



The Science for Monitoring, Assessment, and Mitigation of the Deepwater Horizon Event

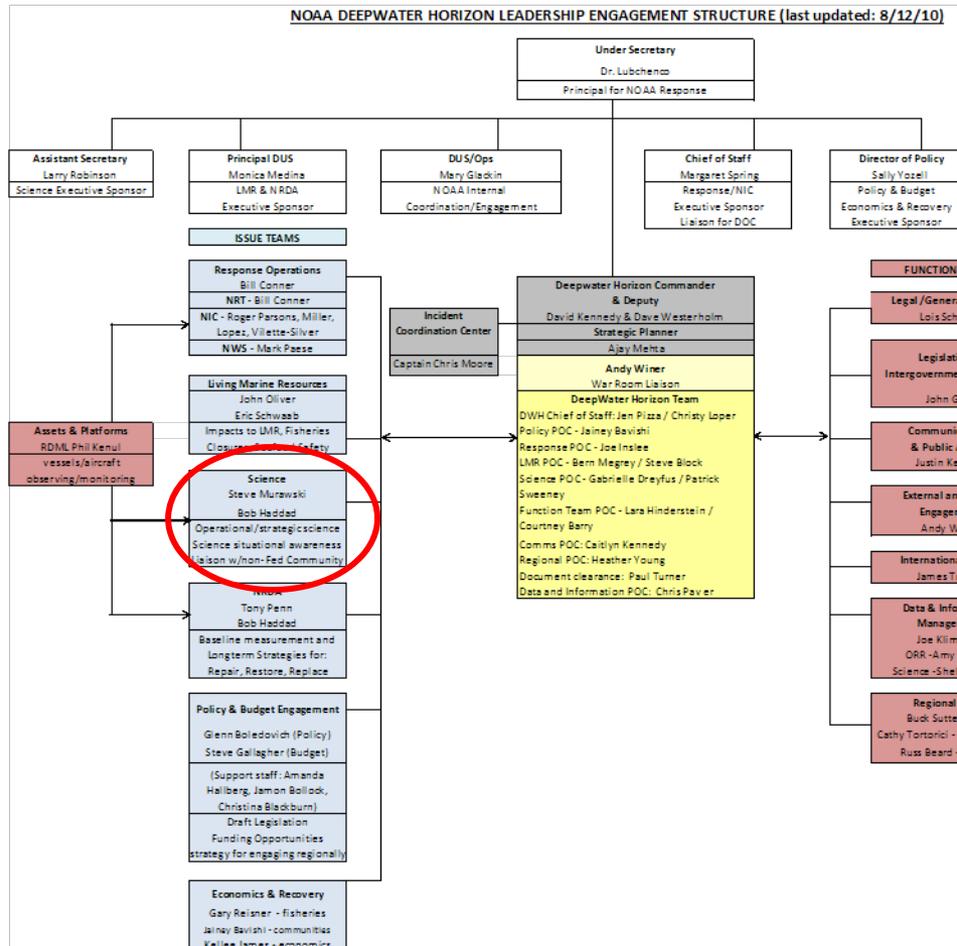
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Lisa Desfosse, et. al**

Office of Science and Technology, NOAA Fisheries Service

October 20, 2011



NOAA Responds to DWH





Ocean Policy Task Force

National Priority Objectives

1. Ecosystem Based Management
2. Coastal and Marine Spatial Planning
3. Inform Decisions and Improve Understanding
4. Coordinate and Support
5. Resiliency and Adaptation to Climate Change and Ocean Acidification
6. Regional Ecosystem Protection and Restoration
7. Water Quality and Sustainable Practices on Land
8. Changing Conditions in the Arctic
9. Ocean, Coastal, and Great Lakes Observations, Mapping, and Infrastructure



THE WHITE HOUSE COUNCIL ON ENVIRONMENTAL QUALITY

*Final Recommendations
Of The
Interagency Ocean Policy
Task Force
July 19, 2010*





What are the Issues?

- Distribution and fate of the oil and dispersants
 - Where is it now, and where is it going?
 - How fast will it degrade, and what will it become?
- Short- and Long-term Impacts
 - Seafood safety
 - Living marine resources
 - Ecosystem structure and function
- Long-term Recovery Plan

