GULF OF MEXICO RESEARCH INITIATIVE

WINTER ISSUE 2017

NEWSLETTER

Upcoming Events:

2017 International Oil Spill Conference

May 15-18, 2017
Long Beach, California

Stop by the GoMRI booth (#826) in the exhibit hall and say hello!

Banner provided by Ben Prueitt/C-IMAGE.

Escobar   Robichaux   Henry   Farrington   Campo

C-IMAGE Partners with Story Collider to Share Oil Spill Science Stories

On February 6, 2017, the Center for Integrated Modeling and Analysis of Gulf Ecosystems (C-IMAGE) and the Story Collider teamed up to feature five speakers who shared their stories surrounding the Deepwater Horizon oil spill. The event took place in New Orleans, Louisiana.

The Story Collider is a New York-based storytelling show created in 2010 by two physicists dedicated to providing a forum for scientists to share their personal stories about science. The Story Collider continues to host shows across the country and has expanded into a podcast series. This Story Collider event was hosted by Ari Daniel, digital producer of NOVA and a freelance science reporter for public radio, and Erin Barker, host and artistic director of the Story Collider.

The event featured five storytellers sharing their connections to the Deepwater Horizon oil spill and oil spill science. Most speakers began their stories with where they were when they received news of the 2010 Deepwater Horizon oil spill.

Charlie Henry, Director of the National Oceanic and Atmospheric Administration (NOAA)'s Gulf of Mexico Disaster Response Center opened the show, sharing a "behind the scenes" look at oil spill response from his more than 30 years of experience in the field. He shared that the gravity of responding to oil spills is never lost on him; one mistake can result in additional damage to ecosystems or even cost someone their life.

Elva Escobar-Briones, Director of the Instituto de Ciencias del Mar y Limnologia at the Universidad Nacional Autonoma de Mexico, and member of the C-IMAGE consortium, shared her memories of her first ever dive in a submersible to study hydrothermal vents. In particular, she fondly recalled the three course lunch she was treated to (including French wine!) at the bottom of the ocean and the warm

Meiofaunal eukaryotes. RFP-V awardee Dr. Kelley Thomas is building a benthic genome database for better monitoring of oil spills using bioinformatics. Read more here. Photo Credit: Larry Hyde.

reception she received upon returning to the surface, which ironically included a bucket of ice water poured over her head! To this day, she still tries to convey that same kindness and enthusiasm during her dives and to all of her graduate students.

John Farrington, Dean Emeritus of the Woods Hole Oceanographic Institution and member of the Gulf of Mexico Research Initiative's Research Board shared his experiences having worked in oil spill science for more than four decades. When he first learned of the Deepwater Horizon spill, Dr. Farrington thought, "not again." He recalled his experiences responding to and studying the Ixtoc I oil spill in Mexico, which occurred in 1979. Ixtoc I has many parallels to Deepwater Horizon and has become an important part of C-IMAGE's research.

Estelle Robichaux, a senior restoration project analyst at the Environmental Defense Fund, told of her experiences with the Deepwater Horizon oil spill as both a native of Louisiana and also as a graduate student studying wetlands at the time of the spill. She shared how watching the impact of oil spill on her home state inspired her to follow a career path in which she continues to advocate for restoration and conservation of coastal wetlands.

Robert Campo is a commercial oyster fisherman in Shell Beach, Louisana. His family has owned and operated Campo's Marina for more than 117 years. He learned of the Deepwater Horizon oil spill when a reporter called him to ask about it while out fishing. Even seven years later, Mr. Campo said some areas still haven't produced a single oyster. He said it's hard to think that he may have to consider doing something else, after having been in the business for his entire life.

The Story Collider event brought together five unique stories and perspectives surrounding the Deepwater Horizon oil spill. For many other science stories, visit the Story Collider website here. To view videos from the Story Collider event C-IMAGE hosted at the 2016 Gulf of Mexico Oil Spill and Ecosystem Science Conference in Tampa, FL, visit C-IMAGE's YouTube Channel here.

GULF OF MEXICO RESEARCH INITIATIVE INFORMATION & DATA COOPERATIVE
GRIIDC

Check out GRIIDC's recent stories!

GRIIDC Partners with RESTORE Act Centers of Excellence Programs

BP Datasets Now Discoverable through GRIIDC

1,000 Datasets Available for Download Now on the GRIIDC Website!

GRIIDC Joins DataONE

Keep up with the Consortia Blog Roll and Social Media!

Some of the Consortia have updated their blogs. Check them out!

ACER News

CARTHE's Blog: Measure. Model. Mitigate

CRGC: Resilient Gulf News

RECOVER News

Many Consortia are active on social media, including Twitter, Facebook, and Instagram.

