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NMFS Southeast Fisheries Science Center
Response to the
Deepwater Horizon MC252 Oil Spill:
Living Marine Resources

**Presentation to the
Joint Subcommittee on Ocean and Science Technology**

**Todd Gedamke, PhD
NOAA, National Marine Fisheries Service
October 2010**



NMFS Mission Statement

**Stewardship of living marine resources
through science-based conservation and
management and the promotion of healthy
ecosystems**



- Seafood Safety
- Laboratory Experiments
- Protected Resources
- Plankton Surveys
- Bluefin Tuna
- Fishery Independent Data



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Seafood Safety



Seafood Safety Program

Purpose:

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



Seafood Safety Strategy

Gulf seafood is being safeguarded by a multi-prong approach



Fishery area closures (SERO)
Dockside seafood sampling

At-sea seafood sampling
Market seafood sampling



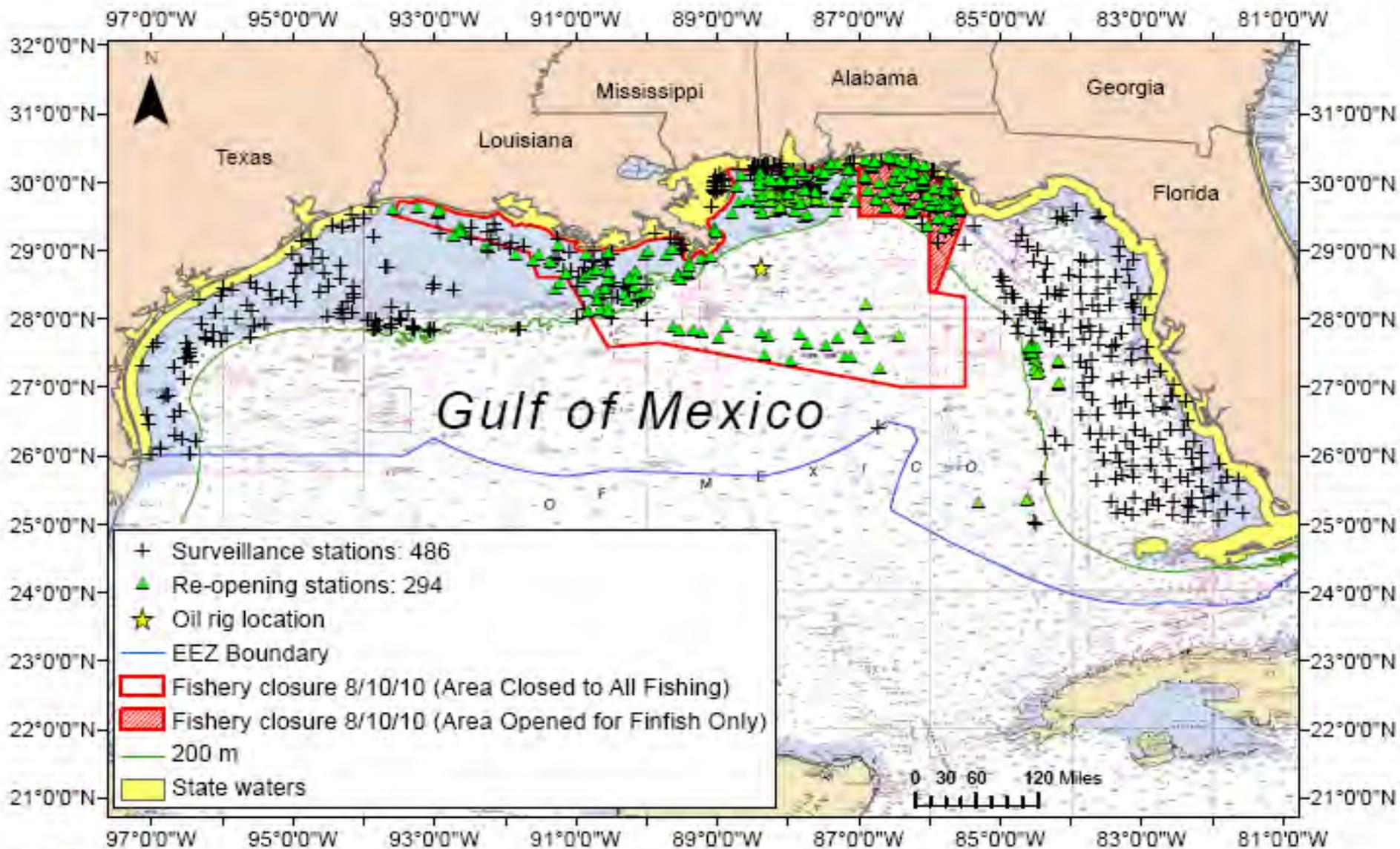
Seafood Safety Program

Coordinated precautionary approach:

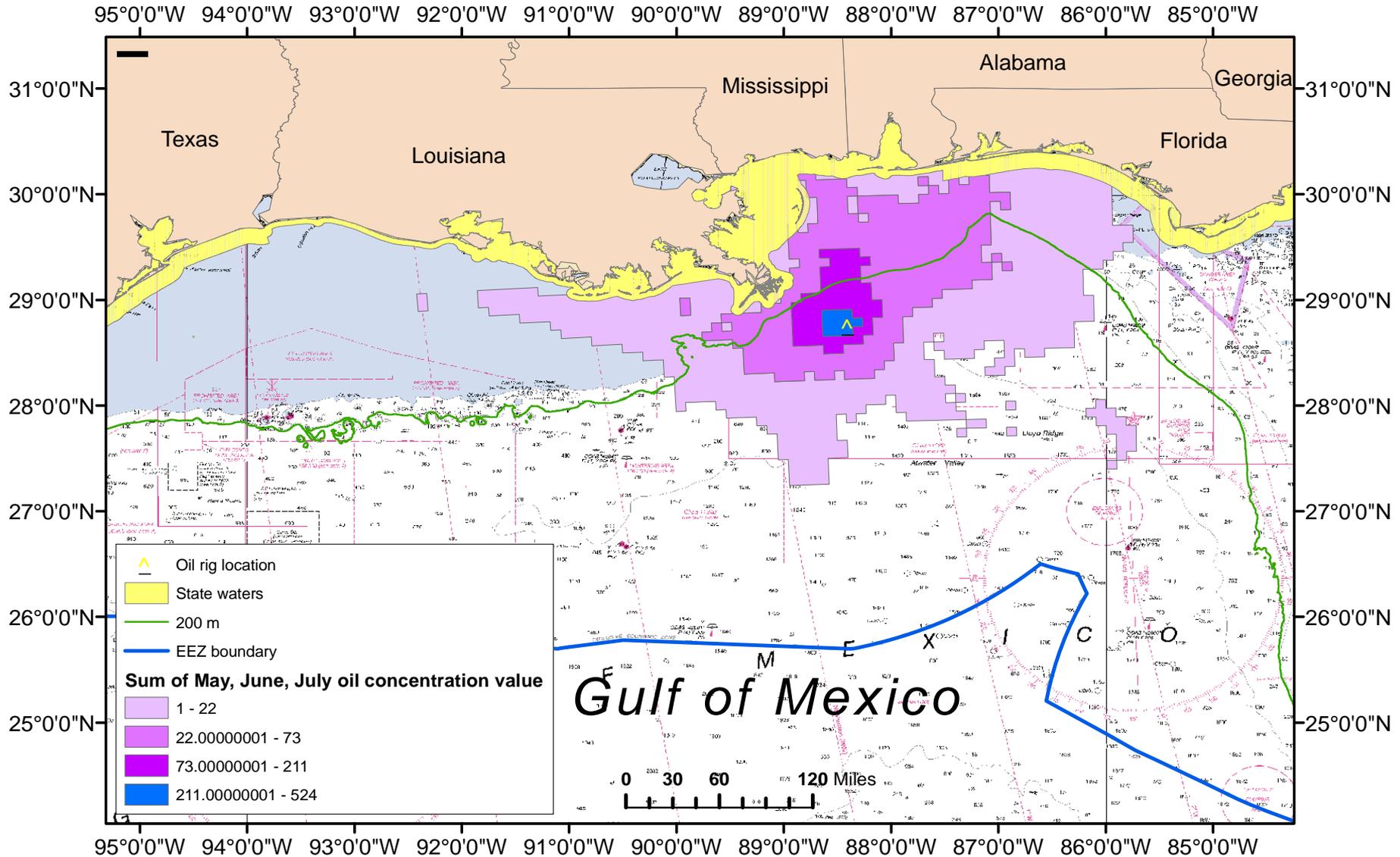
- Food and Drug Administration (FDA)
- National Oceanic and Atmospheric Administration (NOAA)
- Gulf of Mexico State Agencies



STATIONS SAMPLED FOR DEEPWATER HORIZON OIL SPILL RESPONSE FROM 4/28/2010 TO 8/16/2010: TOTAL 780 REPORTED STATIONS



OIL DENSITY ESTIMATED FROM MODELED TRAJECTORIES

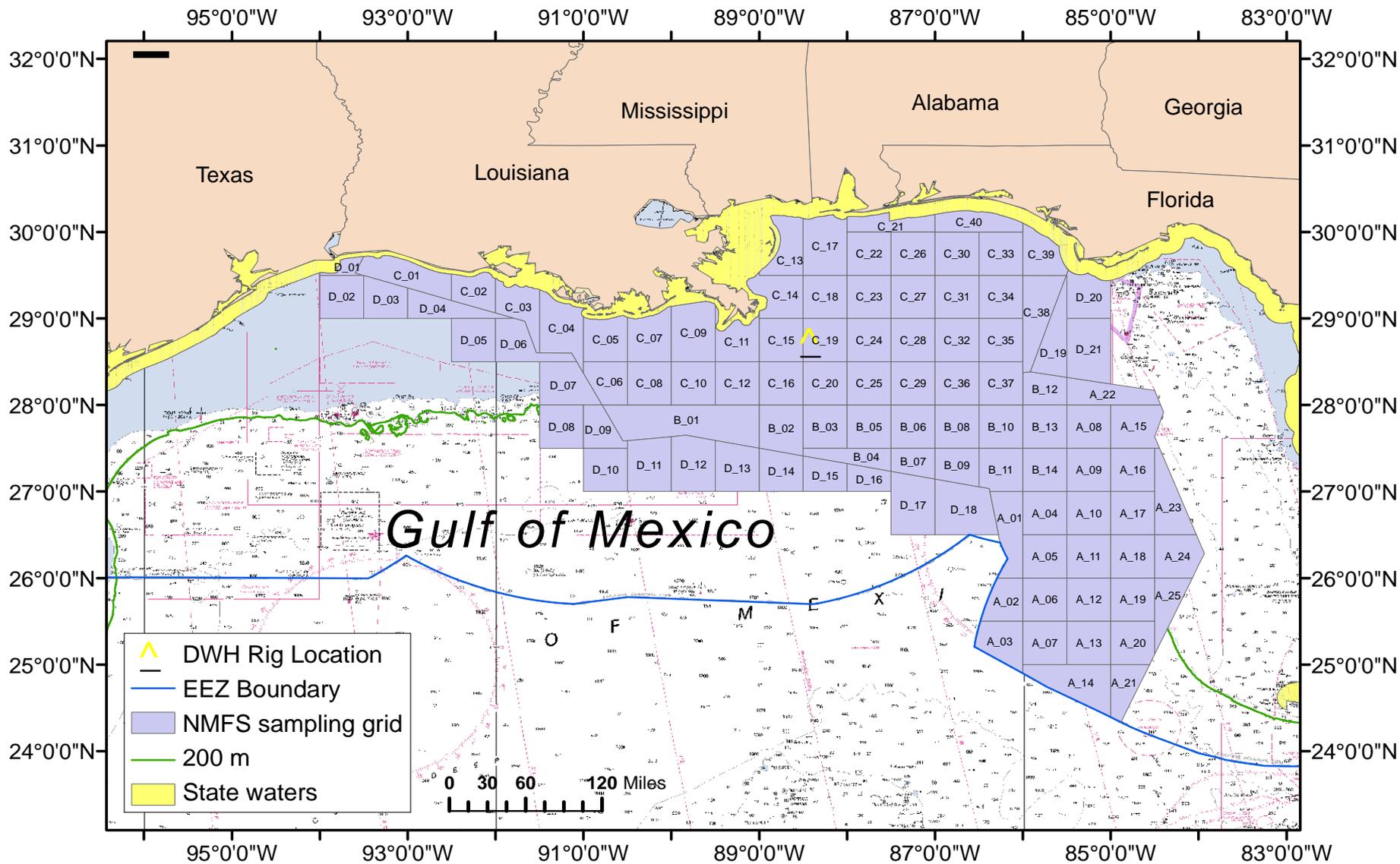


NMFS/SEFSC – Mississippi Laboratories
 Prepared by P. Moreno on 09/12/10

For Internal Use Only - Please Do Not Distribute

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

National Marine Fisheries Services (NMFS) sampling grid in response to the Deepwater Horizon, BP oil spill