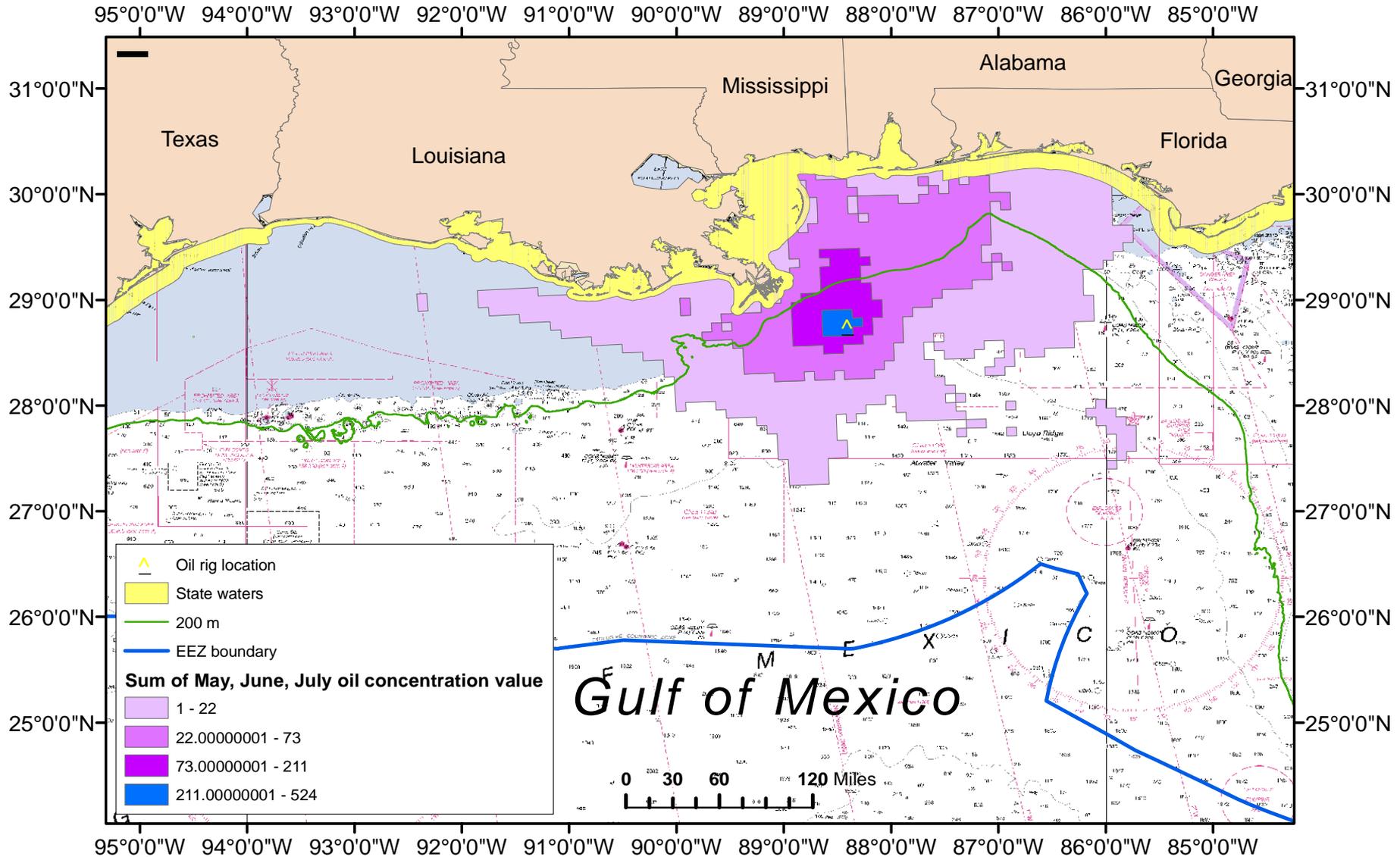


Where are we now?

- United Area Command has >16,000 personnel working on protection and clean up
- >31,000 water and sediment samples collected from >850 days at sea
- >2700 seafood samples completed sensory and chemical analyses
- 90% of federal waters now open to fishing
- Shoreline oiling still occurring
 - Moderate to heavy - 98 miles (88 in LA)
 - Light to trace – 458 miles (203 in LA)

Source: <http://www.restorethegulf.gov/>

OIL DENSITY ESTIMATED FROM MODELED TRAJECTORIES



NMFS/SEFSC – Mississippi Laboratories
 Prepared by P. Moreno on 09/12/10

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Oil density estimation spatial data produced by: AFSC/Jan Benson
 (data source: NOAA, The Response Group, ESRI)



Draft Sub-sea / Sub-surface Plan*

- Adaptive plan for sampling, data sharing, and involving academic and private sector for removal phase of DWH to assess presence of actionable oil
 - Monitor & assess oil and degradation products in water and sediments
 - Evaluate presence of dispersants & break-down products
 - Identify any additional response requirements
- Three spatial domains: nearshore, offshore, deep water
- Open-ended time frame



Seafood Safety Program

Purpose:

- Ensure the safety and quality of Gulf of Mexico seafood
- Minimize unnecessary economic impacts on seafood industries
- Monitor key finfish and invertebrate species for oil and/or dispersant contamination

Partners:

- FDA, NOAA, state agencies

Elements:

- Fishery area closures (SERO)
- Sampling: at-sea, dockside, market
- Sensory analyses
- Chemical analyses





Re-opening Protocol*

An area previously exposed to oil is now free of oil and the seafood products tested meet FDA standards for public health and wholesomeness.

Samples must undergo:

- a) Sensory testing (Organoleptic analysis)
 - Sniff raw product
 - Sniff cooked product
 - Taste cooked product
- b) Chemical testing
 - Analysis of PAH
 - Compare to FDA Levels of Concern



*[http://sero.nmfs.noaa.gov/sf/deepwater_horizon/attachment1\(3\).pdf](http://sero.nmfs.noaa.gov/sf/deepwater_horizon/attachment1(3).pdf)



NOAA Seafood Surveillance & Monitoring Plan

- NOAA requesting BP funding
- 3-5 year duration
- At-sea sampling (2400 in 2011, 1200 by 2013)
- Dockside sampling (fish & shellfish, multiple tissues)
- Economic monitoring (harvesters, dealers, processors, distributors, and retail outlets)



Laboratory Exposure Experiments with Corexit 9500A

- Cooperative between SEFSC & NWFSC
- Seeking to determine if exposure to dispersant contaminates seafood
- Galveston workshop (7/10) established experimental protocols



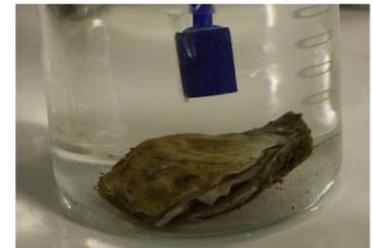
Table 1. Experimental exposure concentrations (ppm) of the dispersant Corexit 9500A based on potential concentrations from a recommended surface application rate of 2-10 gallons per acre.

Treatment	ppm	Equivalence
Corexit 9500A	100	10x expected concentrations from surface application
Corexit 9500A	10	10 gal/acre in 1 m of water = 9.35 ppm
Corexit 9500A	1	10 gal/acre in 10 m of water = 0.94 ppm
Corexit 9500A	0.1	2 gal/acre in 20 m water = 0.09 ppm
Corexit 9500A	0.01	2 gal/acre in 200 m water = 0.009 ppm
Control	0.0	



