



How MOSSFA Factored into the DWH Natural Resource Damage Assessment: Considerations for Future Responses and Assessments

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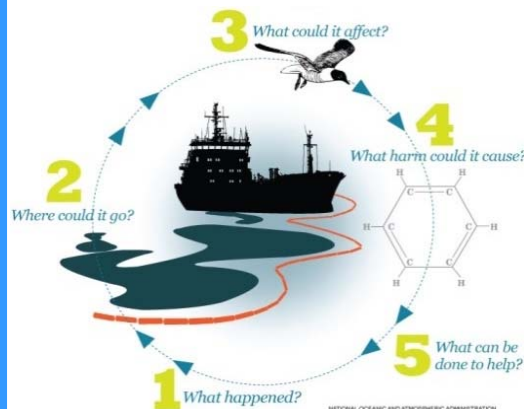
Office of Response and Restoration Organization

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 shrimp gear, and entangled in plastic bands and other marine debris.
- HAZARD TO NAVIGATION**
Marine debris can be difficult to see in the ocean 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 obstructed 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**
Communities lose a lot of money cleaning up trash, as well as the economic benefit of beach tourism and recreation.

WORLDWIDE,
MORE THAN
200
SPECIES
ARE IMPACTED BY
ENTANGLEMENT

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

AT LEAST
1/3 OF ALL
SEABIRD
SPECIES
EAT DEBRIS

ALL
SEA TURTLE
SPECIES
EAT DEBRIS



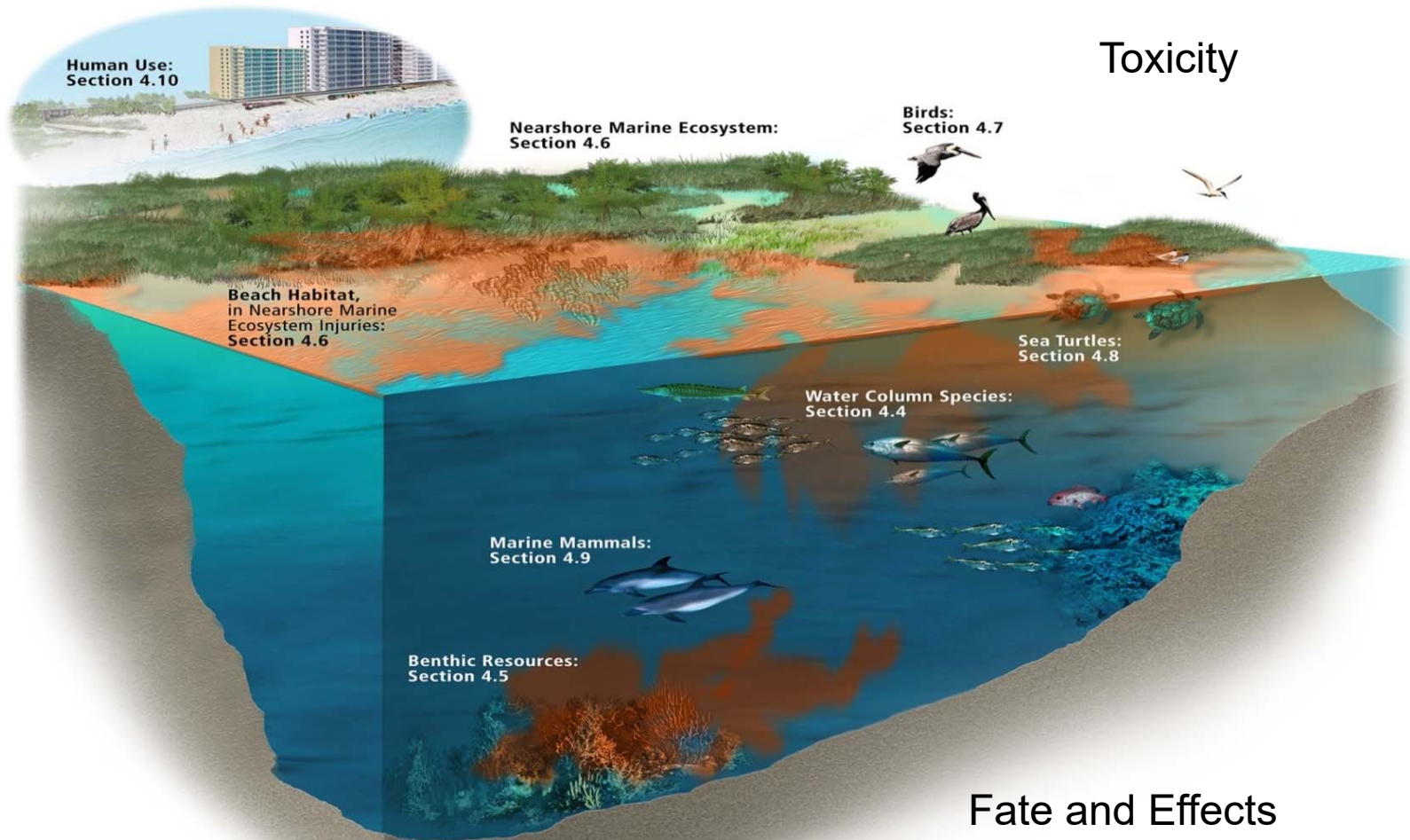
What is a Natural Resource Damage Assessment (NRDA)?

