WRITTEN TESTIMONY OF
MARGARET R. CALDWELL
DIRECTOR, ENVIRONMENTAL AND NATURAL RESOURCES
LAW & POLICY PROGRAM
SENIOR LECTURER IN LAW, STANFORD LAW SCHOOL
EXECUTIVE DIRECTOR, CENTER FOR OCEAN SOLUTIONS
STANFORD UNIVERSITY

HEARING ON ECONOMIC AND ENVIRONMENTAL IMPACTS
OF THE RECENT OIL SPILL IN THE GULF OF MEXICO

BEFORE THE
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
U.S. SENATE

MAY 11, 2010

Good afternoon Chairwoman Boxer, Senator Inhofe, and members of the Committee. I am Margaret Caldwell, a member of the Stanford Law School faculty, where I direct the Environmental and Natural Resources Law & Policy Program, and Executive Director of the Center for Ocean Solutions, a collaboration between Stanford University, the Monterey Bay Aquarium, and the Monterey Bay Aquarium Research Institute (MBARI). The Center's mission is to elevate the impact of the natural, physical and social sciences on ocean policy. Thank you for the opportunity to testify before you today on the critical connection between healthy ocean and coastal ecosystems and thriving ocean and coastal economies and our recent experience with oil spills and how they affect these linked human and natural systems.

Whether we live in a Gulf state, the Atlantic seaboard, along the Mississippi, around the Great Lakes, in New England, or on the west coast of the United States, we all share a common endowment: our coastal and ocean ecosystems and the goods and services they support and provide to each and every state in our union. Even those states lacking coastlines, those of our great deserts, high Rocky Mountains and the corn belt are inseparably linked to the health of oceans through commerce, climate, food resources, the air we breathe and water we drink, as well as for the security of our fellow citizens within our nation.

The National Ocean Economics Program's 2009 report provides a window on both the significance of the nation's ocean economy and its dependence on healthy coastal and marine ecosystems. The most recent comprehensive data available (2004) show that our ocean economy employs about 2.3 million people and pumps approximately $138 billion into our GDP, roughly equivalent to the U.S. insurance industry for jobs and motor vehicle parts industry for contribution to GDP.

Tourism and Recreation is the single largest portion of our nation's ocean economy both in terms of jobs (75%) and dollar value (51%). For example, in 2008, the Gulf of Mexico alone accounted for 30% of recreational fishing trips and almost 42% of the national recreation fishing catch. Louisiana's and Texas' coastal tourism and recreation industries are valued at $2 billion each (2004), and Mississippi's coastal tourism and recreation industry is valued at $200 million (2004). The Gulf state's coastal tourism and recreation will not prosper without clean, healthy, and safe coastal and ocean environments.

<u>The Gulf of Mexico and Western Coastal State's Waters are among our Most Important Ocean Biological and Economic Hotspots.</u>

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My focus today is on the Gulf of Mexico and my own region of the Pacific on the west coast of the U.S., where we also have significant experience with oil spills. Put simply these are two remarkably productive, locally valuable, and globally significant ocean and coastal ecosystems. So much so that natural scientists who study these regions and know their role in the global ocean sometimes refer to these two regions as the Yellowstone and Yosemite of our nation's marine environment. Together these regions account for about 90% of this nation's wild commercial fisheries (the Pacific region accounted for 73.7% and the Gulf accounted for 16% of commercial fisheries landings in 2007). Economists report similar significance of these two regions to the nation's economic health. In 2004, the total value of the gulf state's ocean economies for all ocean-related sectors (marine related construction, living resources, minerals, non-military ship and boat building, tourism and recreation, and transportation) was $29 billion (Louisiana $12 billion; Texas $8.2 billion; Florida (Gulf Coast) $5.5 billion; Alabama $1.7 billion; and Mississippi $1.5 billion). While California alone is the largest ocean economy in the U.S., valued at $42.9 billion in 2000.

<u>The Gulf of Mexico</u>. The Gulf contains the greatest expanses of wetlands in the lower 48 states—over 5 million acres—and supports the world's largest remaining harvest of native wild oysters. The Gulf's remaining wetlands and oyster reefs provide vital shoreline protection, water filtration, nursery habitats for commercial and recreational fisheries as well as foraging and nesting habitat for scores of sea and shorebirds. Approximately 85-90% of fish and shellfish caught in the Gulf spend some portion of their life history in the wetlands and nearshore habitats of the Gulf and 75% of migrating waterfowl that traverse the U.S. pass through the Gulf on their annual migrations. The Gulf's coastal habitats are also vital nesting areas for dozens of ground-nesting species, including brown pelicans, royal terns, and laughing gulls. Not surprisingly, the Gulf is home to over 20 coastal National Wildlife Refuges.

