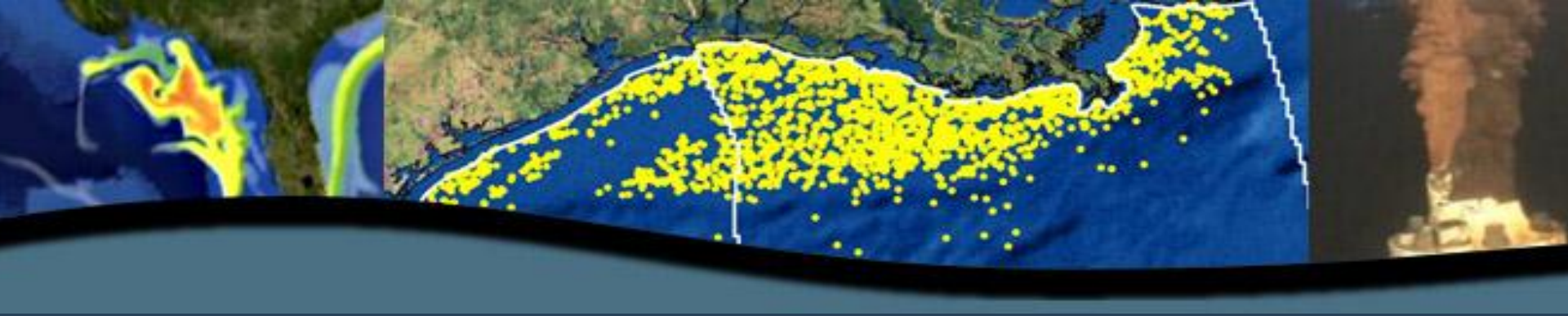
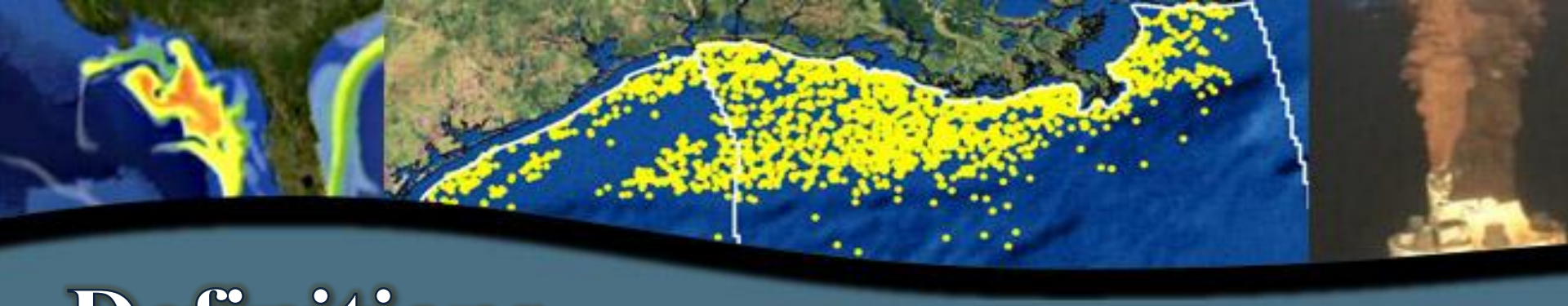


Learning From Deep Horizon:
Connecting The Public, Researchers, And Decision Makers In Risk Assessment And Response To Oil Spills

College of Earth, Ocean, and Atmospheric Sciences,
Oregon State University

Spatial Environmental Energy Research (SEER),
National Energy Technology Laboratory (NETL)

Jim Graham, Kelly Rose, Lawrence Sim, Jake Nelson, Kaylyn Van Acker, Corinne Disenhof, Chris Ringo, Jen Bauer, and others…

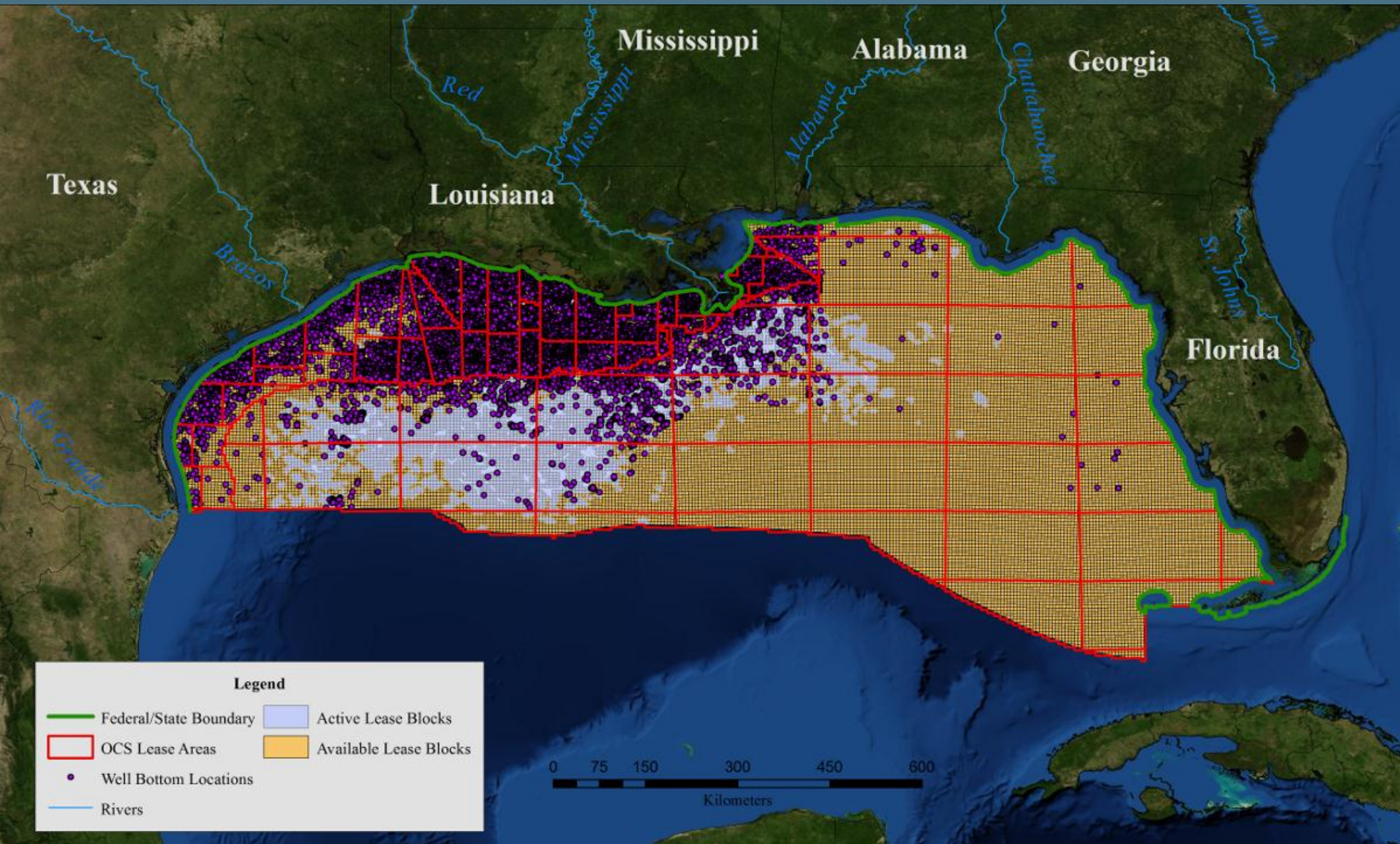


Definitions

- Deep-water Horizon
  - Oil drilling rig
- British Petroleum (BP)
  - Company operating the rig (Transocean owned the rig)
- Macondo Prospect –
  - Lease block in the Gulf

Wikipedia

Lease Blocks and Oil Wells




Arkansas
Mississippi
Alabama
Louisiana
Texas
Florida
Alabama
Mississippi-Alabama Shelf
Texas-Louisiana Shelf
Gulf of Mexico

What Happened

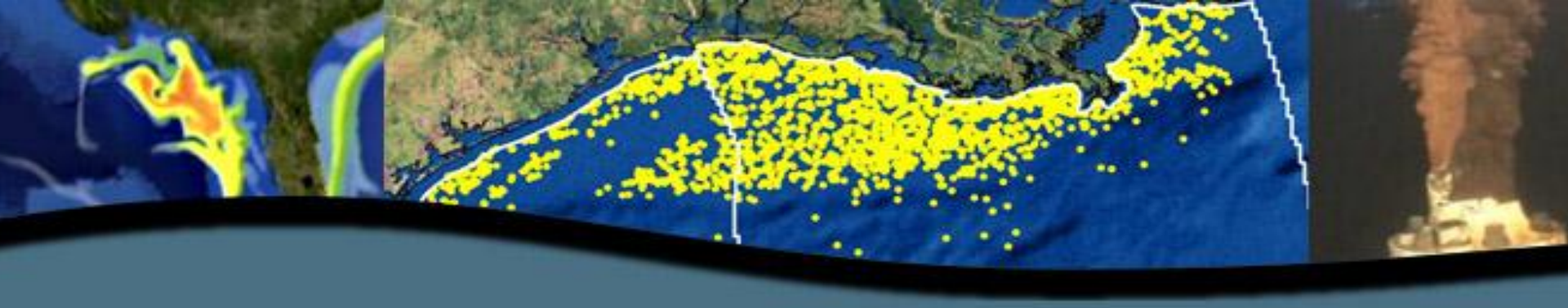
- April 20th, 2010
  - Cement failed to block oil and gas from moving up the “pipe” allowing gas to collect in the rig
  - Gas ignited in the rig, the resulting fire eventually caused the rig to sink
  - The pipe from the well-head to the rig broke, allowing a mix of crude oil and gas to “spill” into the Gulf of Mexico