NMFS/SEFSC – Mississippi Laboratories

Prepared by P. Moreno on 09/10/10



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





Laboratory Experiments on Dispersant



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

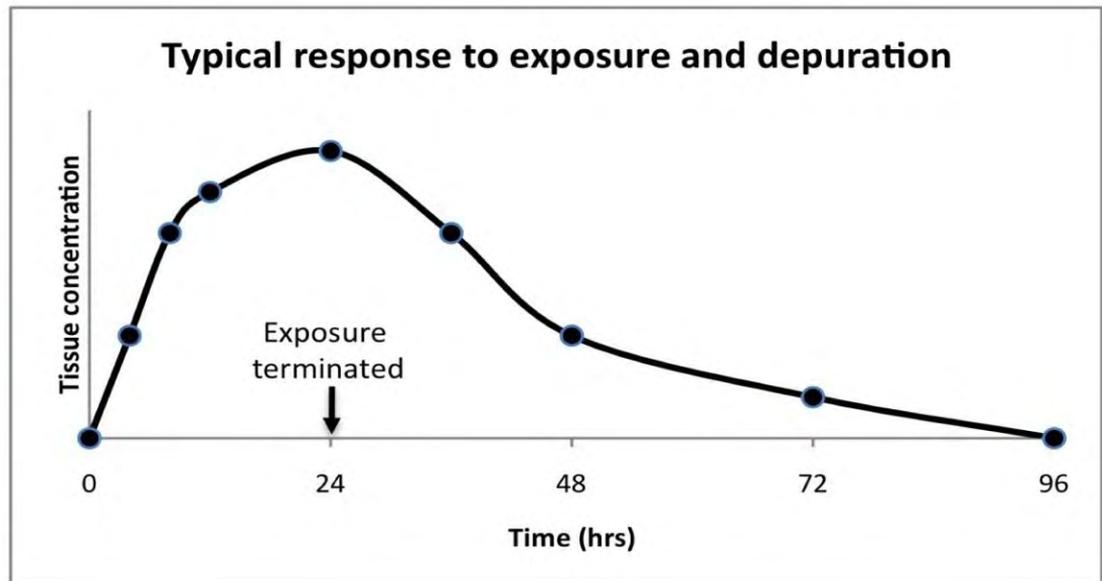
- Brown shrimp *Farfantepenaeus aztecus*
- White shrimp *Litopenaeus setiferus*
- Eastern oysters *Crassostrea virginica*
- Red snapper *Lutjanus campechanus*
- Red drum *Sciaenops ocellatus*





Laboratory Exposure Experiments with the Dispersant Corexit 9500A

In depuration experiments, animals are exposed to 10 or 100 ppm of Corexit 9500A for 24 hours and then moved to clean seawater. Concentrations in tissues (plus bile and blood for fishes) are measured periodically over the exposure and depuration period.





Laboratory Exposure Experiments with the Dispersant Corexit 950

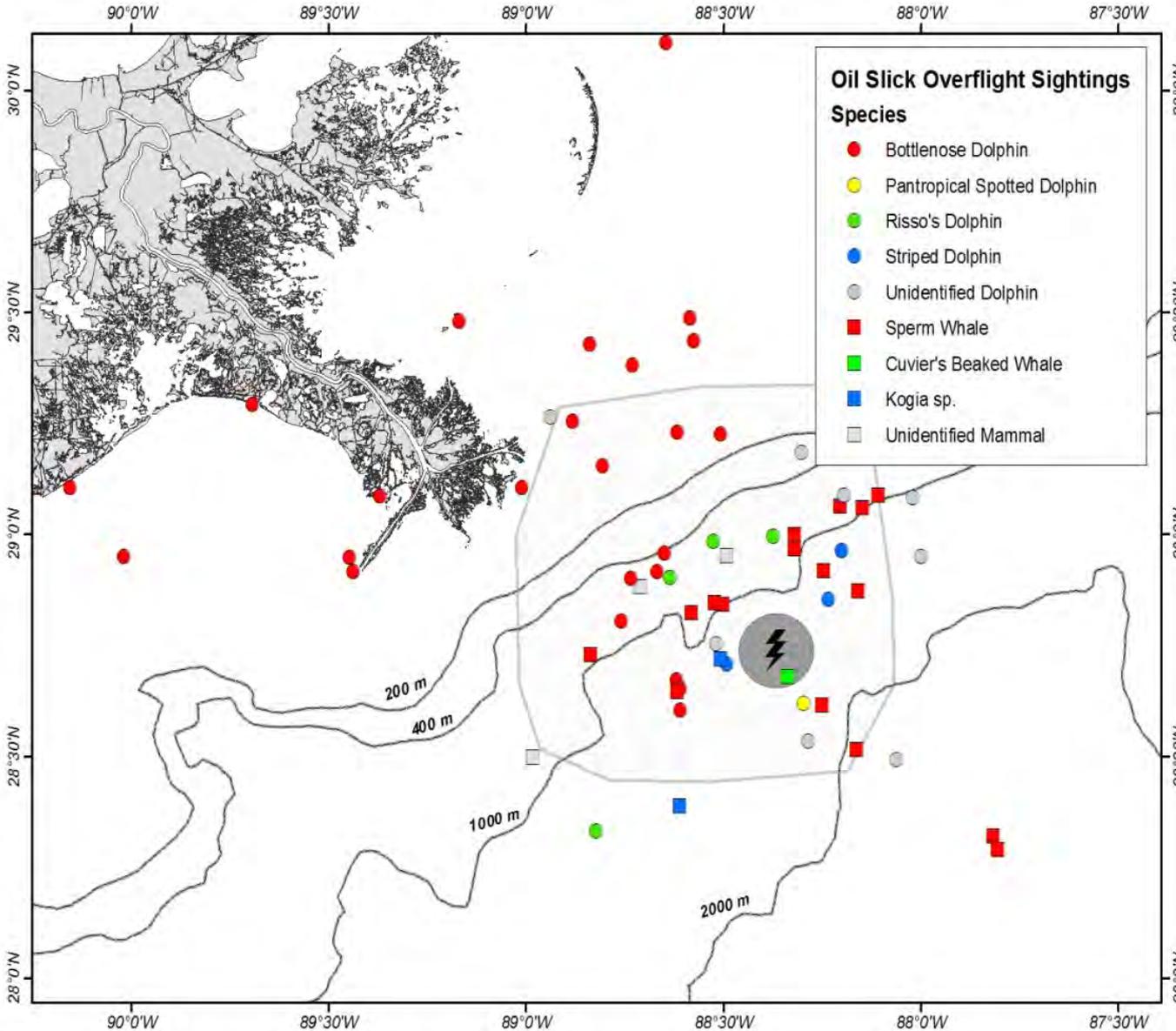
Samples are sent to the NWFSC Laboratory in Seattle, WA for chemical analysis of tissues. NMFS and FDA have worked together to develop a chemical analysis to detect dioctylsulfosuccinate (DOSS) in seafood. DOSS is a surfactant and a major component of Corexit 9500A.





