Offshore Environments

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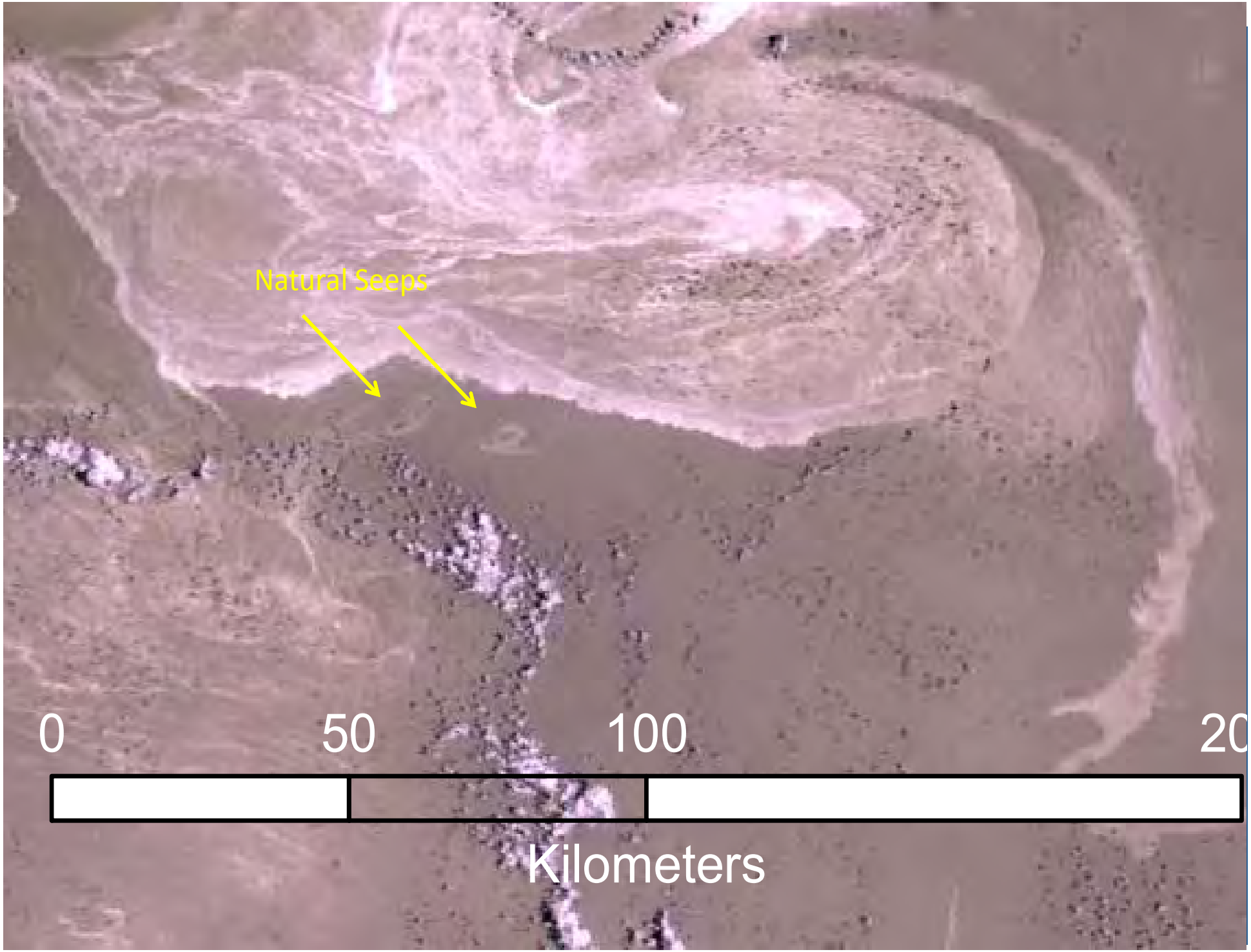
National Institute for Undersea Science and Technology

University of Mississippi

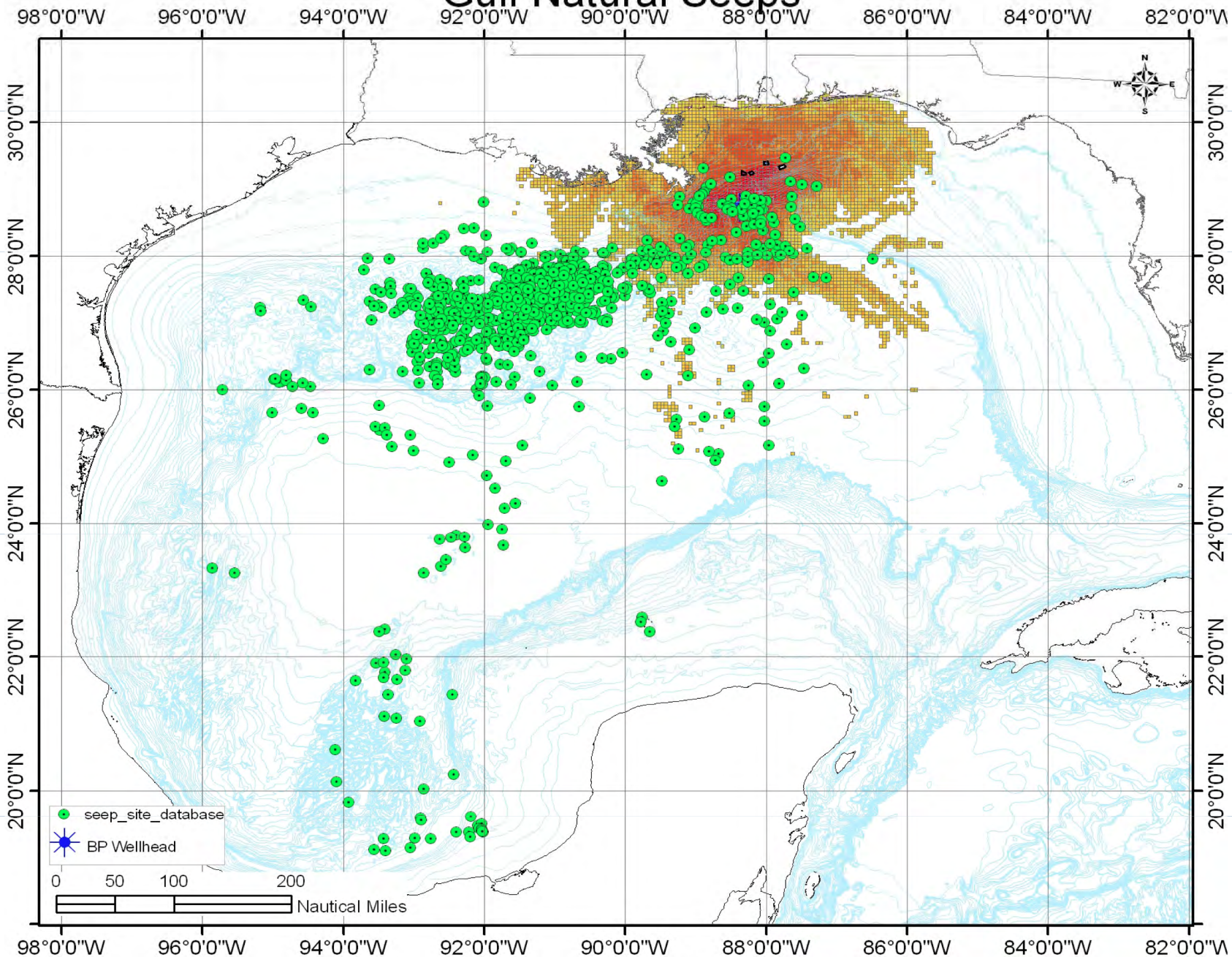
Topics

- Seeps
- Coral communities
- Deepwater plume
- "Oil Snow"
- Where is the oil now?
- In the news
- GRI New Projects