Zimbo

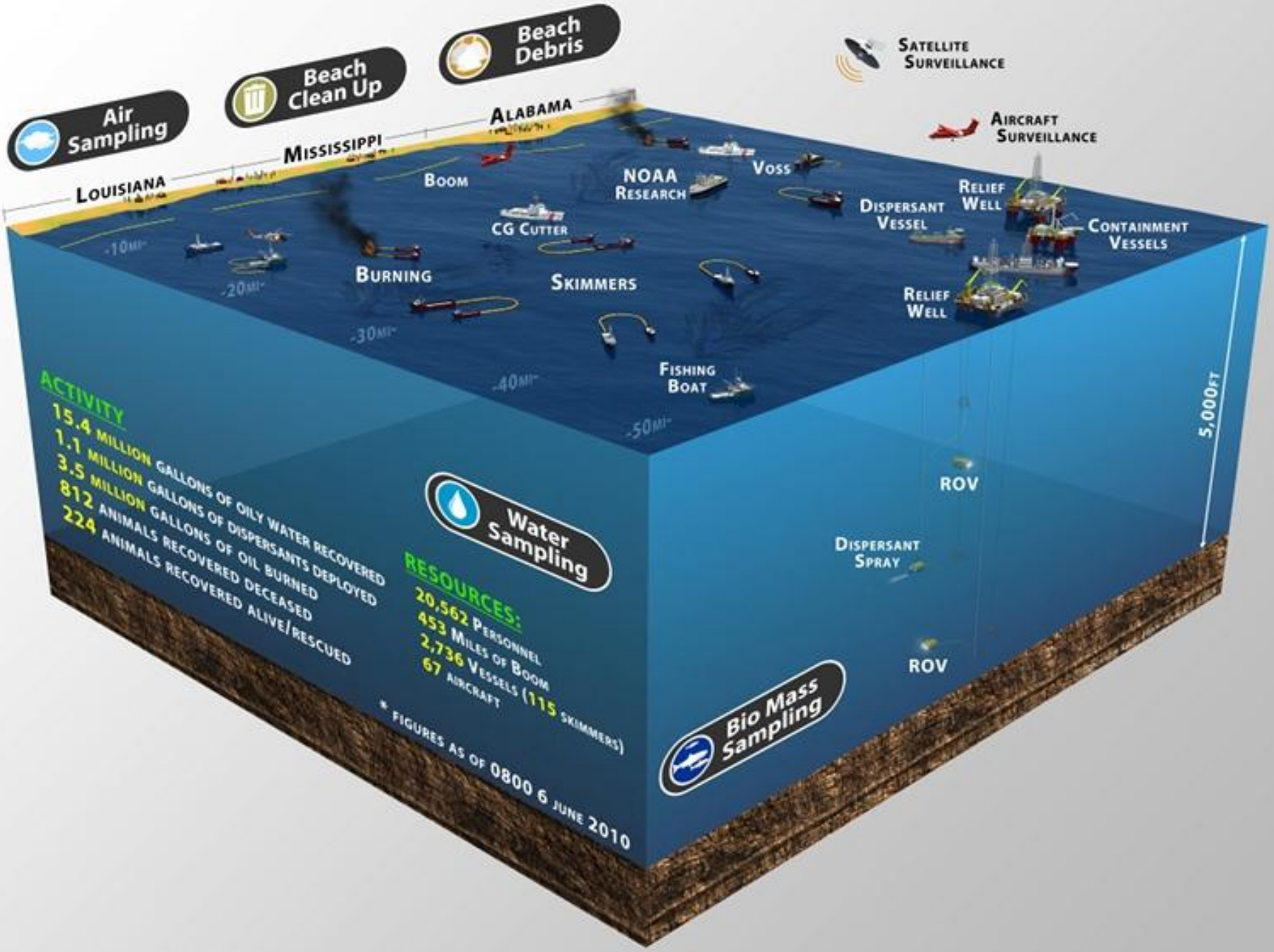
What Happened

- As the pipe sank, it broke at the wellhead on the ocean floor
- All attempts at stopping the leak failed until it was sealed with mud and then cement
- 4.9 million barrels of "oil" leaked into the Gulf
- Stopped on August 4th

oilspillhub.org



- Probable causes of the failure:
  1. Fewer barriers to gas flow
  2. Improper placement of cement around the tubes
  3. No test on the cement bond
  4. Pressure test misinterpreted
  5. Drilling mud barrier removed early
  6. Blowout preventer failed
- For a concise description search the web for:
  - "Six steps that doomed the rig"
- Complete report: www.oilspillcommission.gov



Federal Deep-water Response Team

Extent of the Event

- Deaths (at least):
  - 11 people
  - 2,263 birds
  - 18 turtles
  - 4 marine mammals
- Involved:
  - 20,562 people
  - 2,736 vessels
  - 67 aircraft
  - 453 miles of booms

- Rescues:
  - 2,079 birds
  - 456 sea turtles
  - 2 marine mammals

Fishermen hired to deploy booms

telegraph.co.u

bp.com, restorethegulf.gov


Guardian


www.oil-electric.com

Organizations Involved

- States:
  - Alabama
  - Louisiana
  - Florida
  - Texas
  - Mississippi
- Commercial
- Military

- Federal:
  - NOAA
  - NASA
  - Dept. of Interior
  - Fish & Wildlife Service
  - Dept. of Energy
- Local:
  - Too many to list!

Hundreds of Organizations…

Impacts

- Impacts:
  - Marshlands: Birds, shellfish, grasses
  - Open water: shell fish, fish, marine mammals, turtles


NOAA

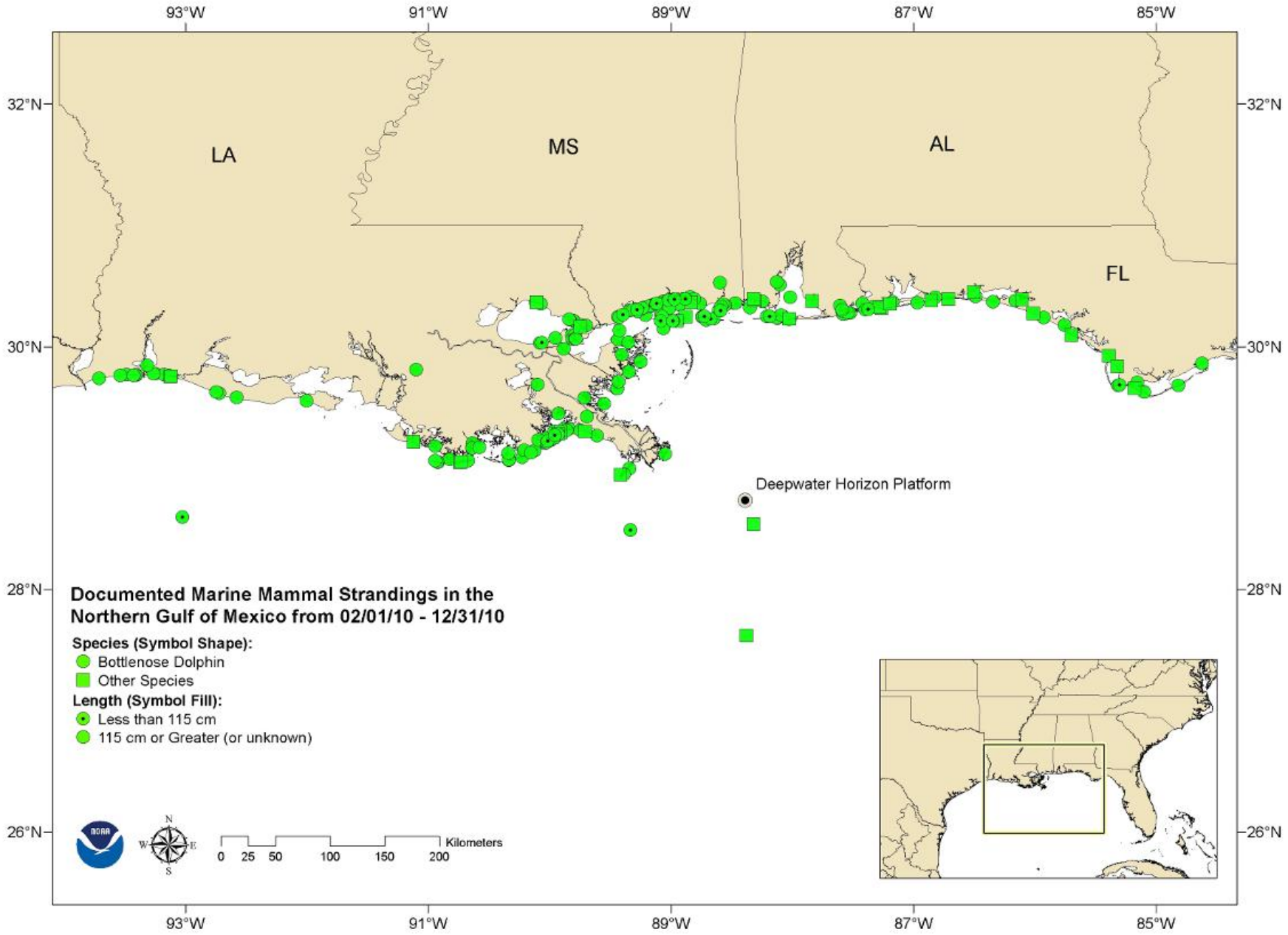

www.bp.com


Lee Celano/reuters

Long-Term Impacts?