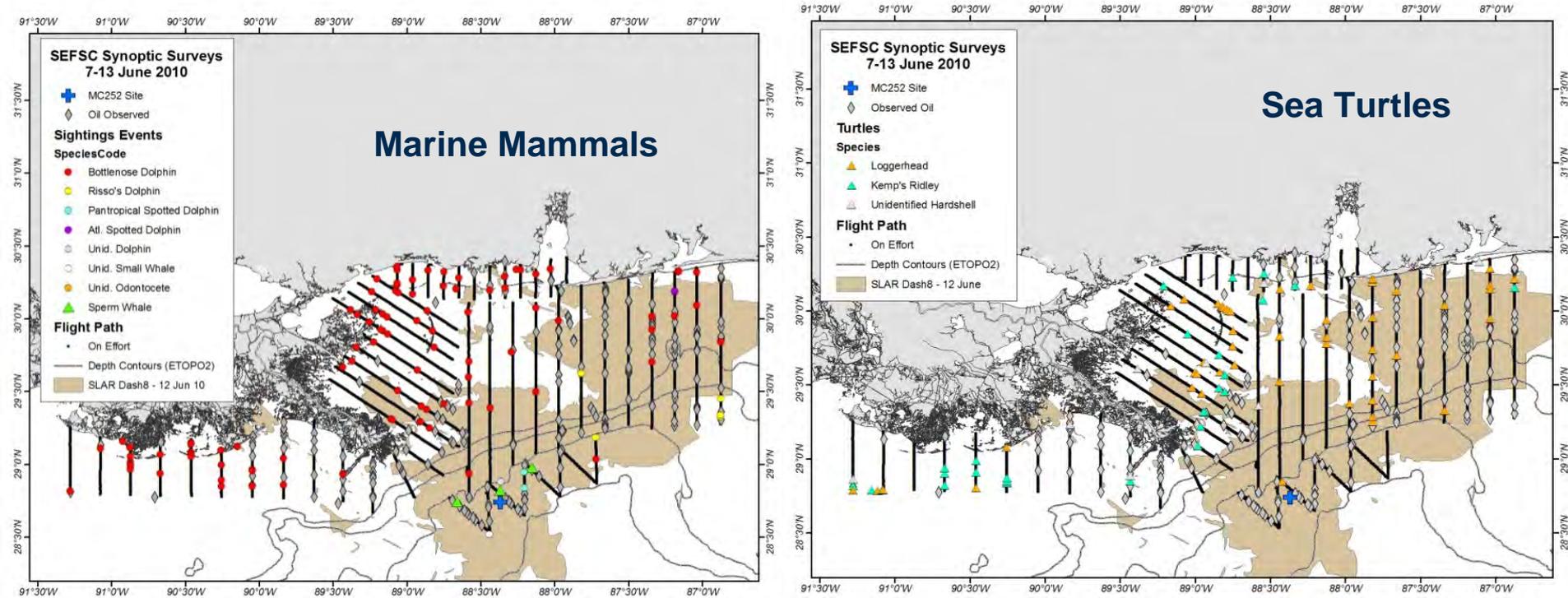
Protected Species Surveys

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

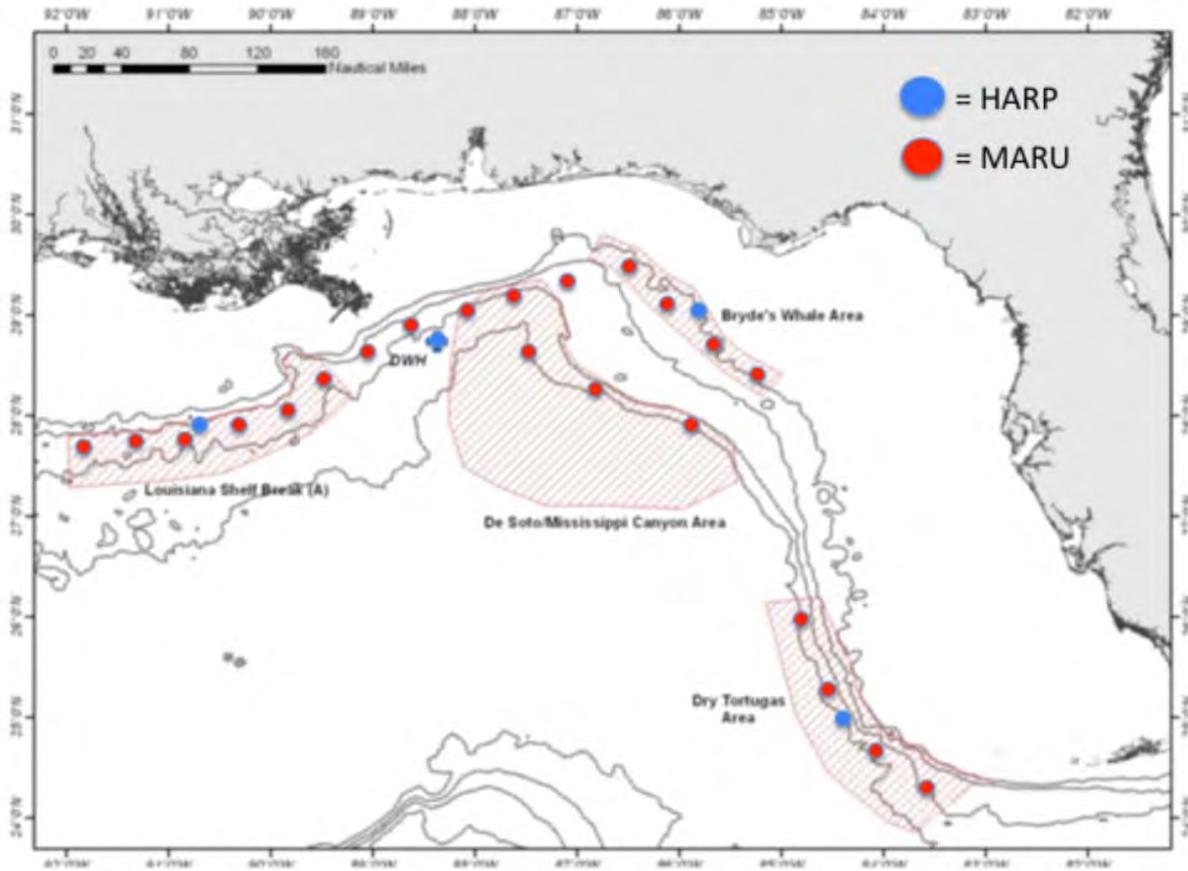


• Transect surveys flown on NOAA Twin Otter airplane. Goal was to quantify any changes in abundance and spatial distribution in response to DWH event.

• 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

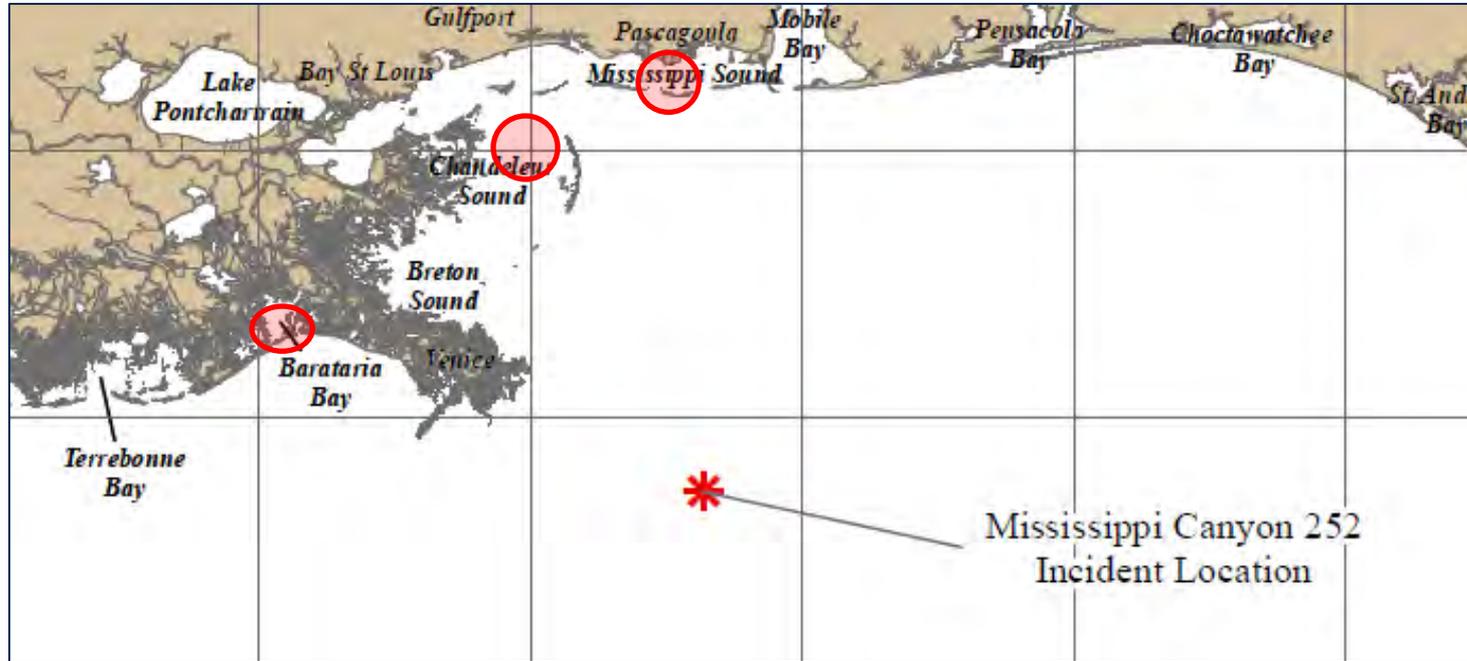
- Deployed 12 satellite-tracking tags on sperm whales for long term monitoring of movements

- 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



Estuarine Bottlenose dolphin Population Studies

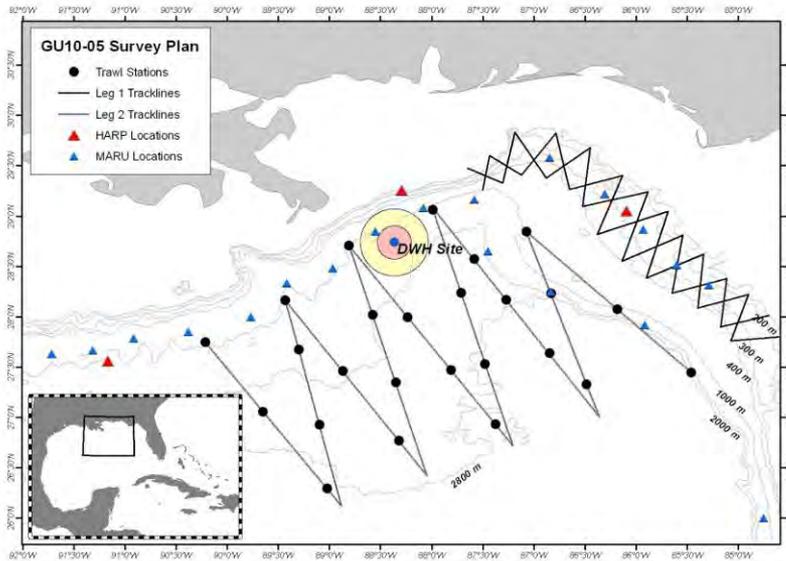


- Joint project between SEFSC, NCCOS, and Chicago Zoological Society.
- Photo-identification mark-recapture studies for abundance of estuarine bottlenose dolphin stocks with different levels of exposure to oil from the event
- Collection of biopsy samples for genetic analysis and assessment of potential exposure and injury
- Sampling initiated in early May and will extend into spring 2011



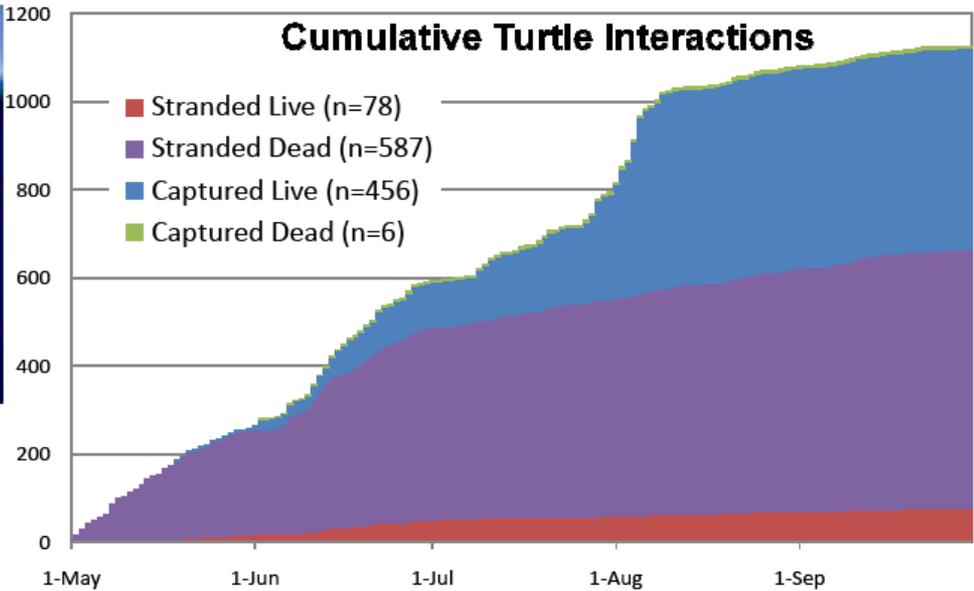


Continuing Work to Assess Impacts to Marine Mammals



Follow-on cruise on NOAA Ship Gordon Gunter to collect additional data on Bryde's whales, recover and re-deploy acoustic monitoring units, and conduct midwater trawl sampling for prey of sperm whales and other oceanic marine mammals. Scheduled for 8 October – 23 November

- Bryde's whale habitat study and midwater prey sampling cruise (departs 8 October)
- Seasonal aerial surveys of the continental shelf through 2011 to track changes in abundance/spatial distribution
- Targeted health assessment studies of estuarine dolphins (in partnership with NCCOS)
- Extend monitoring of estuarine dolphin populations beyond 2011

