National Commission on the

BP DEEPWATER HORIZON OIL SPILL AND OFFSHORE DRILLING

Attachment 16

Presentation of Chris Johns

Editor-in-Chief, *National Geographic*

NATIONAL GEOGRAPHIC

THE GULF OIL SPILL

National Geographic Magazine

October 2010

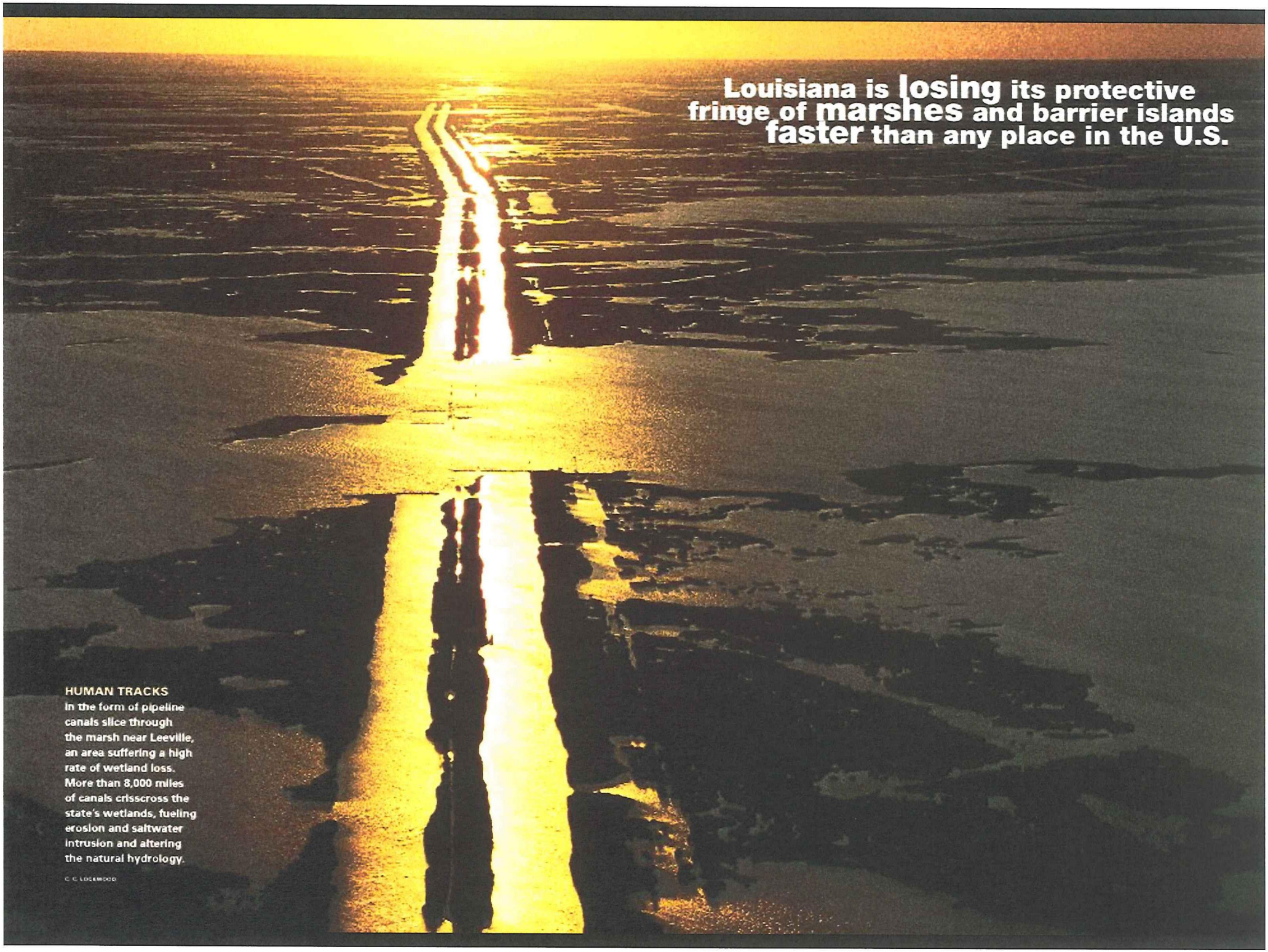
Gone with the Water

Louisiana's wetlands are twice the size of Everglades National Park, funnel more oil into the United States than the Alaska pipeline, sustain one of the nation's largest fisheries, and provide vital hurricane protection for New Orleans. And they're disappearing under the Gulf of Mexico at the rate of 33 football fields a day.

By Joel K. Bourne, Jr. ASSISTANT EDITOR
Photographs by Robert Caputo and Tyrone Turner

Then and now: Awash in memories, Pete Vujnovich, Jr., holds a picture of what was once his grandparents' home near Empire, Louisiana.

TYRONE TURNER



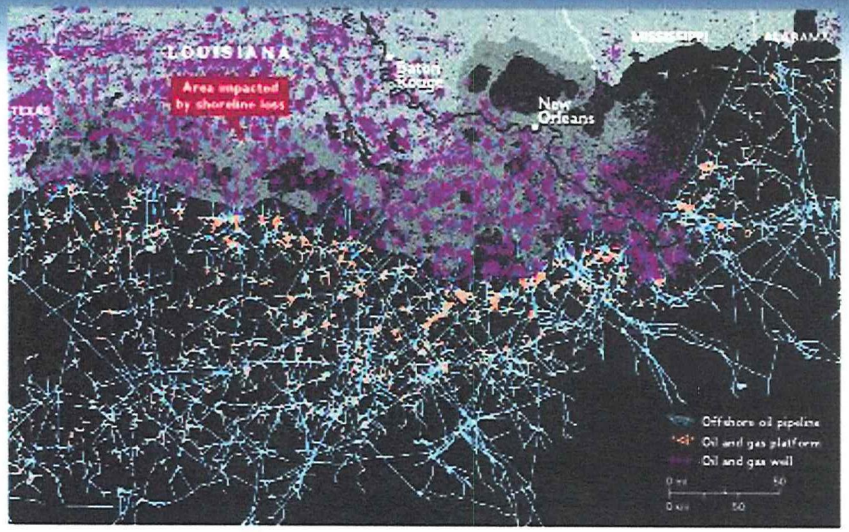
Louisiana is losing its protective fringe of marshes and barrier islands faster than any place in the U.S.

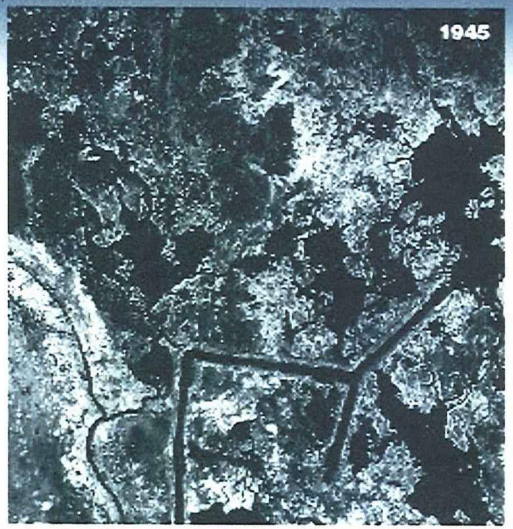
HUMAN TRACKS
In the form of pipeline canals slice through the marsh near Leeville, an area suffering a high rate of wetland loss. More than 8,000 miles of canals crisscross the state's wetlands, fueling erosion and saltwater intrusion and altering the natural hydrology.

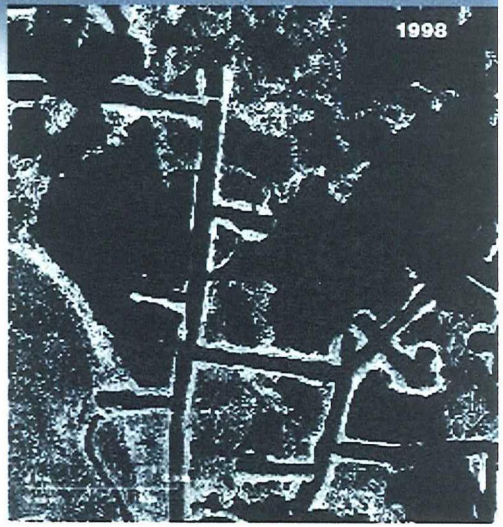
© C. LOCKWOOD

the Lost Coast

With the runoff from a third of the nation (inset map, far right), the Mississippi River built coastal Louisiana, a swath of marsh, islands, and swamp that covered more than 6,000 square miles in the early 20th century. Levees raised in the 1930s ended spring floods that pumped vital sediments and nutrients into wetlands. Then nutria, a South American rodent imported by fur farmers, escaped into the wild and began devouring marsh roots. By the 1960s the U.S. Army Corps of Engineers had dredged 14 major ship channels to inland ports, while oil companies cut countless canals for pipelines and wells (below). The resulting wetland loss is seen in aerial photos of an oil field in the Barataria Basin (below). Add the toll from subsidence and sea-level rise, and Louisiana has lost 1,900 square miles of wetlands since the 1930s. With another 700 square miles likely to vanish by 2050, the state has proposed an ambitious 14-billion-dollar plan to save what's left. "We ripped the guts out of south Louisiana," says University of New Orleans geologist Shea Penland. "Now we want it back."







Texas state line, Louisiana is losing its protective fringe of marshes and barrier islands faster than any place in the U.S. Since the 1930s some 1,900 square miles of coastal wetlands—a swath nearly the size of Delaware or almost twice that of Luxembourg—have vanished beneath the Gulf of Mexico. Despite nearly half a billion dollars spent over the past decade to stem the tide, the state continues to lose about 25 square miles of land each year, roughly one acre every 33 minutes.

A cocktail of natural and human factors is putting the coast under. Delta soils naturally compact and sink over time, eventually giving way to open water unless fresh layers of sediment offset the subsidence. The Mississippi's spring floods once maintained that balance, but the annual deluges were often disastrous. After a devastating flood in 1927, levees were raised along the river and lined with concrete, effectively funneling the marsh-building sediments to the deep waters of the Gulf. Since the 1950s engineers have also cut more than 8,000 miles of canals through the marsh for petroleum exploration and ship traffic. These new ditches sliced the wetlands into a giant jigsaw puzzle, increasing erosion and allowing lethal doses of salt water to infiltrate brackish and freshwater marshes.

While such loss hits every bayou-loving Louisianan right in the heart, it also hits nearly every U.S. citizen right in the wallet. Louisiana has the hardest working wetlands in America, a watery world of bayous, marshes, and barrier islands that either produces or transports more than a third of the nation's oil and a quarter of its natural gas, and ranks second only to Alaska in commercial fish landings. As wildlife habitat, it makes Florida's Everglades look like a petting zoo by comparison.

Such high stakes compelled a host of unlikely bedfellows—scientists, environmental groups, business leaders, and the U.S. Army Corps of Engineers—to forge a radical plan to protect what's left. Drafted by the Corps a year ago, the Louisiana Coastal Area (LCA) project was initially estimated to cost up to 14 billion dollars over 30 years, almost twice as much as current efforts to save the Everglades. But the Bush Administration balked at the price tag, supporting instead a plan to spend up to two billion dollars over the next ten years to fund the most promising projects. Either way, Congress must authorize the money before work can begin.

To glimpse the urgency of the problem afflicting Louisiana, one need only drive 40 minutes southeast of New Orleans to the tiny bayou village of Shell Beach. Here, for the past 70 years or so, a big, deeply tanned man with hands the size of baseball gloves has been catching fish, shooting ducks, and selling gas and bait to anyone who can find his end-of-the-road marina. Today Frank "Blackie" Campo's ramshackle place hangs off the end of new Shell Beach. The old Shell Beach, where Campo was born in 1918, sits a quarter mile away, five feet beneath the rippling waves. Once home to some 50 families and a naval air station during World War II, the little village is now "ga'an pecan," as Campo says in the local patois. Gone forever.

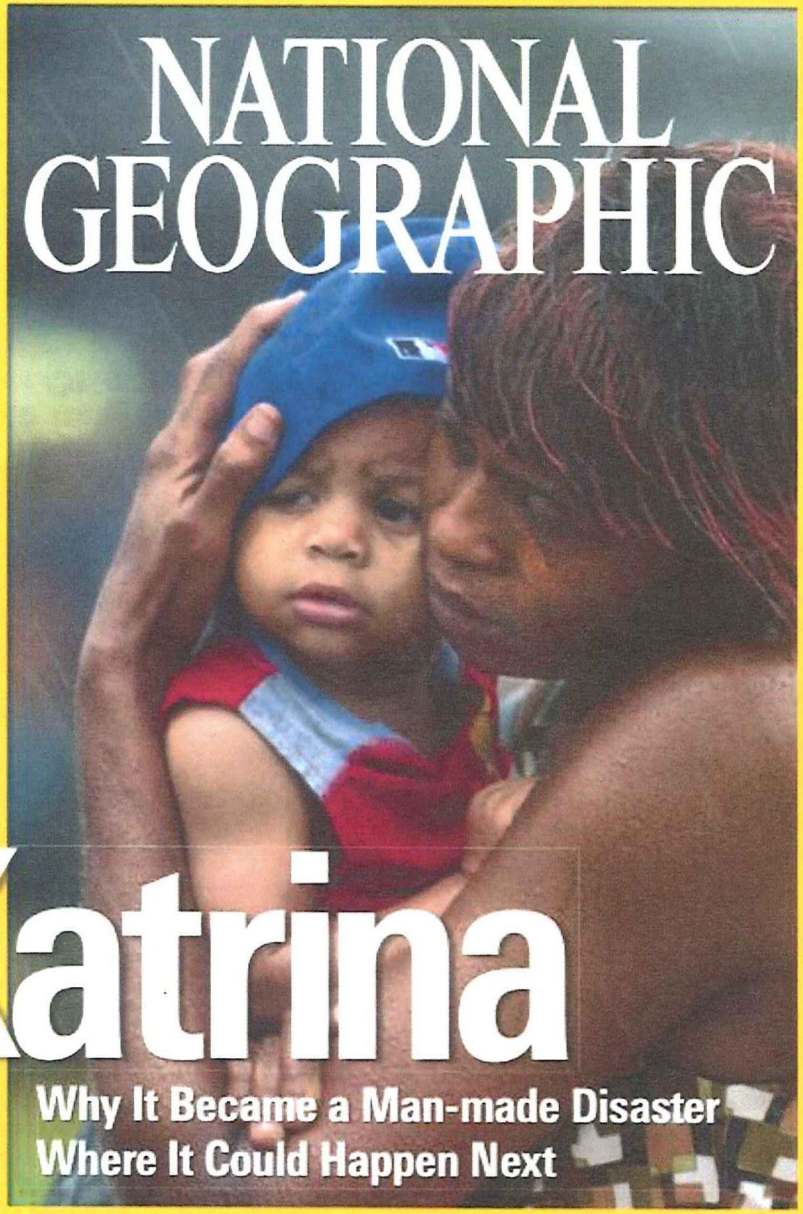
Life in old Shell Beach had always been a tenuous existence. Hurricanes twice razed the community, sending houses floating through the marsh. But it wasn't until the Corps of Engineers dredged a 500-foot-wide ship channel nearby in 1968 that its fate was sealed. The Mississippi River-Gulf Outlet, *(Continued on page 101)*

Even the Red Cross no longer opens hurricane shelters in New Orleans, claiming the risk to its workers is too great.

"WHEN I WAS A KID, you could walk through the swamp in summer in dress shoes," says 80-year-old Elward Stephens (above), wading through cypress knees near Morgan City. Today the swamp never dries out. Other changes are more dramatic: Thousands of acres of bald cypress (below) have been killed by saltwater flowing up canals, while once buried pipelines now lie exposed and must be regularly marked (left) to keep them from being struck by boats.

SPECIAL EDITION

NATIONAL GEOGRAPHIC



Katrina

Why It Became a Man-made Disaster
Where It Could Happen Next

PROFITS FROM THIS EDITION WILL BENEFIT HURRICANE VICTIMS

END OF THE ROAD

Local volunteers rescue the Taylor family from the roof of their car, stopped by rising waters along U.S. 90 in Bay St. Louis, Mississippi.

Sean Sisler, Associated Press

THROUGH THE WALLS
Floodwaters drain out of New Orleans Lower Ninth Ward through a breach in the Industrial Canal a day after the storm. Thousands of homes in this neighborhood, built over a cypress swamp, were destroyed when a series of waves from Lake Pontchartrain and Lake Borgne overran levee defenses.

Vincent LaMarca, *New York Times*

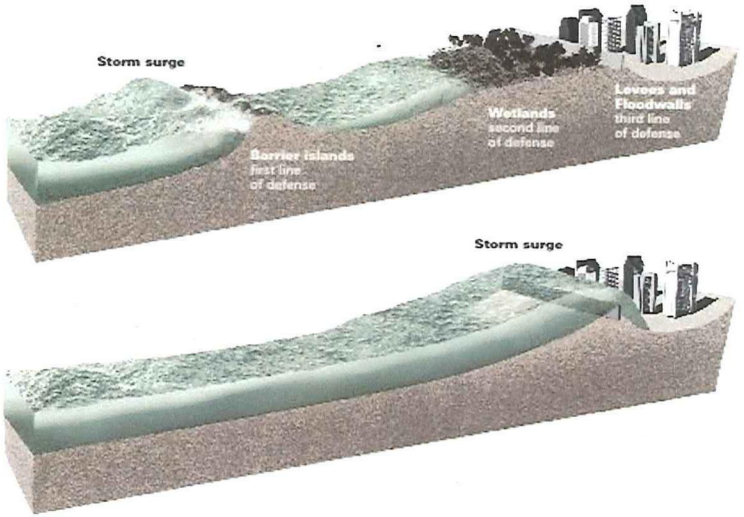
How the defenses break down

Shelter from wind, run from water—that's the advice emergency managers have been giving coastal residents for years. The most lethal weapon in a hurricane's arsenal isn't howling winds, but rather the large dome of water it brings ashore known as a storm surge. For centuries, residents of low-lying Louisiana could count on a combination of natural and man-made barriers to at least slow down these tsunami-like waves, from fringing barrier islands to the once vast coastal marshes to the levees that have been thrown up since the French settled the region in the early 1700s.

But over the last half-century, the natural defenses have been quietly melting away. Louisiana's barrier islands have some of the highest erosion rates in the country, with some islands losing more than 30 feet of shoreline every year. Sand and silt flowing down the Mississippi River once maintained the islands but are now dredged from ship channels and dumped far offshore. During big hurricanes like Katrina, the low islands serve as little more than speed bumps and often get devastated in the process. Before the storm the Chandeleur Islands (below)—a thin crescent of barrier islands some 60 miles southeast of New Orleans—were intact; photos taken by the USGS after Katrina show the islands completely stripped of sand.

Louisiana's once dense coastal wetlands, which act like a sponge on a storm surge, have been vanishing as well at the rate of 25 square miles a year. Research after Hurricane Andrew showed that every linear mile of wetland cut the height of the surge by three inches. Some researchers believe that if Louisiana's original marsh had been intact, it might have kept the city dry. Others say it would have made little difference against the possible 20-foot-high surge generated by Katrina.

Levees—big earthen mounds sometimes topped by floodwalls—are the last line of defense. Researchers have long known that the Lake Pontchartrain levees, which are about ten feet lower than the river levees near the French Quarter, were the city's Achilles' heel—particulary since the levees, like much of the city, are slowly sinking. Katrina poured an estimated six feet of surge into the lake. When the water rose above the floodwalls along three of the city's main drainage canals, the last defenses were breached.



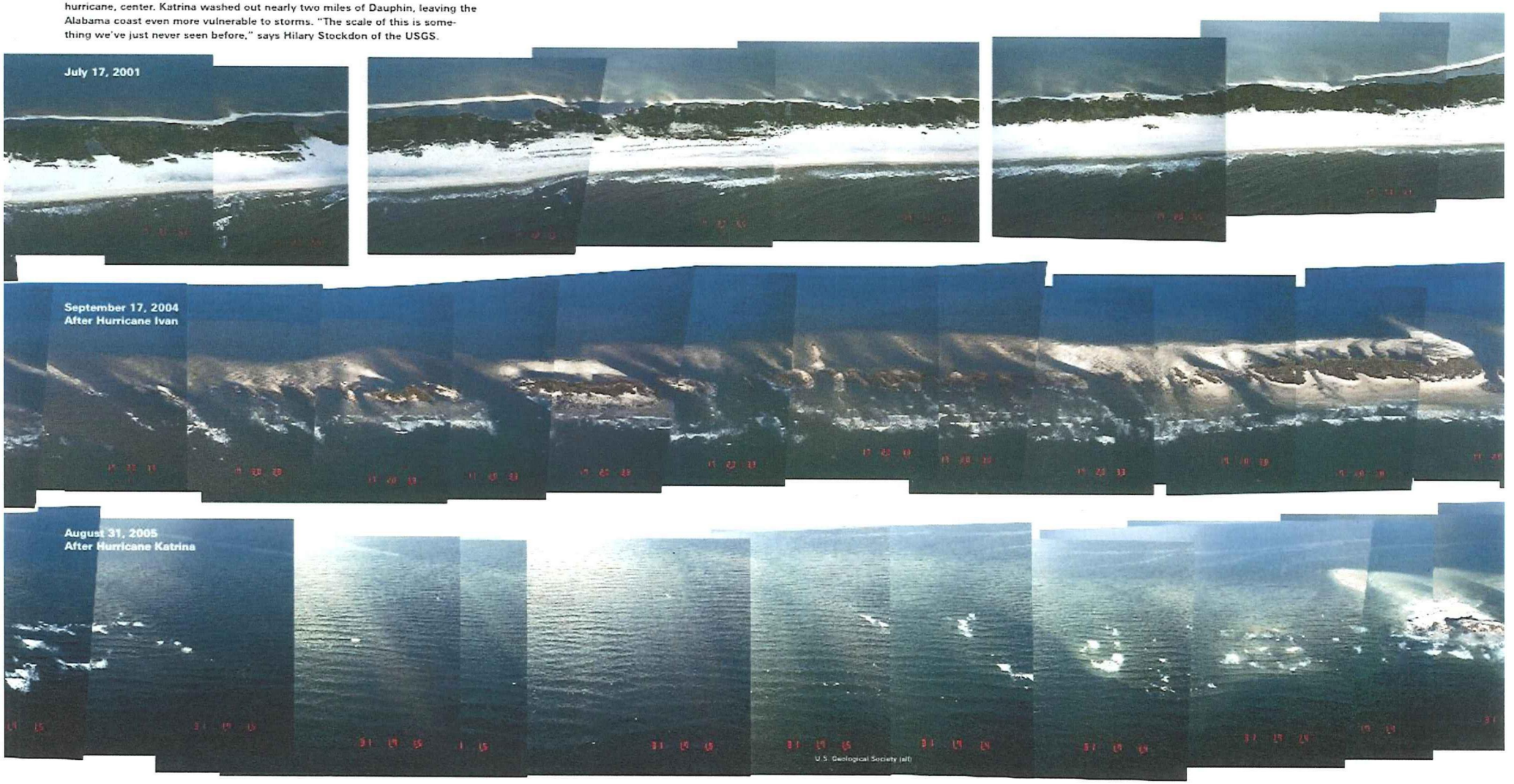
When natural barriers vanish

Louisiana's beleaguered barrier islands pull double duty as the first line of defense against a surge, while protecting the second line of defense—coastal wetlands—from the day-to-day erosive power of the open Gulf. Wetlands act like a sponge, soaking up water and creating friction that can knock down a surge one foot for every four miles of wetlands it crosses. Without these natural barriers New Orleans would need massive dikes to keep out storm surges, like those the Netherlands uses to keep out the North Sea. "That's the future of New Orleans," says USGS oceanographer Jeff List. "If you're going to have a city below sea level, you'd better have levees high enough to protect it."

