Written Testimony of Dr. Christopher F. D'Elia, Ph.D.
Committee on Natural Resources
Subcommittee on Insular Affairs, Oceans and Wildlife
"Ocean Science and Data Limits in a Time of Crisis: Do NOAA and the Fish and Wildlife Service (FWS) have the Resources to Respond?"
Tuesday, June 15th at 10:00 a.m.

Chairwoman Bordallo and members of the Subcommittee, my name is Christopher F. D'Elia, and I am a Professor and the Dean of the School of the Coast and Environment at Louisiana State University. I welcome this opportunity to be with you today to testify about the gaps and limits in our understanding of the complex estuarine, coastal, and marine environments of the Gulf, and especially, how limited investments in coastal ocean science programs and ocean observation systems affect capabilities for NOAA and other Federal agencies to provide timely and accurate scientific information to target response activities and to assess damages to natural resources.

You have asked me to provide my perspectives on the existing gaps in observation data needed to predict the extent and trajectory of the oil spill, including information about subsurface plumes; the adequacy of pre- and post-impact spill data needed for conducting natural resource damage assessments; and additional data required to understand the impact of the oil spill on the marine environment.

Federal personnel and their research and monitoring assets are critically important at this time of national crisis, and agencies like the Coast Guard, NOAA, USGS, and EPA have been challenged by the complexity and magnitude of this spill. Moreover, the Federal Government plays a critical role in funding extramural research and monitoring.

The academic community and private sector's potential contributions to understanding an event as complex as this are enormous. Non-Federal partners such as universities like LSU depend heavily on federal funding to undertake their research and monitoring efforts. Unfortunately, for a variety of reasons that funding, regardless of source, has been slow to materialize as this crisis evolves. Before I elaborate further on that, let me address the issues that you asked me to comment on.

Existing Gaps in Observation Data Needed to Predict the Extent and Trajectory of the Oil Spill

One of the greatest challenges faced is predicting the extent and trajectory of the oil leaking from the seabed. Doing so requires synoptic and real-time physical oceanographic and meteorological information, in tandem with robust satellite observations and simulation modeling. The Integrated Ocean Observing System (IOOS) is a federal, regional, and private-sector partnership for collecting, delivering, and using such information. IOOS provides essential data and information needed for predicting the extent and trajectory of the spill. IOOS is a prime example of the value added by academic and private sector entities that receive support from Federal agencies. The IOOS community, like many others, has been rallying to aid the response effort. Despite the best efforts of all involved, there is still a critical lack of actual data for the surface and subsurface conditions in the Gulf that dictate the fate of the oil. A well-designed network of sustained observations in real-time is critical to providing the data needed for forecasts that guide the work of responders. Later, these same data will provide critical baseline information that will be an essential component during the restoration process.

Unfortunately, the Gulf of Mexico has, until recently, had very poor coverage for measurements of currents and meteorological conditions. For example, high frequency (HF) radars, which provide real time data on the direction and strength of surface currents, are unavailable in Louisiana coastal waters. In response to the spill disaster, the University of Mississippi, with assistance from the NOAA IOOS Office and Scripps Institution of Oceanography, recently re-deployed 3 high-frequency radar (HF radar) units. However, these systems provide coverage of only a portion of the Mississippi/Alabama/Florida continental shelf. The Louisiana coast, including the Mississippi Delta region, still has no HF radar coverage! This data gap needs to be filled as soon as possible. The lack of this information is jeopardizing the Louisiana oil containment efforts. Considering that the port of South Louisiana (New Orleans/Baton Rouge) is the largest bulk cargo port in the world and the Louisiana coast is the location of the majority of drilling for oil and gas in the U.S., this expenditure by the federal government is well justified and long overdue. With the onset of hurricane season, a robust suite of HF radar systems is needed especially in the region around the Mississippi delta. In addition, the redeployed HR radar units along the Miss/Al/Fla coast should be made permanent. There are also other technologies for measuring and monitoring ocean conditions critical to understand the fate of the oil that can and should be deployed.

