



Deepwater Horizon How Science Might Transform Future Responses and Damage Assessment

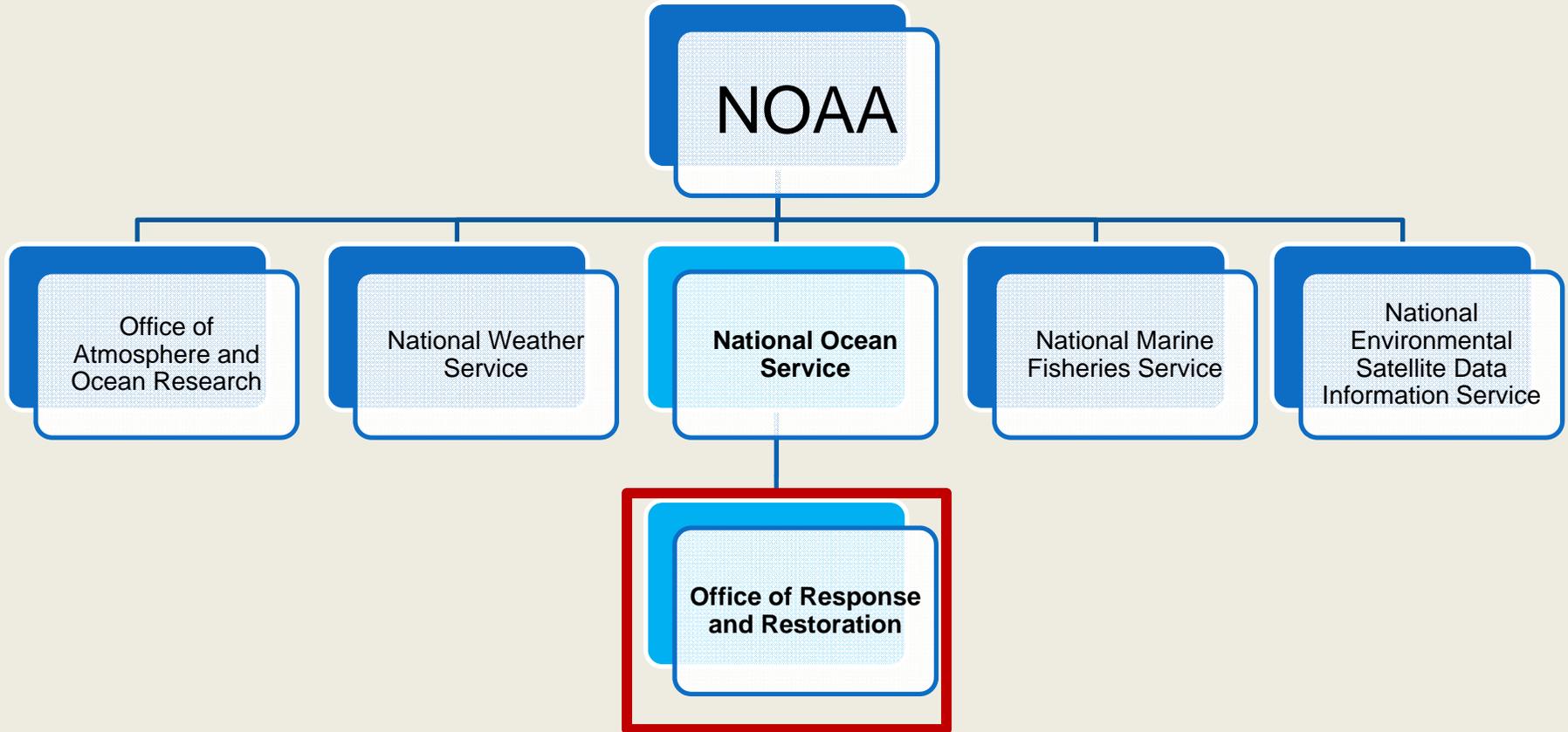
April 2016

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NOAA and Deepwater Horizon

- Overview of NOAA
- NOAA's Scientific Support Role
 - Coordination
 - Tools
- NOAA's Trustee Role and Natural Resource Damage Assessment
- DWH Research and Data - How will it change NRDA and Response?
- Where do we go – Answering the “What if” question





Our Mission and Mandates

To provide world-class science and information-based solutions to protect and restore the nation's resources and their uses from coastal environmental hazards.

OR&R supports some of the nation's strongest ocean protection laws.

- *Oil Pollution Act of 1990*
- *CERCLA/Superfund*
- *Marine Debris Act*
- *Clean Water Act*

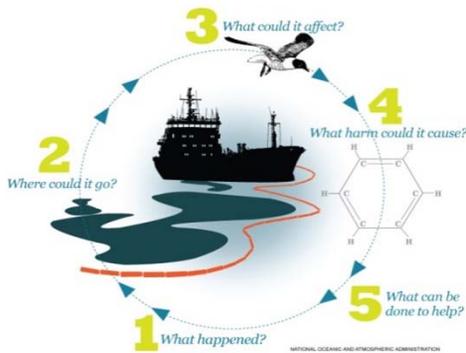


Department of Commerce / NOAA
National Ocean Service
Office of Response and Restoration

Gulf of Mexico Disaster
Response Center 



Emergency
Response Division



Assessment and
Restoration Division



Marine Debris
Division

IMPACTS
OF MARINE DEBRIS

- INGESTION**
Animals mistakenly eat plastic and other debris.
- ENTANGLEMENT & GHOSTFISHING**
Marine life gets caught and killed in ghost nets, trapped in derelict gear, and entangled in plastic bands and other marine debris.
- HAZARD TO NAVIGATION**
Marine debris can be difficult to see in the open if it's floating below the water's surface. Encounters with large items at sea can result in costly vessel damage, either to its structure or through a targeted propeller or obstruct mechanical gears.
- HABITAT DAMAGE**
Heavy marine debris crushes sensitive habitat, such as coral reefs and sea grass.
- NON-NATIVE SPECIES**
Marine debris transports alien and invasive species from one region to another.
- ECONOMIC COST**
Consumers lose a lot of money cleaning up trash, as well as the economic benefits of beach tourism and recreation.

