Abstracts

Deepwater Horizon Oil Spill – The Discoveries and Outreach

designated Spotlight Session at the

7th SETAC World Congress/SETAC North America 37th Annual Meeting

View the full conference abstract book HERE.

Sharing the science behind the spill: The partnership of the Gulf of Mexico Sea Grant programs & the Gulf of Mexico Research Initiative (GoMRI)

E.S. Maung-Douglass, Louisiana Sea Grant – LSU / Louisiana Sea Grant; L. Graham, Mississippi-Alabama Sea Grant Consortium; C. Hale, Texas Sea Grant; S. Sempier, Mississippi-Alabama Sea Grant Consortium; M. Wilson, UF/IFAS Florida Sea Grant Extension

Deepwater Horizon oil spill occurred in 2010 off the coast of Louisiana (USA) and continues to be the largest accidental release of oil on record. While scientists from various sectors (e.g., research initiatives, government, environmental consulting) are making major advances in understanding the implications of the incident, effectively communicating those scientific findings continues to be challenging. Two years ago, the Gulf of Mexico Sea Grant programs partnered with the Gulf of Mexico Research Initiative (GoMRI). The resulting outreach program extends oil spill science to target audiences who could utilize oil spill science in decision-making and/or who depend on the Gulf for their livelihood. These target audiences include, but are not limited to, emergency responders, natural resource managers, elected officials, fishermen, and tourism dependent businesses. Since 2014, our program has met with more than 1000 people within our target audiences from communities across the Gulf of Mexico. Based on our assessment of their needs, we work collaboratively with scientists from all sectors to help us create scientifically accurate extension publications and informational seminars that are a synthesis of published literature from a wide range of areas (e.g., seafood safety, impacts to aquatic life, fate of oil and dispersants). As our program enters its second phase in Fall 2016, we will share approaches used and lessons learned during Phase I, including the need to connect audiences that have not traditionally worked to improve communication during future spills, and unexpected challenges encountered while working with our target audiences and disseminating the science of the spill. More depth on deliverables, program structure and evaluation, as well a peek at what is to come in Phase II of the program will be shared.

Polycyclic aromatic hydrocarbons in white shrimp following the Deepwater Horizon accident: community-based science from southeast Louisiana

J. Wickliffe, Tulane Univ; D. Nguyen, Mary Queen of Vietnam Community Development Corporation; M. Wilson, B. Simon, J. Howard, Tulane Univ; S. Frickel, Brown Univ

The Deepwater Horizon Oil Spill had a profound impact on communities living and working along the US Gulf Coast. One could easily argue that the impacts were felt well beyond the US in myriad ways including research, science, policy, and how those are interconnected. Among those most deeply impacted were our fishing and seafood harvesting communities. Generally speaking, research intensive academic institutions and surrounding seafood-reliant communities

do not have "shovel-ready" working relationships. Specifically, those that would allow them to jointly respond to environmental health issues during and immediately following a coastal disaster. This was not the case as we report our research results here. We worked as a team (academic researchers and shrimpers) to develop a plan to address paramount concerns regarding the quality of white shrimp that could or would be harvested in 2010 immediately following the capping of the Macondo well. This was done in a culturally appropriate and transparent manner to produce high quality scientific results (i.e. publishable) and meaningful information to our local seafood reliant communities. In short, we developed a sampling strategy that addressed community- and fisherfolk-specific concerns and used analytical chemistry to determine the presence and quantity of 81 polycyclic aromatic hydrocarbons (both pyro- and petro-genics) in white shrimp from distinct sites in southeast Louisiana. Very few PAHs were detected in white shrimp collected in November 2010, consistent with the findings of other researchers and health agencies. Survey data regarding consumption behaviors specific to heavy consumers (Vietnamese-American shrimpers and their local community) were used to develop relevant and comprehensive probabilistic risk assessments. No unacceptable health risks were found even among the heaviest consumers with respect to PAHs with known toxicities. Together, the results of this community based research project were effectively communicated back, including translations into Vietnamese, to this and other communities. In addition, research results have also been published in peer-reviewed scientific journals. While working with communities as part of a research effort requires patience, time, and energy, our work clearly demonstrates that it can produce meaningful results for all stakeholders that are involved.

Risk Messaging and Public Perception Among Gulf Coast Residents After the Deepwater Horizon Oil Spill

A.S. Kane, Univ of Florida / Dept of Environmental and Global Health

Developing and delivering meaningful risk communications for vulnerable or impacted communities presents dynamic and often multifaceted challenges for researchers. In response to Gulf coast community concerns regarding safety of inshore-harvested seafood after the DWH oil spill, we conducted analytical toxicology for oil spill-related contamination in fish, shrimp, blue crab and oyster, and discerned seafood consumption rates for Gulf coast residents relative to these same seafood categories. This presentation describes approaches taken to provide risk messaging and hazard communications back to participating communities. Many study participants were seafood workers who depend on ecosystem services for their livelihood, and personal identity relative to their multigenerational culture and heritage fisheries. Loss of ecosystem services to seafood working communities, where regular work and remuneration are essential to support families and businesses, can make community members more vulnerable, i.e., less resilient in coping with adverse events and adapting. A case study approach portrays how outreach materials for these communities was developed and delivered by a team of scientists in concert with community partners. Two primary tenets were considered to develop outreach and hazard communication content for communities that were both affected by the oil spill and suffered declines or collapses in their fishery resources: (1) know your audience, and (2) know your audience. Piloting of outreach materials with community partners and

