EXECUTIVE SUMMARY

A Once and Future **Gulf of Mexico Ecosystem**

Restoration Recommendations of an Expert Working Group

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Executive Summary

The Deepwater Horizon (DWH) well blowout in April 2010 released more oil into the marine environment than any previous U.S. oil spill (4.9 million barrels), harming marine life, damaging deep-sea and shoreline habitats and closing economically valuable fisheries in the Gulf of Mexico. Beyond the direct effects that were captured in photographs of oiled birds in the media, it is likely that there are subtle, delayed, indirect and synergistic effects from the spilled oil and the chemicals used to disperse it.

Dramatic images from the blowout renewed public interest in protecting this economically, socially and environmentally critical region. The 2010 Mabus Report, commissioned by President Barack Obama and written by Navy Secretary Ray Mabus, provided a blueprint for recovering the resources of the Gulf of Mexico. To help turn the Mabus Report into a plan that revitalizes and sustains the Gulf's ecosystem and economy, the Pew Environment Group assembled a team of leading experts in nearshore and marine ecosystems to identify strategies and specific actions to guide restoration efforts.

Because the Deepwater Horizon spill occurred in highly interconnected ecosystems that were already stressed by overfishing, development and global climate change, this expert group contends that recovery of the Gulf of Mexico must go beyond the traditional in-place, in-kind restoration approach that targets specific habitats or species. A successful revival of the Gulf requires:

1. **Recognizing** that ecosystem resilience has been compromised by multiple human interventions predating the spill.
2. **Acknowledging** that significant future environmental change is inevitable and must be factored into restoration plans and actions for them to endure.
3. **Treating** the Gulf as a complex and interconnected network of ecosystems from shoreline to deep sea.
4. **Recognizing** that human and ecosystem productivity in the Gulf are codependent and that human needs from, and effects on, the Gulf must be integral to restoration planning.

Guided by these principles, the expert group agreed on a foundation for a sustainable restoration program along three themes:

1. Assess and repair damage from the oil spill and other stresses on the Gulf of Mexico.
2. Protect existing habitats and resources.
3. Integrate sustainable human use with naturally occurring ecological processes in the Gulf.

Under these themes, the expert group developed 15 historically informed, adaptive and ecosystem-based recommendations to recover Gulf resources and rebuild the resilience of its ecosystems. Taken alone, each of the recommendations and their related action items may be no more effective than the in-place, in-kind approach. However, the expert group designed its recommendations to work in concert, treating the Gulf of Mexico as a holistic system that must accommodate the complex, intersecting and changing needs of plants, wildlife, microscopic organisms and humans.

Recommendation Themes

THEME 1

Assess and repair damage from DWH and other stresses on the Gulf of Mexico.

THEME 2

Protect existing Gulf of Mexico habitats and resources.

THEME 3

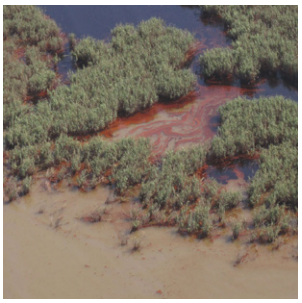
Integrate sustainable human use with ecological processes in the Gulf of Mexico.

Opposite page, from left: An oiled brown pelican stands on a jetty near Grand Isle, LA. Photo: Eileen Romero/Marine Photobank; Oil on a marsh is visible from the air after the Deepwater Horizon spill. Photo: NOAA; Dying corals have been found near the Deepwater Horizon site. Photo: NOAA Ocean Exploration and Research and Bureau of Ocean Energy Management, Regulation and Enforcement; Fishing vessels drag an oil boom after trapped oil is set ablaze in the Gulf. Photo: Jeffery Tilghman Williams, U.S. Navy/Marine Photobank

Major Natural Resource Damage From the Deepwater Horizon Well Blowout

Damage from surface oil at sea

Oil on the sea surface injured and killed many seabirds, especially gulls, terns, northern gannets, brown pelicans and black skimmers, as well as sea turtles and bottlenose dolphins.



Damage from oiling of shoreline habitats

Oil fouled a variety of ecologically important habitats, including coastal marshes, beaches, sea grass beds, tidal flats and oyster reefs.

