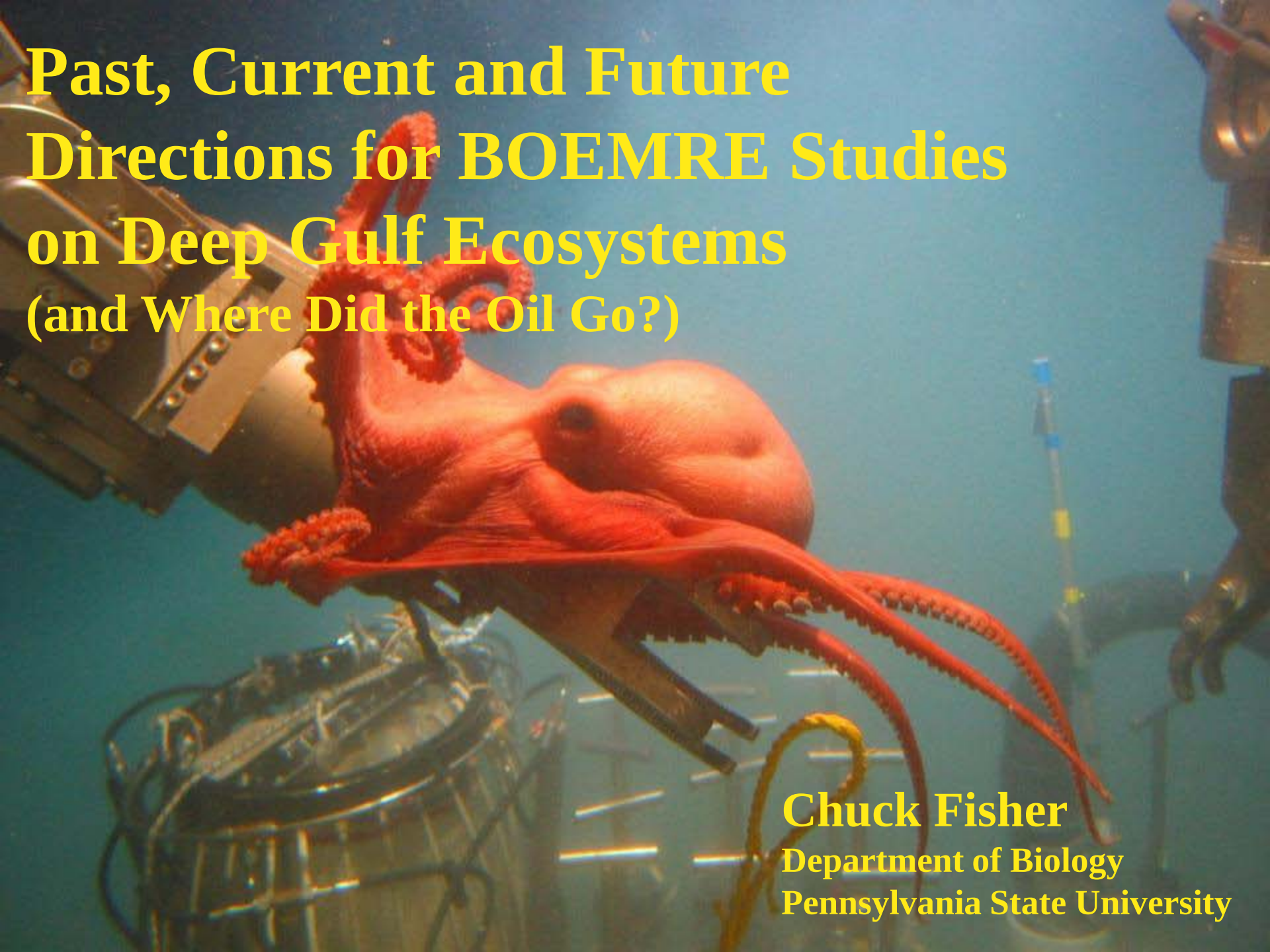
Past, Current and Future Directions for BOEMRE Studies on Deep Gulf Ecosystems

(and Where Did the Oil Go?)



Chuck Fisher
Department of Biology
Pennsylvania State University

- Chemo I (Chemosynthetic Ecosystem Study)
  - 1991 – 1994 MMS
- Chemo II (Stability and Change in Gulf of Mexico Chemosynthetic Communities)
  - 1997 – 2001 MMS
- Chemo III (Investigations of chemosynthetic communities on the lower continental slope of the Gulf of Mexico)
  - 2005 – 2009 MMS
- *Lophelia* I (Characterization of northern Gulf of Mexico deep-water hard-bottom communities with emphasis on *Lophelia* coral)
  - 2003 – 2007 MMS
- *Lophelia* II (Exploration and research of northern Gulf of Mexico deepwater natural and artificial hard-bottom habitats with emphasis on coral communities: Reefs, rigs and wrecks.)
  - 2008 – 2012 BOEMRE

The big picture: Chemo I – III and *Lophelia* I and II

These programs had many specific goals,
but the broad goals were:

1) Discover and characterize deep water megafaunal communities (who is where and what are the patterns)
2) Better understand the biology and ecology of the fauna: growth rates and ages, physiology (energy sources and resiliency), metapopulation structure (of species and communities)
3) Learn where they are likely to occur (strengthen predictive power from surface ship data)

Chemo I – III and *Lophelia* I and II

We learned a lot (and a lot more than listed below):

- Chemosynthetic foundation fauna live a long time
- Young chemo communities get 95%+ of their nutrition locally
- Chemo community composition changes as it ages
  - (and corals are the climax communities at many seeps sites)
- Old tubeworms get sulfide from beneath the sediment, and therefore, old tubeworm communities include lots of "normal" fauna and have input of non-seep primary production
  - (and seep communities cannot be considered to be isolated from the surrounding deep sea)

Chemo I – III and *Lophelia* I and II

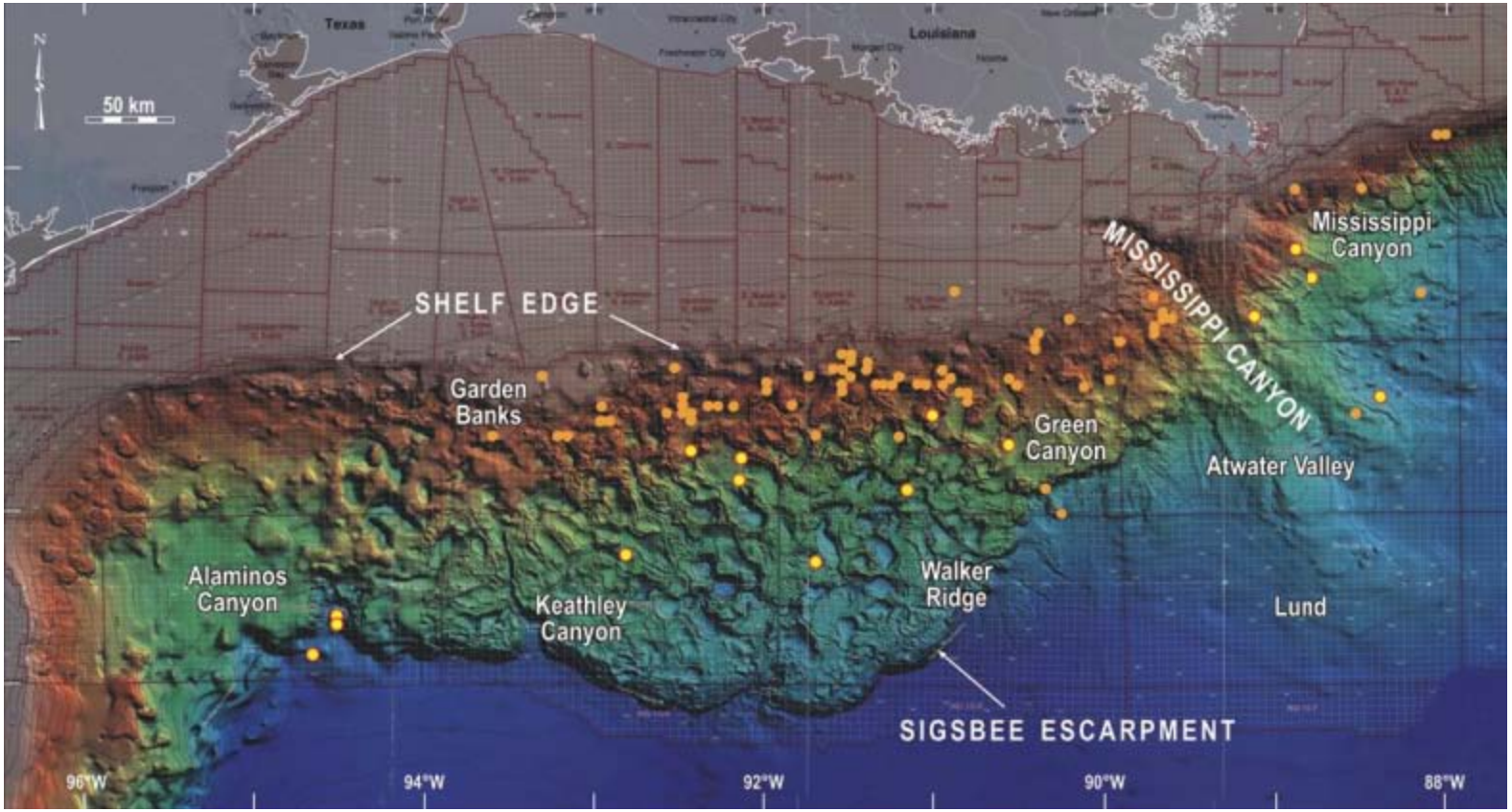
We learned a lot (and a lot more than listed below):

- Coral communities do not get significant nutrition from seep primary production.(even when in close spatial proximity to seep communities)
- In general, communities (of the same type) at the same depth are similar in species composition
- There is very little population subdivision of chemo foundation fauna within species within a depth range ** But corals …
- Although the same type of communities are found at different depths, the species change with depth (dramatically between 800 and 1,200m, but also in general)