At the request of the NOAA IOOS Office, SECOORA and GCOOS have been working with their numerous partners in academia and industry on a strategy for mapping and monitoring the subsurface plume and for providing observations for the initialization, validation and assimilation of the available circulation models. This provides the Incident Command Center with one high-level strategy that represents the input from multiple institutions and players.

Regional ocean circulation models operated by researchers at Texas A&M and the University of South Florida are now accessed daily by the Federal Incident Command Center. NRL and NOAA operate similar models but as the experience of the National Weather Service in predicting hurricanes has shown, ensemble modeling improves forecasts and predictions. I understand that such ensemble models are in development. Circulation models provide enhanced understanding of how currents, such as the Loop Current and its eddies, winds, river plumes, and other salinity patterns and temperature regimes will influence the fate of the oil.

More alternative models by different teams of investigators would increase the robustness of plume forecasts.

While large-scale regional models are critical to understanding the circulation of the Gulf, in deep water, these models are not particularly useful for near-shore predictions of the fate of oil, such as in Barataria Bay, Breton Sound or the numerous other estuaries along the northern Gulf of Mexico coastline. Here, LSU scientists are able to provide considerable expertise based on their long-term observations of coastal processes and as well as their experience with near-shore and estuarine models in these areas.

The northern Gulf communities deserve the best possible real-time satellite images showing the location of oil especially in near-shore regions. The satellite data are useful for indicating the presence of oil. However, aerial overflights are also essential to resolve adequately the details of oil thickness and identify coastal areas at greatest risk. This information is currently not being provided to local responders in a timely manner. According to BP, such coverage by aerial surveys is too much of an expense! The government should demand this information with daily updates. These data are essential in tandem with real-time currents from the HF radar systems for predicting inner shelf trajectories of oil that are currently and will continue to impact our barrier islands and enter through tidal channels to adversely affect Louisiana's environmentally sensitive shallow bays and marshlands.

The Earth Scan Laboratory (ESL), the WAVCIS Program, and the Coastal Studies Institute Field Support Group, all in the School of the Coast and Environment at LSU, currently provide some of the data essential to the real-time tracking of the oil from the BP-Deepwater Horizon drilling accident allowing short-term predictions as to trajectories of the oil in various sectors of our coast. The Earth Scan Lab has three antennas which give it access to real-time satellite coverage many times each day of the Gulf of Mexico using several sensors (MODIS, GOES-East, AVHRR). These data have been used to reveal the spatial extent of the oil, its motion, and the motion of the Loop Current and its eddies. They are provided on the ESL web site in near real-time (www.esl.lsu.edu) and archived at the ESL for time-series studies. In addition, the ESL staff has been using radar (SAR) data obtained daily from the University of Miami CSTARS lab, augmenting capabilities for detecting oil across the Gulf. The satellite coverage has been an essential component of the response to this spill. However, the satellite data could be more useful with validation, which has been almost impossible for LSU researchers to obtain.

The WAVCIS system provides real-time met-ocean data at eight stations along the Louisiana coast. Coupling of remote sensing and physical data into numerical coastal models could improve the prediction of the path and fate of the oil. Each WAVCIS station collects data on wind speed and direction, wave height and period, and current speed and direction among other parameters. These data are telemetered by satellite link back to a central processing station at LSU and the data are made available in a web-based format in near real-time. In addition, the

WAVCIS program boasts a highly sophisticated suite of hydrodynamic models that have proven very useful in tracking and predicting future migration of the oil slick. In addition, WAVCIS models are used to provide a series of predictions including an 84-hour wave forecast and a 120-hour surface current forecast (see: http://wavcis.csi.lsu.edu/forecasts/forecasts.asp?modelspec=currents).

With such sophisticated data-collection systems it is absolutely essential to have high quality technical support during the current oil spill period. Sustained Federal funding is necessary for us to continue to provide essential services such as ESL and WAVCIS. Current Federal appropriations do not provide sufficient resources for us to meet our needs, and we are unaware of any Federal program that can provide necessary support.