Laboratory Exposure Experiments with the Dispersant Corexit 9500A

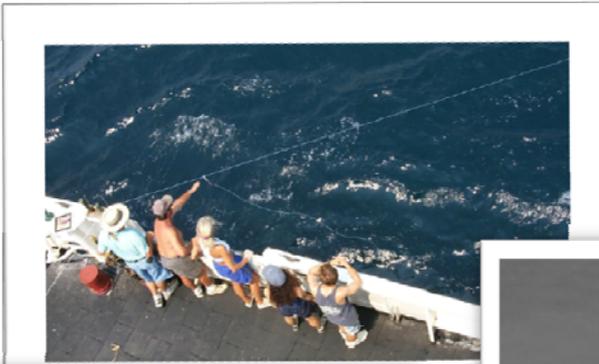
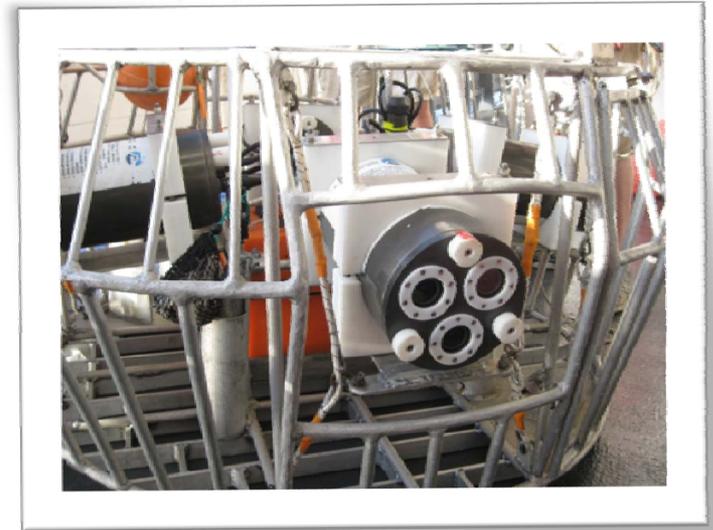
- Brown shrimp *Farfantepenaeus aztecus*
- White shrimp *Litopenaeus setiferus*
- Eastern oysters *Crassostrea virginica*
- Red snapper *Lutjanus campechanus*
- Red drum *Sciaenops ocellatus*



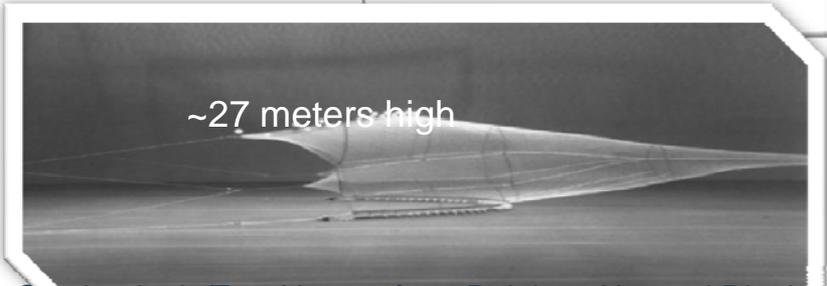


Fishery-Independent SEFSC/SEAMAP Surveys

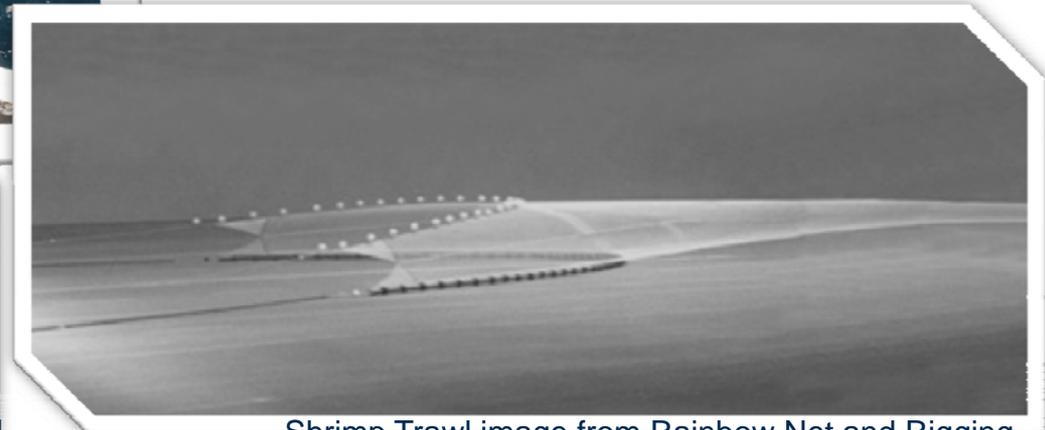
- Bottom Longline
- Shrimp/Groundfish Trawl
- Small Pelagics/Deepwater Trawl
- Reef Fish
- Plankton



~27 meters high



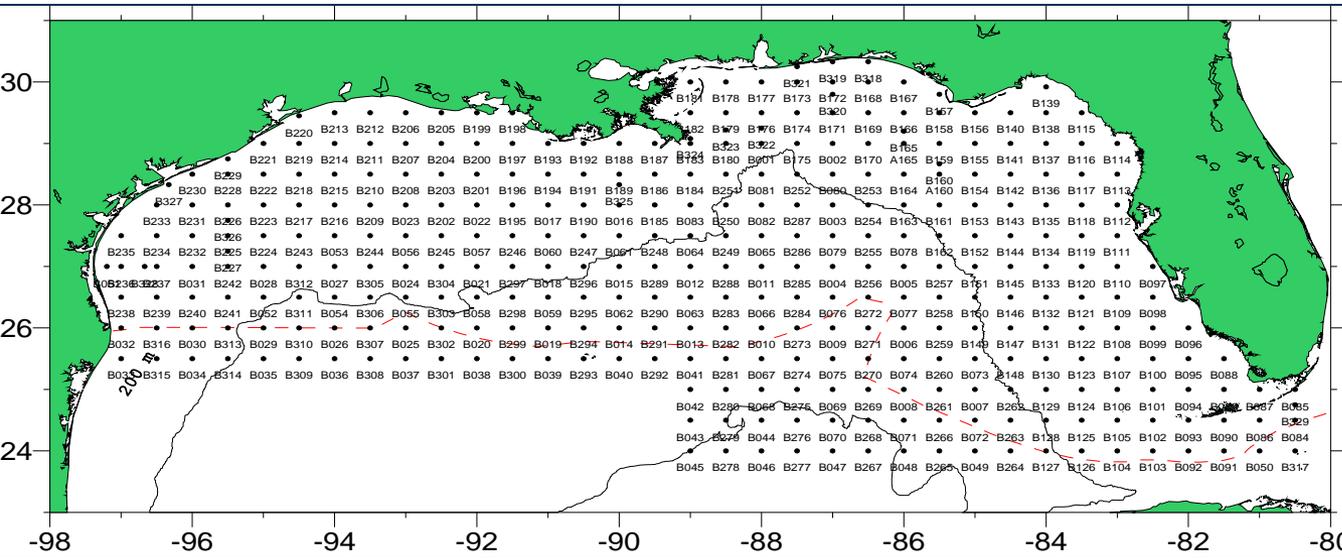
Semi-pelagic Trawl image from Rainbow Net and Rigging



Shrimp Trawl image from Rainbow Net and Rigging

SEAMAP Plankton Sampling (Southeast Area Monitoring and Assessment Program)