Chemo I – III and *Lophelia* I and II

We learned a lot

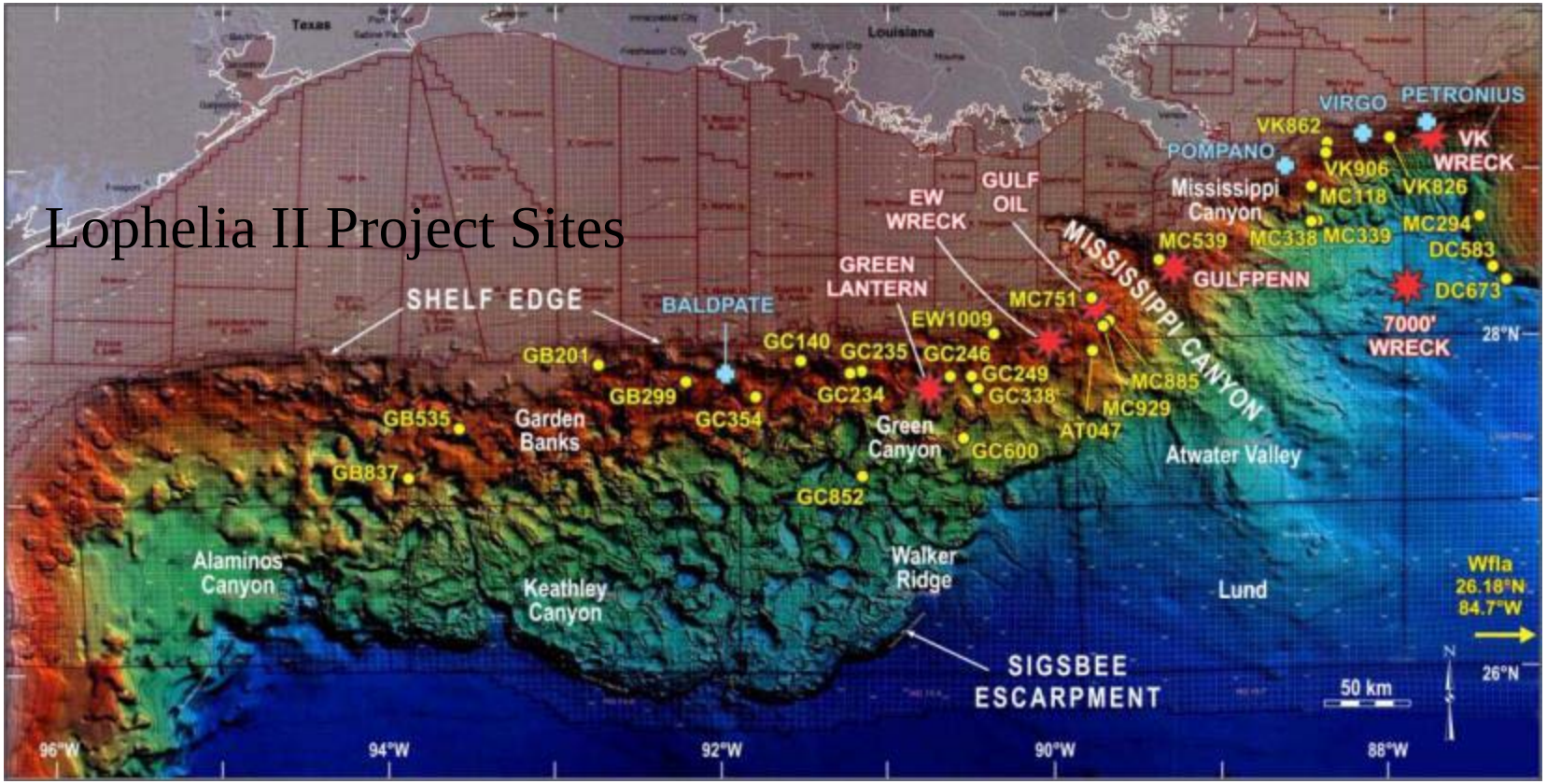
- Chemo communities are very widespread in the GOM
  - And we (Bill and Harry) are getting very good at finding them



Chemo I – III and *Lophelia* I and II

We learned a lot

- Deep water coral communities are proving to be widespread as well



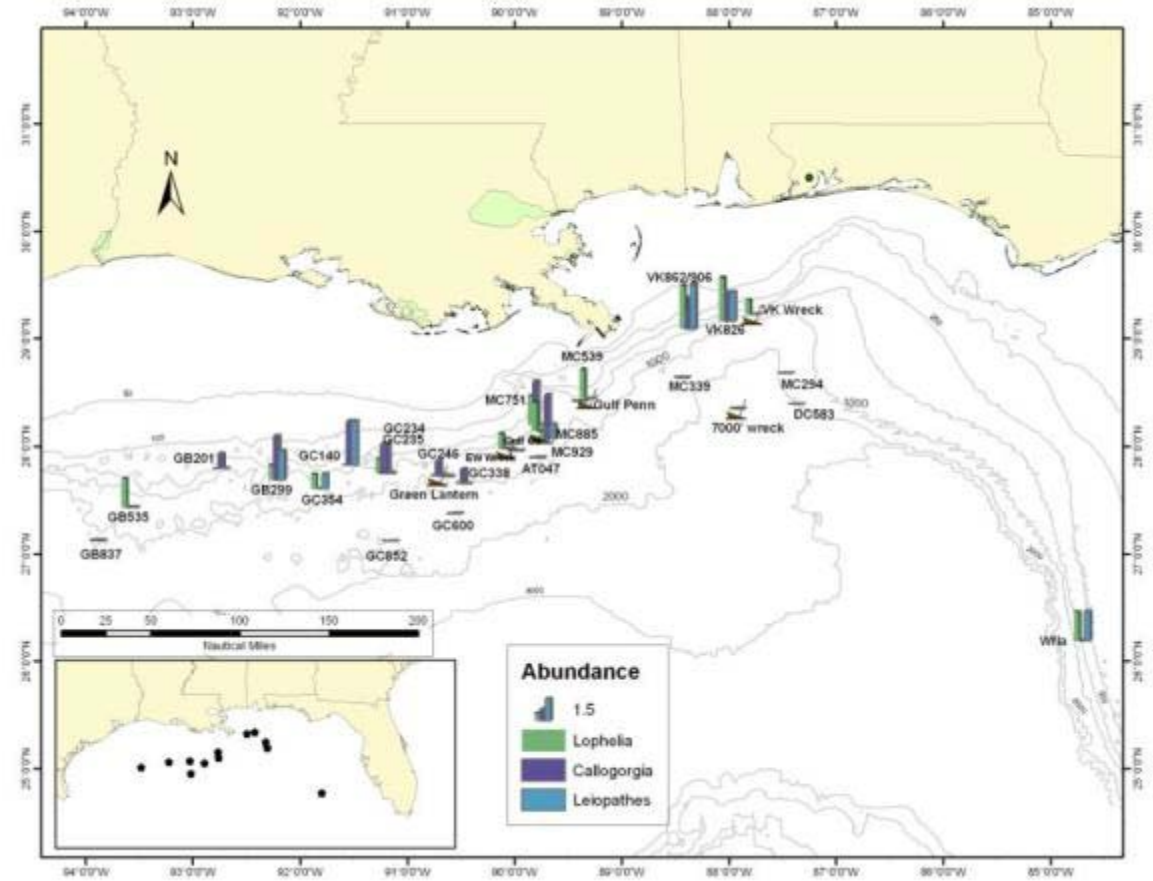
Chemo III and *Lophelia* II

The most recent projects were in large part in response to increasing energy company activity in deeper water (these were the first two projects with mandates extending below 1,000m), and as a result had a very significant exploration and characterization component.

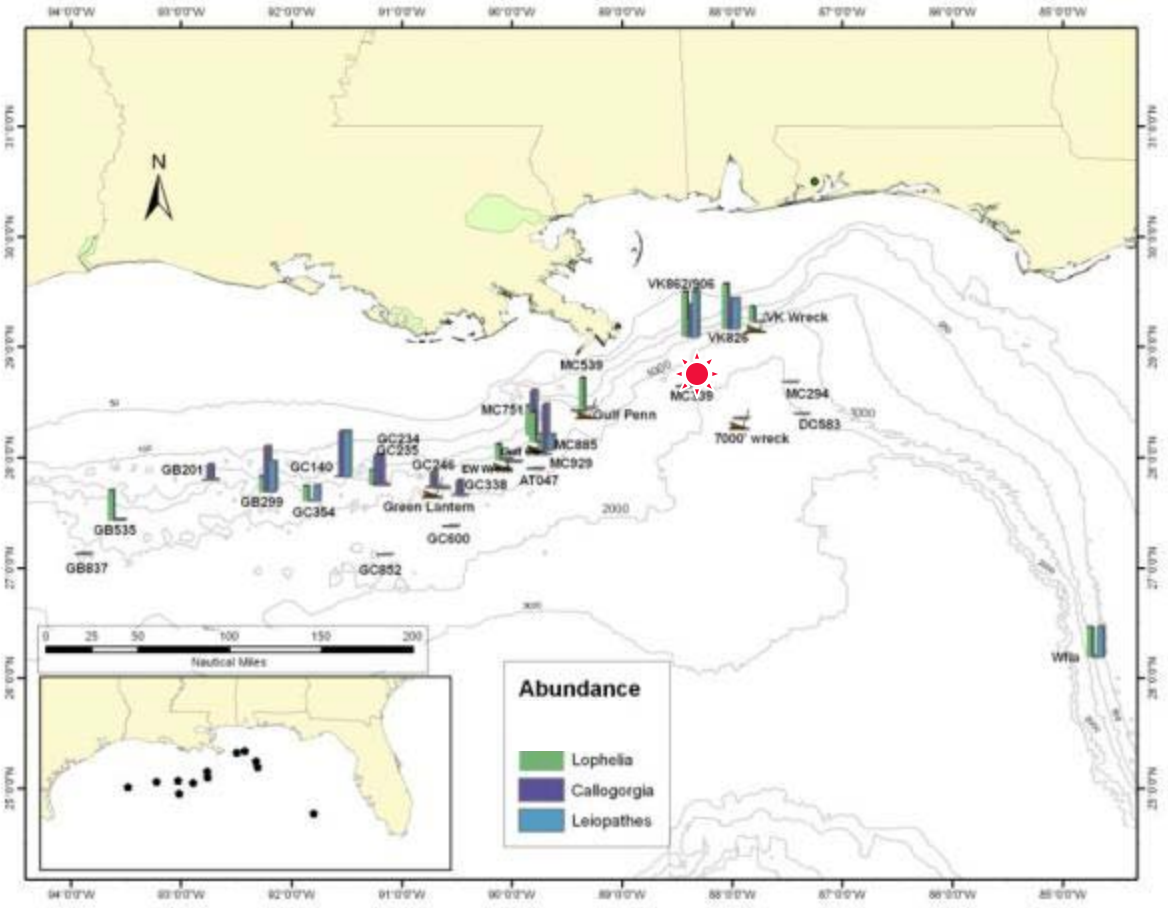
Both had continuing components to promote understanding of the biology of the species present.

And both also had increased population genetic and longer term monitoring aspects.