residents provided feedback essential to refocusing and better targeting content to foster clarity and meaningfulness for coastal residents. Community engagement in all phases of the study proved an important component of this community-based research to build trust essential to perceiving scientists as a resource, understanding how background levels of PAHs and DOSS in their seafood were not related to the spill, nor their fishery collapse, and valuing scientists' contributions to the community. Understanding different perspectives between and within communities, relative to environmental issues and perception of risk, is vital to messaging science in support of community resiliency, and contributing to the sustainable health of residents and their coastal environments. Supported, in part, by grant from the National Institute of Environmental Health Science (U19 ES020683).

Mining the Traditional Ecological Knowledge of Gulf of Mexico Communities to Help Unravel the Legacy of the Deepwater Horizon Oil Spill

D. Wetzel, Mote Marine Laboratory / ELF; J. Reynolds, Mote Marine Laboratory

The Deepwater Horizon oil spill tragedy happened over six years ago, with long lasting impacts on the affected environment and the people who live there. As is expected after such an environmental disaster, a number of studies have been or are being conducted to assess a range of physical, chemical and biological issues, including but not limited to factors that influenced movement and distribution of the oil, the fate of the spilled oil and dispersant, and the effects of oil and dispersant on exposed habitats and organisms. Studies have also been conducted that have addressed the socio-economic and human health impacts on the residents of the impacted areas. However, this effort, as in most environmental research, has typically occurred in the absence of any community input or even awareness. Granted, the execution of research must be done using principles of proper scientific process, which does not require an engagement of local communities. However, the coastal communities of the Gulf of Mexico are deeply dependent on healthy ecosystems and living resources for their survival and well-being, and whereas they rely less than scientists on written documents or scientific analyses, they possess unusual insights into types, extent and causes of environmental changes. They can be productive and valuable partners in developing research initiatives by providing traditional environmental knowledge (TEK) that non-local scientists will never have. Community based participatory research benefits scientists significantly by providing historic environmental information, which is usually not formally documented, but rather is orally passed down through the generations. Archival of videos and diary notes from community members collected during and after the Deepwater Horizon spill, documenting daily observations of a major spill, are yet untapped resources that can still be used to help understand the environmental impacts from the spill. A partnership between a multidisciplinary group of scientists and communities directly impacted by environmental changes takes considerable time in which to achieve trust, extra communication, and a willingness to explore alternative ways of understanding nature and the natural environment. That effort is worthwhile both scientifically and societally, to better assess and solve environmental problems, manage and regulate natural resources, and promote compelling environmental awareness.

Oiled Vision: Understanding Fishes' Visual Response to Oil Spills through Research and Film

E.K. Barnes, Univ of North Texas; D. DiNicola, Univ of Miami RSMAS; J.T. Magnuson, Univ of North Texas / Biology; M. Levin, Univ of North Texas / Dept of Media Arts; J. Stieglitz, Univ of Miami – RSMAS / Division of Marine Biology and Fisheries; M. Grosell, Univ of Miami / Deaprtment of Marine Biology and Ecology; A.P. Roberts, Univ of North Texas / Dept of Biological Sciences Inst of Applied Science

The Deepwater Horizon oil spill resulted in a variety of issues concerning both environmental and human health and consequently had extensive coverage by the press during clean-up efforts. Research on the ramifications of the spill is still being undertaken six years later. This project centers on a charismatic gamefish potentially affected by the spill, mahi-mahi (*Coryphaena hippurus*). Mahi-mahi are dependent on vision for feeding, schooling, spawning, and predator avoidance, like many other large pelagic sportfish. The immediate effects of oiling on juvenile mahi-mahi vision were the focus of research and the basis for a short film. As humans are a highly visual species, the film is designed to make the mahi dealing with visual impairment and deformities caused by oil exposure, relatable. When the eyesight of another animal is failing, the volume of the loss can be understood by the public because of how dependent humans are on vision. The film covers an aspect of the research following the Deepwater Horizon oil spill in a way that helps viewers understand the effects in a new and engaging way; through the eyes of a fish. This research was made possible by a grant from The Gulf of Mexico Research Initiative.

