

**The National Academies  
Division on Earth and Life Studies  
Ocean Studies Board**

**Effects of the Deepwater Horizon Mississippi Canyon-252 Oil Spill on Ecosystem Services  
in the Gulf of Mexico**

**Project Summary**

The Deepwater Horizon Mississippi Canyon-252 oil spill (DWH MC-252) resulted in nearly 5 million barrels (>200 million gallons) of crude oil spilling into the Gulf of Mexico. Impacts of the spill on ecosystem services could extend from the near term to years and decades in the future. This study will first assess the methodologies available for assessing spill impacts on ecosystem services in the Gulf of Mexico in an interim report. A second report will summarize what is known about the effects of the spill, evaluate impacts in the context of stresses from other human activities in the Gulf, and identify research and monitoring needs to more fully understand the effects of the spill and gauge progress towards recovery and restoration.

**Statement of Task:**

In order to evaluate the loss of ecosystem services in the Gulf of Mexico Large Marine Ecosystem due to the Deepwater Horizon Mississippi Canyon-252 spill, it is necessary not only to collect and analyze information related to specific types of services, but also to identify relationships among the lost ecosystem services and assess interdependencies. An evaluation of the effects of the spill on ecosystem services in the Gulf will require consideration of the effects of other human activities that have changed the balance of ecosystem services in the region. The following questions will provide a framework to assist federal agencies in assessing the effects of the oil spill on ecosystem services within the context of other human activities:

- (1) What methods are available for identifying and quantifying various ecosystem services, at spatial and temporal scales conducive to research, that provide meaningful information for the public and decision-makers?
- (2) What kinds of valuation studies and metrics are appropriate to measure the recovery of ecosystem services over time with regard to each of the following: natural processes, mitigation, and restoration efforts? What baseline measures are available that would provide benchmarks for recovery and restoration efforts?
- (3) Is there sufficient pre-spill baseline information available to separate oil spill impacts from impacts of other human activities? What methods are available to help distinguish impacts specific to the spill?
- (4) What ecosystem services (provisioning, supporting, regulating, and cultural services) were provided in the Gulf of Mexico Large Marine Ecosystem prior to the oil spill? How do these differ among the subregions of the Gulf of Mexico?
- (5) How did the spill affect each of these services in the short-term, and what is known about potential long-term impacts given the other stresses, such as coastal wetland loss, on the Gulf ecosystem?

(6) How do spill response technologies (e.g., dispersant use, coastal berm construction, absorbent booms, in situ burning) affect ecosystem services, taking into account the relative effectiveness of these techniques in removing or reducing the impacts of spilled oil?

(7) In light of the multiple stresses on the Gulf of Mexico ecosystem, what practical approaches can managers take to restore and increase the resiliency of ecosystem services to future events such as the Deepwater Horizon Mississippi Canyon-252 spill? How can the increase in ecosystem resiliency be measured?

(8) What long term research activities and observational systems are needed to understand, monitor, and value trends and variations in ecosystem services and to allow the calculation of indices to compare with benchmark levels as recovery goals for ecosystem services in the Gulf of Mexico?

### **Project Context and Issues:**

People benefit from a multitude of resources and processes that are supplied by natural ecosystems. Collectively, these benefits are known as ecosystem services. Ecosystem services are produced as a byproduct of the functioning of the ecosystem - the interactions of plants, animals and microbes with the environment. The spectrum of benefits provided by ecosystem services is ubiquitous and immensely valuable to society; they underpin our use of the land and sea and the well-being of all people. The Millennium Ecosystem Assessment employed a typology of ecosystem services relevant to the current proposed study: The provisioning services or material goods provided by ecosystems - "often simplified to "food, feed, fuel and fiber - " are the more easily recognizable services, because many of them are marketable commodities. The net benefits of these services typically will be overstated if there are external costs associated with providing these marketable commodities. For example, if the cost of bycatch and habitat degradation are external costs and not considered in determining the cost of providing seafood products, the net benefit of the seafood products will be overstated. Similarly, if pollution is a byproduct of providing these marketable commodities and the cost of pollution is not accounted for, the net benefit of those commodities will be overstated. Regulating services (climate regulation, flood control, water purification), cultural services (recreational, spiritual, aesthetic), and supporting services (nutrient cycling, primary production, soil formation) are less well understood and more difficult to quantify and value. However, current research is increasing our understanding of these ecosystem services, the interactions among different ecosystem services, and the impacts of humans on the ecosystems that produce these services. This research is increasing our ability to quantify and value ecosystem services and to use this information to inform decisions.

The Gulf of Mexico (GOM) Large Marine Ecosystem provides a wealth of provisioning services. Examples of these services include food, biochemical and medicinal compounds, energy, and fresh water. One of the most economically valuable ecosystem services is seafood; the 2007 GOM commercial fish and shellfish harvest yielded a first-sale value of \$654 million (1.35 billion pounds). Between 1992 and 2001, the GOM commercial fisheries accounted for approximately 25% of the nation's seafood landings. The GOM also has a significant recreational fishery, which accounted for over 40% of all U.S. marine recreational fishing catches in 2006. About 98% of these fisheries resources are dependent on the estuaries and wetlands of this region for food, protection, and spawning habitat. Marine species are also being

used as sources of biochemical and medicinal compounds. Extracts from the sponges, tunicates, bryozoans, and other invertebrates have shown pharmacological promise in the treatment of cancer, cardiovascular disease, infections, and inflammation.

