Testimony of

Dr. Denise J. Reed
Professor, Department of Earth and Environmental Sciences
Interim Director, Pontchartrain Institute for Environmental Sciences
University of New Orleans

before
The Subcommittee on Insular Affairs, Oceans and Wildlife
Committee of Natural Resources
U.S. House of Representatives

on
Ocean Science and Data Limits in a Time of Crisis:
Do NOAA and the Fish and Wildlife Service (FWS) have the Resources to Respond?

15 June 2010

Madam Chair and Distinguished Members of the Committee:

Thank you for this opportunity to discuss with you the need to respond to the Deepwater Horizon oil spill and the role that science and data collection can play in that effort. This crisis highlights the importance and vulnerability of our coastal ecosystems. I will focus on the existing status of scientific understanding of coastal change, how that can be leveraged to respond to the spill and where gaps in data and understanding are currently limiting our ability to respond. I will also identify several areas where the extent and character of our coastal system make the long-term tracking of the impact of the spill more challenging that may be immediately apparent. More specifically I recommend:

- Investments in predicting change in the impacted coastal ecosystems to enable the impacts of Deepwater Horizon to be separated from ongoing ecosystem degradation.
- Specifically track the performance and effects of response measures on the coastal ecosystem to allow the implementation of additional measures if necessary, and to assess the total impact of the event.
- Utilization and refinement where necessary of predictive models of water movements within the estuary to inform mobilization of response techniques.
- Focus on measuring and understanding the effects in open inshore waters of low concentrations of oil, especially on lower trophic levels and early life stages of commercially important species.
- Increasing access to agency collected data through a data management system, thus allowing university researchers to better leverage existing funding sources and develop necessary understanding for assessment of impacts.

My expertise has been developed through my training as a coastal geomorphologist at the University of Cambridge, specializing in the dynamics of coastal wetlands, and almost twenty five years of research on coastal marshes and barrier islands in Louisiana. I have authored scholarly publications on coastal wetland response to sea-level rise, and the effects of hydrologic change on marsh sustainability. I have also worked actively in restoration planning in Louisiana since the early 1990's including 'Coast 2050' in 1998, the Louisiana Coastal Area Study of 2004, the State Master Plan for coastal protection and restoration of 2007, and now the 2012 update of that Master Plan where we must consider the effects of this crisis on our long term goals for the coast. In addition, in recent years I have conducted research on coastal wetland restoration and participated in restoration planning in the Sacramento-San Joaquin Delta, San Francisco Bay and Puget Sound. I live in Terrebonne Parish, Louisiana in the small town on Montegut.

As a Professor at the University of New Orleans my research on coastal ecosystems is currently funded by a number of federal agencies including the US Fish and Wildlife Service, NOAA and the US Army Corps of Engineers. The thoughts and opinions expressed here are my own and do not represent the views of the University or any of these agencies.

Putting the Effects of the Spill in Context of Current Change on the Louisiana Coast

Coastal wetland loss in Louisiana is occurring at a rapid pace and wetland sustainability has become an issue of paramount importance even before the Deepwater Horizon event. The processes involved with coastal land loss and their interactions operate on a range of spatial and temporal scales. Essentially, most agree that coastal land loss and the massive degradation of the coastal ecosystem can be attributed to two types of factors – natural and human induced. This is a very dynamic landscape with riverine floods, sea-level rise, natural land subsidence, and storms from the Gulf leading to patterns of land building and decay on time scales from days to millennia. The constant adjustment among these natural factors produced a coastal ecosystem which sustained itself for thousands of years – constantly changing but productive. This balance has been disturbed by multiple human influences on the landscape, such as the construction of levees on the Mississippi River, the internal disruption of hydrology associated with the construction of canals for various purposes, and the introduction of an exotic herbivore, the nutria. Ecosystem degradation is the result of these and other factors interacting to produce complex patterns of stress to the ecosystem, ultimately resulting in land loss.