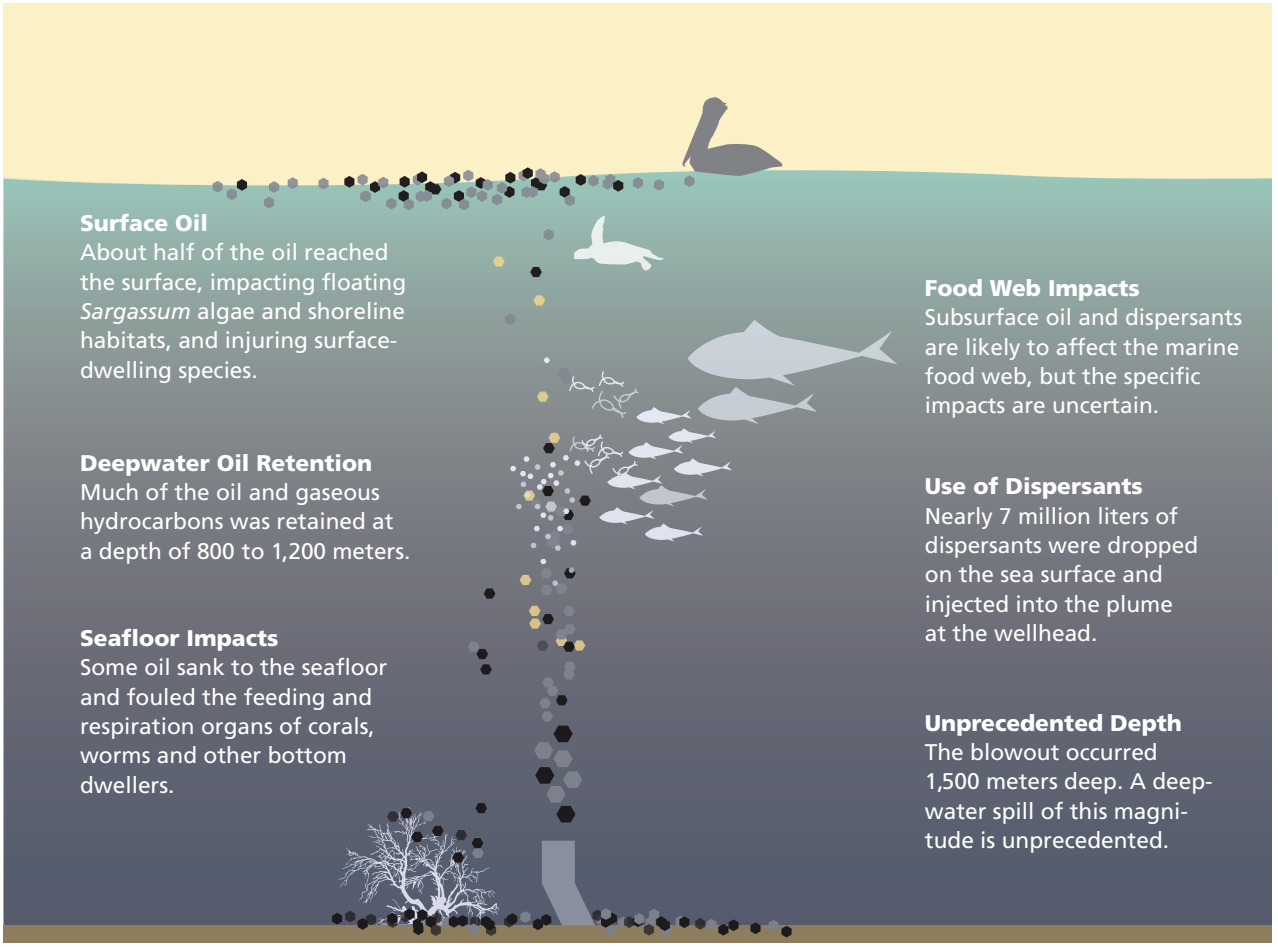
Damage from subsurface oil and gas

Benthic, or bottom-dwelling, invertebrates such as corals, sponges and echinoderms were impacted by apparent oil deposition. Surface organisms were exposed to oil droplets and dispersant to an unprecedented degree.

Collateral damage caused by response actions

Collateral damage from spill response actions included toxicity from dispersants; habitat damage from berm construction, breakaway booms and river diversions; and injuries to species from oil burning and beach disturbance.

Characteristics of the Deepwater Horizon Oil and Gas Release



Gulf Ecosystem Stressors

The increased frequency of intense hurricanes arising from global climate change has exposed the Gulf Coast to greater risks of catastrophic flooding, shoreline erosion and associated geomorphic changes.

Land subsidence (sinking), sea level rise and marsh channelization from petroleum-industry activities have led to losses in coastal habitats, protective coastal barriers and ecosystem services.