In addition to these and other provisioning services, the GOM provides important regulating, supporting and cultural services. These include such diverse services as coastal tourism, along worth \$100 billion per year, storm surge protection by coastal wetlands, habitat for migrating waterfowl, cycling of nutrients from river discharges and the unique cultural heritage of coastal communities.

With the world's most developed infrastructure for oil and gas production, the GOM is one of the single largest suppliers of oil and gas to the U.S. market. Approximately 25,000 miles of active oil and gas pipeline exist on the GOM sea floor, a length long enough to wrap around the Earth's equator. This extensive infrastructure helps the industry to produce 52% of the total crude oil and 54% of the natural gas in the U.S., contributing \$12.7 billion in total wages earned in the Gulf Coast Region. In 2007, the annual oil production in the GOM exceeded 1.2 million barrels of oil per day (MMBPD). Within the next 10 years, the region's oil production is expected to exceed 1.6 MMBPD to meet increasing demand for energy and to help address the government's objective to decrease dependence on foreign sources of oil. The development and maintenance of this infrastructure has had numerous and significant consequences for the ecosystem services provided by the GOM and its coastal zone, from the presence of numerous structures on the continental shelf to the pipeline corridors that cross the coastal wetlands.

The Deepwater Horizon Mississippi Canyon-252 oil spill (DWH MC-252) resulted in nearly 5 million barrels (>200 million gallons) of crude oil spilling into the Gulf of Mexico. Impacts on the totality of ecosystem services are unknown but expected to be considerable, and will be expressed over years to decades. In the short term, up to 80,000 square miles of the U.S. BEZ were closed to fishing, resulting in loss of food, jobs and recreation. Similarly, coastal tourism, beach-going, boating and other provisioning and cultural services were heavily affected by the DWH MC-252 oil spill. The impacts on regulating and supporting services involve accounting for the effects on the ecosystem, its productivity and functioning. Little information is yet available to assess such impacts for either the short- or long-term.

Prior to the spill, the Gulf of Mexico Large Marine Ecosystem had been modified by many human activities which also affected ecosystem services. To reduce the impact of future spills on ecosystem services, managers may need to assess the full spectrum of activities that impact the Gulf and implement measures to increase resiliency. As described in the 2008 NRC report, *Increasing Capacity for Stewardship of Oceans and Coasts*, "Resilience thinking is one new approach to addressing the decline in the capacity of communities, ecosystems, and landscapes to provide essential services. The intent is to recognize the complexity and variability of ecosystems, including the human component, and to build systems that can adapt to incorporate new knowledge or adjust to changing conditions."

The 2010 Supplemental federal budget legislation included language supporting a study by the National Academy of Sciences on the impacts to ecosystem services of the DWH MC-252 spill:

*“ECOSYSTEM SERVICES IMPACTS STUDY” - For an additional amount, in addition to other amounts provided for the Department of Commerce, \$1,000,000 to be available for the National Academy of Sciences to conduct a study of the long term ecosystem service impacts of the Deepwater Horizon oil discharge. Such study shall assess long-term costs to the public of lost water filtration, hunting, and fishing (commercial and recreational), and other ecosystem services associated with the Gulf of Mexico.”*

### **Work Plan**

The committee will meet a total of 6 to 7 times over the course of the study, including two information-gathering workshops involving a variety of participants to be held in the Gulf of Mexico region.

To assist the federal agencies in their preparation of the National Resource Damage Assessment, an interim report that covers questions 1, 2, and 3 in the statement of task will be delivered to the sponsor 6 months after the receipt of funding. The final report, encompassing the interim report and including questions 4 through 8 in the statement of task will be delivered after 24 months. An additional 6 months will be used for report publication and dissemination for a total performance period of 30 months. Dissemination will include a report-in-brief document and other briefing materials. Briefings will be provided for Congress, the federal agencies, states in the Gulf of Mexico region, and other regional bodies. A public briefing will be held in the Gulf and in DC for other interested parties.

### **FEDERAL ADVISORY COMMITTEE ACT (FACA)**

The Academy has developed interim policies and procedures to implement Section 15 of the Federal Advisory Committee Act, 5 U.S.C. App. § 15. Section 15 includes certain requirements regarding public access and conflicts of interest that are applicable to agreements under which the Academy, using a committee, provides advice or recommendations to a Federal agency. In accordance with Section 15 of FACA, the Academy shall submit to the government sponsor(s) following delivery of each applicable report a certification that the policies and procedures of the Academy that implement Section 15 of FACA have been substantially complied with in the performance of the contract/grant/cooperative agreement with respect to the applicable report.

### **PUBLIC INFORMATION ABOUT THE PROJECT**

In order to afford the public greater knowledge of Academy activities and an opportunity to provide comments on those activities, the Academy may post on its website (<http://www.national-academies.org>) the following information as appropriate under its procedures: (1) notices of meetings open to the public; (2) brief descriptions of projects; (3) committee appointments, if any (including biographies of committee members); (4) report information; and (5) any other pertinent information.

### **ESTIMATE OF COSTS**

The estimated cost of this 30-month project is \$ 990,000. Funding is requested to cover staff time; domestic travel for 4 meetings and 2 workshops for 12 committee members and 3 staff members; domestic travel for 14 invitees to attend 2 workshops; international travel of 2 international committee members from Europe to attend 4 committee meetings and 2 workshops; international travel of 4 experts to attend 2 workshops. Other direct costs include materials and supplies, publication and dissemination, consultant services for report writing and editing, stipends for one Mirzayan Fellow, computer services, photocopies, postage and delivery, long distance telephone, conference calls, telephone equipment charge and meeting expenses.