Surface oil at height of BP discharge
Natural Seeps
0
50
100
200
Kilometers

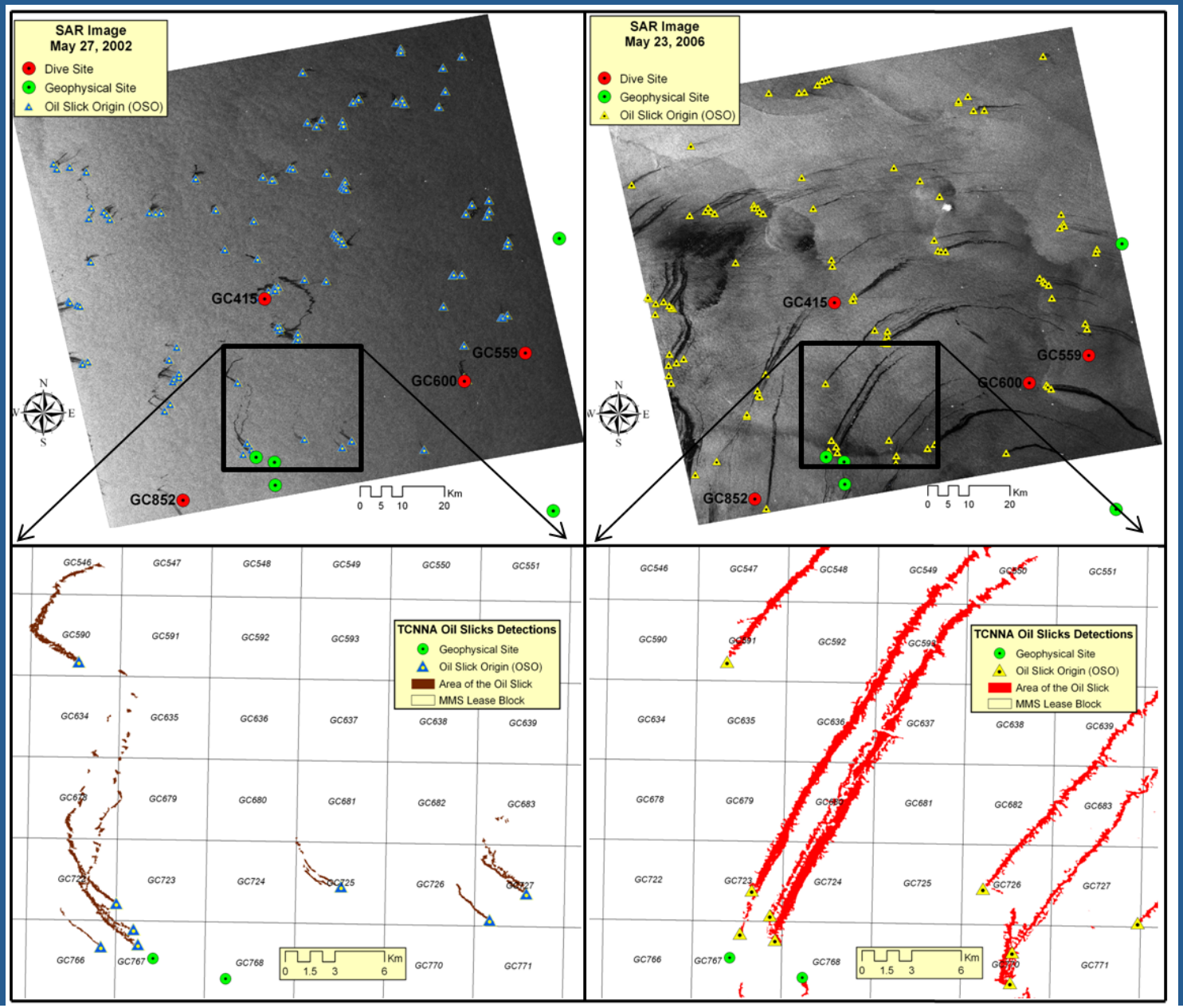

Natural Seeps
0
50
100
20
Kilometers

Gulf Natural Seeps



Annual dose:
~400,000 bbl oil and substantial gas

Satellite Seep Detection



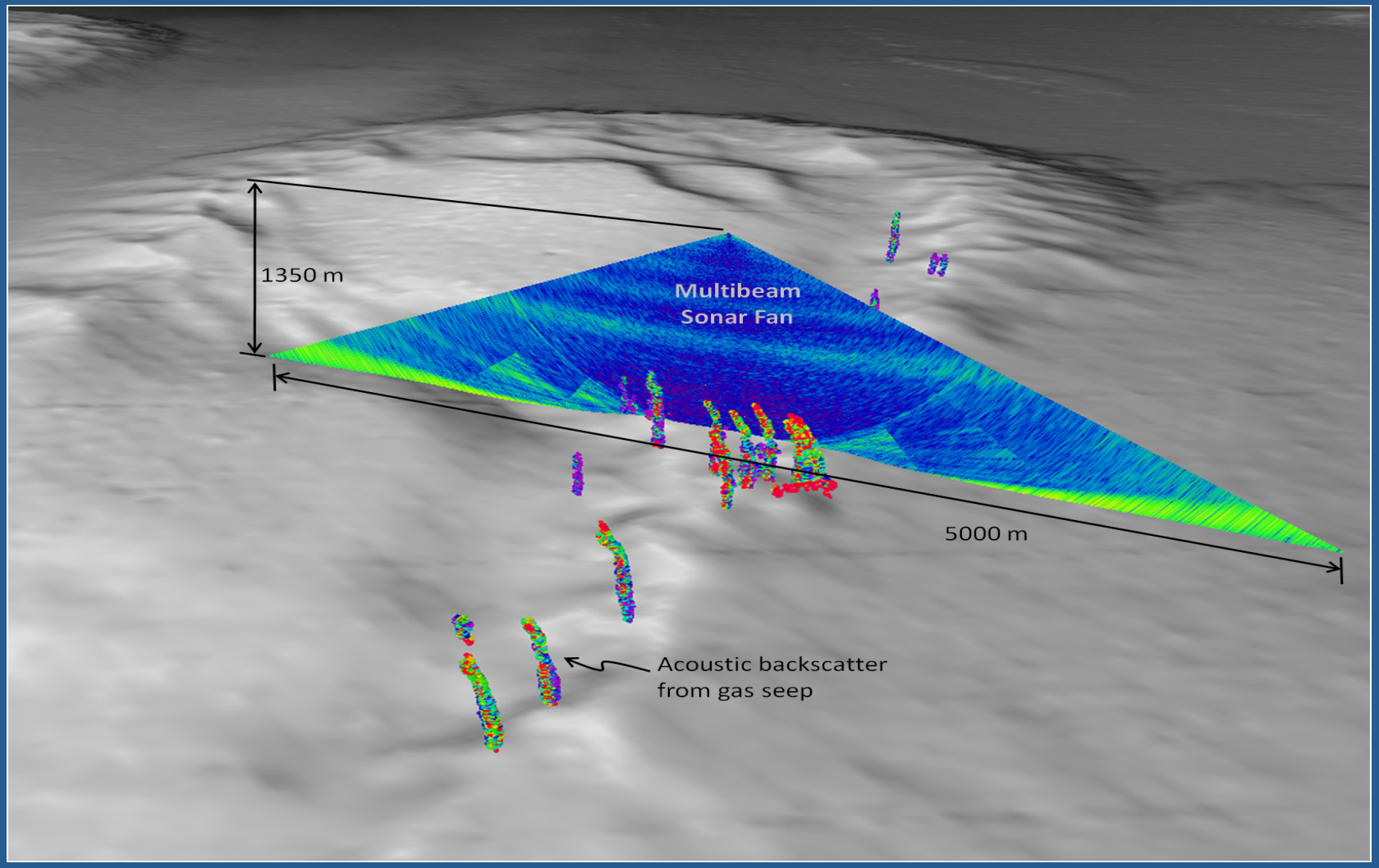


Image produced by the University of New Hampshire Center for Coastal and Ocean Mapping/Joint Hydrographic Center using IVS Fledermaus software.

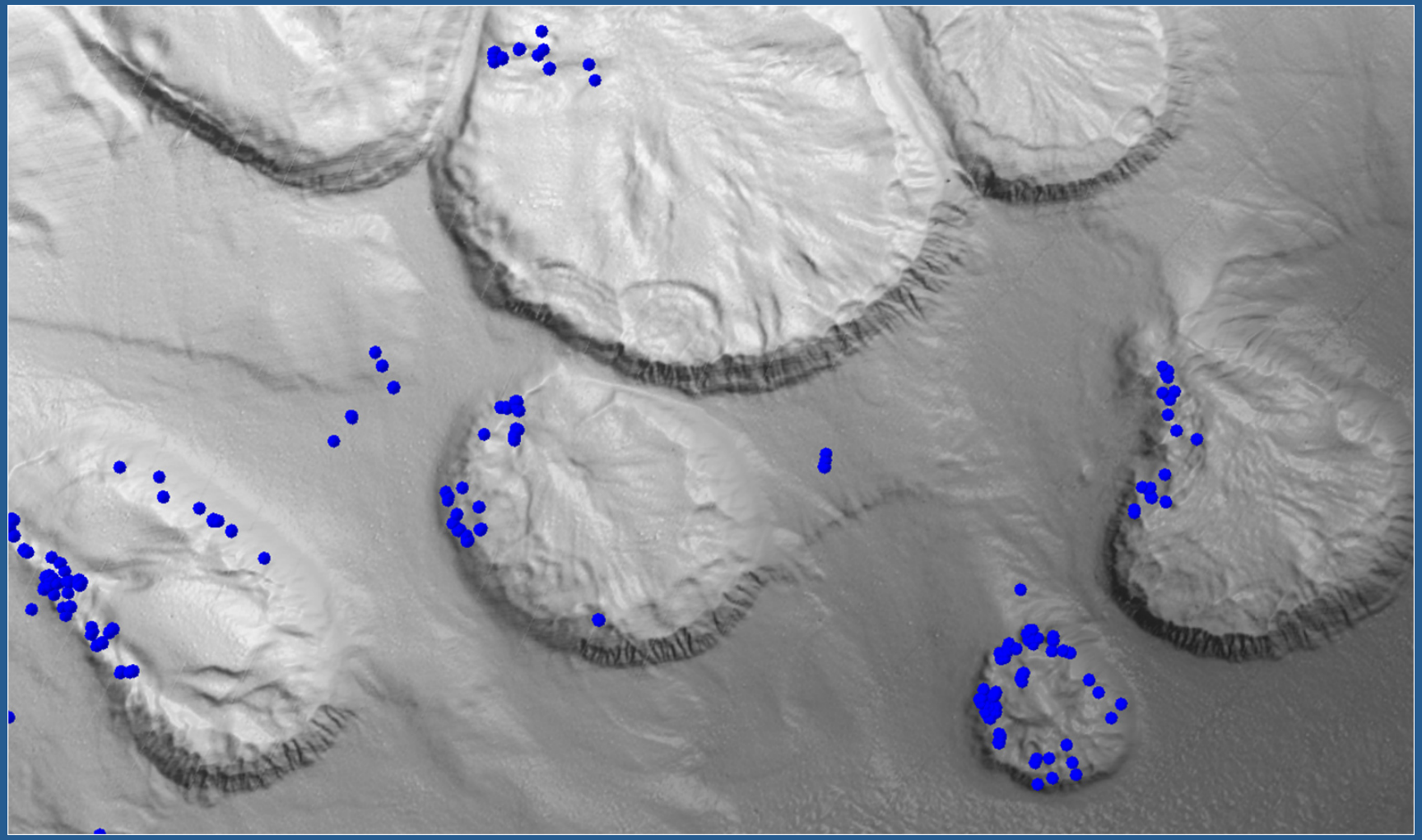
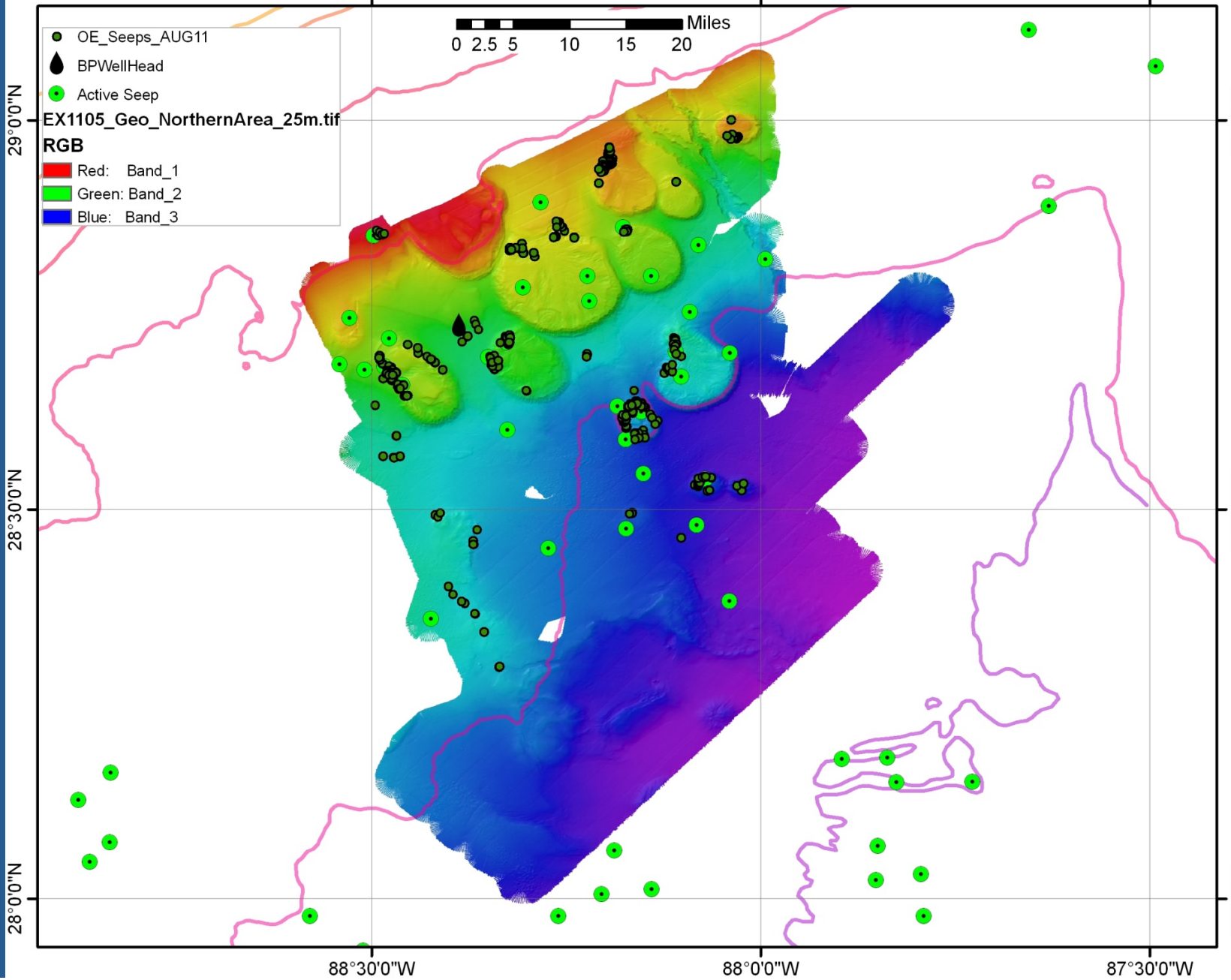


Image produced by the University of New Hampshire Center for Coastal and Ocean Mapping/Joint Hydrographic Center using IVS Fledermaus software.