ACER: Facebook, Instagram

ADDOMEx: Facebook, Twitter, Instagram

CARTHE: Facebook, Twitter

C-IMAGE: Facebook, Twitter

CONCORDE: Facebook, Twitter, Instagram

CRGC: Facebook

CWC: Facebook, Instagram

DEEPEND: Facebook, Twitter, Instagram

DROPPS: Facebook, Twitter

ECOGIG: Facebook, Twitter, Instagram

RECOVER: Facebook, Twitter

Gulf of Mexico
OIL SPILL & ECOSYSTEM
SCIENCE CONFERENCE
2017

2017 Gulf of Mexico Oil Spill and Ecosystem Science Conference Brings Together Oil Spill Scientists and GoMRI Community in New Orleans

The 2017 Gulf of Mexico Oil Spill and Ecosystem Science (GoMOSES) Conference took place from February 6-9, 2017 at the Hyatt Regency in New Orleans, Louisiana. This year's conference theme was "Ecosystem Approaches to Gulf Response and Restoration," encouraging attendees to consider the application of their results to practical use. More than 950 people from 13 countries participated in twenty-three scientific sessions, including 337 oral presentations (59 from students) and 260 posters (119 from students).

Building on the conference theme, the opening plenary focused on The Role of Science in Oil Spill Response and Management Decisions. A keynote address was given by Dave Westerholm, Director of the Office of Response and Restoration at the National Oceanic and Atmospheric Administration (NOAA), followed by a panel that included Captain Joe Loring from the U.S. Coast Guard, Steve Buschang from the Texas General Land Office, John Caplis from the Bureau of Safety and Environmental Enforcement (BSEE), Greg DeMarco from ExxonMobil, Nancy Kinner from the Coastal Response Research Center for Spills and Environmental Hazards, and Scott Lundgren from NOAA. Speaker biographies are available here.

Wrapping up the week, the closing plenary focused on Linking Science and Restoration: Now and in the Future. Moderated by Monty Graham from the University of Southern Mississippi and principal investigator of the GoMRI-funded consortium CONCORDE, the panel included Amy Hunter from the Alabama Department of Conservation and Natural Resources, Becky Prado from the Florida Department of Environmental Protection, Robin Riechers from the Texas Parks and Wildlife Department, Jim Pahl from the Louisiana

Coastal Protection and Restoration Authority, and George Ramseur from the Mississippi Department of Marine Resources.

Several workshops, poster sessions, and other events took place throughout the week. In addition, C-IMAGE partnered with the Story Collider for the second time to host an event ahead of the conference (read more in the cover story of this issue). The Consortium for Ocean Leadership and the Gulf Research Program of the National Academies of Sciences, Engineering, and Medicine supported five awards for the James D. Watkins Student Award for Excellence in Research, for best student oral presentation. This year's awardees were Brittany Evans from Eckerd College, Travis Washburn from Texas A&M University - Corpus Christi, Aprami Jaggi from the University of Calgary, Joseph Sevigny from the University of New Hampshire, and Susan Snyder from the University of South Florida. GoMRI extends its congratulations to the awardees! The Gulf of Mexico University Research Collaborative and the Gulf Research Program also provided Student Presenter Awards, which covered registration fees for student presenters.

For more information on emerging outcomes from this year's conference surrounding the response and restoration theme, please visit the FAQs on page 7. Additional information on this year's GoMOSES conference can be found here. An official conference report will also be posted to the conference website soon. Next year's conference will take place from February 5-8, 2018 in the same location, at the Hyatt Regency in New Orleans, Louisiana. We look forward to seeing you there!

GoMRI Attends Restore America's Estuaries Summit in New Orleans

Members of the GoMRI Management Team, in partnership with the four Gulf Sea Grant programs and the Gulf of Mexico Research Initiative Information and Data Cooperative (GRIIDC), attended the Restore America's Estuaries Summit from December 11-14, 2016 in New Orleans, Louisiana. This year's summit theme was *Our Coasts, Our Future, Our Choice*, and the goal was to discuss the current state of the coastal communities and ecosystems; understand where they are going in the future; and discuss how to balance the environmental welfare of these communities with the socioeconomic, security, and climate change concerns of the future. GoMRI, GRIIDC, and the four Gulf Sea Grant programs shared a booth in the exhibit hall distributing materials and Sea Grant publications and talking to conference attendees about the program.

Larissa Graham from the Mississippi-Alabama Sea Grant Consortium moderated a session which featured many scientists and science funded by GoMRI. The session was called *Deepwater Horizon Oil Spill Impacts to Coastal Wildlife, Fish Populations, and Wetlands in the Barataria Bay, Louisiana*. The panel featured presentations by GoMRI researchers Dr. Eugene Turner from Louisiana State University, Linda Hooper-Bui from Louisiana State University, and Lori Schwacke from the National Oceanic and Atmospheric Administration (NOAA), as well as Fernando Galvez from Louisiana State University. The session was a complement to the session prior moderated by GoMRI researcher Irv Mendelssohn called *Impacts and*

Recovery of the Deepwater Horizon Oil Spill to Coastal Marshes in Northern Barataria Bay, Louisiana. A joint panel concluded both sessions, which saw many questions from the session attendees.

Members of the GoMRI Management Team attend the Restore America's Estuaries Summit. From left to right: Katie Fillingham, Suzanne Garrett, and Jessie Swanseen. Not pictured: Larissa Graham from Sea Grant and Rosalie Rossi from GRIIDC. Photo Credit: Katie Fillingham.

GoMRI Scholars in Action

The Gulf of Mexico Research Initiative (GoMRI) is recognizing the graduate students whose vital research contributes to improving understanding about the damage, response, and recovery of the Deepwater Horizon oil spill. Candidates for this program must be graduate students who have participated in a GoMRI-funded project for at least one year, whose work is primarily funded by GoMRI, and who are working on a dissertation or thesis based on GoMRI-funded science.