Lophelia II project (from a presentation in 2009):



April 20, 2010:
Deepwater Horizon disaster …



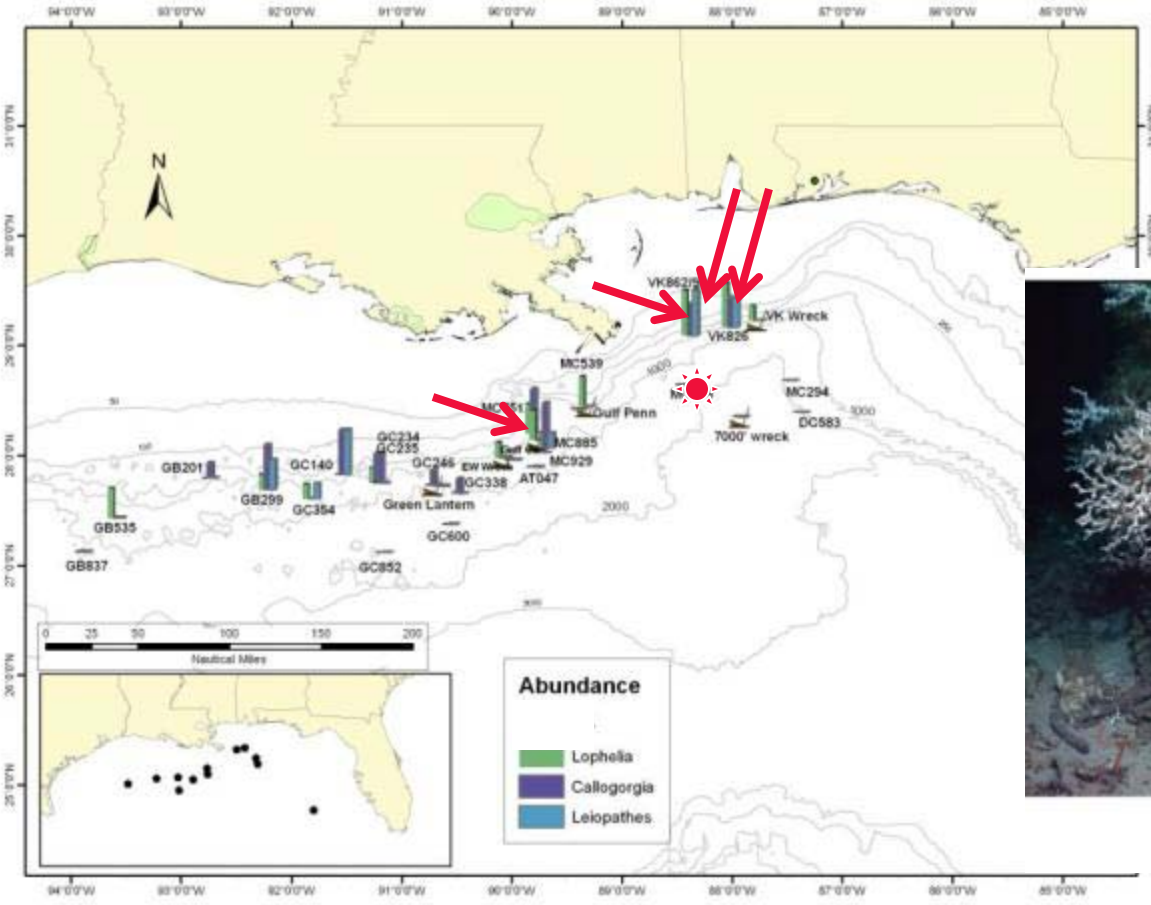
July 2010

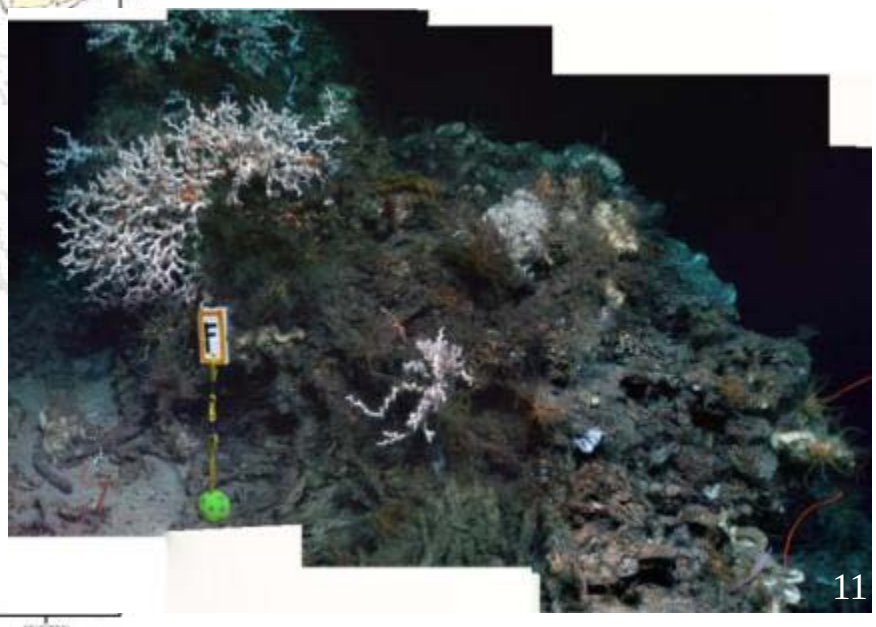
NRDA

Trustees

BP

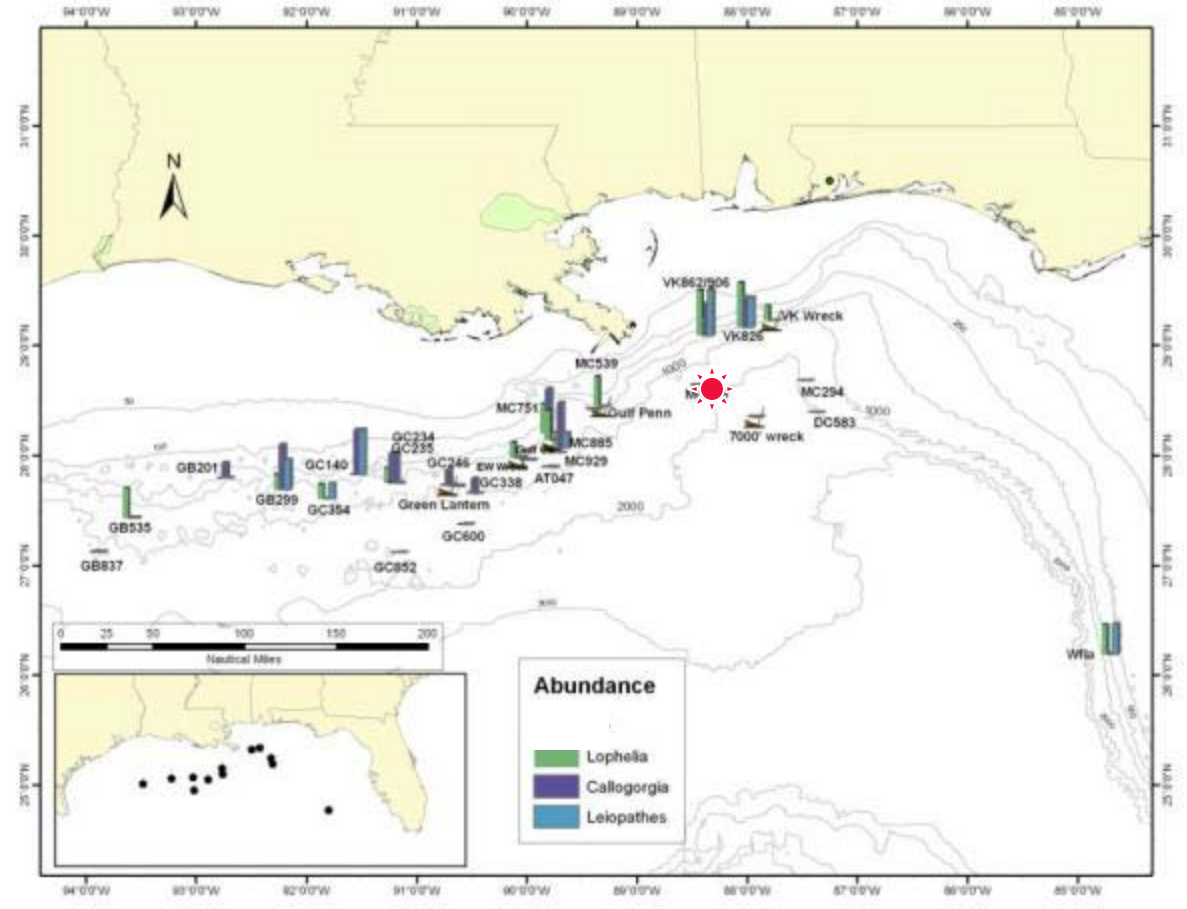
National Resource Damage Assessment response cruise to known rich coral sites with established, BOEMRE, long-term study stations