Satellite Seeps v OE Acoustic Survey Seeps



Natural Seep Fauna & Habitats

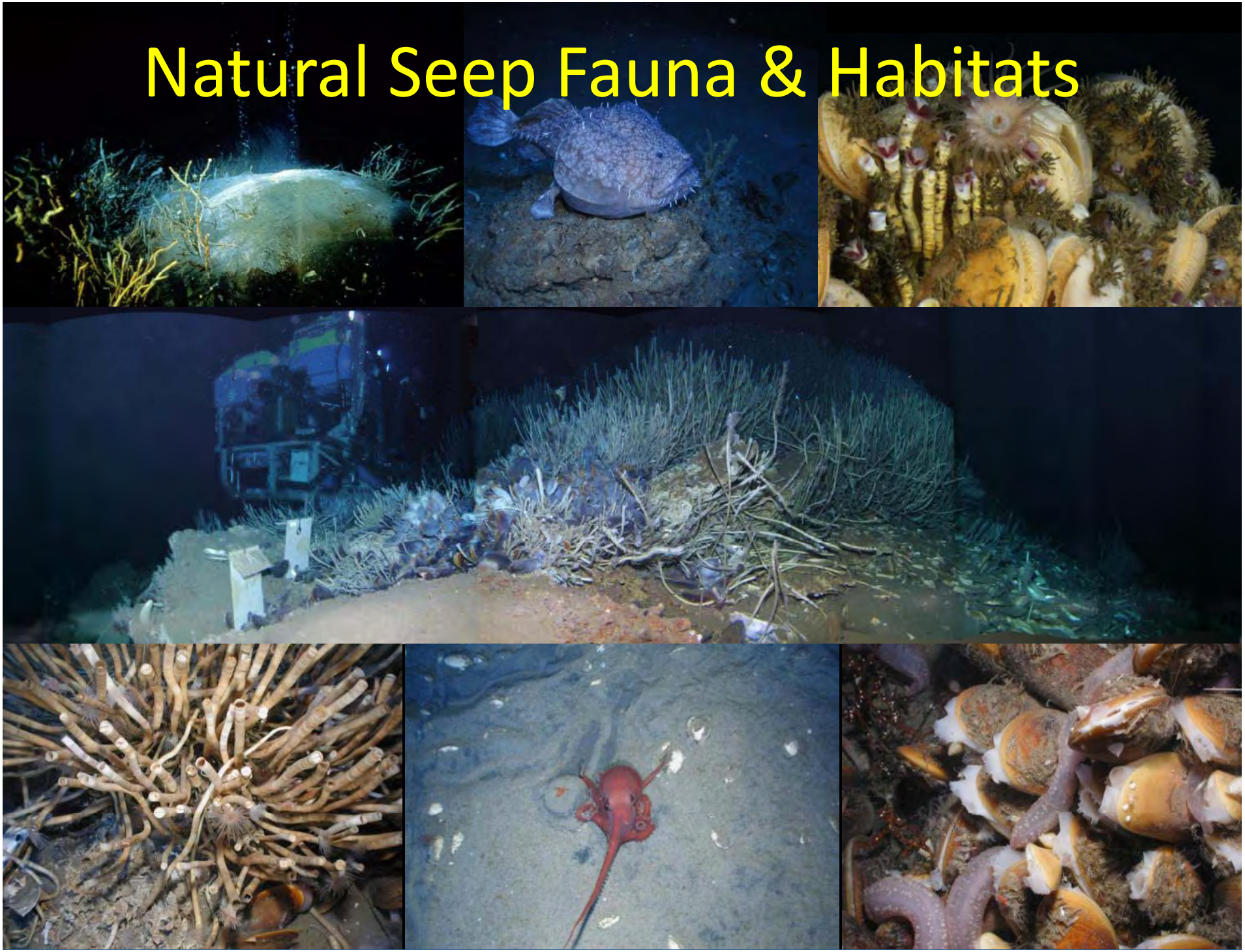
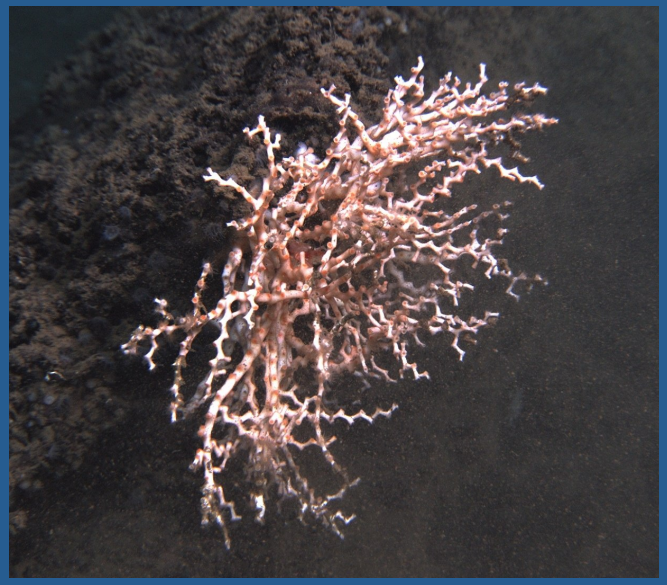
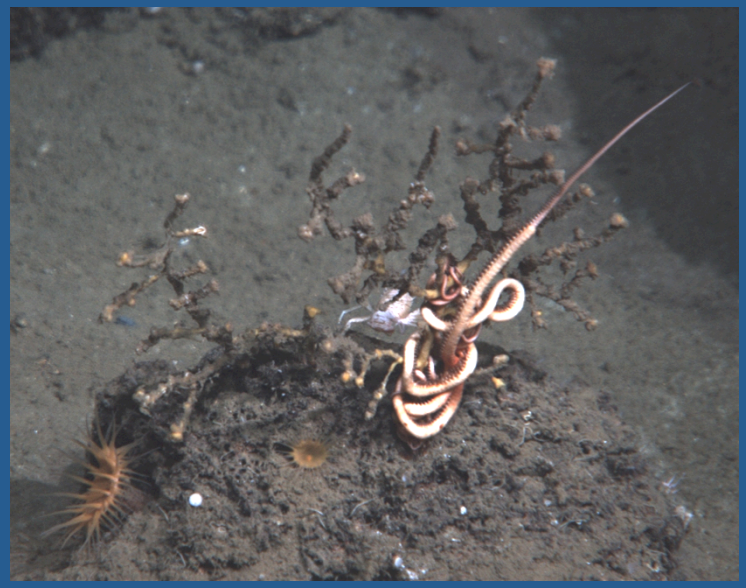


Photo courtesy of Chuck Fisher

Recently and severely impacted corals and associates

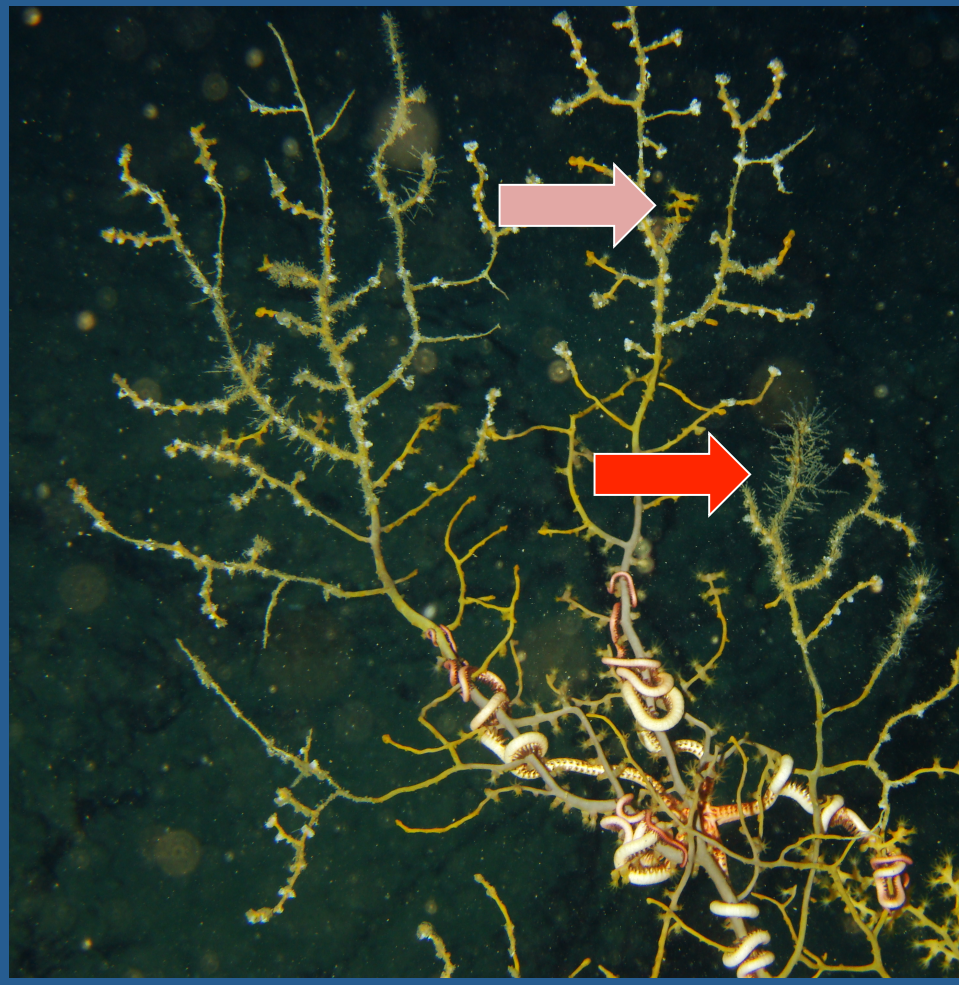




Courtesy Chuck Fisher

Paramuricea A-10 at MC 338

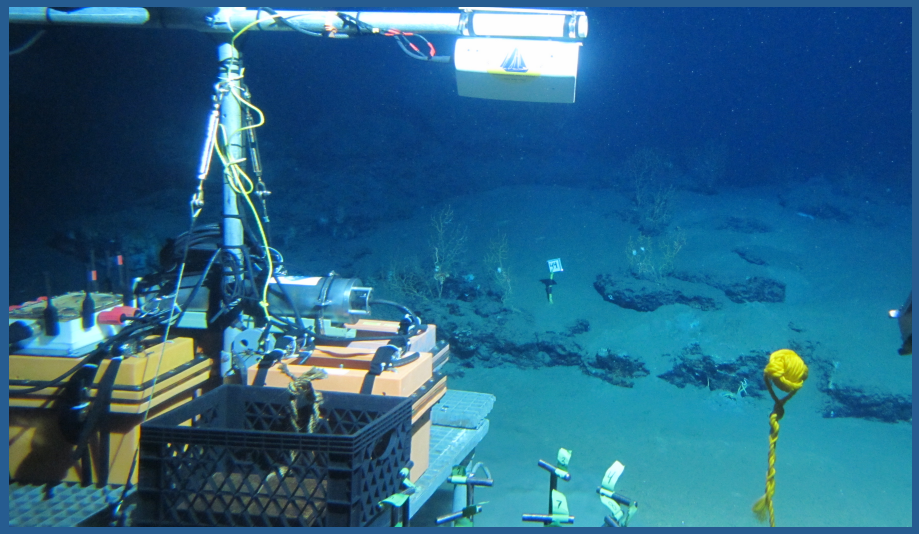
November 2010



March 2011

(At least) Three big questions remain:

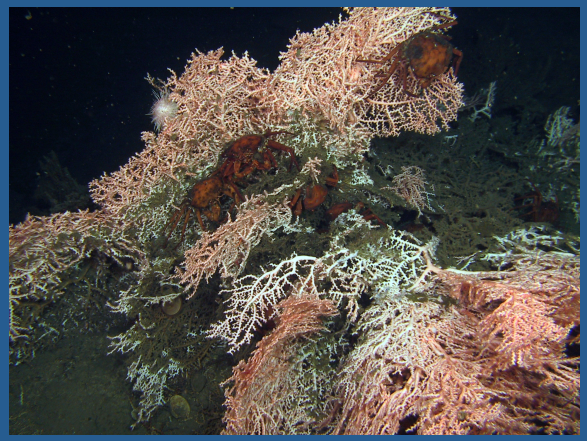
2) What is the long term effect of the acute impact?
Monitor affected sites (e.g. MC 338 and MC 118)



Courtesy Chuck Fisher

(At least) Three big questions remain:

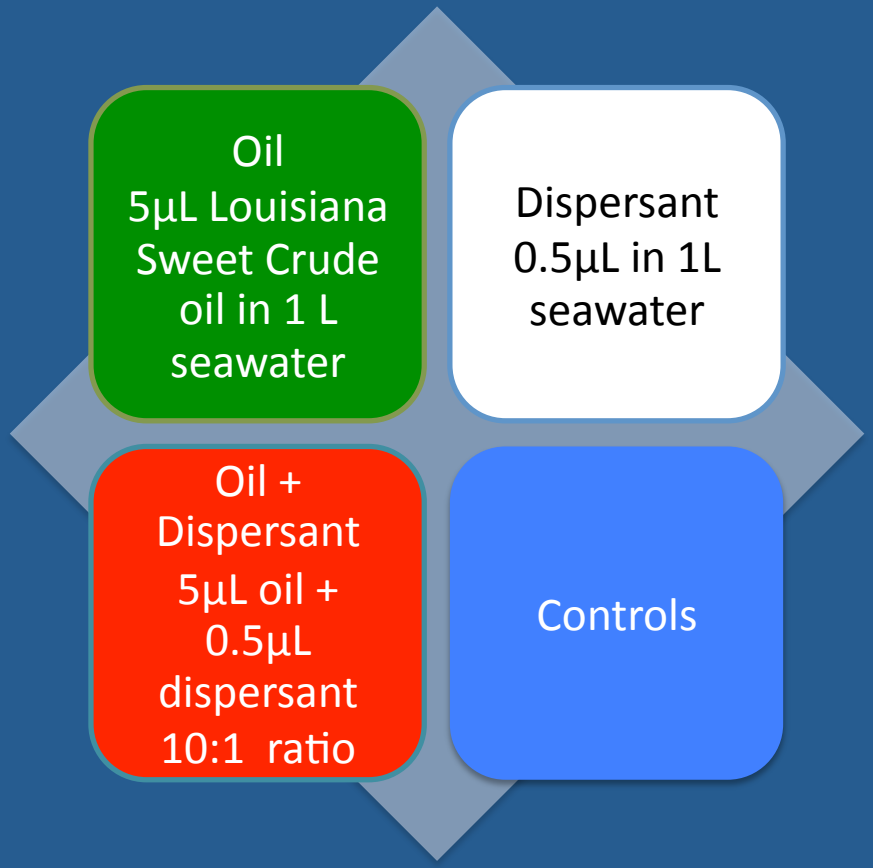
3) Are there sublethal effects not yet detected?
   Monitor well characterized and closest apparently healthy sites



Helen White

Effects of crude oil and the dispersant Corexit 9500A on the black coral *Leiopathes glaberrima* – Dannnise Ruiz

Preliminary experiments



3 Colonies
8 fragments
2 replicates

Sampled for RNA at hrs:
6, 24, 48, 72

Survivals

5 fragments in Oil + Dispersant (62%)

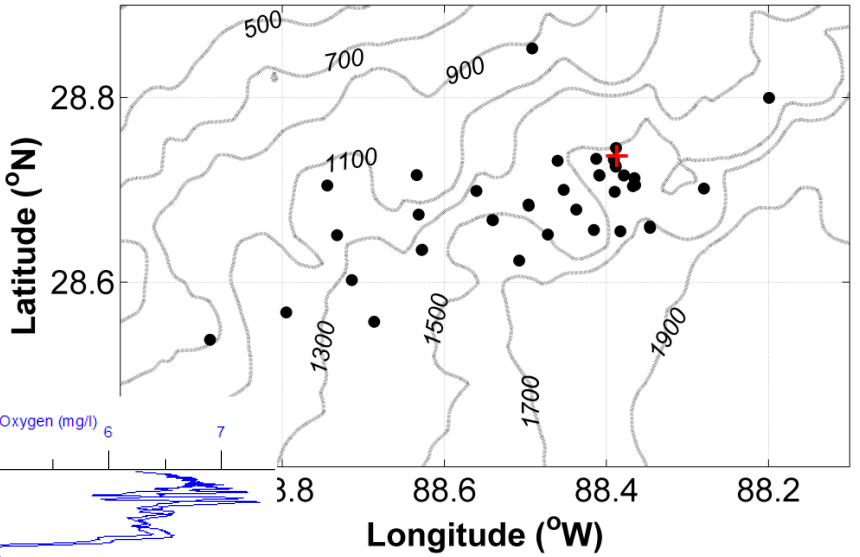
4 fragments in Oil (50%)

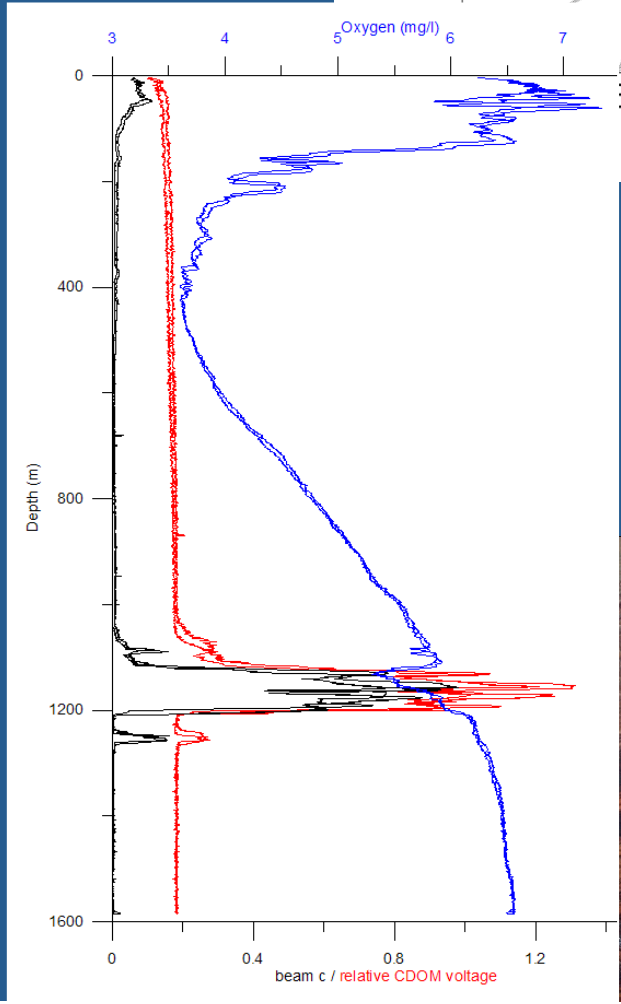
4 fragments in Dispersant (50%)

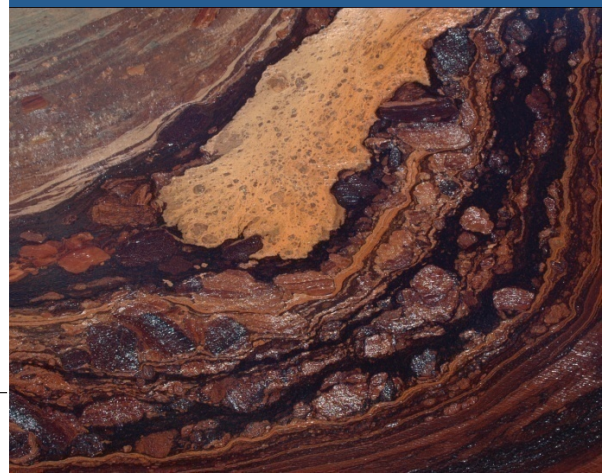
6 fragments in controls (75%)

NIUST Research

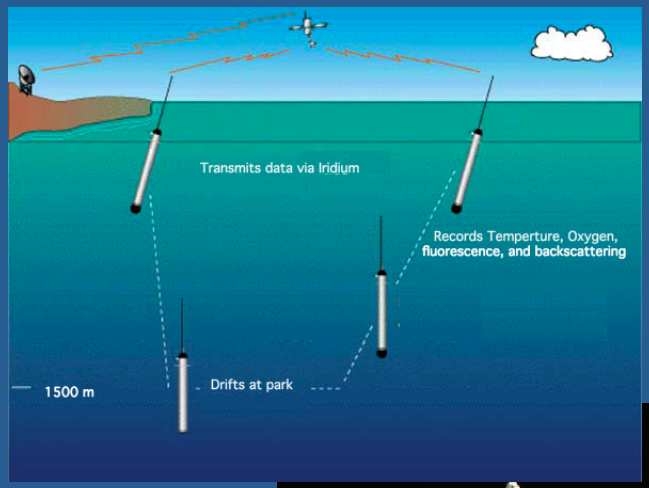
- May 3-16 (13 days after the explosion)
- 60 stations:
  - CDOM (oil) fluorescence
  - ROV video
  - Sediment samples
  - Trace metal samples
- Discovered “plumes” of oil
  - Up to 15 km long x 5 km wide
  - Below 1,000 m
  - Discrete samples confirm presence of oil components