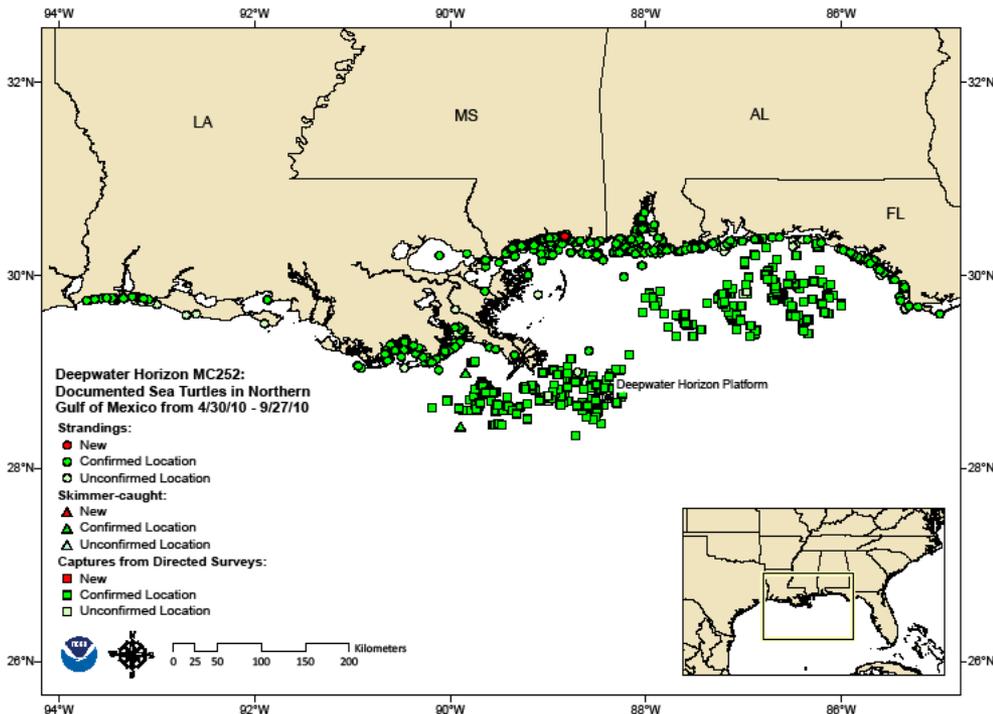


SEFSC:

- Stranding response (including some necropsies/sampling)

Partners:

- Sea turtle at-sea rescue
- Rehabilitation
- At-sea observer program for skimming / burn operations
- Nest marking
- Nest translocation
- Nesting beach observers



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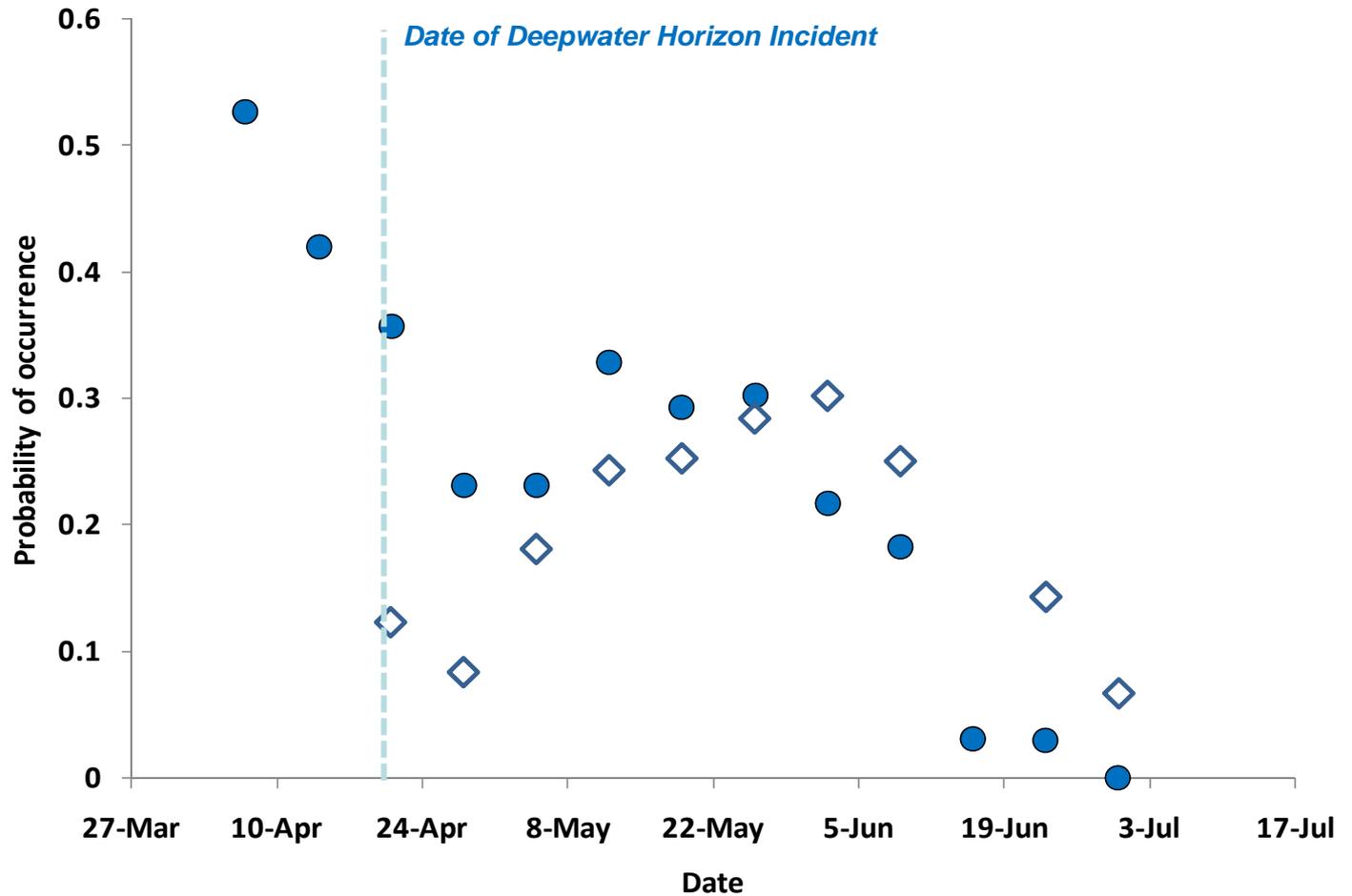
Bluefin Tuna



ICCAT ■ INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS



GOM Historical BFT abundance by date



Adults

Larvae



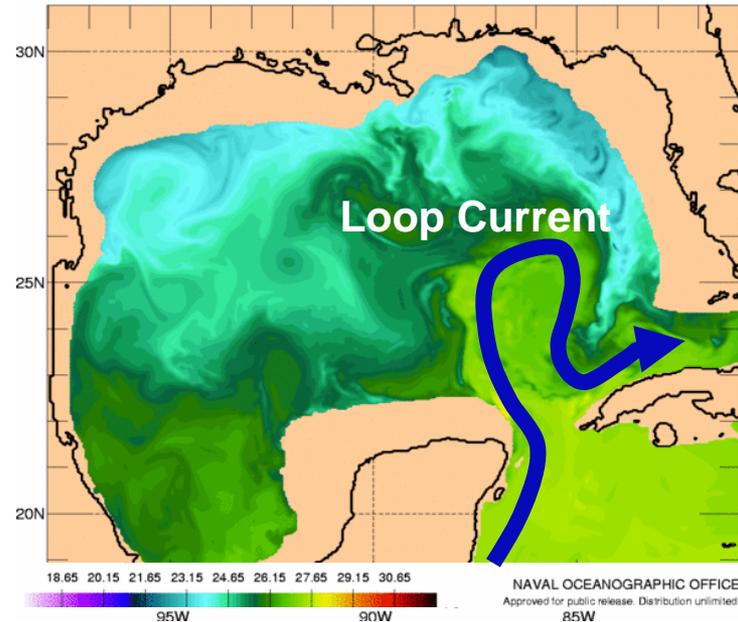
Bluefin Tuna Larvae Gulf of Mexico

Objectives and Background -

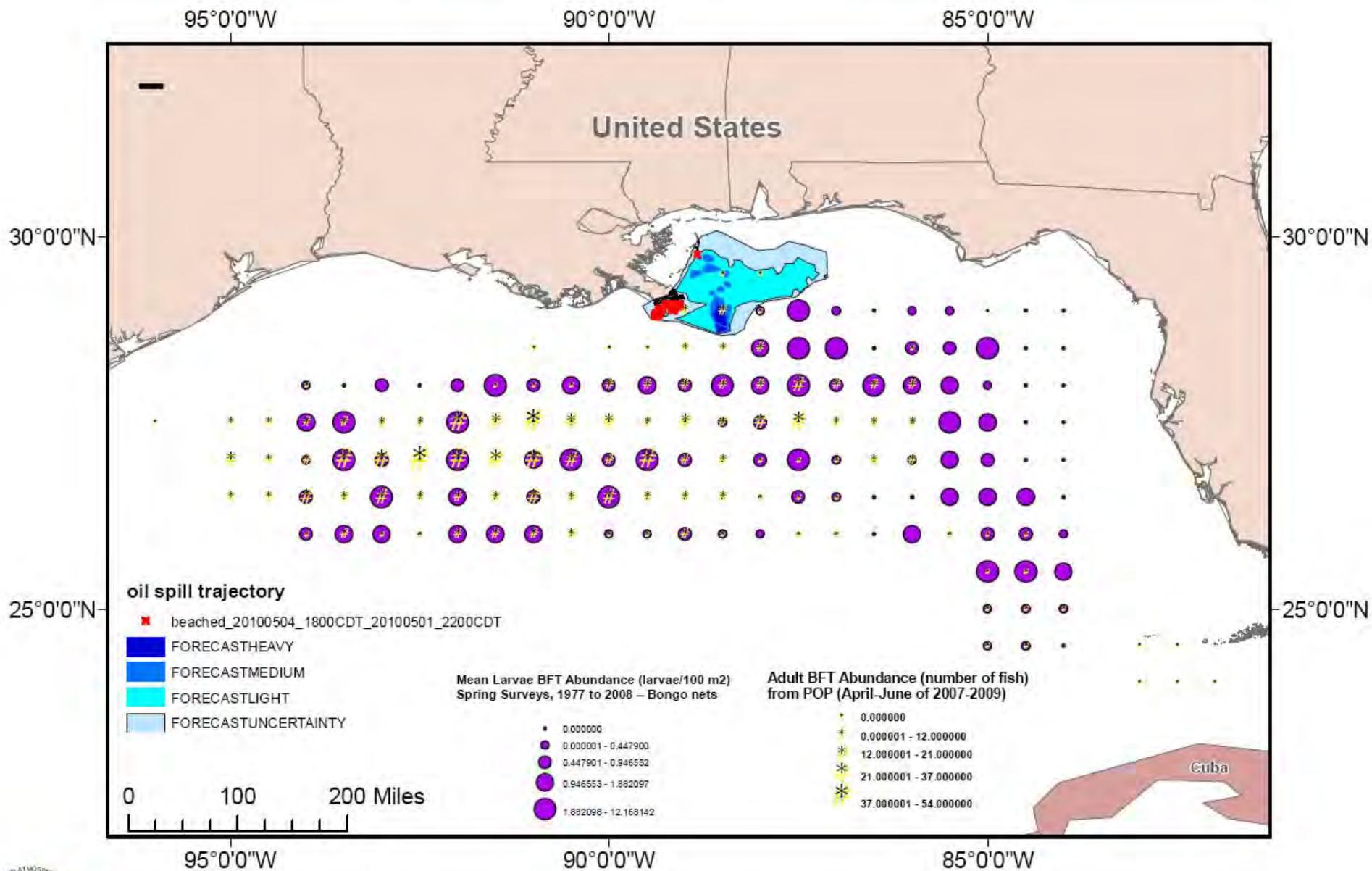
Annual (since 1977) spring plankton surveys (April-June)