Learn more about the scholars' research and career paths on the GoMRI website!

Photo Credit: Dan DiNicola

Grad Student Pasparakis Looks to Fish Embryos for Long-Term Oil Spills Answers

Photo Credit: Emily Seubert

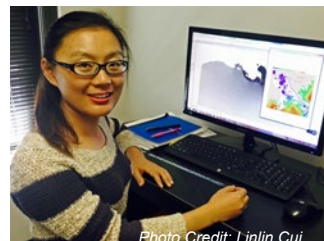How Grad Student Seubert Interprets Gulf of Mexico Resiliency Using Predator Diet

Photo Credit: Linlin Cui

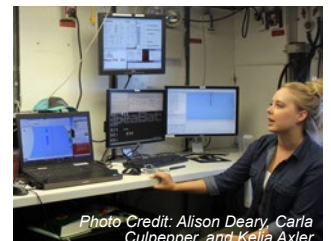How Grad Student Cui Uses River Diversion Models to Inform Oil Spill Remediation

Photo Credit: Alison Deary, Carla Culpepper, and Kelia Axler

Grad Student Quas Analyzes Sediment Grain Size to Characterize Oil Behavior

Science Corner

Published Science Highlights
from the GoMRI Program

Study Summarizes Current Knowledge on Marine Oil Snow During and After Deepwater Horizon

K. L. Daly, U. Passow, J. Chanton, D. Hollander
Anthropocene, 2016, Vol. 13, pgs. 18-33

Study Advances Predictions of Air Pollution from Oil Slick Evaporation

G.T. Drozd, D.R. Worton, C. Aeppli, C.M. Reddy, H. Zhang, E. Variano, A.H. Goldstein
Journal of Geophysical Research: Oceans, 2015, Vol. 120(11), pgs. 7300-7315

Study Finds UVB Radiation Increases Oil Toxicity in Marine Copepod Larvae

R. Almeda, T.E. Harvey, T.L. Connelly, S. Baca, E.J. Buskey
Chemosphere, 2016, Vol. 152, pgs. 446-458

Study Provides 1st Large-Scale Blue Crab Transcriptome Resource for Insights into Oil Exposure

B.K. Yednock, T.J. Sullivan, J.E. Neigel
BMC Genomics, 2015, Vol. 16(521)

Study Describes Oil Slick Differences in Natural Seeps and Deepwater Horizon

I. MacDonald, O. Garcia-Pineda, A. Beet, S. D. Asl, L. Feng, G. Graettinger, D. French-McCay, J. Holmes, C. Hu, F. Huffer, L. Leifer, F. Muller-Karger, A. Solow, M. Silva, G. Swayze
Journal of Geophysical Research: Oceans, 2015, Vol. 120(12), pgs. 8364-8380

Rapid Response Study Documents Marine Microbial Response to Hercules Gas Blowout

S.C. Weber, L. Peterson, J.J. Battles, B.J. Roberts, R.N. Peterson, D.J. Hollander, J.P. Chanton, S.B. Joye, J.P. Montoya
Deep Sea Research Part II: Topical Studies in Oceanography, 2016, Vol. 129, pgs. 66-76

Study Advances Food Web Matrix for Improved Atlantis Ecosystem Model

J.H. Tarnecki, A.A. Wallace, J.D. Simons, C.H. Ainsworth
Fisheries Research, 2016, Vol.179, pgs. 237-250

Study Examines Killifish Rapid Adaptive Resistance to Contaminants

E.M. Oziolor, B. Dubansky, W.W. Burggran, C.W. Matson
Aquatic Biology, 2016, Vol. 175, pgs. 222-231

Study Identifies Ocean Processes That Drive Surface Material Clustering

G.A. Jacobs, H.S. Huntley, A.D. Kirwan, Jr., B.L. Lipphardt, Jr., T. Campbell, T. Smith, K. Edwards, B. Bartels
Journal of Geophysical Research: Oceans, 2016, Vol. 121(1), pgs. 180-197

Study Finds No Obvious Recovery from Oiled Island Shoreline Erosion

R. E. Turner, G. McClenachan, A. W. Tweet
Marine Pollution Bulletin, 2016, Vol. 100(1), pgs. 316-323

Study Introduces Computer Science Students to Problem Solving Using Deepwater Horizon Imagery

M. Zhang, C. Hu, G. Amu
Frontiers in Education 2013 Conference Proceedings, IEEE

To see all GoMRI publications,
please visit the GoMRI Publication Database.

RFP-V awardee Dr. Villy Kourafalou, Research Professor in the Department of Ocean Sciences at the Rosentiel School of Marine and Atmospheric Science at the University of Miami, and her team partnered with Waterlust to create a short video on ocean eddies. The video explains that eddies are capable of transporting nutrients, heat, etc. all over the planet. An eddy in the Gulf of Mexico even helped contain some oil from the Deepwater Horizon oil spill. Check out the video here.