Excessive nutrient loading from agriculture and other human sources has resulted in a massive dead zone where commercially viable populations of shrimp and fish are seasonally absent.

The exploitation of apex predators such as sharks and bluefin tuna—crucial components of the Gulf food web—has pushed them to the brink of extinction.

Disturbance from shrimp trawling and dredging has removed habitat-providing invertebrates from the continental shelf seafloor and encouraged the establishment of opportunistic species.

Rising CO_2 concentrations in the atmosphere from fossil fuel combustion are leading to growing acidification of coastal ocean waters.

Development of low-lying lands and coastal barriers has degraded and destroyed shoreline habitats and led to structural responses and dredge-and-fill projects to protect housing and infrastructure. However, such responses interfere with natural movement of barrier islands and resilience of shoreline habitats.

Sea level rise puts major Gulf cities such as New Orleans and Houston at risk of flooding and, in combination with hurricanes, challenges the long-term viability of human occupation of the Mississippi Delta and coastal barrier shorelines.

Top row, from left: The skyscrapers of New Orleans are visible behind houses flooded by Hurricane Katrina. Photo: Tyrone Turner/National Geographic; A sign warns of a pipeline crossing in LA. Because of coastal erosion, many pipelines are getting closer to the surface and in some cases are even in open water. Photo: Paul Goyette; Dairy cattle stand in water holes in Suwannee, FL. Cattle waste contributed to the destruction of a thriving oyster industry in the town, located on the Gulf of Mexico. Photo: Melissa Farlow/National Geographic; Bluefin tuna swim in the Gulf. Photo: NOAA

Bottom row, from left: A shrimp trawler in Key West, FL. Photo: Wolcott Henry 2005/Marine Photobank; Factory smokestacks emit pollution in Florida. Photo: Monica McGivern; Finger channels have been constructed over mangrove and oyster reef habitats in South Florida. Photo: Courtesy of Ping Wang; Houseboat Row on South Roosevelt Boulevard in Key West after Hurricane Georges in September 1998. Photo: Florida Keys Public Libraries/The Dale McDonald Collection

Recommendations for Resilient Restoration of the Gulf of Mexico

THEME 1

Assess and Repair Damage From the Deepwater Horizon Spill and Other Stresses on the Gulf of Mexico

Recommendations 1–6

Crop dusting can contribute to water pollution through chemical runoff. Photo: Roger Smith

Recommendation 1

Restore shoreline habitats directly and indirectly damaged by the oil release.

Restore critical habitats such as coastal marsh, sea grass and oyster reef using proven methods and with consideration of sustainability under conditions of global climate change.

Allow natural recovery to restore ocean beach and estuarine mud flats.

Recommendation 2

Investigate effects of dispersed oil and dissolved natural gas on deep-sea ecosystems and test capacity for restoration of ecosystem services.

Conduct field observations and experiments to estimate damage to deep-sea particle feeders.

Test and implement restoration strategies to stimulate recovery of particle feeder populations.

Evaluate the fate of the oil-spill induced microbial bloom through field observations and experiments.

Recommendation 3

Determine effects of the Deepwater Horizon oil spill on the *Sargassum* community and restore its lost habitat services to fish and wildlife.

Conduct experiments to complement field observations made during the spill to assess acute and chronic mortality of *Sargassum* and its animal associates.

Restore *Sargassum* by prohibiting commercial harvest and by culturing it in lab settings to test whether building up *Sargassum* populations increases survival or production of its animal associates.

Recommendation 4

Modify farming practices in the Mississippi River basin to reduce nutrient loading in the Gulf.

Establish demonstration watersheds upstream in the Mississippi River basin to test the economic benefits to farmers and the nutrient runoff reductions achievable by transforming and locally managing regional farm policy.

Adjust U.S. farm policy to allow regionally tailored crop diversification and reduction of subsidies in the Farm Bill without loss of income to the farmers because of decreases in fertilizer costs.

Recommendation 5

Reduce fish and wildlife casualties resulting from marine debris from anthropogenic sources, such as cargo ships, fishing boats and the offshore oil and gas industry.

Conduct field programs to assess types, locations and sources of debris.

Develop programs to limit and prevent debris at the source and to remove debris at "hot spots" where it collects.

Recommendation 6

Restore water flows, riparian habitats and water quality to reduce nutrient loading and enhance ecosystem services of smaller rivers.