State and Federal Cooperative Research Program

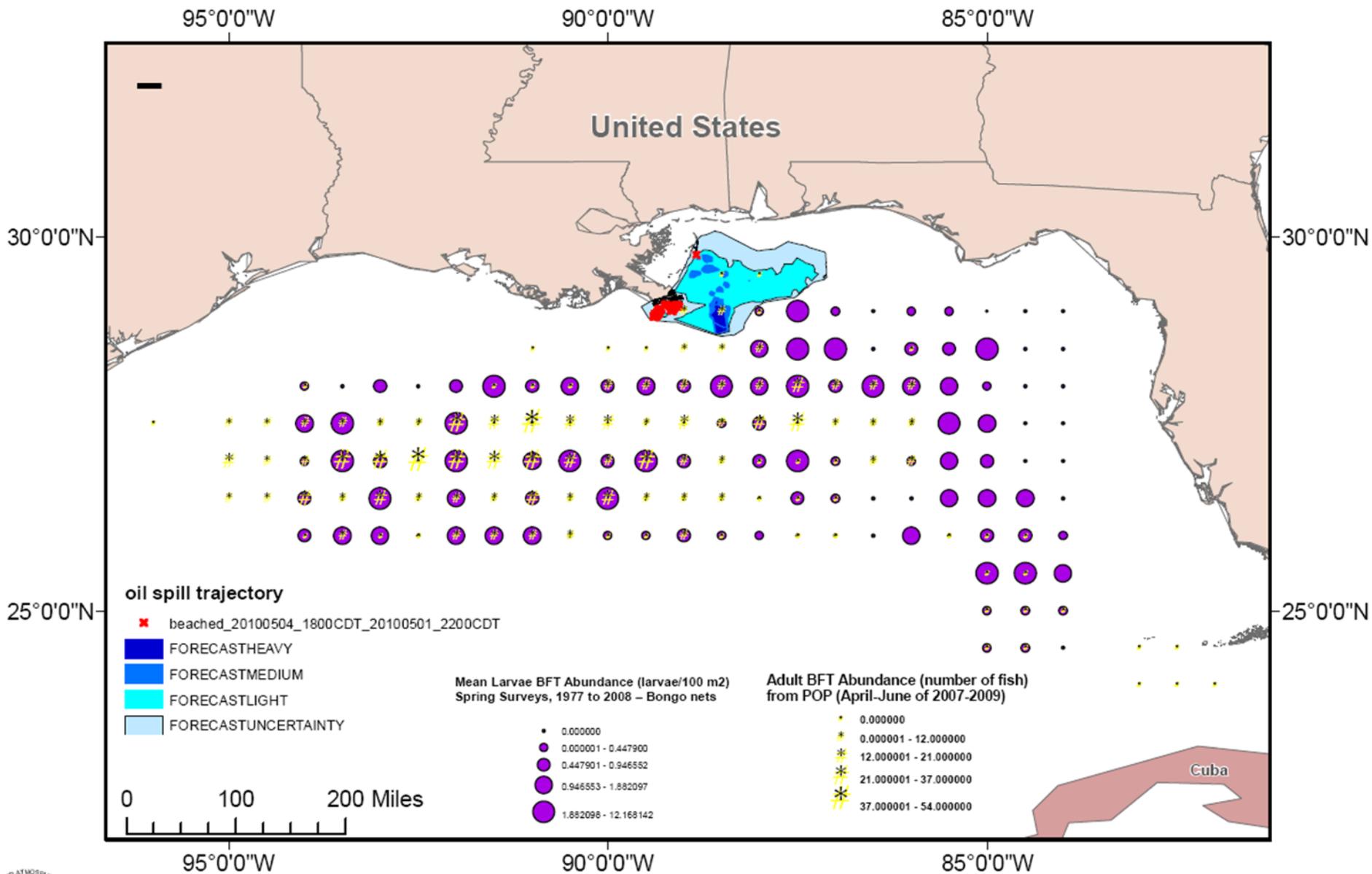


Cruises	360
Plankton Stations	12,979
Plankton Samples	34,324
Plankton Samples with Taxonomic Information	20,370
Cataloged Vials of Larvae	353,884
Individual Larvae	4,348,780
Measured Larvae	719,283
Taxonomic Updates	7439+



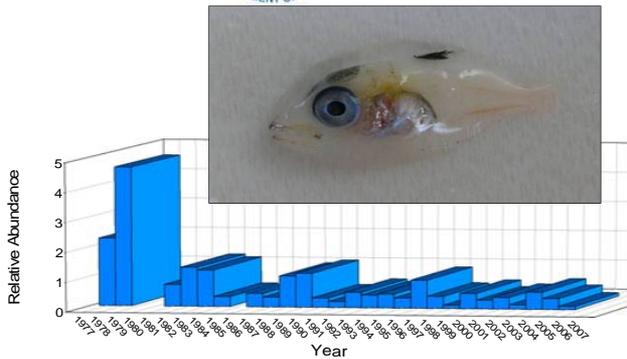
- Annual SEAMAP Plankton surveys (1982 to present) yield data on abundance and distribution of fish eggs, larvae and invertebrate (non-fish) zooplankton.
- Gear Used: bongo net, neuston net, CTD and water bottle carousel, a CUFES (continuous underway fish egg sampler, and MOCNESS

Adult and Larvae Bluefin Tuna Abundances

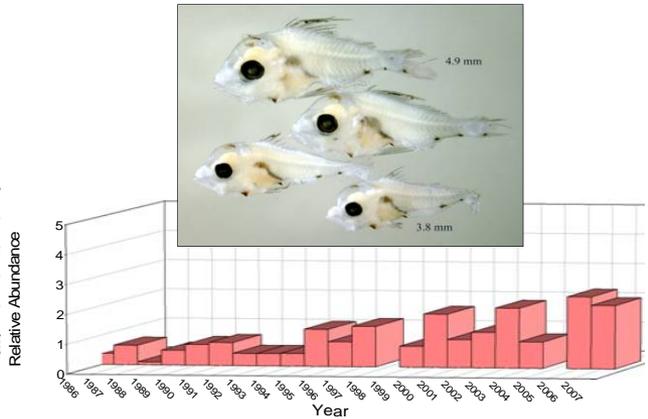




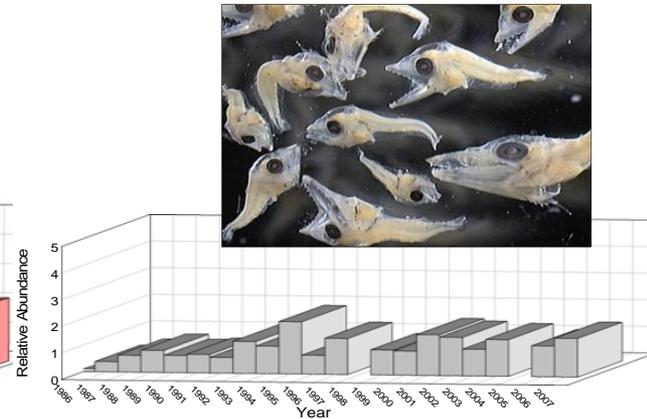
SEAMAP Larval Indices



Bluefin Tuna
(*Thunnus thynnus*)