Scientists with C-IMAGE are using sediment cores from the bottom of the ocean to learn about changes in sedimentation rates during the Deepwater Horizon oil spill and the formation of marine oil snow sedimentation and flocculation accumulation (MOSSFA) events. Traditionally, sediment core sampling has taken place at the centimeter or half-centimeter scale, but depending on the sedimentation rate, this sampling interval is often not detailed enough to understand short-term events. Patrick Schwing and others from C-IMAGE recently published a new method of sampling sediment cores that allows for millimeter-scale resolution. Their publication includes a video that details the strategy. Check out the video and the publication here.

GoMRI Newsmakers

GoMRI congratulates Dr. Rita Colwell, Chair of the GoMRI Research Board, on two recent honors. Dr. Colwell was awarded the 2015 Mahathir Science Award, given annually by the Mahathir Science Award Foundation and the Academy of Sciences Malaysia, to scientists who have made great contribautions to the field of tropical medicine and research relating to infectious diseases and their spread. She was also selected as a National Academy of Inventors Fellow. This honor is given to academic inventors who have "demonstrated a prolific innovative spirit in creating or facilitating outstanding inventions that make a tangible impact on quality of life, economic development, and welfare of society." Dr. Colwell has several patents in computational biology, and her company CosmosID has produced many inventions and innovations toward the advancement of DNA sequencing of the human micro biome. The diversity of these awards illustrates the breadth of Dr. Colwell's many significant contributions to science, and the GoMRI community extends its congratulations to her on receiving these honors.

RECOVER Launches New Virtual Lab

The GoMRI-funded consortium Relationships of Effects of Cardiac Outcomes in Fish for Validation of Ecological Risk (RECOVER) recently launched a new education tool called the "RECOVER Virtual Lab." Narrated by Ph.D. and Master's students working with the consortium, the RECOVER Virtual Lab takes teachers and students through a series of videos and simulations, similar to experiments scientists would do in the lab to study oil impacts on mahi-mahi and red drum. The simulations include a description of RECOVER's swim tunnel, or "swim treadmill" for fish. Students and educators can then visualize the data produced, repeat the experiments, and discuss their findings. In addition to the simulations, the Virtual Lab includes transcripts and a workbook educators can use as a lesson guide in their classroom. At the end of the experiments, the RECOVER Virtual Lab provides a brief quiz to test users on what they've learned. RECOVER plans to add additional lessons in the future to cater to different grade levels and assess the impact of oil on fish though multiple types of experiments.

The Virtual Lab is available online at www.recovervirtuallab.com and will also be available for free download for the iPad from the App Store.
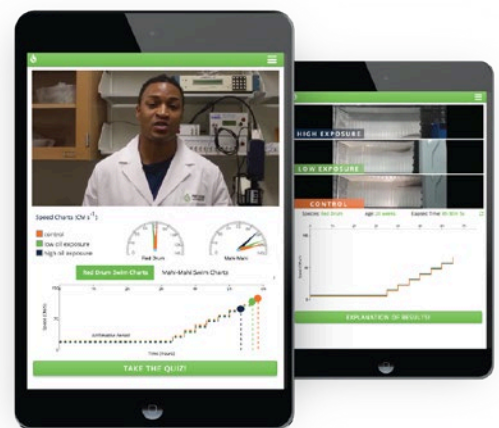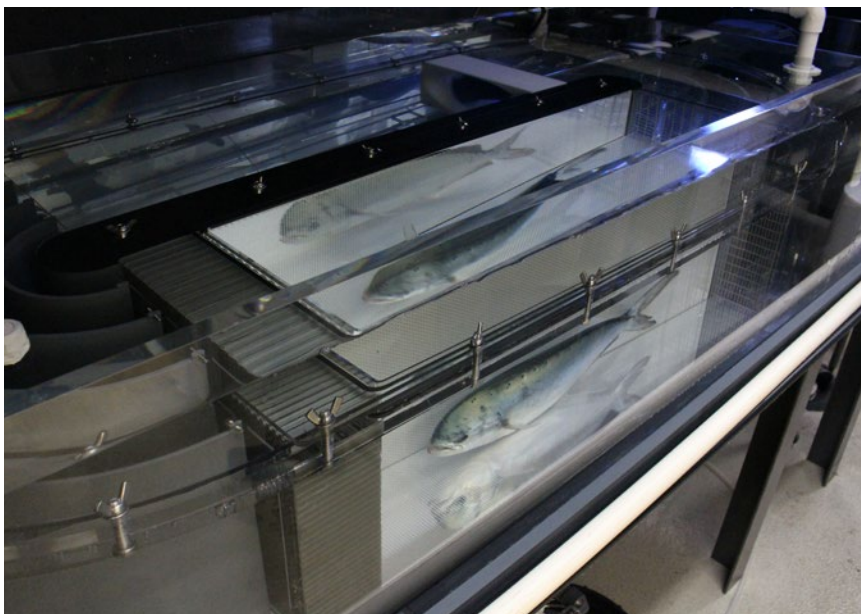
Left: Mahi mahi in the RECOVER swim tunnel.
Above: Images of the new Virtual Lab. Photo Credits: RECOVER.

