WRITTEN TESTIMONY OF
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TESTIMONY ON
Examining the Lingering Impacts of the BP Deepwater Horizon on the Gulf of Mexico
HOUSE COMMITTEE ON NATURAL RESOURCES

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Good morning Mr. Chairman, Mr. Ranking Member, and the distinguished members of the House Committee on Natural Resources. I thank you for the opportunity to testify today. My name is Fernando Galvez. I am an Assistant Professor in the Department of Biological Sciences at Louisiana State University. My team, in collaboration with Dr. Andrew Whitehead at LSU, is leading a collaborative research endeavor to study the effects of the BP Deepwater Horizon oil spill on marsh fish in the northern Gulf of Mexico. I would like to discuss some of the recent findings of our research published on August 26, 2011 in The Proceedings of the National Academy of Sciences (*www.pnas.org/cgi/doi/10.1073/pnas.1109545108; see Abstract of publication below)*. To my knowledge, this is the first report in the scientific literature on the biological effects of the DWH oil spill in fish. In my written testimony, I will also discuss some of the difficulties we encountered in doing this research, and some of the remaining issues that impede the ability of academic institutions to conduct similar work.

Following the Deepwater Horizon (DWH) drilling disaster on April 20, 2010, in the Gulf of Mexico, acute oiling and the resulting mortality of marine wildlife were evident. The close proximity of Louisiana State University to the northern Gulf of Mexico and our capacity to mobilize quickly in the first few days following the explosion of the DWH oil platform, provided us the unique opportunity to study the biological effects of this unprecedented and tragic event. In contrast, the sublethal effects, critically important for predicting long-term population-level impacts of oil pollution have not been well described following the DWH disaster. Here we report effects of oil exposure on fish resident in Gulf of Mexico coastal habitats.

We chose the gulf killifish as our test organism because it is the most abundant fish in the coastal marsh of the Gulf of Mexico and thus an excellent environmental sentinel. Indeed, we are using it as our canary in the coal mine. Unlike other fish species in the Gulf, we understand a lot about their ecology, physiology, biochemistry, and genetics, and have

excellent experimental tools at our disposal to use. Tissues were collected from fish at six different sites from Louisiana to Alabama (Figure 1), and sampling was performed in early May 2010, before oil made its landfall, in July 2010, during the peak of oil landfall, and in early September 2010, when much of the oil had disappeared from the water surface. We also sampled the water and sediments from each site for hydrocarbon analyses, and satellite imaging provided an estimate of the proximity of surface oil to each site. An important and unique feature of this study is that we have data collected from fish before oiling. These pre-event data are extremely rare in toxicological studies, and add to the strength of our conclusions. To collect these early-event data required the ability to mobilize our research programs quickly.

Without going into too much detail, we found dramatic cellular effects in fish collected from coastal Louisiana coincident with the timing and location of oil contamination. Cellular effects were predictive of adverse health consequences, including developmental and reproductive impairment, toxicity, and death. Fish gill tissues, which are important for maintaining critical fish body functions, appeared damaged and showed cellular changes diagnostic of exposure to the toxic components of hydrocarbons (Figure 2). What was equally striking was that these biological effects persisted even though chemical testing found only low to non-detectable concentrations of hydrocarbons in fish tissues. In other words, although chemistry suggested these fish were safe for human consumption, it was insufficient to predict or detect any of the sublethal biological effects in Louisiana killifish we observed. The magnitude of tissue, cellular, and genetic effects seen in fish from our oiled site in Louisiana suggest impacts on fish growth, reproduction, development, and performance, all highlighting the potential ecological consequences of exposure.

We also found that most of the oil in the marsh is not in the water, but rather tied up in sediment, where it is found in extremely high concentrations. A big lesson from the Exxon Valdez is that sediments can act as a long-term reservoir of oil that can persist to expose animals to toxic concentrations over long periods of time. In current studies, we are finding that embryos exposed to oiled Louisiana sediments are hatching at lower frequencies and are showing developmental abnormalities, and that embryos that do go on to hatch successfully are smaller and listless. Additionally, sediments from oiled sites appear to be almost as toxic today as they were during the peak of oiling in the summer of 2010.

What our data describe are the early-warning signs that have been shown in the past to correlate well with population-level declines as seen with Pacific herring, pink salmon, and the sea otter, in the years that followed the Exxon Valdez oil spill. What we don't know is how wide spread these effects are going to be over space and time, nor whether the responses we see in killifish also exist in other ecologically-important species, or in fish of commercial importance. We need to be measuring these end points in many species to know the full extent of the problem. We can wave our hands all we want, but unless we collect these biological data, it will be difficult to link the oil spill to future population declines. Another important point is, that we need to be making these measurements over the long-term to get a better handle on multi-generational effects,

which although time-consuming and resource-intensive, are the most predictive of population and community level effects.

Research on the DWH oil spill has provided several important insights I would like to conclude by making brief statements regarding research funding, access to sample sites during the peak of oiling, and access to Mississippi Canyon 252 oil.