Annie Griffiths Belt (left); art by Doug Stern, both National Geographic

GOING, GOING, GONE—DAUPHIN ISLAND

Even 90 miles from where Katrina made landfall, the storm annihilated a section of Dauphin Island, Alabama. The top mosaic shows the barrier island still intact in 2001, three years before it was ripped apart by Ivan, a Category Three hurricane, center. Katrina washed out nearly two miles of Dauphin, leaving the Alabama coast even more vulnerable to storms. "The scale of this is something we've just never seen before," says Hilary Stockdon of the USGS.



U.S. Geological Society (all)

FREE MAP
How the Gulf Works

CELEBRATING JANE
Goodall's 50 years with chimps

GIANTS DOWN UNDER
Animals that once ruled Australia

NGM.COM OCTOBER 2010

NATIONAL GEOGRAPHIC

SPECIAL REPORT

THE SPILL

Photos You Haven't Seen
Stories You Haven't Heard

PLUS

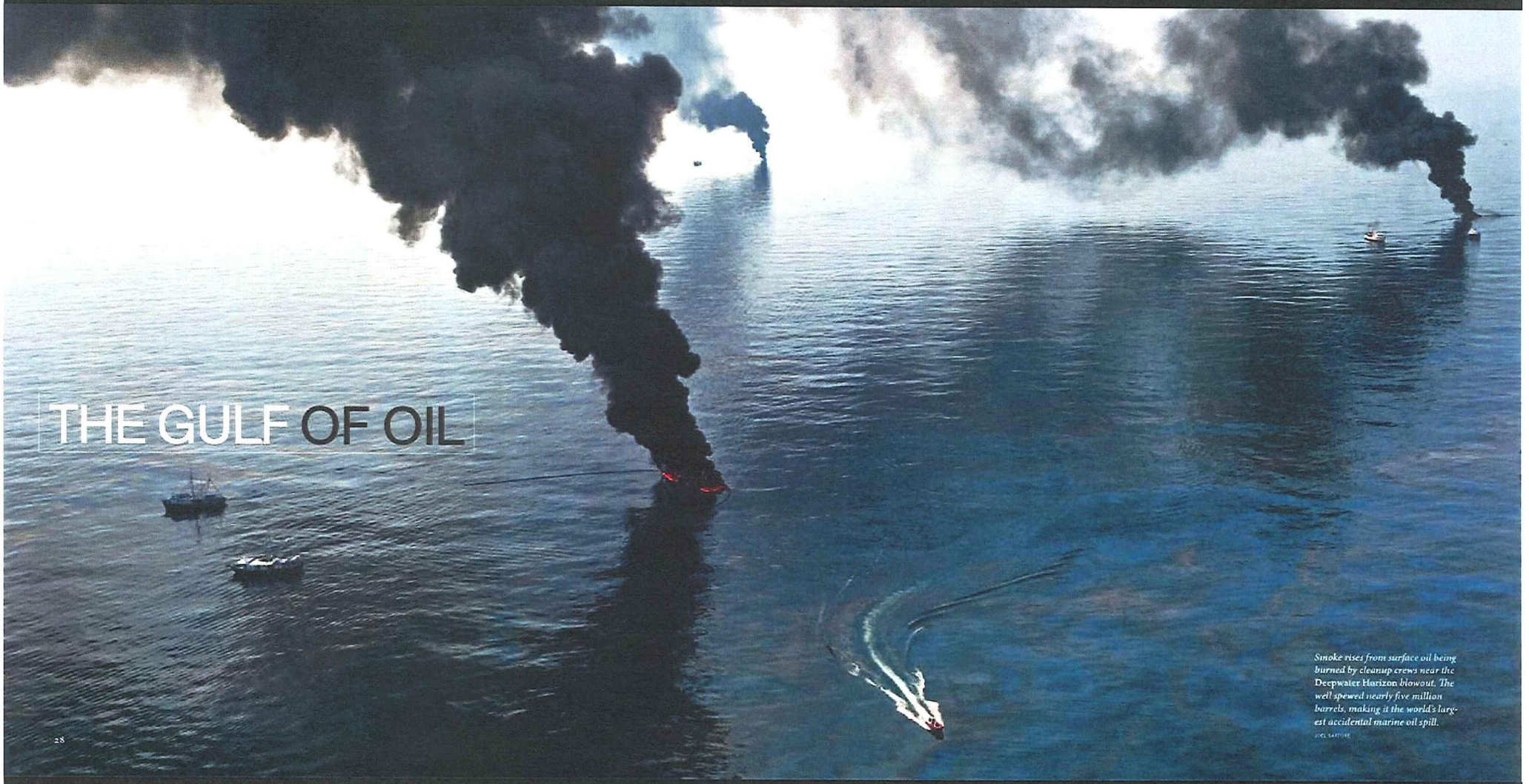
The Future of Deepwater Drilling

Geography of Offshore Oil

MISSION BLUE
Our Call to Protect Marine Wildlife

Brown Pelican, Fort Jackson Bird Rehabilitation Center

THE GULF OF OIL



Smoke rises from surface oil being burned by cleanup crews near the Deepwater Horizon *blowout. The well spewed nearly five million barrels, making it the world's largest accidental marine oil spill.*

JOEL SARTORE

UNFLAGGING DEMAND FOR OIL PROPELLED THE INDUSTRY INTO DEEP WATER. BUT THE BLOWOUT IN THE GULF FORCES THE QUESTION:

IS IT WORTH THE RISK?

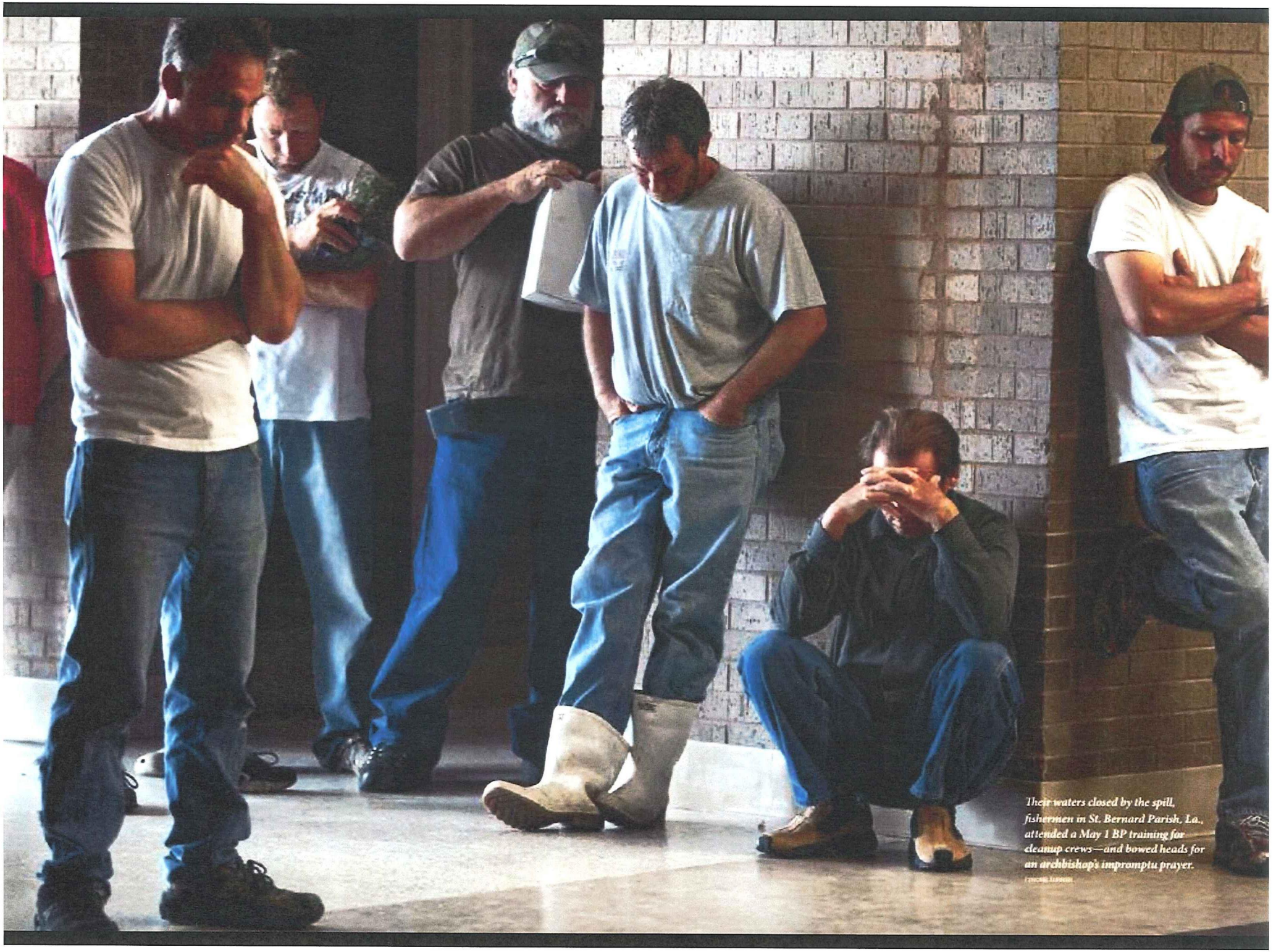
"You could see the life draining out of it," says parish official P. J. Hahn, who impulsively rescued this severely oiled brown pelican on Queen Bess Island, La. The bird lived.

A shrimp the size of a staple swims amid dark brown globules of oil. The effect of the spill on the eggs and larvae of shrimps, crabs, and fish, all key to the local economy, remains unknown.

DAVID LAITE/SHANESH

Bottlenose dolphins slip through oiled waters in Chandeleur Sound, La. An adult dolphin can weigh up to 600 pounds. Because of their size, only a few were rescued and relocated to clean waters.

NATIONAL GEOGRAPHIC



Their waters closed by the spill, fishermen in St. Bernard Parish, La., attended a May 1 BP training for cleanup crews—and bowed heads for an archbishop's impromptu prayer.

PHOTOS: [illegible]

THE DEEP DILEMMA

The largest U.S. oil discoveries in decades lie in the depths of the Gulf of Mexico—one of the most dangerous places to drill on the planet.

BY JOEL K. BOURNE, JR.

ON A BLISTERING JUNE DAY in Houma, Louisiana, the local offices of BP—now the *Deepwater Horizon* Incident Command Center—were swarming with serious men and women in brightly colored vests. Top BP managers and their consultants wore white, the logistics team wore orange, federal and state environmental officials wore blue. Reporters wore purple vests so their handlers could keep track of them. On the walls of the largest "war room," huge video screens flashed spill maps and response-vessel locations. Now and then one screen showed a World Cup soccer match.

Mark Ploen, the silver-haired deputy incident commander, wore a white vest. A 30-year veteran of oil spill wars, Ploen, a consultant, has helped clean up disasters around the world, from Alaska to the Niger Delta. He now found himself surrounded by men he'd worked with on the *Exxon Valdez* spill in Alaska two decades earlier. "It's like a high school reunion," he quipped.

Fifty miles offshore, a mile underwater on the seafloor, BP's Macondo well was spewing something like an *Exxon Valdez* every four days. In late April an explosive blowout of the well had turned the *Deepwater Horizon*, one of the world's most advanced drill rigs, into a pile of charred and twisted metal at the bottom of the sea. The

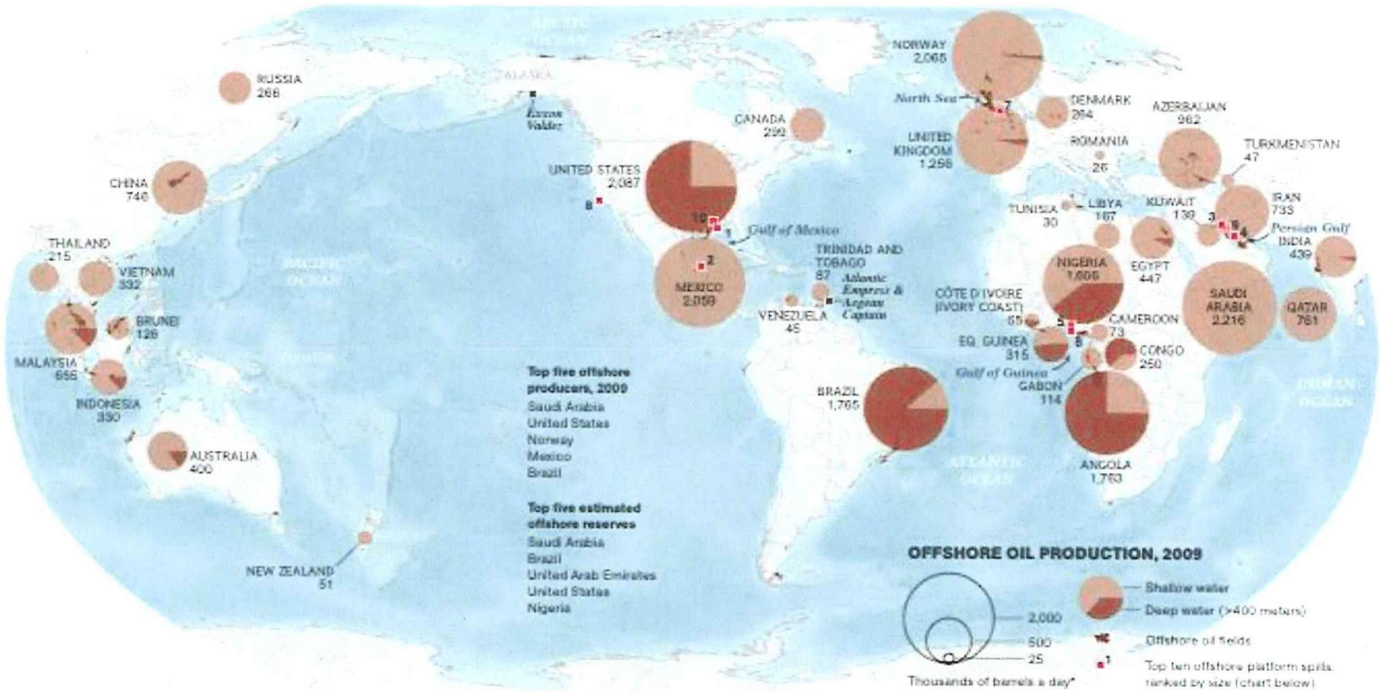
Joel Bourne is a contributing writer. His article about California's water supply appeared in April.

The $560-million Deepwater Horizon drilling rig burns after the April 20 well blowout. Eleven workers died in the explosion and flames that followed. On April 22 the rig sank.

industry had acted as if such a catastrophe would never occur. So had its regulators. Nothing like it had happened in the Gulf of Mexico since 1979, when a Mexican well called Ixtoc I blew out in the shallow waters of the Bay of Campeche. Drilling technology had become so good since then, and the demand for oil so irresistible, that oil companies had sailed right off the continental shelf into ever deeper waters.

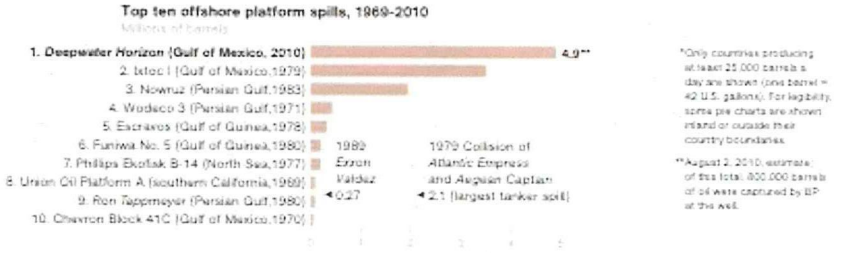
To many people in industry and government, spills from tankers like the *Exxon Valdez* seemed a much larger threat. The Minerals Management Service (MMS), the federal agency that regulated offshore drilling, had claimed that the chances of a blowout were less than one percent, and that even if one did happen, it wouldn't release much oil. Big spills had become a rarity, said Ploen. "Until this one."

In the Houma building, more than a thousand people were trying to organize a cleanup unlike any the world had seen. Tens of thousands more were outside, walking beaches in white Tyvek suits, scanning the waters from planes and helicopters, and fighting the expanding slick with skimmers, repurposed fishing boats, and a deluge of chemical dispersants. Around the spot Ploen called simply "the source," a small armada bobbed in a sea of oil. A deafening roar came from the drill ship *Discoverer Enterprise* as it flared off methane gas captured from the runaway well. Flames also shot from another rig, the *Q4000*, which was burning oil and gas collected from a separate line attached to the busted blowout preventer. Nearby, two shrimp boats pulling fire boom were burning oil skimmed from the surface, creating a curving wall of flame and a towering plume of greasy, black smoke. Billions of dollars had already been spent. But millions of barrels of light, sweet crude were still snaking toward the barrier islands, marshes, and beaches of the Gulf of Mexico.



DRILLING FOR OFFSHORE OIL

Undersea oil provides an increasing amount of the global supply, as exploration heads ever deeper in search of new "plays." In 2020 wells more than 400 meters below the sea surface will likely provide 10 percent of the world's oil. But going deep poses technical challenges and safety risks.



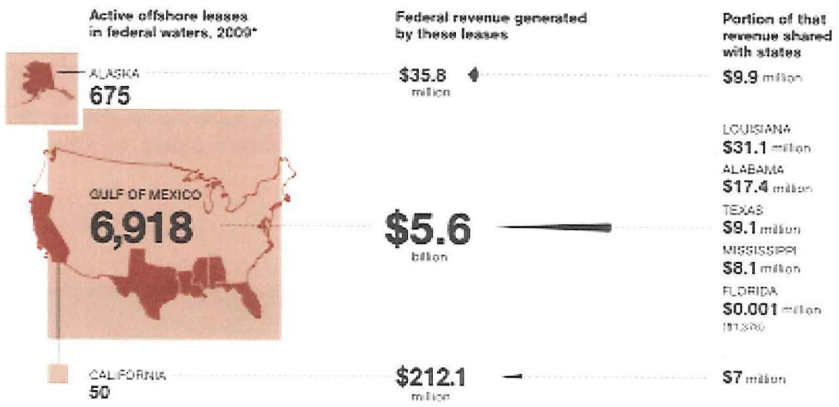
The waters of the Gulf below a thousand feet are a relatively new frontier for oilmen—and one of the toughest places on the planet to drill. The seafloor falls off the gently sloping continental shelf into jumbled basin-and-range-like terrain, with deep canyons, ocean ridges, and active mud volcanoes 500 feet high. More than 2,000 barrels of oil a day seep from scattered natural vents. But the commercial deposits lie deeply buried, often beneath layers of shifting salt that are prone to undersea earthquakes. Temperatures at the seafloor are near freezing, while the oil reservoirs can hit 400 degrees Fahrenheit, they're like hot, shaken soda bottles just waiting for someone to pop the top. Pockets of explosive methane gas and methane hydrates, frozen but unstable, lurk in the sediment, increasing the risk of a blowout.

For decades the exorbitant costs of drilling deep kept commercial rigs close to shore. But shrinking reserves, spiking oil prices, and spectacular offshore discoveries ignited a global rush into deep water. Recent finds in Brazil's Tupi and Guará fields could make that country one of the largest oil producers in the world. Similarly promising deepwater leases off Angola have excited bidding frenzies involving more than 20 companies.

In the Gulf of Mexico, the U.S. Congress encouraged companies to go deep as early as 1995. That year it passed a law forgiving royalties on deepwater oil fields leased between 1996 and

U.S. OFFSHORE LEASES

Offshore leases poured $5.8 billion into federal coffers in 2009. Most of the money—$5.6 billion—came from Gulf of Mexico wells, which have helped drive offshore oil's contribution to domestic production to 35 percent, up from 12 percent in 1981. Leasing is expected to resume once drillers adopt new federal safety standards.



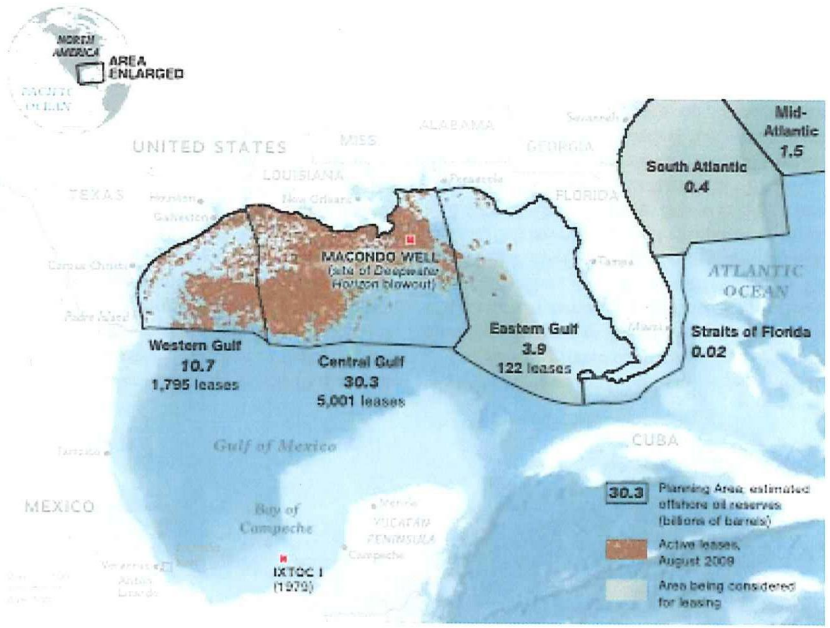
2000. A fleet of new rigs was soon punching holes all over the Gulf at a cost of up to a million dollars a day each. The number of leases sold in waters half a mile deep or more shot up from around 50 in 1994 to 1,100 in 1997.

It wasn't long before the industry hit pay dirt. New fields with names like Atlantis, Thunder Horse, and Great White came just in time to offset a long-term decline in shallow-water oil production. The Gulf of Mexico now accounts for 30 percent of U.S. production, with half of that coming from deep water (1,000 to 4,999 feet), a third from ultradeep water (5,000 feet or more), and the rest from shallow water. BP's Macondo well, in about 5,000 feet of water and reaching another 13,000 feet beneath the seafloor, wasn't particularly deep. The industry has drilled in 10,000 feet of water and to total depths of 35,050 feet—the latter a world record set just last year by the *Deepwater Horizon* in another BP field in the Gulf. The U.S. government estimates that the deep Gulf might hold 45 billion barrels of crude. "We're in deep water because that's where the resources are," says Larry Reed, an operations consultant in Houston who has worked with many of the major oil companies. Deepwater wells tend to be highly productive, he adds, like wells in the Middle East.

As technology was taking drillers deeper, however, the methods for preventing blowouts and cleaning up spills did not keep pace. Since the early 2000s, reports from industry and academia warned of the increasing risk of deepwater blowouts, the fallibility of blowout preventers, and the difficulty of stopping a deepwater spill after it started—a special concern given that deepwater wells, because they're under such high pressure, can spout as much as 100,000 barrels a day.

The Minerals Management Service routinely downplayed such concerns. A 2007 agency study found that from 1992 to 2006, only 39 blowouts occurred during the drilling of more than 15,000 oil and gas wells in the Gulf. Few of them released much oil; only one resulted in a death. Most of the blowouts were stopped within a week,

*ALASKA AND CALIFORNIA DATA AS OF SEPTEMBER 30, 2009; GULF OF MEXICO DATA AS OF AUGUST 19, 2009



typically by pumping the wells full of heavy drilling mud or by shutting them down mechanically and diverting the gas bubble that had produced the dangerous "kick" in the first place.