Frequently Asked Questions by Dr. Chuck Wilson

The 2017 Gulf of Mexico Oil Spill and Ecosystem Science (GoMOSES) Conference theme was Ecosystem Approaches to Gulf Response and Restoration. The goal of this year's conference was to provide an opportunity for attendees to hear from the federal, industry, and state oil spill response communities and to encourage attendees to consider practical applications of their science to response and restoration efforts during and after oil spill events. Dr. Chuck Wilson, Chief Scientific Officer for the Gulf of Mexico Research Initiative (GoMRI), answers a few frequently asked questions about this topic in order to explore the intersection between science and restoration and response, as well as lessons learned from this year's conference.

Photo Credit: LSU Media Relations.

Question: What have we learned that leaves the Gulf and other regions better prepared for oil spills and other environmental management challenges?

Answer: The conference plenary keynote speaker, David Westerholm, Director of the National Oceanic and Atmospheric Administration (NOAA)'s Office of Response and Restoration, provided attendees with an excellent framework of how oil spill response is governed by the Clean Water Act and the Oil Pollution Act and how those laws are interpreted by the agencies and parties responsible. The diverse array of attendees at this year's conference is clear evidence that the scientific community and the oil spill response and environmental management communities are working more closely together. This will provide more rapid integration of science into future oil spill response and restoration efforts, particularly in the Gulf of Mexico. The large amount of science funded by GoMRI and emerging out of the Natural Resources Damage Assessment (NRDA) has certainly improved our understanding of oil spill impacts and will enable the response and scientific communities to be better prepared for the next event. A critical step that we cannot overlook is to encourage and help the science and response communities to work together to report new science findings in applicable ways.

Question: What do resource managers and response and restoration practitioners still need to know?

Answer: There were a number of very interesting presentations at the GoMOSES conference that highlighted where more research would be beneficial. Based on the reports by the session chairs, there were recommendations for further investigation into model integration, particularly connecting the various scale and watershed models into ecosystem level models, and advances in chemical analysis, which have led to new questions regarding the toxicity and fate of previously unidentified daughter products that result from oil photooxidation, microbial degradation, and other sources of breakdown. We heard a lot of excellent presentations on long-term fate and impacts of oil on ecosystems, particularly through the use of genomics, but were reminded that there is little known about the impacts on deep-sea organisms that live at the depths where oil exploration and production are currently taking place. An exciting area of research is in the field of "omics," which is providing us with tools to detect sub-lethal responses by organisms as indicators of genome impacts and if some of those responses are epigenomic (passed on to future generations).

Question: How can the GoMRI community and oil spill responders help in bridging these gaps?

Answer: The short answer is to communicate and engage with one another. Meetings like GoMOSES are a great opportunity to exchange ideas and work through perceived differences in scientific findings and their interpretation. Researchers should invite practitioners to help and advice during research project development. There are some great examples of how scientists are engaging oil spill response and restoration practitioners as they pose new questions and write proposals to address problems/gaps. It is also important for scientists to attend oil spill response focused meetings, such as the International Oil Spill Conference (IOSC), to continue to engage with practitioners (the next IOSC meeting will be in Long Beach, CA, May 15-18, 2017).

GoMRI Researcher Interview with Dr. Jacinta Conrad

Dr. Jacinta Conrad from the University of Houston answered a few questions about her RFP-V project on the Role of Microbial Motility for Degradation of Dispersed Oil.

1. Thank you so much for talking with us! Tell us a bit about your research. What are the goals of your RFP-V project?

Our RFP-V project explores the role of bacterial motility on adhesion to oil-water interfaces during the initial stages of biodegradation. This project was inspired by one of the most striking findings from earlier GoMRI work – that oil was disappearing much more rapidly than expected and was thought to be due to bacteria-driven biodegradation. Most work to understand biodegradation had focused on biology, whereas I am a physical scientist - the ocean is a highly heterogeneous environment that features gradients in temperature, pressure, and salt and organic matter concentration. I was interested in trying to understand how the heterogeneity in the ocean environment might affect the ability of bacteria to first find dispersed oil and then consume it. For this project, I recruited three great collaborators: Arezoo Ardekani at Purdue, a computational scientist focused on complex and multiphase fluids (such as a solution of polymers or an emulsion of oil drops suspended in water) who studies the motility of microscale swimmers; Douglas Bartlett at the University of California San Diego Scripps Institution of Oceanography, a microbiologist interested in deep sea microbial diversity and ecology who has studied how microbes adapt to the high pressures and low temperatures of the deep-sea ocean; and Roseanne Ford, a chemical engineer who was one of the first to quantitatively study bacterial chemotaxis (their directed motion toward a chemical attractant) and apply mathematical models. Given the team's expertise, our goals are to explore four factors that may influence the motion of hydrocarbon-degrading bacteria near or towards dispersed oil and hence affect the rate of biodegradation: chemotaxis; elevated pressure; the presence of dispersants, used in an oil spill scenario to break up oil drops; and viscoelastic fluids and interfaces. We're hoping that insights derived from these studies can be used to improve predictive models for bacterial biodegradation and inform and enhance future efforts to clean spilled oil.

2. Can you talk more about how information related to the four factors in your proposal might be used in oil spill cleanup efforts?