Red Snapper
(*Lutjanus campechanus*)



King Mackerel
(*Scomberomorus cavalla*)

Larval abundance and/or presence/absence data are important indicators of the size of spawning populations of Key Gulf Species such as: western Atlantic bluefin tuna, red snapper and king mackerel.

Additional plankton collections



VESSEL/CRUISE	INCLUSIVE DATES	No. of Stations	No. Plankton Samples	Environmental Data
FRV Gordon Gunter 1001	4/21 - 5/23	93	1015	500
R/V Caretta	4/30 - 5/16	13	13	13
Chartered fishing vessels	4/30 - 6/15	92	92	n/a
FRV Gordon Gunter 1002*	5/28 - 6/3	6	28	6
FRV Oregon II*	6/26 - 7/31	35	136	35
FRV Delaware II*	7/14 - 7/24	58	289	58
R/V Tommy Munro*	7/28 - 8/6	37	41	n/a
FRV Gordon Gunter 1004*	8/24 - 9/29	185	1384	755
TOTAL		519	2998	1367

Cruises in **Blue** were modified SEAMAP surveys
 Cruises in **Red** were added in response to DWH



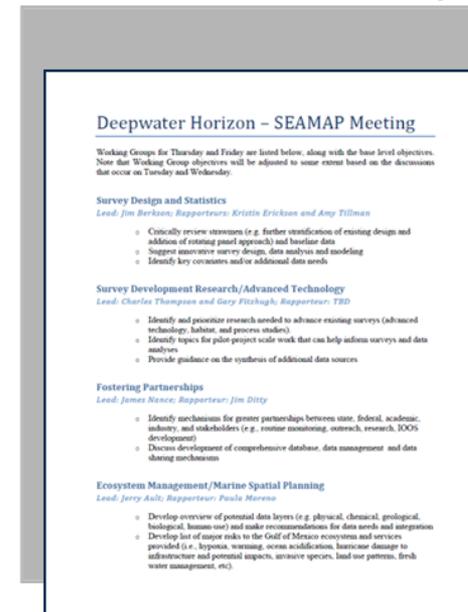
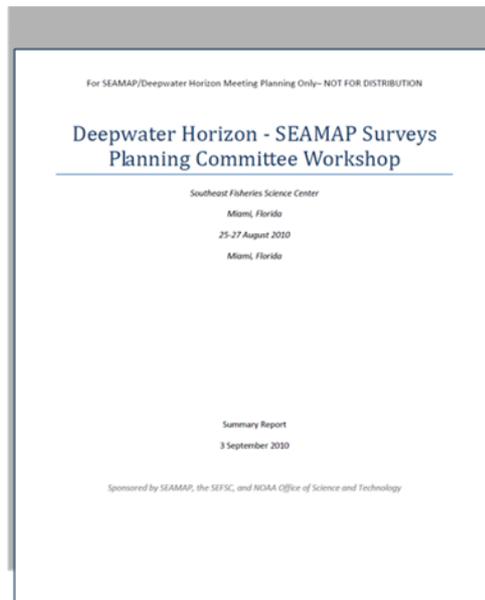
During * cruises specialized sample and specimen handling protocols were used so that future chemical, gene expression and biomarker analyses of bulk plankton and fish larvae could be conducted at the NWFSC, Seattle



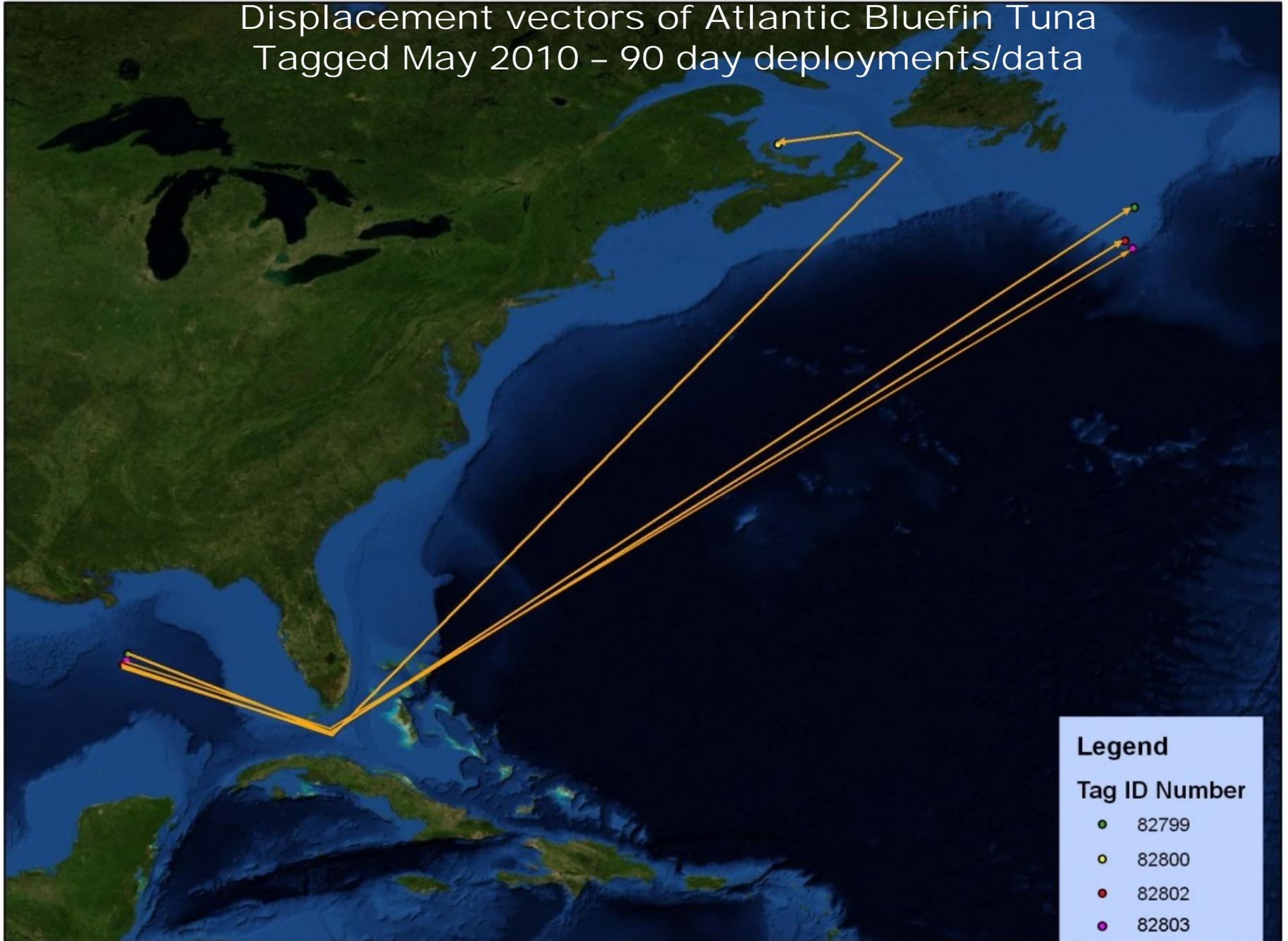
Deepwater Horizon/SEAMAP – Planning for Fishery Independent Surveys

