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An Opportunity to Inform and Educate Through the Gulf of Mexico Research Initiative

OUTREACH EFFORTS SURROUNDING THE DEEPWATER HORIZON OIL SPILL

By Debra S. Benoit, Leigh A. Zimmermann, Katie H. Fillingham, Stephen H. Sempier, Nilde M. Dannreuther, Jarryl B. Ritchie, and Kenneth M. Halanych

ABSTRACT. The role of science and technology (S&T) in society is fundamental to community progress in a number of ways, from improved engineering and production, to environment and human safety, to a basic understanding of natural systems. How science and technology influences lives within a community can be unclear. Events of the Deepwater Horizon (DWH) oil spill immediately thrust several unfamiliar and complex concepts to the forefront of daily news outlets for weeks on end. From the outset of the Gulf of Mexico Research Initiative (GoMRI), there was a realization of the need to demystify S&T concepts associated with the DWH spill (from drilling for oil to human health and ecological impacts), as well as to increase baseline S&T understanding in local communities. In particular, effective outreach on S&T addresses the societal need to have informed constituents who can help communities make educated decisions on resource management, community health, and environmental and occupational safety. Although many of these issues are local, the impact of the DWH oil spill transcended regional, national, and international interests, and impinged on numerous segments of society. Because of these issues, GoMRI deemed it paramount to develop and execute a progressive and ambitious outreach program focused on its scientific discoveries. With the hope of stimulating similar efforts in the future, this article outlines and documents key aspects and decision points of this broad-scale outreach program.

INCEPTION/HISTORY

Committed to fostering broader impacts of science discoveries, the Gulf of Mexico Research Initiative (GoMRI) Research Board (RB) created the RB Outreach and Communication Committee (OCC) to develop outreach standards and oversee execution of outreach efforts, and included outreach review criteria in calls for funding. Because GoMRI was essentially a *de novo* research foundation, the scope and extent of the outreach effort remained to be clearly defined. Thus, this committee was tasked with developing a

broad taxonomic approach to outreach and communications, including addressing key questions such as: Who are the stakeholders? Which stakeholders can we most effectively reach? How do we determine and prioritize outreach messages? What is the size and scale of the effort we need and can afford? What partners do we need to be effective?

Seven key stakeholder groups are targeted in GoMRI outreach efforts: (1) society (with most emphasis on the general public); (2) the scientific community; (3) the GoMRI community; (4) K–12

students, undergraduates, graduate students, and educators; (5) government officials and policymakers; (6) industry, nongovernmental organizations (NGOs), and practitioners; and (7) public health officials¹. Specific activities correlated to many of the stakeholder groups are slated and documented in an Annual Outreach and Communications Work Plan, which is updated and approved by the RB each year. All outreach activities are tied to GoMRI's overarching legacy goals and mission, the former defining its organizational commitments and the latter defining its founding purpose (see <http://gulfresearchinitiative.org> and click on the About menu to get to the goals and mission pages). To accomplish these targets, the RB increased the scope of its outreach efforts through a three-tiered approach, which included GoMRI- and consortium-level programs and leveraged and extended outreach through other science education organizations.

GoMRI's science communication initiatives are directed at filling in likely societal deficits in knowledge about risks, consequences, and mitigation possibilities for oil spills proximal to ocean coastlines. The basic premise is that if stakeholders understood the scientific facts, they would be more likely to see the issues as experts do. Strategies to inform

¹ The Sea Grant partnership targets this stakeholder group.

“ To date, GoMRI-funded research projects have involved the services of almost 250 postdocs, roughly 900 graduate students, and more than 700 undergraduates. ”

stakeholders include (1) developing content for traditional science media outlets that typically reach a relatively small audience of already knowledgeable science enthusiasts, and (2) sharing oil spill related discoveries through popular science outlets such as documentaries, science magazines, graphic novel adaptations, podcasts, newspaper science coverage, science websites, and social media.

PROGRAM LEVEL

Internal Communication

In order to effectively manage and complete the large number of tasks in the Annual Work Plan, frequent communication among the management team is imperative. Weekly conference calls are held with the entire GoMRI Management Team (GMT), and monthly one-hour calls are scheduled with the outreach management team members and RB Outreach and Communication chairs. Every other month, outreach calls open to consortia outreach coordinators allow each group to briefly provide updates on recent and planned outreach activities, trainings, tips, and latest outreach tools. In the fall of each year, strategy retreats for the GMT provide an opportunity for the group to meet face-to-face, network, generate new strategies, discuss challenges or concerns, and draft documents such as the Annual Outreach and Communications Work Plan.