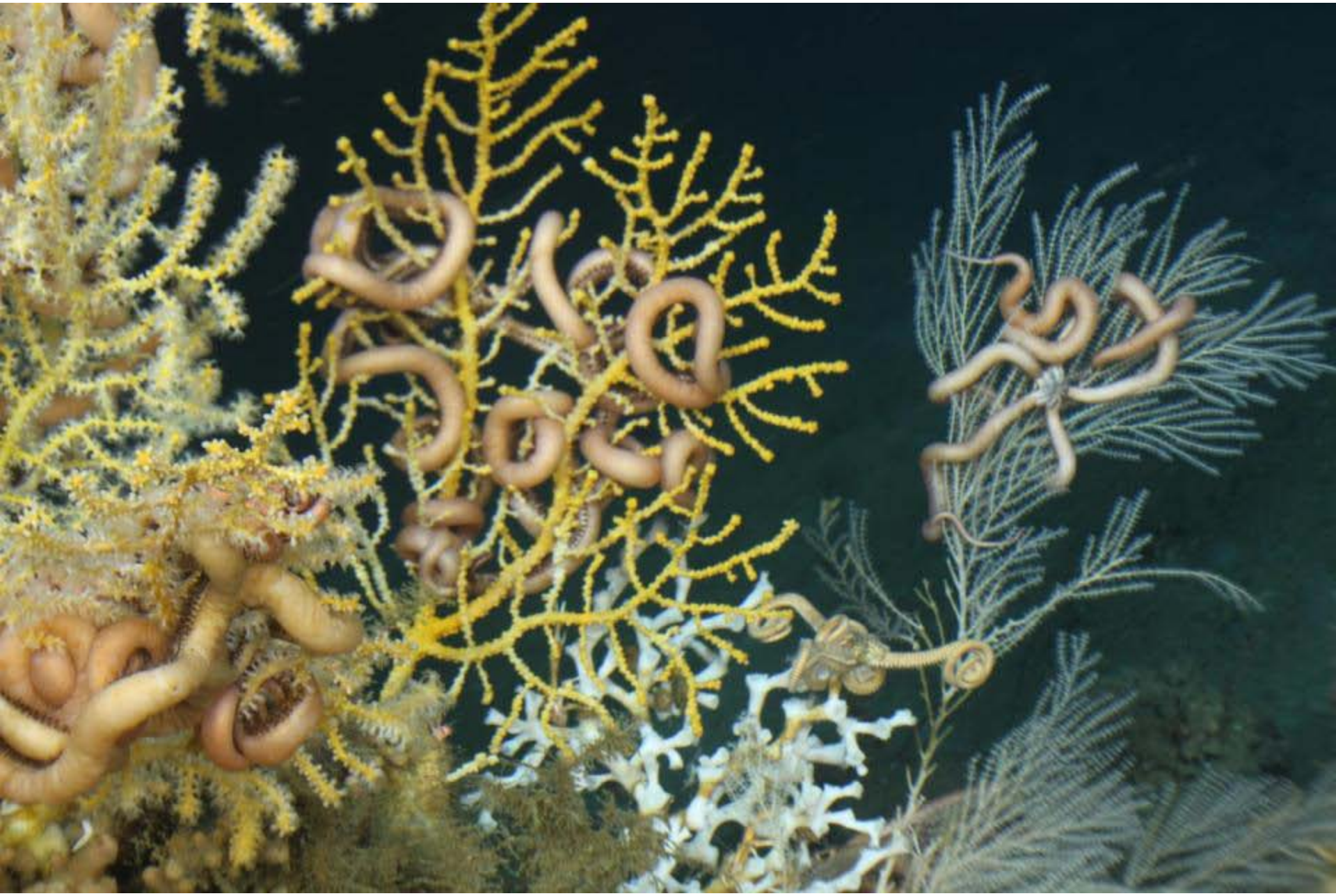


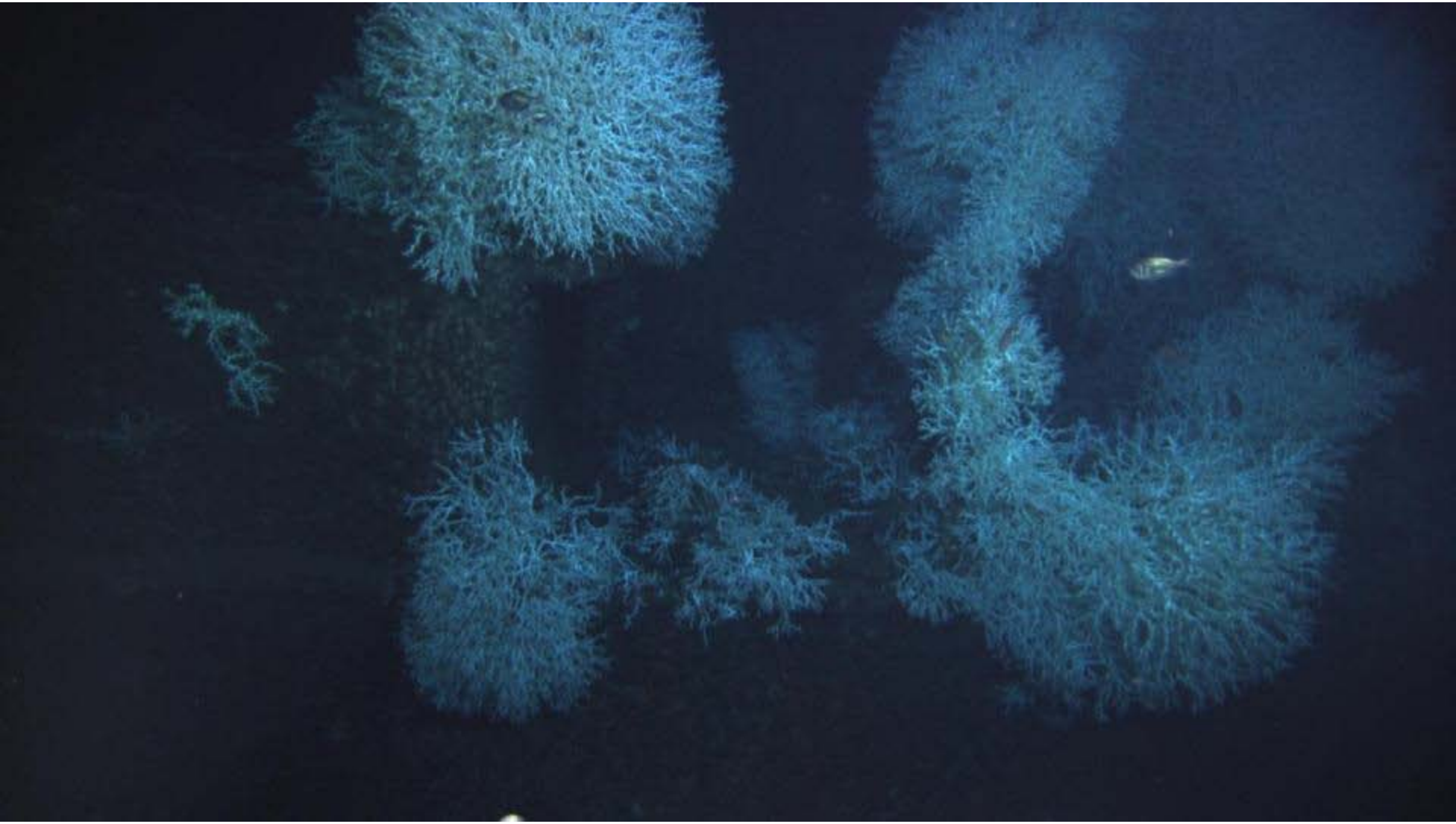


October–November 2010

Revisited most of our deep coral study sites during a regularly scheduled BOEMRE/NOAA cruise