Planning Committee Workshop
5-27 August 2010, Miami, Florida
Federal, State, Academic Representatives

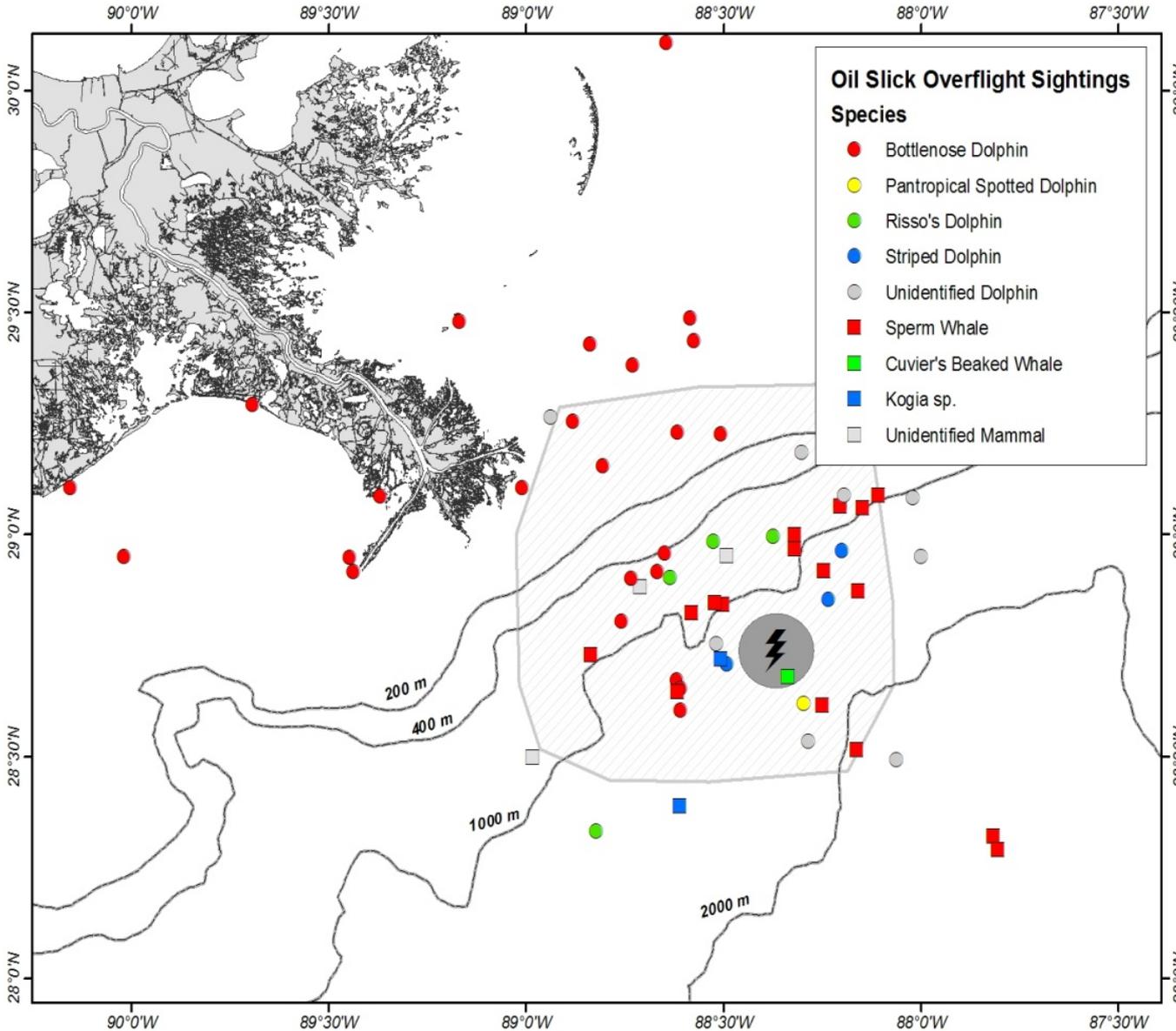
Fishery Independent Data Collection Workshop
21-24 September 2010, St. Petersburg, FL
Federal, State, Academic Representatives



Displacement vectors of Atlantic Bluefin Tuna Tagged May 2010 – 90 day deployments/data