- A structured legal process defined in regulations
 - OPA, CERCLA, CWA, NMSA, other State and Federal Acts
- Determine amount and type of injury to natural resources and lost services from time of incident through recovery of resources, develop and implement restoration
- NRDA Trustees must document: **Release-Pathway-Exposure-Injury-Restoration**
- Develop and oversee implementation of restoration plan(s) to compensate the public for injuries and lost services

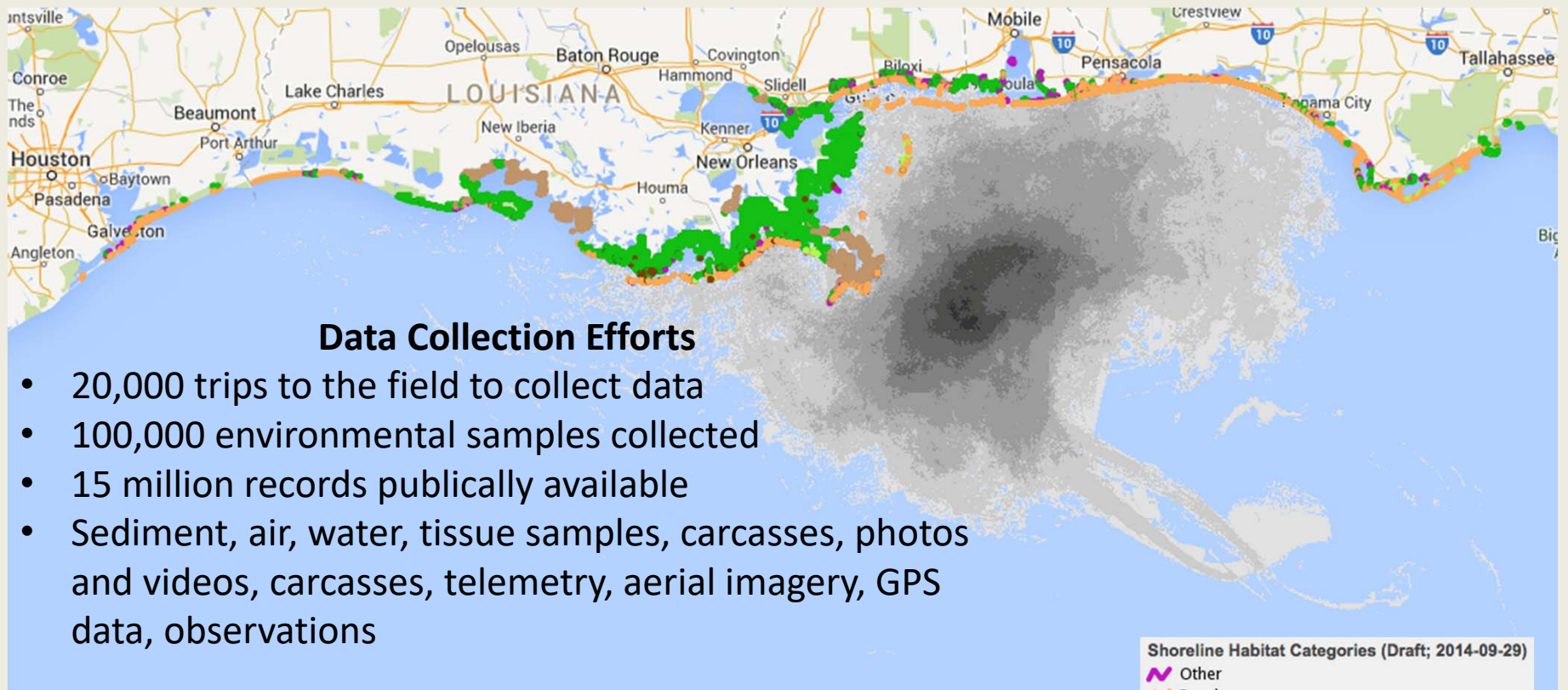
DWH was not the “normal” oil spill



NRDA Assessment Activities

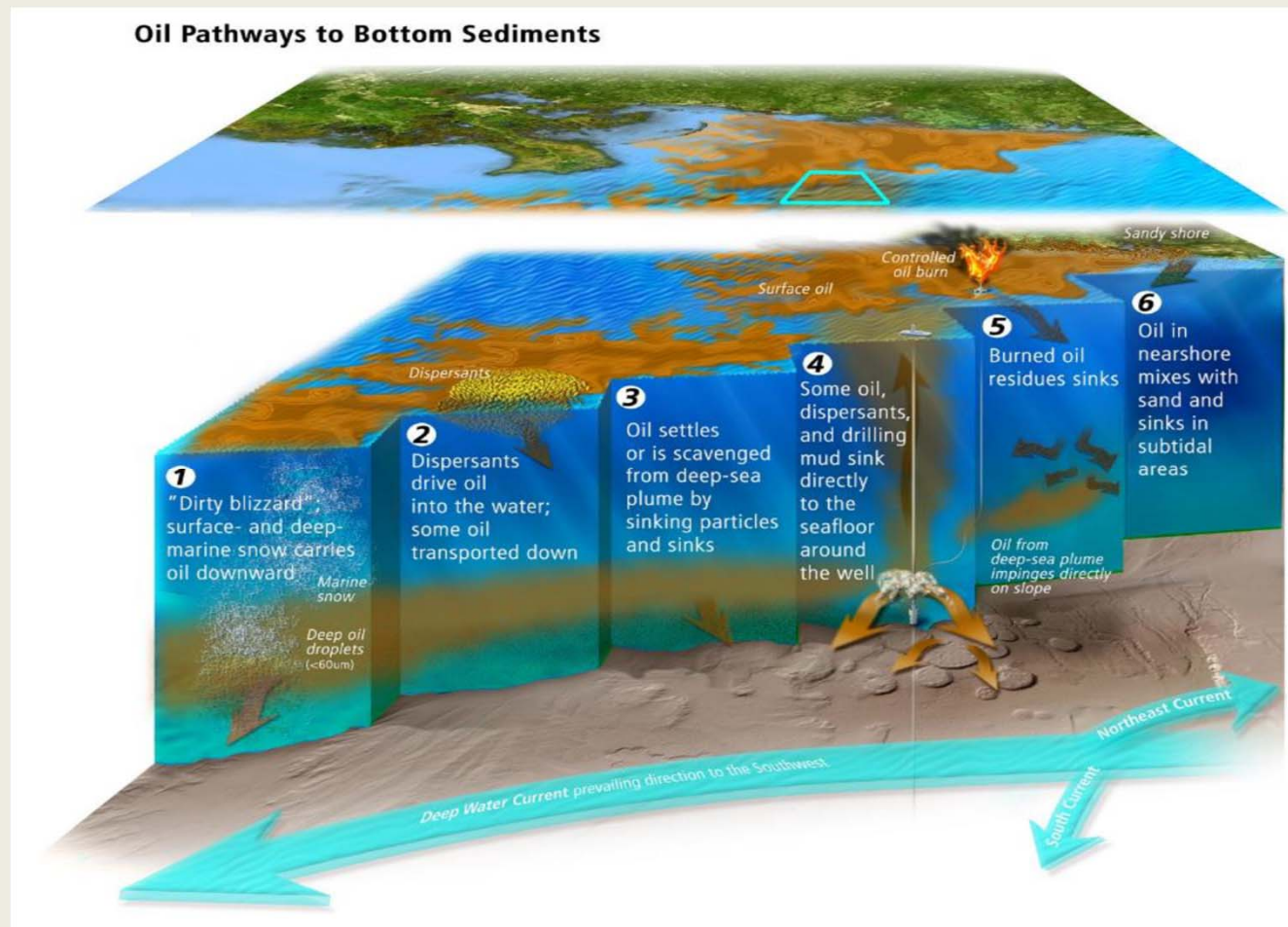


A Massive Spill, a Massive Response, a Massive NRDA



<https://dwhdiver.orr.noaa.gov>

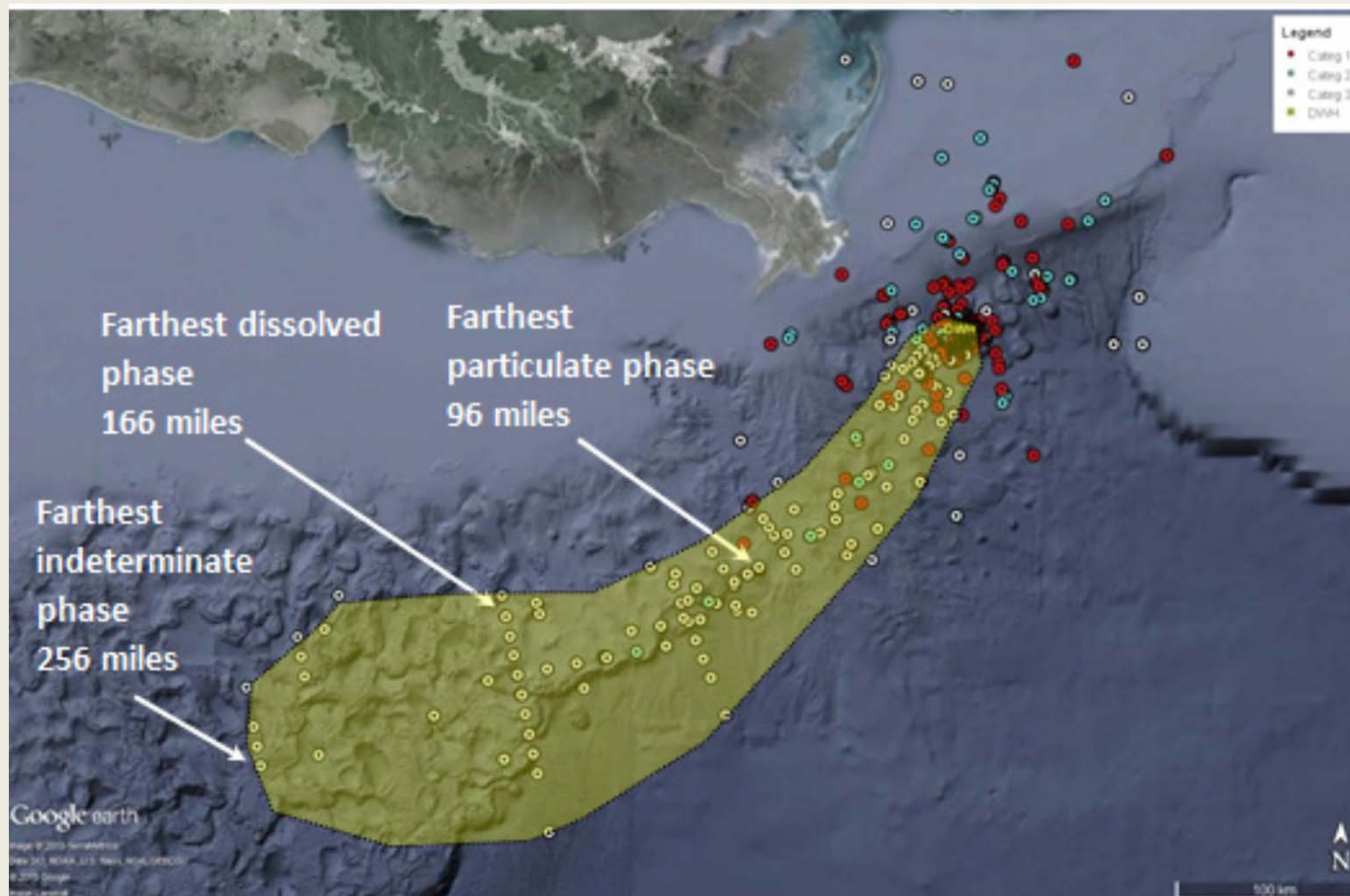