The Gulf of Mexico is the only known breeding ground in the Western Hemisphere for the protected Western Atlantic Bluefin Tuna (December to July). It is also one of only two nesting habitats and the primary foraging ground for the world's most endangered sea turtle, the Kemp's Ridley sea turtle. These turtles are now in the peak of their nesting season and have been observed foraging for food near the Deepwater Horizon oil slick. Additionally, 21 species of marine mammals routinely inhabit the northern Gulf, including manatees which are presently

migrating back into their summer areas along the Louisiana coast, and the endangered sperm whale.

The Gulf possesses a substantial shallow shelf area (*see* Figure 1 below) that is benthic (seafloor habitat associated) dominated. As a result, species that make their living off benthic species, such as shrimp and crabs and their prey are particularly vulnerable to the effects of submerged oil. We know from previous oil spills that sediment-associated oil persists in the marine environment for many years and can be re-released in toxic concentrations.

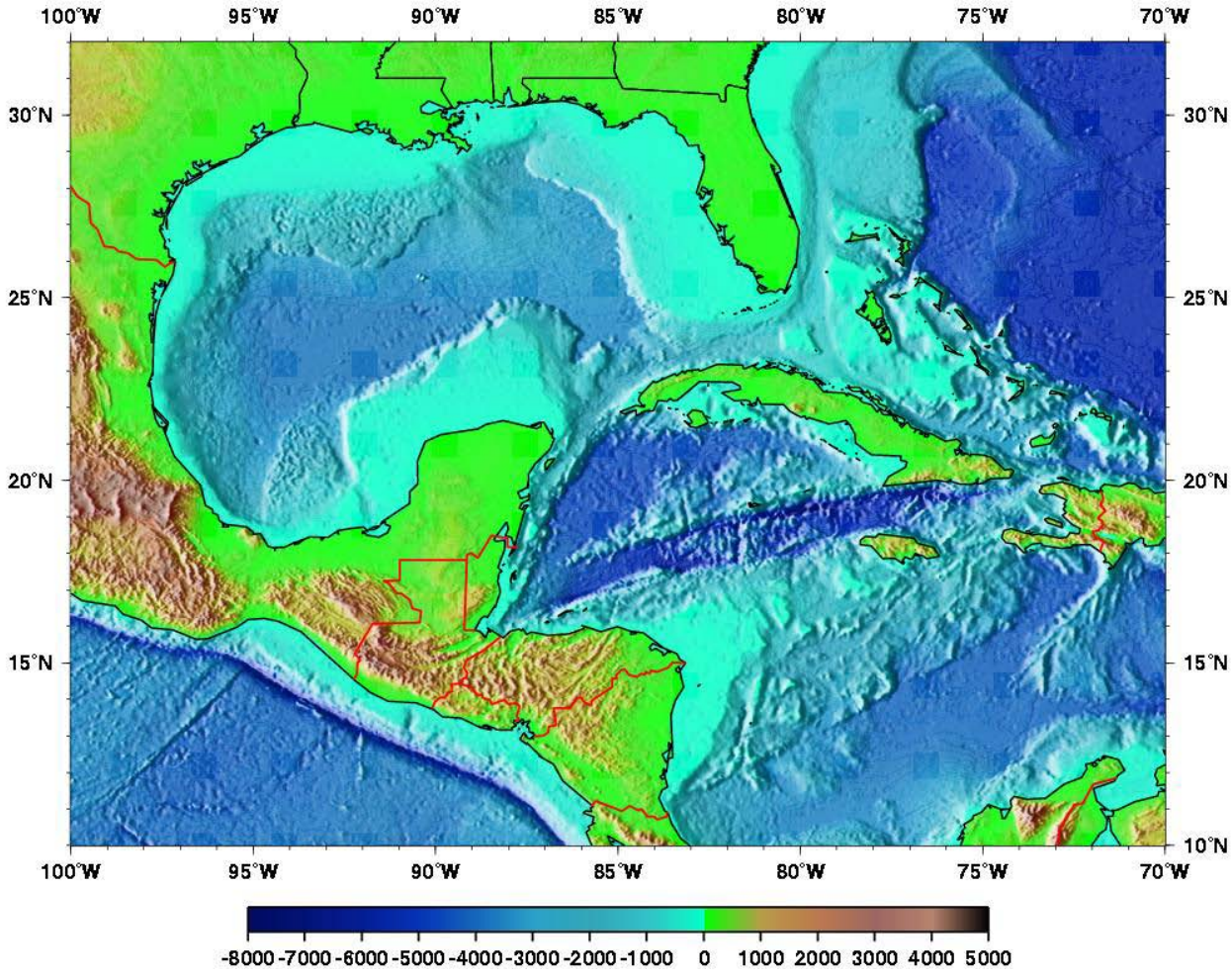


Figure 1. Topography/Bathymetry of the Gulf of Mexico region. http://oceancurrents.rsmas.miami.edu/atlantic/img_topo2/loop-current2.jpg

The Gulf is dominated by the "Loop Current," a precursor to the Gulf Stream that bathes the Atlantic seaboard. The Loop Current (*see* Figure 2 below) flows clockwise from Texas, parallel with the shore, down to the Florida Keys, where it then flows through the Florida Straits and becomes part of the Gulf Stream. Many marine species use the Loop Current at key stages of