The Adequacy of Pre- and Post-Impact Spill Data Needed for Conducting Natural Resource Damage Assessments (NRDA)

For many years, LSU has occupied numerous research sites in wetlands, estuaries and embayments all along the Louisiana coast. For example, the Shell/LSU Breton Sound Ecosystem Project of the Northern Gulf Institute includes data collection from a variety of platforms and sensors. The pre-impact data obtained at those sites will undoubtedly be extremely useful for spill impact assessment for NRDA and to understand the unexpected consequences, and for other purposes. We emphasize that it is critical that our research at these sites continue and be adapted to monitor conditions as the spill progresses, as clean up efforts are undertaken, and throughout the ensuing recovery phase. It is essential to understand the resilience of Louisiana's coastal ecosystems to an event like the BP 2010 oil spill, because of the critical role these ecosystems have in sustaining seafood harvests and in providing essential habitat for wildlife. We are waiting to be informed of a mechanism by which we can apply for significant Federal funding to support our work, although we are told to expect opportunities shortly. It is nearly two months now since the spill began.

The NRDA assessments are obviously an important focus of the Administration for the recovery of damages from the spill. However, many scientists I have talked to express concern that important information must also be obtained outside of the NRDA process. One senior faculty member in my School expressed it as follows: "I haven't that much time left in my career, and I would prefer not to spend it in court. I would rather be working in the field doing my research on behalf of future generations."

The baseline to measure change and impacts is slipping away with each day and week that supplemental funds are absent, or that adaptive and focused new initiatives are stalled. The environmental, social and economic insults have come quickly (months), but the results will be here for decades. If we are to truly learn from this disaster, then we need to know much more about the pre-existing conditions and the transition as the spill progresses. We cannot start this in December – it needs to begin immediately.

Additional Data Required to Understand the Impact of the Oil Spill on the Marine Environment

Most of the research, monitoring and modeling that is now being conducted seems to be focused on offshore concerns pertaining to the fate and effects of oil and dispersant. Considerable attention has been paid to determining the location and magnitude of deep-sea plumes of oil and dispersant. While these are important concerns, particularly since dispersants have been used in unprecedented ways and amounts, we must not forget that the Louisiana coastal environment is particularly vulnerable and threatened. Since Louisiana's extensive wetlands constitute approximately 40% of the national total, and the State is second only to Alaska in terms of seafood production, we need to accelerate our efforts to understand the impacts of this dreadful spill on living resources from the continental shelf to coastal wetlands.

Louisiana is the focal point of the "Fertile Fisheries Crescent" that extends east and west into all or parts of Mississippi and Texas. Important fishery species include: oysters, brown and white shrimp, Gulf menhaden, blue crabs, king mackerel (offshore), red snapper, amberjack, cobia, dolphin fish, grouper, tuna/swordfish (offshore), spotted seatrout, and red drum. These species support economically important commercial and recreational fisheries as well as the human communities that depend on them in many ways – for employment, tourism, marinas, charter boats, seafood industries, etc.

Additionally, the above species depend on the "forage fishes" near the base of food webs such as Gulf menhaden and bay anchovy. Loss of these species would have serious implications for the entire food web. At present, we have little firm information on the status of these fish stocks vis-à-vis the oil spill.

Habitat concerns are also important and growing. Louisiana estuaries provide spawning, nursery and rearing (grow out) habitat for a huge array of estuarine-dependent species that migrate and spread to populate coastal systems across the northern Gulf of Mexico.

Louisiana's most important fishery habitat asset is its expansive coastal wetland system with an extensive marsh-edge shoreline that provides foraging (feeding) and refuge (shelter) sites for the early life history stages of commercial and sport fisheries and forage species. The marsh edge is highly vulnerable to oiling and resulting damage to its nursery function will form a bottleneck for the recruitment of virtually all of our most important species into adult populations. Up to 90% of our important species use our marshes and estuaries at some point in their life cycles.

The open waters of the Gulf of Mexico are also important for many estuarine-dependent species and for offshore species. Offshore food webs are potentially affected by Deepwater Horizon plumes, but this has yet to be studied. The Gulf of Mexico is the only spawning area for the heavily depleted Western Atlantic Bluefin

Tuna and the Gulf is an area of concentration of swordfish and marlin. While the densities of organisms may be lower in open waters than in other habitats, this translates into many numbers of organisms because of the volume of the open water habitat.