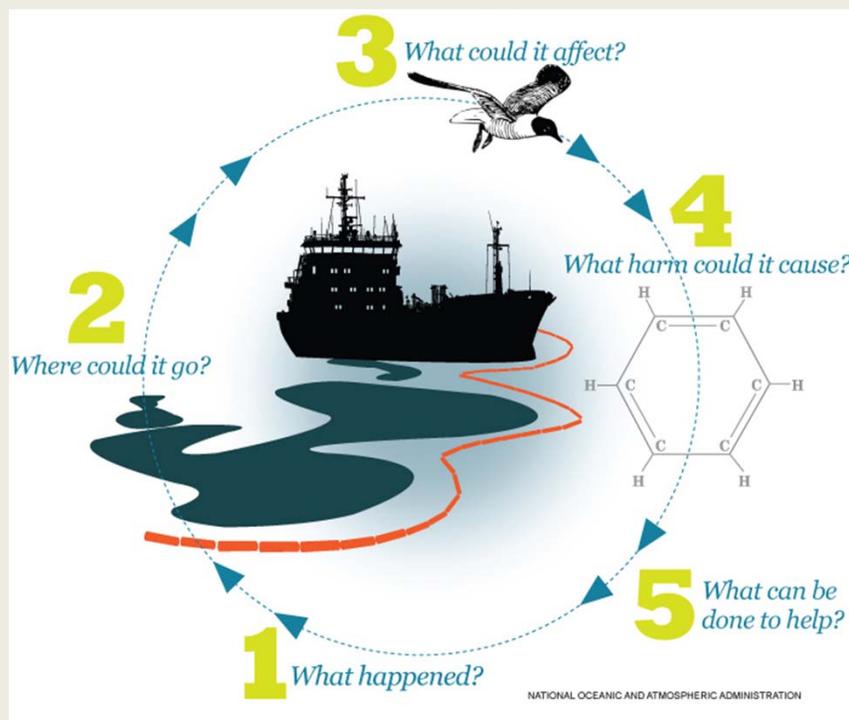
WORLDWIDE
MORE THAN
200
SPECIES
ARE HARMED BY
ENTANGLEMENT

PACKING BANDS ARE
RESPONSIBLE
FOR SOME DEATHS OF THE
STELLER
SEA LION
ENTANGLEMENTS
IN ALASKA

AT LEAST
1/3 OF ALL
SEABIRD
SPECIES
EAT DEBRIS

ALL
SEA TURTLE
SPECIES
EAT DEBRIS

Emergency Response to Oil and Chemical Spills



Activities

- Cleanup strategies
- Shoreline assessment and aerial observations
- Coordinate NOAA's resources (i.e. forecasts, fisheries)
- Analyze pollutant chemistry & environmental effects
- Identify Resources at Risk
- Train emergency responders



NOAA Scientific Support Includes:

- Science coordination
- Trust resource representation
- Weather/Trajectory forecasts
- Protection/Cleanup recommendations
- Field assessments
- Resources at Risk assessment
- Chemical assessment/analysis
- Seafood Safety
- Satellite & Aerial Imagery
- Aircraft & Vessel operations
 - Including UASs and UAVs
- Navigation support
- Hydrographic surveys and water levels
- Integrated Ocean Observations (IOOS)
- Information & data management
- Damage Assessment and Restoration





RESPONDER TOOLS

MARPLOT® (Mapping Applications for Response, Planning, and Local Operational Tasks) is a mapping program in CAMEO that allows users to add objects to maps, as well as view and edit data associated with those objects.



ERMA® (Environmental Response Management Application) is an online mapping tool integrating static and real-time data in an easy-to-use format for environmental responders and decision makers.

ALOHA (Areal Locations of Hazardous Atmospheres) is an air hazard modeling program in CAMEO that estimates how a toxic cloud might disperse after a chemical release, including fire and explosion scenarios.

CAMEO® (Computer-Aided Management of Emergency Operations) is a software suite designed to help prepare for and respond to chemical emergencies.

ESI Maps (Environmental Sensitivity Index maps) Maps provide a concise summary of coastal resources at risk if an oil spill occurs nearby.

CRW (Chemical Reactivity Worksheet) predicts possible hazards from mixing chemicals and is used to help prevent dangerous chemical incidents.

ROC (Response Options Calculator) predicts how spilled oil will change and degrade over time and the volume of oil that can be recovered, burned, or treated using different response tactics.

TAP® (Trajectory Analysis Planner) analyzes statistics from potential spill trajectories generated by the oil spill trajectory model.

GNOME® (General NOAA Operational Modeling Environment) is a software modeling tool used to predict how oil and other pollutants might move and spread on the water.

CAFE (Chemical Aquatic Fate and Effects) Database is a software program that helps responders assess potential harm to aquatic life from chemical or oil spills.

ADIOS (Automated Data Inquiry for Oil Spills) models how different types of oil change and degrade in the marine environment.



Restoring Injured Natural Resources

OR&R and co-trustees have generated over \$1.5 billion for natural resource restoration projects through resolution of liability, and worked cooperatively to restore over 15,000 acres of habitat, 47 stream miles, and built facilities to support the public's use of coastal resources. With the DWH early restoration and recent settlement an additional \$8.8 billion has been and will be used for restoration.

Key Products

- DIVER
- Habitat Equivalency Analysis
- Natural Resource Economic Surveys
- Damage Assessment and Restoration Plans





Why do a Natural Resource Damage Assessment (NRDA)?