their life histories. Economically important species such as tuna, snapper and grouper begin their life cycle as larvae, awash in this current, taking advantage of the natural conveyer belt to migrate from spawning grounds to both coastal and oceanic areas where they will reside as adults. Some, such as lobsters, are now known to be retained by coastal eddies, cycling off the greater ocean current, thus highlighting the local vulnerability of discreet regions within the larger current system. The unique northwest Atlantic drift algae, *Sargassum*, also forms vast mats upon this current, providing a mobile nursery on par with seagrasses and mangrove wetlands in their role for nurturing the young stages of many fish species and four species of sea turtle. Drift algae also provide the singularly most important feeding habitat for other fishes such as the dolphinfish. Atlantic dolphinfish, directly dependent on *Sargassum* cycling out from the Gulf, are the most frequently taken fish on charter boats off Florida's east coast, and represent the most important offshore fishery in North Carolina. Containing the Deepwater Horizon oil spill before it reaches the Loop Current is a priority not only for these species and the human and biological communities who depend on them, but also due to the extremely high biological vulnerability and economic value of the Florida Keys' shallow coral reef habitat which the Loop Current passes through on its way to the Atlantic.

Apr-May-Jun Seasonal Average Loop Current

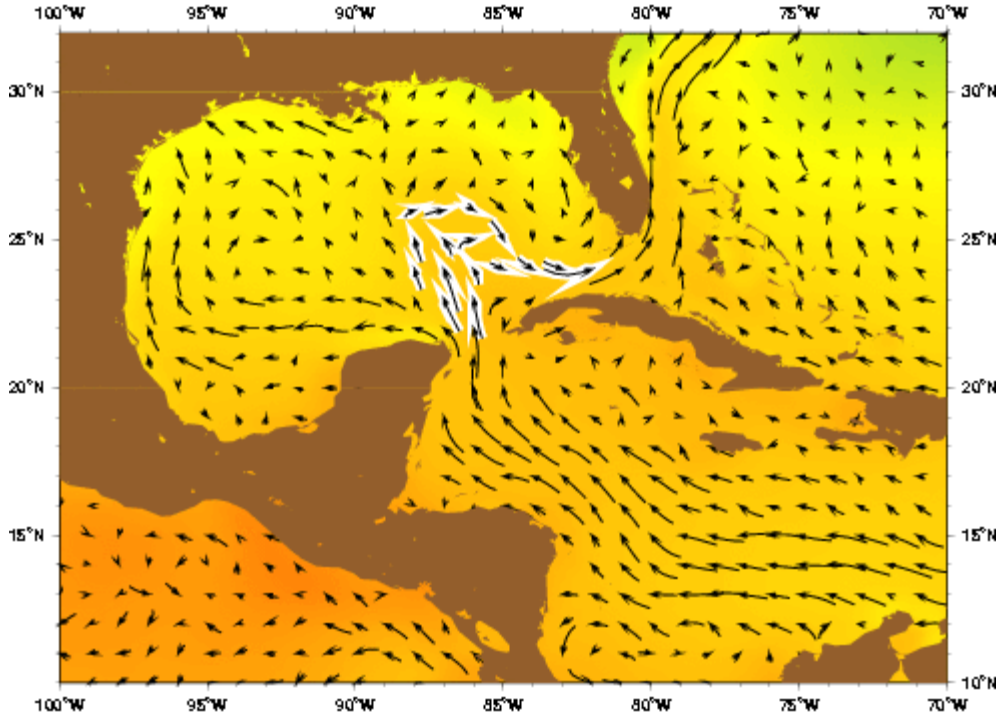


Figure 2. The average ship-drift derived surface velocities show the well-know omega-shaped flow pattern of the Loop current. The Loop Current (1) feeds the Florida Current that transports significant amounts of heat poleward; (2) transports surface waters of tropical origin into the Gulf of Mexico; and (3) is fed by the Caribbean current and the Yucatan Current. http://oceancurrents.rsmas.miami.edu/atlantic/loop-current.html.