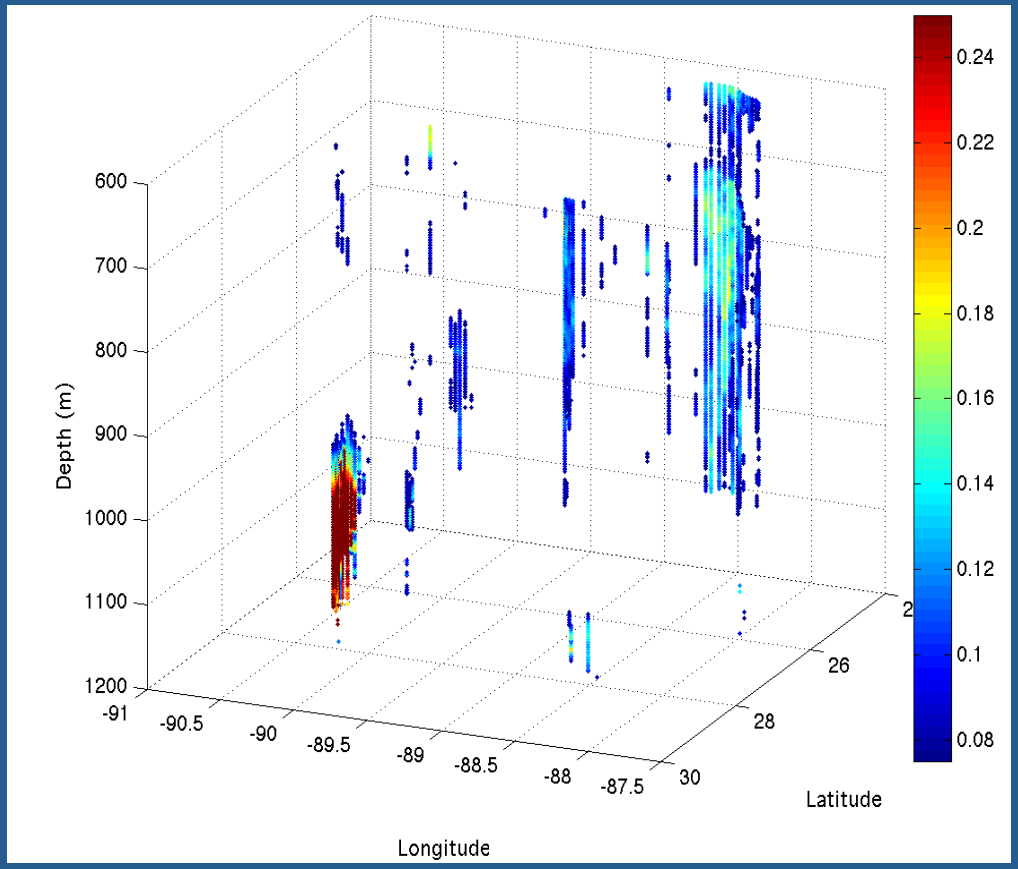






Water column instrumentation for *in situ*, time-series measurements of hydrography

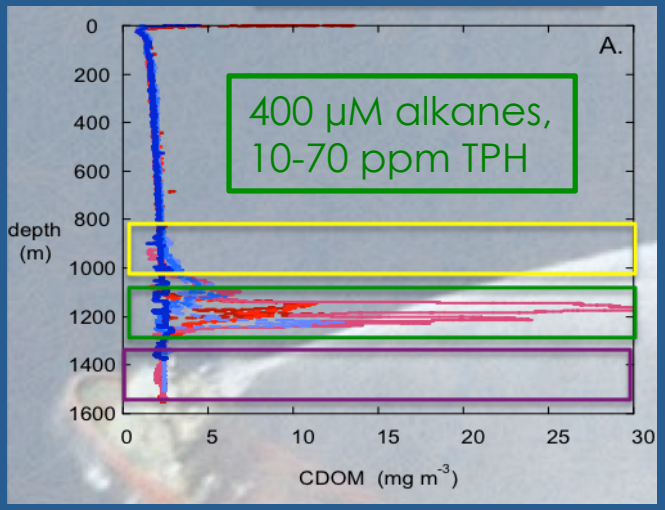




Courtesy Ajit Subramaniam, LDEO

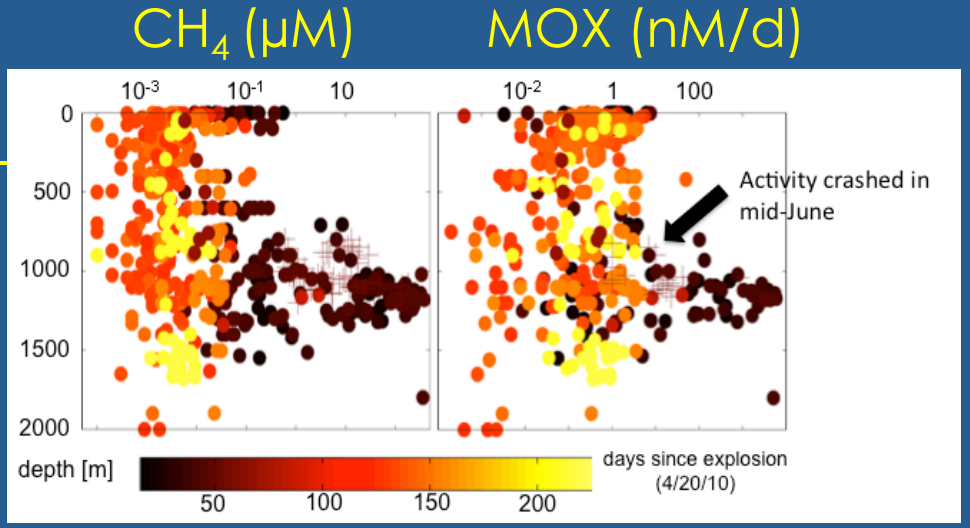
ECOGIG group contributions to DWH discovery

-1st independent science mission (R/V Pelican, May 2010)

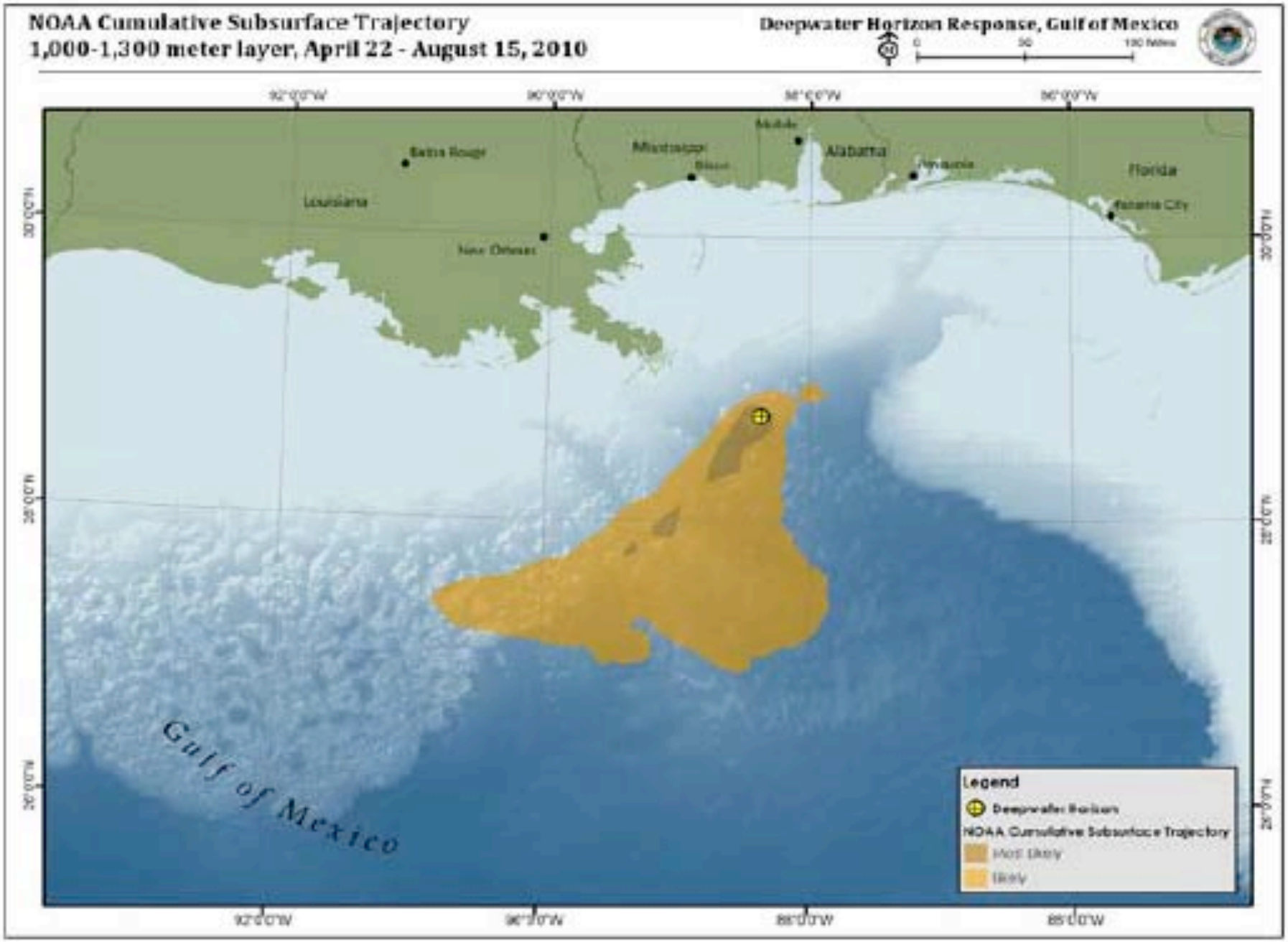


-deepwater gas/oil plumes (Asper, Diercks, Joye, Teske, Highsmith)

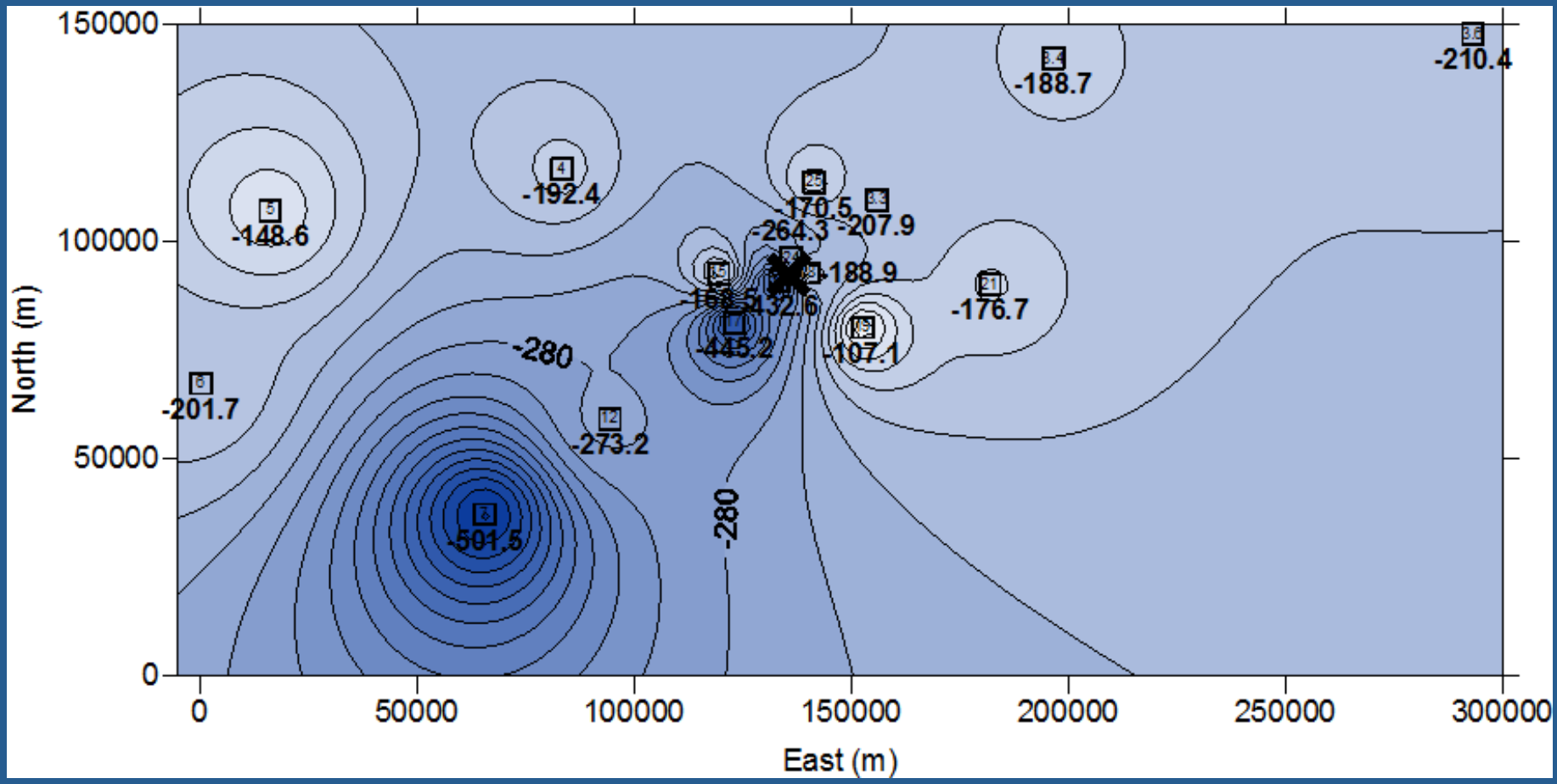
-dynamic- but ephemeral – microbial response to gas input (Joye et al.)