Life histories of species found in affected waters must also be considered. The longevity of a species relates to how risky its reproduction is. Short-lived species can complete their life cycles in 1 to 3 years. Because they are dependent on good and bad spawning years, their population sizes are quite variable from year to year. These species are highly productive but the fisheries associated with them are volatile as well, tracking good and bad years of spawning. Thus, additional mortality from external sources could accentuate the volatility.

Longer-lived species may not mature for five years or more and may live for 20-50 years. When unexploited, they can withstand a run of poor years of reproduction until conditions are right. However, long-lived species are also vulnerable to fishery impacts and in the Gulf of Mexico red snapper and a number of other long-lived species have been depleted and are under heavy management regimes. Accordingly, additional sources of mortality will dissipate the management benefits. For these long-lived species, the effects of high mortality years or low recruitment (due to oil) will leave a gap in the age structure of their populations. So if we lose the next 3-5 or more years of reproduction due to oil, there will be a long period of lowered egg production as these impacted year-classes make their way through the age-structure.

In extremis, large-scale recruitment failures could lead to long-term and serious changes in coastal ecosystems. It is possible for a “state change” to occur, for example. What is now a highly productive system in terms of fisheries and wildlife could become one dominated by microbial processes that are less capable of sustaining fish and shellfish species that coastal residents depend on in so many ways. I can only speculate here about this prospect, but it must be considered.

Habitat damage in Louisiana is likely to have severe effects on the reproductive success of both short- and long-lived species, but short-lived species like brown, white shrimp, blue crabs, seatrout and forage fishes (including bay anchovy and Gulf menhaden) are likely to suffer immediate population declines that will affect fisheries and the entire food web until estuaries and marshes recover from smothering and toxic effects of the Deepwater Horizon event. I have heard several fisheries scientists comment that herring have still not recovered in Prince William Sound more than 20 years after the Exxon Valdez spill. Will similar situations develop in the Fertile Fisheries Crescent?

We know that there are a number of possible exposure pathways that must be researched and quantified. Direct exposure may occur when fish swim through any concentration of dissolved or suspended petroleum constituents. Gill breathing animals like fish exchange gases and solutes with their environment across gill surface areas that appear small but are actually large compared the entire surface area of their bodies. Gill damage imperils respiration and gill uptake results in a body load that may have lethal or sub-lethal effects. Sub-lethal effects could seriously reduce a fish's viability or probability of reproductive success. The mix of individual contaminants may be at low concentrations and have only minor impacts, but the combined effects of different petroleum constituents, dispersants, and other contaminants may be more than additive (i.e., synergistic). The Deepwater Horizon Event is clearly adding many kinds of contaminants to the environment. Many scientists have urged that there be full disclosure of the composition of chemical compounds and mixtures used in dispersing spills such as Corexit 9500.

Fishes may suffer from indirect exposure that may also result from ingestion of contaminant-exposed prey. Fishes feeding on contaminated prey can accumulate an additional body load to that acquired from direct exposure. Contamination of food webs is likely to change the species composition of open water and estuarine fish communities. Sensitive species will diminish in population size and reduce prey availability to higher trophic levels. Thus, indirect effects of the Deepwater Horizon event could be spreading though the food web in unforeseen ways.

The timing of this event is troubling. Had it occurred during the winter, one would have expected less potential impact. Unfortunately, it has occurred during a season when many species are reproducing or migrating, and during which primary productivity (photosynthesis) is high. We do not know what if any, effects this spill will have on fundamental ecosystem processes such as energy flow and nutrient cycling. Fortunately, ongoing studies on these processes have been conducted in this region for years, but sampling frequency and geographic coverage should be increased markedly in spill-affected areas.

Because oil is a mixture of organic compounds that are subject to microbial processes such as respiration that consumes oxygen, there are other implications as well. Susceptibility of shelf waters to hypoxia is well known. Whether the added burden of the metabolism of the extra organic material represented by oil and dispersants is going to exacerbate hypoxia is unknown.

Other Considerations

Sitting on the sidelines and taking potshots at BP and Federal agencies is now accepted practice by many. One can easily understand why a mounting feeling of hopelessness has developed that leads to this happening. I prefer instead to make some constructive suggestions here about what might be done to improve our knowledge about the spill, its fate, its effects, and the ability of the environment to assimilate hydrocarbons and recover.