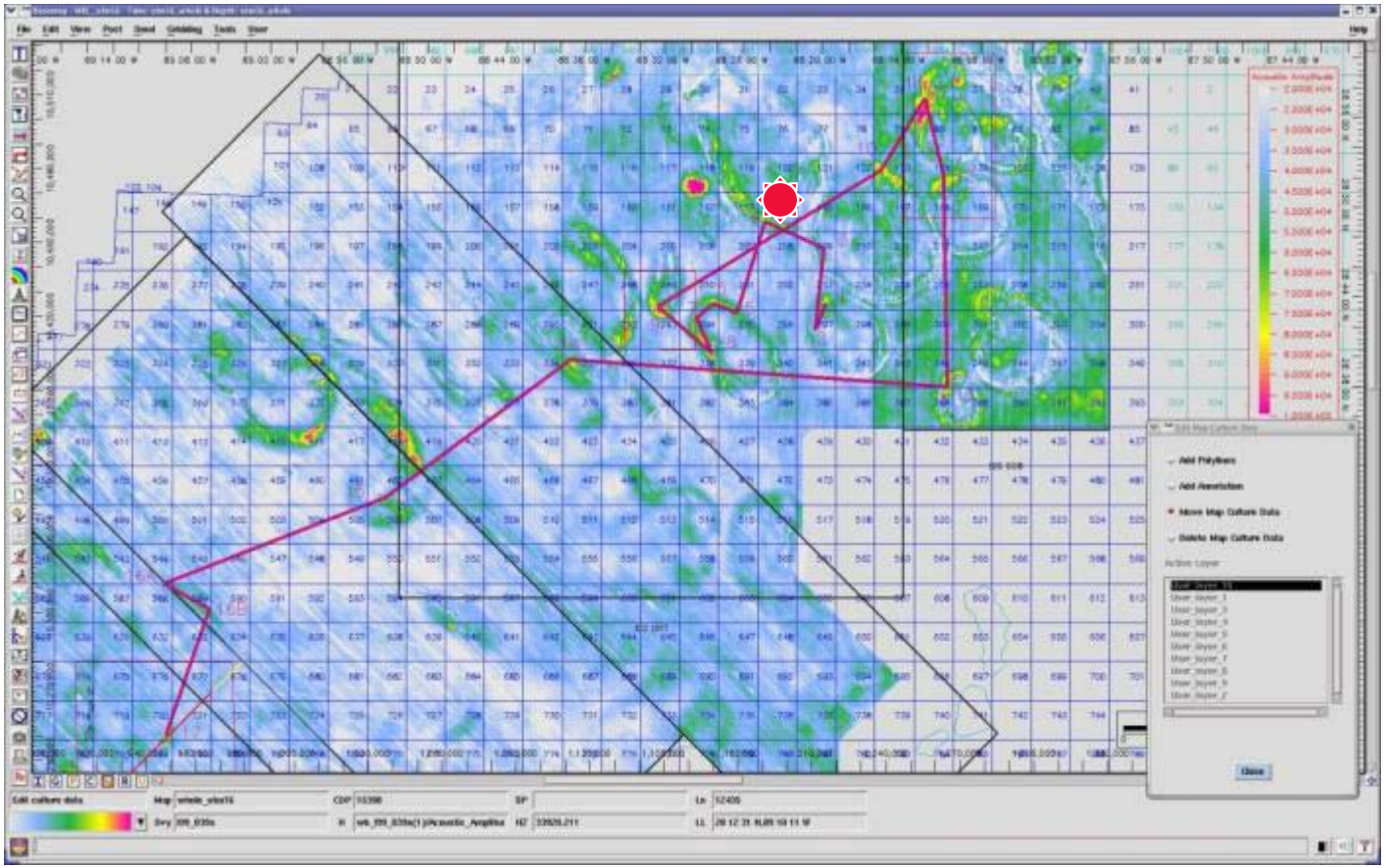


Explore for Hard Grounds near the Spill Site

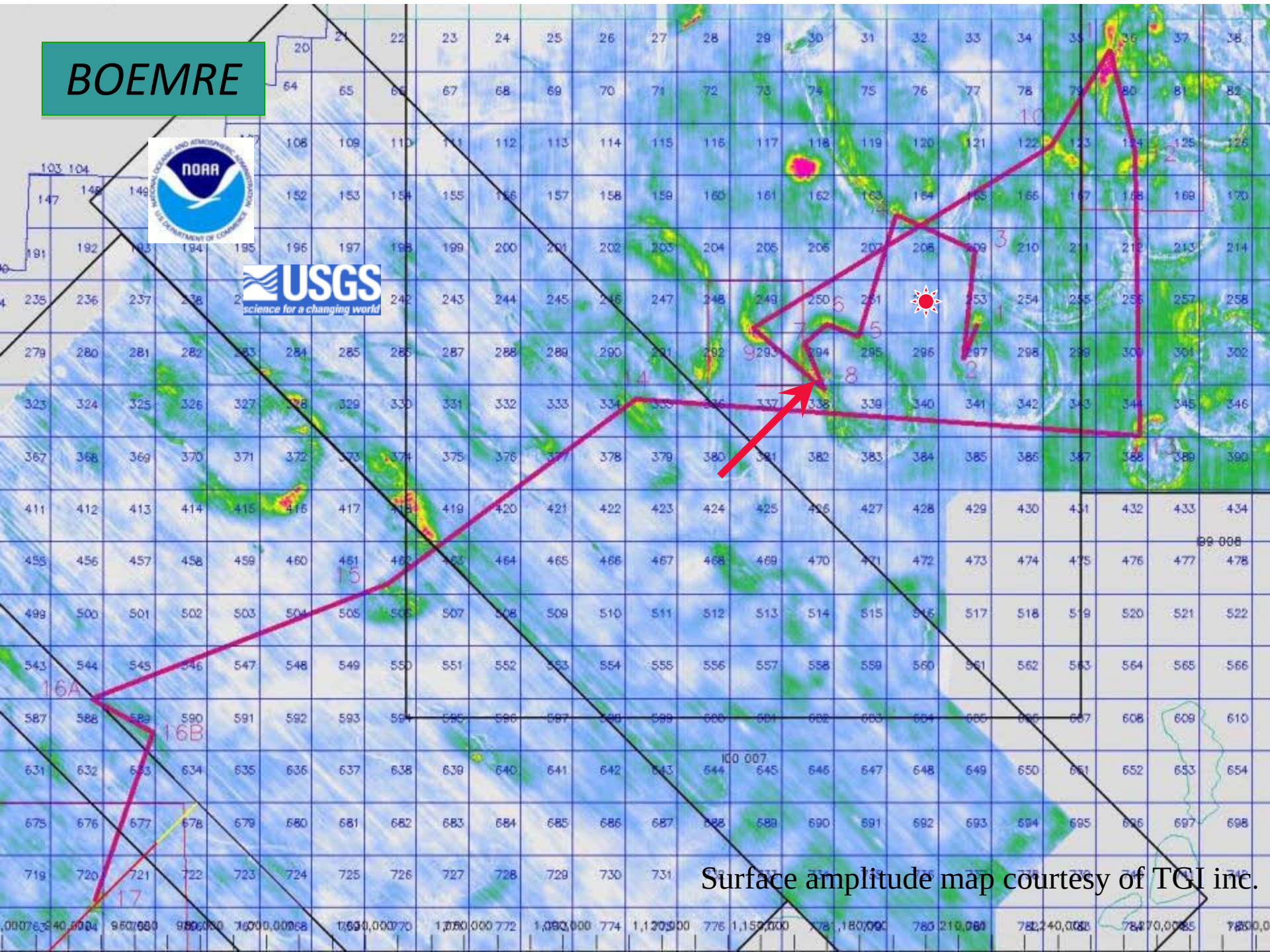
NRDA

BOEMRE

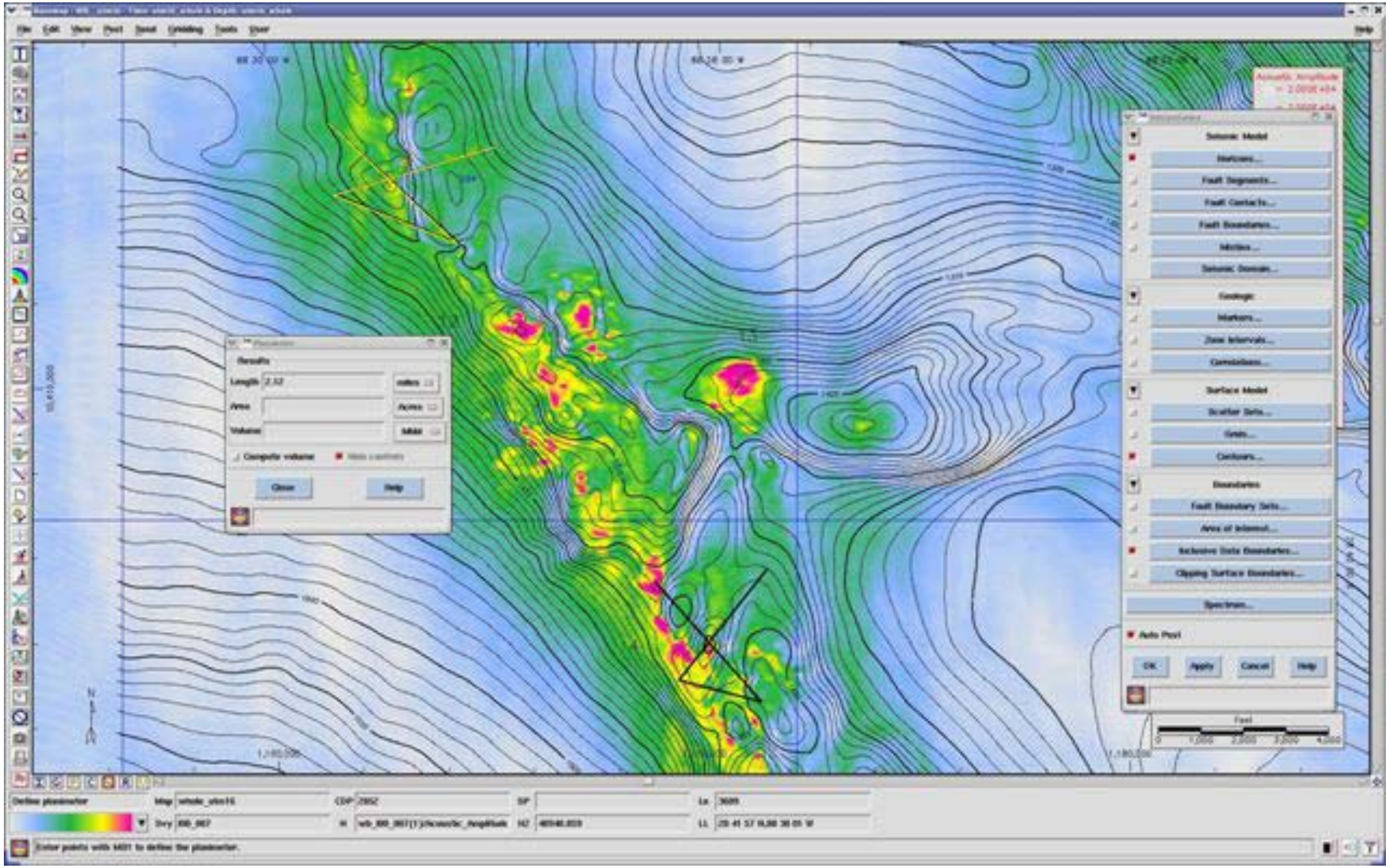
(Using techniques developed for BOEMRE studies)



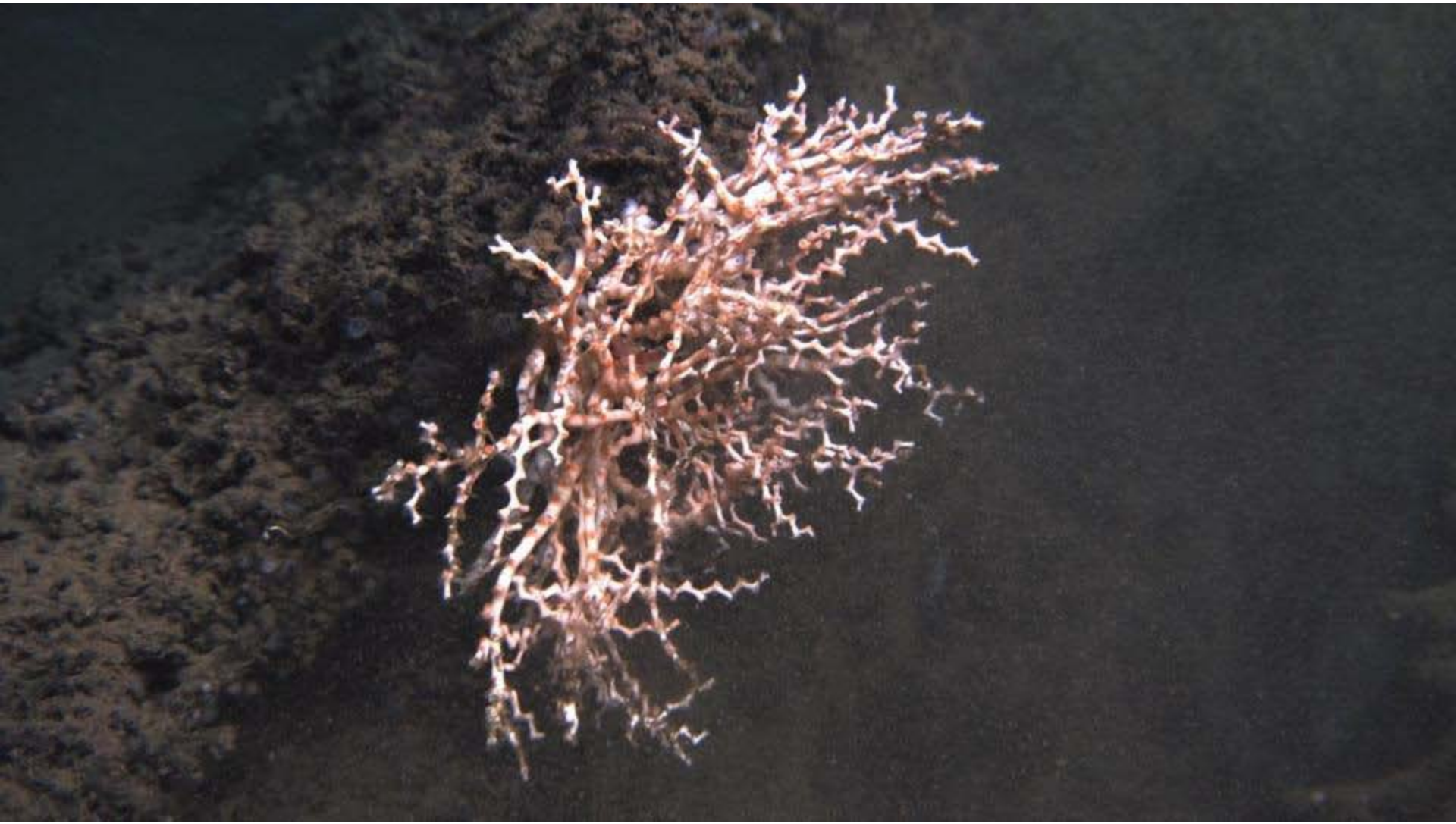
Surface amplitude map courtesy of TGI inc.


BOEMRE
NOAA
USGS
science for a changing world
Surface amplitude map courtesy of TGI inc.