Sampling area is affected by the strength and position of the Loop Current and large Loop Current eddies

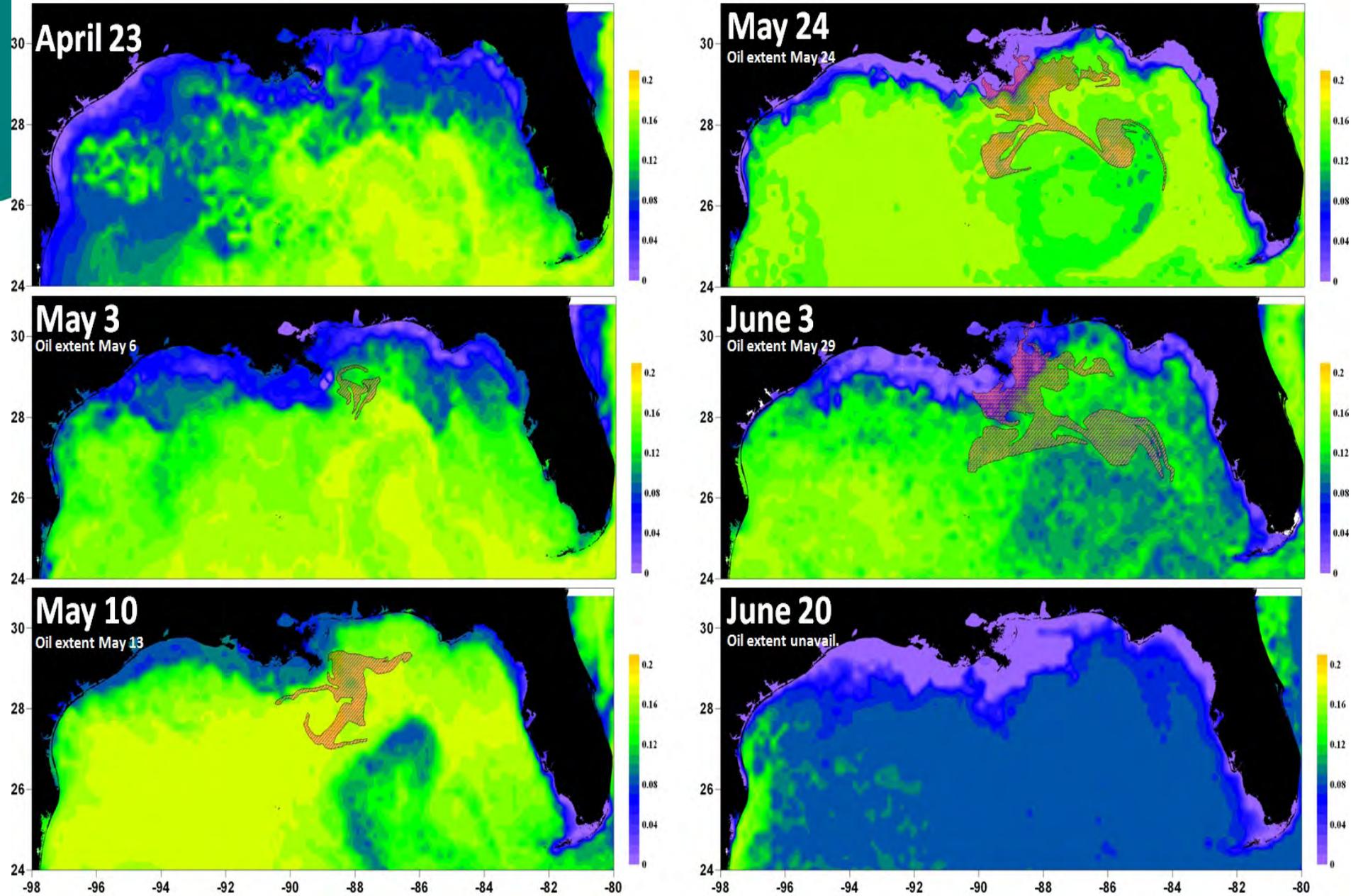
- Ichthyoplankton analyzed pre oil spill in multivariate data set provides baseline ichthyoplankton abundances



Adult and Larvae Bluefin Tuna Abundances



Probability of larval bluefin tuna occurrence, and extent of oil



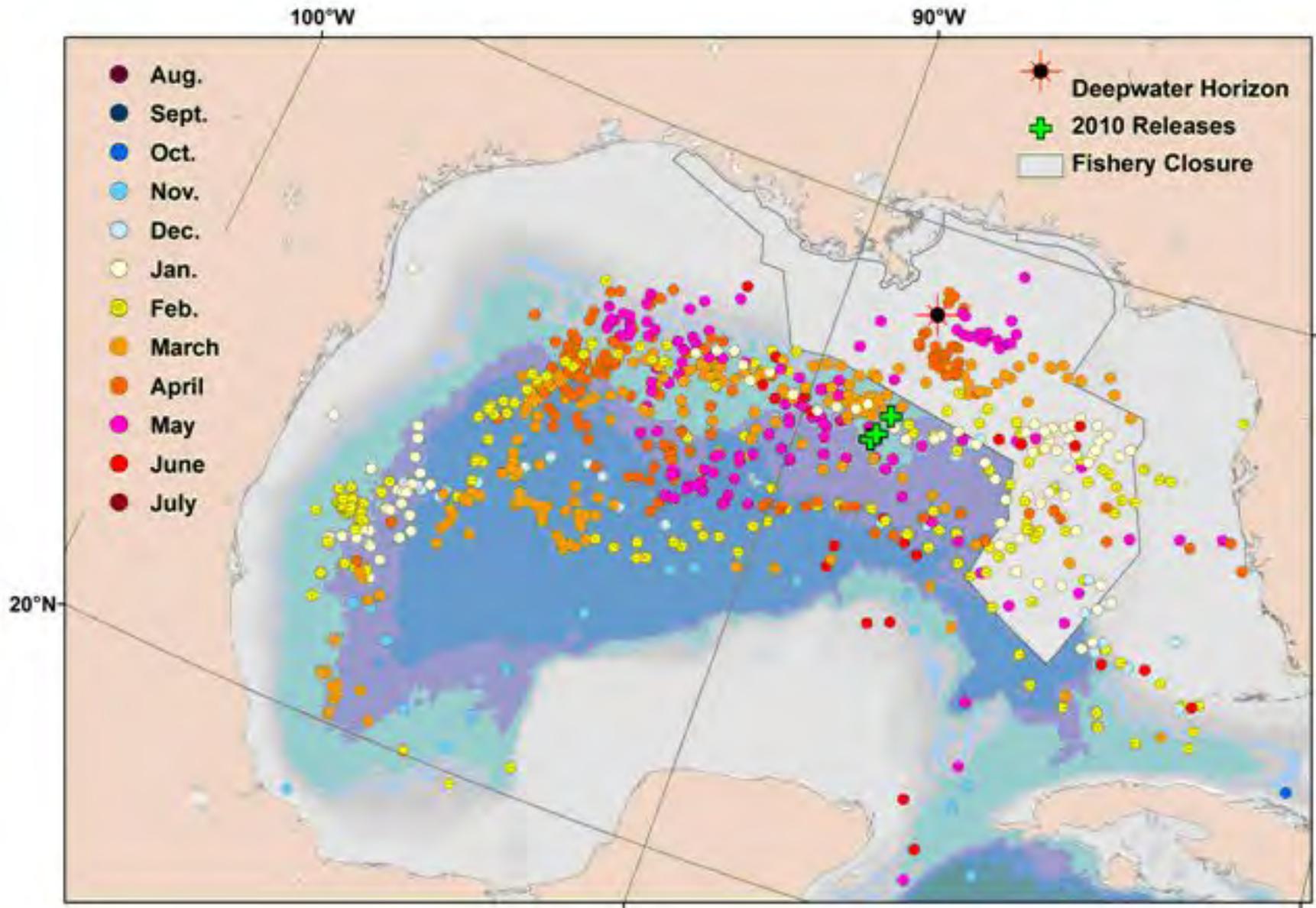
Slide courtesy of John Lamkin and Samantha Whitcraft



Bluefin Tuna - Pop-up Satellite Tagging Program

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





Pre-Oil spill BFT PSAT Tagging Data (13 tags)

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

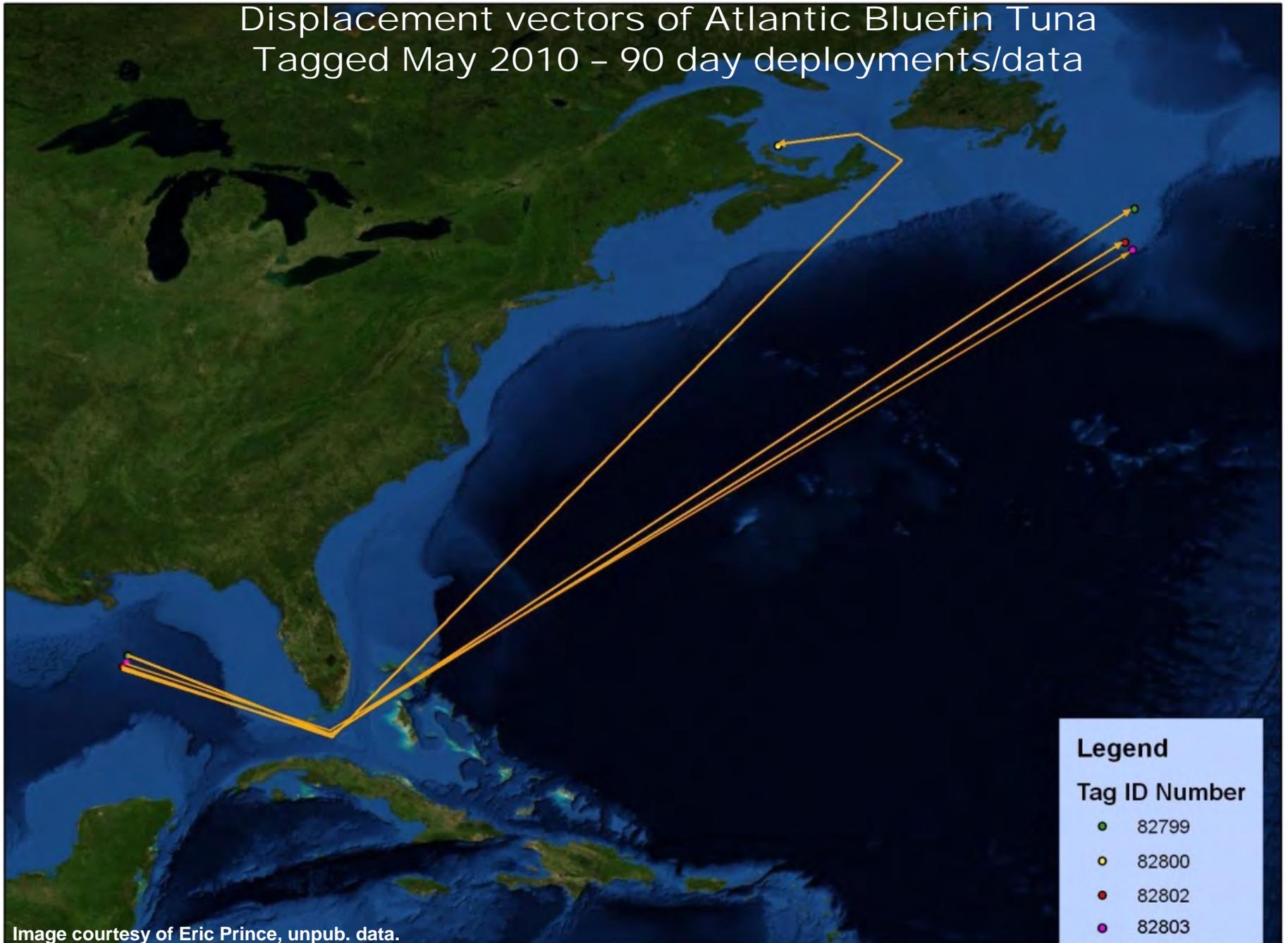


Image courtesy of Eric Prince, unpub. data.