How research in oil and surfactant toxicity helped create a community outreach program in southern Louisiana

C. Green, Louisiana State Univ; J.A. Nyman, Louisiana State Univ / School of Renewable Natural Resources

Large amounts of oil spill and wetland research is virtually unintelligible to non-scientists. We are attempting to help non-scientists understand some of this research. Although no spills are preferred, the public is concerned that many current oil-spill clean-up products are only slightly better than the spill effects alone. The public also express concerns about the overall toxicity of the ecosystems they live and work in. Initially, we planned to share information with non-scientists at fishing rodeos within coastal Louisiana, however, that proved unworkable. We then prepared and posted videos on YouTube and also offered public meetings. Our outreach team conducted a series of informational workshops at libraries in Louisiana and recorded metrics of attendance and participation. These initial meetings provided incomprehensible jargon to small audiences but later meetings have been better suited and to larger audiences. Collaborations with LSU's Coastal Roots program, Louisiana Sea Grant and its network of extension agents, and creating a Facebook page to assist in advertising the YouTube videos and public meetings has increased our ability to interface with the community. The team has also conducted a two-day workshop for high school science teachers intended to help them create curriculum for oil and surfactant related topics within their courses. These workshops are a mixture of demonstrations, relevant classroom experiments, and lectures. Printed materials distributed at events complement our oral presentations and demonstrations. To date we have brochures that detail

importance of fish physiology and how surfactants in everyday life and their use. We have created videos to detail how toxicologist determine acute toxicity and have created a brief video to inform people about the use of aquatic organisms in toxicology testing. We continue to be challenged when we try to teach non-scientists information, however, we believe that we have discovered what works and what does not work within our community.

Post-settlement conclusions of the Trustee toxicity testing program conducted in support of the Deepwater Horizon Natural Resource Damage Assessment

J.M. Morris, M.O. Krasnec, C. Lay, H. Forth, R. Takeshita, J. Lipton, Abt Associates; M.L. Gielazyn, NOAA / co USEPA Region IV

A settlement resolving civil claims in excess of $20B with BP was finalized in April 2016, six years after the Deepwater Horizon (DWH) disaster. Since 2010, we have designed, implemented and managed the Trustee toxicity testing program for the DWH Natural Resource Damage Assessment. This program included over 600 toxicological bioassays and related chemical characterizations. The objectives of the program were to determine the toxicity of DWH oil, dispersed oil, and dispersant to native and surrogate species in the Gulf of Mexico. To that end, we developed a large study matrix with over 35 species of fish and invertebrates and a variety of lethal and sublethal endpoints. Samples of DWH oil representing four distinct degrees of weathering and one dispersant (COREXIT 9500) were tested through a variety of different exposure routes including water accommodated fractions, surface sheens, direct oil exposure, sediment, and dietary. We also investigated the effects of additional environmental stressors including photo-induced toxicity. The studies were conducted by Abt Associates and NOAA scientists along with over 24 principal investigators from collaborating university, government, and private laboratories. We will discuss our more unique discoveries and how information from this program is being reported to the public through various presentations, data portals, and documents.

Sublethal impacts of the Deepwater Horizon oil spill on pelagic top predators from the Gulf of Mexico – communicating science to a broad audience

M. Grosell, Univ of Miami / Deaprtment of Marine Biology and Ecology; D. DiNicola, Univ of Miami RSMAS; J. Stieglitz, Univ of Miami – RSMAS / Division of Marine Biology and Fisheries; Y. Wang, RSMAS Univ of Miami; E. Mager, Univ of North Texas / Dept of Biological Sciences; D. Nelson, R.M. Heuer, Univ of North Texas; D. Crossley, Univ of North Texas / Dept of Biology; L. Schlenker, RSMAS, Univ of Miami / Marine Biology and Ecology; C. Pasparakis, Univ of Miami; P. Perrichon, Univ of North Texas; J.T. Magnuson, Univ of North Texas / Biology; L.E. Sweet, Univ of North Texas / Dept of Biological Sciences; A.P. Roberts, Univ of North Texas / Dept of Biology Inst of Applied Science; D.D. Benetti, Univ of Miami / Dept of Marine Ecosystems and Society

A wide range of sublethal effects have been observed in mahi-mahi following exposure to surface slick oil obtained from the 2010 oil spill in the Gulf of Mexico. These sublethal effects include, but are not limited to, reduced swim performance, impaired ability to avoid oil, impaired visual acuity, reduced stroke volume and cardiac output in adults as well as larvae, increased

embryonic metabolic rate and energy depletion. An overview of these effects, many of which are observed after brief exposures (< 24 hours) at low and environmentally relevant PAH concentrations (< 10 µg total PAHs/l) will be presented. While these sublethal effects may impair ecological fitness and long term survival, they are difficult to relay to a broad lay audience due to the complexity of the findings. We employ a range of outreach strategies, including social media, hands-on demonstrations at various events, school visits, and web based video media to disseminate our findings to the broader public. In addition, we are currently developing and testing a web-based interactive teaching module aimed at grades 4-12 on aerobic swim performance. In this web-based teaching module, students at various levels will be able to use real data to perform simulated experiments. As part of the simulations students will select experimental animals and experimental conditions and be introduced to data analysis and complex physiological considerations. The web-based simulation module is paired with lesson plans to assist teachers in tailoring teaching to their students' grade level and includes an assessment of the knowledge gain obtained by the students after having completed the module. The assessment is paired with detailed demographic data allowing for direct evaluation of impact of this outreach effort. This research was made possible by a grant from The Gulf of Mexico Research Initiative. Data are publicly available through the Gulf of Mexico Research Initiative Information & Data Cooperative (GRIIDC) at https://data.gulfresearchinitiative.org.