Though blowouts were relatively rare, the MMS report did find a significant increase in the number associated with cementing, the process of pumping cement around the steel well casing (which surrounds the drill pipe) to fill the space between it and the wall of the borehole. In retrospect, that note of caution was ominous.

SOME DEEPWATER WELLS go in relatively easy. The Macondo well did not. BP hired Transocean, a Switzerland-based company, to drill the well. Transocean's first drill rig was knocked out of commission by Hurricane Ida after just a month. The *Deepwater Horizon* began its ill-fated effort in February 2010 and ran into problems almost from the start. In early March the drill pipe got stuck in the borehole, as did a tool sent down to find the stuck section; the drillers had to back out and drill around the obstruction. A BP email later released by Congress mentioned that the drillers were having "well-control" problems. Another email, from a consultant, stated, "We have flipped design parameters around to the point that I got nervous." A week before the explosion, a BP drilling engineer wrote, "This has been [a] nightmare well."

By April 20 the *Deepwater Horizon* was six weeks behind schedule, according to MMS documents, and the delay was costing BP more than half a million dollars a day. BP had chosen to drill the fastest possible way—using a well design known as a "long string" because it places strings of casing pipe between the oil reservoir and the wellhead. A long string generally has two barriers between the oil and the blowout preventer on the seafloor: a cement plug at the bottom of the well, and a metal seal, known as a lockdown sleeve, placed right at the wellhead. The lockdown sleeve had not been installed when the Macondo well blew out.

In addition, congressional investigators and industry experts contend that BP cut corners on

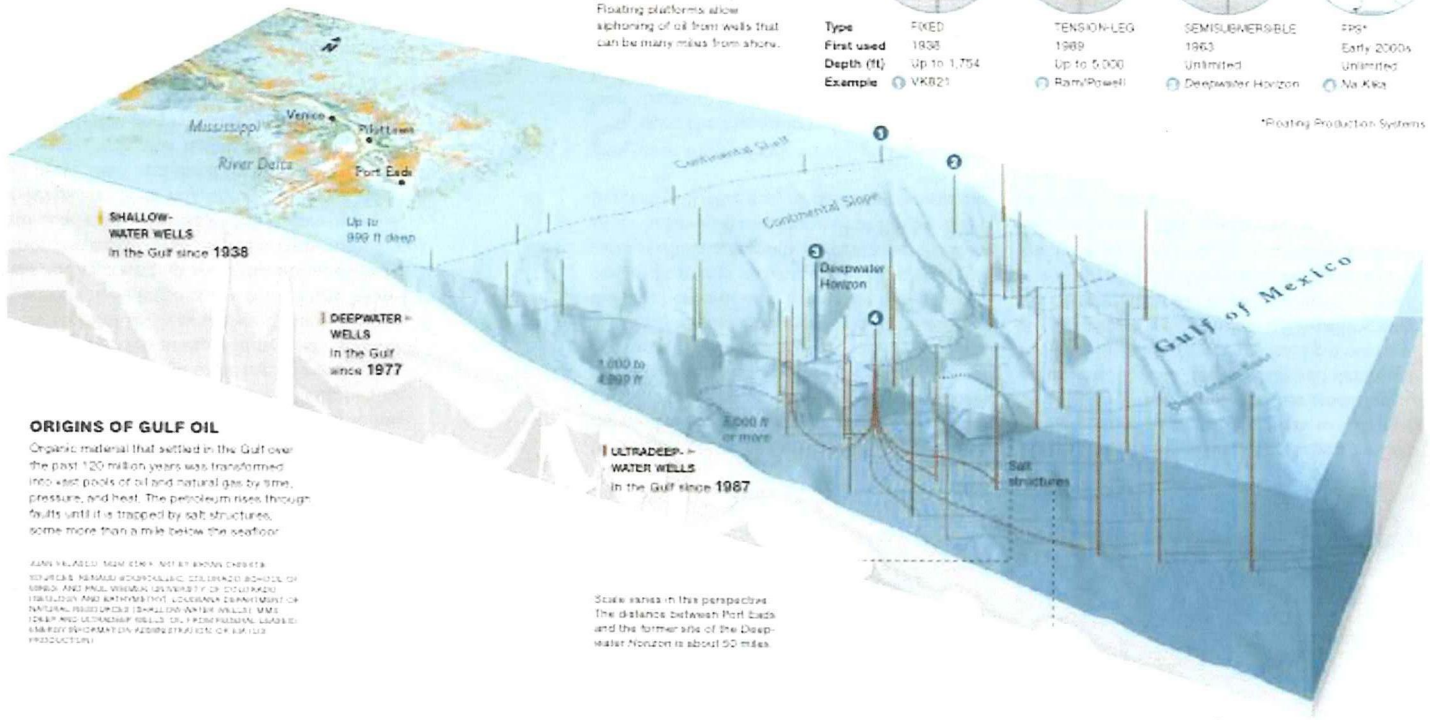
MAPPING SPECIALISTS, NGM STAFF; SOURCES: BUREAU OF OCEAN ENERGY MANAGEMENT, REGULATION AND ENFORCEMENT, FORMERLY MINERALS MANAGEMENT SERVICE; OFFICE OF NAVAL RESEARCH; AND LEASES; CONGRESSIONAL RESEARCH SERVICE (RESERVE ESTIMATES)

DRILLING DEEPER

As oil and gas reserves close to shore have been pumped dry, prospectors are plumbing a new frontier: the depths of the Gulf of Mexico. In 2009 Gulf oil production jumped 34 percent—largely from waters deeper than 5,000 feet. New technologies have made it possible to drill more than 35,000 feet down through water and rock.

U.S. Gulf oil from federal leases, 1985-2009

U.S. domestic oil production, 1985-2009



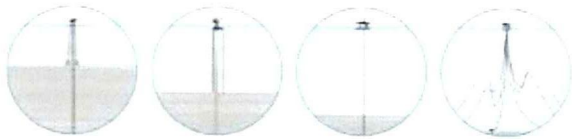
ORIGINS OF GULF OIL

Organic material that settled in the Gulf over the past 120 million years was transformed into vast pools of oil and natural gas by time, pressure, and heat. The petroleum rises through faults until it is trapped by salt structures, some more than a mile below the seafloor.

Scale varies in this perspective. The distance between Port Eads and the former site of the Deepwater Horizon is about 50 miles.

SEAFARING RIGS

Floating rigs, first developed in the 1960s, have opened deep water to petroleum exploration. Floating platforms allow siphoning of oil from wells that can be many miles from shore.



	FIXED	TENSION-LEG	SEMISUBMERSIBLE	FPS*
Type	FIXED	TENSION-LEG	SEMISUBMERSIBLE	FPS*
First used	1938	1989	1963	Early 2000s
Depth (ft)	Up to 1,754	Up to 5,000	Unlimited	Unlimited
Example	VK821	Ram/Powell	Deepwater Horizon	Na Kika

*Floating Production Systems

its cement job. It failed to circulate heavy drilling mud outside the casing before cementing, a practice that helps the cement cure properly. It didn't put in enough centralizers—devices that ensure that the cement forms a complete seal around the casing. And it failed to run a test to see if the cement had bonded properly. Finally, just before the accident, BP replaced the heavy drilling mud in the well with much lighter seawater, as it prepared to finish and disconnect the rig from the well. BP declined to comment on these matters, citing the ongoing investigation.

All these decisions may have been perfectly legal, and they surely saved BP time and money—yet each increased the risk of a blowout. On the night of April 20, investigators suspect, a large gas bubble somehow infiltrated the casing, perhaps through gaps in the cement, and shot straight up. The blowout preventer should have stopped that powerful kick at the seafloor; its heavy hydraulic rams were supposed to shear the drill pipe like a soda straw, blocking the upward surge and protecting the rig above. But that fail-safe device had itself been beset by leaks and maintenance problems. When a geyser of drilling mud erupted onto the rig, all attempts to activate the blowout preventer failed.

The way BP drilled the Macondo well surprised Magne Ognedal, director general of the Petroleum Safety Authority Norway (PSA). The Norwegians have drilled high-temperature, high-pressure wells on their shallow continental shelf for decades, he said in a telephone interview, and haven't had a catastrophic blowout since 1985. After that incident, the PSA and the industry instituted a number of best practices for drilling exploration wells. These include riserless drilling from stations on the seafloor, which prevents oil and gas from flowing directly to a rig; starting a well with a small pilot hole through the sediment, which makes it easier to handle gas kicks; having a remote-controlled backup system for activating the blowout preventers; and most important, never allowing fewer than two barriers between the reservoir and the seafloor.

"The decisions [BP] made when they had indications that the well was not stable, the decision to have one long pipe, the decision to have only six centralizers instead of 21 to create the best possible cement job—some of these things were very surprising to us here," says Ognedal.

The roots of those decisions lie in BP's corporate history, says Robert Bea, a University of California, Berkeley expert in both technological disasters and offshore engineering. BP hired Bea in 2001 for advice on problems it faced after it took over the U.S. oil companies Amoco and ARCO. One problem, Bea says, was a loss of core competence: After the merger BP forced thousands of older, experienced oil field workers into early retirement. That decision, which made the company more dependent on contractors for engineering expertise, was a key ingredient in BP's "recipe for disaster," Bea says. Only a few of the 126 crew members on the *Deepwater Horizon* worked directly for BP.

The drilling operation itself was regulated by

"Mix two parts sugar white sand with one part crystal blue water," reads a tourism slogan for Orange Beach, Ala. In early June Deepwater Horizon oil was added to the recipe.

BP's spill-response plan for the Gulf mentioned walruses and sea otters. It had been cut and pasted from plans for the Arctic.

the MMS (which, in the wake of the accident, was reorganized and renamed the Bureau of Ocean Energy Management, Regulation, and Enforcement). In 2009 the MMS had been excoriated by the U.S. General Accounting Office for its lax oversight of offshore leases. That same year, under the new Obama Administration, the MMS rubber-stamped BP's initial drilling plan for the Macondo well. Using an MMS formula, BP calculated that the worst-case spill from the well would be 162,000 barrels a day—nearly three times the flow rate that actually occurred. In a separate spill-response plan for the whole Gulf, the company claimed that it could recover nearly 500,000 barrels a day using standard technology, so that even a worst-case spill would do minimal harm to the Gulf's fisheries and wildlife—including walruses, sea otters, and sea lions.

There are no walruses, sea otters, or sea lions in the Gulf. BP's plan also listed as an emergency responder a marine biologist who had been dead for years, and it gave the Web address of an entertainment site in Japan as an emergency source of spill-response equipment. The widely reported gaffes had appeared in other oil companies' spill-response plans as well. They had simply been cut and pasted from older plans prepared for the Arctic.

When the spill occurred, BP's response fell well short of its claims. Scientists on a federal task force said in early August that the blowout well had disgorged as much as 62,000 barrels a day at the outset—an enormous flow rate, but far below BP's worst-case scenario. Mark Ploen estimated in June that on a good day his response teams, using skimmers brought in from around the world, were picking up 15,000 barrels. Simply burning the oil, a practice that had been used with the *Exxon Valdez* spill, had proved more effective. BP's burn fleet of 23 vessels included local shrimp boats that worked in pairs, corralling surface oil with long fire boom and then igniting it with homemade napalm. In one "monster burn" the team incinerated 16,000 barrels of oil in just over three hours.

"Shrimpers are naturals at doing this," said Neré Mabile, science and technology adviser for the burn team in Houma. "They know how to pull nets. They're seeing that every barrel we burn is a barrel that doesn't get to shore, doesn't affect the environment, doesn't affect people. And where's the safest place to burn this stuff? The middle of the Gulf of Mexico."

In June the *Discoverer Enterprise* and the *Q4000* began collecting oil directly at the busted blowout preventer, and by mid-July they had ramped up to 25,000 barrels a day—still far less, even when the efforts of the skimmers and the burn team were added, than the nearly 500,000 barrels a day BP had claimed it could remove. At that point the company finally succeeded in placing a tight cap on the well, halting the gusher after 12 weeks.

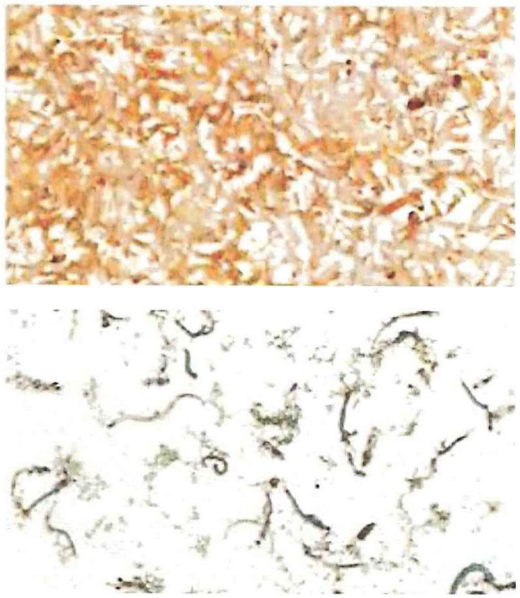
In 1990, after the *Exxon Valdez* spill, Congress's Office of Technology Assessment analyzed spill-response technologies and found them lacking. "Even the best national response system will have inherent practical limitations that will hinder spill-response efforts for catastrophic events—sometimes to a major extent," wrote OTA's director, John H. Gibbons. "For that reason it is important to pay at least equal attention to preventive measures as to response systems…The proverbial ounce of prevention is worth many, many pounds of cure."

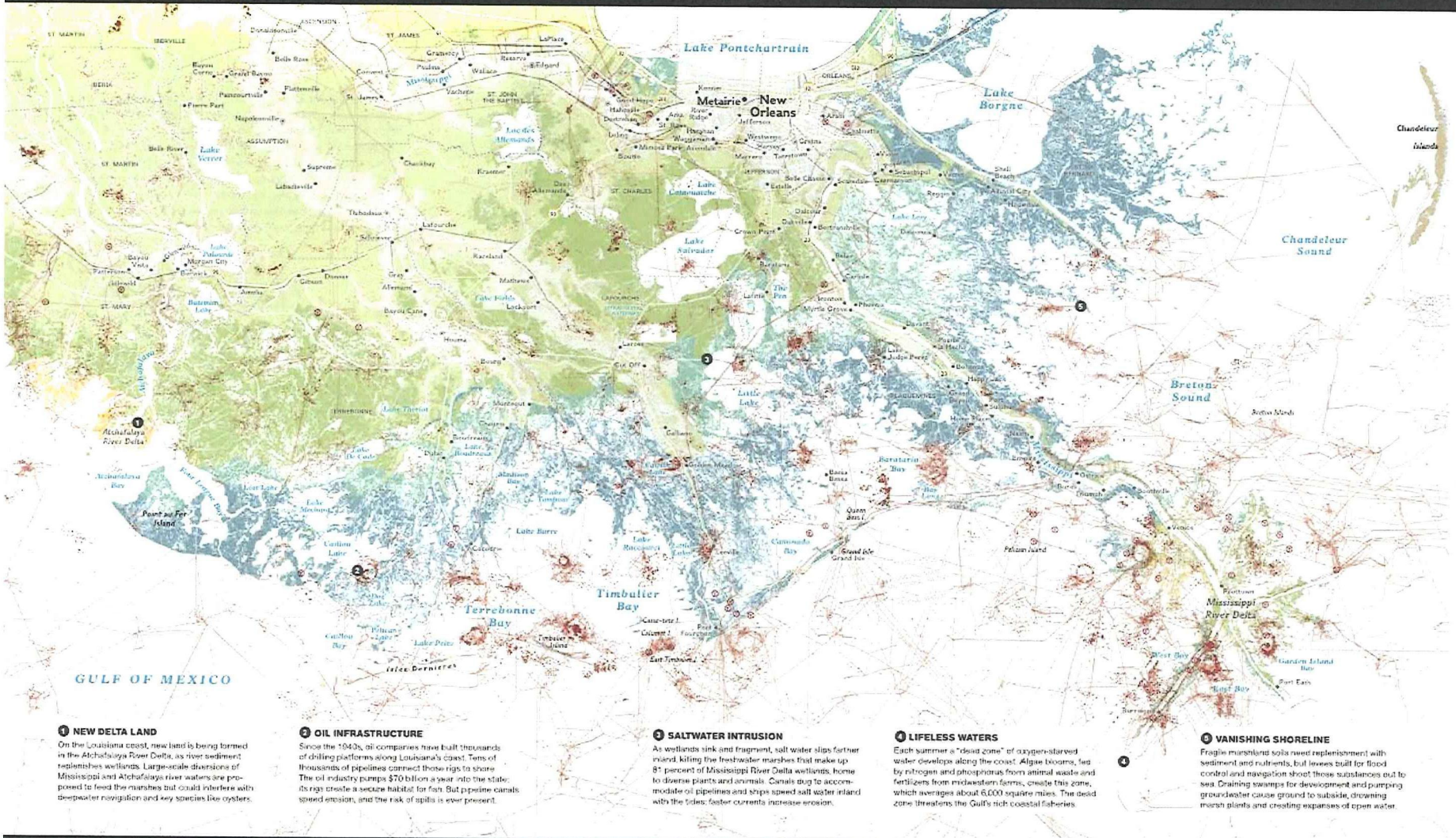
Just weeks before the Macondo blowout, the Obama Administration had announced with some fanfare an expansion of offshore drilling. By summer the administration was struggling

THE SPILL'S UNSEEN TOLL

Three formaldehyde-filled jars tell a tale of diminishing life in a water column about 90 miles north of the well. The May 4 sample (far left), collected by the Dauphin Island Sea Lab, Ala., shows a normal amount of plankton—minute plants and animals that are the foundation of the ocean's food chain. The June 2 jar holds only 40 percent of the first. The June 28 jar is down to 10 percent. Plankton cannot survive as waters become hypoxic—depleted of oxygen. The probable cause in this case: microbes digesting oil and methane gas from the spill.

Waters sampled about 35 feet deep on June 28 support a thriving population of tiny crustaceans called copepods (top right). Twenty feet farther below was a hypoxic layer almost devoid of life. Deep waters are more likely to remain hypoxic.





ENDANGERED WETLANDS

The *Deepwater Horizon* spill is just the latest threat to the Mississippi River Delta and its inhabitants. Both natural processes and human interference have submerged more than 2,300 square miles of coastal marshes. Nonetheless, the area is still one of the world's richest river deltas, home to shrimp and oyster fisheries, endangered sea turtles, millions of birds, a multibillion-dollar oil industry, and two million people. This map details the ongoing problems that confront the delta.

1 NEW DELTA LAND

On the Louisiana coast, new land is being formed in the Atchafalaya River Delta, as river sediment replenishes wetlands. Large-scale diversions of Mississippi and Atchafalaya river waters are proposed to feed the marshes but could interfere with deepwater navigation and key species like oysters.

2 OIL INFRASTRUCTURE

Since the 1940s, oil companies have built thousands of drilling platforms along Louisiana's coast. Tens of thousands of pipelines connect those rigs to shore. The oil industry pumps $70 billion a year into the state; its rigs create a secure habitat for fish. But pipeline canals speed erosion, and the risk of spills is ever present.

3 SALTWATER INTRUSION

As wetlands sink and fragment, salt water slips farther inland, killing the freshwater marshes that make up 81 percent of Mississippi River Delta wetlands, home to diverse plants and animals. Canals dug to accommodate oil pipelines and ships speed salt water inland with the tides; faster currents increase erosion.

4 LIFELESS WATERS

Each summer a "dead zone" of oxygen-starved water develops along the coast. Algae blooms, fed by nitrogen and phosphorus from animal waste and fertilizers from midwestern farms, create this zone, which averages about 6,000 square miles. The dead zone threatens the Gulf's rich coastal fisheries.

5 VANISHING SHORELINE

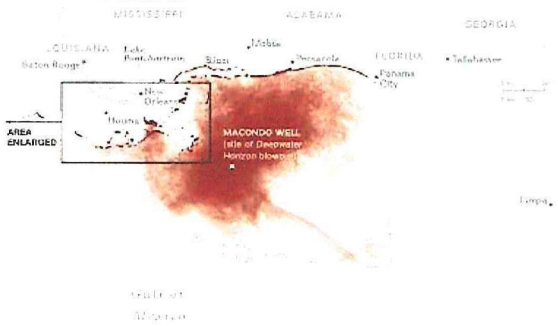
Fragile marshland soils need replenishment with sediment and nutrients, but levees built for flood control and navigation shoot those substances out to sea. Draining swamps for development and pumping groundwater cause ground to subside, drowning marsh plants and creating expanses of open water.

WILLIAM MCNULTY, NOM STAFF; DEBBIE GARSON AND MAUREEN J. FLYNN, NG MAPS; THEODORE A. FUNDLEY

SOURCES: NOAA AND THE NATURE CONSERVANCY; JUAN CHOPIN, MAPS AND LOUISIANA DEPARTMENT OF NATURAL RESOURCES, OFFICE OF COASTAL MANAGEMENT AND OFFICE OF COASTAL MANAGEMENT, SOIL AND GAS INFRASTRUCTURE; LANDSCAN 2009 AMERICAN ARCHIVE

AN OILY STAIN

Winds and currents spread surface oil, contaminating more than 625 miles of coastline, most in Louisiana. The spill prompted a fishing ban in one-third of federal waters (partly rescinded in late July) and a massive and ongoing cleanup effort. Experts believe much of the oil never reached the surface and remains in voluminous and elusive underwater plumes.



THE BATTERED GULF COAST

Two centuries of efforts to tame the Mississippi River with levees, pumps, and channels have left its vast wetlands ecosystem dwindling and on the verge of collapse. "We know there was a crisis in the Gulf prior to what happened April 20," Tom Strickland, an assistant secretary of the interior, said after the *Deepwater Horizon* spill. Coastal-restoration plans have been authorized by Congress but are not yet under way. They include breaking open levees to restore the flow of rivers to marshlands. Environmentalists are lobbying to apply oil spill penalty funds to restoration.

Canals carved through Golden Meadow, La., and elsewhere hold pipelines that deliver oil and gas from offshore wells. This chopping up of the wetlands is one of many forces contributing to the decline of the Mississippi Delta.

JOEL SARTORE

A dead juvenile sea turtle lies marooned in oil in Barataria Bay, La. More than 500 sea turtles died in the spill area. As of August 2, eggs from 134 turtle nests had been moved to oil-free beaches, and 2,134 hatchlings released.

JOEL SARTORE

FORLORN IN THE BAYOU

Louisiana's wetlands are resilient and have bounced back before. But no one knows how long this recovery will take.

BY BRUCE BARCOTT

WHERE LAND MEETS THE SEA in the Mississippi River Delta, down at the bottom of the Louisiana boot, the term "coastline" doesn't really apply. There is no line. There are only the dashed pen strokes of the barrier islands, a dozen or so thin beachheads, and beyond, a porous system of open bays, canals, salt and brackish marshes, and freshwater swamps running inland for 25 to a hundred miles.