- Marshlands
- Tar-balls on the ocean floor
- Mutant animals?

US Coast Guard


93°W
91°W
89°W
87°W
85°W
32°N
30°N
28°N
26°N
LA
MS
AL
FL
Deepwater Horizon Platform
Documented Marine Mammal Strandings in the Northern Gulf of Mexico from 02/01/10 - 12/31/10
Species (Symbol Shape):
Bottlenose Dolphin
Other Species
Length (Symbol Fill):
Less than 115 cm
115 cm or Greater (or unknown)
N
W
E
S
0 25 50 100 150 200
Kilometers

SKYTRUTH | Surfrider Foundation | Ocean Conservancy

SHARE | English (US)

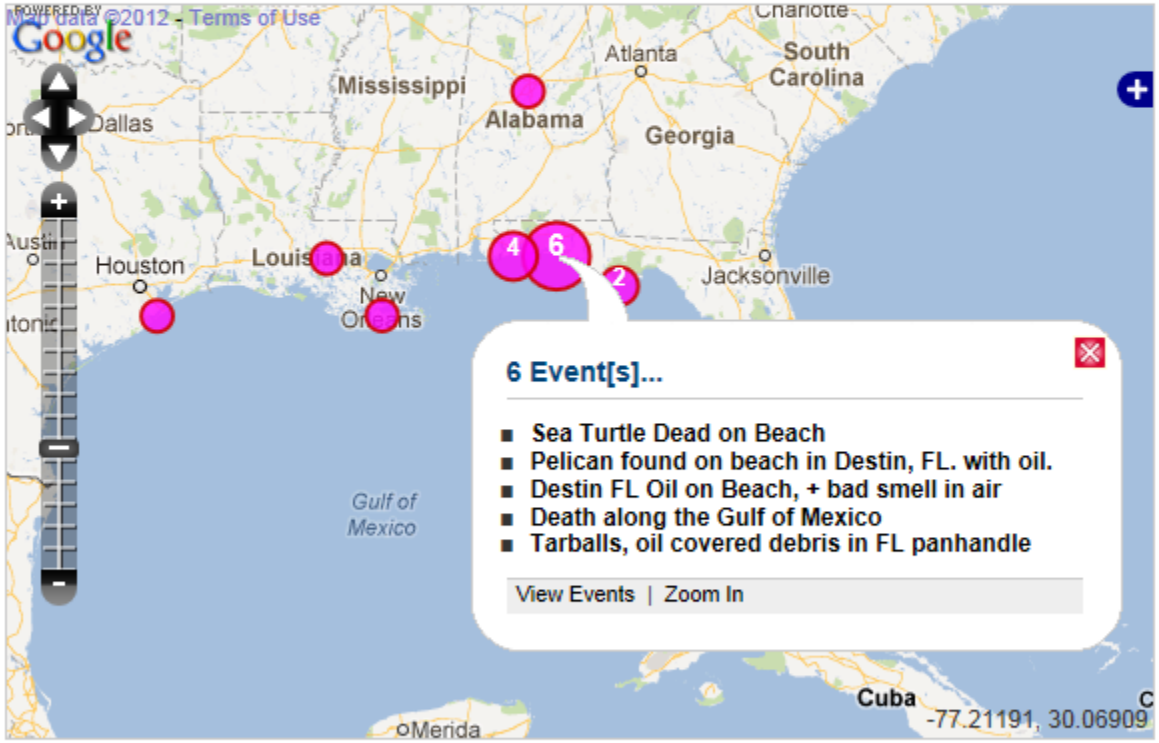
GULF OIL SPILL TRACKER

SUBMIT AN INCIDENT

HOME | REPORTS | SUBMIT AN INCIDENT | GET ALERTS | CONTACT US | HOW TO HELP | ABOUT US

FILTERS → REPORTS | NEWS | PICTURES | VIDEO | ALL

VIEWS → CLUSTERS | TIME



From: Oct 2012 To: Dec 2012 PLAY

Jan 2010 | Oct 2010 | Jul 2011 | Dec 2012

Official & mainstream news

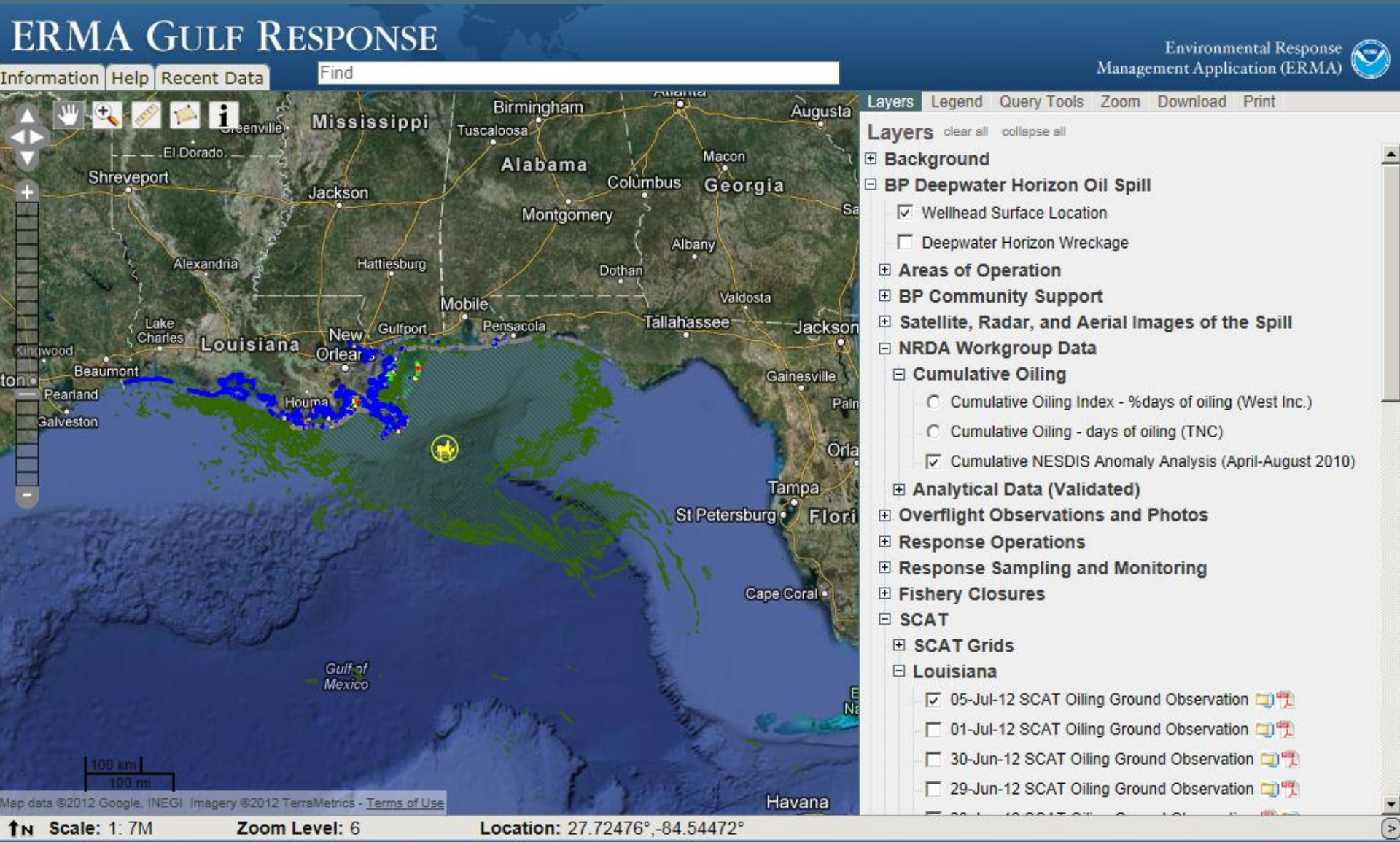
HOW TO REPORT

1. By sending an email to reports@skytruth.org
2. By filling a form at the website

↓ CATEGORY FILTER

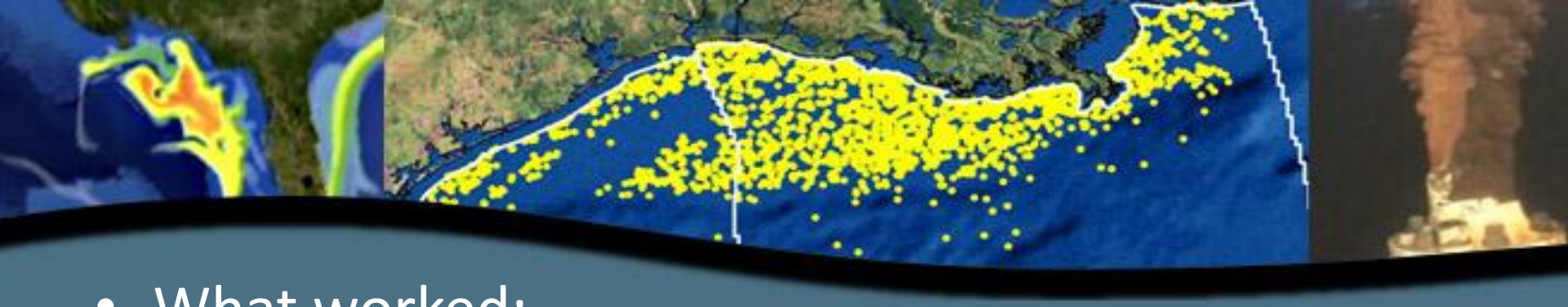
- ALL CATEGORIES
- OIL IN THE WATER
- OIL ON LAND
- WILDLIFE
- UNAFFECTED AREA
- TRASH / DEBRIS - UNOILED
- TRASH / DEBRIS - OILED
- AIR QUALITY
- NRC REPORTS

Long-Term Impacts?