Reliable Sources of Federal Funding Are Required to Promote Early-Response Research Following Natural and Man-Made Natural Disasters.

Emergency funding for scientific research was virtually non-existent for several months following the DWH spill. In fact, Dr. Whitehead and I paid for the initial funding of this research with our own credit cards before our Dean of Science graciously pitched in for expenditures. With time, we were able to secure funding through the invaluable, NSF RAPID program and through the Gulf of Mexico Research Initiative (GRI). Unfortunately, the National Science Foundation was faced with budgetary constraints at the end of the fiscal year that limited their ability to provide extensive funding. Furthermore, GRI money took up to 4 months to disseminate, making it difficult to pay for early time point sampling. Although these funds were well received, they consisted of small amounts of funding over short durations. Both factors precluded hiring additional staff to conduct the work. Instead, we were forced to divert existing students and postdoctoral fellows from existing projects due to the time-sensitive nature of the DWH work. In my opinion, the federal government needs to do a better job of providing a reliable source of emergency funding to support transparent, cutting-edge, and unbiased academic research following natural and man-made environmental disasters – especially since early-event data are the most important.

For the past 20 years the Department of Interior has directed funds through the BOEM (formerly MMS) to LSU for the purpose of conducting environmental research that is directly relevant to oil and gas exploration in the Gulf of Mexico. The funding has been administered through LSU's Coastal Marine Institute (CMI). Ironically, at a time when the importance of such ongoing research has never been more apparent, this funding is at risk of being eliminated or significantly reduced. We urge congress to take action to insure that this important funding is at least maintained and hopefully increased. This funding has allowed for sustained long-term environmental research and could be a good vehicle for providing rapid-response funding that was so desperately needed in the early stages of the Macondo disaster. Further, it would also be helpful to urge BOEM to modify its long-standing policy of requiring 1:1 institutional match. Especially during this period of dramatically reduced funding for higher education, this matching requirement is a substantial impediment for innovative research.

Access to Sample Sites Should be Available to University Researchers.

It is understandable the need to regulate the movement in and out of coastal habitats following oiling, however far too many researchers found it difficult or impossible to gain access to critical sample sites along the northern Gulf of Mexico. Private security

companies and local police were used to keep people at bay, while citizens became increasingly cynical of BP and federal agencies for the complete lack of transparency. University researchers who did manage to obtain funding were finding it difficult to complete projects due to the inability to gain access to field sites. Fortunately, our research group managed to obtain a BP Access Pass, which allowed us uninterrupted access to sample sites. Ironically, had we not obtained this permission, we likely may never have had the opportunity to sample the Grande Terre, Louisiana site during the height of oiling when sublethal biological effects were most pronounced.

Access to South Louisiana Sweet Crude from Mississippi Canyon 252

It has been exceedingly difficult for researchers to obtain Louisiana sweet crude from Mississippi Canyon 252 (MC252), or even comparable surrogate oil, for toxicity testing under controlled, laboratory conditions. Early on, researchers were provided with standard letters from BP stating that oil was not available for distribution. Some laboratories did manage to obtain limited quantities of MC252 oil, but its distribution was once again disrupted when a federal judge issued a preservation order requiring its storage. With that said, a formal request process to obtain small quantities of MC252 does exist, although researchers need to complete an application process ensuring that the oil is absolutely necessary. Regardless, BP does not appear to have made any significant shipments of the oil to academic researchers capable of conducting independent and transparent research. Recently, a surrogate well was drilled capable of producing oil of similar chemical composition to that of MC252. Like the case for MC252, its distribution has been slow to transpire and subject to the same application process. As an example, my colleague, Dr. Andrew Whitehead, received a letter from BP confirming that shipment of a surrogate crude had been approved, and would be arriving soon. Seven months later, his group still has no oil, putting this federally-funded research in serious jeopardy.

Importance of Basic Science Research Funding:

It should be clearly noted that much of the tools, techniques, and paradigms applied in our oil spill research was facilitated by advances in basic sciences research (as distinguished from applied science research). For example, incredible recent advances in comparative physiology, cell biology, molecular biology, and genome biology, facilitated through basic science sources of support such as the National Science Foundation, were critically important for enabling the discoveries that we have made about the effects of this oil spill. Basic science has been, and will remain, the foundation upon which applied science discovers solutions to immediately practical problems for example in health and environmental sciences. However, funding for basic science in the United States, for example through the National Science Foundation, has remained flat or declined in recent years, whereas support for applied sciences, such as through the National Institutes of Health, has remained relatively robust. We think that this is short-sighted. Funding for basic sciences in the United States must be considerably increased as an investment for remaining internationally competitive.

Thank-you for your attention. I would be pleased to answer your questions.