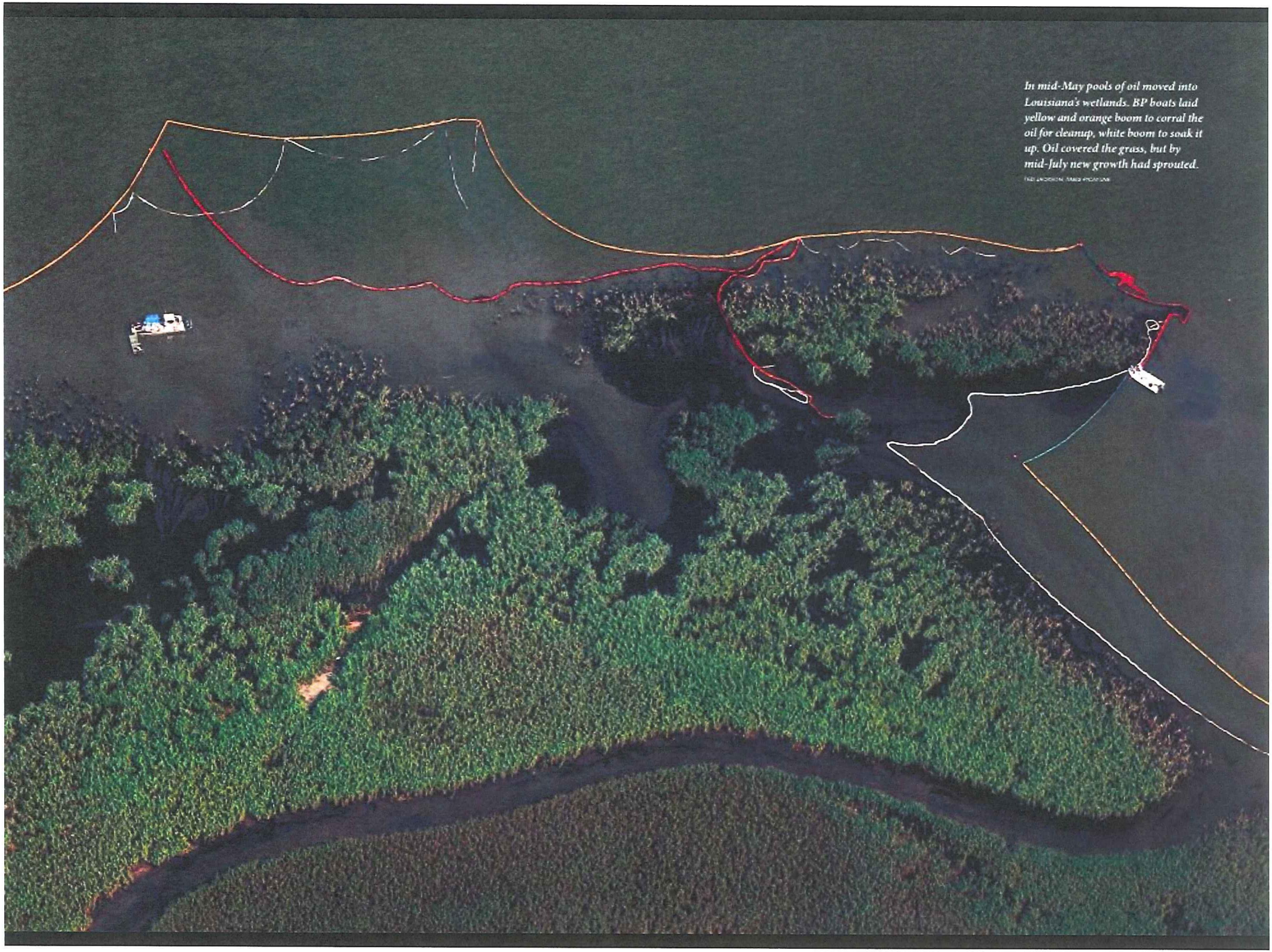
These are the Louisiana wetlands—12,355 square miles of one of the most productive ecosystems in North America. Mullet are so profuse they will literally jump into a fisherman's boat. Brown pelicans, tricolored herons, roseate spoonbills, great egrets, and blue-winged teal ducks call this place home.

One-third of the United States oyster and shrimp crop comes out of the waters along the Louisiana coast. And 98 percent of the fish, shrimps, crabs, and oysters harvested along that coast depend on habitat in and around the marshes of the Barataria-Terrebonne estuary, an area that encompasses some four million acres south and west of New Orleans. Without these

Environmental journalist Bruce Barcott lives on Bainbridge Island, Washington. This is his fourth feature for National Geographic.

Workers bag oil-collecting pom-poms near a bird rookery in Barataria Bay, La. Absorbent boom snakes at their feet. By the end of July, the cleanup had generated almost 40,000 tons of solid waste.

JOSE AZEL



In mid-May pools of oil moved into Louisiana's wetlands. BP boats laid yellow and orange boom to corral the oil for cleanup, white boom to soak it up. Oil covered the grass, but by mid-July new growth had sprouted.

The federal government would not ride to the rescue. If Louisianans wanted the marshes protected, they would have to do it themselves.

that was heavily oiled two weeks ago," Kulp said. He showed me pictures of dark reddish-brown oil gunked on the shore at Devils Point. "It was pretty badly hit."

Kulp had recommended no radical cleaning. "We had them run some boom to suck oil from the water along the shoreline. I'm hoping the tidal action will slowly wash the oil out of the vegetation and into the boom." The material in the boom is hydrophobic (water repellent) and oleophilic (oil absorbent). So when oil touches it, the boom won't let it go.

Three hours later an airboat dropped us off on Devils Point. We sloshed ashore at high tide. Nearly the entire peninsula was under six inches of water. "What I want to know is if the oil is moving into the interior, or if it's staying on the fringe," Kulp said.

It took about five minutes to make our way across. The news was mostly good. Some mangrove leaves had gone black, and some areas of glasswort were still lightly oiled. But the tidal and wave action had worked like a washing machine agitator, lifting the oil off the plants and moving it onto the white boom, which was now black with oil.

Back at SCAT headquarters that evening, division leader Ed Owens brought his 45-member staff together for a half-hour debriefing. Owens, a bigger-than-life British man with a rakish eye patch, came up with the SCAT concept while working on the *Exxon Valdez* response. Each SCAT team reported on what it had found.

"Team two. Mark?"

Kulp nutshelled it. "We went back to Devils Point, where we're seeing progressive flushing with the tides. If we keep changing out the dirty boom, I think the high tides will continue doing us some good."

One of the other SCAT teams reported that the beach on East Grand Terre, a barrier island, was still full of pooled oil. "This is the poster child right now," the team leader said. "We need to get a cleanup team out there."

Owens sighed. In this complex cleanup operation, the assignment of cleanup crews was beyond his purview. He could recommend, but he could not dispatch. That was the job of the operations division.

"We'll go to ops tonight and tell them they've got to get on this now," Owens said, clearly frustrated at the thought of yet another delay. As the meeting broke up, he turned to his deputy. "We're going to have to kick some ass on that Grand Terre situation." Whether that would result in any action, nobody could say.

Kulp stayed late filling out a report on Devils Point. It might get filed in the bureaucratic ether. Or somehow it might make a difference in the recovery of Timbalier Bay. On his computer screen he called up a photo of the oil from his original visit to Devils Point. "It certainly looks a lot less scary than when I saw it two weeks ago," he said. "With what we saw today, I do feel a sense of hope."

CLEANING OIL from the marshes is one thing. Cleaning the wildlife that lives in the marshes is another thing entirely. BP had hired dozens of wildlife professionals to collect oiled birds and turtles, but they were often overwhelmed by the workload. That led to frustration and sometimes improvisation.

Every morning in early June the Plaquemines Parish coastal director, P. J. Hahn, met a fishing guide named Dave Marino at 4:45 in the refinery town of Port Sulphur, and the two of them went oil scouting. Hahn needed to know where the oil was washing up. Marino, his business wrecked by oil, was happy to have the work.

On the morning of June 5 Hahn said to Marino, "We better take a look at Queen Bess."

A 97-acre clump of oyster grass and shell midden, Queen Bess Island is one of the fragile masterpieces of Barataria Bay. When Louisiana reintroduced the extirpated brown pelican in the late 1960s, Queen Bess became a primary nesting ground. In 1990 coastal-restoration advocates ringed the island with a rock barrier to keep it from sinking into the bay. Hundreds of brown pelicans, Forster's terns, and laughing gulls now flock there annually to nest.

Hahn glassed the shore as we approached the island. "It's getting worse over here," he said.

Workers wipe oil from marsh grass in St. Tammany Parish, La. It does look silly, a parish spokesman concedes, using diaper-like cloths to "wipe up seven billion blades of grass." But the task helped gauge the degree of marsh grass contamination, which turned out to be small, and provided oil samples for testing. Below, rust-colored crude oil coats a blue crab's face and claws at Grand Isle State Park, La.

SCOTT THRELKELD, TIMES-PICAYUNE (TOP); C. C. LOCKWOOD

We carried the pelican to the boat. The sopping, sun-heated bird felt as warm as fresh bread.

fingerlike breathing tubes that provide oxygen to the tree's underwater roots. "Even a light sheen can clog those tubes," St. Pé said as we scrutinized a number of empty pelican nests in the mangroves on Cat Island. Their oiled residents had been caught and taken to the rehab center the previous day.

As we drifted along the shore of Cat Island, gobs of oil floated by, fraying at the edges in the 97-degree heat. "It's degrading pretty quickly," said St. Pé. "The hot Louisiana sun can induce a lot of photooxidation and evaporation," he said. "And oil-consuming bacteria will multiply quickly now, because there's lots of food."

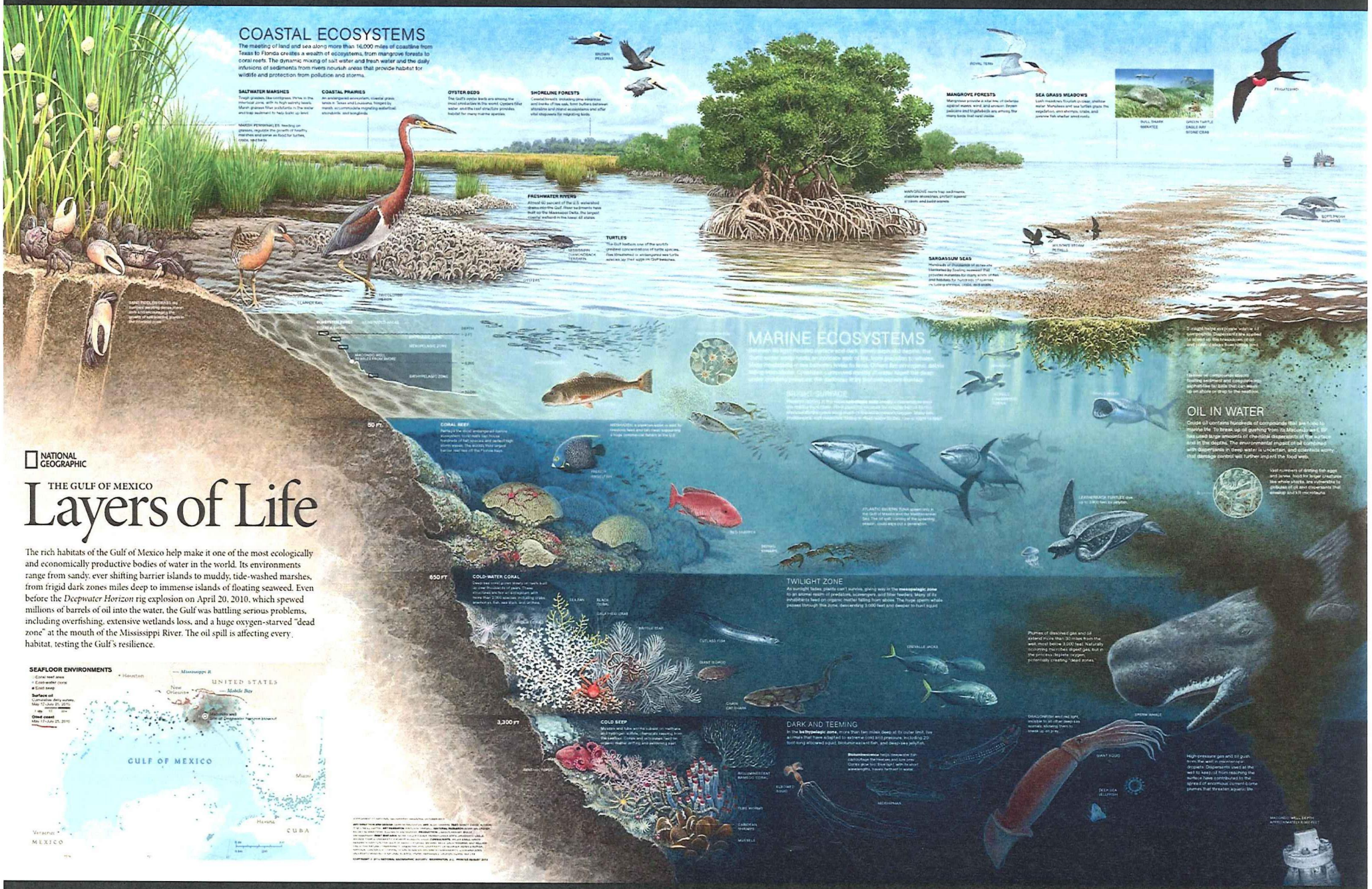
For the marshes of the Barataria-Terrebonne estuary, the damage done by the oil spill didn't compare with the damage done by decades of canal cutting and sediment starvation, St. Pé said. "The ecological effects of this will gradually subside. But the socioeconomic impacts will be devastating. No oysters, at least in the near future. No crabbing. No fishing. No seafood to restaurants. Nobody buying ice or bait or marine supplies. Lost paychecks with the offshore-drilling moratorium. Those impacts will stay for a long time."

ONE EVENING in early June I drove down to the Grand Isle shore and watched coin-size gobs of oil wash up in the surf. The beach at Grand Isle has become famous for visits from President Barack Obama and clean-up crews scooping oil out of sand. But on this night it was deserted. The only sound was a light whoosh from the waves.

Then I spotted two birds flying low from the east along the tide line. It took me a moment to identify them. Oystercatchers? No. By their motion they revealed themselves. They were black skimmers, which catch small fish by dipping their lower bills into the top three inches of water as they fly. As they flew past, I watched them skim water poxed with oil. I wanted to wave them away, flash a warning sign, scare them off. But it was too late. They continued down the shore, skimming and skimming and skimming. □

A brown pelican rests at the Fort Jackson Bird Rehabilitation Center in Buras, La., after a cleaning. Only a tiny fraction of birds are retrieved and released. No one yet knows how oil and dispersants will affect reproduction.

JOEL SARTORE



NATIONAL GEOGRAPHIC

THE GULF OF MEXICO

Layers of Life

The rich habitats of the Gulf of Mexico help make it one of the most ecologically and economically productive bodies of water in the world. Its environments range from sandy, ever shifting barrier islands to muddy, tide-washed marshes, from frigid dark zones miles deep to immense islands of floating seaweed. Even before the *Deepwater Horizon* rig explosion on April 20, 2010, which spewed millions of barrels of oil into the water, the Gulf was battling serious problems, including overfishing, extensive wetlands loss, and a huge oxygen-starved "dead zone" at the mouth of the Mississippi River. The oil spill is affecting every habitat, testing the Gulf's resilience.


NATIONAL GEOGRAPHIC
Gulf of Mexico
A GEOGRAPHY OF OFFSHORE OIL
For the past half century, oil has driven the economy of the Gulf of Mexico. A third of U.S. oil production flows from nearly 3,500 platforms in the Gulf, with thousands of miles of pipeline delivering oil and natural gas to shore. Since the first Gulf well was drilled off Louisiana in 1938, in less than 15 feet of water, close-in reserves have been depleted and exploration has marched off the continental shelf, onto the continental slope, and beyond. Today Gulf oil is deep oil; the bulk of U.S. production draws from wells in more than a thousand feet of water. U.S. Gulf oil reserves are estimated at 44.9 billion barrels, but as the Deepwater Horizon disaster showed, the challenges of deep drilling are formidable.
THE LOOP CURRENT
The Gulf's largest current, the Loop Current, enters from the Caribbean as the Yucatán Current. Running to depths of 2,600 feet, it can swing directly east to join the Gulf Stream or surge north before curling back through the Straits of Florida. If it penetrates deeply into the Gulf, it often sheds a great eddy, which drifts westward. The Loop Current could carry oil from a Gulf spill up the Atlantic coast.
U.S. PLATFORMS
A waterborne city of oil rigs rises off the coasts of Texas, Louisiana, Alabama, and Mississippi—but not Florida. Exploration off the Florida coast, starting in the 1940s, yielded largely dry holes, and the potential threat to the state's top industry, tourism, has been considered too great a risk.
DEEPWATER DISASTER
Working in 5,000 feet of water, the Deepwater Horizon rig had drilled 13,000 feet into the seabed when the exploratory Macondo well blew out on April 20, 2010. The explosion and fire sank the 58,000-ton mobile rig, killing 11 workers. An estimated 4.9 million barrels of oil flowed from the well, creating the worst accidental marine oil spill in history.
MEXICO'S OIL DROP
Daily output of Pemex, the state-owned oil monopoly, hit 3.4 million barrels in 2004 but has fallen to 2.6 million. The drop is blamed on poor management and declining close-in reserves. Three-quarters of the oil comes from the Gulf, where Mexico has estimated reserves of at least 11.3 billion barrels. Oil and gas sales fund a third of the federal budget; the U.S. is the top importer.
IXTOC I OIL SPILL
Mexico's Ixtoc I well blew out in the Bay of Campeche in 1979 and flowed for 295 days. Some 3.5 million barrels of oil fouled hundreds of miles of shore as far as Padre Island, Texas. Most habitat recovered, but three-inch-thick tar mats remain in some lagoons. Ixtoc I ranked as the world's largest accidental marine spill until it was surpassed by Macondo.
NEW DEPTHS
The world's deepest offshore well, the Tiber well (art, above) reaches nearly six miles below the Gulf's seafloor. Not yet operational, it was drilled in late 2009 by the rig Deepwater Horizon, which was destroyed months later drilling the Macondo well. Other record holders in the Gulf: The floating production platform Perdido operates in the deepest water—8,000 feet—and the Petronius tower, the tallest fixed platform, stands in 1,754 feet of water.
CUBA'S POTENTIAL
Estimates for Cuba's offshore oil reserves range as high as 4.6 billion barrels. No production has begun, but offshore development rights have been leased by the government to companies from Brazil, India, Malaysia, Norway, Spain, Venezuela, and Vietnam.
ECONOMY OF THE U.S. GULF
Annual revenue (in $ billions) | Jobs (estimated)
Oil and gas 62.7 107,000
Tourism 38.1 524,000
Commercial fishing 0.7 14,000
Total 101.5 645,000
Map Legend
UNITED STATES
TEXAS
LOUISIANA
MISSISSIPPI
ALABAMA
GEORGIA
SOUTH CAROLINA
FLORIDA
ATLANTIC OCEAN
NUEVO LEON
TAMAULIPAS
VERACRUZ
TABASCO
CAMPECHE
YUCATAN
QUINTANA ROO
YUCATÁN PENINSULA
MEXICO
CUBA
BAHAMAS
SIGSBEE PLAIN
FLORIDA PLAIN
FLORIDA ESCARPMENT
CAMPECHE ESCARPMENT
CAMPECHE BANK
CAMPECHE CANYON
BAY OF CAMPECHE
STRAITS OF FLORIDA
YUCATAN CHANNEL
CARIBBEAN SEA
Florida Keys
Houston
Galveston
Port Arthur
Lake Charles
Baton Rouge
Morgan City
New Orleans
Houma
Grand Isle
Venice
Gulfport
Mobile
Pensacola
Fort Walton Beach
Panama City
Tallahassee
Jacksonville
Gainesville
St. Augustine
Daytona Beach
Orlando
Clearwater
Tampa
St. Petersburg
Bradenton
Sarasota
Fort Myers
Cape Coral
Naples
Palm Bay
Fort Pierce
Port St. Lucie
West Palm Beach
Fort Lauderdale
Miami
Key West
Savannah
Corpus Christi
Brownsville
Matamoros
Veracruz
Xalapa
Minatitlan
Coatzacoalcos
Campeche
Mérida
Cancún
Havana
Matanzas
Pinar del Río
Nueva Gerona
Cienfuegos
Santa Clara
Sancti Spíritus
National Geographic Society

National Commission on the

BP DEEPWATER HORIZON OIL SPILL AND OFFSHORE DRILLING

Attachment 17

Written Statement of John Barry

Author, *Rising Tide,* and member of Louisiana Coastal Protection and Restoration Authority

John M. Barry
Testimony before the Oil Spill Commission
September 28, 2010

Mr. Chairman and members of the commission. My name is John Barry. I'm a writer and historian, but in the past six years have become actively involved in two areas that relate to homeland security. Today I'd like to discuss one of them, the Gulf Coast. Thank you for the opportunity to present my views. They are my personal views only. I am not speaking for any of the organizations with which I am associated.

Currently I'm vice president of the Southeast Louisiana Flood Protection Authority East, a board which oversees several levee districts protecting most of metropolitan New Orleans. I also represent this board on the Louisiana Coastal Restoration and Protection Authority, which is responsible for hurricane protection for the entire state. I'm Distinguished Scholar at the Center for Bioenvironmental Research of Tulane and Xavier Universities, and I serve on advisory boards and committees at MIT's Center for Engineering Systems Fundamentals and Johns Hopkins Bloomberg School of Public Health's Center for Refugees and Disaster Response.

I'd like to step back from the spill itself and give you a somewhat broader perspective on the situation on the Gulf Coast.

As you all know, Louisiana has lost 2300 square miles of barrier islands, coastal marsh, and once seemingly-solid land on the coastal, which is an area larger than Delaware. If you place Delaware between New Orleans and the sea, it wouldn't need any levees. The land loss had made populated areas in Louisiana and Mississippi vastly more vulnerable than did nature. They are vastly more vulnerable than they were even 50-60 years ago. And that land loss is continuing; as you also have all heard by now, a football-field size chunk of coast melts into the ocean every 45-50 minutes, constantly increasing the vulnerability.

I want to cover four points: How we got here, what can be accomplished, how to accomplish it, and what happens if we fail.

Let me take the last point first.

I. What happens if we fail.

The majority of all domestic oil and gas off shore production occurs in Louisiana. 19 refineries and 15% of the nation's refining capacity is in Louisiana, all of it within reach of hurricane storm surge. The life cycle of over 90% of all fish and 98% of all commercial species in the Gulf of Mexico depend on Louisiana marshes. By weight, 40% of all commercial fish caught in the US is caught in Louisiana waters. 5 of the 15 largest ports in the country are in Louisiana, and 18% of all waterborne commerce in the US passes through Louisiana waters. 20% of all US exports go down the Mississippi River,

and 56% of all grain exports. The Gulf Intracoastal Waterway (GIWW) was built for national security in the 1930s and 40s; it still serves that role in addition to generating enormous commercial benefits.

The continued erosion of the Louisiana coast threatens all of that. The national economy, and national security, depends on protecting and preserving the economic infrastructure currently in place. Proof of that assertion: after Katrina interrupted Gulf supplies and refining, gasoline prices jumped roughly $1 a gallon.. And, incidentally, Katrina knocked out access to the Strategic Petroleum Reserve. Continued erosion of land threatens all that energy infrastructure. That's just the impact on national energy supplies, not the port system.

There is no substitute for Louisiana's port system. Tulsa and Pittsburgh and cities in between are all ports with direct access to the ocean because of it. There is simply no other way to give the interior of the nation, the body of the nation, cheap, efficient access to the sea. The GIWW carries barge traffic east west connecting other great ports from Florida to Texas, and the existence of that waterway is at risk. So, what's at stake is the well-being of the entire nation.

400 years ago John Donne described what is in effect out situation: "No man is an island, entire of itself; every man is a piece of the continent, a part of the main. If a clod be washed away by the sea, Europe is the less, as well as if a promontory were, as well as if a manor of thy friend's or of thine own were: any man's death diminishes me, because I am involved in mankind, and therefore never send to know for whom the bells tolls; it tolls for thee."

II. How we got here

Our present circumstances were created by a combination of geology and too-narrow a view held by those who made political decisions. Those political decisions translated into engineering decisions with unintended consequences,.