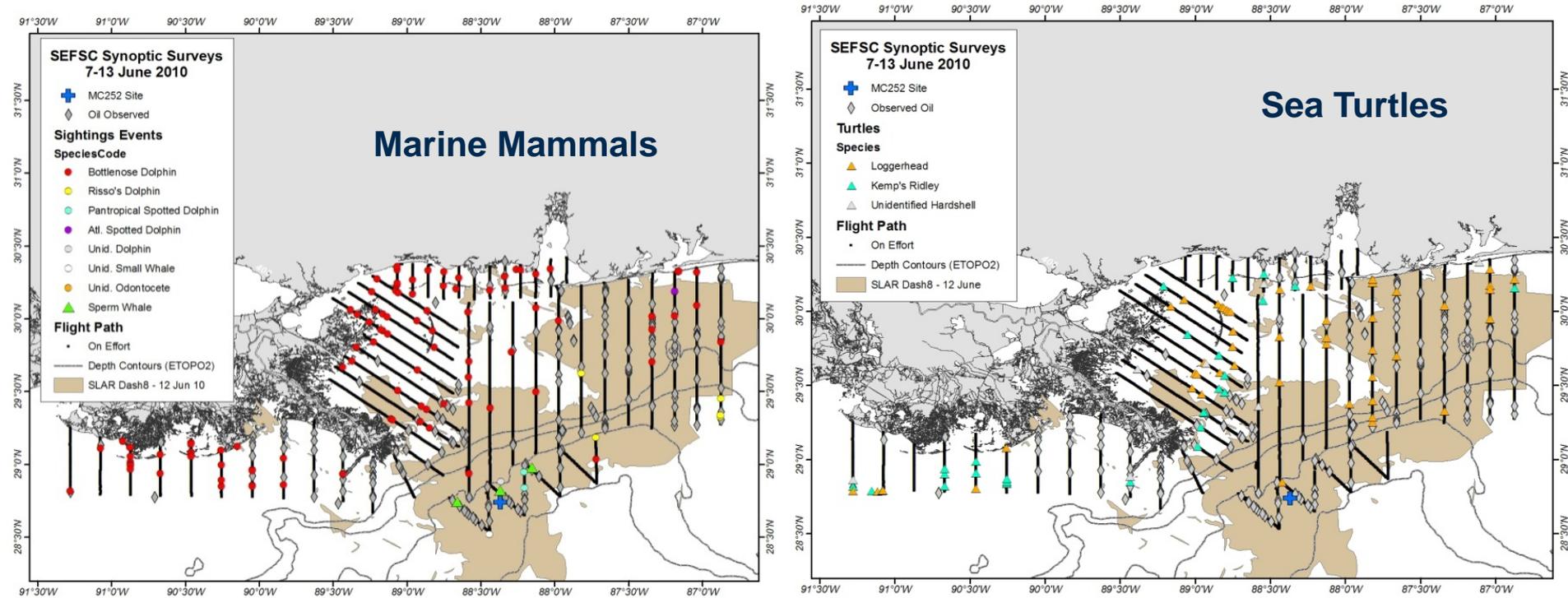


DWH Site Protected Species Distribution Surveys



- Helicopter flights based out of Houma
- Started 28 April, 3 days per week through 31 July
- Focus on area near the DWH site in deep water
- Historical high use habitat for sperm whales, pan tropical spotted dolphins, and other marine mammals
- Observations of 7 marine mammal taxa and loggerhead, leatherback sea turtles

Protected Species Synoptic Aerial Surveys

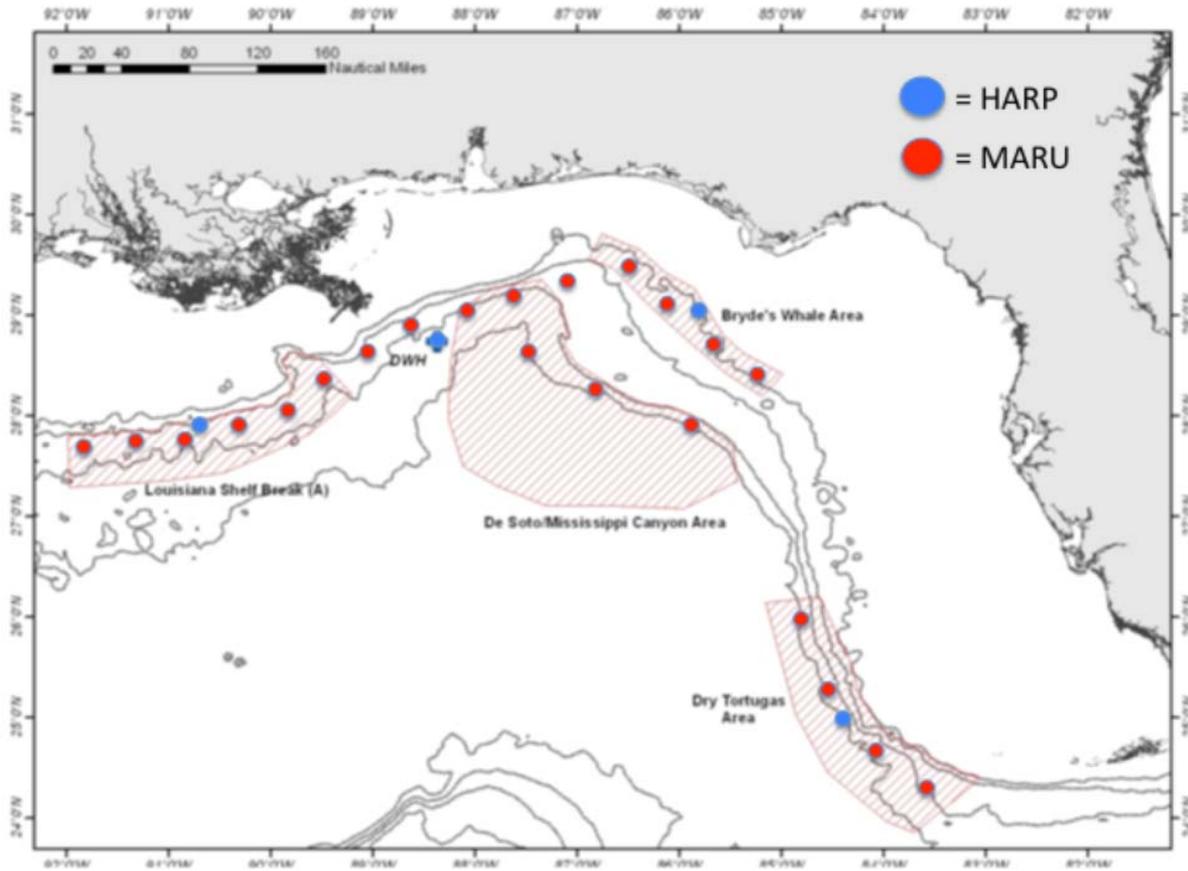


• Transect surveys flown on NOAA Twin Otter airplane. Goal was to quantify any changes in abundance and spatial distribution in response to DWH event.