Oil Pathways to Bottom Sediments



Source: Kate Sweeney for NOAA.

Figure 4.2-6. Depiction of processes by which DWH-related contaminants exposed resources within the deep-sea pelagic water and sea floor.

Spatial Extent of Deep Sea Plume

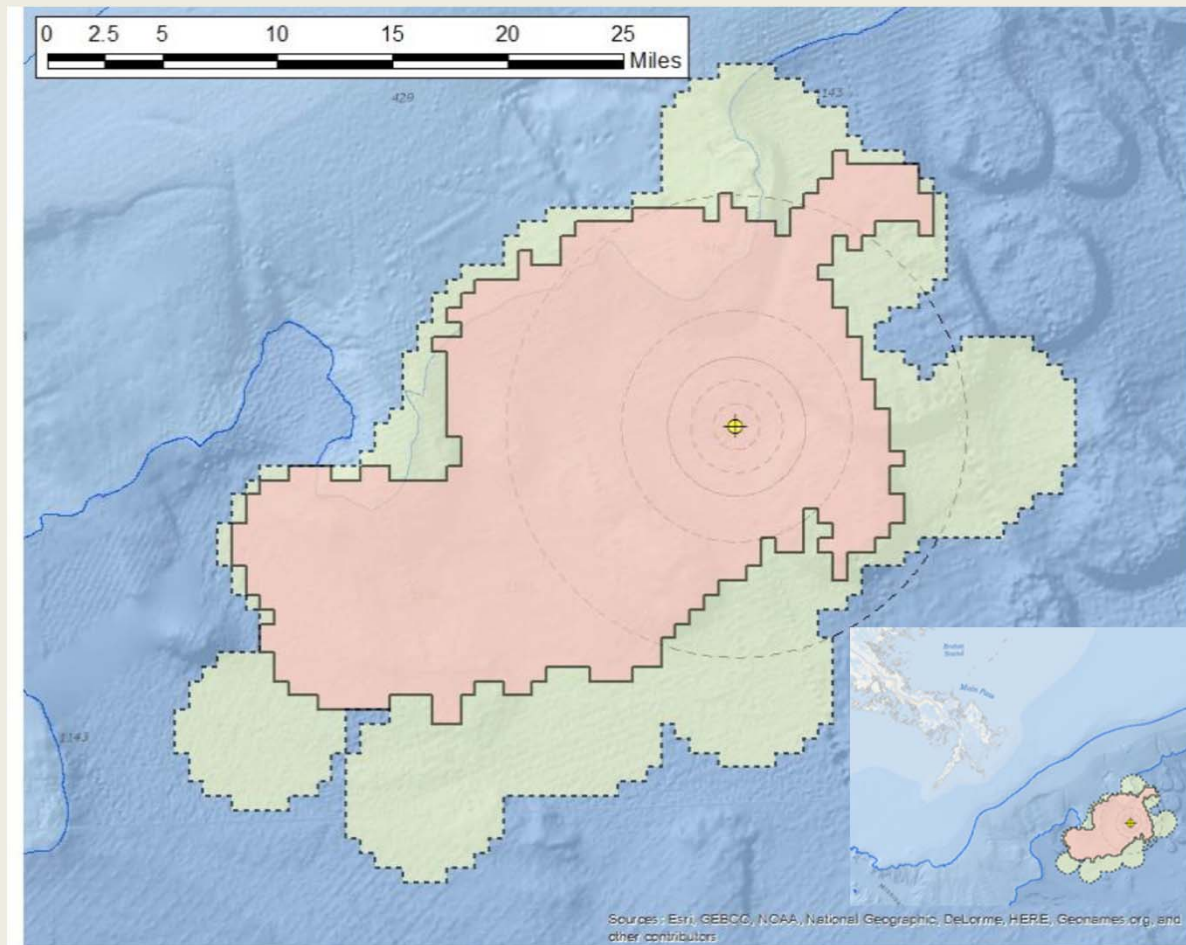


Source: Payne and Driskell (2015d); yellow plume added for clarity.