To understand the problem, you need first to understand the role of the Mississippi River. The Gulf of Mexico once reached north to Cape Girardeau, Missouri. Through a combination of falling sea level and the deposit of sediment, the Mississippi River created almost 35,000 square miles of land in 7 states. Coastal currents carrying sediment horizontally from the river's mouth made several thousand additional square miles of land outside of the river's flood plain; to the west this land goes to the Texas border. In total, river sediment created roughly 40,000 square miles, including about 8,000 square miles on the coast.

Engineering has reversed the natural process and transformed land-making into land loss. Virtually all of this engineering benefits the entire nation. But the Gulf Coast, and mostly the Louisiana coast, bears all the costs. Let me give you a few lesser-known obvious factors.

1. The Mississippi River now carries less than half its historic natural sediment load, and some scientists believe it carries less than 30% of that load. The river once carried close to 400 million tons a year. Now it carries between 125 and 140 million tons a year. This decline is a major factor in land loss.

The decline occurred because of literally tens of thousands of engineered interventions throughout the entire system, from putting riprap on river banks to development. All of these interventions benefited people far from upriver, often more than 1,500 miles or even more from the Gulf. But more than half the total sediment decline is caused by just six dams on the upper Missouri River.

These six dams in Montana and North and South Dakota—the last dam sits just above the Nebraska line-- provide hydro-electric power, irrigation, and, ironically, flood protection along the Missouri River. Construction began in the 1940s, the first dam was completed in 1952, and construction ended in 1963. According to the Corps of Engineers, after completion sediment at Omaha dropped from 175 million tons annually to 25 million tons.

In other words, these six dams, built entirely with federal dollars, alone retain 150 million tons of sediment, while the entire river system currently delivers 125-140 million tons to the Gulf.

These dams may well have provided tremendous benefits to people from St. Louis to the Rockies. They have produced tremendous damage and greatly increased the danger to the Gulf Coast.

2. At least half the sediment still available to the Gulf is now wasted, prevented from replenishing the Louisiana and Mississippi coasts and barrier islands, again to benefit the entire nation. This is what happened:

In the natural land-building process, when the river hit the ocean it dropped its sediment load. This created massive sandbars which blocked shipping. To solve that problem, engineers built jetties extending more than two miles out into the Gulf of Mexico, dropping most of the sediment remaining in the river into deep water off the continental shelf.

The benefits have clearly been enormous. For example, in 1875, the year construction on the jetties started, 6,500 tons of shipping went from St. Louis out into the Gulf. Just four years later, the year the jetties were finished, St. Louis sent 456,000 tons out the same route. A similar explosion of trade occurred throughout the entire Mississippi Valley, on the Ohio, Missouri, and Arkansas rivers.

Today, jetties continue to carry most of the sediment in the river out into the Gulf and drop it into deep water. This waste benefits the national economy but increased the danger to the Gulf Coast. When more sediment was available in the whole system, when

there were no other insults to the natural order, this waste was not a major factor. Now, when every particle matters, it is.

3. Levees that prevent river flooding in Louisiana and Mississippi interfere with the replenishment of the land locally as well. To the extent they protect populated areas from floods, that is a local benefit. But the levees in the areas of greatest land loss are well down river from populated areas, and they were not built to protect people-- much of the area is entirely unpopulated. The levees in this region were built to help control the shipping channel; they benefit interstate and international commerce. Again, the benefits to the national economy have increased the danger to Louisiana.

4. Benefits to the shipping industry in other areas have also caused enormous damage. The Mississippi River Gulf Outlet has been much discussed. It never delivered the promised benefits. It did deliver all the damage warned against by its opponents. It destroyed tens of thousands of acres of natural buffer, and it did so right on the edge of an urban area. In addition, the federal government through the Corps of Engineers maintained this channel—or, more accurately, failed to maintain it-- with reckless disregard for life and property. A federal judge spent weeks listening to expert testimony and ruled that—not even considering the impact of the lost buffer, just on the basis of direct engineering maintenance failures on MRGO— the Corps was directly responsible for the destruction of the homes of 90,000 people in St. Bernard Parish and the Lower 9th Ward. I might add, the Corps and the state of Louisiana are now in dispute over whether the state needs to share the cost of fixing the damage to wetlands which MRGO caused.

MRGO has received much publicity because of its direct role in bringing storm surge to metropolitan New Orleans, yet MRGO has not caused as much damage to coastal marsh as the Gulf Intra-coastal Waterway. The GIWW was originally built to protect shipping from German submarines, and it still contributes to national security. But it and other shipping channels have brought much salt water into coastal marsh, generating significant erosion. Are there local benefits from the GIWW? Yes, it does benefit the port of New Orleans, but it provides far greater benefit to the ports of Houston, Gulfport, Biloxi, Mobile, and even Tampa by giving them access to the Mississippi system.

5. Louisiana is by far the country's largest producer of off shore oil and gas, and the extraction of oil and gas has itself contributed to subsidence. The industry has also dredged more than 10,000 miles of canals and pipelines through the marsh to service that production. Every inch of those 10,000-plus miles lets salt water penetrate and eat away at, the land. The Mineral Management Service has never been accused of favoring environmentalists, yet even it concluded the energy industry is responsible for 60% of the land loss directly attributable to a cause. (Not 60% of all land-loss; 60% of all the loss with direct causes). These canals and pipelines have enormously accelerated what was a slow degradation, transforming a long-term problem into an immediate crisis.

A good analogy is that the decline of sediment in the river, the jetties and other engineered factors that benefit shipping, and the levees created a situation akin to taking a big block of ice out of the freezer so it begins to melt. The impact of the canals and

pipelines is akin attacking that block of ice with an ice pick, breaking it up far rapidly.

Given all these facts, there is no other possible conclusion but that benefits accruing to the entire nation have dramatically increased the danger to the Gulf Coast.

III. What can be accomplished

The bulk of the land lost *cannot* be rebuilt. Rebuilding is impossible because the river no longer carries enough sediment to do it. The National Academy of Science's review team of the Corps's Louisiana Coastal Protection and Restoration (LACPR) study of a system that would protect against major hurricanes made this point, and no expert disagrees. And unfortunately the sediment load in the river is still trending downward.

Nonetheless, the scientific community does support the proposition that if the right decisions are made we can achieve no net loss of coastal lands, rebuild land in strategic places to protect densely populated regions, and do so in a sustainable way.

We have a chance to succeed even with rising sea level. The delta of the Mississippi River is a dynamic, living system. It's alive. Like everything living, it will fight for life. If supplied with sediment and fresh water, it will adjust to and rise with the consensus predictions for rising sea level.

Unfortunately, even in a best case, not all areas can be protected. In some cases the cost will be too great. In others, choices will have to be made to sacrifice some areas in order to make others safer. The LACPR report recognizes this: the greatest expense in several of their alternative strategies is not for construction; it's for buy-outs for people whose homes will become untenable. Mississippi has at least begun to address some of the buy-out issues. Louisiana has not yet done so. This is important and worth mentioning because, right now, people who have already had their lives disrupted live in the most vulnerable areas. The disruption could make them receptive to a fair buy-out that might be good for them, good for the region, and good for the country. They should have that option.

IV. How to Accomplish the Goal

Do I believe the dams on the Missouri should come down, oil production in the Gulf should cease, and international shipping interrupted? No, of course not. I do not believe any of those things. The nation needs the benefits it gets. But I do believe that educating the nation about the trade-offs and unintended consequences which have created dangers on the Gulf Coast is essential. Otherwise restoration efforts will not get sustained support

from the Congress in future years. If people in the Dakotas, Nebraska, and Missouri understood that their profits and even their safety have endangered the lives and property of people in the Gulf, they would support rather than oppose national policies to help the Gulf. They would see them as a responsibility, not a hand-out.

There is urgency. Two years ago a group of highly respected coastal scientists stated that if within a decade major steps weren't taken to restore the coast, it would be too late, that we would pass a tipping point. We have already started, but we need to scale up our efforts dramatically, and soon. So what should we do?

The easy part is to identify specific policies and legislation that need to be acted upon. To give just one example, let me describe some of the issues associated with dredging, and this is by no means are they an inclusive list even regarding dredging:
… The Corps's interpretation of current law requires them to waste some sediment they do dredge from the river; we have to absolutely maximize the beneficial use of dredged material.
… Foreign dredges operate on an entirely different scale than U.S. dredges; it may be necessary to change the Jones Act to use their capabilities.
… River diversions—cutting the levee to let some of the river run where nature put it--will be necessary to get sediment where needed, but diversions also create dredging costs to keep the shipping channel open. The Corps seems to want the state to pay a full cost share for this, just as it wants the state to pay to restore the marsh destroyed by MRGO.

Frankly, I consider the idea of requiring local cost share for such dredging ludicrous. It's like having a tractor trailer drive over your lawn and crash through your living room, and then having the trucking company send you a bill to fix not only your lawn and house but the truck too.

But identifying a few specific things which need to be done is the easy part. The harder part is to devise a governance structure that can accomplish the goal, that can restore as much of the coast as can be restored, and to get the money for it.

Governance needs to operate in a decisive, flexible, disciplined, and science-based manner. Those last two points—it has to be disciplined and science-based-- are crucial because sediment is more important even than money. We can at least in theory always get more money. But even in theory we cannot get more sediment. There is a saying that when you mix religion and politics you get politics. It's also true that when you mix science and politics you get politics. Only science can determine the best use of sediment. And the structure must have the discipline to, as much as possible, insulate science from politics.

The governance structure has to do three things:

1. First, it has to coordinate efforts of many federal agencies and get rapid response.

2. Second, it has to involve the states, local government entities, and possibly non-profits. Each state should be able to identify its priorities, and considerable deference should be given to those choices, but I don't think they should automatically be acceded to. The federal government should also define certain priorities which may or may not be the same as a governor's.

I think whatever governance structure is set up, it should function like the grant process at the National Institutes of Health, or perhaps the Small Business Innovation and Research Act, with projects scored and prioritized. If the idea is good, it shouldn't matter where it comes from. Not only the states but counties, parishes, municipalities, levee districts, and possibly non-profits should be able to compete for funds. This should generate maximum speed and maximum activity, with projects fully integrated in concept and when completed and underway simultaneously, not sequentially. The Coastal Impact Assistance Program gives money directly to counties and parishes, for example, and that money has been well spent. Similarly, the flood protection authority with which I am associated has some coastal restoration projects identified and ready to go, but no money to spend.

An assessment is not an excuse for delay. And we do not need to reinvent the wheel. I'm familiar only with planning in Louisiana, and we have spent nearly 20 years planning. We created a Coastal Protection and Restoration Authority which has written a master plan, and every entity in the state has to conform to that master plan. Right now the master plan is conceptual, but it is an important and quality first step. CPRA has also identified a number of projects already authorized by the Congress and engineered; these projects lack only funding for construction to start. The state should get the funding.

3. Third, the governance has to foster scientific research and integrate both existing and new science immediately into projects. Senator Landrieu has proposed creating a science institute. That is an excellent idea. Too much of what needs to be done involves science that is not yet fully worked out, or engineering that has never been applied to the scale now needed. For example, we don't know the best way to maximize benefits of river diversions, and to compensate for the decline of sediment in the river, we need to improve our ability to harvest what remains. We also need to maximize benefits from any technical advances. There may be a model in medicine, where in the last decade or so an entire field has developed called "translational medicine." This is designed to move laboratory advances to patient care as rapidly as possible. There may be a medical model that's useful.

The best means to accomplish these things is to use an inter-agency and inter-governmental group-- several now exist that could be adapted to the task-- headed by a single chair person with accountability, as much authority as an executive order can provide, legislation to augment the chair's authority, and direct access to the president. Once a decision is made, OMB and other agencies should not be able to re-litigate it. In other words, I believe we need a czar. The post-Katrina federal effort

demonstrates that a "coordinator," even one personally close to the president, lacks the power to do what was necessary and what he seemed to want to do.

I am not convinced that the various review processes of projects, for example of environmental impacts, need to be scrapped, but restoration projects do need to be fast-tracked. They need to jump to the front of the line in various agencies. This is where White House leadership is essential.

Finally, where should the money come from? There are two obvious sources: BP and off shore oil revenues.We need both.

The Natural Resource Damage Assessment process will generate billions of dollars. Normally that process takes years. BP should provide funding up front for restoration and simply deduct this from any final agreement. EPA fines will generate billions more. The administration has already stated 80% of this money should go to restore the coast. But this requires legislation. Obviously, I believe Congress should accept this recommendation.

Another source is off shore oil revenues. Since the 1920s national policy has recognized that oil and gas production comes at a price. To "relieve social or economic impacts occasioned by" this production, the federal government gives inland states 50% of revenues from such activities on federal land. Last year Wyoming alone received $1.3 billion from this source.

Louisiana has suffered immense damage from oil and gas production on off-shore federal land, and the federal government has received $165 billion in off-shore drilling revenues over the years. Yet until 2006 the federal government gave Louisiana nothing. After Katrina, Congress did give Alabama, Mississippi, Louisiana, and Texas, the Gulf states which allow off-shore drilling, a 37.5% share of revenue from new off-shore wells. But it capped the total at $500 million divided by those four states and delayed any substantial money until 2017; this year Louisiana, which passed a state constitutional amendment requiring all this money to go to coastal restoration or flood protection, will get only $400,00 to 600,000 from this source. Congress should treat all states the same and lift the cap, cancel the delay, equalize the revenue share, and give it on existing wells, not just new ones. Off shore oil and gas production has contributed greatly toward creating the problem; treating coastal states the same as inland states would provide the revenue to address it.

There is also a third source, although it's impossible to say at this point how much money it would generate. This involves the private sector. Some investment bankers are looking at ways to monetize mitigation banks. If building marsh in the Gulf could turn a profit for someone besides companies building it, it would be useful both politically—bringing the private sector in—and substantively in building land.

Thanks for your attention. I welcome any questions.

National Commission on the

BP DEEPWATER HORIZON OIL SPILL AND OFFSHORE DRILLING

Attachment 18

Written Statement and Presentation of Dr. John W. Farrington

**Interim Dean and Professor, School of Marine Science and Technology,
University of Massachusetts-Dartmouth and Scientist Emeritus,
Woods Hole Oceanographic Institution**

WRITTEN TESTIMONY OF
JOHN W FARRINGTON
INTERIM DEAN AND PROFESSOR
SCHOOL OF MARINE SCIENCE AND TECHNOLOGY
UNIVERSITY OF MASSACHUSETTS-DARTMOUTH
AND
SCIENTIST EMERITUS
WOODS HOLE OCEANOGRAPHIC INSTITUTION

AS SUBMITTED SEPTEMBER 24, 2010
TO THE
NATIONAL COMMISSION FOR THE BP DEEPWATER HORIZON OIL SPILL AND OFFSHORE DRILLING
(corrected final version October 1, 2010)

Good morning Senator Graham, Administrator Reilly, and Commissioners. My name is John W. Farrington. Thank you for the opportunity to present testimony to the Commission and contribute to our nation's efforts to minimize loss of life due to accidents related to Outer Continental Shelf (OCS) oil exploration, production, and decommissioning, and to minimize economic hardship to people and ecological damage to marine ecosystems as a result of oil spills. I have served as Interim Dean and Professor of the School of Marine Science and Technology, University of Massachusetts-Dartmouth since August 2009 while a search has proceeded for a Dean. I am also a Scientist Emeritus at Woods Hole Oceanographic Institution from which I retired after a career there beginning as a postdoctoral investigator in 1971 and lasting until my retirement in 2006. From August 1990 until November of 2005 I served as Dean of the Institution. My research has focused on the biogeochemistry of organic chemicals in the coastal and ocean ecosystems with about fifty percent of the effort focused on oil pollution and concerns with other chemicals of environmental concern such as PCBs. Among my service at the science-policy interface, I have participated in various capacities in the preparation of the three U.S. National Academy of Sciences reports (1975, 1985, 2003) reviewing oil pollution in the marine environment. I Chaired the National Academy of Sciences Committee that reviewed the Minerals Management Service Environmental Studies Program, issuing six reports between 1986 and 1993.

I have been asked to testify today on: (1) scientific findings in the aftermath of the IXTOC I oil well blowout spill of 1979-1980 in the Gulf of Mexico and subsequent resilience of the Gulf Mexico based on my participation in a research cruise to that event, (2) research on other applicable oil releases and (3) direct experience related to and scientific recommendations regarding the Deepwater Horizon oil spill. My testimony represents my own point of view, conclusions and recommendations and does not reflect an official statement by either the University of Massachusetts-Dartmouth or Woods Hole Oceanographic Institution. However, I acknowledge with gratitude that my understanding of inputs, fates and effects of oil in the marine environment has benefited substantively from cooperative research and discussions with several colleagues, students, and coworkers at these institutions and several other institutions and organizations in the United States and elsewhere in the world. I have appended a list of references that are mentioned in my testimony.

Before addressing the specific issues stated above, I note for the record that one of your Commission members, Professor Donald Boesch, co-edited(with Professor Nancy Rabalais) an excellent review of the "The Long Term Effects of Offshore Oil and Gas Development" in 1987. More recently, that review has been updated and broadened to all aspects of oil inputs, fates and effects in the marine environment by the National Academy of Sciences report "Oil in the Sea III" published in 2003. This report provides an

excellent review supported by extensive scientific references. Using the knowledge contained in that report and our own experience, my colleague Dr. Judith McDowell and I wrote an article for the general lay person audience "Mixing Oil and Water" published in *Oceanus* magazine in 2004. While there has been progress since 2003-2004 in understanding the inputs, fates and effects of oil in the marine environment, I believe the *Oceanus* article and the 2003 National Academy of Sciences report are acceptable starting points with respect to the state of knowledge about oil pollution in the marine environment. I have appended a copy of the Farrington and McDowell *Oceanus* article in the hope that it may be helpful to the Commission and its staff as background literature.

1) IXTOC I Oil well blowout spill.

The IXTOC - I oil well was an exploration well being drilled by PEMEX (Petroleos Mexicanos) in 51.5 meters water depth in the Bay of Campeche, Mexican waters of the Gulf of Mexico at 19°24'29.418"N;92°19'36..690"W, about 80 km NNW of Ciuad del Carmen, when it suffered a blowout with resulting fire and collapse of some of the drilling platform to the sea floor and eventual towing away of the hulk of the remainder of the drill platform as described by S. L. Ross et al (1980). A detailed account of the IXTOC I event through November 1979 is available in testimony before the U.S. Senate December 5, 1979 Congressional Record 1980 Serial No. 96-66 –Campeche Oil Spill: Joint Hearings before the Committee on Commerce, Science and Transportation, and the Committee on Energy and Natural Resources. Eventually the IXTOC I oil well blowout was stopped by completion of two relief wells and cementing in March of 1980 after spilling 475,000 metric tons (tonnes) according to Jernelov and Linden (1981).

Oil from the IXTOC I spill was transported by normal water circulation for that season of the year around the Gulf of Mexico to the west , northwest, and then north, entering U.S waters and coming ashore on the coast of Texas by late July- early August. Shortly after that time, the United States government decided to seek permission from the Mexican government to send a NOAA research vessel on a cruise to the oil spill site, along the coast of Mexico, and then along the coast of Texas and into port in Galveston. This cruise was part of NOAA's and other federal agencies'(e.g. BLM-DOI, EPA,) and state agencies overall response to the oil spill. This involved over 200 scientists from a number of federal and state agencies, academic institutions, and private companies.

The efforts along the coast of Texas are documented in a report (Hooper, ed., NOAA, 1981). Since I was not directly involved in those efforts, I will not comment in detail other than to state that, in my opinion, from reading the report and related documents, the efforts were predominantly "state of the art-knowledge" efforts for that time or, in some instances, innovative and at the forefront of oil spill response from a scientific perspective. These efforts included:

- numerical modeling of slick trajectories,
- classification of sensitive shoreline areas in need of protection,
- deployment of oil containment booms where possible to protect sensitive areas,
- testing of dispersants in laboratory conditions with a resulting decision not to use dispersants because they were ineffective for dispersing the oil-water emulsions and somewhat weathered slicks coming to the Texas coastal areas,
- assessment by physical and chemical observations and measurements of the oil that did come ashore in Texas,

- biological assessment of effects of the oil on biota and ecosystems of the Texas coastal area.

NOAA Ship *Researcher* cruise to the IXTOC I oil spill. The NOAA ship *Researcher* was chosen for the cruise and its research cruise schedule was altered to accommodate the need for the oil spill cruise. A second vessel, the Tracor Marine Inc. vessel *G. W. Pierce* (a keel-cooled vessel) was contracted to accompany the *Researcher* because (i) it had been determined early in the IXTIC I oil spill that the oil-water/water-oil emulsion type mixtures near the spill could block or reduce flow through the engine cooling systems for the type of power plant of the *Researcher,* and (ii) the desire to keep the *Researcher* free from oil contamination to sample control stations. Portable laboratory vans were placed on the *G. W. Pierce* to expand available laboratory space on that vessel.

The specific mission of this combined two-ship expedition, officially labeled ***Researcher/Pierce* Ixtoc –I Cruise**, was limited to conducting research on the biogeochemistry (i.e. the transport, chemical and microbial alteration/degradation and fate) of the spilled oil at or near the well site and along a cruise track in the western Gulf of Mexico up to the coast of Texas. Along the Texas coast sediments at samples of surface sediment at stations previously analyzed as part of the Bureau of Land Management's OCS studies program were obtained for purposes of assessing if IXTOC-I oil could be detected in sediments at these study sites.

The Mexican government did not grant permission for biological effects studies. A detailed physical oceanography study was not possible because of insufficient time to secure appropriate equipment for the cruise and also concerns about the irreversibility of oil damage to sensitive instruments or inability of the instruments to operate in the oil contaminated environment.

In addition to the two vessels, a four person contract helicopter from Crescent Airways was onboard *Researcher* for flight operations to facilitate surveillance of the slick and the locations of sampling by the vessels relative to the slick. The *Researcher* operated as the command center and provided more extensive laboratory space for analytical instruments and microbiology experiments. A U. S. Public Health Service MD was aboard *Researcher* and provided oversight for safety precautions for exposure to petroleum fumes for scientists and crew of both *Researcher* and *Pierce.* This was especially important for those on the *G. W. Pierce* since they operated frequently inside the oil slick and sampled close to the actually blowout site.

Dr. Donald C. Atwood, Head of the Ocean Chemistry Division of NOAA's Atlantic Oceanographic and Meteorological Laboratories (now retired) was Chief Scientist for the cruise. Dr. Randolph Fergusson of the National Marine Fisheries Laboratory, NOAA, Beaufort, North Carolina was Senior Biologist onboard. I served as Senior Chemist on the cruise and was supported in this effort by the Office of Naval Research grant I had for marine organic geochemistry research. A complete list of all scientific personnel and groups can be found in the report "Proceedings of a Symposium on Preliminary Results from the September 1979 Researcher/Pierce IXTOC-I Cruise, June 9-10, 1980."(NOAA, December, 1980, 591 pp). The report is available as a pdf at http://www.noaa.aoml.gov/ocd/ocdweb/petroleum.html. My testimony here will refer to the results of research and dedicated efforts of these people.

The cruise track for both ships and the sampling locations are detailed in figures 1 and 2. NOAA ship *Researcher*, vessel *G.W. Pierce*, and the Crescent Airways helicopter operations are exemplified in

figures 3, 4 and 5. The observations, sampling, and results of analysis and interpretations for samples from this cruise are detailed in the NOAA Symposium report.

I will highlight here and illustrate those findings that are the most germane to the Deepwater Horizon MC 252 spill and response. During August and early September 1979 there had been several tropical storms and a hurricane in the area of the spill or passing through contiguous areas. During our time sampling in the well area, tropical storm Henri came close to the area. We believe that this explains why we observed, during helicopter survey flights, various types of oil slick containment booms and moorings in various states of intense snarls and disarray spread throughout the Bay of Campeche area. When we arrived in the Bay of Campeche area on September 15th the slick was headed about northeast, away from the Mexican coast and not west and northwest along the coast of Mexico towards the Texas coast. This situation prevailed in a general sense throughout our time at the well site until September 18th when the slick began to bend around toward the east and east-southeast during our last two days and over flights on September 20th and 21st, after which we departed the well site area for the remainder of the cruise (Figure 1).