• Initiated 28 April before significant oil occurred over the continental shelf. Conducted surveys approximately every 2 weeks through the beginning of September

• Focus on bottlenose dolphins and larger-sized sea turtles (primarily loggerhead, Kemp's ridley)

Oceanic Marine Mammal Assessment Survey



- Visual and Passive acoustic line transect surveys for abundance and spatial distribution of marine mammals

- Deployed 12 satellite-tracking tags on sperm whales for long term monitoring of movements

- Deployed long-term acoustic recording packages throughout the eastern Gulf

- Collected tissue biopsy samples from sperm whales and other marine mammals to evaluate potential exposure to oil





Pending Science Box LMR Proposals

- Assessing changes in population size and spatial distribution of marine mammals and turtles in the Northern Gulf of Mexico
- Hazard Characterization and Exposure Assessment of Oil and Dispersants in Vertebrate Wildlife via In Vitro Endocrine and Immune Assessments
- Effect of the Deep Water Horizon oil spill on movement and survival of western Atlantic bluefin tuna on their natal spawning grounds in the northeastern Gulf of Mexico
- Damage Assessment to determine changes in habitat use and survival rates of loggerhead sea turtles nesting throughout the Gulf of Mexico by the SEFSC in response to the Deepwater Horizon Incident MC252
- Effect of the Deepwater Horizon Oil Spill on the Distribution, Habitat Use, and Survival of Yellowfin Tuna (*Thunnus albacares*) in the Gulf of Mexico.
- Assessing impacts of the DWH event on marine mammals occupying the DeSoto Canyon/Mississippi Canyon Region
- Oversight of Seafood Safety Assessments including analytical method development for oil and dispersant components and their associated quality assurance/quality control criteria
- Offshore sampling in the Gulf of Mexico to address resource management, seafood safety, response and damage assessment needs
- SEFSC assessment of impacts to sea turtle growth rates and foraging behavior due to the Deepwater Horizon MC 252 oil spill
- Space use, movement and distribution of pelagic state neonate sea turtles in the Gulf of Mexico including loggerhead, Kemp's ridley, green and hawksbill turtles.
- Oil Spill-Induced Forcing Functions for Potential Trophic Cascades in Nearshore Fisheries and Ecosystem Dynamics
- NOAA's National Status & Trends Mussel Watch Program: Gulf Coast monitoring
- Marine Microbial Genomic Diversity and Physiology: The Potential to Mine Biological Potential Associated with the Deep Horizon Oil Spill

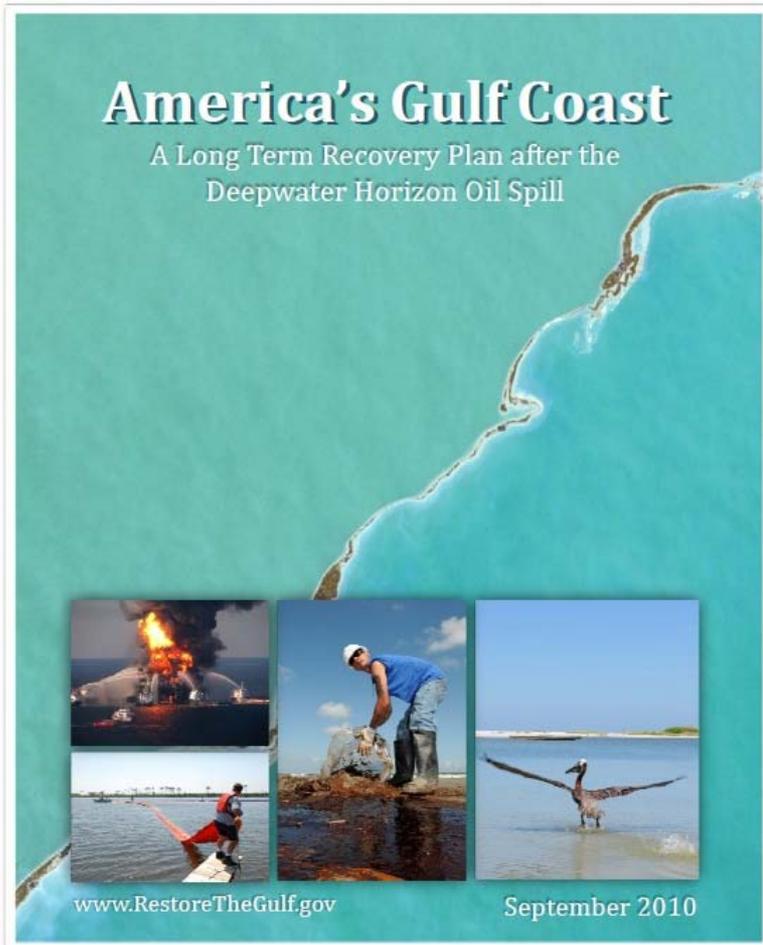


Science Box's Holistic Science Plan

- Scope debate: NOAA plan with on-ramps for other entities vs NOAA-led comprehensive plan
- Considering DWH spill as a component of overall impacts to Gulf ecosystem
- Proposed components
 - Integrated observing system
 - Research on ecosystem process and causes of ecological change
 - Modeling R&D to prediction and hindcasting
 - Communication – data delivery, product dissemination, outreach



Long-term Recovery Plan (aka "Mabus Plan")



- Five topics areas
 - Funding (NRDA, civil penalties)
 - Long-term ecosystem restoration
 - Health and human services recovery
 - Economic recovery
 - Non-profit sector recovery
- Proposes two complementary efforts
 - Gulf Coast Recovery Council
 - Gulf Coast Ecosystem Restoration Task Force



Long-term Ecosystem Restoration in the Mabus Plan

- Recognizes pre-existing challenges
- Addresses DWH impacts: habitat, water column, fisheries, sensitive species
- Coordinates with existing restoration efforts
- Driven by principles
 - Healthy wetlands and barrier habitats
 - Healthy, diverse, sustainable fisheries
 - Resilient coastal communities
 - Sustainable storm buffers
 - Healthy inland habitats, watersheds, off-shore waters



Questions?

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