Citizen Science

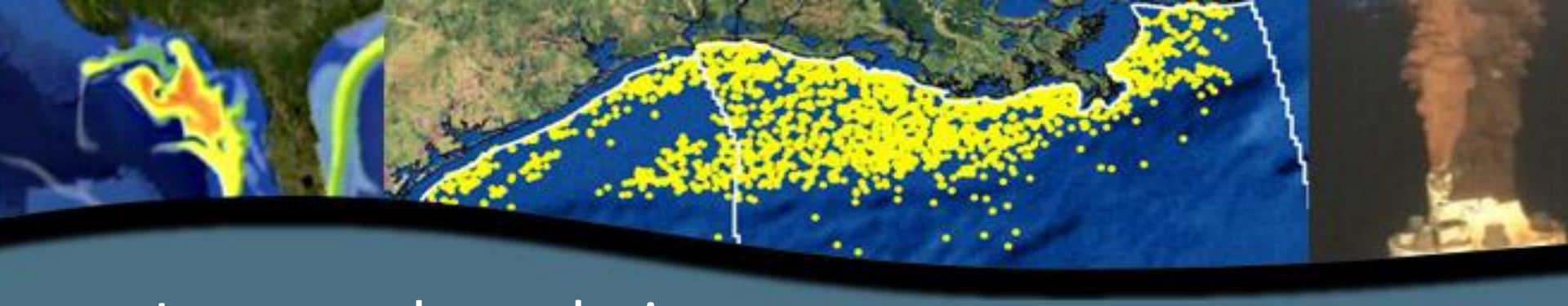
- Monitored oil spills
- Performed surveys before oil arrived
- Helped with rescue and restoration



- What worked:
  - Fishing closures
  - Booms & Siphons
  - Bacteria
  - Working together
  - Internet exchange of “news” information to the public (with a lot of miss-information as well)
- Needs Improvement:
  - Preventative measures
  - Early attempts to close the well
  - Response modeling
  - Exchange of scientific data
  - Broad communication of scientific results

Federal Oil Spill Commission Final Report

- "Scientific understanding of environmental conditions in sensitive environments in deep Gulf waters, along the region's coastal habitats, and in areas proposed for more drilling, such as the Arctic, is inadequate. The same is true of the human and natural impacts of oil spills."

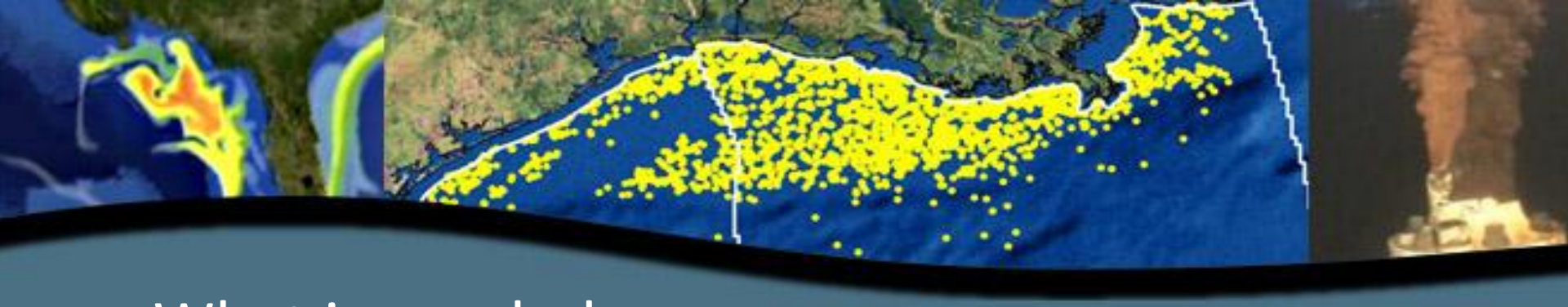


- Increased regulation
- Federal and state websites for coordination
- Federal regulatory organizations reorganized
- Funding for research, restoration
- Restorations continuing

BOEM
Bureau of Ocean Energy Management

BSEE
Bureau of Safety and Environmental Enforcement

RestoreTheGulf.gov



- What is needed:
  - Data collection and web entry
  - Data exchange
  - Researchers ready to analyze results
  - System to relay the results back to the decision makers and the public

Energy Data eXchange

Data Exchange for Energy Solutions

- *R&D coordination & collaboration tool*
- *Share information across networks*
- *Rapid access through one site*
- *Online access for historical data*
- *Venue for newly released datasets*
- *Security, database design, and structure leverage DHS system*
- *Built to accommodate both open access and restricted access data*
- *Role-based security allows for groups or "communities" within the system*
- *Future FY13 roll outs will incorporate spatial/mapping tools, displays and other opportunities*

More information on EDX:
http://www.netl.doe.gov/publications/factsheets/rd/R%26D184%20.pdf

Designed for:

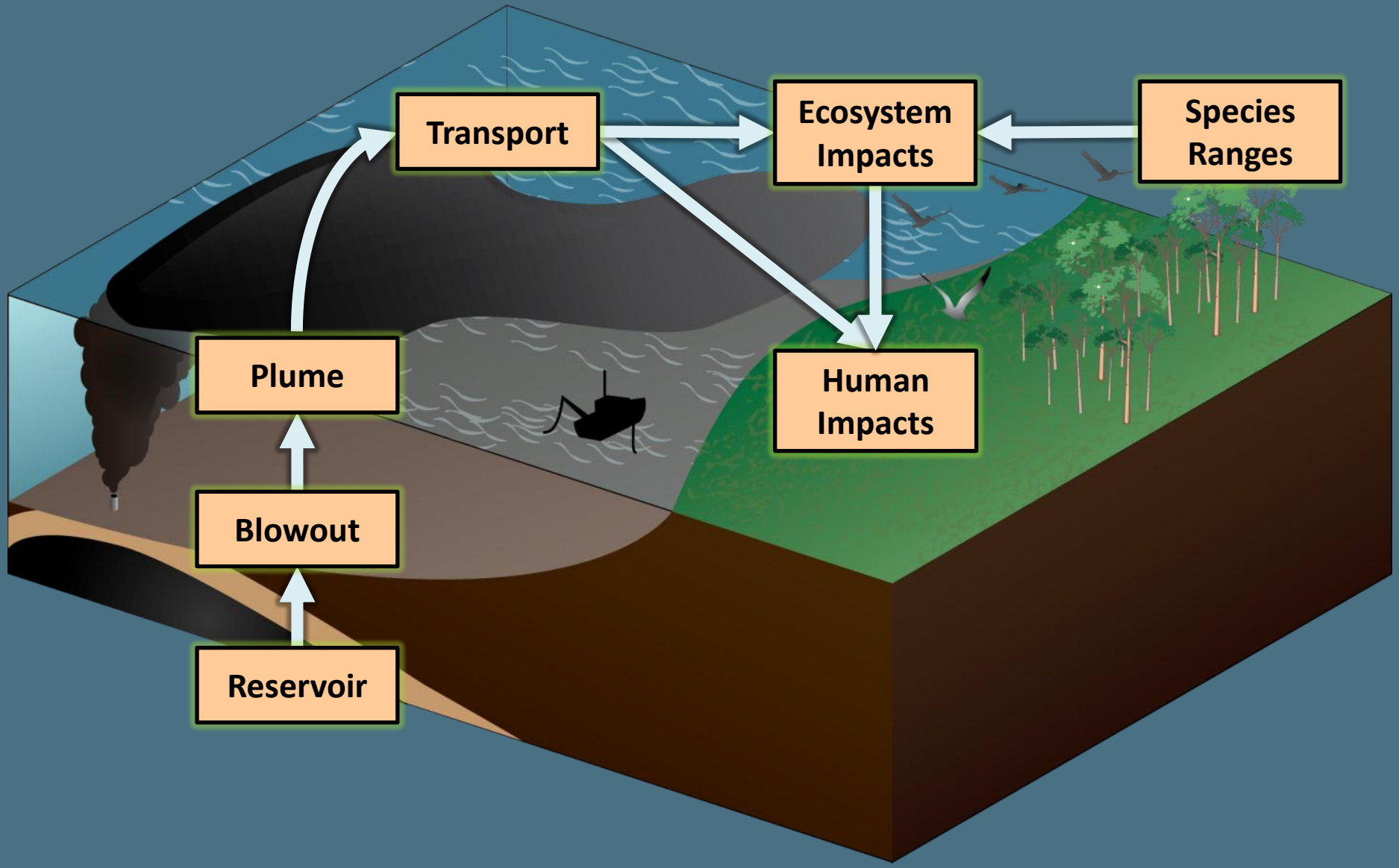
- *Fossil & renewable energy researchers*
- *Policy makers*
- *General public*

Now available at: https://edx1.netl.doe.gov

Spatial Environmental Energy Research

- SEER Lab:
  - Collaboration between DOE's National Energy Technology Laboratory, Oregon State University, and other organizations
- Collect, integrate, make available:
  - Data for researching risks and impacts of energy exploration and production
- Model potential oil spills and extents
- Model impacts on target species and economies
  - Shrimp, shellfish
  - Turtles, birds, marine mammals
  - Marsh vegetation
  - And people!

