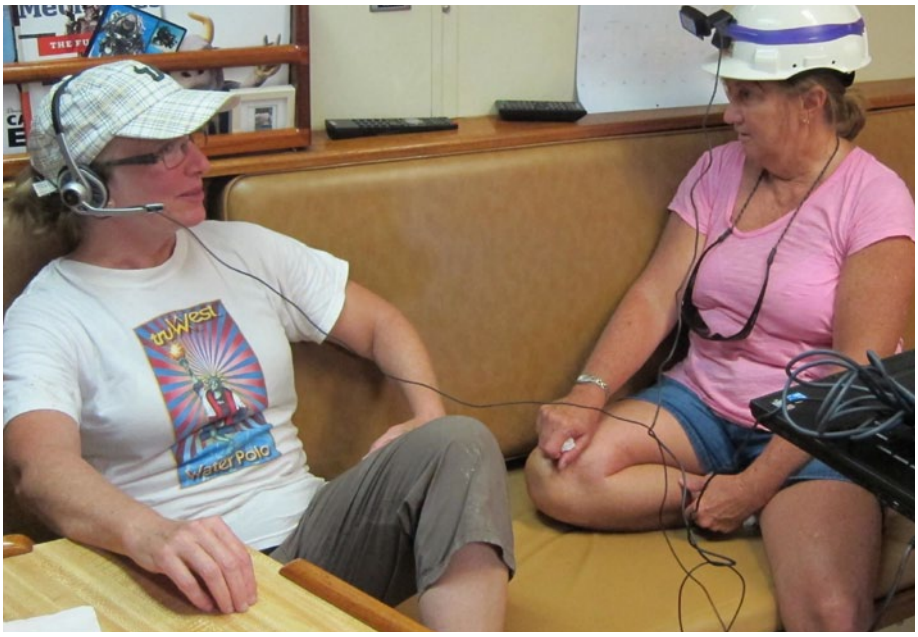
The Center for Integrated Modeling & Analysis of Gulf Ecosystems (C-IMAGE) is a comprehensive research consortium of 13 national and international universities tasked with evaluating the environmental impacts of the 2010 Deepwater Horizon Oil Spill (DWH) on coastal ecosystems, the water column, and the sea floor. C-IMAGE research cruises provide an opportunity for Florida's 6-12th grade teachers to participate in authentic field research at sea alongside ocean scientists.

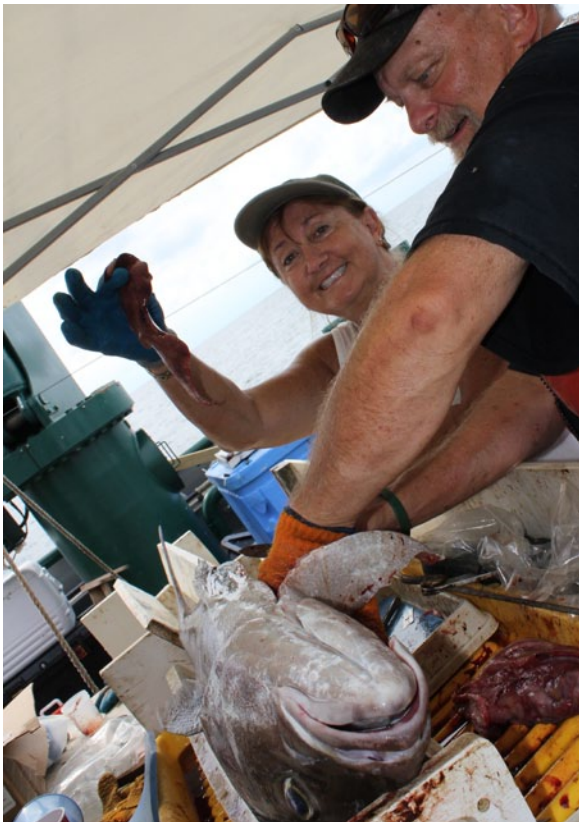
In 2012, C-IMAGE hosted two such educational cruises. The August cruise surveyed fish health and sediment chemistry and hosted Patty Smukall, a science teacher from Wekiva High School in Orange County, Florida. The November cruise focused on the biological studies of toxicity, microplankton community health, and the abundance and distribution of plankton and welcomed Eileen Hayes from Cape Coral, Florida and Abby Madeiros from Madiera Beach Middle School.