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Kalman filter track of the recovered PSAT

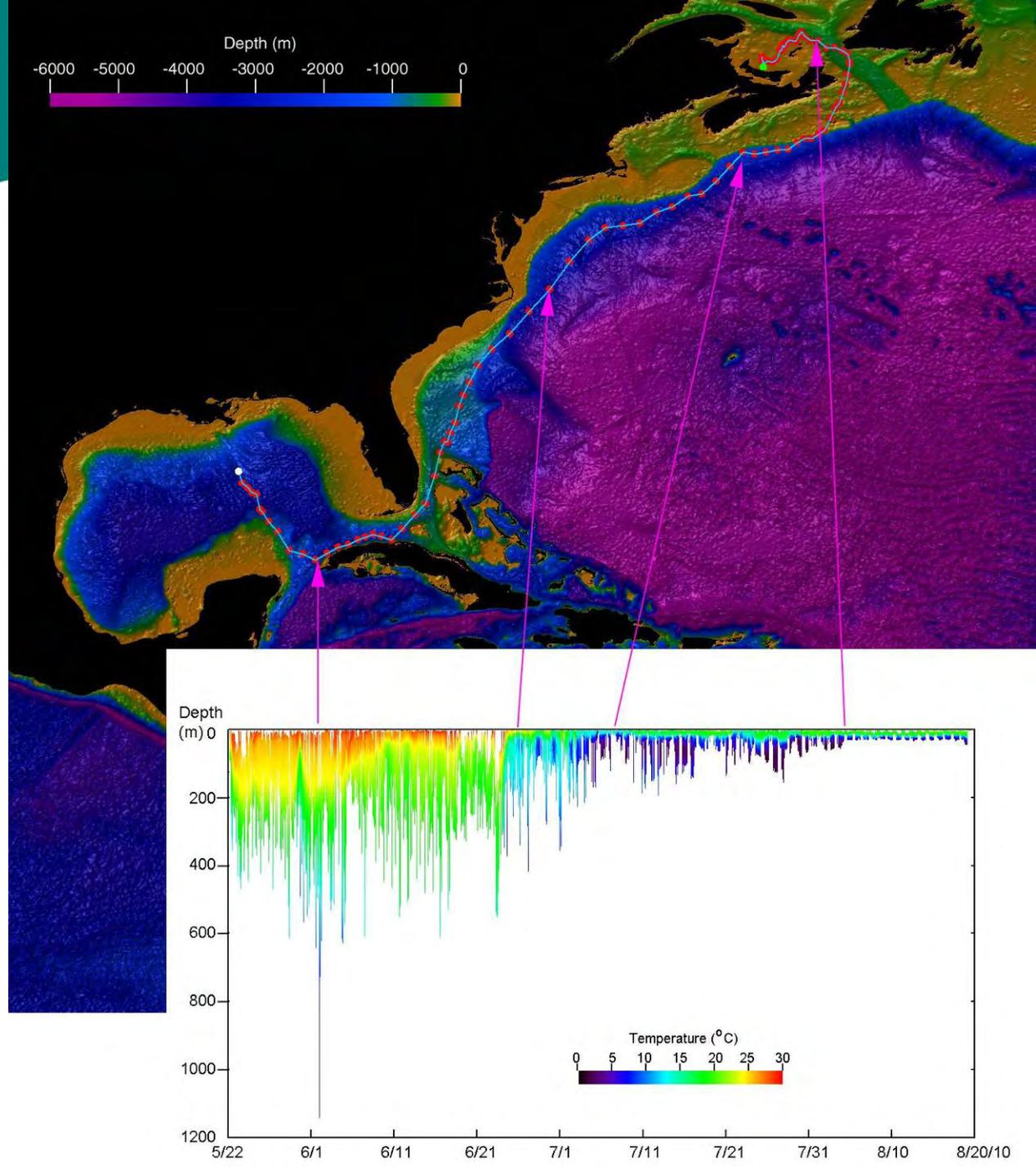


Image courtesy of Eric Prince, unpub. data.



Plankton Sampling - SEAMAP

(Southeast Area Monitoring and Assessment Program)
State and Federal Cooperative Research Program

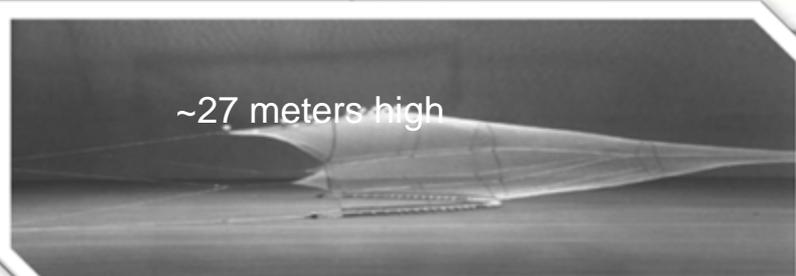


SEFSC/SEAMAP Fishery-Independent Surveys

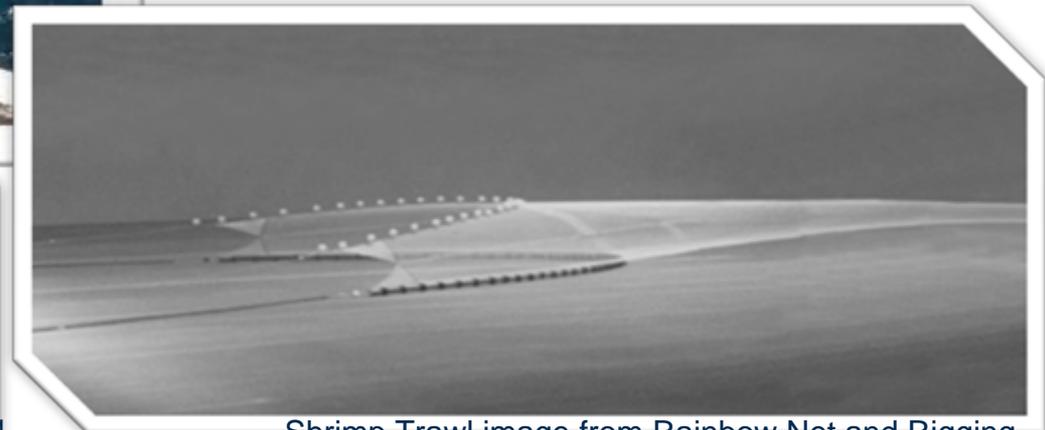
- Bottom Longline
- Shrimp/Groundfish Trawl
- Small Pelagics/Deepwater Trawl
- Reef Fish
- Plankton



~27 meters high



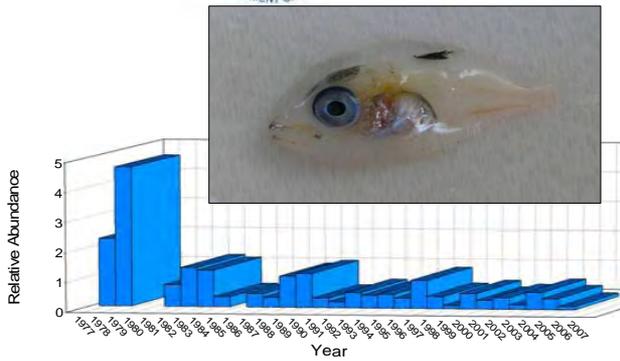
Semi-pelagic Trawl image from Rainbow Net and Rigging



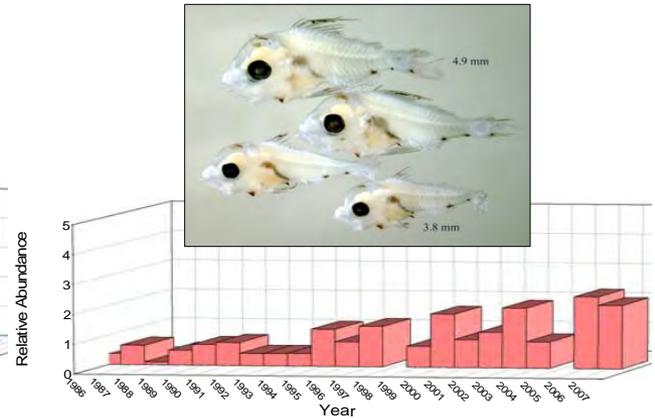
Shrimp Trawl image from Rainbow Net and Rigging



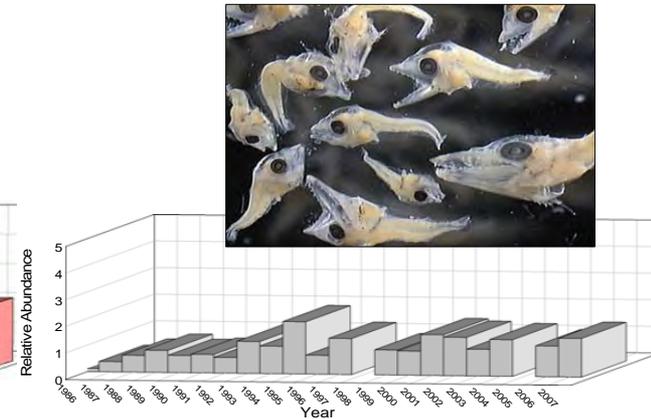
SEAMAP Larval Indices



Bluefin Tuna
(*Thunnus thynnus*)