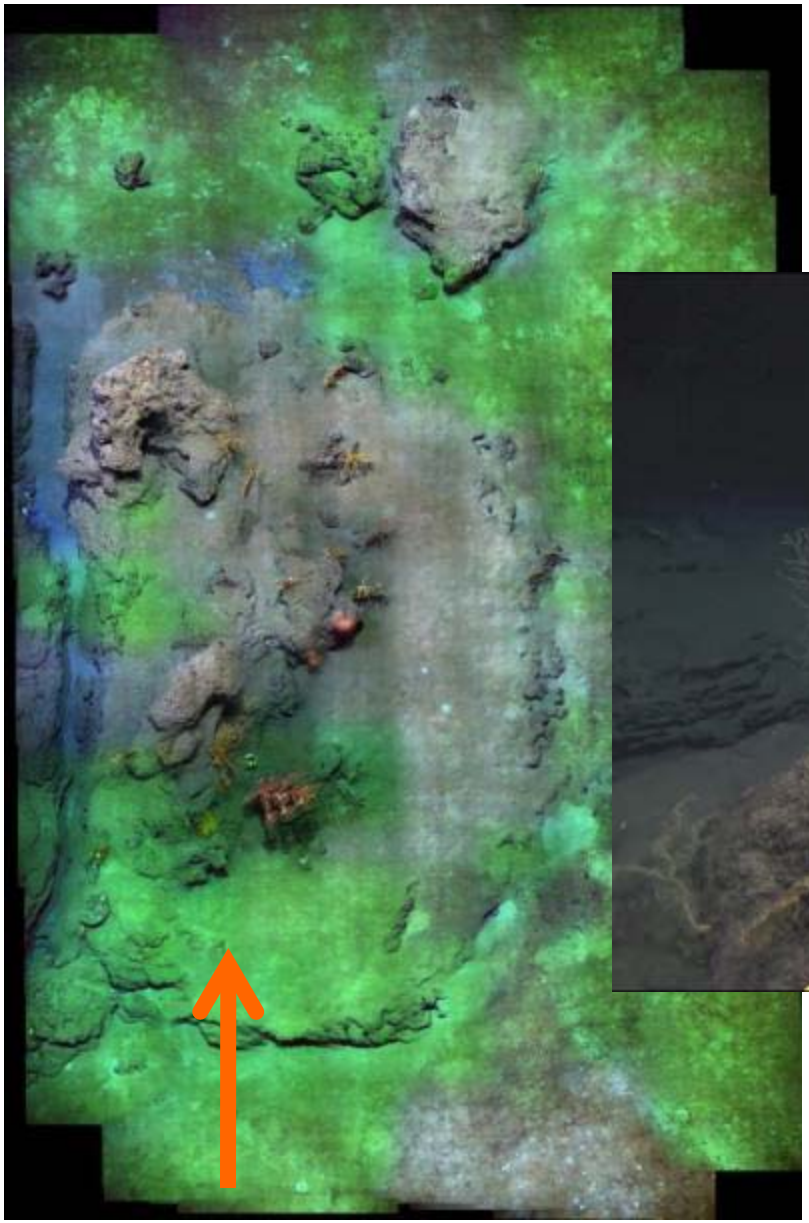
MC 338: 12 km to SW of Macondo

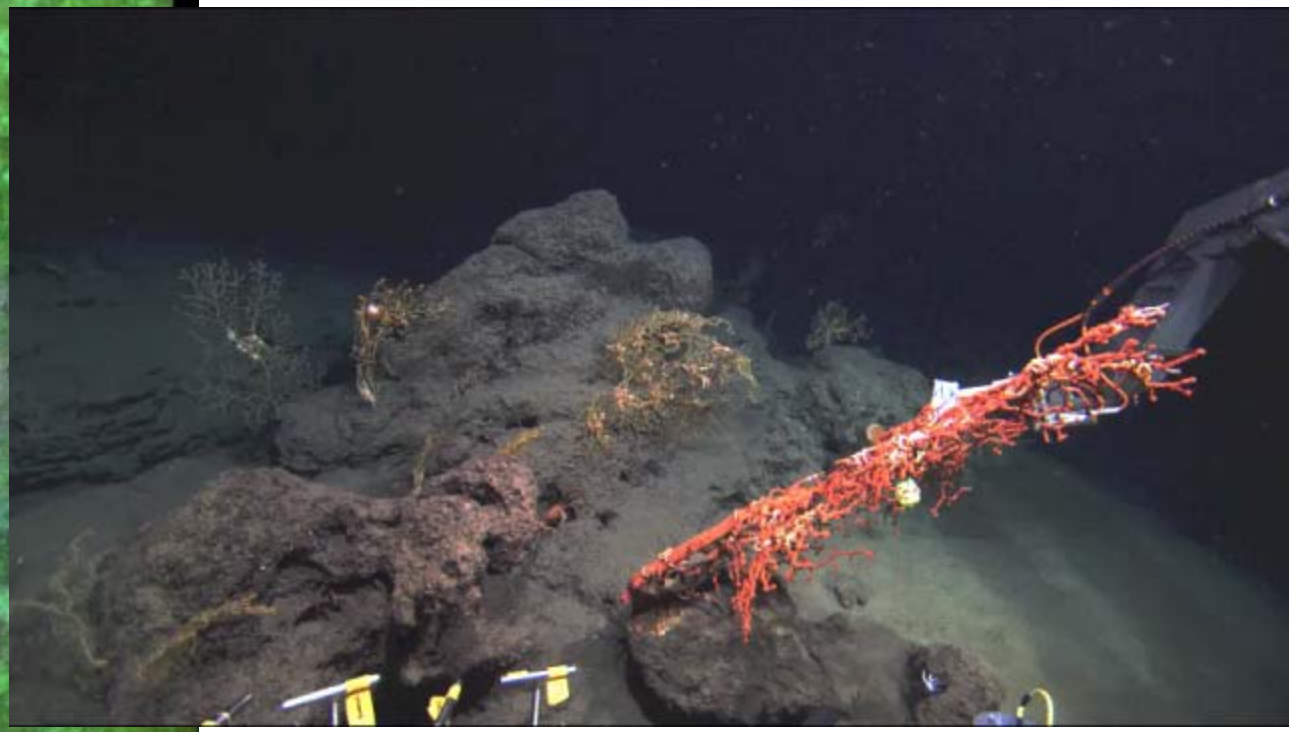


Madrepora oculata



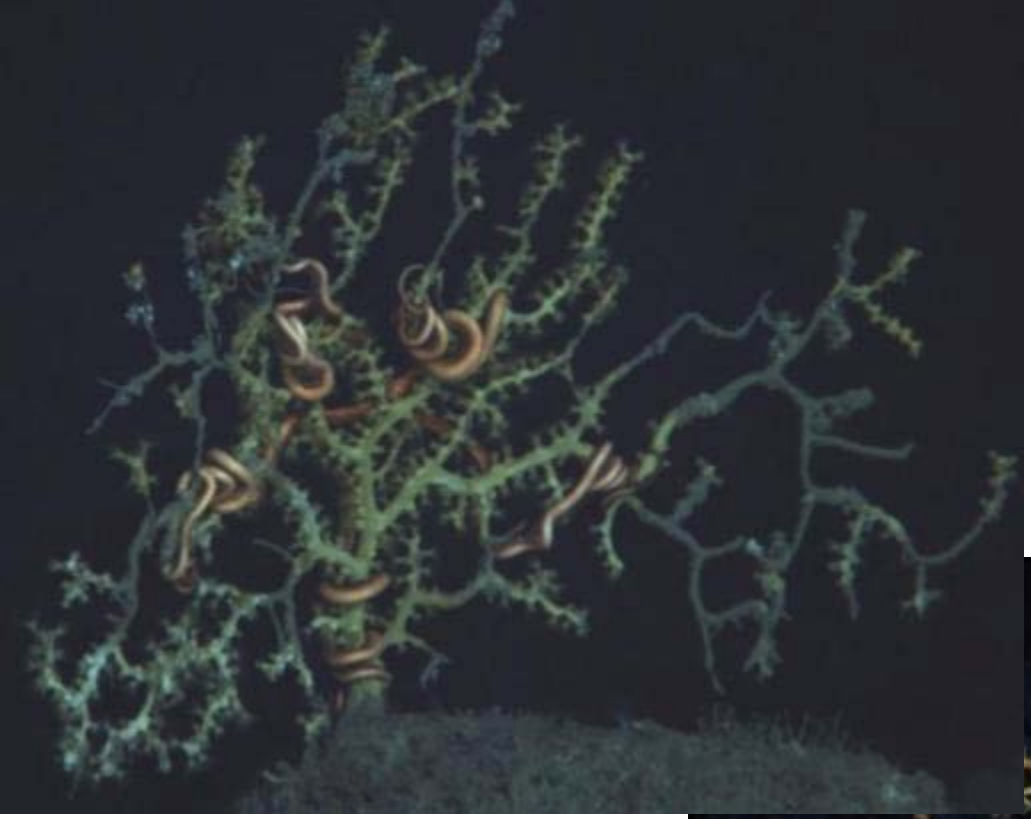
And Then 340 m Further to the NW…



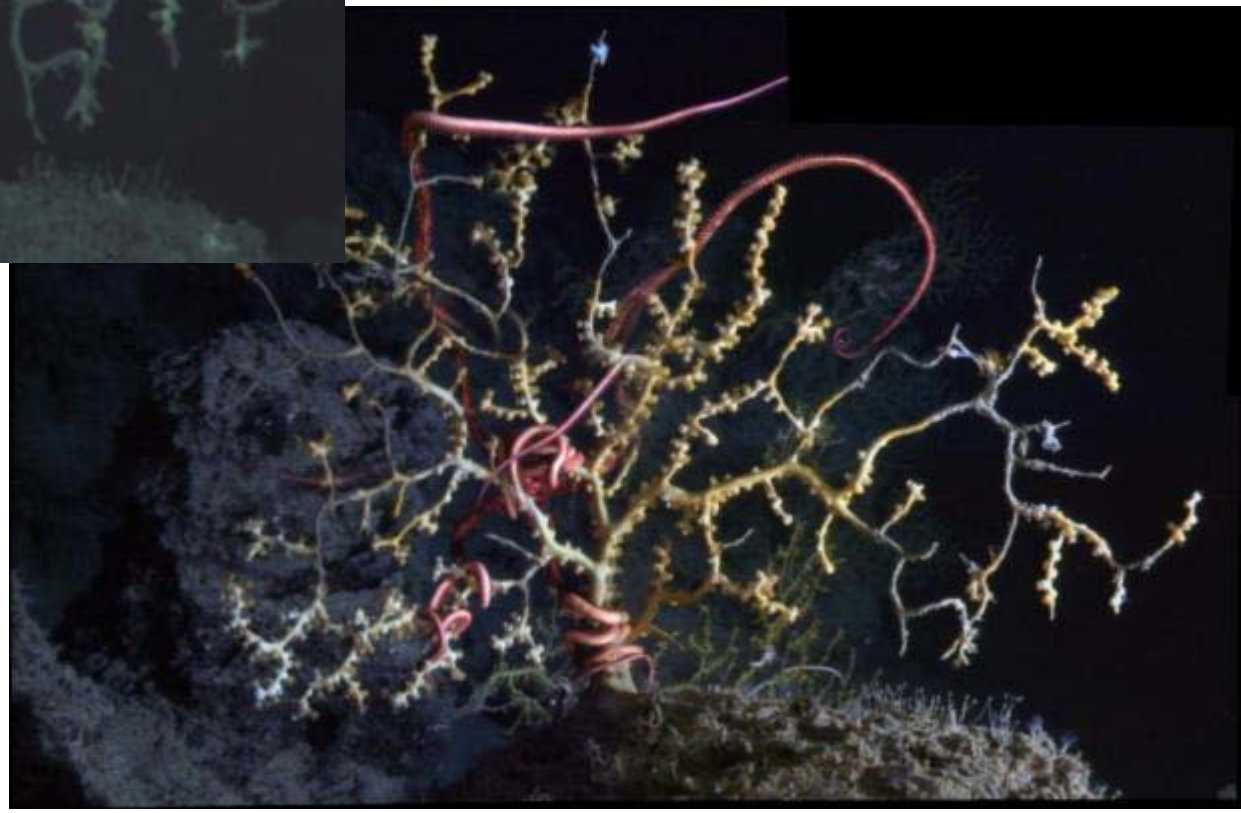


December 2010 NSF- Rapid(s) CoML

Surface amplitude map courtesy of TGI inc

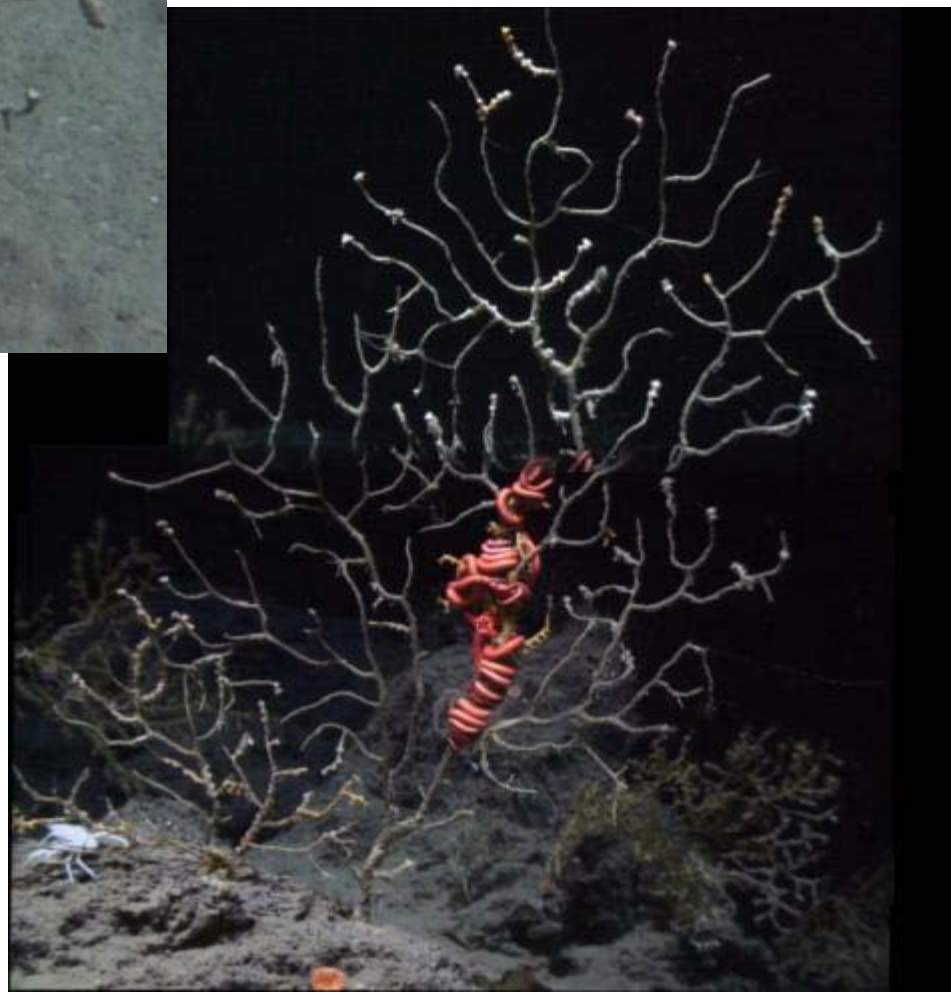


November 11, 2010

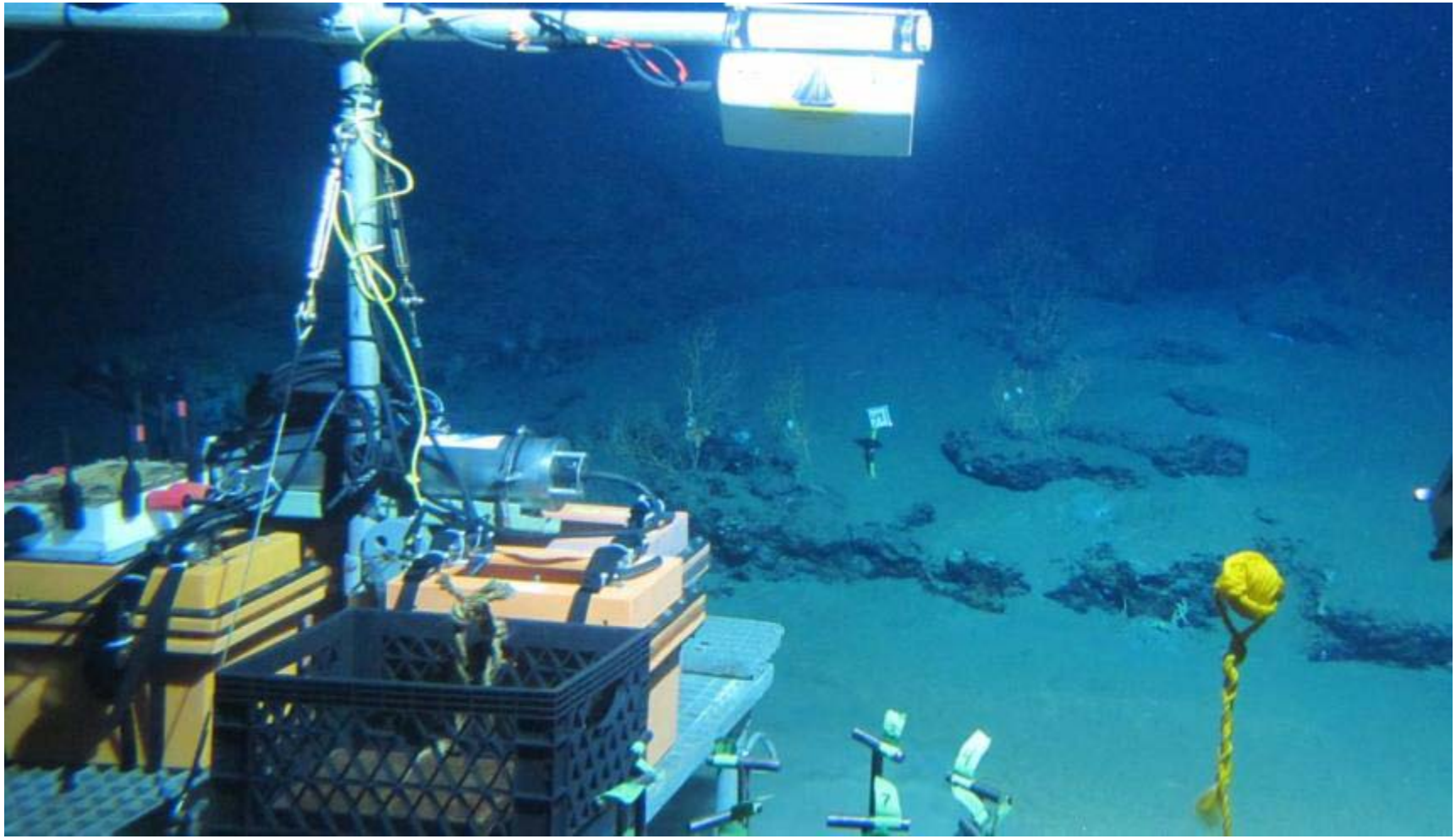


December 13, 2010

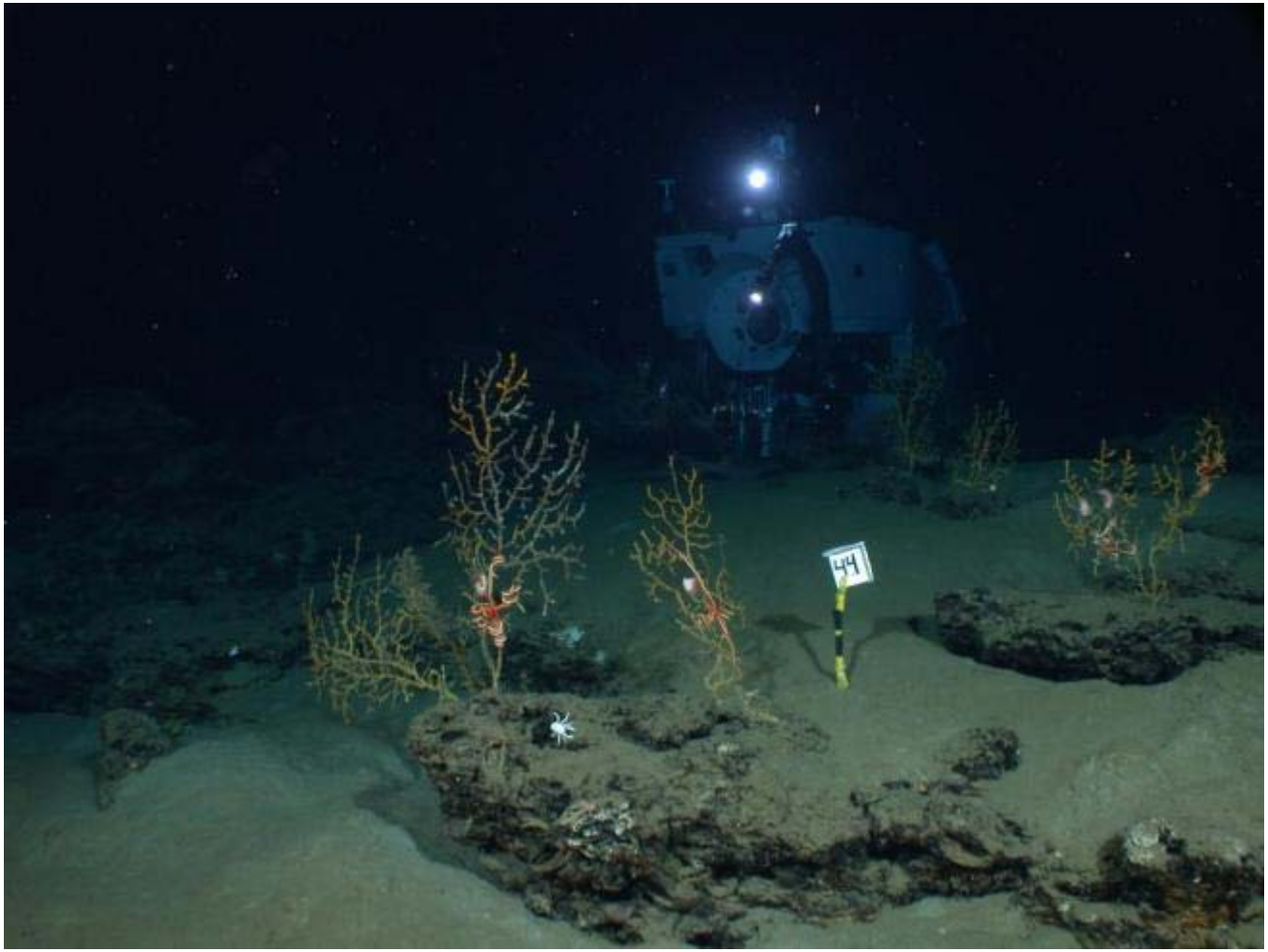
November 11, 2010



December 13, 2010

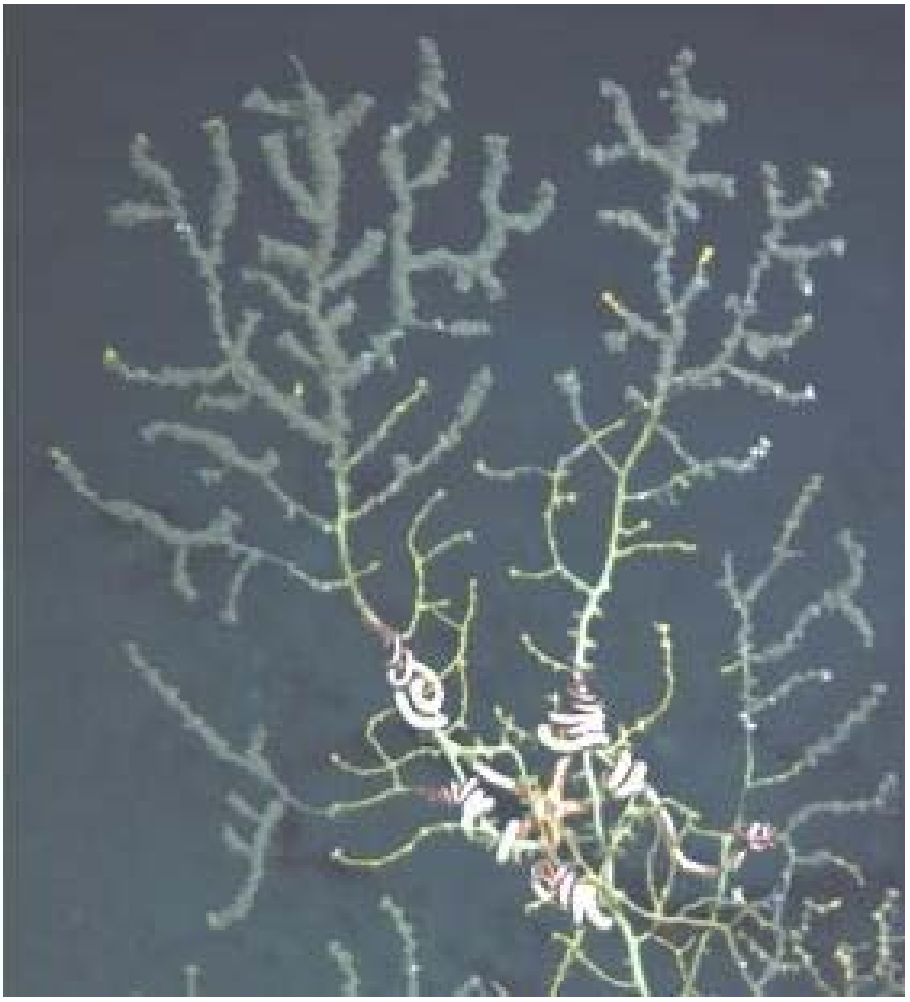


Time lapse camera deployed, December 2010

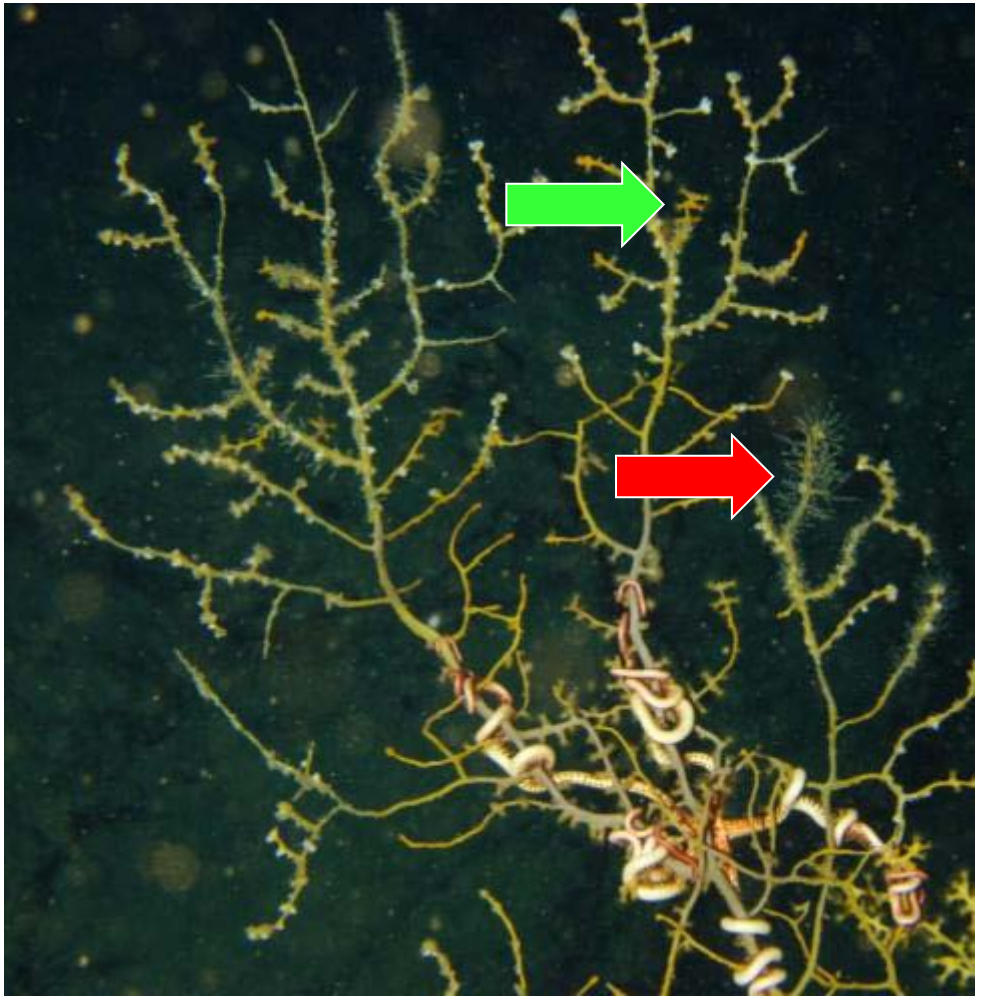


Picture downloaded March 12, 2011

Paramuricea A-10 at MC 338

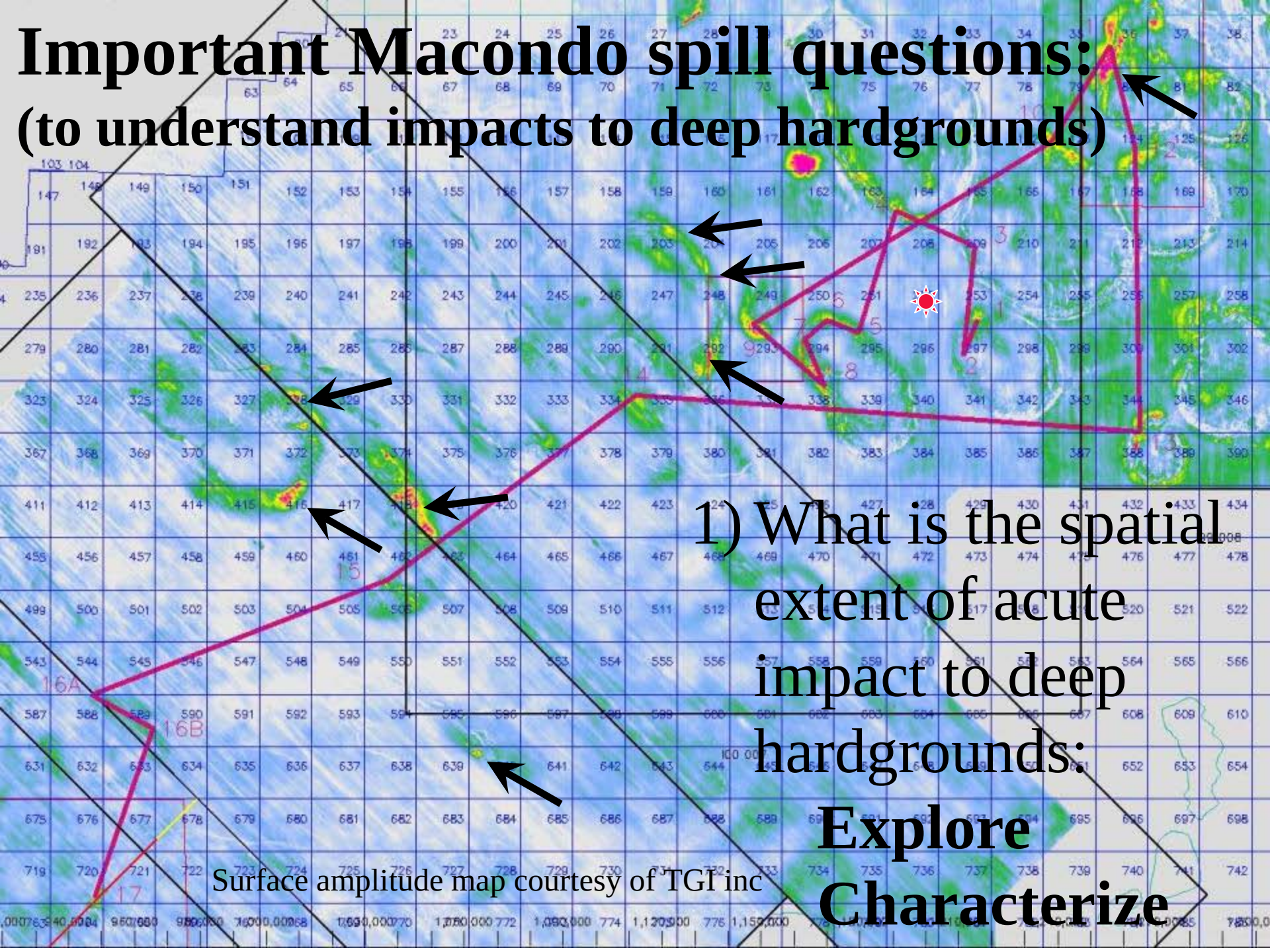


November 2010



March 2011