We understand these processes well and this science has been the foundation of our restoration plans for many years. The challenge for the assessment and restoration of the damages caused by the current oil spill will be separating out the effects of the spill from the long-term changes already going on. While the goal of the ultimate Deepwater Horizon restoration program will be to 'to speed the recovery of injured resources and compensate for their loss or impairment from the time of injury to recover', identifying this injury from the others to which this system is already being subjected will be challenging. It will require federal agencies to work in partnership with coastal scientists to develop and apply predictive models of ecosystem dynamics. We must identify how the trajectory of change of the coastal ecosystem has been influenced by the oil itself and by the response efforts, which if not conducted carefully in these sensitive environments may cause more damage than the oil. It is essential to put the effects of the oil spill in the context of existing coastal change.

Response at the Outer Shoreline

The concept that oil is easier to clean up in sandy environments compared to muddy wetlands is well accepted. This premise has led to calls for action at the outer shoreline to reinforce the sandy perimeter of the coast. The effectiveness of these measures, including a plan to build a long sand berm and close in tidal passes must be put in the context of how these systems have evolved and how they change.

The outer coast of Louisiana consists of low-lying sandy barrier with wide inlets, both deep and shallow. High rates of subsidence, coupled with sea-level rise, are compounded by the effects of tropical storms and hurricanes to produce a system of landward-migrating low sandy barriers which frequently are overtopped. The configuration of the islands and intervening inlets is not only controlled by waves and storms acting on the outer shoreline. Ongoing conversion of back barrier and interior wetlands to open water bays and lagoons increases tidal prisms (the amount of water that enters and leaves the estuary with every tidal cycle). Changes well behind the islands thus result in an increase in the flow of water moving through tidal inlets between the islands. Over time the continual increase in bay-tidal prism size together with the landward migration of the barrier systems results in an ever changing shoreline within which new tidal inlets are being formed and existing inlets are subject to changes in cross-sectional area (deepening and/or widening) and position.

Expectations of the performance of shoreline actions in containing the spill and providing clean up opportunities must take into account the potential for rapid changes at the barrier shoreline and the key role of inlets between islands in allowing tidal flows into and out of the estuary. Studies of just one area of the coast, Little Pass Timbalier, before and after the 2005 hurricane season at in showed that almost 13 million cubic yards of sediment was eroded from a 19 square mile area and this without a direct hit from a hurricane. Over four hundred yards of shoreface retreat was detected. While sand berms in the nearshore, as currently planned, may provide opportunities for cleanup in the near term, they may not last as long as the spill event. Even a minor tropical storm could erode them.

There is broad agreement that limiting the number of pathways for oil to enter the estuary would aid response. Currently the barrier islands are separated by large inlets, those which convey the majority of tidal flow and have formed over decades. In addition, there are many small cuts or ‘low spots’ on the islands which remain from the storms of 2005 and 2008. For the most part such cuts heal over time and natural sand transport fills them in. Accelerating this process to help spill response is certainly a reasonable approach. Using rocks or other unnatural structures for these closures may be necessary under these emergency circumstances but these measures should be considered temporary and be removed post-spill. Hard structures are not a natural feature of the Louisiana shoreline and our history has shown that rocks and breakwaters change patterns of sand movement disrupting the natural adjustments and the healing which can occur after storm events. We must be wary of causing long-term harm to the system with our emergency response measures especially where that harm can be avoided or likely outweighs the benefits of that aspect of the response.

As response measures are implemented at the shoreline it will be essential to understand their effects on shoreline dynamics. Changes in the coast resulting from the response itself could exacerbate ecosystem degradation and make long-term restoration more difficult. Changes in shoreline dynamics, the fate of any sand placed at the shoreline, and the effect on tidal exchange can and should be monitoring during and after the response effort.

Oil Movement into the Estuary

The barrier shoreline represents our outermost defense. But closing the shoreline completely is not an option. Tidal passes must remain open to allow for tidal exchange, the migration of organisms, and provide natural flushing. Rather than closing inlets or restricting their cross sections, efforts should be focused on how to contain the oil passing through the inlet. The amount of water which flows through the passes is not determined by the size of the pass. Rather it is related to the tidal prism and the amount of open water landward of the shoreline. Clearly the massive coastal land loss Louisiana has experienced has increased the tidal prism. That water must move in an out every day. If we make the tidal passes narrower in the hope of 'channeling' the oil and making containment easier the speed of water flow through the passes will simply increase. Containing oil in fast flowing waters is a challenge to our traditional clean up technologies and effective techniques must be incorporated into any plan which focuses on the outer shoreline.