Overall Modeling Problem



- Early Results:
  - Models of the oil plume
  - Shrimp model?
- For Future Results See:
  - Seer.science.oregonstate.edu

Scarabeo 9

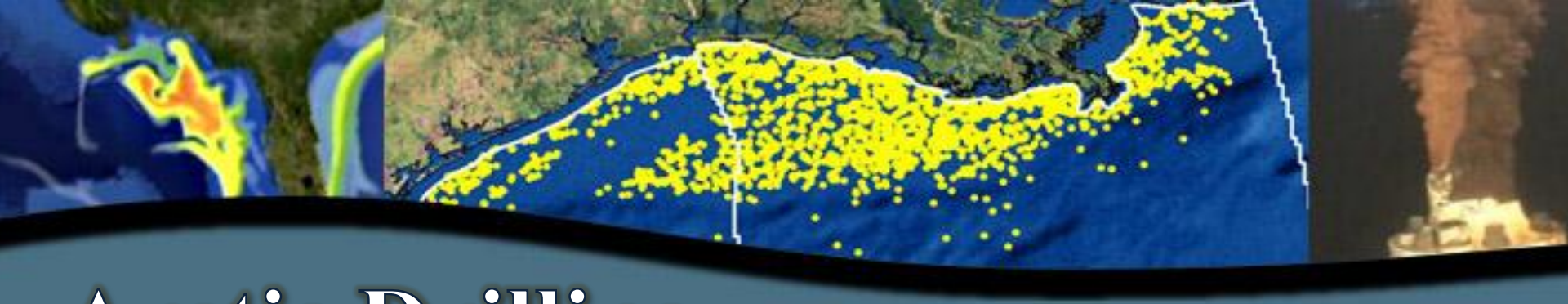
- 50 km north of Cuba
- Roughly 1,700m depth
- Directly in path of Florida current

Image Credit: BBC News

Ultra-Deepwater Drilling

- Deepwater Horizon only about 1,500m
- Current record 2,852m (Dec. 2008)
- Tobago field – 2,925m

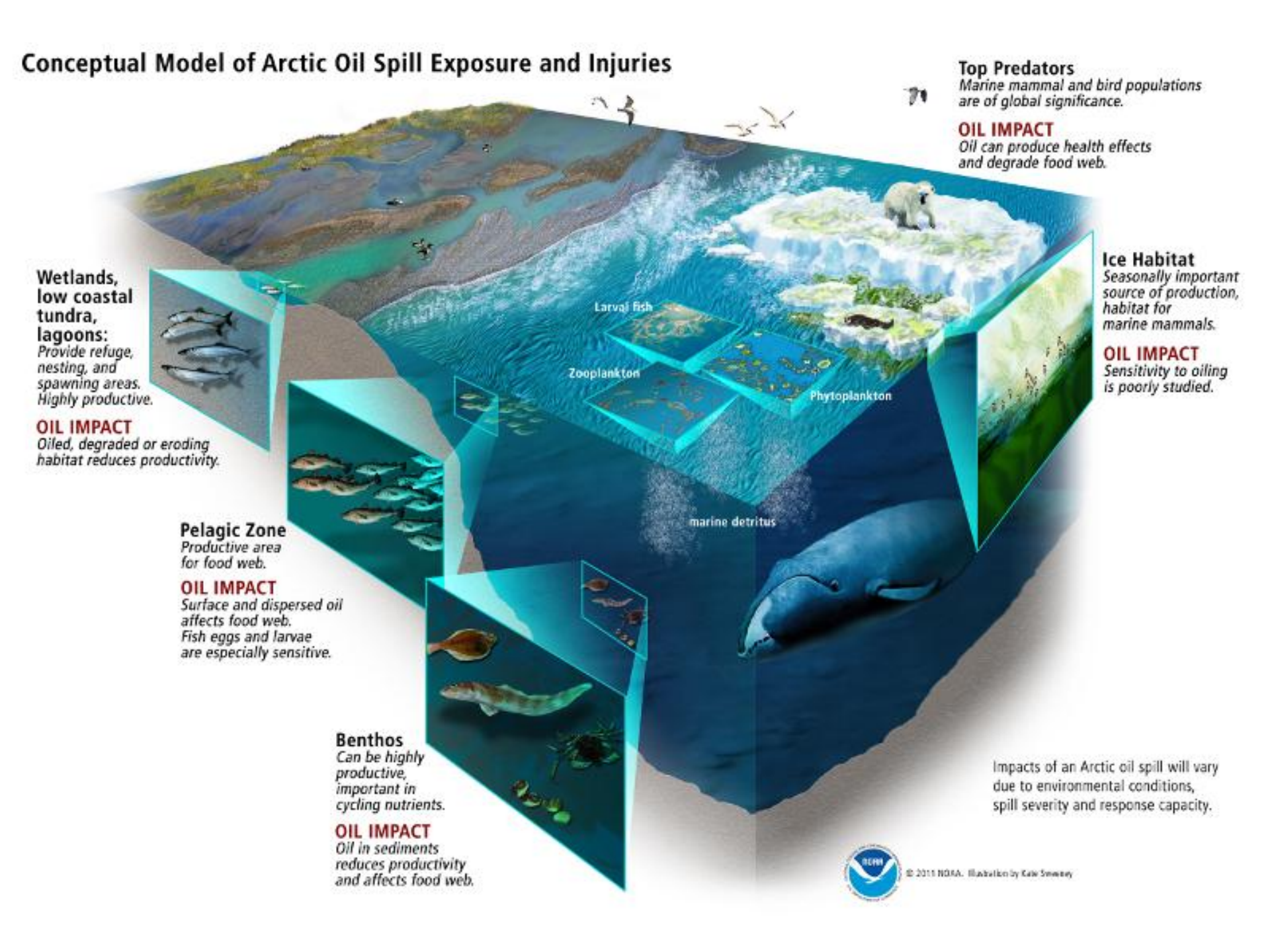
Image Credit: Shell Oil Company



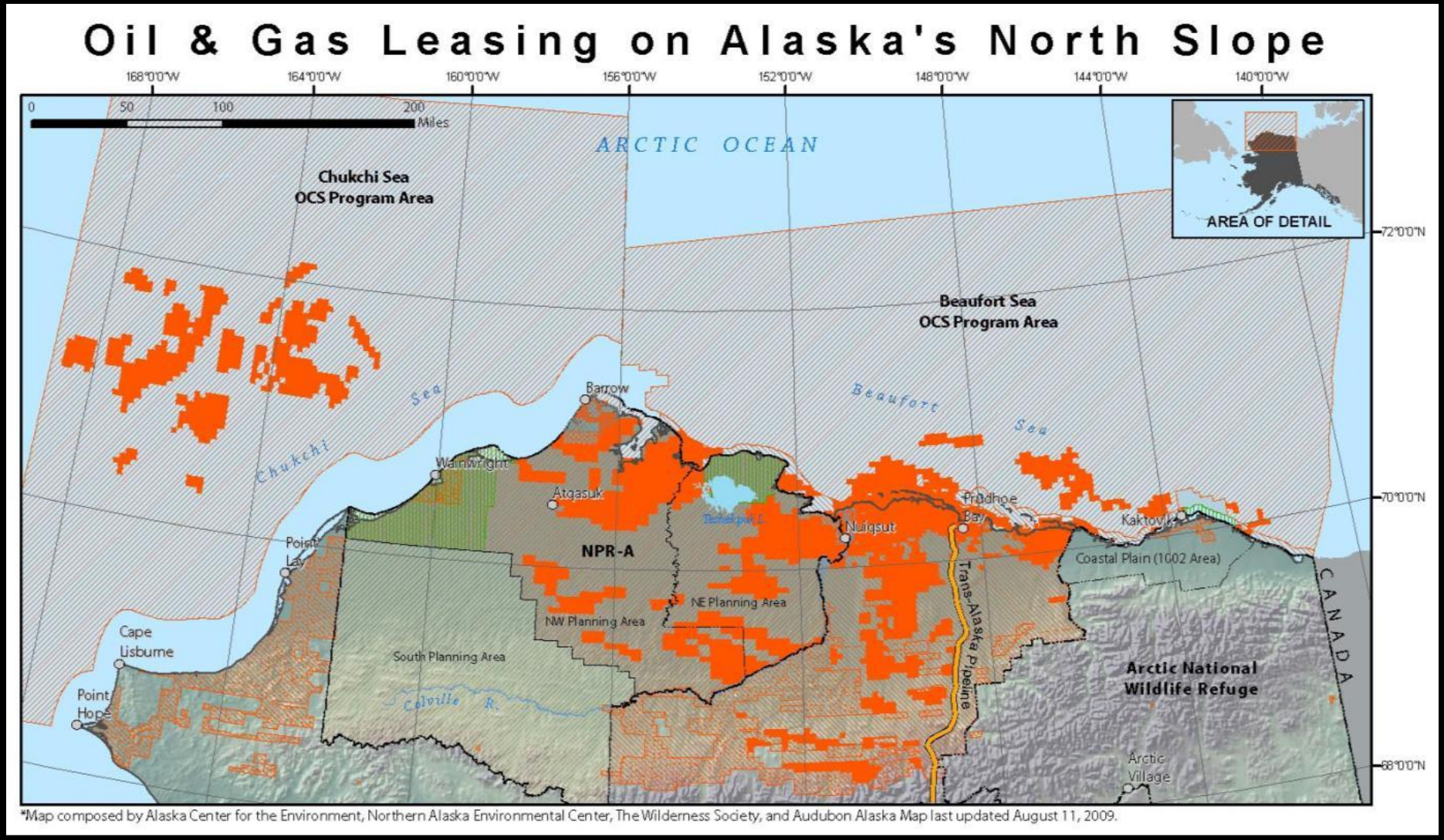
Arctic Drilling

- Dynamics of oil and sea-ice
- Slower decomposition rates
- Sensitive ecosystems
- Difficulty of response times, ability, and logistics