In addition to conference calls, meetings, and work plans, a variety of informational documents are circulated to keep team members up-to-date. These include emails, website links, reports, contracts, requests for proposals, talking points, conference summaries, and research board newsletters that inform the RB of consortia activities and upcoming committee meetings and calls. Faced with the geographic distribution of team members and a lack of daily in-person interaction, these communication mechanisms are critical in order to ensure cohesive teamwork and attainment of programmatic objectives.

External Communication

GoMRI's external communications represent the primary outreach activity for the program. These communications use a variety of channels to share GoMRI oil spill science across the spectrum of targeted stakeholders. The core communication activity distributes information through the program's Web presence and maximizes the use of that material through associated social media channels and newsletters. Additional communication with the science community occurs through presentations and participation at science conferences, via webinars, and at workshops as well as through a variety of student/scientist engagement activities.

The GoMRI website (<http://gulfresearchinitiative.org>) is a comprehensive and sizable reserve of information developed for scientists, the general public, and other stakeholders to learn about the program, the science, and the people involved. The site's education page, designed for K-12 teachers and students, includes a curriculum guide, lesson plans, activities, stories about scientists, reference links, and much more. There are also links to GoMRI's data management site, the Information and Data Cooperative (GRIIDC), and a directory of all GoMRI-funded scientists as well as a repository of GoMRI funded publications. Beyond offering the GoMRI data search and tracking of stats and analytics, links are provided to other Gulf of Mexico searches such as the US Environmental Protection Agency Storage and Retrieval Data Warehouse (STORET), GOMAportal, the US National Oceanic and Atmospheric Administration (NOAA) Operational Model Archive and Distribution System (NOMADS), BP Gulf Science Data, Natural Resource Damage Assessment (NRDA) workplans and data, and others. GoMRI's communication efforts also include a GoMRI Facebook page, a Twitter account, YouTube channel postings, and a Flickr page. Program video content is marketed jointly on YouTube and Vimeo to maximize the use and to overcome potential K-12 restrictions on YouTube access.

Flickr is used to host high-resolution downloadable images of GoMRI research and researchers in action.

A newsletter featuring articles from the website, GoMRI community highlights, and other GoMRI science stories is produced four times a year, posted to the website, and distributed to more than 2,700 subscribers via email. Recently, a biweekly “eNews” was instated to augment the quarterly newsletter. These are sent via email only and include recent stories posted to the GoMRI website, new publications, data links, program announcements, and consortia activities. In the event of a major announcement regarding the program, GoMRI sends out a press release to inform the public.

GoMRI hosts an internal bimonthly webinar series featuring GoMRI scientists to facilitate internal information exchange. Only members of the RB, staff, and GoMRI-funded researchers are invited to participate in these webinars, creating a community of online knowledge sharing among fellow consortia scientists.

Outreach, Education, and Training Initiatives

Providing for the education and development of new scientists is another important component of program-level outreach and is critical to GoMRI’s overall mission and legacy. GoMRI encourages and supports student involvement in science at all levels in order to build scientific and intellectual capacity for response and mitigation strategies for future oil spill events.

To date, GoMRI-funded research projects have involved the services of almost 250 postdocs, roughly 900 graduate students, and more than 700 undergraduates. These students are studying a variety of fields at schools across the United States and around the world. Their areas of study are primarily in biological, marine, Earth, and environmental sciences, and engineering, with smaller numbers in concentrations such as psychology, entomology, mathematics, physics, ecology,

and social sciences.

The GoMRI Scholars Program honors and builds a community for the next generation of ocean science professionals, with particular emphasis on the Gulf of Mexico (<http://gulfresearchinitiative.org/category/gomri-scholars>). This distinction provides unique recognition to GoMRI graduate students who have participated in a GoMRI-funded consortium for a minimum of 12 months, whose work is primarily funded by GoMRI, and who are working on dissertations or theses based on GoMRI oil spill science. On a semiannual basis, the lead principal investigators of GoMRI-funded projects nominate candidates who meet these criteria. The Scholars Program has inducted nearly 200 GoMRI graduate students since its inception. GoMRI also uses student recognition as a recruiting and awareness tool. The Web page hosts a series of personal profiles highlighting the work and experiences of GoMRI scholars. The intent of these vignettes is to capture a candidate’s personal story and potentially encourage young students, particularly women, to consider careers in science.