Oil will move into the estuary. All agree that containment and removal in open water is far preferable to allowing oil to enter the wetlands. However, the complexity of the estuarine landscape means there are thousands of miles of potential destinations for the oil. To more effectively mobilize and deploy resources those on the ground require the best information available on the potential paths of oil movement.

Predictions of where the oil might go within the estuary require tools which appreciate the complex hydrodynamics of these shallow estuaries and the wetting and drying of wetlands each day with the tide. Oceanographic models often fail to incorporate these details, understandably so as they may not be important for understanding Gulf-wide circulation. But within the estuary researchers have developed tools which can support response. At the University of New Orleans researchers are using existing three dimensional computer models to estimate the trajectories of surface and subsurface tracers under various combinations of wind and tidal conditions. They can produce maps of the surface and mid-depth currents and directions for example events to aid local emergency planners is preparing for where the oil might move. The actual movement of oil on any day will depend upon local wind and tide conditions and oil may not move in exactly the same way as the water but these kinds of tools can help plan the response. Real time predictions would require model refinement and additional monitoring of tides and winds within the estuary. Such 'data assimilation' has been used in other estuaries to support emergency response as well as restoration planning and operations. Modeling approaches are available – investments in tool development, data collection and inshore observing systems are necessary for state of the art predictions of oil trajectories within shallow, complex estuarine systems.

Fate and Effects within the Estuary

The potential effects of oiling on coastal wetlands are well documented and the applicability of various clean up techniques, including natural remediation, in different situations is relatively well understood. The most important issue is to ensure that the clean up approach is tailored to the local conditions – what works in a wetland in one area may not be appropriate in others.

However, wetlands are only one part of the estuarine ecosystem. In the open water areas, both on the bay bottoms and in the water column, oil can be having an effect which is less obvious that the coating of larger wildlife or marsh grasses. Open waters are a huge component of the estuarine system and dominate the lower areas, adjacent to the tidal passes and inlets through which the oil enters. The effect on lower trophic levels, phytoplankton, algae and zooplankton, and how these are propagated to higher trophic levels, e.g., fish, must be evaluated not only through monitoring but by field studies of trophic interaction. For any specific organism a life cycle approach is important. This applies to all organisms, but is especially helpful with organisms such as fish because individuals often show very dramatic differences between their life stages. A typical fish life cycle is eggs, yolk-sac larvae, larvae, juveniles, and adults. The different stages can show major changes in their physiology, behavior, diets, and habitats utilized – and in susceptibility to oil – with early life stages being more sensitive.

Existing sampling schemes for routine monitoring of the ecosystem, e.g., Louisiana Department of Wildlife and Fisheries need to be supplemented to ensure they identify these smaller animals and that they encompass the variety of habitats currently and potentially impacted by the oil. In addition, synthesis efforts which refine understanding of the resilience of these populations to effects of oil must be used to guide assessment and subsequent restoration.

Data Accessibility and Management

The unprecedented extent of this event and its impact on a variety of marine and coastal environments has resulted in a massive data collection effort using a variety of sensors and data collection techniques. Making these data available, where appropriate given their use in the official assessment, to interested scientists and stakeholders would increase understanding of the ever changing effects and allow a wider range of experts, including university scientists like myself, to communicate with the public on the effects of the spill. To make such a varied array of data accessible requires a focus on data management as well as collection.

Knowing what data is being collected already also allows researchers to leverage available funding sources to focus on additional sampling. The Natural Resource Damage Assessment process calls for ‘reviewing scientific literature about the released substance and its impact on trust resources to determine the extent and severity of injury’. Establishing causality required understanding as well as data and many excellent scientists are willing and able to contribute and develop knowledge which can at least be used in future events.

Thank you Madam Chair and members of the Committee. This concludes my testimony.