Figure 4.2-7. Spatial extent of deep-sea plume determined through forensic analysis of water samples collected in 2010. Colors depict different forensic match categories reported by Payne and Driskell (2015d)

Deep Sea Oil "Footprint" (Depths > 1,000 Meters)

Footprint Area=
~1,000-1,800
square kilometers



Source: Stout et al. (2015)

Figure 4.2-8. Map showing minimal (pink: 1,030 square kilometers [400 square miles]) and maximal (green; 1,810 square kilometers [700 square miles]) "footprints" of Macondo oil recognized through forensic analysis of deep-sea surface sediments.

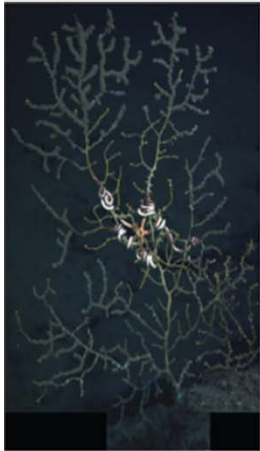
Sediment Cores Documenting DWH Incident Related Marine Snow Event



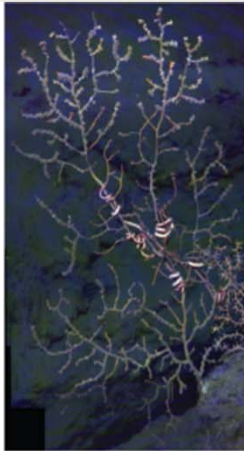
Source: Jeff Baguley.

Figure 4.5-8. Photos of sediment cores taken aboard the R/V *Ocean Veritas* response cruise. (a) A representative pre-spill sediment core with compacted sediments and lacking floc. (b) A sediment core showing the presence of an overlaying, loosely aggregated light-brown flocculent layer.