1. My foremost concern is that the academic research community has the potential of making considerable contributions beyond what it is now making. The biggest obstacle to this happening is funding. One Federal agency we approached told us that BP had funds for research, and we should check there first. In Louisiana, tight State finances have left LSU with frozen budgets and little flexibility to support

research internally. I have heard anecdotally from several faculty members that they are taking a chance and charging some of their research expenses to their own personal credit card accounts, hoping to be eventually reimbursed. Federal agencies need to have better mechanisms to get emergency funding to researchers. Only the National Science Foundation seems to do this effectively via RAPID awards, but even NSF's hands are tied because of budgetary constraints as the end of the fiscal year approaches. NOAA's Sea Grant program does have funding available for "program development" awards, but the amount of funding available is woefully inadequate for the tasks at hand. As of June 11, a search on www.grants.gov did not return any results for "oil spill." This seems remarkable to me.

2. Communication with the academic community should be enhanced. EPA Administrator Jackson did come meet with LSU faculty early on, which we greatly appreciated. It took nearly a month after the spill before other Federal agency leaders made a concerted joint effort to engage academic scientists and engineers in the Gulf. On June 3, NOAA, NSF and USGS sent high-level officials to participate in a meeting organized by the Consortium for Ocean Leadership at the LSU Lod Cook Center. This meeting was highly successful, very informative, and helped the academic community understand better the challenges faced by Federal agencies as they continue to confront the spill and its impacts. I hope that other such meetings follow, and that more frequent communiqués with university research leaders ensue. President Obama has appointed a team of extremely talented scientists to lead many Federal agencies, and they need all the support that can be provided from the White House and us in academe.

3. Ship time is difficult to find. This is quite understandable. Virtually all Federally supported research vessels are presently being fully utilized. Ships are expensive, and the only alternative to using Federally supported ships would be to charter ships from the private sector or abroad. It is not clear where the funding to do that would come from. In any case, again better communication mechanisms would help in making sure that if ships do become available, or berths on scheduled cruises are open, the appropriate opportunities can be conveyed to prospective users.

4. In my opinion, human health impacts (both in terms of exposure from sea food, air quality from the "controlled" burns, as well as the health of the response workers) have received inadequate attention at the Federal level. Again, I have heard rumors that major announcements are on the way, but with every day that passes, important baseline health data are not collected.

5. In my view, it is time to consider new ways in which sustained funding can be brought to bear with respect researching and monitoring the inevitable conflicts between energy and environment. It appears that offshore drilling will need to resume fairly soon, or the U.S. will be in an ever-worsening economic crisis due to a shortage of liquid fuel and an increasingly large balance of trade problem – something noted very clearly by the U.S. Military's "Joint Operating Environment 2010" report. In my view, there should be a Federal Gulf Oil Trust established using

federal oil and gas royalties from the Gulf, and perhaps fuel taxes as well. Sen. Mary Landrieu, D-La., has recently introduced legislation to allow Gulf Coast states to share 37.5 percent of the revenue from offshore oil and natural gas drilling. This is one possible approach. Some of this revenue could be directed to enhance research on oil drilling and production safety issues, on the environmental effects of this drilling and production, and on gaining a better understanding of Gulf of Mexico environment. There are other possibilities as well. The Land and Water Conservation Fund receives about $900 million from revenues from offshore oil and gas development. However, those funds are subject to Congressional Appropriation, which has ranged from zero funding (FY00-02) to as high as $369 million in 1979. This year's appropriation is just $38 million. The LWCF program provides matching grants to States and local governments for the acquisition and development of public outdoor recreation areas and facilities, which is very important. It would be great if the Land and Water Conservation Fund Act could be amended so that some of those funds could also be appropriated for coastal observing systems.

6. Directed federal funding should be provided to follow up on the emergency funding, such as NOAA’s Cooperative Institutes, which many regard as highly successful models. Centers of collaboration that bring together academic, government and even industry scientists and engineers would foster better communication and lead to better synthesis and integration of our interdisciplinary knowledge.

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