The situation in the immediate area of the well blowout site is shown in figure 6. Gas was bubbling to the surface along with an oil/water mixture. The gas was burning with flames varying from about 2 to 7 meters in height. Around this was a turbulent area of about 50 meters diameter in which the oil/water mix was coming to the surface. There was about a 1 knot current transporting an oil slick away from this area to the northeast.

A composite salinity transect to the northeast away from the well site alongside the slick measured by CTD (Conductivity, Temperature, Depth) instrumentation at several stations (Figure 7) documents a salinity of between 35.90 to 35.60 $^{0/00}$ until about 35 to 50 km along the transect where there is an incursion of less saline water of 35.00$^{0/00}$. At 80 to 90 km along the transect, there is a relatively abrupt increase ins salinity to typical open ocean Gulf of Mexico water of 36.00 to 36.50$^{0/00}$. We believe that the less saline water incursion was the result of runoff from the coast which had received heavy rains from tropical storm Henri and previous tropical storms passing through nearby areas prior to the cruise. This hypothesis is supported by surface salinity measurements made during the cruise (Figure 8).

A Gas and Oil Plume underwater. (Data from Brooks et al, Texas A&M University; Boehm et al, Energy Resources Company, Inc.; Payne et al, Science Applications, Inc.; Overton et al, University of New Orleans; all detailed in NOAA, 1980)

Composites of measurements of methane, benzene, and an estimate of total oil by UV-fluorescence in samples along a transect to the northeast taken from the *G. W. Pierce* in the slick and *Researcher* outside the slick in "control" stations document an underwater excursion or "plume" of gas, benzene (a volatile petroleum chemical), and oil extending northeast under the slick to the less saline water incursion. We interpreted these observations and data as follows. The 1 knot current was transporting the gas and oil underwater to the northeast away from the main vertical plume. As this horizontal "plume" was transported away from the well site, gas and oil "bubbles" continued to rise to the surface and were incorporated into the overlying oil slick. An important point to consider is that the "background" or "control" sample concentrations for stations away from the slick and well site should not be considered as "pristine" ocean water concentrations because there were other oil and gas platforms operating at this time in the Bay of Campeche and discharging co-produced waters and mud as was clearly evident in visual observations from the helicopter over flights. It is probable that these chronic releases contribute methane and oil chemicals to the Bay of Campeche waters and ecosystems.

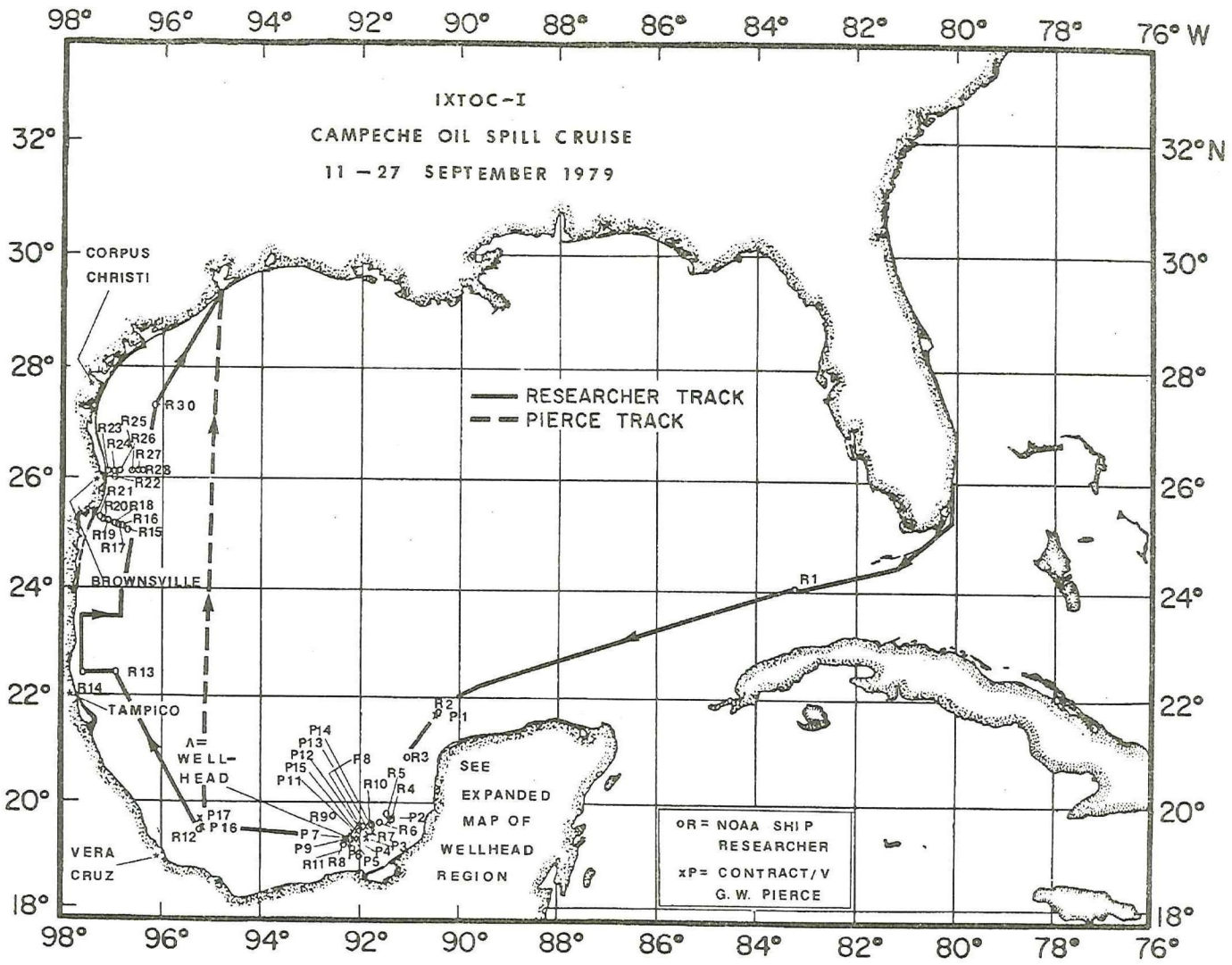


Figure 1. IXTOC-I Campeche oil spill cruise, 11-27 September 1979.

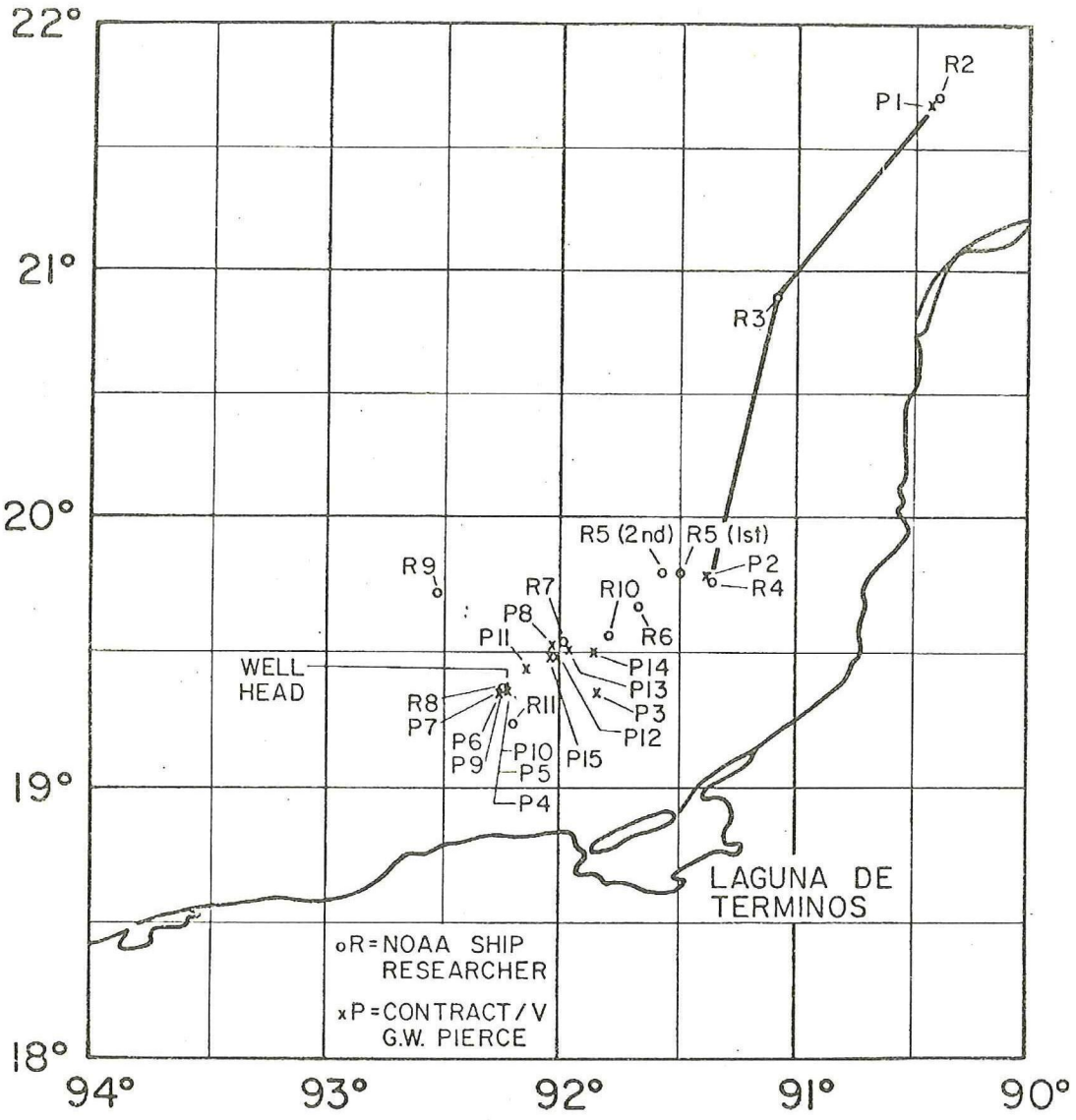


Figure 2. IXTOC-I Campeche oil spill cruise, 11-27 September 1979, expanded wellhead region.

Figure 3. NOAA SHIP *RESEARCHER* IXTOC I Cruise.

Figure 4. Tracor Marine Inc. Vessel *G .W.PIERCE*

Figure 5. Crescent Airways Helicopter aboard *RESEARCHER*

Figure 6. J. W. Farrington photograph of Ixtoc I oil well blowout from helicopter flight *RESEARCHER/PIERCE IXTOC I CRUISE* September, 1979. Facing Southwest with oil slick coming toward the viewer to the northeast. Platforms had been constructed by PEMEX for eventual test of an inverted cone "capping" procedure. Note relatively clean, oil-slick free surface water behind platforms.

These transects of data are composites and state of the art for the time of the cruise. However, they do not provide synoptic, three-dimensional assessments of underwater concentrations of methane and oil chemicals in the spill area. It is probable that the actual situation had more meanders and heterogeneity in the underwater horizontal "plume", similar to that observed for the surface slick.

Several days after arriving at the Bay of Campeche well site general area, and despite operating well outside of any visible slick area, the drinking water on the *Researcher* became contaminated with volatile petroleum chemicals as first detected by taste and then verified by UV-fluorescence measurements. The most likely cause was co-distillation of the volatile chemicals out of sea water into the drinking water as the ship made its drinking water from evaporative distillation of sea water.

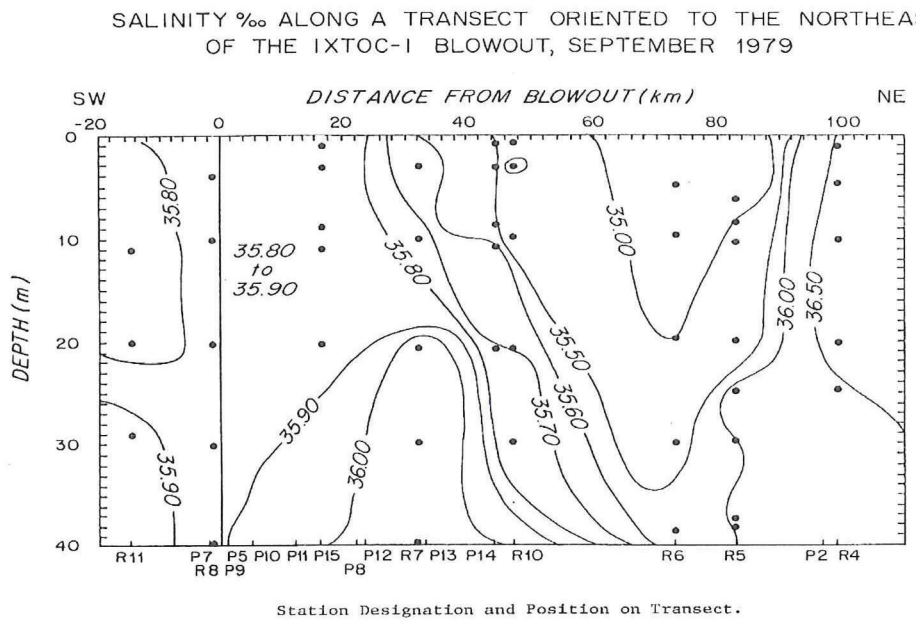


Figure 7. Salinity Transect to northeast from the well site.

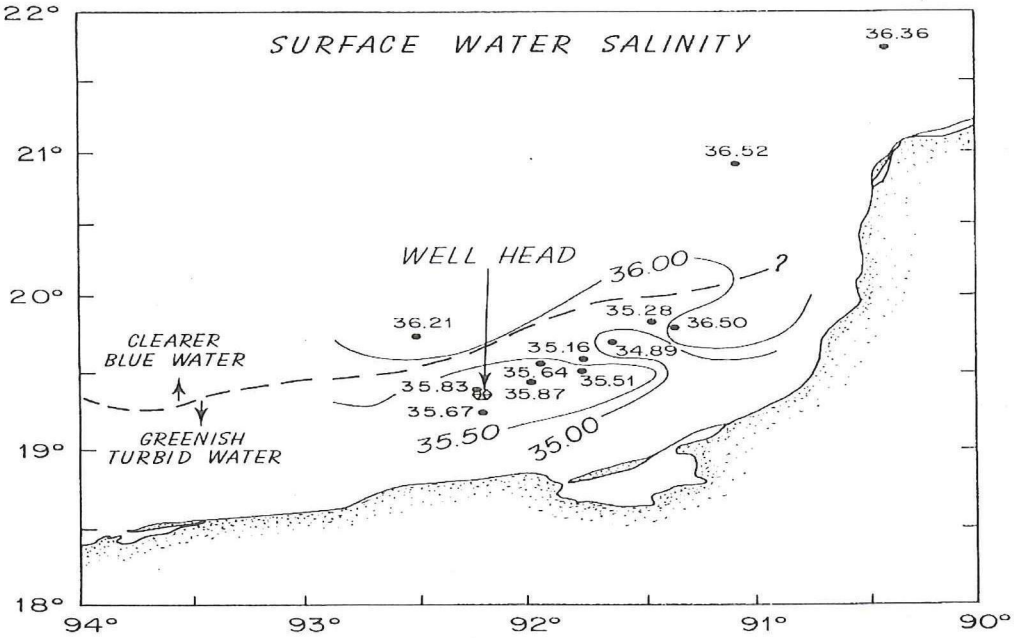


Figure 8. Surface water salinities.

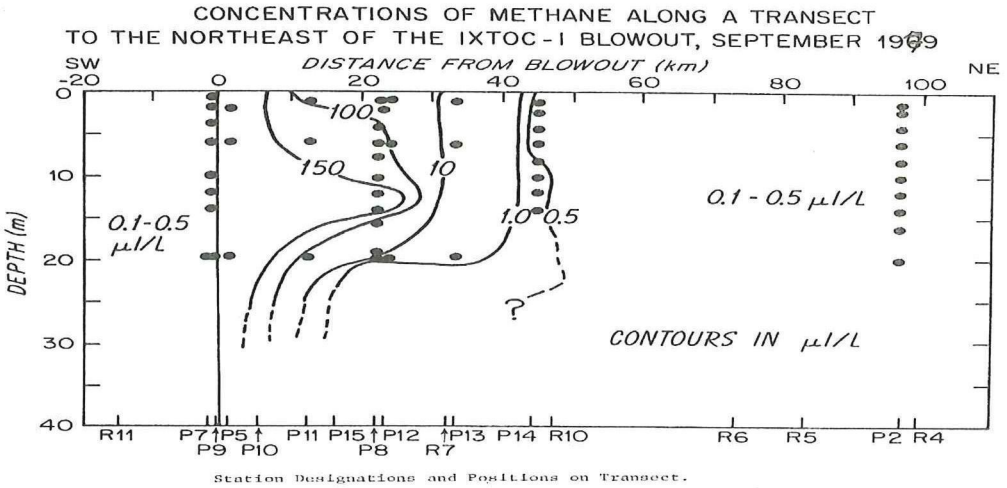


Figure 9. Data from Brooks et al (1980) Texas A & M

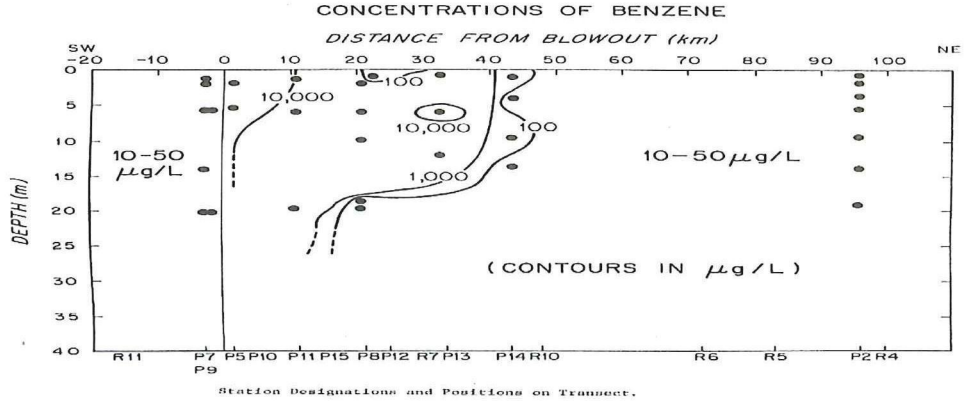


Figure 10. Data from Brooks et al (1980) Texas A & M and Payne et al (1980) SAIC

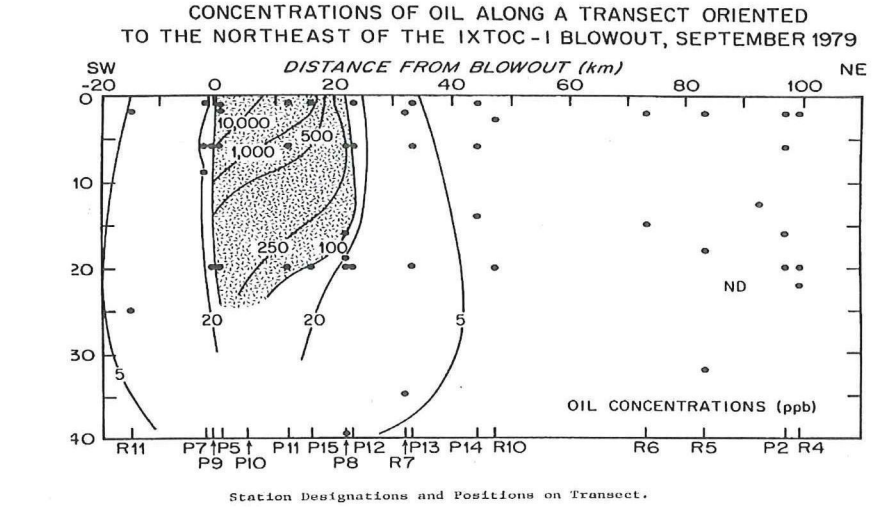


Figure 11. Fiest and Boehm (1980), Boehm and Fiest,(1982).

"Rafts" of emulsified oil and water.

Another important and unexpected finding from the cruise was a distribution in various areas outside the main slick of conglomerates of emulsified oil and water or "mousse" as it is commonly designated in the oil spill literature because of its similarity in appearance and consistency to the chocolate mousse dessert. We designated them "mousse rafts" – ranging in size from about that of an ordinary zodiac raft to sometimes ten times as big. A picture of several of these "rafts" taken from an helicopter over flight (Figure 11)and then comparison of one of those rafts with a zodiac at the bottom for scale (figure 12) provides examples of several we noted during the over flights. The zodiac raft from the *Researcher* went into one of the rafts of mousse to sample the interior, and analyses of this sample by gas chromatography and computerized gas chromatography-mass spectrometry document a chemical composition that indicated that the oil in the interior of the "mousse raft" was not extensively weathered. These "mousse rafts" can be as much as 0.5 meter thick in the center and some had the appearance of being agglomerations of smaller lumps or "balls" of mousse, e.g. see Figure 13.

The exact mechanism of formation was not discerned during our observations. These rafts of mousse may provide a means for transporting only slightly weathered oil long distances because of the protection from dissolution, volatilization, and microbial degradation afforded to oil at the center of the "raft". Amos (1980) in a report from the University of Texas Marine Science Institute, Port Aransas, Texas noted a few instances of mousse coming ashore in Texas, although the predominant form of oil in Texas coastal waters seemed to be tar balls, windrows of tar balls and oil slicks. Similar observations were reported in Hooper (ed. NOAA, 1981).

Figure 12. "Mousse Rafts". Several indicated by black arrows. Photograph taken from helicopter about 800 ft. by J. W. Farrington. RESEARCHER/PIERCE IXTOC I CRUISE September, 1979. Outside the oil slick, Bay of Campeche.

Figure 12. Large raft of "mousse" (black arrow) and Zodiac raft (bottom) for size comparison.

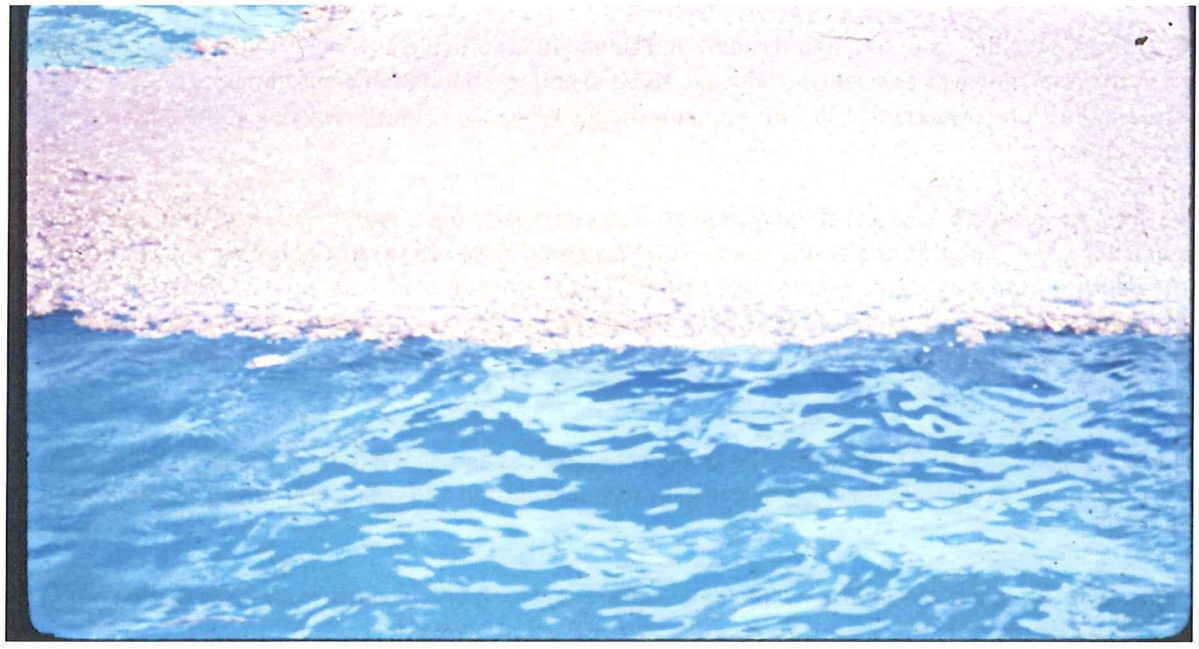


Figure 13. Close up of edge of a "mousse raft " from Figure 12. J. W. Farrington photograph from helicopter. RESEARCHER/PIERCE IXTOC I CRUISE September 1979. Note clumps around the edge and clump appearance of the surface.