Our project will measure and characterize fundamental microscale transport properties: how fast bacteria swim or are transported towards oil drops under different conditions (high pressure versus low pressure, as one example), or in the presence or absence of organic matter (which leads to viscoelastic fluid behavior) or at dispersant-coated interfaces (which again leads to viscoelasticity). Our team will systematically test these different factors and incorporate these measurements into models to predict microbial motility and (ultimately) relate motility to the rate at which bacteria degrade oil. We have hypothesized that this information is essential for improving models to predict the rate of natural biodegradation in very different physical settings; for example, to predict the rate of degradation in the Arctic as compared to the Gulf of Mexico. In turn, we expect that better understanding of the rate at which bacteria will degrade oil will suggest strategies used by humans in oil spill cleanup efforts. For example, if in the presence of organic matter bacteria move very slowly toward oil drops, then this may suggest that biodegradation will occur at a reduced rate and more active intervention is needed to clean oil. (This is a speculation only! I would welcome thoughts and suggestions from other GoMRI researchers here).

3. What is your background and how did you get involved with this kind of work?

Eclectic! My undergraduate degree is in mathematics. My Ph.D. is in soft matter physics; as a graduate student, I studied the non-equilibrium phase behavior of suspensions of microscale colloidal particles. Finally, I was a postdoc in a materials science department and studied the flow and transport of colloidal suspensions. I started working with bacteria at the very end of my postdoc, in collaboration with a faculty member (Gerard Wong, now at the University of California Los Angeles) – he had done work on the structure of bacterial membranes and was interested in looking at near-surface bacterial motility, whereas I had experience in imaging and tracking thousands of micron-sized particles over time. Surprisingly, these kinds of high-throughput methods had not been applied to bacteria, and so we published several papers on the motility of bacteria near surfaces using methods from soft matter physics.

When I started my faculty position in chemical engineering, I wanted to understand how the near-surface motility of bacteria was altered by the surface properties – this question has strong relevance for designing antifouling surfaces and for controlling biofilm

Dr. Jacinta Conrad. Photo provided by Dr. Conrad.

formation but requires skills and methods from multiple disciplines. My group used materials science methods to make and characterize solid surfaces and applied our bacteria-tracking algorithms to identify how motility and adhesion were affected thereon. Our GoMRI project is a natural extension of this work - now we are looking at bacterial motility near the interface between two liquids (i.e., between oil and water) rather than a solid and a liquid.

4. What are some of the most significant or exciting findings so far from your RFP-V project?

Although we've just gotten up to full staffing, I nonetheless want to highlight some early accomplishments. Arezoo published our project's first paper in *Physical Review Letters* last year, in which she and her graduate student showed that the effects of fluid elasticity can be very different for a suspension of micron-sized swimmers than for a single swimmer -- for a certain swimming mechanism, the elasticity of the fluid can cause the swimmers to aggregate. This result is significant because physicists are currently very interested in understanding why and how organisms move collectively (examples include swarming or flocking), and Arezoo is one of the first to study how fluid properties affect collective behavior. Doug has collected twenty-three different strains of bacteria that can degrade oil and is testing them for motility and chemotaxis at elevated pressures. This will be one of the first studies to look at these processes at pressures characteristic of the deep ocean. Roseanne is developing a mathematical model to predict how bacteria will move in response to multiple different hydrocarbon stimuli; in parallel, she is building a microfluidic device that will allow her to test this model. Finally, my group has made a simplified model of an oil spill using microfluidics – we create oil drops of uniform size and stabilize them with different surfactants. We've just started looking at how different strains of bacteria adhere to these drops – but we see differences between adhesion by oil-degrading and non-oil-degrading strains in our preliminary experiments.

5. If funding were not an issue, what would you add to your project?

An ocean voyage to collect microorganisms from oil spills or oil seeps ☺ - but mostly because I think it would be an interesting experience! More seriously, most of the experiments that we have proposed are focused on behavior of bacteria at the microscale – it would be both interesting and practically relevant to design an experiment or simulation that would try to probe the consequences of the microscale properties at larger scales. Similarly, I would love to examine multispecies microbial consortia – in terrestrial biofilms, there are well-known examples of competing or cooperating microbes. Do hydrocarbon-degrading bacteria compete or cooperate to move towards and attach to oil-water interfaces? And does this depend on the local microenvironment?

6. Your group is involved in education and outreach activities; visit Dr. Conrad's website for more information! Have you done any outreach using the science from your RFP-V project? If so, please tell us more about it!

Yes! Our overarching goal is to improve scientific literacy on topics related to our RFP-V proposal and specifically to oil spill remediation and to microbial motility. So far, teams from Purdue, Virginia, and Houston have incorporated their GoMRI science into outreach events. Arezoo and her students at Purdue have worked with the Women in Engineering program at Purdue to teach high school students about challenges in collecting spilled oil and, more broadly, about how microbes move and self-propel through viscous fluids. Roseanne and her students at Virginia, working with their Center for Diversity in Engineering, used the concept of oil spill remediation to introduce high school juniors and seniors to the theory and practice of engineering. Roseanne developed a wonderful demonstration that contrasts the efficacy of physical (skimmers, booms, absorbents) versus chemical (dispersant) strategies to clean spilled oil. Finally, I've incorporated my GoMRI work into two University of Houston public outreach efforts. UH Energy, a cross-cutting, university-wide initiative, sponsors a table of scientific demonstrations at the Houston Earth and Energy Day Festivals. These events are hosted by the city of Houston and open to the public, free of admission. My first GoMRI-related outreach activity was a very simple demonstration of how dispersants work at the Earth Day program in the spring; inspired by Roseanne, we added a physical oil-spill cleanup activity at the Energy Day in the fall. We continue to look for new forums in which to talk about our science and to reach different constituencies.