Melitza Crespo-Medina


NOAA Cumulative Subsurface Trajectory
1,000-1,300 meter layer, April 22 - August 15, 2010
Deepwater Horizon Response, Gulf of Mexico
Louisiana
Alabama
Florida
Gulf of Mexico
Legend
Deepwater Horizon
NOAA Cumulative Subsurface Trajectory
Most likely
likely

C^{14} age of surface sediments



Courtesy of Jeff Chanton

Sperm Whale Activity Areas

Courtesy of Bruce Mate

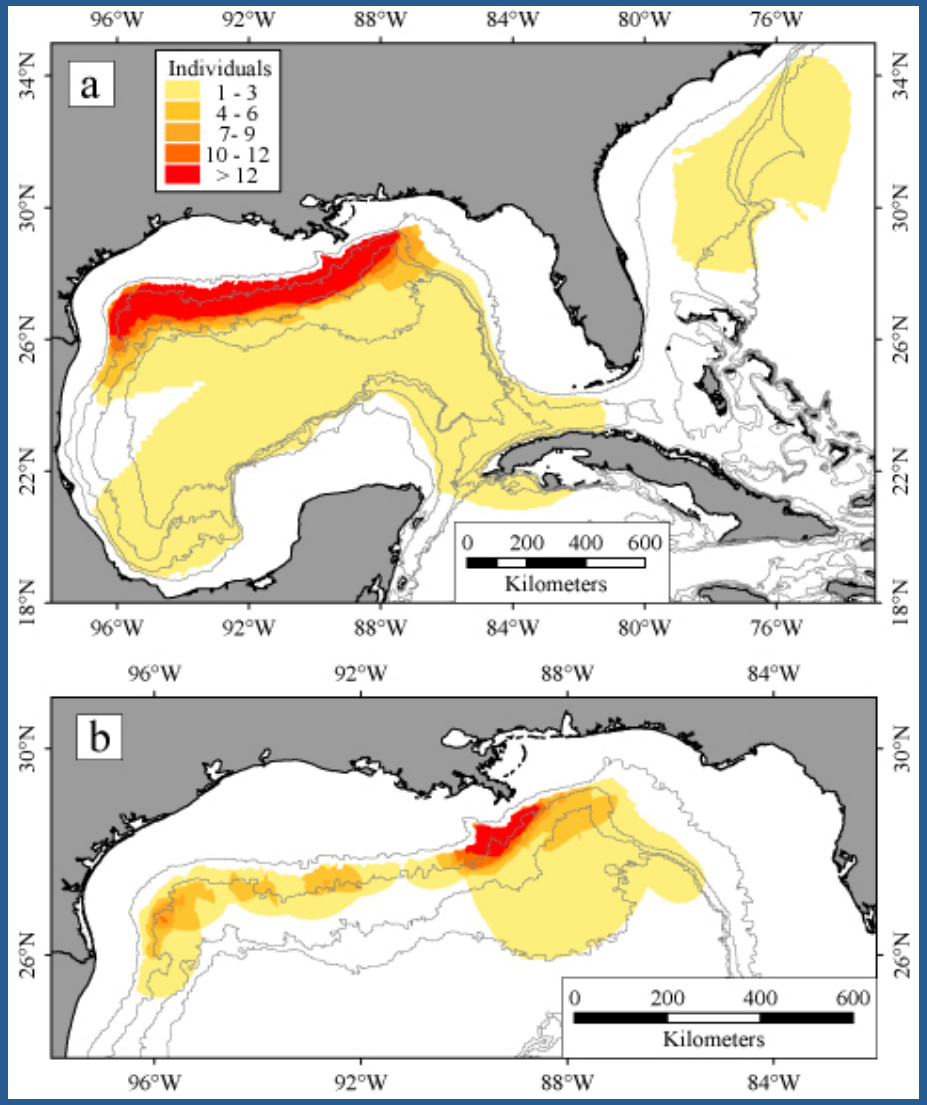
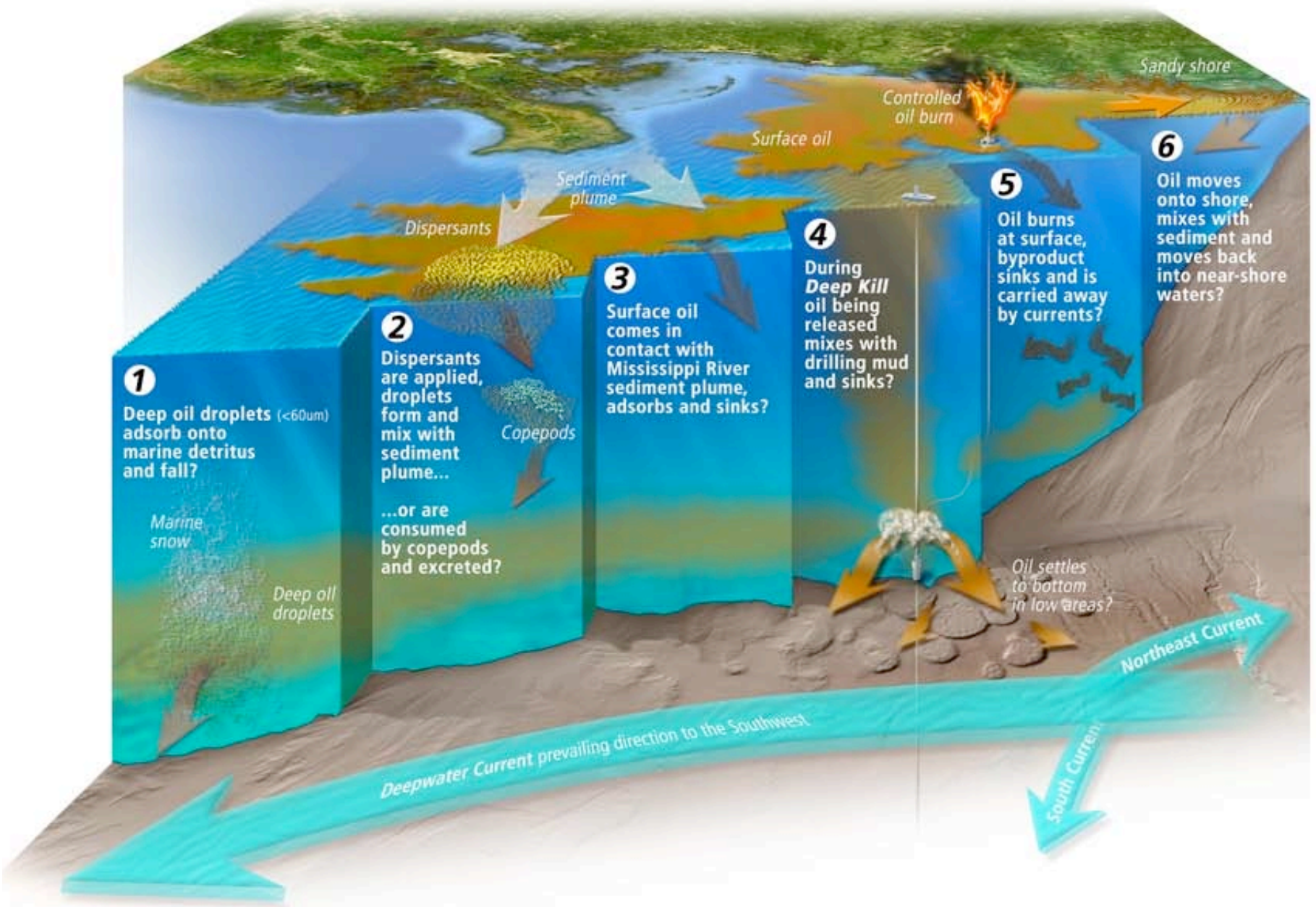
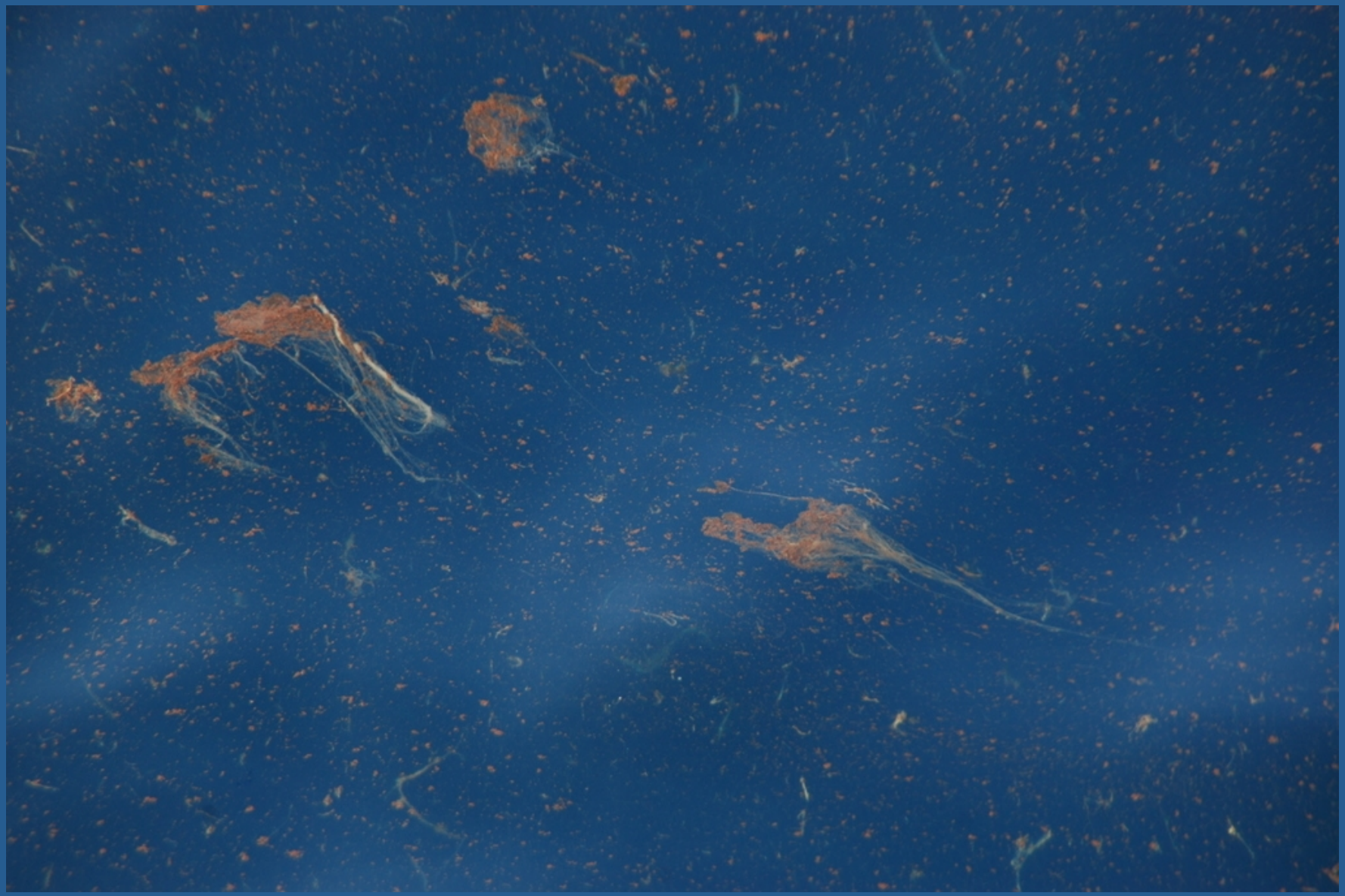