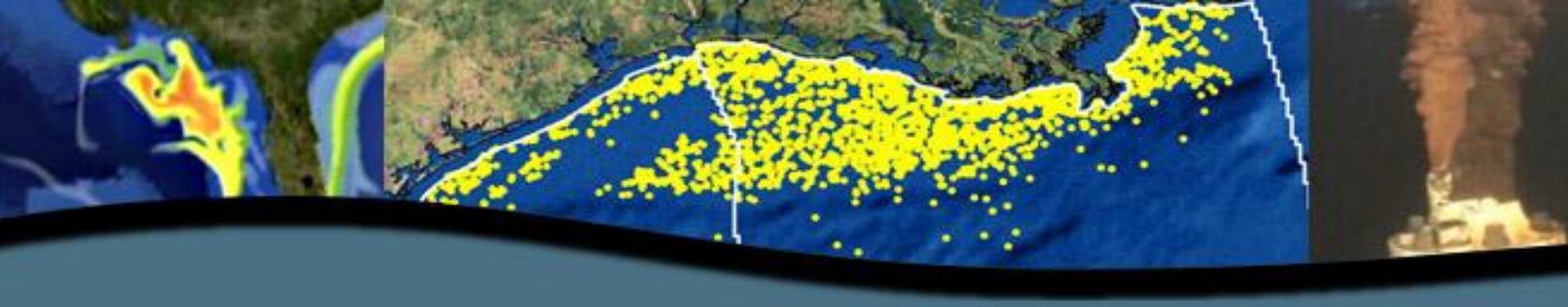
Conceptual Model of Arctic Oil Spill Exposure and Injuries



Future Research & Monitoring



*Map composed by Alaska Center for the Environment, Northern Alaska Environmental Center, The Wilderness Society, and Audubon Alaska Map last updated August 11, 2009.

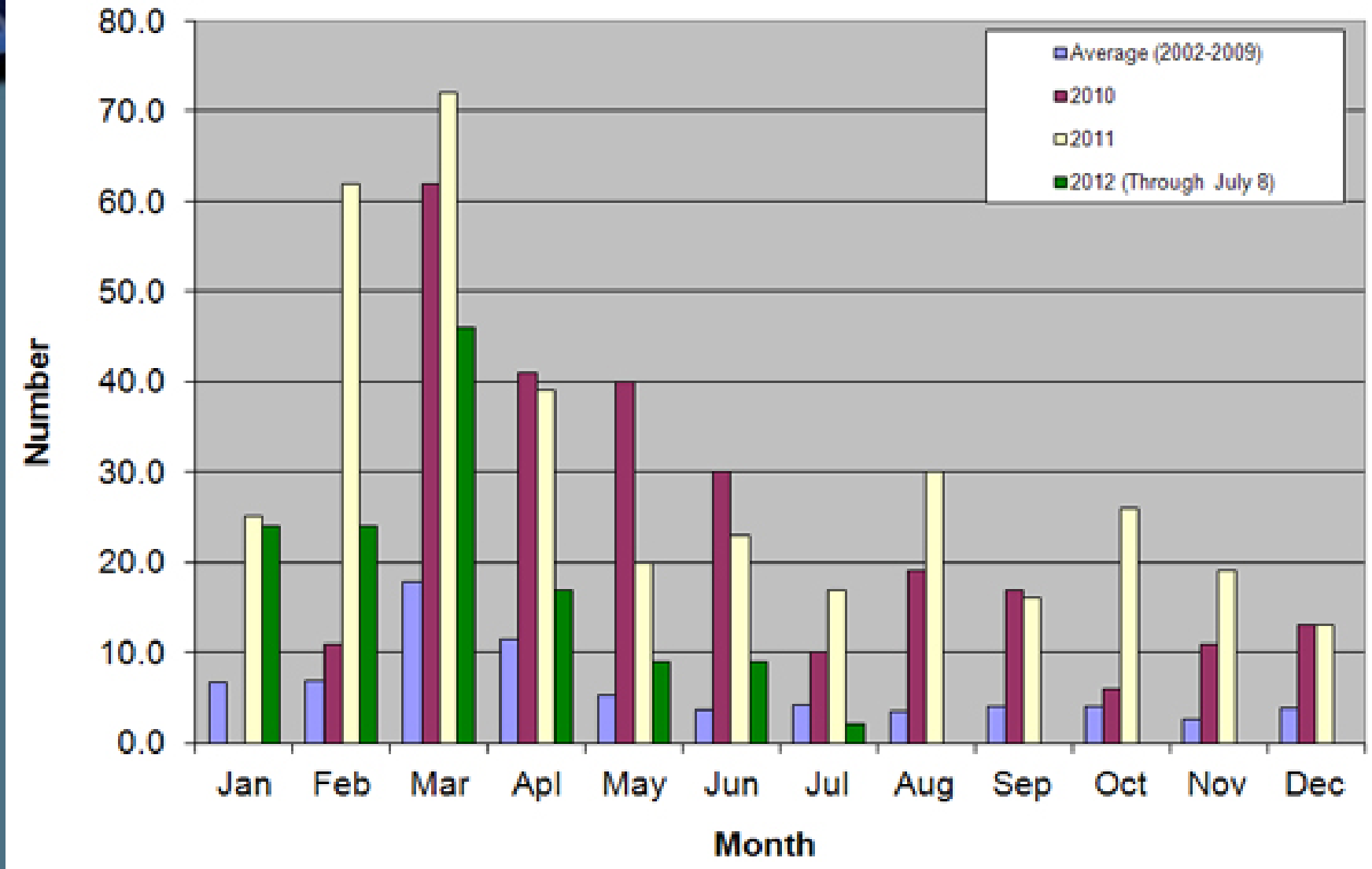


Acknowledgments

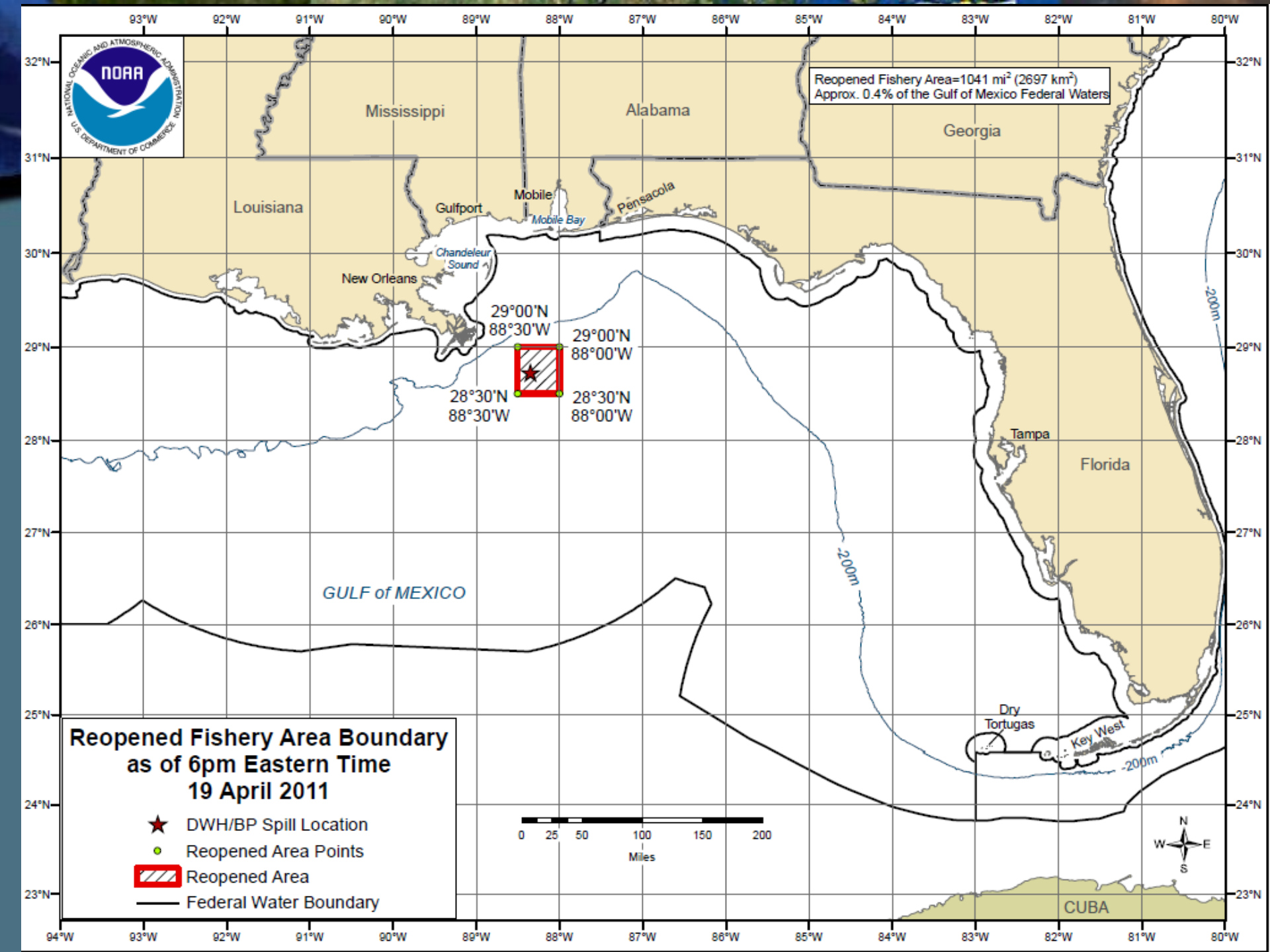
- **Oregon State University**
- **National Energy Technology Laboratory**
- **U.S. Department of Energy**
- Background Image Credits (left to right)
  - *Los Alamos National Laboratory*
  - *National Oceanic and Atmospheric Administration*
  - *U.S. Senate Committee on Environment and Public Works*