GoMRI hosts and supports a variety of workshops and sessions to provide scientists with knowledge and tools to interact with the public and to develop a public engagement approach that promotes their findings, aids in public understanding, and advances conversations. One such workshop offering, the COMPASS communication program, provided a panel of renowned journalists to train consortia principal investigators in the do’s and don’ts of interviewing, creating message boxes, using interpretative schemas, and in responding during mock interview scenarios. These types of science communication programs arm scientists with techniques directed at filling the science literacy deficit and improving their ability to engage with the media.

In an effort to reach new audiences and interact with the community at large, GoMRI RB and management team members also attend conferences, meetings,

and festivals each year, typically hosting a booth where materials can be dispersed and visitors can ask questions and subscribe to the GoMRI newsletters. GoMRI’s involvement in these efforts is primarily a public relations function but also serves to build credibility, public trust, and engagement in science.

Assessment of GoMRI’s outreach tasks is tracked through a variety of instruments, mechanisms, and metrics. Website hits are tracked using Google Analytics, and a media tracking report checks circulation of GoMRI-related stories and media coverage.

The GoMRI newsletter distribution list is constantly growing as is the program’s social media following. Participation data are also collected on the GoMRI Scholars Program and the GoMRI webinar series. Tracking these metrics is important for determining where the program is being effective in reaching various stakeholders and where modifications are needed for optimum results.

CONSORTIA OUTREACH PROGRAM

The RB recognizes the need and its responsibility to share GoMRI’s discoveries with the greater public. As a result, an outreach component is required in all consortia proposals and programs and is a weighted criterion in proposal scoring. Following GoMRI’s outreach guiding principles, consortia design, develop, and implement individualized initiatives. The outreach conducted by consortia supplements, supports, and extends GoMRI program-level outreach to primarily regionally based stakeholders (Figure 1).

Collectively, most consortia outreach activities target the educational and society stakeholder groups, with the lead institutions implementing the majority of the outreach efforts. Notably, with lead institutions primarily located in the Gulf states, the stakeholder groups generally include those most impacted by the Deepwater Horizon (DWH) oil spill.

Forty-four percent of consortia outreach and communications efforts are

targeted at the formal education community and provide the following products and activities:

- Scientist-led lectures and course content (at university level)
- Participation in existing teacher/student workshops/camps
- Development of hands-on teacher/student workshops/competitions (Figure 2)
- Presence/participation at marine educator association meetings
- Development of K-12 curriculum guides, lesson plans, experiments (Figure 3)
- Research assistantships
- Internships
- Remotely operated vehicle student activities (construction, demo, and drivers' licenses)
- Teacher/student blogs/Skype during research participation
- National Ocean Sciences Bowl participation
- Teacher-at-sea programs
- Scientists in classrooms
- Science education videos
- Student-initiated Q&As with scientists
- Girl/Boy Scouts merit badges
- Cruise port day activities
- Ocean Discovery Camp
- Three-dimensional printing activities
- Development of children's book/app/games

Thirty-nine percent of consortia outreach and communications efforts are targeted at society through the following products and activities:

- Websites, social media, image galleries
- Press releases, media interviews
- Newsletters
- Podcasts/video series
- Presence/participation at public events (i.e., festivals, museums, aquaria)
- Invited talks at local meetings and community organizations
- Hosting events that draw public audiences (i.e., open houses, science cafes)
- Citizen science activities (drift cards and drifters)
- Celebration and participation in public science events (World Oceans Day)
- *Limnology & Oceanography* e-lectures
- Colloquial articles for print (*National Geographic*)
- Radio shows (Science Friday)
- Google/Mission Blue
- Science in the Stadium events

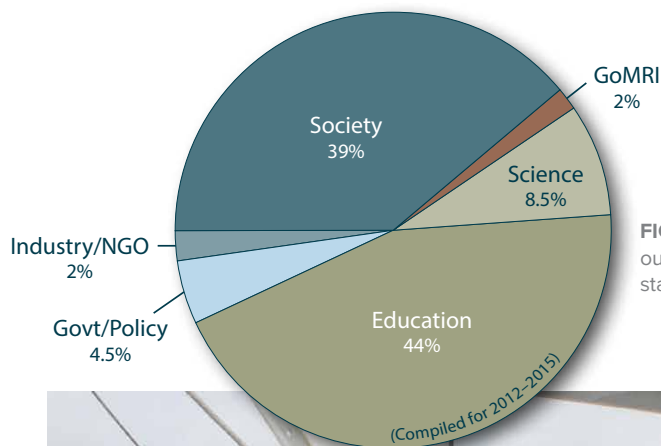


FIGURE 1. Consortia outreach activities by stakeholder group.