The California Current Large Marine Ecosystem. The western states of Washington, Oregon, and California border the California Current Large Marine Ecosystem. It is one of only five large marine ecosystems on earth with seasonal upwellings of cold nutrient rich water that generate localized areas of high primary productivity. The California Current is the feeding ground of the northern Pacific Ocean for millions of marine birds, mammals, and fish, including many far-ranging, highly migratory species that annually travel far beyond our national waters, in some cases spanning the entire Pacific Ocean basin. It hosts amazing marine life, from blue and gray whales to elephant seals, white sharks, loggerhead turtles, sea otters, dolphins, and more than 80 species of groundfish. With several years of animal tagging data now logged and mapped, marine scientists are finding that many of the "bison" and "tigers of the sea" such as blue whales, orcas, and white sharks demonstrate strong fidelity to our western states' waters and use these regions as "home turf." Recognizing this natural bounty, California alone has 10 coastal National Wildlife Refuges, 4 National Parks and Recreation Areas, and over 100 State Parks in its coastal zone.

California's ocean economy ranks first overall in the U.S. for both employment and gross state product. And economic sectors that depend directly on clean ocean environments comprise the most important segments of the state's ocean economy (tourism and recreation, recreational and sports fishing, and commercial fisheries).

The Gulf and Western States of Alaska and California are home to U.S. Offshore Oil and Gas Production.

Another important commonality between the Gulf Coast states and the West Coast states, particularly California and Alaska, is that these regions are also home to our nation's offshore oil and gas industry. The Gulf of Mexico dominates the U.S. offshore oil and gas sector. The Gulf contributed 85% of U.S. offshore production in 2004, with the Central Gulf (state and federal waters off Louisiana) accounting for a full three quarters of oil and gas production. Together, Louisiana, Texas, Alaska, and California account for 90% of the employment in this sector and 95% of production.

Current and Past Ecological Consequences of Oil Spills.

The history of oil exploration, production and transportation in the U.S. includes a number of notable serious accidents with significant consequences for marine and coastal ecosystems and the coastal communities and economies linked to these vulnerable systems. While past oil spills are instructive for scoping likely effects of the Deepwater Horizon spill, I should emphasize that no two oil spills behave alike, even in similar marine environments. Oil spill impacts depend on the type, volume, season of the release, dispersal characteristics, duration of spill, and weather conditions. Before the Deepwater Horizon accident, the Exxon Valdez was the largest oil spill known to occur in U.S. waters. While we wait to see whether the Deepwater Horizon spill will eclipse the 10.8 million gallons of oil spilled from the Exxon Valdez, we have learned some important lessons from previous spills. (In a May 7, 2010 letter to colleagues, Dr. Robert W. Howarth from Cornell University observes that the average rate of spillage from the Deepwater Horizon has been estimated in the range of 170,000 to 630,000 gallons of oil per day. At the

upper range of spillage, he notes that by last week the Deepwater Horizon spill may have already matched the magnitude of the Exxon Valdez spill and at the lower rate, it will equal that spill by mid June if uncontained by that date.)

Oil spills incur direct and indirect effects on marine and coastal systems. Toxins contained in oil can directly kill organisms and can contaminate their tissues, which can then be passed through the food chain to other organisms, including humans through our consumption of seafood. In addition, when marine species come in direct contact with oil, they can experience physical effects from the oil in its various forms (liquid oil, emulsions, particles, and tar balls), including blocked or impaired feeding, decreased ability to photosynthesize or breathe, and impaired mobility and heat regulation. Nursery habitats such as the aforementioned drift *Sargassum* community of the Gulf are particularly vulnerable to hydrocarbon contamination. In fact, even prior to a major spill in the region, some 63% of post-hatchling loggerhead turtles found in association with this habitat have been observed to have tar in either their stomach or mouth. Dispersants do not actually remove oil from the system and may have their own toxic and physical effects on marine life. Overall, hydrocarbons have been shown to affect marine organism survival, growth, physiology, behavior, or disease resistance.