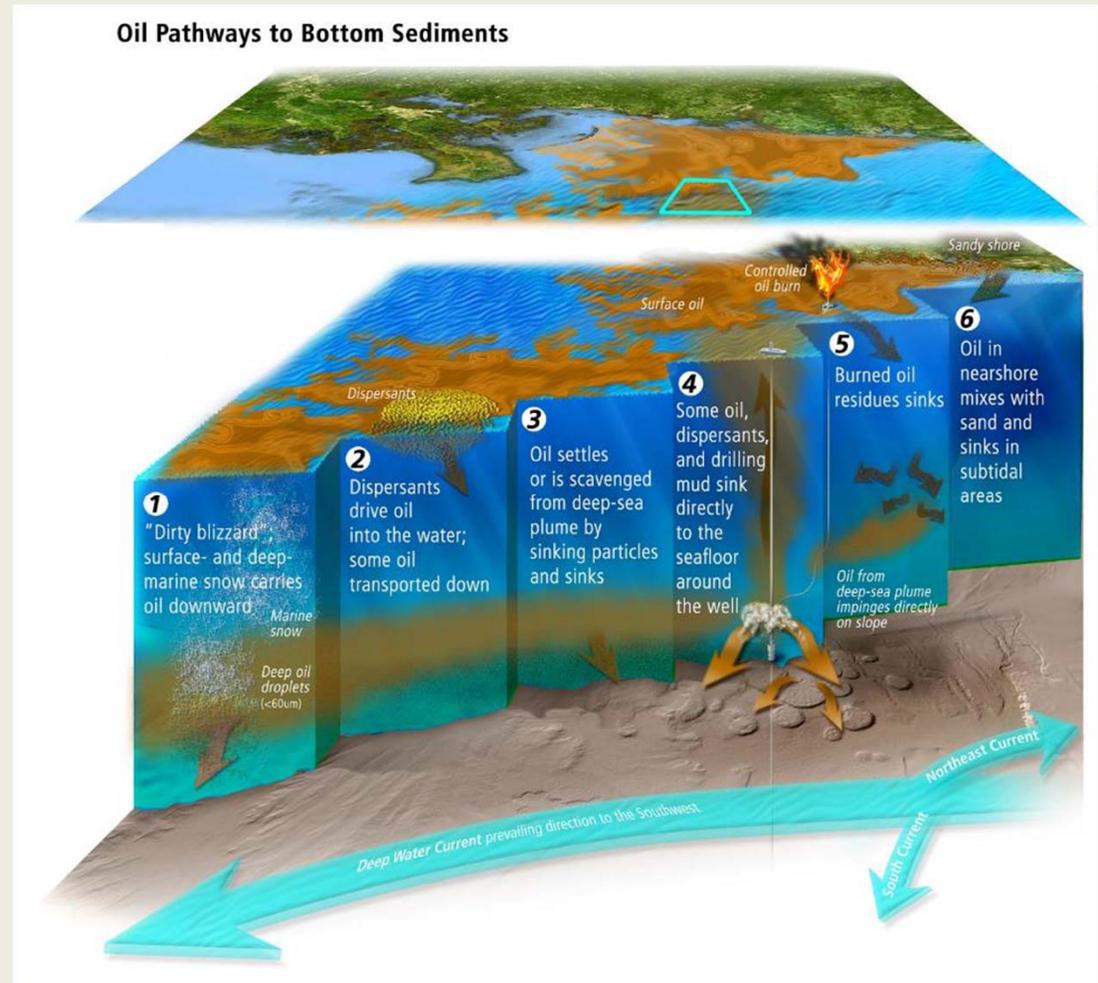
- Public Resources
 - Public resources injured?
 - Public deserves compensation
- It's the Law
 - Oil Pollution Act 1990
 - Comprehensive Environmental Response Compensation & Liability Act (CERCLA)
 - National Marine Sanctuaries Act
 - National Park System Resource Protection Act
 - State Law

Getting to Restoration via a Natural Resources Damage Assessment



NRDA Process

- Source
- Pathway
- Exposure
- Injury



Assessment: what is an injury?

“Injury” includes adverse effects on:

- Survival, growth, and reproduction
- Health, physiology, and biological condition
- Behavior
- Community composition
- Ecological processes and services
- Physical and chemical habitat quality or structure
- Public services, such as recreation





Proposed NRDA settlement

Up to \$8.8B for NRDA with Restoration outlined in PDARP/PEIS

PDARP – Programmatic Damage Assessment and Restoration Plan

PEIS – Programmatic Environmental Impact Statement

Payments must be used to restore or replace nature resources lost or injured by the spill – restoration projects

Payments include:

- Unknown conditions and adaptive management – up to \$700 million
- \$1B in Early Restoration
- Costs of assessment

Will be paid out over 15 years (starting one year after Consent Decree was final)

The Judge signed off on the agreement on April 4, 2016

Trustee responses to public comments and associated PDARP revisions underway



Deepwater Horizon – Setting the Scene

The Deepwater Horizon offshore oil platform exploded on 04/20/10 and sustained an uncontrolled well release of oil from that date until 7/15.

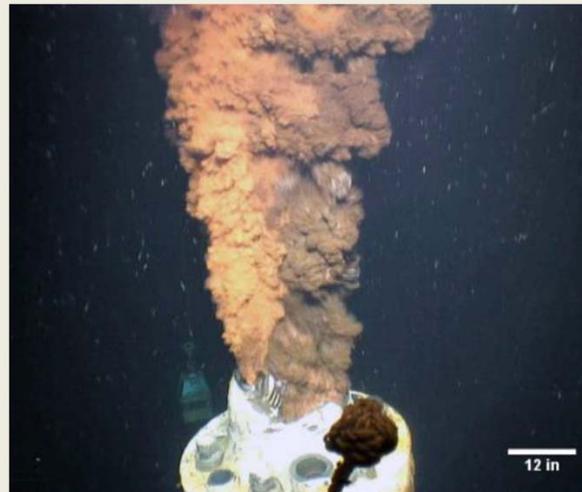
It turned out to be the largest offshore oil spill in our nation's history with estimates of 4-5 million barrels