FIGURE 2. Hands-on science, such as collecting samples of marine life in a marsh, helps students gain a deeper understanding about the science they later use in their artistic depictions. Students are shown here on board R/V *Acadiana*. More information on this project is available at <http://gulfresearchinitiative.org/teens-explore-oil-spill-impacts-wetlands-science-art>. Photo credit: Murt Conover

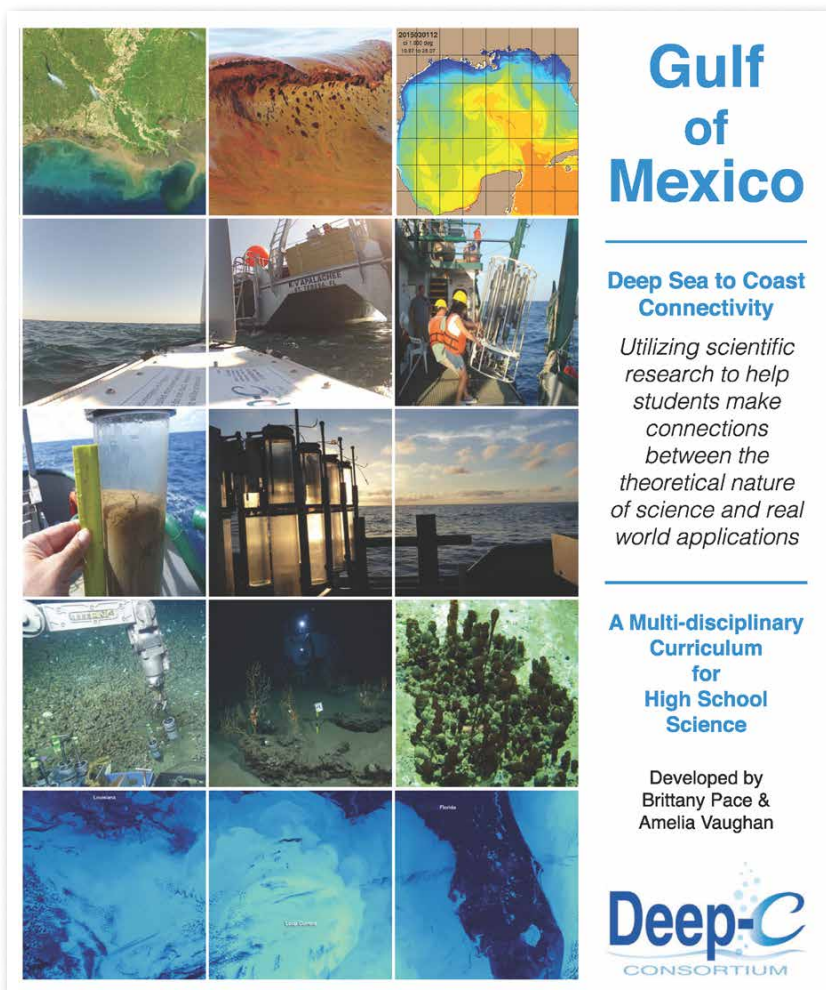


FIGURE 3. Gulf of Mexico Research Initiative projects have supported development of K–12 curriculum guides, lesson plans, and experiments.

The remaining (<10%) consortia outreach and communication efforts are targeted at the media, government and policymakers, industry, NGOs and practitioners, the science community (including the GoMRI community and partners), and public health officials. Primary activities include:

- Testimony at congressional hearings
- Invited presentations at local, state, and regional government meetings
- Participation in Coast Guard meetings and exercises
- Coordinating joint response to petroleum-related events with officials' memberships on advisory boards; presentations/invited talks at universities, organizations, working groups
- Thesis defenses
- Participation in consortia all hands

- and GoMRI meetings/calls
- Leveraged/matched funding through partnerships/collaborations
- Publication of papers/journals
- Synthesis activities
- Collaborative emergency response efforts

LEVERAGED AND EXTENDED OUTREACH

To forge relationships with RB-identified stakeholders who were often not reached through program-level and consortia outreach efforts, independent contractors filled the gaps. External contractors have existing networks, audiences, and segments of stakeholders that would be hard to establish or replicate by the GoMRI management team and/or the funded research teams.