Note from the Research Board Chair

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

The 2017 Gulf of Mexico Oil Spill and Ecosystem Science conference theme was focused on the ecosystem of the Gulf, encouraging participants to share practical applications of their research to address oil spills. GoMRI has funded thousands of researchers over the past six years through its RFPs and subsequent awards to address five major research themes. Excellent science has been accomplished, much of which is focused on understanding impacts of the Deepwater Horizon oil spill on the Gulf ecosystem. Taking a step into the future, some of this science has produced discoveries and applications that have a much broader reach beyond oil spill science. Here are some examples:

Photo Credit: CC 4.0, no changes made.

- Dr. Demetri Spyropoulos at the Medical University of South Carolina has been studying how exposure to oil and dispersants *in utero* can impact long-term human health. Through Dr. Spyropoulos' research, a major component of COREXIT, the dispersant used during the Deepwater Horizon oil spill called dioctyl sodium sulfosuccinate (DOSS), has been identified as an obesogen. These findings are important because DOSS is also found in many food products, including soda and laxatives. This could be particularly detrimental if women who are pregnant or breastfeeding transfer DOSS to their babies. Stay tuned for more information and look for the publications from this important work.

- The CARTHE consortium focuses on understanding oil transport to improve prediction of the migration of oil during a spill and to make mitigation practices more effective. One result of their research is that CARTHE's findings have contributed to forecasting hurricane intensity. In 2012, CARTHE's drifters were in the Gulf of Mexico when Hurricane Isaac passed by, providing a unique opportunity to track ocean currents during a hurricane event. CARTHE's research is also contributing to better understanding of storm surges. In the event of a spill, this information may prove critical for responders since storm surges can force oil further inland than current understanding suggests. Knowledge of currents and storm surges is very important for those who conduct search and rescue operations.

- GoMRI scientists are studying Gulf animals and a variety of other organisms and their habitats. The information gathered is extremely useful for scientists and responders, notably in assisting them in determining impacts on these marine populations in the event of a spill. As a by-product of this work, scientists have discovered new species! Such discoveries contribute to our overall understanding of the rich biodiversity of Gulf ecosystems. For example, in 2015, Dr. Stephen Landers and his team from Troy University discovered two new species of mud dragons, and scientists from the DEEPEND consortium discovered a new species of angler fish. Dr. Dean Grubb's work with the DEEP-C consortium also provided new information about the lives of a rarely encountered deep sea shark species.

- In 2015, scientists from the CONCORDE consortium used technologies they developed to study effects of the Deepwater Horizon oil spill to monitor a red tide event. Being able to track these events is important because red tide species release toxins that can seriously impact the health of humans and animals.

All of us associated with the Gulf of Mexico Research Initiative are very proud of our scientific teams and the excellent science being produced. We are delighted with the scientific contributions our community is making towards providing a better understanding of the Gulf of Mexico ecosystem and how we can respond to oil spills. I am especially pleased to know that our science is helping the scientific community in general, but most of all, we are helping those who live in the Gulf of Mexico states and love their beautiful environment. It is discoveries of the committed investigators who comprise our GoMRI consortia and individual research teams that make me hopeful we will continue to innovate and meet the challenges of some of our world's most pressing problems.

DISPATCHES
From the Gulf

William Mills on the Dispatches from the Gulf set. Photo Credit: Screenscope.

Screenscope, Inc. and the "*Dispatches from the Gulf*" documentary received two exciting honors in recent months. They received the Blue Whale Award for Best in Broadcast Program at the 2016 Blue Ocean Film Festival, and the film's Director of Photography, William Mills, won an Emmy for Best Cinematography. Congratulations to Screenscope and the Dispatches team on these awards!

Screenscope is pleased to announce that they will be releasing a sequel to "*Dispatches from the Gulf*," another episode in their "*Journey to Planet Earth*" series. A trailer of the new documentary can be viewed here!

GoMRI and Screenscope continue to share the fifty short videos developed as a complement to the first documentary on social media; follow along using the hashtag #50shorts. Don't forget to check out the podcast series "Gulfcast" as well. If you are an educator, or know someone who is, be sure to request a free copy of the "*Dispatches from the Gulf*" DVD to use in your classroom here.

LADC-GEMM Hosts SeaGlide Workshop in New Orleans
Model SeaGliders help local Louisiana educators explore Gulf of Mexico Ecosystem Science

Sara Heimlich, Oregon State University
Dianne Maygarden, University of New Orleans

The Littoral Acoustic Demonstration Center – Gulf Ecological Monitoring and Modeling (LADC-GEMM) consortium, funded by GoMRI, in partnership with Louisiana Sea Grant and Oregon State Sea Grant, hosted a SeaGlide Workshop following the Gulf of Mexico Oil Spill and Ecosystem Science (GoMOSES) conference on February 11, 2017 in New Orleans, Louisiana.