More than 1,300 miles of shoreline fouled by oil. 5 States were impacted

Oil slicks were observed cumulatively across 43,300 square miles



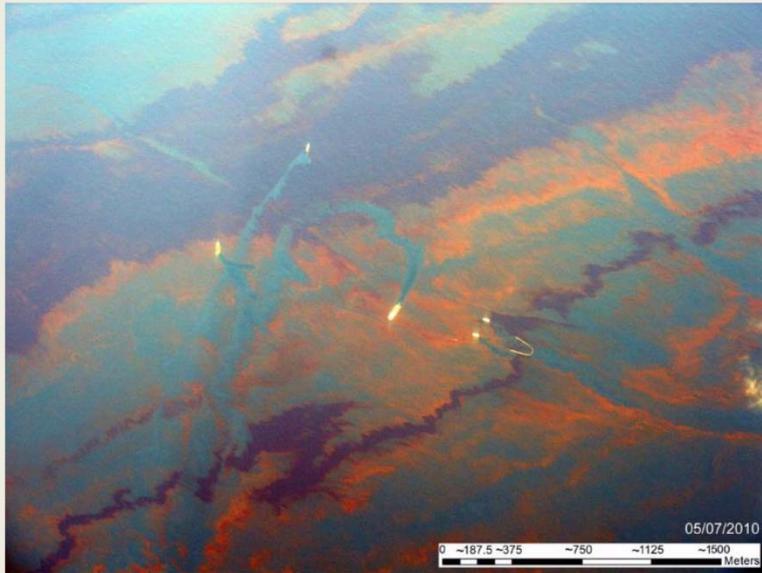
Source: U.S. Coast Guard



Source: Oceaneering International

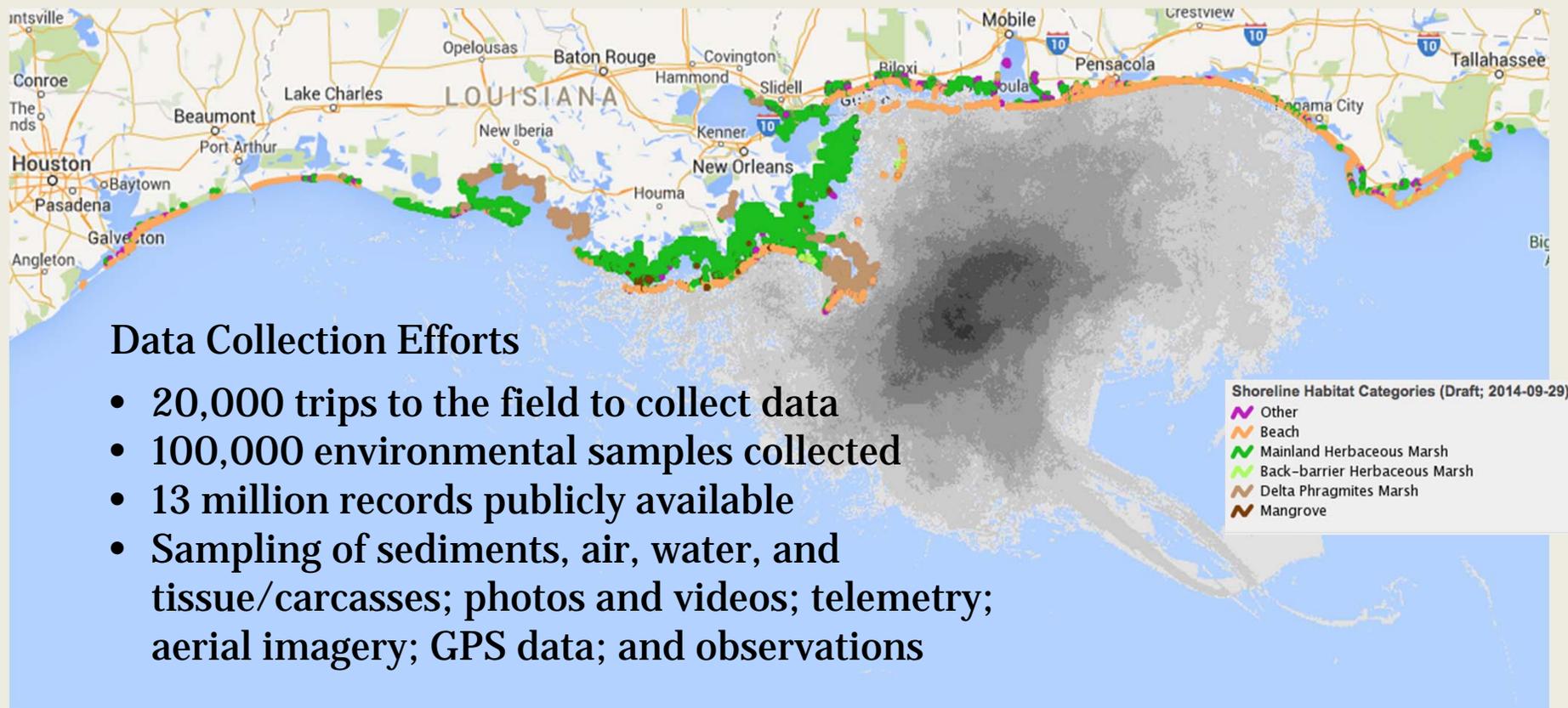


Aerial View



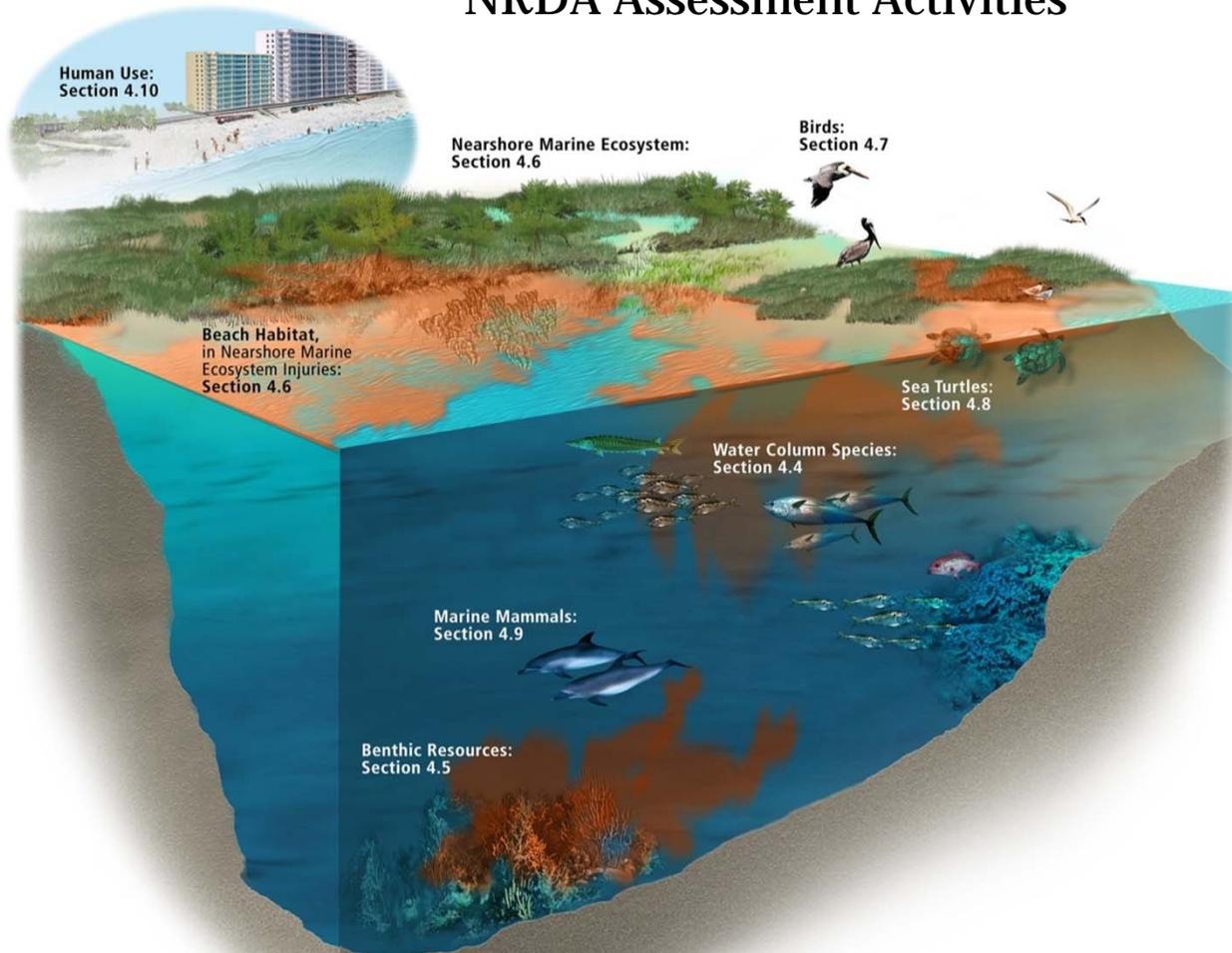
Source: NOAA

A massive spill, a massive response, a massive NRDA

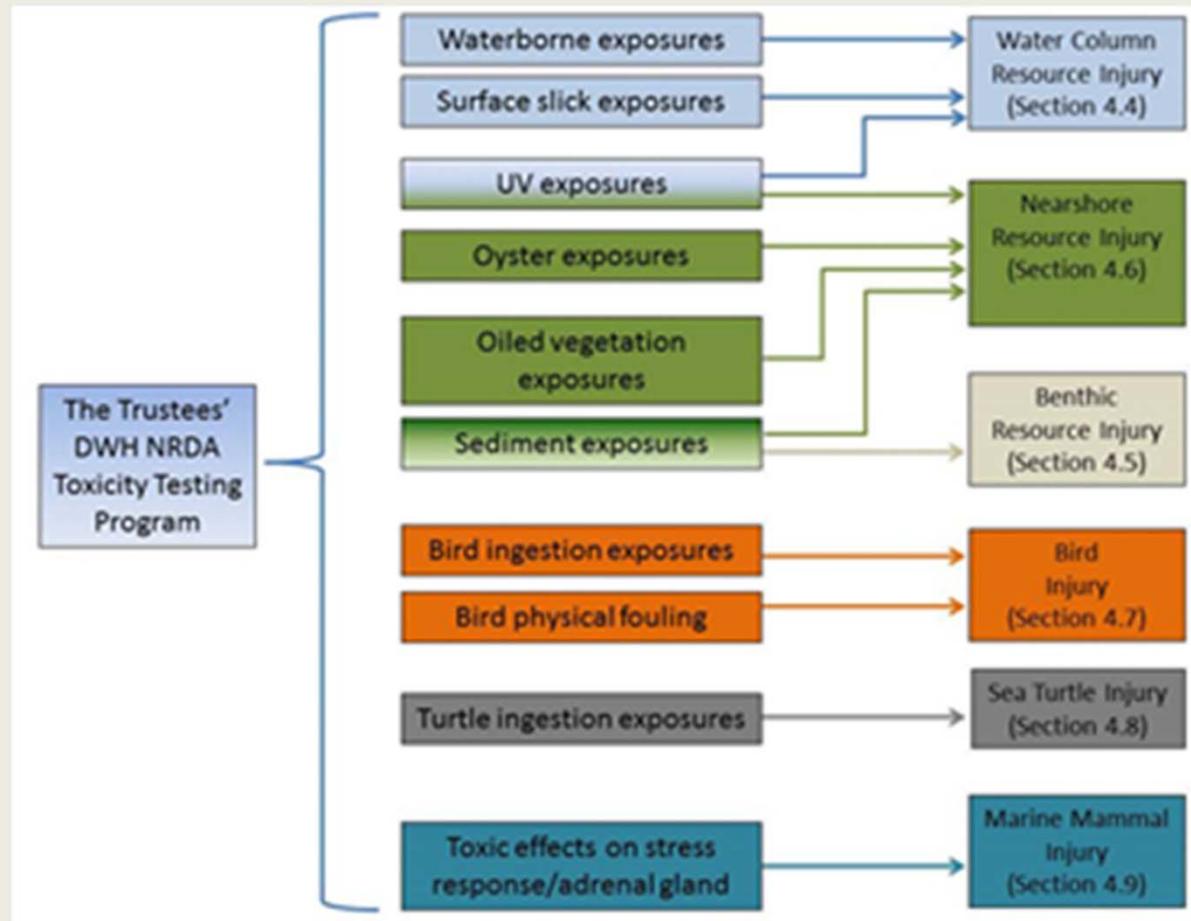




NRDA Assessment Activities



Toxicity program



Multiple tests on 40 species including fish, invertebrates, plankton, 2 freshwater turtle species, birds, and marine mammals



Toxicity program

- Adverse effects at sediment concentrations ~ 1 ppm (mg/kg) TPAH50 (reporting LC20s)
- Adverse effects at water concentrations ~ 1 ppb (ug/L) for fish and ~ 13 ppb for invertebrates TPAH50
- Some toxic effects conserved across species (e.g., cardiotoxic effects in fish and birds, adrenal impairment in fish, birds and mammal cells, other)
- Oil mixing methods: for a given species and life stage, the toxicity of DWH oil to fish was generally similar across WAF preparation methods when toxicity is expressed in terms of the concentration of TPAH50

Toxicity program



- Source: NOAA. Figure 4.3-11. Cardiotoxic effects of oil on developing fish. Two images are shown of early life-stage red drum from Trustee studies (Morris et al. 2015b; Morris et al. 2015d). The top picture is a control fish that was not exposed to oil. The bottom fish was exposed to DWH oil (Slick A LEWAF) for 36 hours. This fish developed edema (excess fluid) around the heart (arrow). Other developmental deformities observed included curved spine and reduced growth (Incardona & Scholz 2015). Young fish in the wild with these types of effects are considerably less likely to survive



Water Column

- Average daily volume of water affected by surface oil slicks was 57 billion cubic meters (15 trillion gallons)
- Toxicity data for representative high and low sensitivity fish and invertebrates used to bracket range of injury in both UV and non-UV areas