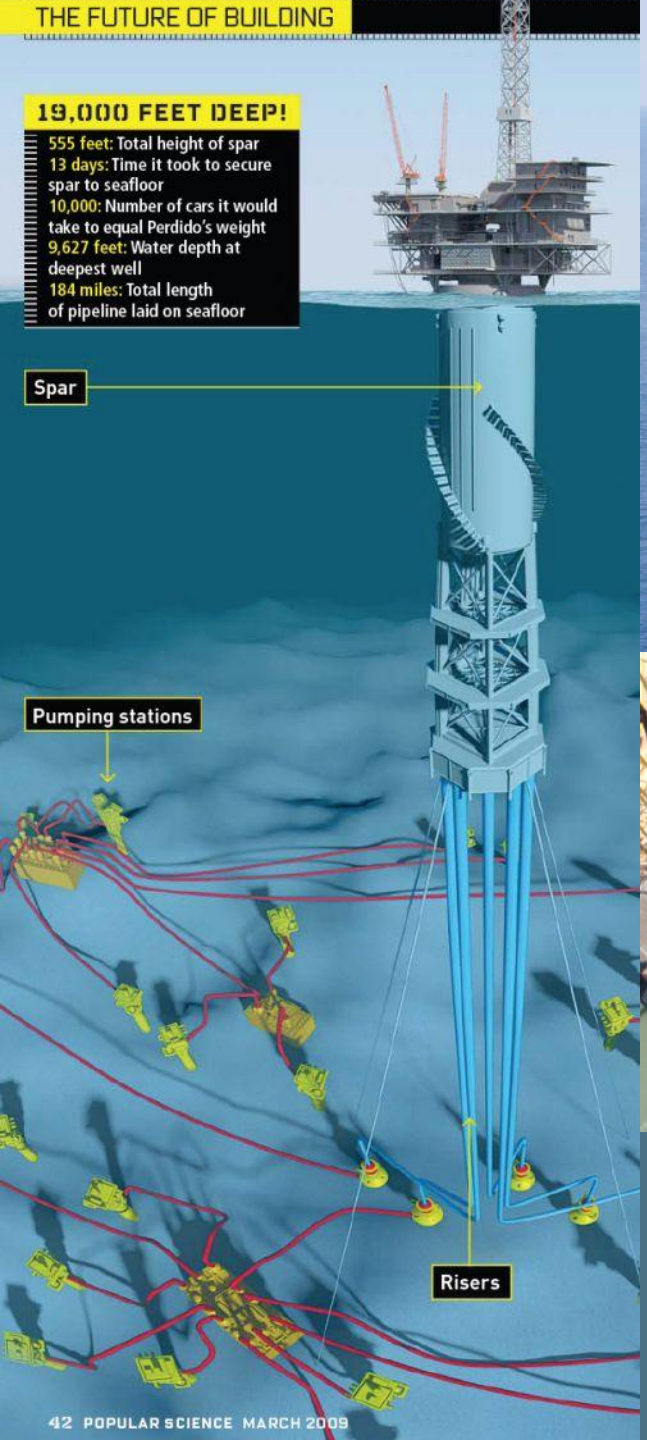
Additional slides

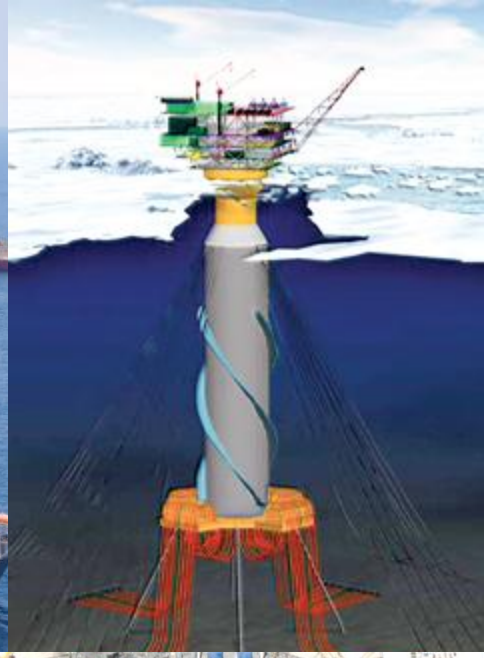
- Following are potential slides or “pocket slides” to be used if needed.
- Citation:
  - Graham, J., K. Rose, L. Sim, J. Nelson, K. Van Acker, C. Disenhof, C. Ringo, and J. Bauer. 2012. Learning From Deep Horizon: Connecting The Public, Researchers, And Decision Makers In Risk Assessment And Response To Oil Spills. North America Congress for Conservation Biology.

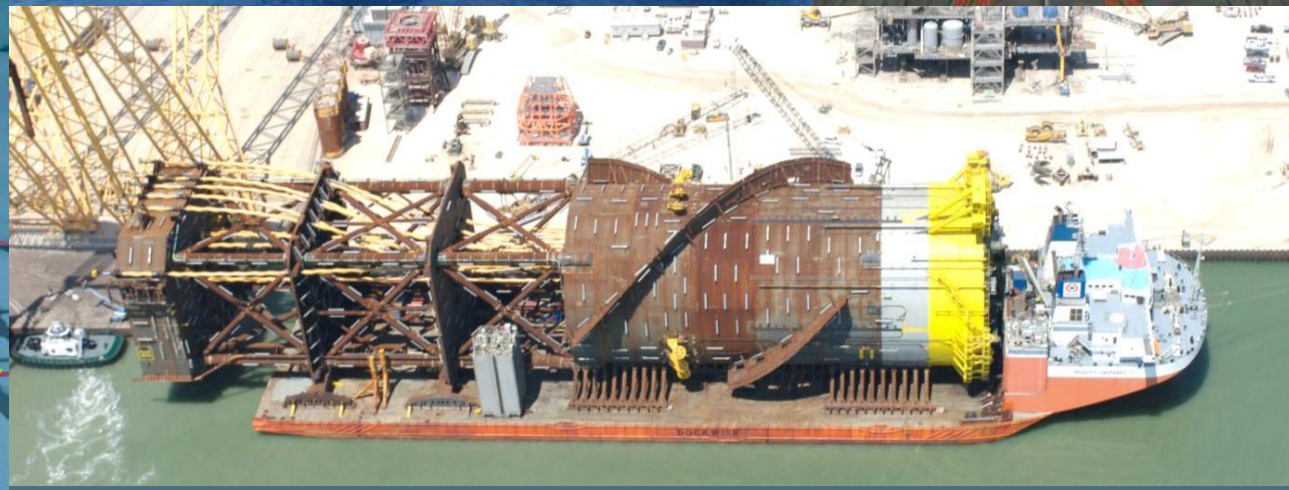


NOAA Fisheries: Office of Protected Resources


Reopened Fishery Area=1041 mi² (2697 km²)
Approx. 0.4% of the Gulf of Mexico Federal Waters
Mississippi
Alabama
Georgia
Louisiana
Florida
Gulfport
Mobile
Mobile Bay
Pensacola
Chandeleur Sound
New Orleans
Tampa
Dry Tortugas
Key West
CUBA
GULF of MEXICO
200m
29°00'N 88°30'W
29°00'N 88°00'W
28°30'N 88°30'W
28°30'N 88°00'W
Reopened Fishery Area Boundary as of 6pm Eastern Time 19 April 2011
DWH/BP Spill Location
Reopened Area Points
Reopened Area
Federal Water Boundary
0 25 50 100 150 200
Miles
N
W
E
S