Survey the smaller rivers of the Gulf to determine their water and habitat quality and their flow challenges.

Assess potential effects of changing environmental conditions on the ecosystem services of these river networks.

Preserve the more pristine rivers and restore damaged rivers accounting for environmental changes.

THEME 2

Protect Existing Gulf of Mexico Habitats and Populations

Recommendations 7–10

Brown pelicans fly over St. Vincent National Wildlife Refuge in Apalachicola, FL. Photo: Nicole Rankin/U.S. Fish and Wildlife Service Southeast

Recommendation 7

Preserve critical habitat in fish and wildlife sanctuaries to enhance injured species recovery.

Conduct a systematic review of available large parcels of prime habitat, rating them by the importance of uses by injured species.

Purchase land and/or development rights to habitat of highest-rated value to injured species.

Establish permanent stewardship for these habitat protections by merging them with national parks, wildlife sanctuaries or other responsible public agencies.

Recommendation 8

Implement and augment existing recovery actions for species injured by the Deepwater Horizon oil spill.

Use metrics established in prior population status reviews to help assess damage to injured species.

Implement existing recovery plans for injured species.

Recommendation 9

Maintain and enforce existing legislative protections for water, habitat, fish and wildlife to preserve public health and provide valued resources.

Enforce existing federal and state environmental and natural resource laws.

Develop state-level environmental legislation that is tailored to specific needs of Gulf states and is adaptive to changing environmental conditions.

Promote holistic interpretations of environmental legislation that consider indirect and cumulative impacts.

Recommendation 10

Create networks of protected habitats to enhance fish stocks and other economically valuable species.

Establish marine protected areas on the inshore shelf to allow recovery of overexploited reef fish.

Protect the connected habitats in the Big Bend area from the Apalachicola River estuary to the De Soto Canyon that are used sequentially in the development and migration of reef species.

Establish deep-sea biological preserves to protect organisms such as coral that provide critical habitat and install observation systems to monitor deep-sea ecosystems.

THEME 3

Integrate Sustainable Human Use With Ecological Processes in the Gulf of Mexico

Recommendations 11–15

A sea grass recovery project is under way in the Florida Keys. Photo: Florida Fish and Wildlife Conservation Commission

Recommendation 11

Engage Gulf Coast communities to adapt to increasing coastal inundation while also sustaining fish and wildlife.

Share with Gulf coastal communities information about the environmental changes expected from global climate change: sea-level rise, increased hurricane damage and flooding.

Develop science-based scenarios in collaboration with communities that depict the consequences and risks of maintaining residence in coastal hazard and flood zones.

Promote community engagement to encourage sound decisions that provide integrated resilience for people and the ecosystems upon which they depend.

Recommendation 12

Manage Gulf fisheries sustainably by recognizing ecosystem processes.

Develop a suite of ecosystem models that will improve capacity to forecast fishery yields and the impacts of environmental changes.

Apply these ecosystem-based models to fishery management in the Gulf of Mexico.

Recommendation 13

Assess damage from shrimp trawling and potential fishery benefits of no-trawling reserves.

Conduct reviews of museum collections and other historical information on bottom communities of intensely trawled areas to estimate the pre-trawling baseline.

Find and record video of non-trawled areas that are similar to trawled areas to determine differences.

Conduct small-scale, experimental tests of consequences of establishing no-trawling reserves to test capacity to restore habitat and habitat-dependent fisheries.

Recommendation 14

Endow Gulf capacity building in social-environmental monitoring and problem solving.

Invest Deepwater Horizon monies to establish an endowed fund directed by a broad-based board of advisers to support a range of programs for Gulf restoration:

- A regional long-term ecological research site in the Gulf.
- A Gulf Center for Ecological Analysis and Synthesis modeled after the national center in California.
- An annual scientific symposium on Gulf science intended to foster collaboration, information exchange and capacity building in ecosystem restoration.
- One or more NOAA National Estuarine Research Reserves to serve as models for monitoring and research in valuable estuaries.

Recommendation 15

Communicate within Gulf communities to inspire informed environmental decisions.

Develop and test novel community engagement processes, including creative communication approaches, to inform Gulf residents about the value of natural ecosystems and the implications of global climate change.

Establish coalitions of knowledgeable, approachable and articulate scientific and social experts to engage with Gulf residents through educational programs and community meetings.

Cover photo: A barrier island in Louisiana's Barataria Bay is surrounded by boom after the April 2010 Deepwater Horizon oil spill. Photo: Tyrone Turner/National Geographic Stock

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