While taking part in these cruises, teachers, as members of the actual scientific party, work 12-hour shifts deploying sampling gear and collecting fish, plankton, and sediment cores for analysis. By day, K-12 and college students join the expeditions via live Skype events hosted by the onboard teachers and scientists. These interactive sessions include tours of the vessel, views of research on deck, and interviews with scientists, crew members, and the ship captain. By night, teachers share the science as it unfolds aboard the ship with K-12 and adult learners via daily blogs and social media (i.e. Facebook, Twitter) in collaboration with scientists, post docs, and graduate students. Each also shares favorite seagoing stories, career paths, and further details about ongoing research.

Nearly 700 students remotely participated in these two expeditions. Preliminary results are reported from teacher surveys, blog posts, student comments, and social media metrics.

- 26 blog posts (*http://adventuresatsea.blog.usf.edu/*)
- Over 10,000 re-tweets (source, USF Mass Communications)
- 10 schools directly participated via Skype broadcasts
- ~ 146 student questions answered live or via email





Above: Skyping to students. (l-r: USF Dean Jackie Dixon and Patty Smukall)

Left: Patty Smukall helps C-IMAGE PI Steven Murawski collect tissue samples from fish.

Seven Questions with Dr. Steve Murawski

University of South Florida

1. Can you tell me a bit about C-IMAGE? What are the goals and what knowledge gaps will the program fill?

C-IMAGE, or the Center for Modeling and Analysis of Gulf Ecosystems, is a broad-based consortium of 13 institutions dedicated to the proposition that understanding the impacts of the Deep Water Horizon oil spill and similar large scale environmental issues is essentially interdisciplinary and requires observations nested in theory. From its inception, and at the urging of Dr. Jackie Dixon, the Dean of University of South Florida's College of Marine Science, the leadership of C-IMAGE has reached out to tap expertise wherever it resides globally. While there are many relatively narrow but worthwhile projects to be addressed in this domain, we seek to tackle some big, overarching issues. For example, was the use of deep dispersant injection "worth it" when looking at the array of processes atomizing the oil into small particles to be consumed by microbes? Second, can we differentiate among six competing hypotheses of why oil has become stranded on the bottom? And third, is there a relationship between exposure to Deepwater Horizon oil and an array of fish health effects observed in the Gulf? These and a number of other overarching questions are the basis for filling knowledge gaps, as opposed to just collecting data. It is the model-based demonstration of general principles that will make predicting impacts of the next spill possible because the specific circumstances are always different. Paraphrasing the late President John F. Kennedy, we seek to do these things not because they are easy but because they are hard.

2. What do you think the legacy of GoMRI should be?

This is perhaps the largest science mobilization around an ocean-related event in the history of the world. The research is extremely diverse and involves literally hundreds of PIs, post-docs, students, and technicians. The legacy of the GoMRI will be a much broader body of work on the Gulf ecosystem than existed before the event but with a better process-based understanding of how the ecosystem responded to these events. GoMRI will re-establish the baselines for a number of ecological and physical phenomena, which, hopefully, will be periodically re-evaluated from the legacy of a much more robust ocean and coastal observing system.

3. C-IMAGE is a very diverse project, which includes scientists with different backgrounds. How do you encourage collaboration and do you think that there are similar opportunities for collaboration in the wider GoMRI program?

Because of the rather far flung set of institutions involved in C-IMAGE (located in the United States, Canada, the Netherlands and Germany), it remains an ongoing challenge to encourage and enrich meaningful collaborations among our Principal Investigators (PIs) and institutions. That being said, the use of regular thematic conference calls and webinars, participation in joint oceanographic cruises, and regular exchange of personnel and samples has resulted in an effective model for collaboration. Our Deputy Director, Sherryl Gilbert, is in virtually constant contact with the various PIs and institutions to resolve their administrative issues and "wire-up" specific collaborations. As we complete our first year and enter the second year, we have gathered initial samples, set up laboratory apparatus, and developed working models for analyzing the complex set of issues involved in our GoMRI Research *Theme two and Theme three* work. We will use our "all hands" meeting in New Orleans to check on progress and most importantly to set up a second round of collaborative studies based on performance so far. I am encouraged that the outreach among C-IMAGE partners has also extended to researchers in other GoMRI-funded Centers and individual projects and to the federal and state partners, as well. I think that researchers naturally gravitate to collaborations that they see addressing the "big things" and that create energy and enthusiasm. By setting such a vision, we hope to leverage our projects into wider collaborations as well.