SeaGlide is an educational tool in which students and educators build a fully-functioning miniature sea glider. Like real gliders, the SeaGlide models can travel through water by taking in or expelling water, changing their buoyancy. The SeaGliders can even collect temperature and pressure data as they move through the water. Gliders are quickly becoming a popular technology used in studying many aspects of marine science, from currents and temperature to collecting sounds made by whales and dolphins, like scientists from LADC-GEMM do for their research. The SeaGlide models provide an excellent teaching tool to help educators learn and then teach about these principles in their classrooms. LADC-GEMM has hosted several SeaGlide workshops for teachers.

Twenty-six educators local to the New Orleans region participated in a SeaGlide Workshop at the Coastal Education and Research Facility (CERF). The educators were instructed by researchers from the University of New Orleans and Oregon State University, as well as by eight students from Warren Easton Charter High School. These students have already built their own seagliders, and some have also been working on analyzing acoustical data from LADC-GEMM (see the fall 2016 Newsletter for more information!). They were able to provide instruction and guidance to the educators while they built their own gliders.

Educators build miniature sea gliders using SeaGlide model kits in a teacher workshop hosted by LADC-GEMM in New Orleans, LA. Photo Credit: LADC-GEMM.

For more information on LADC-GEMM and their work with SeaGlide, visit www.ladcgemm.org.

Education Spotlight

ACER recently launched a new fact sheet series. The series will ultimately include fifteen fact sheets, which will focus on emerging science from ACER's seven research groups. The fact sheets can be viewed and printed from the ACER website here!

DEEPEND has shared a series of lesson plans, categorized by grade level, on their education site. The lesson plans include coloring sheets for younger students to teaching modules and classroom activities for high school students. Check out these great resources here!

The Gulf of Mexico Sea Grant Oil Spill Science Outreach Team co-chaired a session at the Society of Environmental Toxicology and Chemistry (SETAC) conference, which took place from November 6-10, 2016 in Orlando, Florida. The session was called *Deepwater Horizon Oil Spill – The Discoveries and Outreach* and featured a presentation by Emily Maung-Douglass on *Sharing the science being the spill: The partnership of the Gulf of Mexico Sea Grant programs and the Gulf of Mexico Research Initiative*. A recording of the presentations from the session are available here.

Larissa Graham attended the Restore America's Estuaries Summit in New Orleans, Louisiana from December 11-14, 2016 in partnership with GoMRI Management Team members and GRIIDC. She also moderated a session that featured several speakers from the GoMRI community called *Deepwater Horizon Oil Spill Impacts to Coastal Wildlife, Fish Populations, and Wetlands in the Barataria Bay, Louisiana*. A full summary of that conference can be found on page 4.

The Team hosted a workshop ahead of the Gulf of Mexico Oil Spill and Ecosystem Science (GoMOSES) conference on February 6, 2017 in New Orleans, Louisiana called *Exploring the Intersection Between Oil Spill Science and Response*. The goals of the workshop were to discuss how scientists and responders can work together on oil spill response events. The workshop included presentations by Dave Westerholm, Director of the National Oceanic and Atmospheric Administration (NOAA)'s Office of Response and Restoration; Paige Doelling, NOAA Scientific Support Coordinator; Commander Kelly Denning, U.S. Coast Guard Sector New Orleans, Response Department Head; Lt. Ryan Dickson, U.S. Coast Guard; Tim Nedwed, ExxonMobil Upstream Research Company; Edward Overton, GoMRI-funded scientist and Emeritus Professor, Louisiana State University; and Eugene Turner, GoMRI-funded scientist and Professor, Louisiana State University. More information on this workshop can be found here.

The Team has also released several new publications in recent months. *The Deepwater Horizon Oil Spill's Impact on People's Health: Increases in Stress and Anxiety* explores how the oil spill impacted the mental health of residents of the coastal Gulf communities. Read the publication here. *Frequently Asked Questions: Oil Edition* features general information on oil, including what it is, how it gets released into the environment and what happens to it once it's there, and how scientists can track it. Read the publication here.

Tim Nedwed of ExxonMobil Upstream Research Company and Eugene Turner and Edward Overton of Louisiana State University take questions from the audience at the February 6th workshop. Credit: Gulf of Mexico Sea Grant Oil Spill Science Outreach Program.
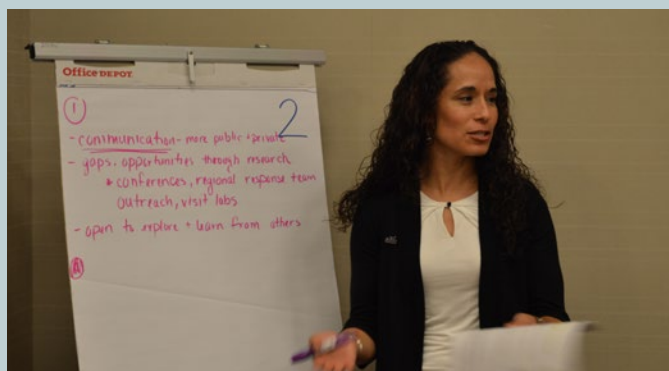
Sea Grant oil spill science specialist Monica Wilson led the February 6th workshop. Here, she speaks directly with audience members about ideas for improving communication between researchers and responders. Credit: Gulf of Mexico Sea Grant Oil Spill Science Outreach Program.