Important Macondo spill questions:
(to understand impacts to deep hardgrounds)



1) What is the spatial extent of acute impact to deep hardgrounds:

Explore

Characterize

Surface amplitude map courtesy of TGI inc

Important Macondo Spill Questions:

2) What is the long term result of the acute impact?
Monitor affected sites (MC 338 so far)

November 2010

March 2011

Important Macondo Spill Questions:

3) Are there sublethal effects not yet detected?

Monitor well characterized and closest apparently healthy sites (VK 826, 862, 906, MC 118, 388, 751, DC 673)

What is BOEMRE's Role?

BOEMRE is the federal agency responsible for overseeing the safe and environmentally responsible development of energy and mineral resources on the Outer Continental Shelf.

To accomplish this, the BOEMRE collects information about the environment through funding of ocean research. Cumulatively, these activities help BOEMRE to pursue an adaptive and ecosystem-based approach to its stewardship responsibilities.

Important Next Steps for BOEMRE Hardground Ecosystem Studies
(A Personal Opinion)

Establish and maintain a Gulf-wide ecosystem monitoring network that will inform on natural processes in deep water hard ground communities over a wide depth range and also provide baseline information and monitoring sites as anthropogenic impact to the deep sea continues into the future.

This monitoring network should include a combination of attached macrofauna community monitoring stations (protected from sampling), and a faunal sampling and analysis design that can inform on changes in condition and metapopulation relations over time.