Surface Oil and Sargassum

- Fish larvae and invertebrates, larger fish, sea turtles, sea birds rely on Sargassum as habitat, foraging area, protection from predators
- Sargassum concentrates in convergence zones -- as does surface oil
- Loss of up to 23 percent of this habitat including lost growth of 4,300 square miles

Surface Oil and Sea Floor Floc

- Larger quantities of floc were observed on the sea floor beneath areas experiencing persistent surface oil and application of dispersants

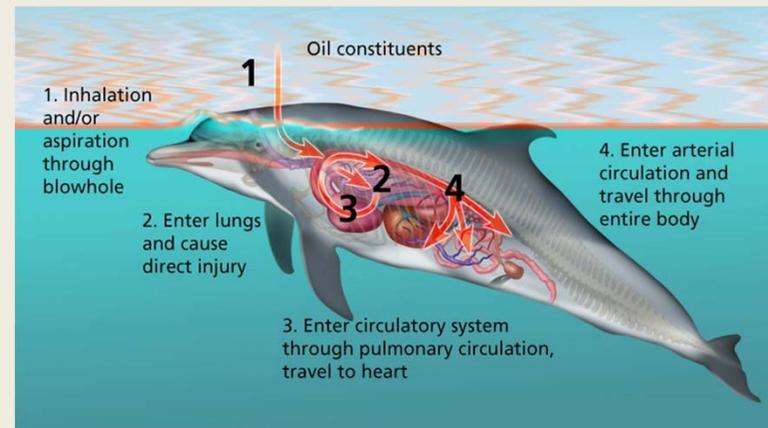
Nearshore Oysters

- 4-8.3 billion subtidal adult 'oyster equivalents' lost Gulf-wide from combination of oiling and river-water releases



Marine Mammals

- Tens of thousands of marine mammals exposed to DWH surface slick inhaled, aspirated, ingested, physically contacted, and absorbed oil



- Oil damaged tissues and organs; led to adverse health effects including lung disease, reproductive failure, adrenal disease, poor body condition
- Mammal exposure to DWH oil contributed to the largest and longest lasting marine mammal unusual mortality event (UME) on record in the northern Gulf of Mexico (>1,000 stranded)
- Barataria dolphins one of the most severely injured populations.
 - 35% increase in death
 - 46% increase in failed reproduction
 - 37% increase in other adverse health effects



Where can I find the data?

ERMA DEEPWATER GULF RESPONSE

Information Help Recent Data Search Layers, Folders, and Bookmarks Geographic Search

Environmental Response Management Application (ERMA)

Layers Legend Query Tools Zoom Download Print

clear all collapse all

- Background Layers
 - Google
 - Esri
 - Esri Street Maps
 - Esri World Imagery
 - Esri World Topo
 - Esri Light Gray Canvas
 - Esri Dark Gray Canvas
 - Esri Ocean
 - Esri National Geographic
 - Open Street Maps
 - BP Deepwater Horizon Oil Spill
 - Wellhead Surface Location
 - Deepwater Horizon Wreckage
 - Areas of Operation
 - NRDA Workgroup Data
 - NRDA Integration Grid 5 Km (PDARP)
 - Analytical Data

Bookmark Views: Hide

- Shared Views
 - Deepwater Horizon Programmatic Damage Assessment and Restoration Plan
 - Chapter 4 Injury Assessment
 - 4.1 Approach To The Injury Assessment
 - 1. Approach To Injury Assessment Default View
 - 4.2 Natural Resource Exposure
 - 4.4 Water Column
 - 4.5 Benthic Resources
 - 4.6 Nearshore Marine Ecosystem
 - 4.8 Sea Turtles
 - 4.9 Marine Mammals
 - 4.10 Lost Recreational Use
 - 4.11 Summary of Injury Effects and Quantification
 - default
 - Incident Milestones Dates
 - OSAT

Scale: 1 : 3M Zoom Level: 7 Location: 32.69245°,-84.30302°

National Oceanic and Atmospheric Administration | Environmental Protection Agency
U.S. Department of the Interior | U.S. Department of Homeland Security | University of New Hampshire | Privacy policy | Official Citation | Email Comments

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<https://dwhdiver.orr.noaa.gov> and <http://gomex.erma.noaa.gov>



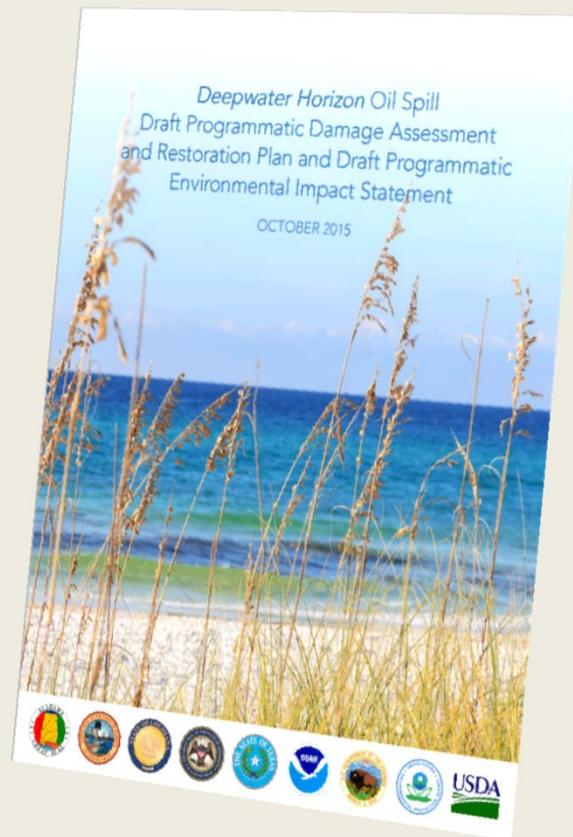
Where can I find the data?