The RB understood that to achieve the program's mission and legacy goals in a timely manner, all stakeholders acknowledged within its Outreach and Communication Plan must be pursued. To that end, three independent groups, each with different approaches, tools, and products, accepted the challenge: Sea Grant (four Gulf state programs); the Smithsonian (Ocean Portal); and Screenscope Inc. (filmmakers). Each group is described in detail below.

Sea Grant

The four Sea Grant (SG) college programs in the Gulf of Mexico have served coastal communities for more than 40 years. Florida Sea Grant, Louisiana Sea Grant, Mississippi-Alabama Sea Grant Consortium, and Texas Sea Grant are university-based programs partially supported by NOAA and each program's respective state government (<https://gulfseagrant.wordpress.com/oilspilloutreach>). The four programs sponsor coastal research, extension, and education. More than 70 people affiliated with the four SG programs serve Gulf of Mexico industries and residents. In 2014, GoMRI and the SG college programs formed a partnership to share oil spill science with people whose livelihoods depend on a healthy Gulf of Mexico. The partnership created the Sea Grant Oil Spill Science Program (SGOSSP) for outreach.

The DWH oil spill affected several groups that received limited or no oil spill science information in formats that were of use to them. SGOSSP works with these groups, including elected officials, emergency responders, fishermen, natural resource managers, ports and harbors employees, public health officials, tourism specialists, environmental nonprofit staff, other SG and outreach personnel, and university researchers. Because most of these audiences are not specifically targeted by the other GoMRI education and outreach efforts, SGOSSP augments other programs that are being implemented through GoMRI's diverse education

and outreach portfolio.

SGOSSP is made up of four oil spill science outreach specialists and a coordinator who work across all four Sea Grant programs. Each specialist has an advanced degree and/or interest in a different GoMRI theme area and is based in a different SG college program. The specialists are integrated into the four SG programs and are able to engage with the entire SG network, which has allowed the specialists to quickly build relationships with specific target audiences. The specialists have met with more than 500 representatives from the groups mentioned above in order to identify their oil spill science-related questions and develop customized outreach products to serve them.

During the initial two-year pilot of the GoMRI Sea Grant partnership, SGOSSP members have established several ways to synthesize and deliver oil spill science. First, the program produces outreach publications (<https://gulfseagrant.wordpress.com/oilspilloutreach/publications>) that are focused on specific topics requested by target audiences. Early outreach publications cover topics such as seafood safety, dispersants, fisheries management and disasters, and frequently asked questions from tourists. The program also organizes science seminars (<https://gulfseagrant.wordpress.com/oilspilloutreach/presentations>) in which multiple scientists and others present peer-reviewed research results that focus on topics audiences have requested. So far, the oil spill science seminars have explored oil spill impacts to specific habitats, ways for university researchers and emergency responders to collaborate during future spills, and other topics.

Finally, the SGOSSP outreach team provides short presentations throughout the Gulf of Mexico region and the United States for use by other interested groups. When a group requests an update on oil spill science, the team assembles a presentation that addresses specific topics of interest for that group. Presentations have been provided for Gulf of Mexico

Alliance meetings, Gulf States Fisheries Commission meetings, public health worker trainings, and many other venues.

Each year the education and outreach leaders of various GoMRI-supported activities meet during the annual Gulf of Mexico Oil Spill and Ecosystem Science Conference. Members of SGOSSP help lead the development of the outreach session at that conference. SGOSSP also identifies opportunities to collaborate with others working on GoMRI outreach and education activities, shares videos and Web content produced by other GoMRI groups, and presents them at outreach events.

To learn how oil spill science is shared across the region, the SG program implemented a social network analysis (SNA). The process began in 2014 in order to understand where oil spill science information flowed and to identify key nodes. In the summer of 2015, a formative evaluation was conducted to obtain input from a small sample of stakeholders served through GoMRI's program-level outreach efforts. This evaluation served to inform any need for mid-course adjustments. The next evaluation phase will occur in 2016, and that assessment should show that outreach specialists team members are becoming important nodes in the network of sharing oil spill science information. It will also allow GoMRI to compare how the network has changed between the two periods and provide cost-benefit evidence.