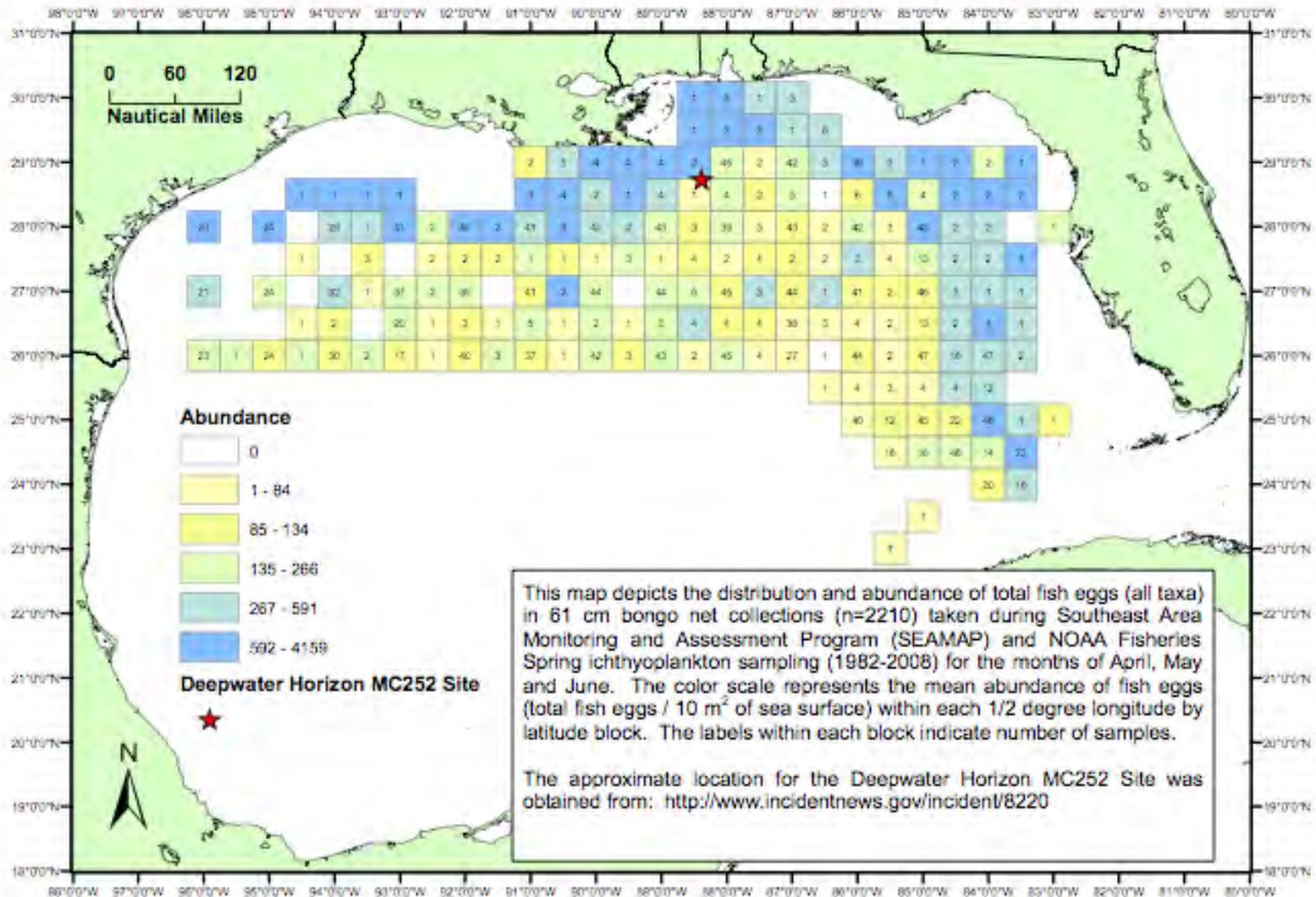
Red Snapper
(*Lutjanus campechanus*)



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.

Distribution and abundance of total fish eggs (all taxa) in bongo net collections taken during Spring ichthyoplankton sampling from 1982 to 2008



Additional plankton collections



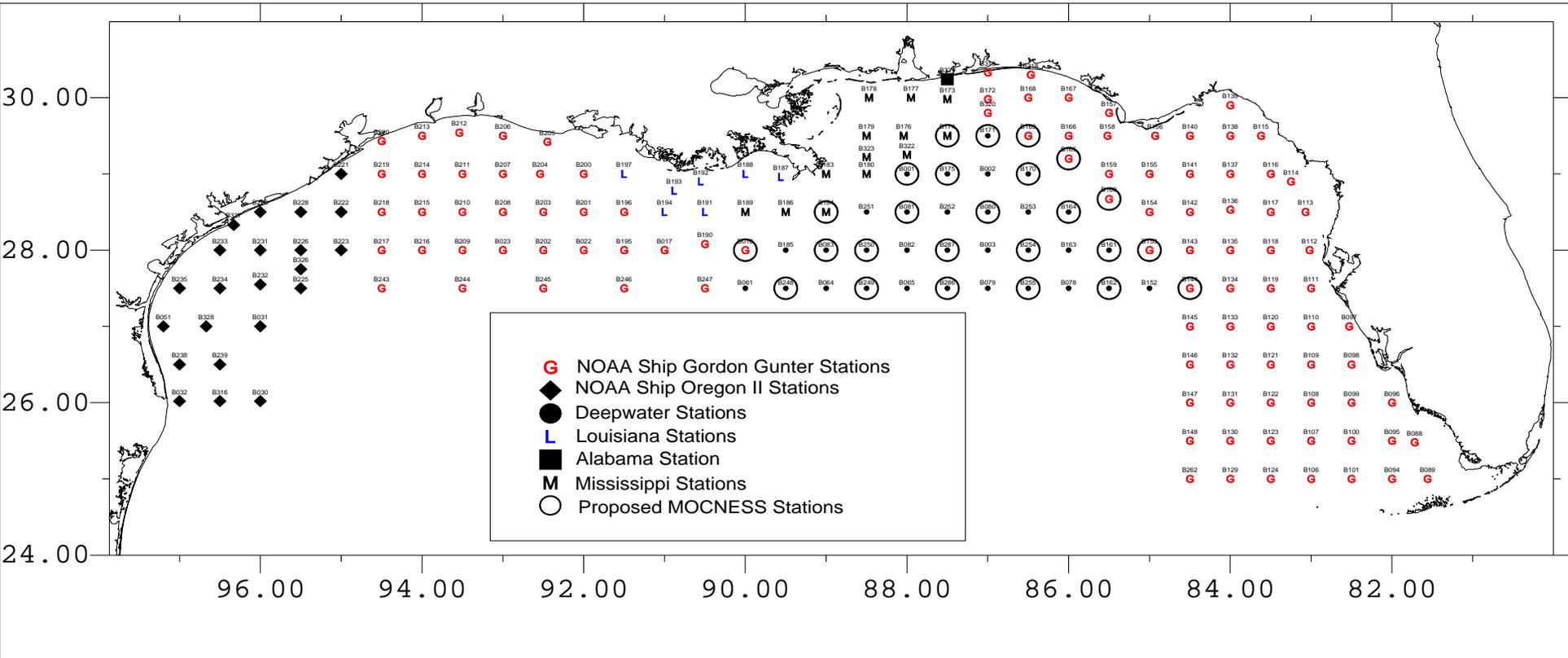
VESSEL/CRUISE	INCLUSIVE DATES	No. of Stations	No. Plankton Samples	Environmental Data
FRV Gordon Gunter 1001	4/21 - 5/23	93	1015	500
R/V Caretta	4/30 - 5/16	13	13	13
Chartered fishing vessels	4/30 - 6/15	92	92	n/a
FRV Gordon Gunter 1002*	5/28 - 6/3	6	28	6
FRV Oregon II*	6/26 - 7/31	35	136	35
FRV Delaware 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 Oil Spill (DWHOS) NRDA SEAMAP 2010 Fall Plankton Sampling Cruise August 24 to September 29, 2010



Cooperation of SEAMAP Partners and adaptive multi-tasking (e.g. longline survey) resulted in most comprehensive survey ever

Results: 185 stations sampled yielding 376 bongo, 161 neuston, 189 MOCNESS, 726 CUFES samples; 555 Chl a measurements; 200 CTD profiles; and oceanic bird counts.

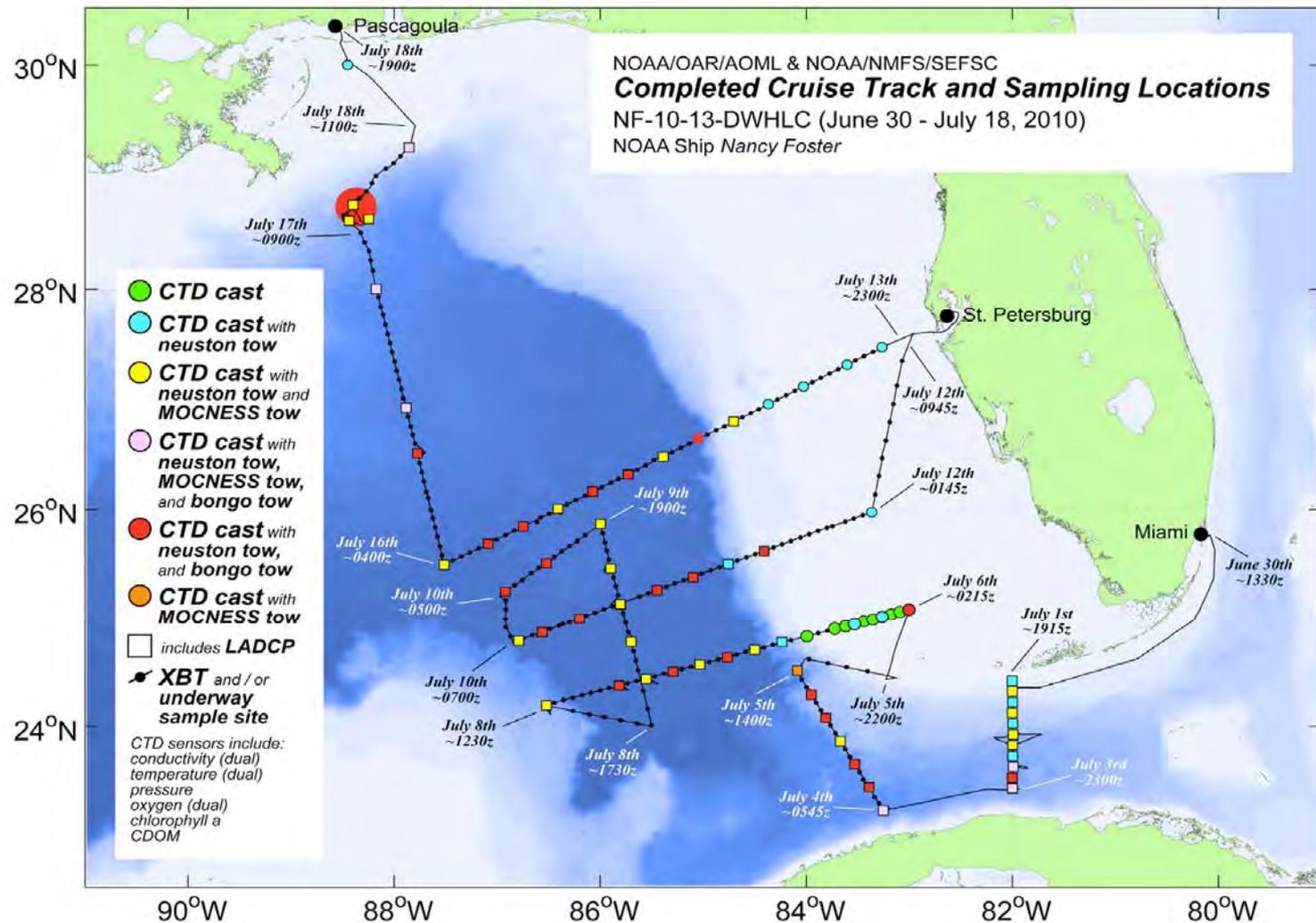
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Additional DWH Plankton Work

Potential Impacts of DWH Oil Spill via the Loop Current on Downstream Marine Ecosystems

- Joint cruise - Atlantic Oceanography and Meteorology Laboratory, and SEFSC
- Assess Connectivity and Baseline conditions (Water Column and Plankton)