Figure 1: a. 95% kernel home range of all sperm whales tagged during SWSS. b. 50% core area of all sperm whales tagged during SWSS

Potential Scenarios for Oil in Sub-surface Areas



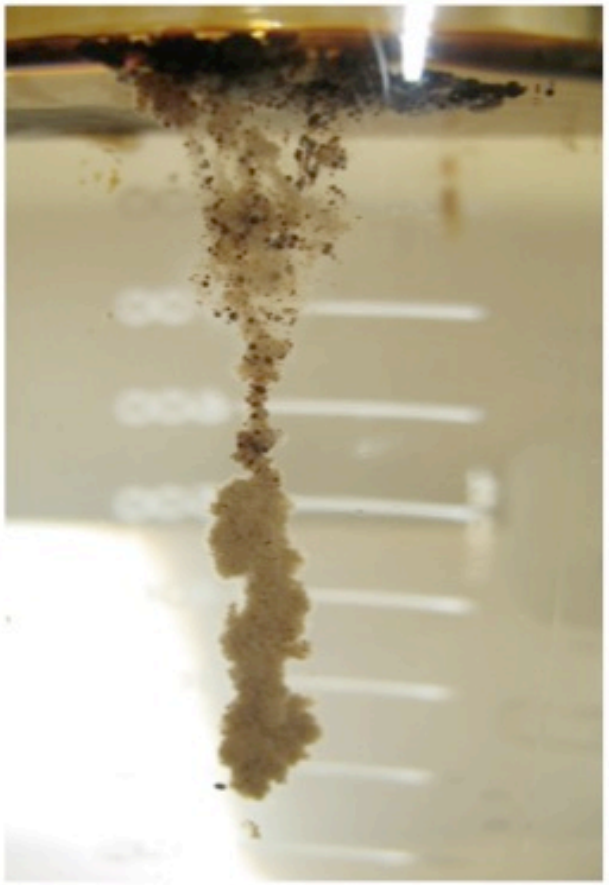
Microbial Mucous Flocs



Rapid formation of aggregates in oil bottles

Bottle 3, one day after roller table incubation

After 21 days, massive stringers of oil slick marine snow have formed at the surface



Courtesy of Kai Zeirvogel, UNC

Oily Sediment Layer

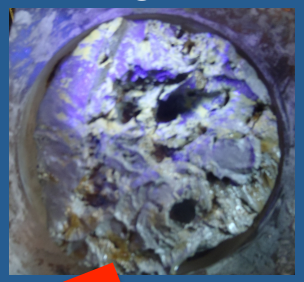
Photo: Arne Diercks

Natural vs. unnatural

Deepwater control foram ooze

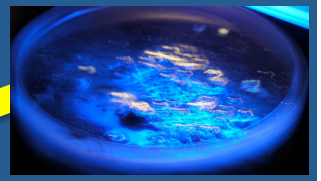
MC118 oil seep

under UV



"oil snow" layer

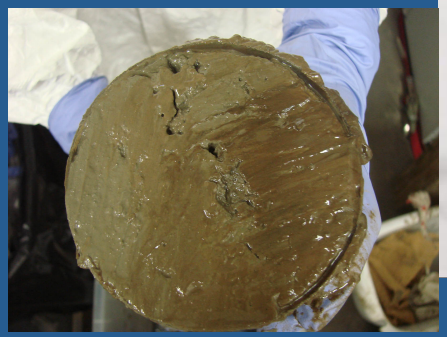
under UV



SEPT

MAY

Rapid sedimentation of oil-containing ‘snow’



Sick fish suggest oil spill still affecting gulf

By Craig Pittman, Times Staff Writer
In Print: Sunday, April 17, 2011

Fishermen in the Gulf of Mexico have caught red snapper with bacterial infections that have eaten through skin. Scientists say it's a sign a toxin has compromised the fish's immune system.

[Courtesy of Jim Cowan, Louisiana State University]

http://www.tampabay.com/news/environment/wildlife/sick-fish-suggest-oil-spill-still-affecting-gulf/1164042

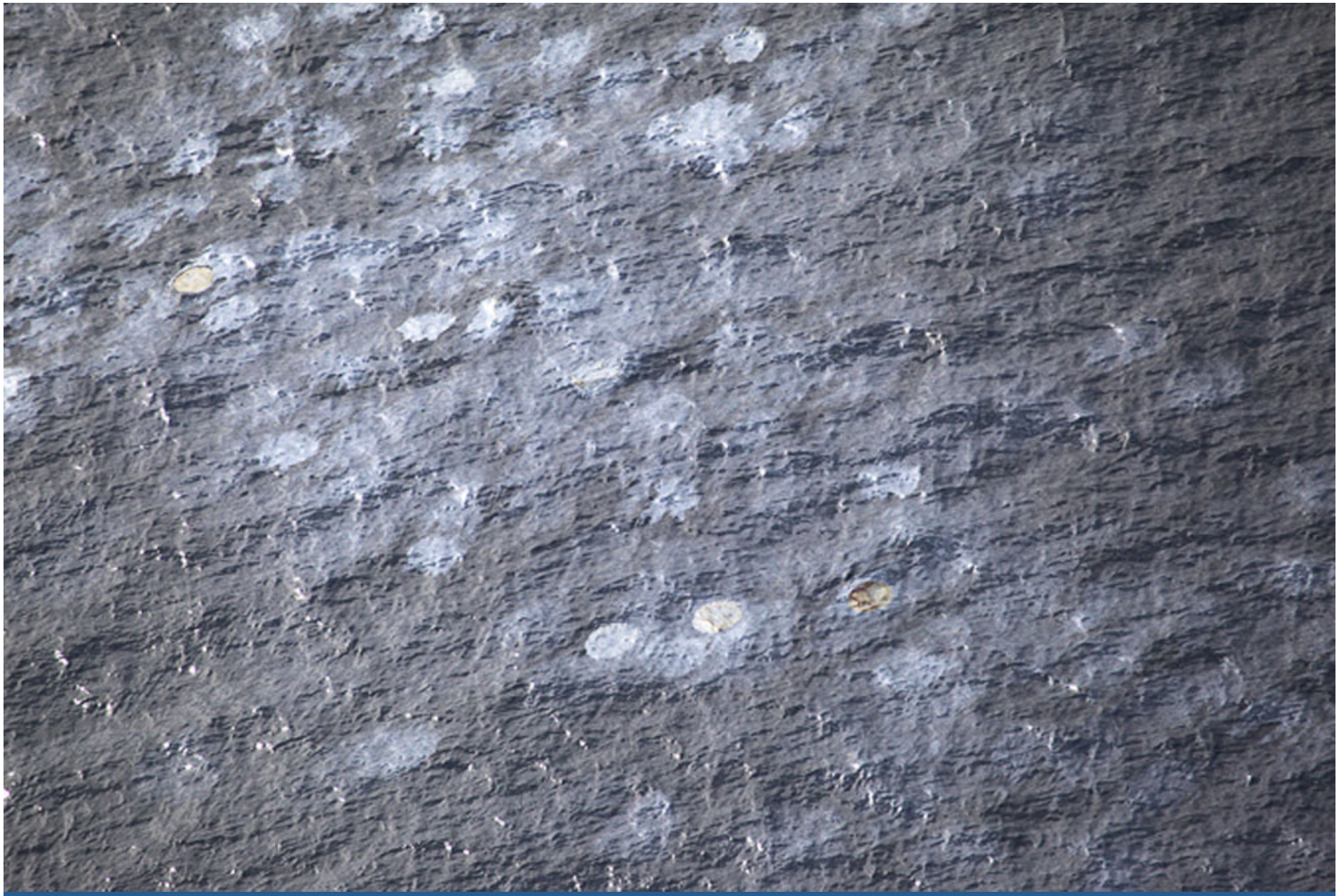
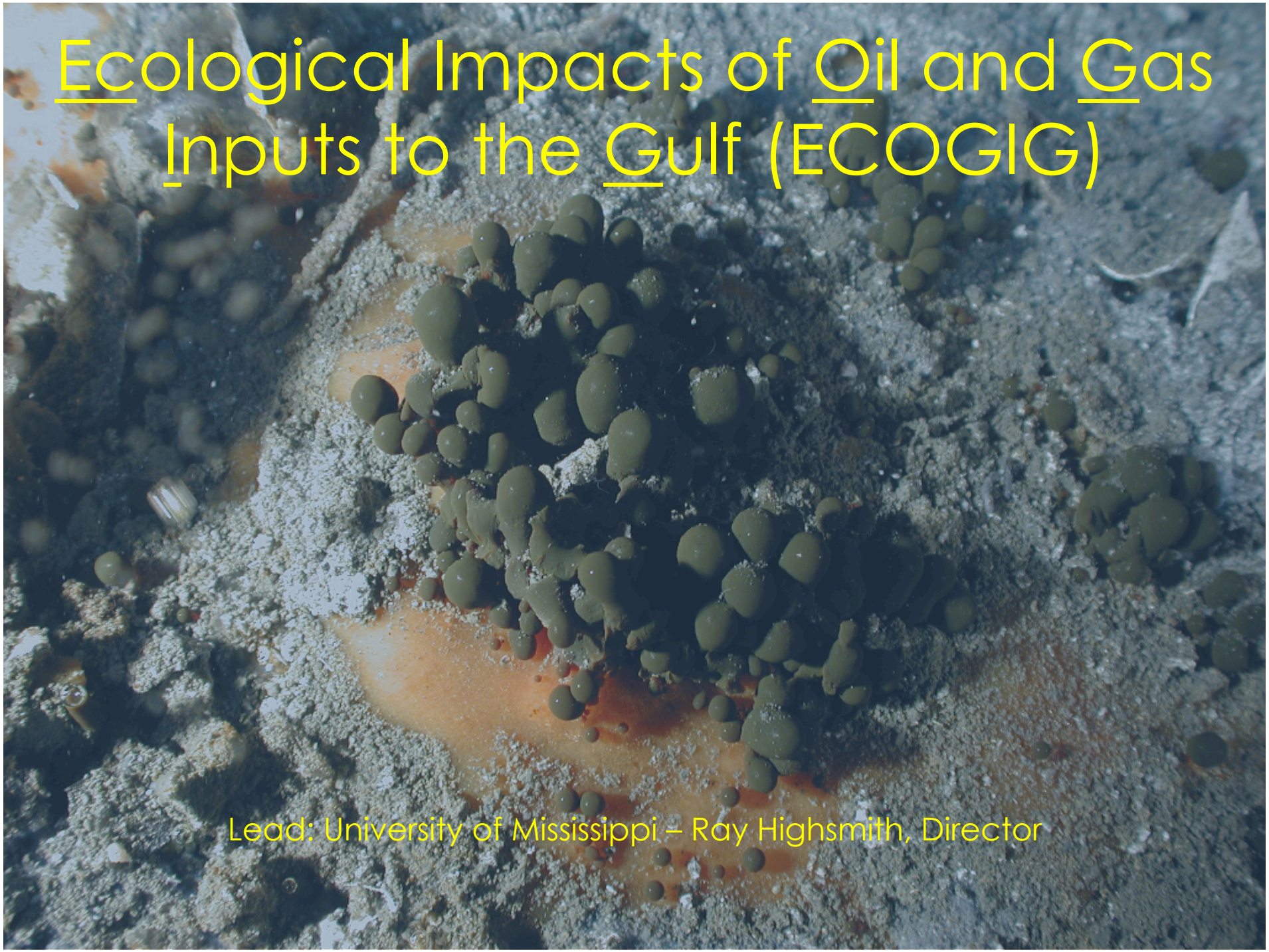