Abstract from Recent PNAS publication:

The biological consequences of the Deepwater Horizon oil spill are unknown, especially for resident organisms. Here, we report results from a field study tracking the effects of contaminating oil across space and time in resident killifish during the first 4 months of the spill event. Remote sensing and analytical chemistry identified exposures, which were linked to effects in fish characterized by genome expression and associated gill immunohistochemistry, despite very low concentrations of hydrocarbons remaining in water and tissues. Divergence in genome expression coincides with contaminating oil and is consistent with genome responses that are predictive of exposure to hydrocarbon-like chemicals and indicative of physiological and reproductive impairment. Oil-contaminated waters are also associated with aberrant protein expression in gill tissues of larval and adult fish. These data suggest that heavily weathered crude oil from the spill imparts significant biological impacts in sensitive Louisiana marshes, some of which remain for over 2 months following initial exposures.

Figure 1. The sample sites used in the PNAS study. GT- Grande Terre, LA; BSL- Bay St. Louis, MS; BFP- Belle Fontain Point, MS; BLB- Bayou La Batre, AL; FMA- Fort Morgan, AL; MB- Upper Mobile Bay, AL.

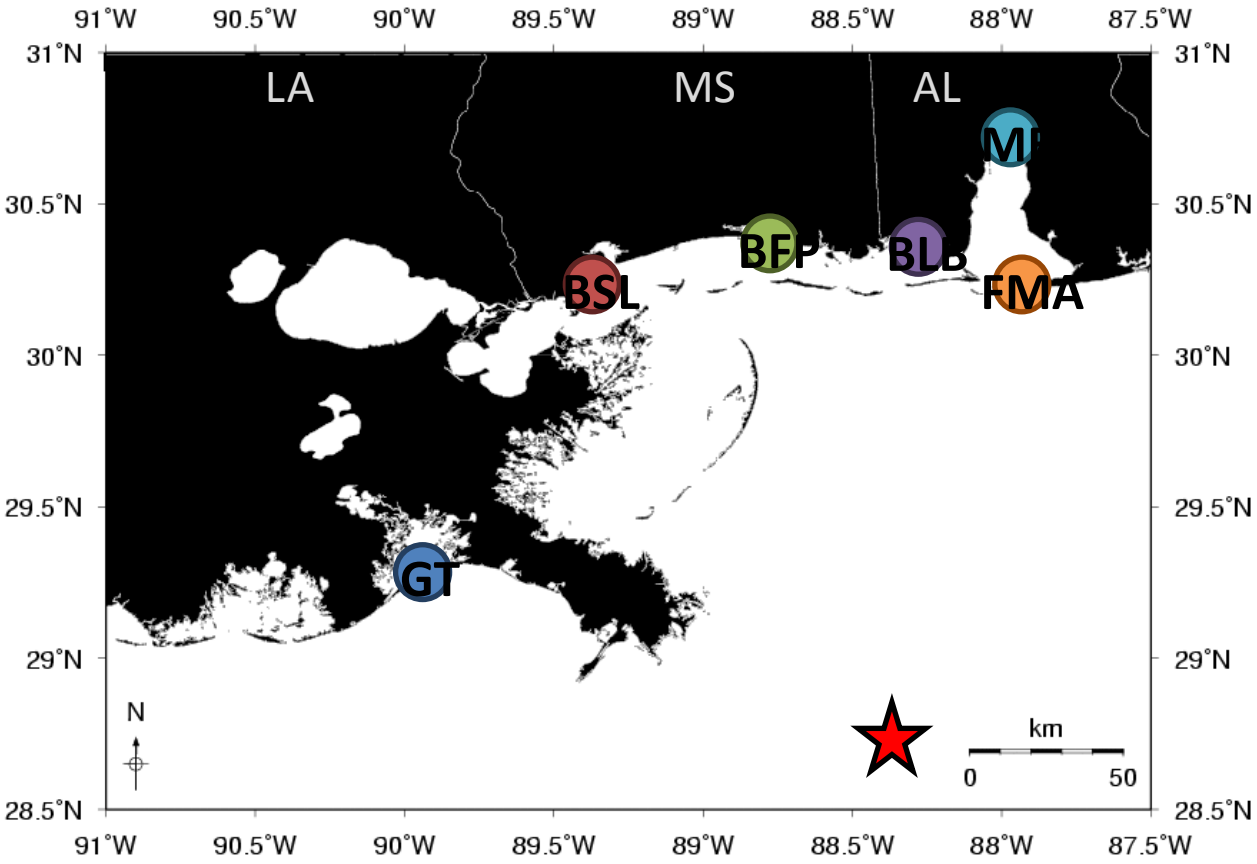

Figure 2. The gills of fish collected from an unoiled site and an oiled site at Grande Terre, Louisiana. Gills were tested for exposure to crude oil using a technique called immunohistochemistry for the changes in the relative concentrations of the protein, CYP1A (dark red color). CYP1A is a hallmark of exposure to the toxic components of crude oil, and is increased significantly with crude oil exposure.. Gill tissues from oiled fish showed a clear cellular response to exposure to crude oil at Grande Terre, LA, and caused deleterious alterations in the structure of the tissue.