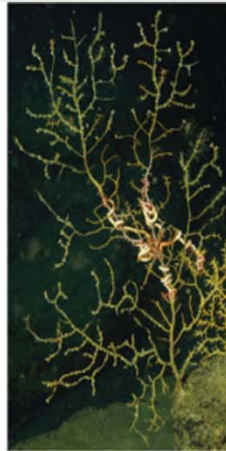
Deepsea Coral Colony Injury Progression



November 2010



December 2010



March 2011



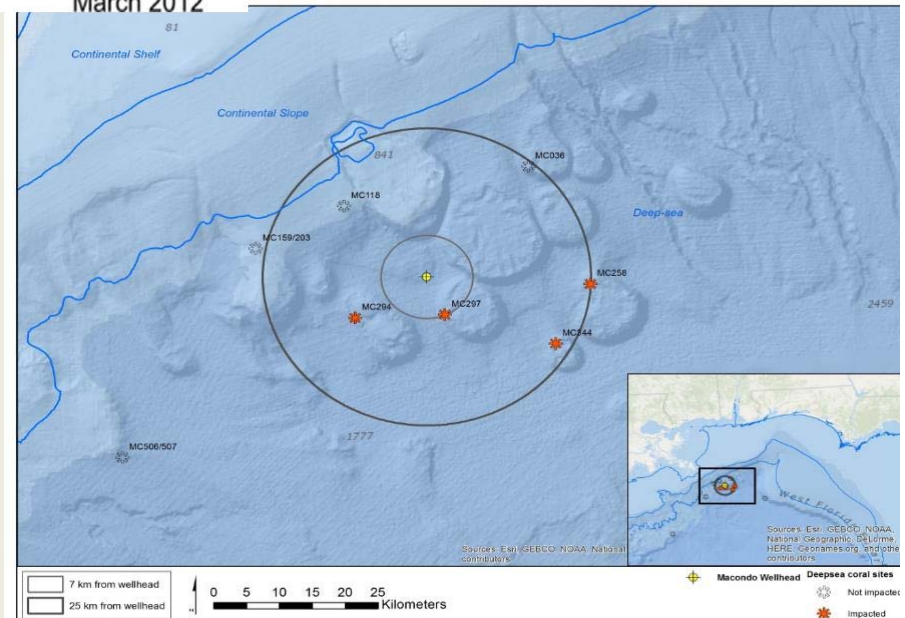
October 2011



March 2012

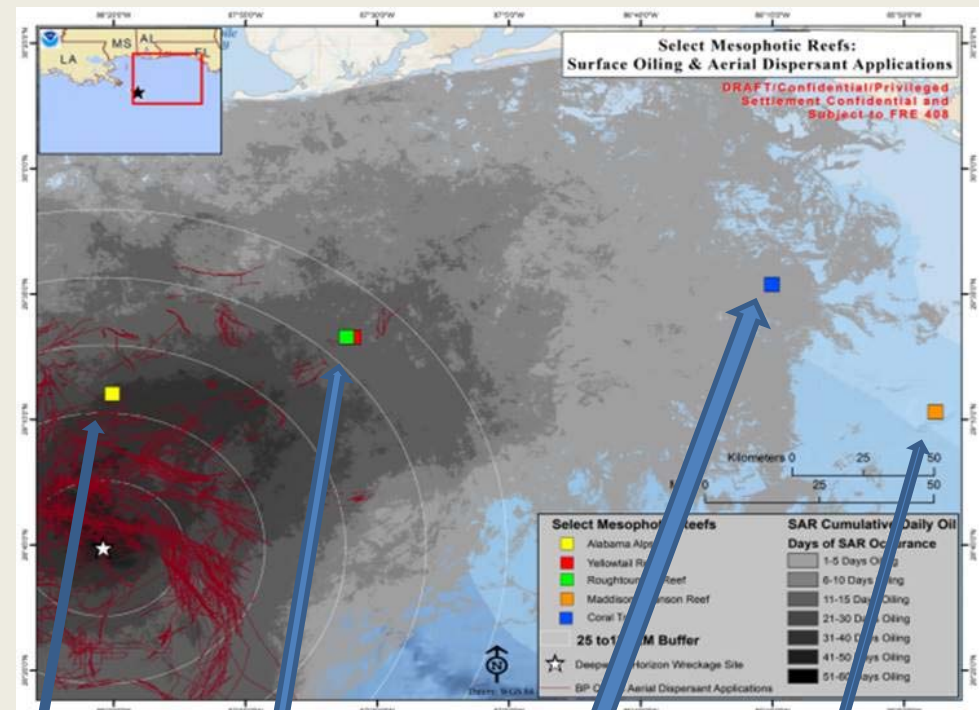
Progression of coral injury from coverage by flocculent material in 2010, through hydroid colonization in 2011 and onset of terminal branch loss in 2012

Map of locations of injured coral sites in relation to the DWH wellhead (w/in 25 kilometer radius)



Mesophotic Reefs

- Injured mesophotic reefs located under surface slicks (AA and RTR closer to release)
- Long term pre-spill monitoring (video transect) data on these reefs indicate acute coral mortality post spill
- Approximately 1/3-1/2 large sea fan colonies experienced injury
- Associated order of magnitude decreases in planktivorous fish abundances