Microbiological Studies. (Atlas et al, University of Louisville, and Pfaender et al University of North Carolina-Chapel Hill).

The studies of Professor Atlas and his group at the University of Louisville and those of Professor Pfaender and his group at the University of North Carolina-Chapel Hill provided valuable insights into the microbial community and its activity in the spill area as reported in their papers in the report from the Symposium on RESEARCHER/PIERCE IXTOC I Cruise (NOAA, 1980). In summary, the microbial community in the spill site waters changed in community structure and function compared to control sites. The numbers of hydrocarbon degrading bacteria increased in the oiled areas but the total microbial biomass was not a simple function of the presence or absence of oil. There was sufficient oxygen for microbial degradation of the oil, but onboard experiments suggested that there were insufficient nutrients present in the water column in the oil slick area to promote extensive oil degradation at the time of the *Researcher/Pierce* research cruise.

Other interesting Findings. Time and space for this testimony does not permit more extensive discussion of other aspects of the research findings such as those related to weathering of the oil -- including photochemical reactions; difficulty in detecting any oil deposition to surface sediments in the Bay of Campeche area due to prior contamination of the sediments from drilling and production operations; and research to use acoustic methods to detect subsurface oil and gas in the water column. All of these are discussed in the NOAA (1980) report. One of our conclusions was that we were not prepared to adequately sample the various physical chemical forms of the oil-water and water-oil emulsions present in the well site area and we recommended research to develop sampling methodology for these forms of oil during future oil spills.

Overviews. Waldichuk (1980) and Jernelov and Liden (1981) provide overviews of the Ixtoc I oil spill from their perspectives as scientists with extensive experience in marine environmental quality assessments for various United Nations organizations. Waldichuk (1980) provides quote and commentary.

"It has been stated by oil-well drilling experts: 'the damage to lives, equipment, and the environment can be of great magnitude. Yet this risk must be accepted if we are to extract the energy we need from the depths of the earth.'(see Rhodes, A. F. 1979. The ultimate control problem – a wild oil or gas well. Mechanical Engineering, June, 1979, 21-26). One wonders, nevertheless, why the oil industry does not put higher priorities into developing a fully fool proof blow-out prevention system."

Jernelov and Linden(1981) reviewed the biological resources and ecosystems of the Bay of Campeche area and noted the importance of economically valuable shrimp and oyster fisheries. They then went on to state:

"Thorough studies of the long-term biological effects of the spill have either not been carried out in Mexican waters, or the results of such studies are not yet available."

To my knowledge, the situation remains the same today.

Jernelov and Linden (1981) provided some valuable comments about the potential for biological effects using sound reasoning based on laboratory studies of toxicity and field measurements of the concentrations of oil in the water column.

"Laboratory experiments exposing larvae and adults of other crustaceans, including shrimp, to crude oil show the acute toxicity levels are in the range of 0.1 to 10 ppm total oil. If we assume 0.1 ppm was the acute toxicity concentration (Ixtoc I oil is particularly rich in the highly toxic, low boiling aromatic fraction); a mixing depth of 25 m; a five day persistency of the toxic oil fractions in the water solution; and a required concentration of 0.1 ppm to cause damage to shrimps: then an area of 15,000 km^2 can be regarded as poisoned by the Ixtoc I oil. This is equal to 2.5 percent of the Mexican part of the Gulf."

Jernelov and Linden (1981) go on to note the difficulties in assessing long term effects on fisheries and ecosystems – a fact of the current state of the art and knowledge repeated in 2003 by the National Academy of Sciences Report "Oil in the Sea III" (NAS, 2003).

2. Research on Other Applicable Releases

I believe that the NAS (2003) report and the Farrington and McDowell (2004) article accurately portray my view of the current lessons learned from other oil releases. I note in particular that in Farrington and McDowell (2004) we stated in the next to last paragraph:

"We also need to expand research on oil pollution in deeper waters. Most concerns and research have traditionally focused on coastal waters. Yet new concerns arise as oil production moves offshore. We can only speculate on the impact of oil exploration and production in deeper waters until we have more detailed knowledge of the biological organisms in these habitats and the biogeochemical processes that govern their lives."

I chaired the National Research Council Committee on the OCS Environmental Study Program 1986 to 1993. We noted in our last of six reports that with Congressional and Executive Branch Moratoria in place for several years, there was a "window of opportunity" to quote our report, to gain essential new knowledge about OCS environmental concerns. This would have allowed the United States to move forward with wise management and use of OCS oil and gas resources, including appropriate environmental protection with continued moratoria in some areas if warranted. Instead, both the Executive Branch and Congress reduced funding to the Environmental Studies Program of MMS. In my opinion, stated in my letter of July 15, 1993 to the late Senator Robert C. Byrd, then Chairman of the Subcommittee on Interior and Related Agencies, Committee on Appropriations, " By reducing the Environmental Studies Program funding, Congress jeopardizes wise use and management of the nation's OCS oil and gas resources by denying orderly and cost effective acquisition of vital new knowledge. "

I recognize that there are many competing priorities for federal funding. However, I would be remiss in my duty to my scientific colleagues and, through them, to our nation, not to note that carefully thought out and peer reviewed scientific advice sometimes gets shunted aside in the political process because of political and financial concerns and competing priorities. Then some crisis emerges, and science is asked to respond on an emergency basis. Such responses are often less cost effective and less efficacious than would be the case if there had been steady attention to the potential of problems to be encountered. Having stated this, I realize that there is a delicate balance of competing priorities that has to be taken into account within the Executive Branch and the Congress.

Important Lesson Learned from other Oil Spills from 1960s to the present:

- Each oil spill is unique in several ways: type of oil spilled, receiving ecosystem, weather conditions, season of the year, clean up and containment attempts.
- If oil gets into low energy marshy or muddy environments (sub tidal or inter-tidal), then persistence and longer term impacts are more likely than for high energy environments such as a rocky inter-tidal coastal ecosystems.
- Volatile components will evaporate.
- Soluble components dissolve in sea water and are subject to dispersion.
- Certain oil compounds such as n-alkanes are more susceptible to microbial degradation. However, the degradation of these compounds does not mean that the oil is being totally degraded. Other oil compounds such as the cycloalkanes and certain of the polycyclic aromatic hydrocarbons (PAH)can persist for long periods of time – decades in some cases.
- Oil compounds can be taken up from water by marine organisms across gills or by feeding on particulate matter and contaminated prey. Concentrations of a few ppm in sea water can be biomagnified by marine organisms by factors of 1,000 to 100,000. Thus low concentrations in sea water should not lead to conclusions that there will be no adverse effects on marine organisms.
- Bivalves such as mussels and oysters have limited capacity to metabolize petroleum hydrocarbons.
- PAH can be metabolized by fish, crustacean, marine mammals and birds. In some instances the metabolites are excreted. In other instances they may cause harm to the organisms.
- There is a large range of toxicity and long term sub lethal effects/responses to varying concentrations of petroleum hydrocarbons in given ecosystems.
- Large oil spills attract media attention and attention of the public, and various branches of federal, state, and local governments. There is a burst of initial interest and funding, or promise of research funding.
- Once an oil slick goes away, attention/interest of most people decreases despite the fact that petroleum hydrocarbons may still be present in the sediments and biota of an ecosystem. In some respects this is the old cliché "Out of sight, out of mind".

3. Direct Experience related to and scientific recommendations regarding the Deep Water Horizon Oil Spill.

I participated in the May 19th, White House Science Summit convened by the Office of Science, Technology and Policy and hosted by the Environmental Protection Agency that identified the science that should be addressed in the DWH MC 252 oil spill. I also participated in the Deepwater Horizon Oil Spill Scientific Symposium at Louisiana State University June 3, 2010 and presented a lunch seminar, "Conducting Oil Spill Research in a Regulatory Framework." I am not a paid consultant to any government agency, private organization or industry with an interest in this DWH MC252 oil spill. I have provided advice to colleagues at the Woods Hole Oceanographic Institution regarding their research at sea and in the laboratory with respect to the DWH MC252 spill. I have also provided comments when asked about a NOAA Joint Analysis Group report. I have responded to numerous news media requests for background information and interviews.

The fact that there is a Presidential Commission speaks to the seriousness of the matter. I believe numerous academic, government, and industry and consulting company scientists and engineers have been exerting substantive effort to stop the spill, contain and clean up the spilled oil, assess the fate and effects of the spilled oil. Much needed new knowledge has been gained that will assist in preventing a future spill or, if a spill of this magnitude occurs, to be better prepared to deal with it.

Hindsight is always 20/20 or better, and I have not been directly involved in the daily crisis management science that is pursued in this type of situation. Much of what I have observed and learned from the distance of my office, via emails and telephone conversations, and discussions at meetings seems familiar to me in terms of what has happened at other oil spills. The following are a few thoughts that I wish to bring to your attention:

- Scientific research often gets tangled with debates about: "Who is to blame for the spill? Who will get credit for being the lead federal agency? The legal requirements of NRDA.
- The delays and confusion with respect to allocations and release of the research funding from BP to consortia of academic institutions resulted in missed opportunities for research on the fate and effects of the spilled oil – missed opportunities that cannot be recaptured at this late date.
- Advances in numerical modeling and the application of floats, gliders, and other modern physical oceanographic instrumentation, coupled with various remote sensing capabilities provided excellent assessments and projections about where the oil slick was and would go. This was a significant application of the nation's emerging Coastal Ocean Observing System and, in my opinion, it was a significant success.
- The deployment of an in situ mass spectrometry coupled with an Autonomous Underwater Vehicle (AUV) demonstrated the advances in "cutting edge" analytical chemistry and engineering technology now available for assessing oil chemicals in waters of oil spill areas, and in deep water depths (Camilli et al, 2010).
- The application of the latest molecular biology/microbiological methods in genomics and proteomics provided tools for rapid and relatively thorough assessment of microbial populations in the spill area and control stations, allowing an assessment for the potential of microbial degradation of the oil (Hazen et al, 2010).
- Too much attention was focused initially on comparisons to the *Exxon Valdez* oil spill and not the more relevant Ixtoc I oil spill or other oil spills that have occurred along the Gulf of Mexico coast of the United States.
- Scientists today are encouraged to communicate effectively with the media. This is a good thing. However, there needs to be some careful post assessment by both scientists and the media about why initial scientific hypotheses, based on first interpretations of field data aboard ship by admittedly somewhat exhausted scientists, was parlayed into seemingly contradictory findings by various press reports.
- The DWH MC252 spill had several unique aspects such as being a very deepwater blowout, use of dispersants pumped into the vertical plume, with admixture at the bottom of drilling mud when there was an attempt to stop the flow by pumping mud into the well and the mud flowed out.
- Clearly, too little attention had been given to the real potential for a deepwater blowout. Statements that this was unexpected contradict the fact that such a spill scenario at 1,500 meters water depth was diagrammed and discussed in the National Academy of Sciences 2003 report "Oil in the Sea III", pages 106-108.

- There are numerous other sources of oil inputs to the Gulf of Mexico in the US Exclusive Economic Zone as noted in the NAS(2003) report. Adding up ten to fifteen years of estimated inputs for some of the sources such as natural oil seeps and runoff from land and normal operations of large and small ships/boats in coastal areas yields amounts of oil in the same total range as that released by the DWH MC252 spill. Obviously, chronic inputs such as those other sources and acute inputs such as the DWH MC252 spill are not strictly comparable. However, given these other sources of input, it will be a significant analytical chemistry challenge to accurately assess the contributions of DWH MC252 oil contamination of water, sediments, and living marine resources in several locations.

CONCLUDING REMARKS/RECOMMENDATIONS

I have two overarching recommendations:

1) The nation should not let the lessons from the DWH MC 252 fade from memory as time goes on and the visible presence of slicks from the spill disappear. This has happened too often in the past.
2) I hope the Commission can recommend, as soon as practicable, the allocation of the funds that BP set aside for research. These funds should be allocated through some type of rapid peer review process in a manner that maximizes the very best scientific research. I am concerned that there seems to be a move towards "centralized" cooperation in the research on the DWH MC252 spill. Coordination is fine. However, my experiences suggest to me that centralized control often has the unwanted effect of stifling creative scientific research.

Thank you again for the invitation and opportunity to share the preceding with the Commission

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Testimony of
John W. Farrington
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University of Massachusetts-Dartmouth
and
Scientist Emeritus
Woods Hole Oceanographic Institution

President's Oil Spill Commission

September 28, 2010

Requested Testimony

- Scientific findings in the aftermath of IXTOC-I Oil Well Blowout 1979 .
- Research on other applicable oil releases.
- Direct experience related to and scientific recommendations regarding Deepwater Horizon Oil Spill.

IXTOC I Oilwell Blowout June 3, 1979 to March 23, 1980.

- Petroleos Mexicanos (PEMEX) well, Bay of Campeche, Mexican waters ,Gulf of Mexico.
- 50 meters water depth.
- Explosion, fire, oil release at ocean bottom.
- 475,000 metric tons released.
- Research cruise to site 11-27 September 1979.

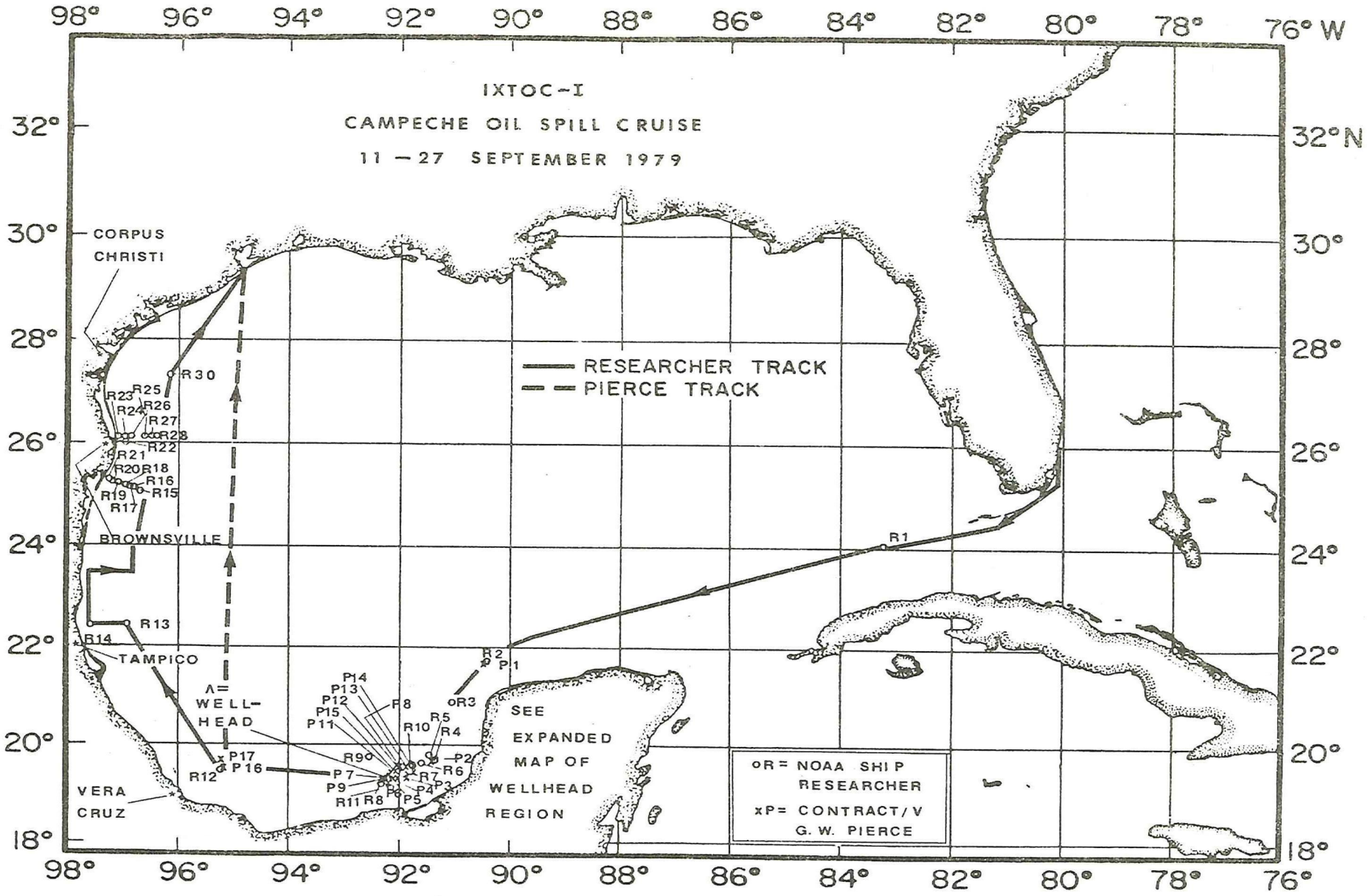


Figure 1. IXTOC-I Campeche oil spill cruise, 11-27 September 1979.

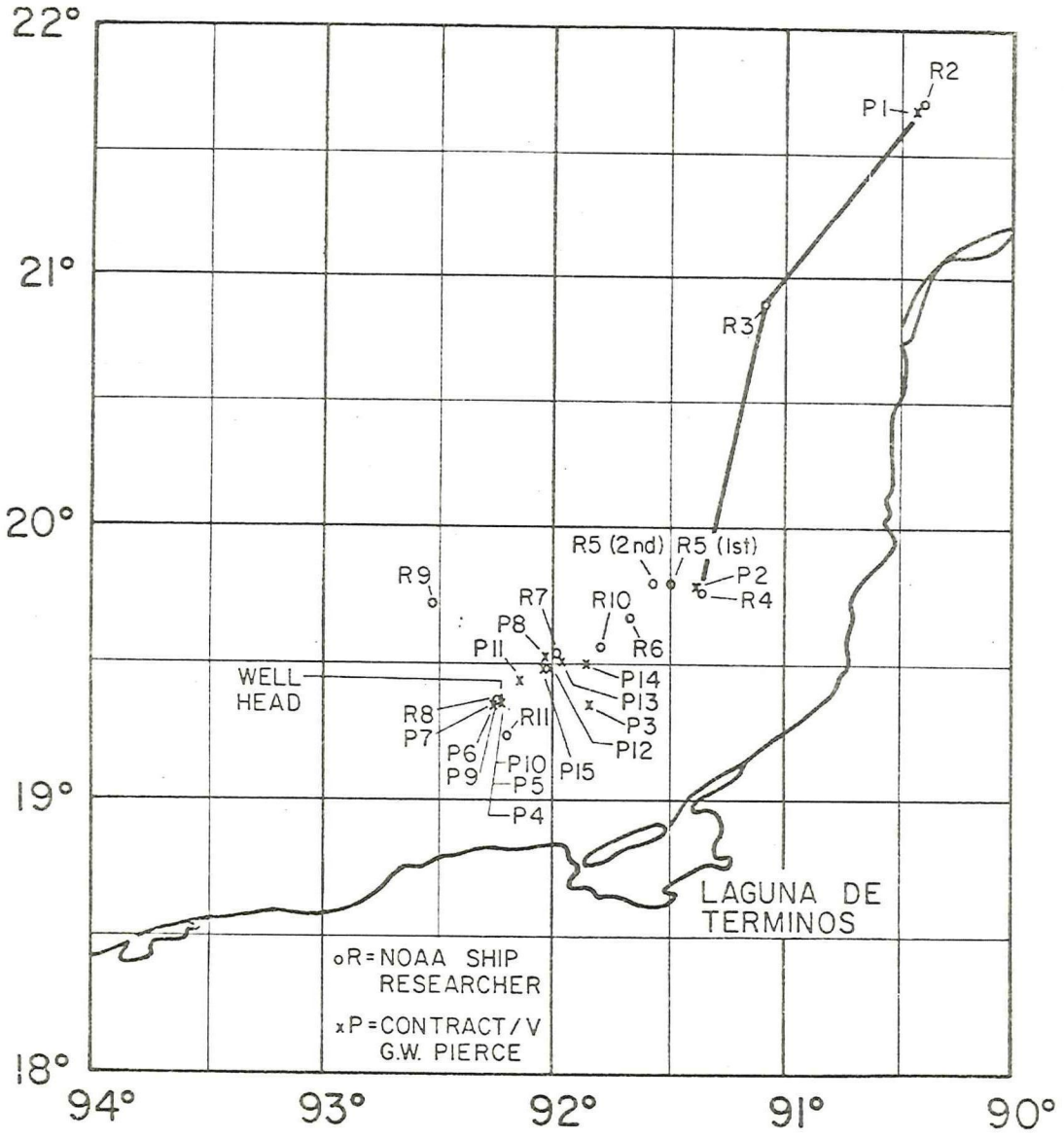
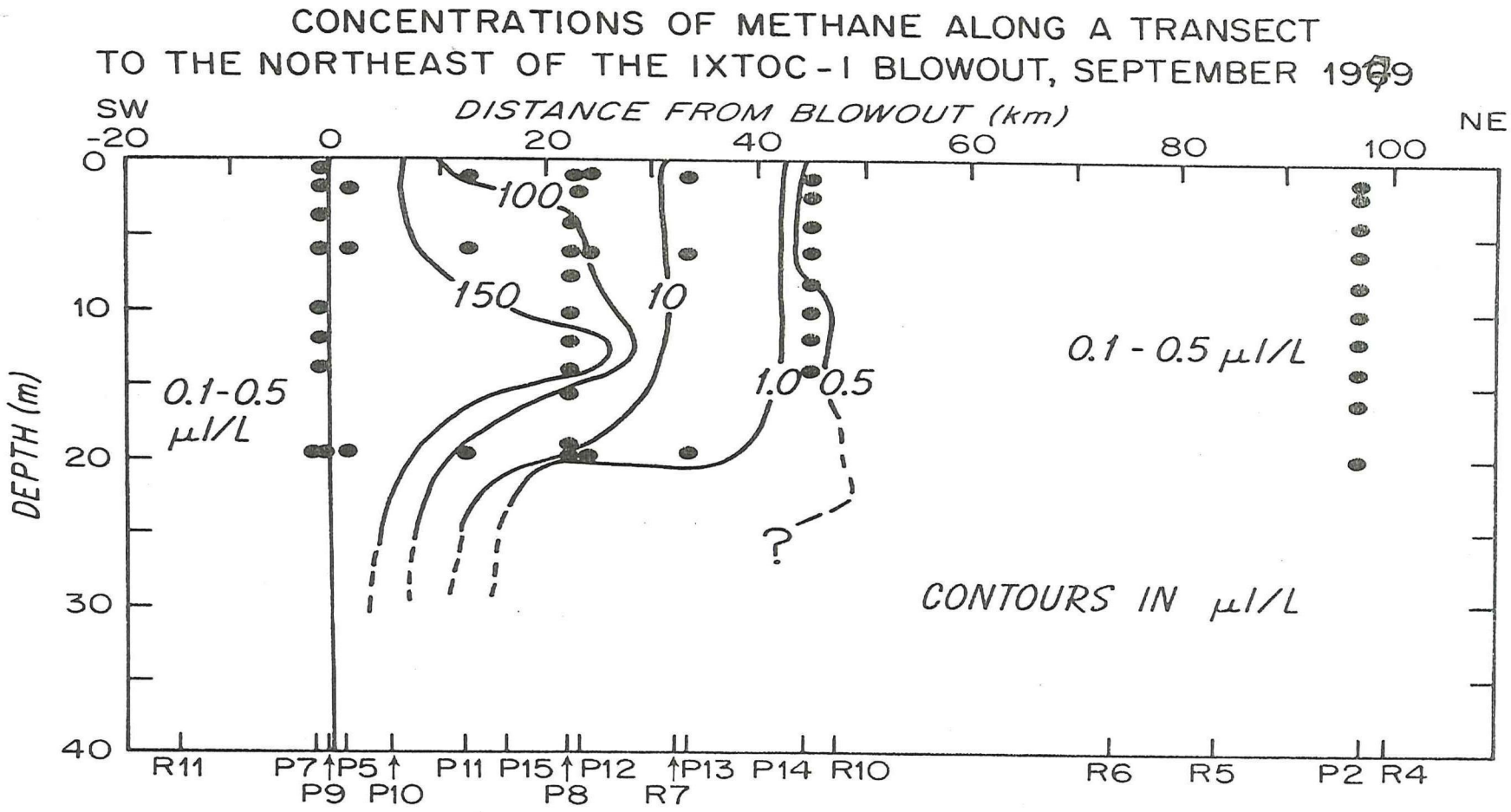