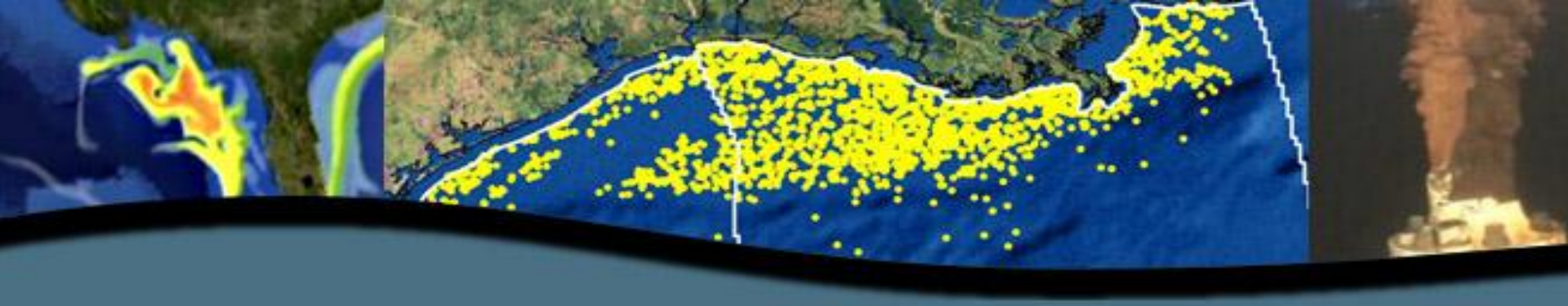




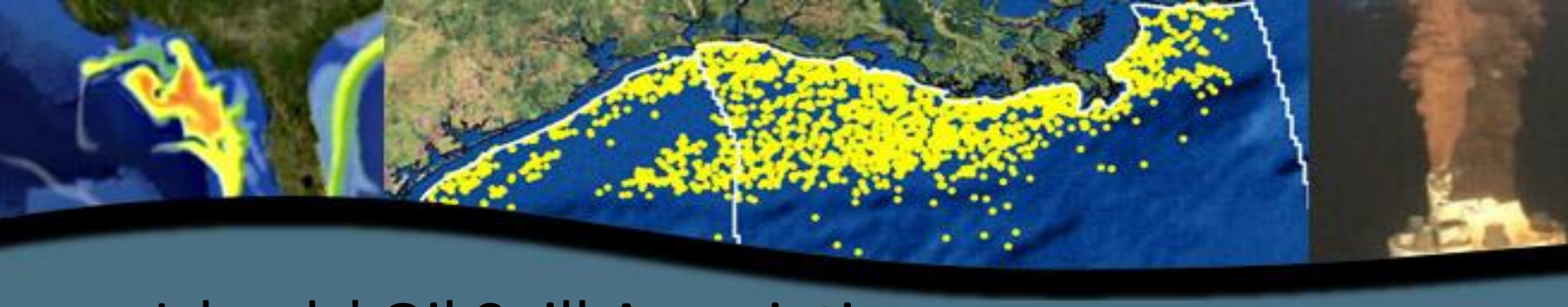


Drilling Operations

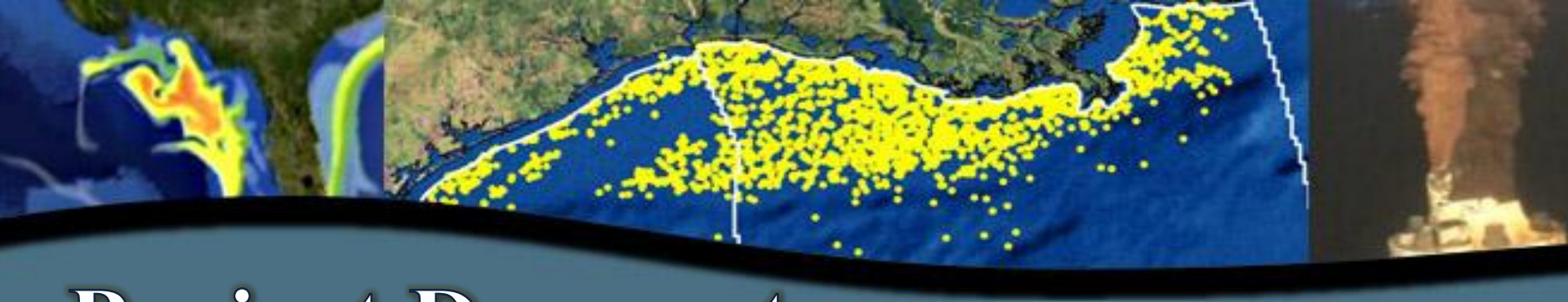
Images Credits (from left-most, clockwise): Popular Science, U.S. Coast Guard, World Oil Online (worldoil.com), Dockwise.com



Pbs.org



- Islands' Oil Spill Association
  - A non-profit, community-based, community-supported IOSA's mission is to provide San Juan County with prompt, effective, local spill response and prevention, w
    oil containment, e
  - and oiled wildlife



Project Deepwater

What are the risk of major impacts – ecologically, economically, and otherwise – for any particular deepwater/ultra-deepwater well project?

SEER (Spatial Environmental Energy Research)

NETL (National Energy Technology Laboratory)

U.S. Dept. of Energy

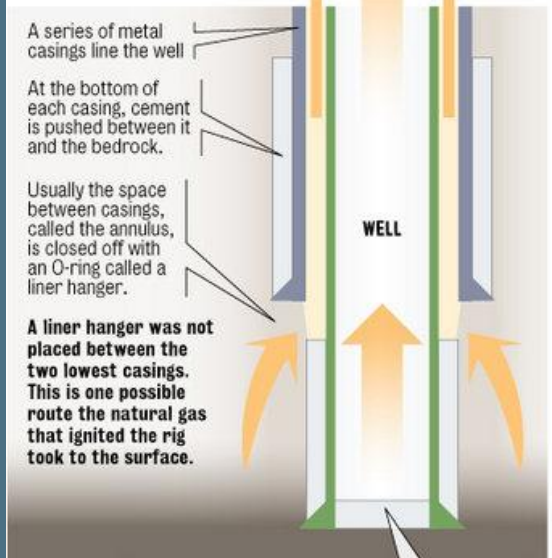
SIX STEPS THAT DOOMED THE RIG

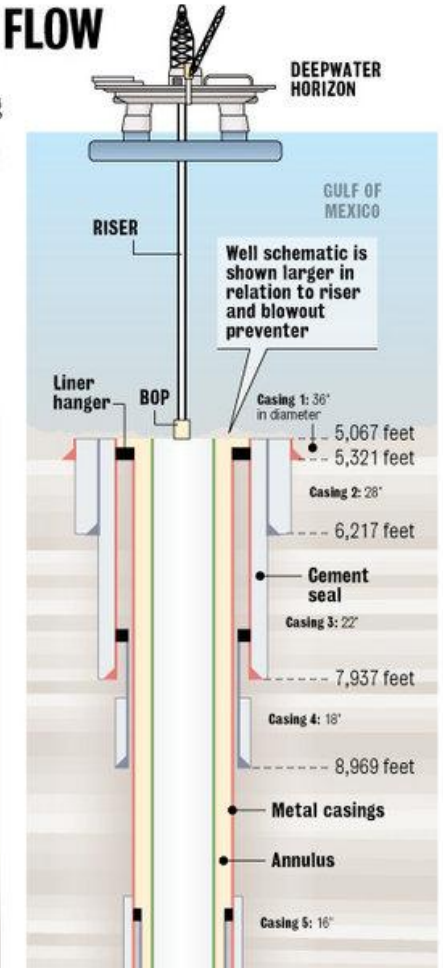
The blowout of BP's Macondo oil well on April 20 was the result of a string of five human errors and one final, colossal mechanical failure, when the blowout preventer failed to close off the exploding well. The choices were made in the final hours before the exploratory well was to be completed and the Deepwater Horizon removed. BP engineers knew they had an especially tough well, but repeatedly made quicker, cheaper and ultimately more dangerous choices. They seemed to consider each danger in a vacuum, never thinking they could all add up to 11 dead rig workers, a sunken rig and millions of barrels of crude fouling the Gulf.

1 FEWER BARRIERS TO GAS FLOW

BP had two choices of how to line the well with metal tubes and cement seals. Its engineers considered using a typical industry practice of a short liner at the bottom, with additional seals. But they ultimately chose a method that saved the company up to $10 million.

THE BP METHOD:
BP used a single, long string of casing in the middle of the hole, one designed for later use in extracting oil. That created an open space along the sides and fewer plugs in the center.

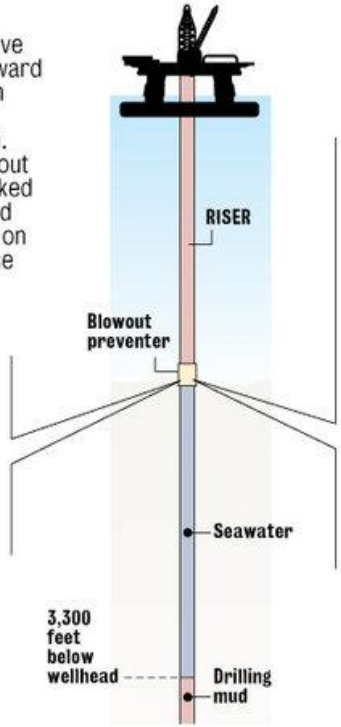




4 PRESSURE TEST MISINTERPRETED

Rig workers reported confusion over the negative test, which measures upward pressure from the shut-in well. It is a key test of whether the well is stable. Material used in the blowout preventer may have masked the test's true results, and heavy pressure readings on the drill pipe failed to raise red flags.

DOUBLE AMOUNT OF SPACER FLUID ADDED:
An extra dose of heavy fluid called spacer is pumped into the blowout preventer so BP won't have to pay to dispose of it. The higher density of the additional spacer may have obscured key test readings.



FIRST PRESSURE TEST:
A valve is closed on the blowout preventer to pressurize the drill pipe for testing. During the test 15 barrels of drilling mud leak from the valve. The mud was a sign that there was gas pressure in the well.

SECOND PRESSURE TEST:
Another test is run with more pressure on the blowout preventer valve. No mud escapes during the second test, which is deemed a success. But 1,400 pounds per square inch of pressure is recorded on the drill pipe when it should have been zero. That red flag was dismissed.

5 MUD BARRIER REMOVED EARLY

BP decided to take heavy drilling mud out of the system, to 3,000 feet below the normal point, and

Dissmeination

- Louisiana, Florida, Alabama, and Mississippi have volunteer websites now: http://volunteerlouisiana.gov