Alabama
Alps

Roughtongue
Reef

Coral
Trees

Madison
Swanson

Deep Sea Sediment Toxicity: Amphipods

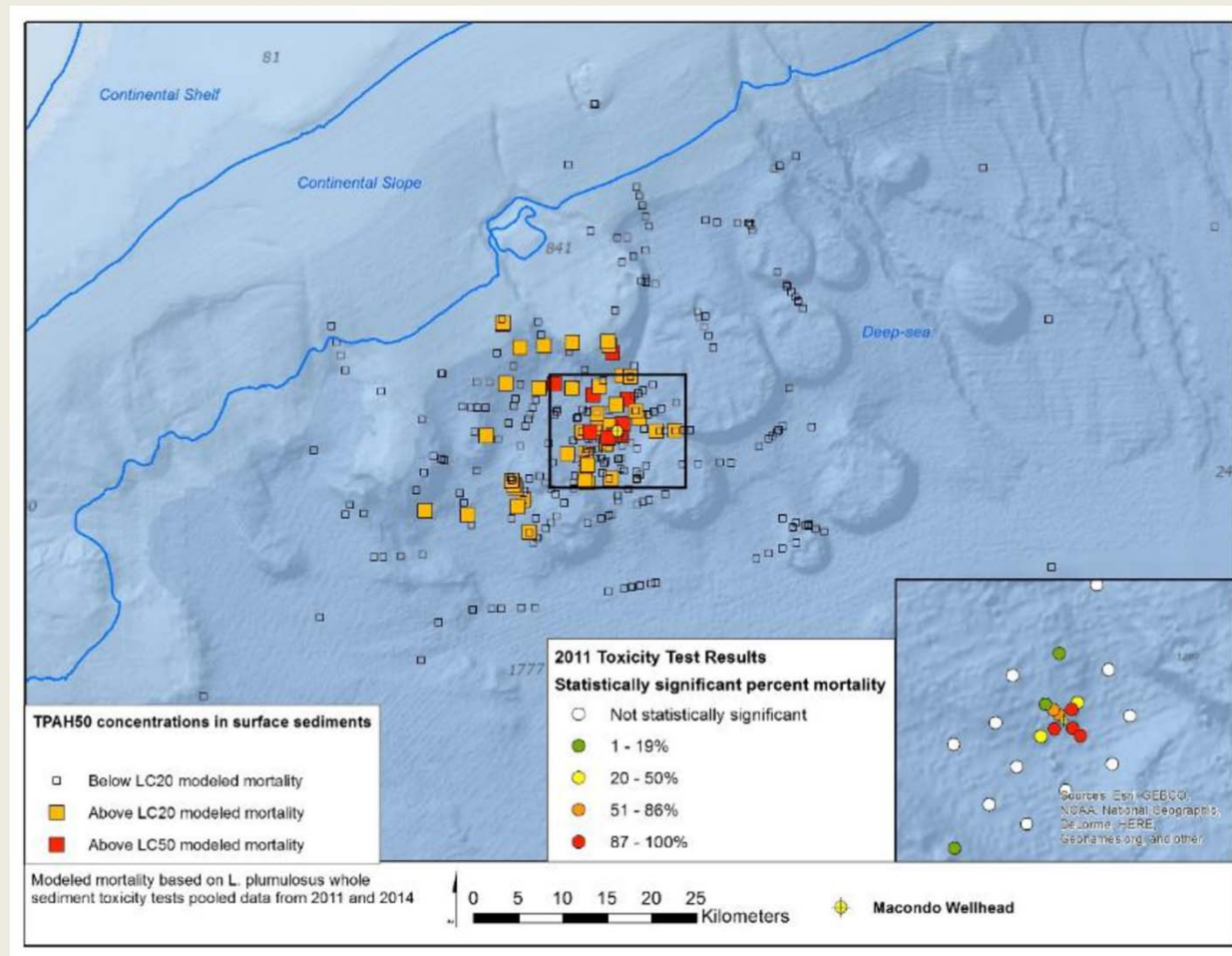


Figure 4.5-10. Map indicating surface TPAH50 concentrations that exceed LC20 and LC50 values for modeled mortality.

Deep Sea Sediment Toxicity: Benthic Community Structure

**Affected Area =
3-16 kilometers
from wellhead**

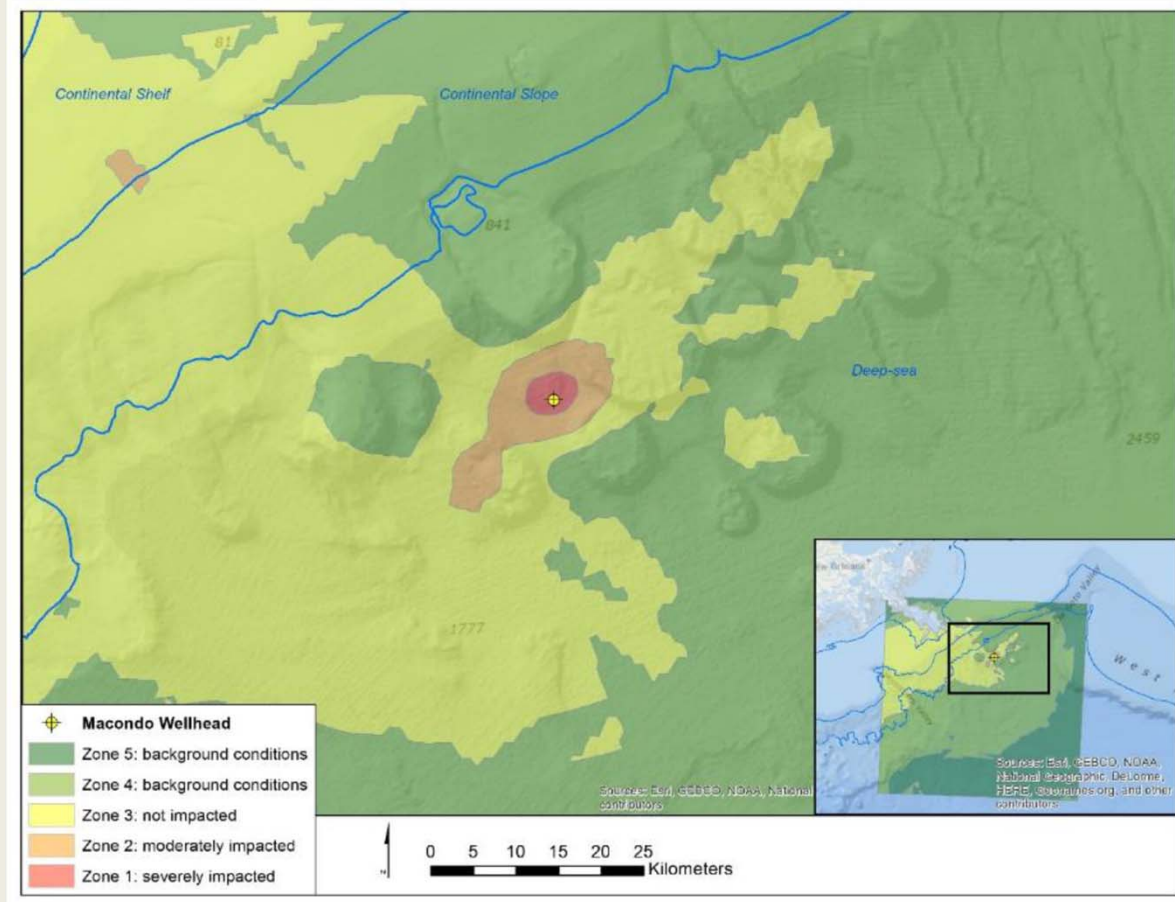


Figure 4.5-11. Footprint of benthic injury to sediment-dwelling infauna and epifauna identified by Montagna et al. (2013) using principle components analysis and spatial interpolation.