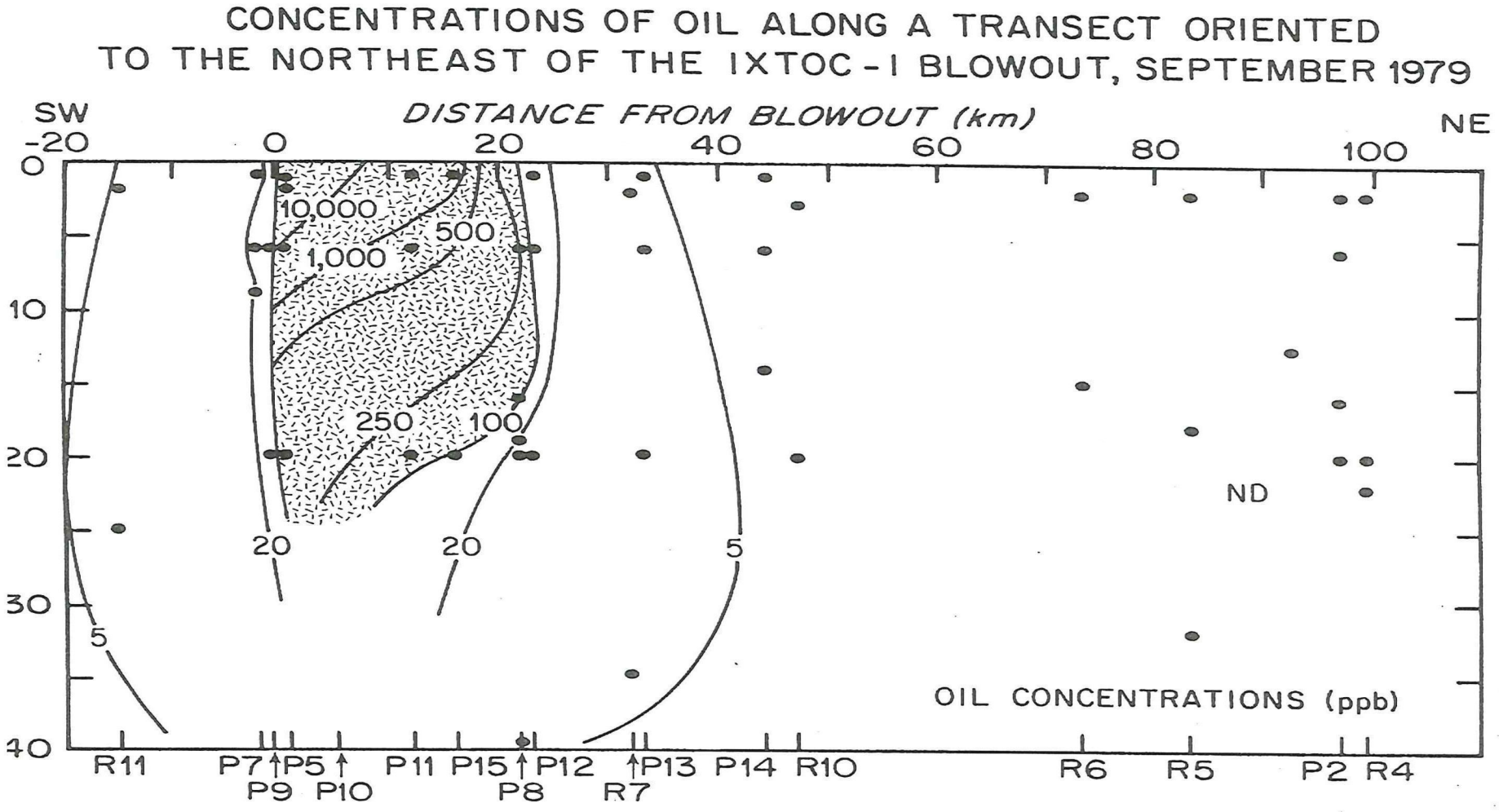
Figure 2. IXTOC-I Campeche oil spill cruise, 11-27 September 1979, expanded wellhead region.

Brooks et al (1980) Texas A & M University



Station Designations and Positions on Transect.

Fiest and Boehm (1980) and Boehm and Fiest(1982) Energy Resources Company, Inc.



Station Designations and Positions on Transect.

RESEARCHER/PIERCE IXTOC I CRUISE ONE IMPORTANT CONCLUSION

There was an underwater horizontal “plume” moving with the current away from the vertical plume and under the surface slick.

2. Knowledge of Oil Pollution in the Marine Environment

- The National Academies of Science 2003 report "Oil in the Sea III" is an excellent compilation of knowledge about oil pollution in the marine environment.

2. Knowledge of Oil Pollution in the Marine Environment (Cont).

- Farrington and McDowell (2004) in an article written in *Oceanus* magazine: *"Mixing Oil and Water",* summarizing the National Academy of Sciences 2003 Report for the layperson wrote:

  "We also need to expand research on oil pollution in deep waters. Most concerns and research have traditionally focused on coastal waters. Yet new concerns arise as oil production moves offshore. We can only speculate on the impact of oil exploration and production in deeper waters until we have more detailed knowledge of the biological organisms in these habitats and the biogeochemical processes that govern their lives. "

Conclusions
(Acknowledging that hindsight is often 20/20 or better)

- Scientific research often gets tangled with debates about: "Who is to blame?" Who will get credit for being the lead federal agency? The legal requirements of NRDA.
- Delays and confusion within our government about allocations and release of research funding provided by BP for consortia of academic institutions resulted in missed opportunities to gain vital new knowledge about fates and effects of DWH MC252 Oil Spill

Conclusions
(Acknowledging that hindsight is often 20/20 or better)

- Too little attention had been given to the real potential for a deep water oil well blowout.
- While I recognize that this was an accident, statements that this was an accident of an unexpected nature are not in accord with the fact that the National Academy Sciences report "Oil in the Sea III" discussed a scenario very similar to the DWH MC252 oil spill – a deep water oil well blow out at the bottom of the ocean in 1500 meters water depth. (pages 106-108 of that report).

Overarching Recommendation 1
(Out of sight, Out mind should not prevail when visible oil slicks disappear.)

The nation should not let the lessons from the DWH MC252 fade from memory as has often happened to oil spills in the past.

Eleven people perished.

The economic well being and quality of life for countless other people has been severely disrupted.

There have been adverse impacts on living natural resources.

Forgetting has too often been the reality in the past!

Overarching Recommendation 2. (Relative to BP Funds set aside for research.)

- The funds for research set aside by BP should be released as soon as practicable by the responsible government agencies, if this has not yet happened as of this date. (I understand that the funds may have been released within the past 24 to 72 hours).
- The award of funds should occur by way of an expedited peer review process.
- The move towards "centralized" control of all research on the DWH MC252 oil spill is troubling. This should be rethought. Coordination is fine. However, too often, centralized control has the unwanted effect of stifling creative scientific research. (If this is still happening, the process should be modified.)

National Commission on the

BP DEEPWATER HORIZON OIL SPILL AND OFFSHORE DRILLING

Attachment 19

Written Statement and Presentation of Jane Lyder

Deputy Assistant Secretary for Fish and Wildlife and Parks
Department of the Interior

TESTIMONY OF JANE LYDER, DEPUTY ASSISTANT SECRETARY FOR FISH AND WILDLIFE AND PARKS, DEPARTMENT OF THE INTERIOR, BEFORE THE NATIONAL COMMISSION ON THE BP DEEPWATER HORIZON OIL SPILL AND OFFSHORE DRILLING

Tuesday, September 28, 2010

Chairmen Graham, Reilly, Members of the Commission, thank you for the opportunity to be here today to discuss the impacts of the Deepwater Horizon Oil Spill on fish, wildlife, and their habitats across the Gulf Coast and the Gulf of Mexico.

It has now been more than 165 days since the Deepwater Horizon oil rig exploded and sank nearly 50 miles off Louisiana's coast, triggering the largest oil spill in American history. In the past 10 days, the Unified Area Command announced that the Mississippi Canyon 252 Macondo well is now completely sealed. The sealing of the well was welcome news, and the recovery that has taken place along the Gulf Coast is a testament to the extraordinary work thousands of responders have been doing since April 20 to minimize the impacts of the spill on Gulf Coast residents, the regional economy, and one of the most diverse and dynamic ecosystems in the world.

The announcement marks a milestone in this effort as we shift from response to restoration. Still, I must caution that oil remains in the Gulf of Mexico, and marsh and coastal habitats will continue to be impacted. We will continue to aggressively address this as long as it remains a threat to our natural resources, local communities, and the regional economy.

Over the course of this response, the Department of the Interior, including U. S. Fish and Wildlife Service, National Park Service, Bureau of Land Management, and U.S. Geological Survey , has worked with partners led by our state fish and wildlife agencies to pursue restoration projects and minimize impacts to wildlife and their habitats.

Impacts to Wildlife and Habitat

The Department manages 36 national wildlife refuges and eight national park units along the Gulf Coast from Texas to Florida's peninsula that cover nearly three million acres of pristine freshwater, tidal and terrestrial habitats. There are 38 federally-listed species protected under the Endangered Species Act along the Gulf Coast for which the Service and National Oceanic and Atmospheric Administration (NOAA) Fisheries are concerned about relative to this spill, and 29 of those are endangered.

Approximately 1,000 miles of shoreline have been impacted, affecting approximately 275 miles of Department of the Interior lands. Currently, slightly more than 100 miles of Gulf Coast shoreline is experiencing moderate to heavy oil impacts. Nearly 500 miles of shoreline is experiencing light to trace oil impacts in Louisiana, Mississippi, Alabama, and Florida.

To give you a sense of the ecological value of these coastal habitats, consider that the northern Gulf Coast is home to one of every four Laughing Gulls. Nearly half of the southeastern population of Brown Pelicans – Louisiana's state bird - lives along the northern Gulf Coast and

generally nests on protected coastal islands. The Brown Pelican was taken off the endangered species list along the Gulf Coast less than a year ago. More than 35 percent of the southeastern populations of Royal Terns and Least Terns rely on northern Gulf Coast habitats as well.

The impacts so far have been significant.

Soon after the spill occurred, oil washed ashore at the Breton National Wildlife Refuge, which includes much of the Chandeleur chain of barrier islands, just as Royal Terns, Brown Pelicans, and Least Terns began nesting.

Oil also impacted the Delta National Wildlife Refuge and Grand Bay National Wildlife Refuge on the Mississippi coast. Bon Secour National Wildlife Refuge, a refuge located on the Alabama coast, was hit hard beginning in early June and continued to see impacts through the summer. Gulf Islands National Seashore was the only NPS unit oiled; most of the affected area was sandy shoreline, and a small part was marsh. Approximately 95% of the shoreline was oiled; approximately half of this was heavily oiled, one-quarter medium, and one-quarter light-medium. Much of the shoreline was oiled twice. Oiling of submerged aquatic vegetation at Gulf Islands appears to be low, but data is still being gathered. There has been some injury to seagrass beds and marshlands due to boat propellers and booms used in response activities at both Gulf Islands and Jean Lafitte National Park and Preserve.

Preliminary data as of this past weekend tells us that 8,180 birds have been collected or captured so far. Of those, 2,076 visibly oiled birds have been captured alive. Of those birds, 1,233 have been released back into the wild. The Service is moving aggressively to verify all of the data collected about those birds and is in the process of releasing species–by-species data as it is verified. You can find that information at http://www.fws.gov/home/dhoilspill/collectionreports.html. With more than 60 percent of the data verified, the three most affected species appear to be Brown Pelicans, Northern Ganets, and Laughing Gulls.

In early September, biologists with the Service and the Louisiana Department of Wildlife and Fisheries began survey work on nearly 100 bird nesting colonies along the coast. The results of those surveys are currently being analyzed.

The fall migration is underway. Songbirds and shorebirds began their migration to the Gulf Coast in July. Waterfowl began arriving in late August and early September. We know there are significant impacts to marsh and coastal wetland habitats along sections of the Louisiana coast, particularly near Grand Isle, Louisiana. We are continuing to monitor what the full impact will be to migratory birds and other wildlife.

As a result of negative impacts to these habitats, the Service joined with the Natural Resources Conservation Service to implement a Migratory Bird Habitat Initiative aimed at creating additional habitat on the ground by asking farmers to flood their fields. We hope this will reduce the probability of migrating birds coming into contact with oil impacted areas. Our biologists also wanted to try to offset any losses to foraging habitat. Other partners in this effort include Ducks Unlimited and Wildlife Mississippi.

Another important trust resource for us is inter-jurisdictional fish. We are evaluating injury to fish, shellfish, and their supporting habitats. The Gulf of Mexico fishery is complex, and to accomplish this we have segmented the evaluation into ecosystem components including coastal zone fisheries, deepwater fisheries, shellfish, and bottom-dwelling organisms. In addition, the Trustees are developing plans to assess injury to specific species of concern such as the threatened Gulf Sturgeon and whale sharks.

In mid-June, as this year's sea turtle nesting season along the northern Gulf Coast was about to begin, Interior's biologists and those with the Florida Fish and Wildlife Conservation Commission and NOAA began considering a range of steps that could be taken in an effort to limit the potential impacts to sea turtle hatchlings. Among the early concerns was that surface oil could saturate sargassum pads that young turtles depend on for shelter and food and ultimately have a devastating impact on this year's population.

What resulted was partnership to translocate sea turtle nests from the northern Gulf coast of Florida and Alabama to the Atlantic Coast of Central Florida at the Kennedy Space Center. Assistant Secretary of the Interior Tom Strickland captured the gravity of the effort when he said, "This is an extraordinary rescue mission to deal with an unprecedented threat to iconic threatened and endangered sea turtles. Nothing on this scale has ever been attempted, but the scientific consensus is that it is worth the risk given the magnitude of the threat."

We will not know how well this translocation worked for some years. We do know, however, that biologists with the Department of the Interior and NOAA in partnership with staff from the Kennedy Space Center, the National Fish and Wildlife Foundation, the Florida Fish and Wildlife Conservation Commission, FedEx Custom Critical, and scores of volunteer conservationists with the Sea Turtle Network came together to do something extraordinary as oil flowed unabated from the Deepwater Horizon oil well.

In all, 278 nests were moved to an incubation center set up at Kennedy Space Center by the time the effort was suspended in early August as habitat conditions improved. So far, nearly 15,000 hatchlings have been released into the Atlantic Ocean along a 25-mile stretch of Florida's Space Coast.

The translocation effort was suspended in early August after surveys found sargassum habitats in the Gulf of Mexico off the northern Gulf Coast to be in good shape and largely out of harm's way. We continue to monitor those habitats as the end of the nesting season approaches in early October.

Overall, 1,125 sea turtles have been captured alive or collected dead over the course of our response. Of those, 592 were collected dead and 533 have been captured alive. So far, 314 sea turtles have been released to date.

Restoring Natural Resources

Many of the long-term impacts from the oil spill are unknown and may not manifest themselves for years.

To address that, the Department of the Interior is working with the Department of Commerce through NOAA; the States of Texas, Louisiana, Mississippi, Alabama, and Florida; and the Department of Defense to complete a comprehensive natural resource damage assessment and restoration blueprint identifying the injury to natural resources along the Gulf Coast and across the Gulf of Mexico associated with this oil spill. The Department of Agriculture and Tribal governments also have been invited to participate. These Trustees will work together to develop a restoration plan that restores the region's natural resources to their pre-spill condition.

The Natural Resources Damage Assessment and Restoration (NRDAR) program, is leading the effort to manage and control the assessments and appropriate restoration projects, as authorized under the Oil Pollution Act of 1990. The purpose of NRDAR is to restore natural resources injured as a result of oil spills or hazardous substance releases into the environment. The Natural Resources Damages Assessment (NRDA) process focuses on demonstrating a pathway of the oil to natural resources, identifying injured natural resources, determining the extent of the injuries, recovering damages from those responsible, and planning and carrying out natural resource restoration activities to pre-spill conditions at no cost to American taxpayers. The NRDA process may help accelerate activities so this extraordinary ecosystem can be restored more quickly.

The Deepwater Horizon Oil Spill Trustee Council established 13 technical working groups in an effort to focus and organize this work. Those working groups are as follows: Bird Technical Working Group, Water Column Technical Working Group, Fish Technical Working Group, Marine Mammals and Sea Turtles Technical Working Group, Submerged Aquatic Vegetation Working Group, Coral Technical Working Group, Shoreline Technical Working Group, Terrestrial and Freshwater Technical Working Group, Human Uses Technical Working Group, Chemistry Technical Working Group, Cultural Resources Technical Working Group, Data Management Technical Working Group, and Aerial Imagery Technical Working Group.

To address the long-term ecological, economic and health impacts of the Deepwater Horizon oil spill, the President asked Navy Secretary Ray Mabus, a former Mississippi governor and son of the Gulf, to develop a long term Gulf Coast Restoration Plan. Work is moving forward aggressively to build a framework that will allow the people of the Gulf to build upon the recovery process and create a more resilient Gulf Coast for the future.

Conclusion

We're five months removed from the explosions aboard the Deepwater Horizon oil rig that triggered this oil spill. The well is now dead and we are transitioning to restoration of natural resources and revitalization of local economies.

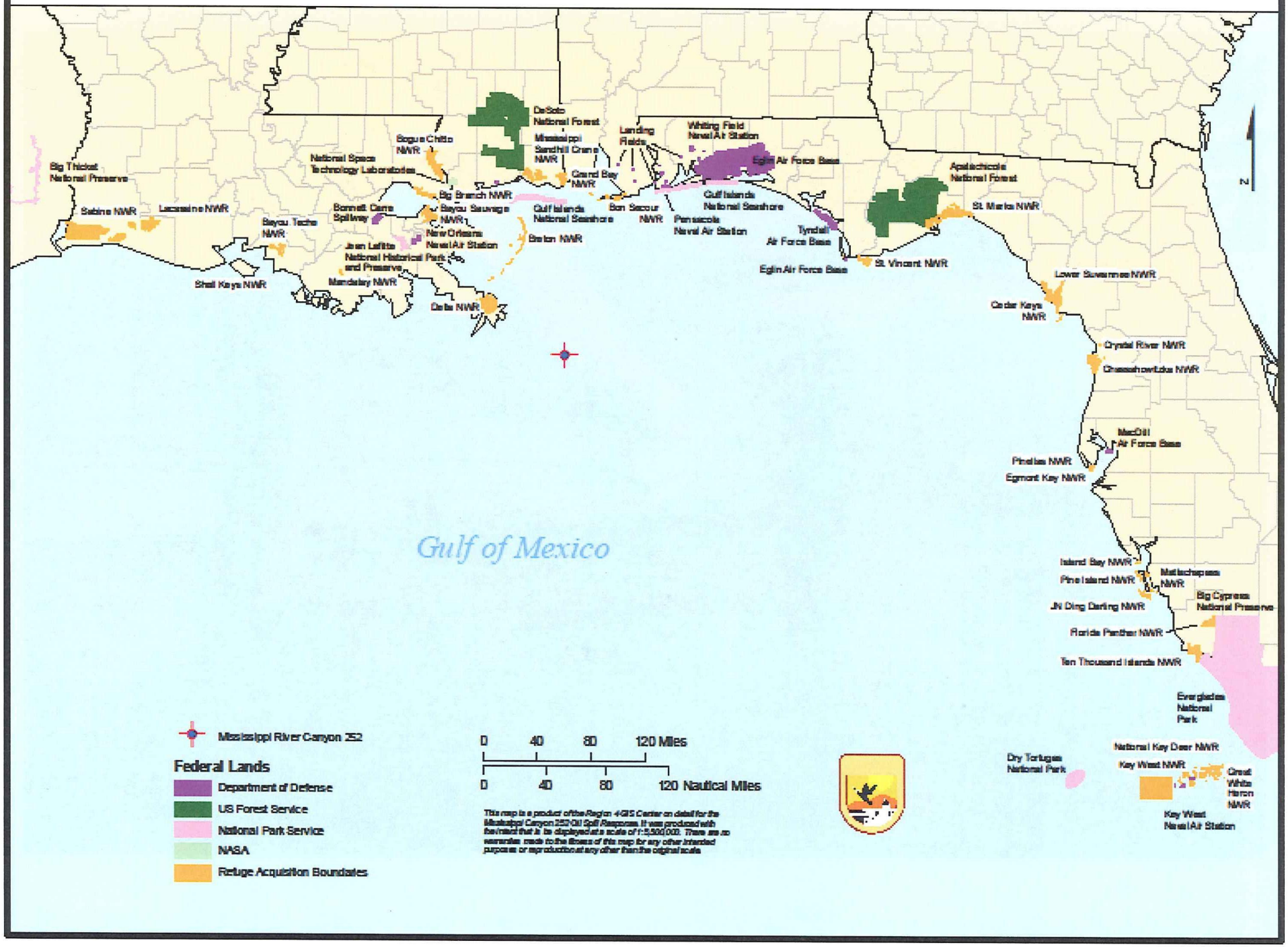
We've documented impacts to fish, wildlife, and their habitats and are working to evaluate the long-term impacts from this spill. There is much that remains uncertain, but we are learning a great deal through the work of some of our nation's best biologists and scientists. Through the effort of the Trustee Council, we will be positioned to better predict the future health of the region's recreational fisheries, its migratory birds and wildlife, and its imperiled species as well as the local tourism economies that those resources support through some of the nation's most robust wildlife-dependent recreational opportunities.

This Administration is committed to helping the people and communities of the Gulf Coast region persevere through this latest environmental and economic disaster. The restoration of the region's rich natural resources to their pre-spill condition and the development and implementation of our integrated Gulf Coast Ecosystem Restoration initiative are evidence of that commitment.

Thank you for the opportunity to present testimony on this important topic this morning. I would be pleased to answer any questions from the Commission.


Photo Credit:USFWS/Greg Thomp

Southeast Region Gulf Coast National Wildlife Refuges and Federal Lands



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Waterfowl
Central Flyway
Mississippi Flyway
Pacific Flyway
Atlantic Flyway