The foundation of SGOSSP is building relationships and fostering dialogue between those seeking information and specialists. The SGOSSP program uses feedback from its audiences to shape programming to meet diverse needs. In addition, SGOSSP synthesizes feedback and gives it to the GoMRI Research Board to assist in addressing remaining oil spill science research questions. The partnership between GoMRI and the four Gulf of Mexico SG college programs is mutually beneficial and helps to meet the oil spill science needs of key stakeholders that rely on a healthy Gulf of Mexico.

Smithsonian

The Smithsonian Ocean Portal (<http://ocean.si.edu>) was launched in 2010 as part of the institution's larger ocean initiative that included the opening of the Sant Ocean Hall in the Smithsonian National Museum of Natural History in Washington, DC, and the creation of the Sant Chair for Marine Science. Shortly after the DWH oil spill, content on the spill (<http://ocean.si.edu/gulf-oil-spill>) was added to the Ocean Portal (OP). These pages received a high number of visits from search engines and continue to be some of the most viewed pages for information on the DWH oil spill.

In 2013, a partnership between GoMRI and the OP was formed to share stories about oil spill research in a public or customer-facing fashion. Since that time, OP writers have worked directly with GoMRI researchers to highlight their ongoing work and emerging results. Pieces include overviews featuring basic scientific discoveries, interactive infographics and maps, slide shows, guest blog posts, and articles on Smithsonian.com. To date, the two articles posted on Smithsonian.com featuring GoMRI science on the online version of *Smithsonian* magazine have had over 37,000 visitors.

In addition to the readership of the OP and *Smithsonian* magazine websites, the OP has a broad social media following. As of January 1, 2016, the OP had approximately 25,000 Twitter and 120,000 Facebook followers. Use of social media outlets allows creative promotion of GoMRI research; for example, to highlight the fifth anniversary of the spill, the OP created an environmental history Twitter campaign (#GulfSpillFlashback) that documented how science unfolded during the spill.

The reach of the OP is evaluated through several methods. Statistics on site metrics are collated quarterly, including the number of unique visitors and time spent on site, bounce rates, and Google search rankings. The Gulf oil spill page remains the most visited page on the OP

website, with more than 232,000 visits in 2015, illuminating the successful nature of the GoMRI/OP partnership. GoMRI continues to leverage the broad distribution of OP content by highlighting new pieces on the GoMRI website, in quarterly newsletters, and sharing through social media outlets.

Screenscope

In 2014, GoMRI released a request for proposals for the creation of a documentary that would target national and secondary media outlets. The intent was to provide an opportunity to independent filmmakers to develop and produce their personal artistic vision while sharing critical oil spill research findings on the effects of the DWH oil spill, with sensitivity to the loss of human lives in the accident. Screenscope Inc., the filmmakers behind the Public Broadcasting Systems (PBS) series *Journey to Planet Earth (JTPE)* were the successful applicants. The company's producers, Hal and Marilyn Weiner, have created over 225 documentaries, two PBS series, and three feature films. Screenscope Inc. produced a 56-minute science-based documentary film centered on oil spill research, "Dispatches from the Gulf," now the fourteenth episode in the *JTPE* series. The film was paid for in part by a grant from GoMRI, with other funding from the Wallace Genetic Foundation and the Farvue Foundation.

The objectives of the documentary film, as described by the filmmakers, were to (1) feature the work and discoveries of a cadre of scientists working toward a common goal of protecting and restoring one of our country's most valuable natural resources; (2) provide policymakers, community leaders, and citizens with examples about how best to cope with the environmental, economic, and social challenges of oil spills; (3) inspire and motivate young people and adults to become more interested in science by participating in a variety of outreach and community activities; and (4) lead viewers toward a deeper appreciation of the

role of science in modern society.

The scientific community viewed the first public release of "Dispatches from the Gulf" on February 4 at the 2016 Gulf of Mexico Oil Spill and Ecosystem Science Conference in Tampa, Florida. Public screenings at museums and science centers include the Mahaffey Theatre in Tampa; the Witte Museum in San Antonio, Texas; the GulfQuest-National Maritime Museum of the Gulf of Mexico in Mobile, Alabama; Sci-Port: Louisiana's Science Center in Shreveport; Baruch College in New York; the Mississippi Museum of Natural Science in Jackson; and the Museum of Science & History in Jacksonville, Florida. Throughout the Gulf region, more than 15,000 people have attended these screenings.