The screenshot shows the NOAA Deepwater Horizon Natural Resource Damage Assessment Data website. At the top, there is a navigation bar with links for Home, About, Data Overview, Explore the Data, and Help. The main content area features a map of the Gulf of Mexico coastline with data points. A large text overlay reads "Search the Deepwater Horizon NRDA Data" with a "DIVER Explorer" logo. To the right, a sidebar titled "DIVER Explorer Help" lists resources: Get Started (Video | PDF), Guided Queries (Video | PDF), Custom Queries (Video | PDF), Spatial Filters (Video | PDF), and Download Data (Video | PDF). Below the map, there are four promotional tiles: "Deepwater Horizon Oil Spill Programmatic Damage Assessment and Restoration Plan" (View the plan), "Explore more Deepwater Gulf Response spatial data" (Visit the Environmental Response Management Application® (ERMA)), "DIVER Overview" (Learn the basics about DIVER (Data Integration Visualization Exploration and Reporting)), and a tile with an image of a fishing net. At the bottom, there is a footer with links for Accessibility, Disclaimer, Privacy Policy, Official Citation, and Contact Us, and a note about the website owner: Office of Response and Restoration | NOAA's Ocean Service | National Oceanic and Atmospheric Administration | US Department of Commerce.

<https://dwhdiver.orr.noaa.gov> and <http://gomex.erma.noaa.gov>



How might DWH research inform and possibly change our planning and response?





Some of the groups that have done and are currently doing oil spill research



Gulf Environmental Benefit Fund





What could this mean for emergency response?

More coordination in planning and preparedness

Public expectations and understanding of impacts may change

Technology will continue to play an evolving role

- Satellites
- UAVs and UASs
- Water column impact measures when using alternative technology
- Instant field GIS and display

Potential for political overlay

Setting public expectations for response actions, assessment and timeliness of restoration



Where do we go?

- We have an unprecedented amount of data and now it would be good to answer the “What if ...?” questions
- The answer to those answers may change our Scientific Support Coordinator recommendations to the Federal On Scene Coordinator on what response actions should be taken and what Damage Assessment tools and research would be appropriate for the next event