In 2003, scientists reported in the journal *Science*, that the ecosystems affected by the 1989 Exxon Valdez spill may take 30 years to fully recover. Last year, the Exxon Valdez Oil Spill Trustee Council's monitoring results were summarized by the Alaska's Deputy Attorney General in his draft report entitled "Legacy of an Oil Spill – 20 Years After the Exxon Valdez." His report states "the most stunning revelations of the Trustee Council-funded monitoring over the last ten years is that the Exxon Valdez oil persists in the environment (last year NOAA Fisheries estimated that about 16,000 gallons of oil remain in intertidal areas, for example) and in places, is nearly as toxic as it was the first few weeks after the spill."

What is the ecological legacy of the Exxon Valdez? Here are some important statistics:

- 250,000 seabirds died (about 40% of the pre-spill population).
- Twenty years later, Pacific herring populations remain depressed and have shown little to no improvement. Pacific herring larvae showed malformations, genetic damage and size reduction. The pre-spill annual catch average was 20 million fish. To date, the commercial fishery remains closed and Pacific herring are now being considered for listing under the Endangered Species Act. Pacific herring is also a vital food source for seabirds in the region; therefore there is great uncertainty about the region's seabird population's long-term sustainability.
- Sea otters born in Prince William Sound after the oil spill had lower survival rates than those born in other areas.
- Salmon populations experienced reduced growth rates and increased egg mortality.
- The two groups of orcas (killer whales) observed in the oil slick following the spill lost approximately 40% of their numbers by 1990. One of the pods now shows signs of recovery, while the other pod shows no signs of recovery and continues to decline.

Researchers have measured accumulations of chlorinated hydrocarbons in orcas frequenting the area.

- Two species are now listed as "not recovered" (Pacific herring and pigeon guillemots); ten species and four human services are listed as still "recovering" (killer whales, sea otters, clams, mussels, harlequin ducks, black oystercatchers, barrows goldeneyes, sediments, intertidal communities, and Designated Wilderness, commercial fishing, recreation and tourism, subsistence, and passive human uses).

The true economic impact of the spill may never be fully accounted for. We do know, however, that recreational fishing revenues dropped by $580 million and recreation and tourism revenues dropped by $19 million the year of the spill alone. Commercial fishing and recreation and tourism are still considered to be "recovering" in the spill area.

Recent spills in California—Cosco Busan (53,569 gallons, San Francisco Bay, 2007) and American Trader (416,598 gallons, Huntington Beach, 1990)—were both much smaller than the Deepwater Horizon spill. Yet both resulted in significant seabird mortality and affected large swaths of coastline. The Cosco Busan spill resulted in a one-month closure for fishing for human consumption in San Francisco Bay and coastal waters between Pt. Reyes and San Pedro Point. The spill delayed the start of one of California's most lucrative fisheries, the Dungeness crab fishery, and impacted both commercial and recreational fisheries for Pacific herring, Dungeness crab, shiner surfperch, red rock crabs, and mussels. The American Trader spill resulted in damage awards for impacts to recreational activities at $13.2 million and combined environmental impacts at $3.1 million.

Conclusion

It is still too early to tell what the extent of the ecological and economic losses caused by the Deepwater Horizon spill will be because we don't yet know the full extent of the volume of oil released and the ultimate duration of the release. Nor do we know how far the spill will spread or the concentrations of oil for specific sites. These are all critical facts for understanding the breadth of the economic and ecological losses we can expect. However, in large part due to the natural processes of ocean circulation and bioaccumulation, we can assume the geographic range of impact to be quite high. Furthermore, we know that this spill is occurring at a time of year that is critical to many of the species, industries and communities that depend directly on the health of the Gulf and the sensitive habitats that this spill will directly affect. We also know that the spill has not yet been fully contained. Unlike an oil tanker spill, like the Exxon Valdez, oil rig blowouts have no known maximum limit. Because the Gulf of Mexico and the coupled human and natural communities that border the Gulf function as a major economic and ecological engine regionally and nationally, we should anticipate the true direct and indirect impacts of the spill to be substantial. In short, the Deepwater Horizon spill will leave a legacy in economic and ecological terms that can endure for decades, and in terms that cannot be reduced to dollars.

Chairwoman Boxer and members of the Committee, thank you for the opportunity to address you today.

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