4. How does your background working for National Oceanic and Atmospheric Administration (NOAA) influence your work on C-IMAGE, especially in terms of communicating science to inform resource management?

Most of my career as a scientist was spent in NOAA, first as a researcher and for the last six years as a science administrator. At NOAA, I was able to work on programs that crossed the traditional line office domains (e.g., Weather Service, Ocean Service, Fisheries Service, and Office of Research, Satellite and Data Service) to encourage programs that seek to combine outstanding expertise in ways that lead to more fundamental understanding of ecosystem function under stress. For example, we were successful at NOAA in convincing Congress to fund a program aimed at developing integrated ecosystem assessments as a basis for cross-sectoral decision making. Communicating science information

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to the wide array of other scientists, user groups, legislators, and the public requires first that we tailor the rhetoric and findings in audience-appropriate ways that resonate with people's interests. They must "see themselves" and their interests in what you are trying to communicate. Second, if we are to be successful, we need to respect alternative points of view, encourage the scientific method of a healthy skepticism, and remain open-minded about alternative explanations for the phenomena we are studying. The public expects this from scientists generating information that is so crucial in the public policy arena. Scientists must constantly be vigilant that they do not cross the line into advocacy, lest their objectivity be lost in the eyes of the public. C-IMAGE has a robust outreach and education program under the leadership of Teresa Greely and Liesl Hotaling, and these are the principles we will use on messaging about our research and findings.

5. Who do you see as the major stakeholders of GoMRI and what do you think are the most effective ways GoMRI can reach out to those stakeholders and how do you hope they view GoMRI results?

GoMRI has a very diverse set of stakeholders that will be informed by and use the outputs from the research it is conducting. First and foremost, we will be successful if the oil companies and their federal and state regulators use results from our studies in designing new, better, and safer procedures with which to explore and generate energy supplies. Likewise, we see much of GoMRI's research as relevant to the issue of oil spill preparedness and "best practices" to be used in the advent of the next spill, globally. Third, we hope that the public views our results as neutral, authoritative, and essentially the "final word" on various subject areas. Last, we hope that legislators will use our results as they contemplate how not only the Gulf of Mexico, but all coastal areas of the United States, will be regulated and managed for the greatest net benefit of society. We need to develop various products from the research results we publish that resonate with these various target audiences.

6. How do you think GoMRI might change science in the Gulf?

The partnerships that GoMRI is creating through its funded centers and individual projects will endure. Even when GoMRI funding ceases, these partnerships, forged from a shared vision, will be an enduring legacy of the program. With respect to the underlying science, we will see more multidisciplinary work in the future, and, hopefully, federal and state agencies seeking to build on the extensive network of collaborating researchers through the partnerships encouraged by GoMRI.

7. If funding were not an issue, what you would add to C-IMAGE? And to GoMRI?

Despite the extensive set of projects currently funded, there remain a number of pressing gaps that need to be funded by someone. First, with respect to impacts on fish, no one, to my knowledge, has done controlled laboratory exposures to understand the sub-lethal impacts on adult fishes. Thus, we are looking for signals in the chemistry, physiology, and morphometry of these animals from wild-caught specimens, with little understanding of exactly what we are looking for. Calibrating effects to exposure scenarios must be an important project in the future.

Second, while the GoMRI and other funders have initiated a considerable and diverse research program in the northern Gulf of Mexico, the United States waters represent only about half of the totality of the Gulf. Comparative studies in Mexico and Cuba would shed considerable light on the context for many of the observations we are taking.

Third, the GoMRI was primarily established to conduct research and not to provide broad-based observations of physical, chemical, and ecological phenomena. However, it is these baseline observations that we require to understand the context of the spill. Someone needs to coordinate a larger Gulf of Mexico effort to gather these baselines, informed by the research that is ongoing.

Each quarter, we will post a "Video Clip of the Quarter." This quarter's clip, while not technically a video, shows hundreds of data-collecting ocean drifters that are "going with the flow" in the Gulf of Mexico as part of the CARTHE project featured in this issue of the newsletter. Dr. Bruce Lipphardt, with the CARTHE project team at the University of Delaware, generates and updates this animation regularly.

http://gulfresearchinitiative.org/2012/follow-the-journey-of-carthe-drifters-in-the-gulf/