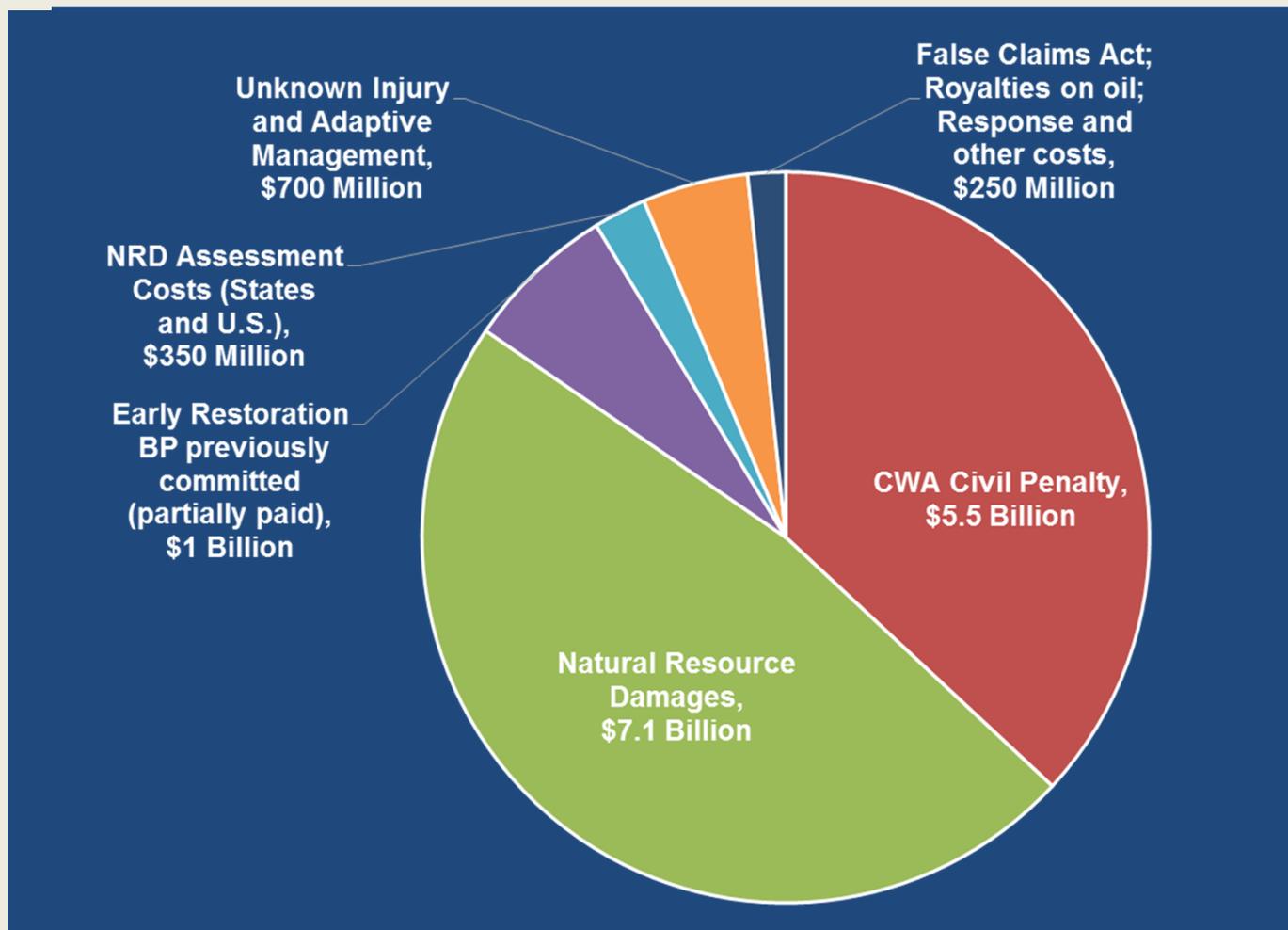


Questions





Consent Decree Payments

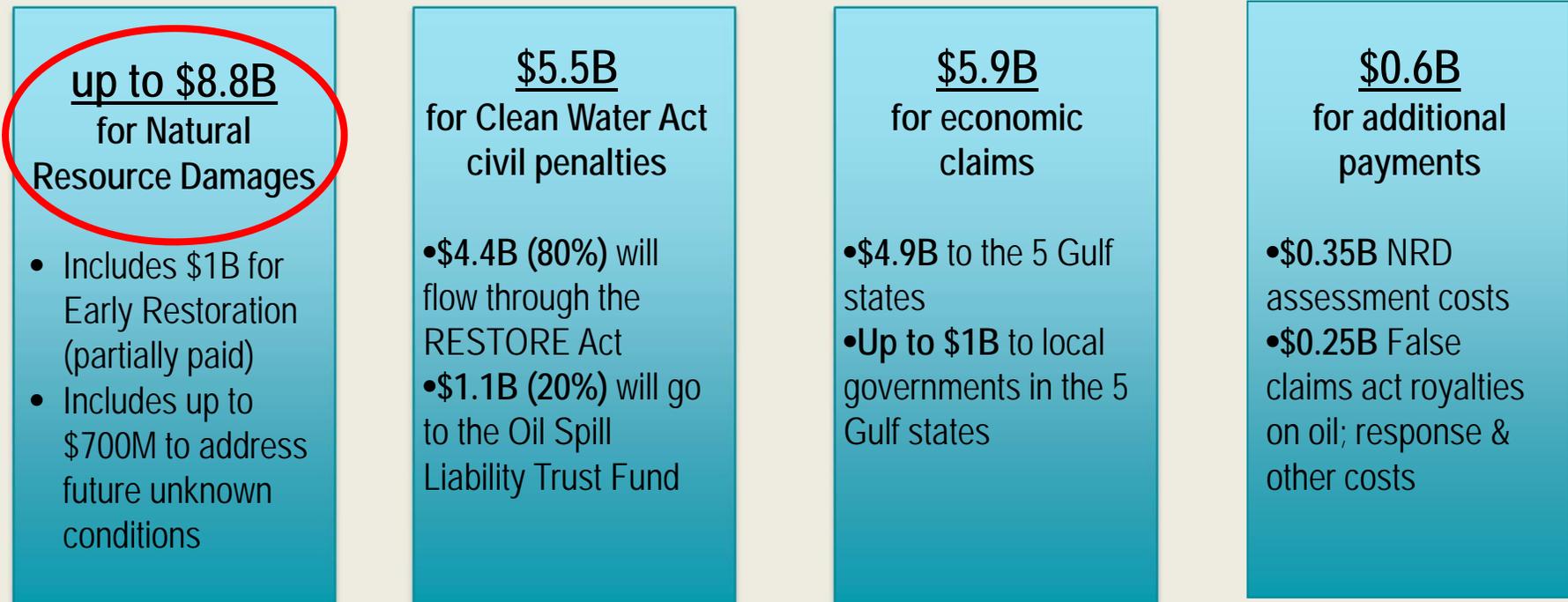


Summary of payments



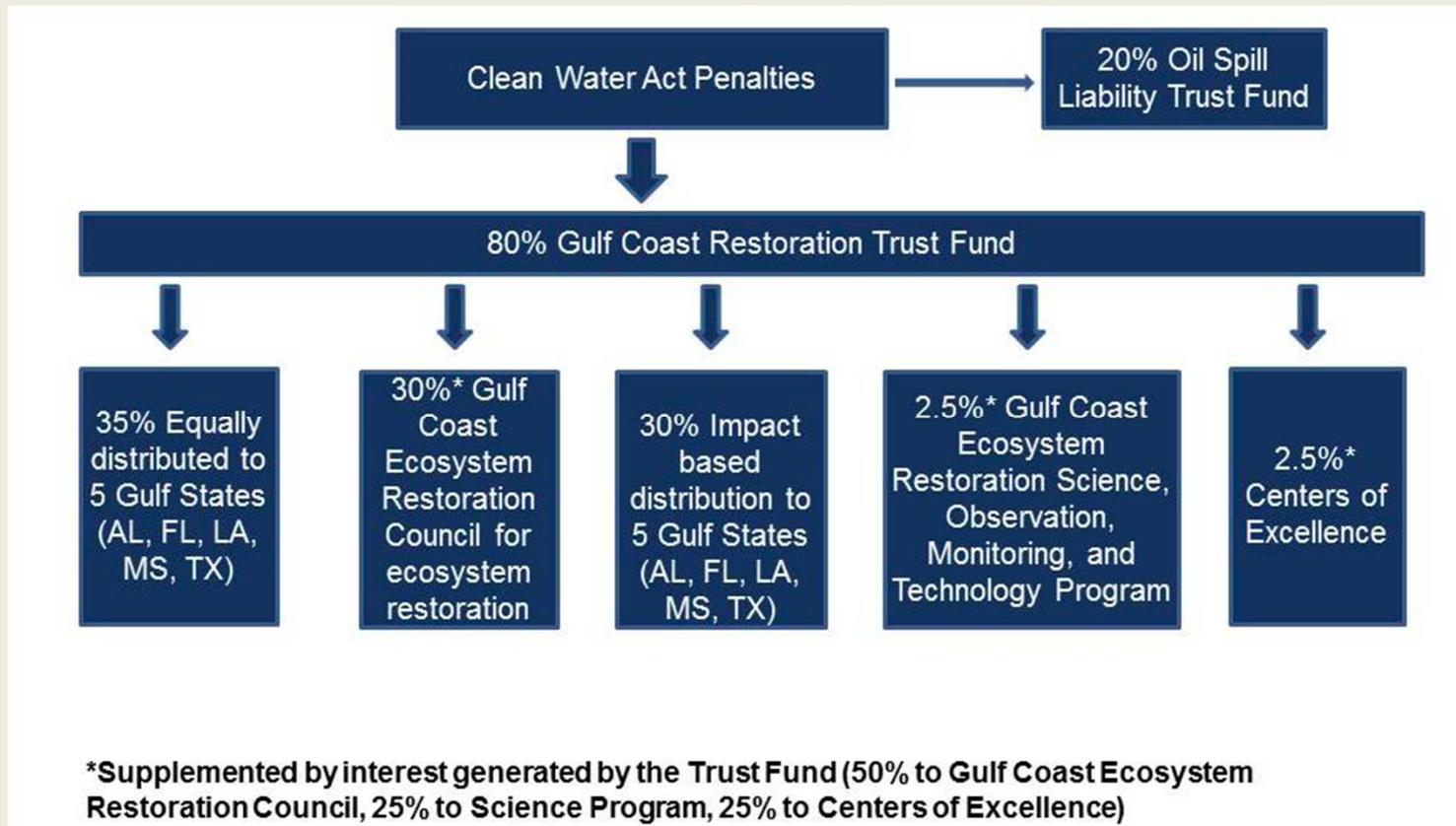
DWH allocation

\$20.8 B





Civil penalty: where does the money go?



Allocation of Gulf Coast Restoration Fund

For more information on the Restore Act visit: www.RestoreTheGulf.gov