Sampling larval fish in the Deepwater Horizon spill zone

R/V Tommy Munro

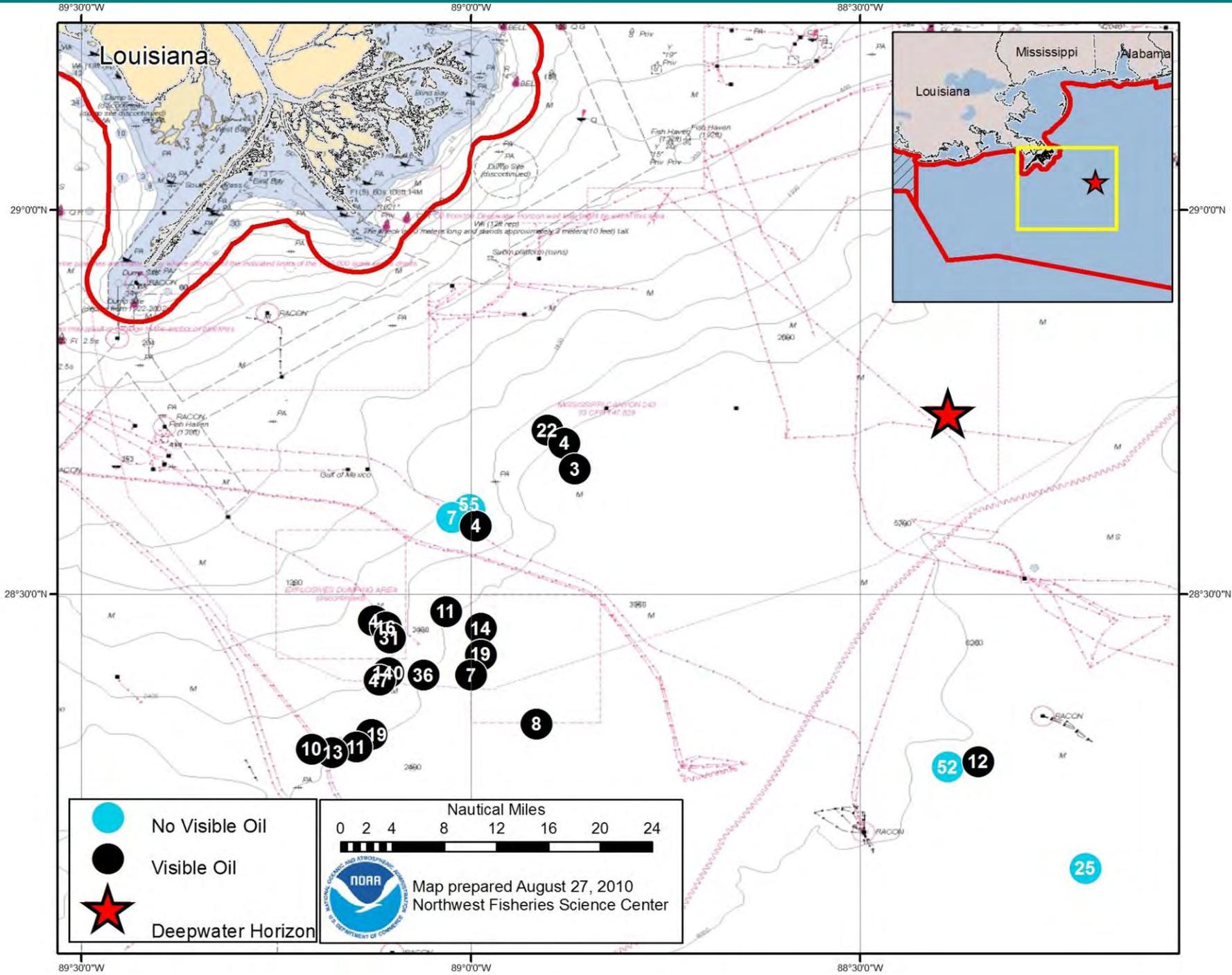
July 28 – August 6, 2010

OBJECTIVE: Collect larval tuna, mackerel, and related species from pelagic surface waters for analyses of oil exposure and toxicity

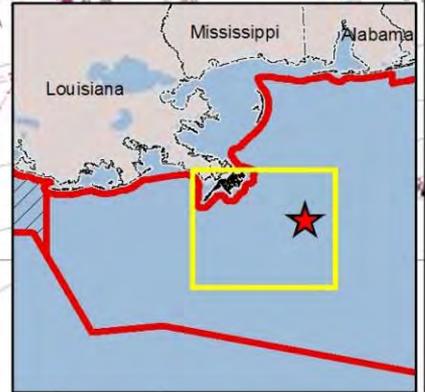
PARTICIPANTS: NWFSC (oil toxicology), SEFSC (larval fish I.D.), Stanford University (tuna physiology), Ocean Media Center (video documentation), U. Southern Mississippi (captain and crew)

METHODS: Shallow plankton tows, on-board larval I.D., cryogenic preservation, sample fixation, bulk plankton and H₂O analytical chemistry, video imaging





Louisiana



29°00'N

29°00'N

28°30'N

28°30'N

- No Visible Oil
- Visible Oil
- ★ Deepwater Horizon

Nautical Miles

0 2 4 8 12 16 20 24

Map prepared August 27, 2010
Northwest Fisheries Science Center

89°30'W

89°00'W

88°30'W

25



Sampling larval fish in the Deepwater Horizon spill zone

R/V Tommy Munro

July 28 – August 6, 2010

OUTCOMES:

~ 900 individually flash-frozen scombrid larvae

~ 900 individually fixed larvae

bulk plankton and water samples from oiled and un-oiled stations

NEXT STEPS :

- RNA extraction
- qualitative/quantitative analyses of gene expression
- chemical analysis of bulk plankton & water samples
- estimates of oil-induced larval loss of managed populations
- corroborative laboratory studies





Fishery-Independent SEFSC/SEAMAP Surveys

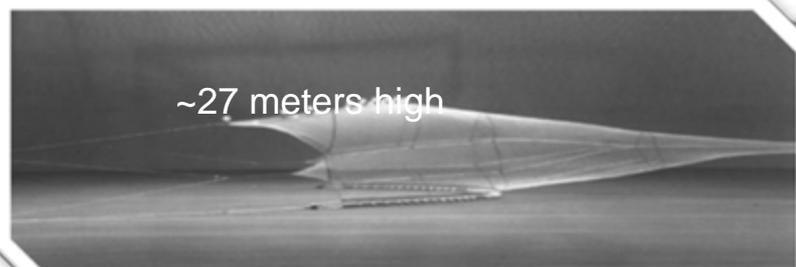


Fishery-Independent SEFSC/SEAMAP Surveys

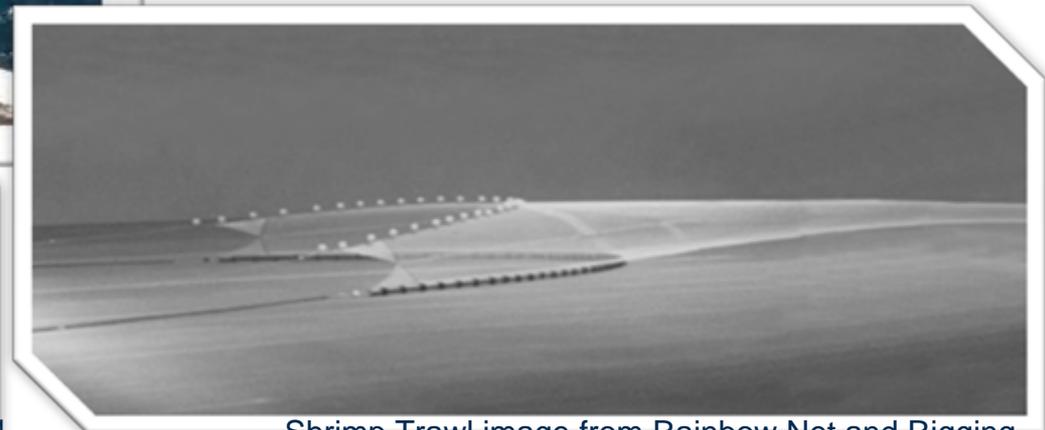
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Semi-pelagic Trawl image from Rainbow Net and Rigging



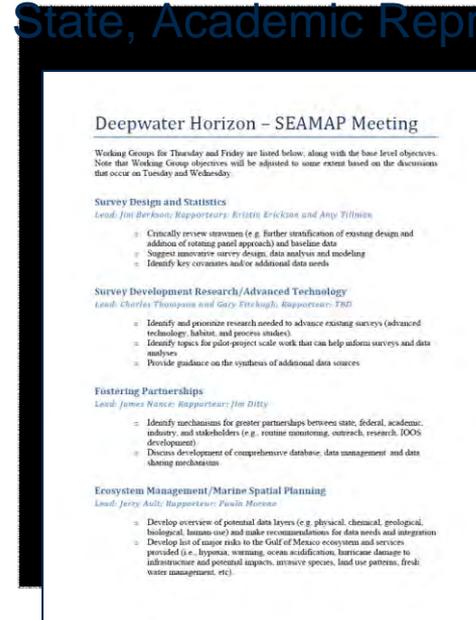
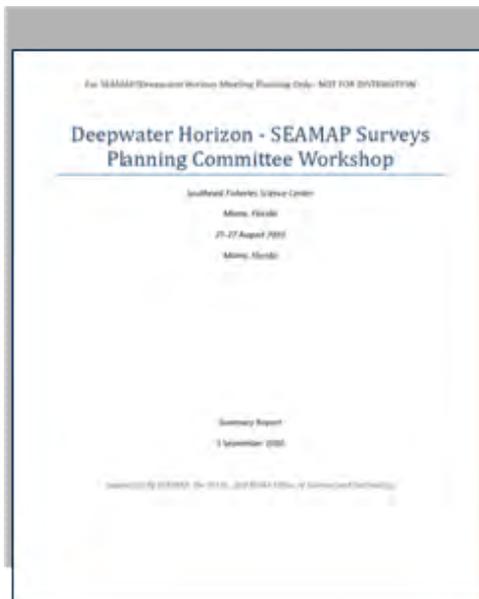
Shrimp Trawl image from Rainbow Net and Rigging



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



OPEN ACCESS Freely available online

Perspective

Integrated Ecosystem Assessments: Developing the Scientific Basis for Ecosystem-Based Management of the Ocean

Phillip S. Levin*, Michael J. Fogarty, Steven A. Murawski, David Fluharty

A series of prominent and controversial papers about the state of marine ecosystems has

point where large-scale, comprehensive EBM is broadly accepted as crucial for effective marine conservation and resource management [15].

While some policy makers clearly grasp the utility of an EBM approach, implementation of EBM in marine ecosystems is a significant challenge. Little practical information is available on how to attain the goals of EBM. IEAs, as we envision them, do not necessarily supplant single-sector management; instead, they inform the management of diverse, potentially conflicting ocean-use sectors. As such, we view IEAs as a necessary supplement to, and extension of, single-species and single-sector approaches.

attaining the goals of EBM. IEAs, as we envision them, do not necessarily supplant single-sector management; instead, they inform the management of diverse, potentially conflicting ocean-use sectors. As such, we view IEAs as a necessary supplement to, and extension of, single-species and single-sector approaches.

A Five-Step Process for IEAs

Below we outline five key steps that,

from a vague principle to a central paradigm underlying living marine resource policy in the United States [10,11]. EBM differs from conventional resource management in that it defines management strategies for entire systems, not simply individual components of the ecosystem [12]. As a consequence, EBM takes into account interactions among ecosystem components and management sectors,

possibly incommensurable objectives is feasible within this general setting. In marine ecosystems, issues span sectors as diverse as fisheries, tourism, energy, shipping, real estate, agriculture, and forestry (among many others). Despite the complexity of the issues, aspects of the IEA framework have been successfully used to guide



Thank you

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John Incardona, Kate
Mansfield

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working diligently on LMRs
in the GOM in response to
DWH