Photo: Erika Blumenfield/Al Jazeera

GoM Research Initiative

- Eight Projects funded for 3 years
- Potential for two 3-yr renewals – competitive
- Wide range of research represented but also some overlaps in region or approach

Ecological Impacts of Oil and Gas Inputs to the Gulf (ECOGIG)

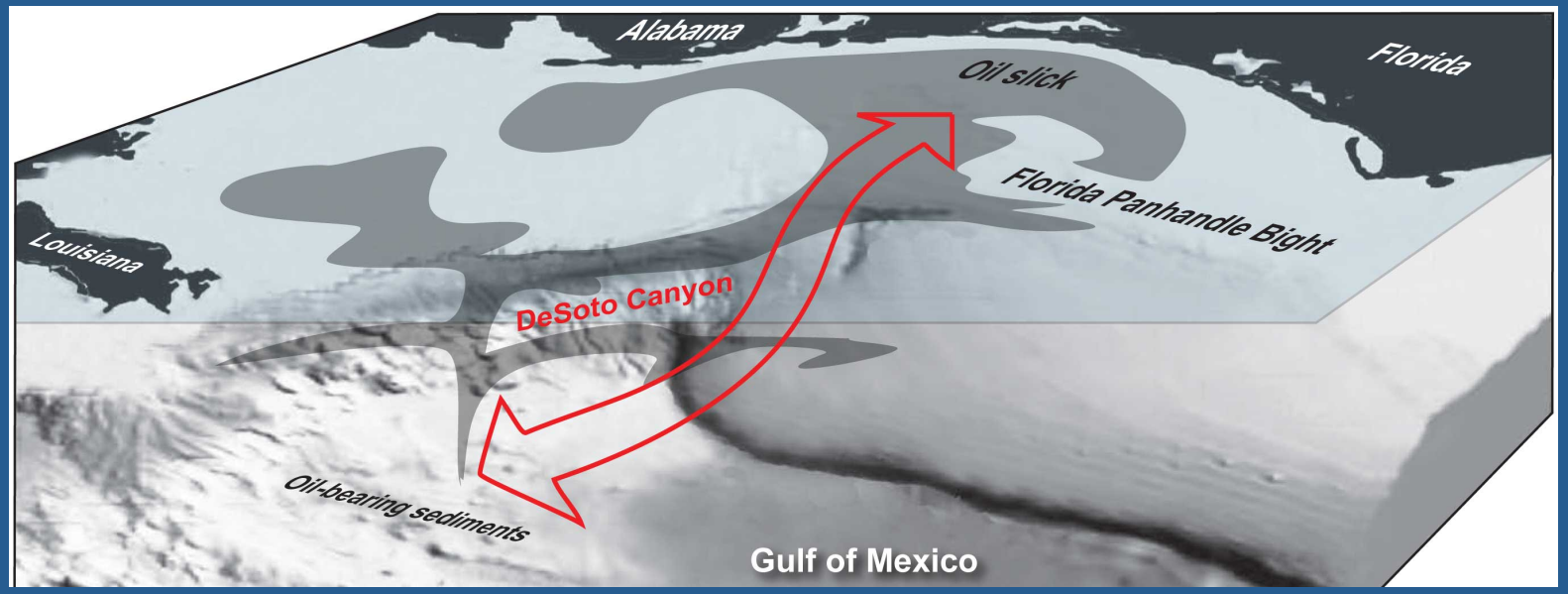


Lead: University of Mississippi – Ray Highsmith, Director

Lead: Florida State University
Eric Chassignet, Director

Deep Sea to Coast

Connectivity in the Gulf of Mexico



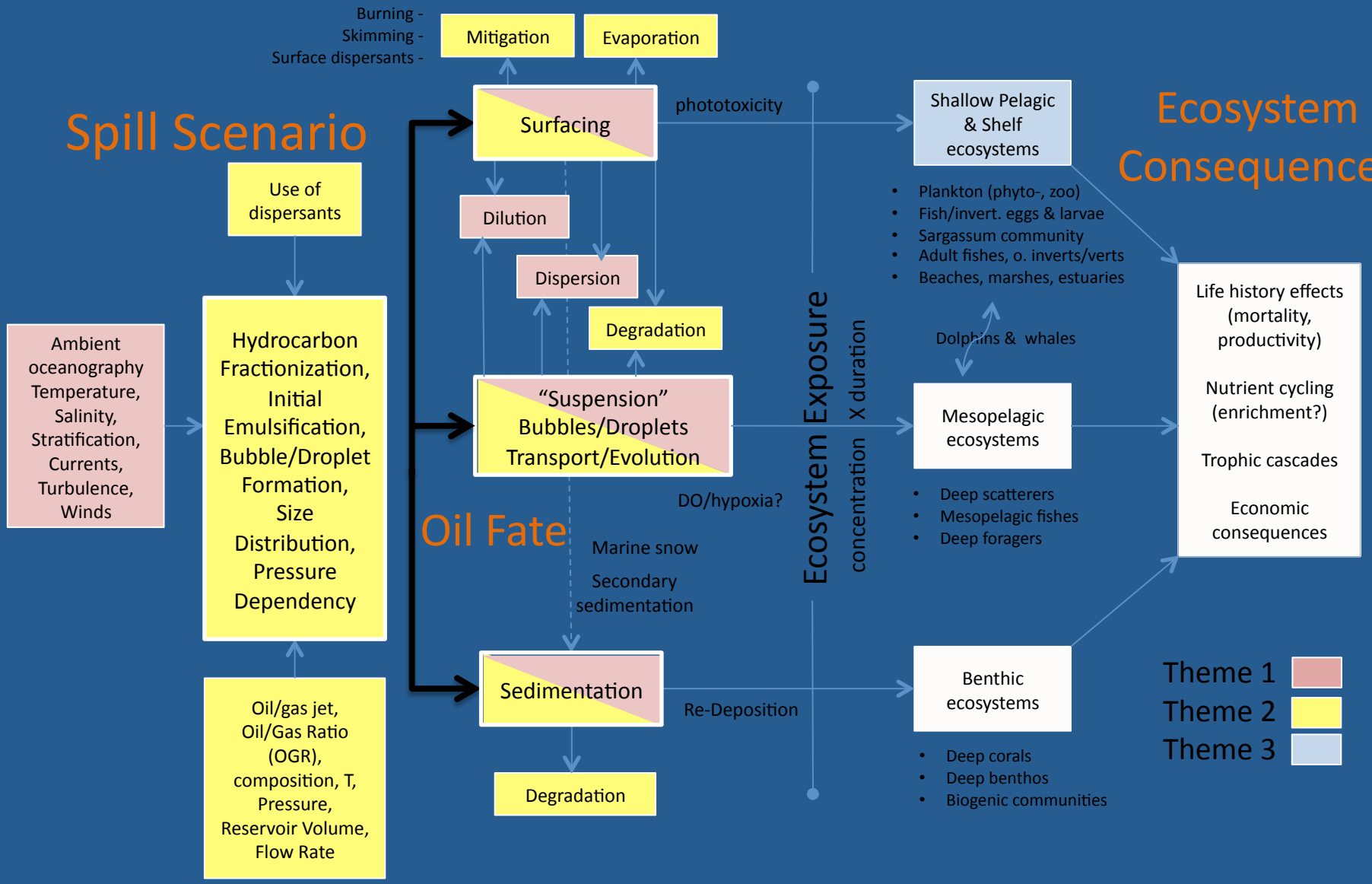
1. What are the magnitudes, directions, and spatial and temporal scales of hydrodynamic processes that transport particles and dissolved substances from the deep Gulf to the Florida Panhandle shelf waters in the northeastern GoM? How are these influenced by canyon and shelf topography?
2. How does the transport of these particles and dissolved substances influence geochemical, biological, and demographic processes, including food web dynamics, across sea floor, pelagic, and near-shore ecosystems?

C-IMAGE Consortium

C-IMAGE
Center for Integrated Modeling and Analysis of Gulf Ecosystems

- **University of South Florida** – *lead, IT, education, various science*
- **Florida Institute of Oceanography** – *Research vessels*
- **Hamburg Technical University** – High pressure lab studies, velocity
- **Texas A&M University** – *Oil physics and chemistry*
- **University of Calgary** – HMW environmental exposure, partitioning of oil/gas
- **Wageningen University & NHL – Netherlands** – Decision support tool
- **Eckerd College** - *Benthic stratographic studies*
- **University of West Florida** - *Microbial studies*
- **Pennsylvania State University** – Degrading enzymes, ^{13}C, ^{14}C studies
- **University of Miami** – Modeling *oil distribution & concentration*
- **University of South Alabama** – *Fish community analyses*
- **Mote Marine Laboratory** - *Biomarkers -vertebrate exposure*
- **Scripps Institution of Oceanography** – *Marine mammals*

Integrated Understanding of Oil Spill Dynamics



Offshore GRI Projects

- Deepsea to Coast Connectivity in the Eastern Gulf of Mexico (Deep-C). Lead: Florida State University
- Center for Integrated Modeling and Analysis of Gulf Ecosystems. Lead: University of South Florida