"Dispatches from the Gulf" was broadcast April 23, 2016, on WEDU Main, a regional PBS-Tampa network and subsequently on June 20, 2016, on Mississippi's PBS stations as part of the *JTPE* series. In addition to airing on regional PBS stations, "Dispatches from the Gulf" was viewed at the Environmental Film Festival in Washington, DC. Looking forward, the filmmakers provided GoMRI with a list of over 80 potential festivals for entry, from the BLUE Ocean Festival (Boston, Massachusetts) to the International Festival (Brazil). Plans for these and other showings will continue as interest in this documentary, narrated by Matt Damon, continues to grow in popularity and demand.

For the "Dispatches" promotion, filmmakers created a suite of 50 shorter documentary-style videos to be used for education outreach activities and events. In addition, a Screenscope-led outreach platform has laid the groundwork for the advertising and distribution of the film. A curated mobile tablet-friendly website (<http://dispatchesfromthegulf.com>) was developed to offer the public multiple elements of this new initiative. The website features a video gallery, a "Meet the Scientist" page, screening dates, and education resources such as downloadable

educator guides, lesson plans, and free DVDs. Viral campaigns for social media channels with hashtags like #DispatchesFromTheGulf, #GulfGram, and #SparkofScience have generated followings from Gulf residents, environmentalists, students, community leaders, and others.

Screenscope Inc. is currently producing a second documentary that will follow up on previous storylines but also focus more on human health and marine mammals, and highlight women in science. The filmmakers' future plans include capturing intimate portraits of scientists at work to potentially influence younger viewers to consider science as a career option. An equally important feature of the next film will be to compare and contrast the specific communities that were affected by the Ixtoc, *Exxon Valdez*, and Deepwater Horizon oil spills. The anticipated release date of this project is spring 2018.

LESSONS LEARNED AND FUTURE CHALLENGES

The questions that scientists are addressing about the oil spill are, at their core, the same questions that the public had during the spill and continue to have to this day: Where is the oil going and how long will it be there? What are the long-term human and environmental effects? How can we be better prepared in the future? Outreach and communications to various audiences about GoMRI-funded science is important because it addresses these concerns. Thus, the GoMRI outreach efforts continue to be aimed at informing stakeholders about Gulf oil spill science, the importance of establishing baselines, and the best practices to be applied in the event of future spills.

However, true engagement has to move upstream so that relevant stakeholders can develop a more meaningful understanding of the issues involved. Understanding can be either stalled or advanced depending on how an issue is framed. Framing is an unavoidable reality of the science communication process and must be applied in GoMRI's



FIGURE 4. PhD Candidate Cheng Li of Johns Hopkins University studies the dispersion of oil by waves inside the wave tank he designed.

communication efforts to aid in the public's understanding of an issue, condense complex events to make them interesting to journalists, and help define options for policymakers. To help society understand, as our mission mandates, we must continue to do more than promote the findings. We must also continue to listen and connect with stakeholders on their terms.


GoMRI must address all identified stakeholders and particularly further expand engagement with industry, policymakers, and public health officials. In moving forward, and to further promote engagement of these groups, the RB Outreach and Communications Committee might consider addressing the following questions:

- Are boundaries of what scientists can or cannot achieve being communicated to the public?
- Does the public understand and/or appreciate scientific uncertainty?
- Are some studies more conducive to misinterpretation than others?
- Are we reporting findings to the public in relentless quantitative terms

that are devoid of jargon to provide a deeper understanding of the fundamentals?

- Is how a study fits with an emerging body of knowledge and/or comparisons to other studies communicated?
- Are current communication paths adequate?
- Are there ways to facilitate incidental exposure on the Web to gain the attention of key stakeholders?
- Can we increase meaningful public participation/dialogue?

The GoMRI program is scheduled to sunset in 2020, and at that time perhaps GoMRI's noblest outreach contribution will be measured by the impact on formal education. Having undergraduates and graduate students as key research team members, working alongside world class scientific experts, establishes an incoming generation of scientists who have working knowledge of applied oil spill research (Figure 4). This cohort of new scientists represents perhaps the most important legacy of the GoMRI program. Additionally, involving the K-12

community in GoMRI research activities and providing teaching and learning resources cultivates a continual pipeline of students who are literate in Gulf of Mexico ocean science and are also knowledgeable about how science is relevant to today's most pressing problems. The education of these students helps to evolve the compact between science and society. 

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