Surface Oil Sea Floor Floc

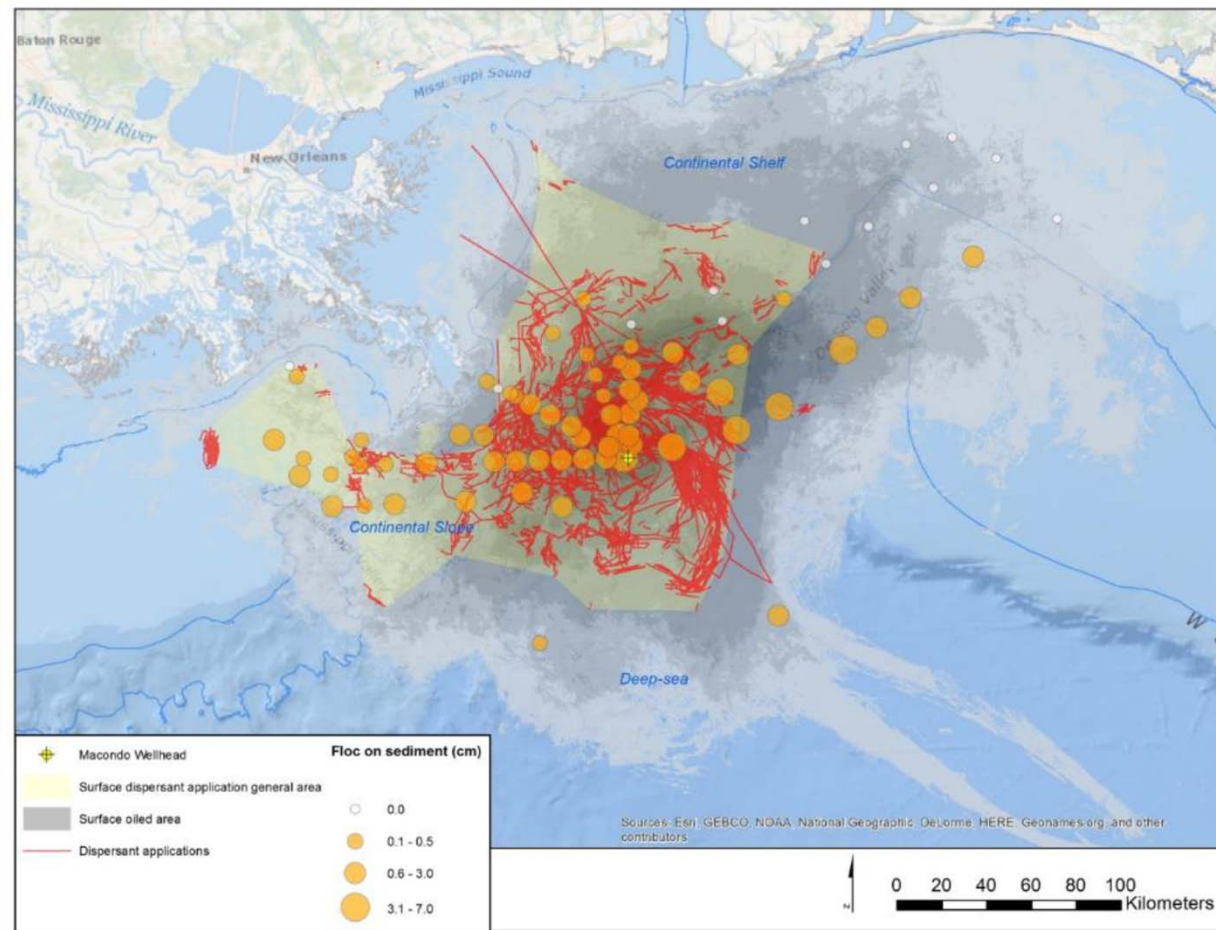


Figure 4.5-9. Map overlaying surface dispersant application area, surface oiled area, and floc thickness (cm) found on the deep-sea sediments.



Considerations for Future Responses and Assessments:

- What spill size?
- What spill location?
- Baseline?
- How to quantify in fate and transport modeling: turning this science into “preparedness” tools
- How to factor into oil budgets
- Role of response actions (e.g., dispersants, ISB, herding)
- Bioaccumulation- fish advisories and associated economic and recreational impacts
- Cascading ecosystem effects



Considerations for Future Responses and Assessments:

- Sampling considerations: capturing ephemeral data
 - **Where** to sample based on MOSSFA influenced horizontal and vertical distribution patterns
 - **How** to sample to capturing sediment surface floc (e.g., slurp guns, sediment traps) or water column marine snow event
- Toxicological considerations
 - Sediment interaction (e.g., demersal versus burrowing)
 - Exposure route (e.g., ingestion, smothering)
 - Exposure duration (e.g., sessile, planktonic, mobile)
- Implications for 'recovery' timeframe? Resuspension?
- Implications for restoration actions?

Questions?

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