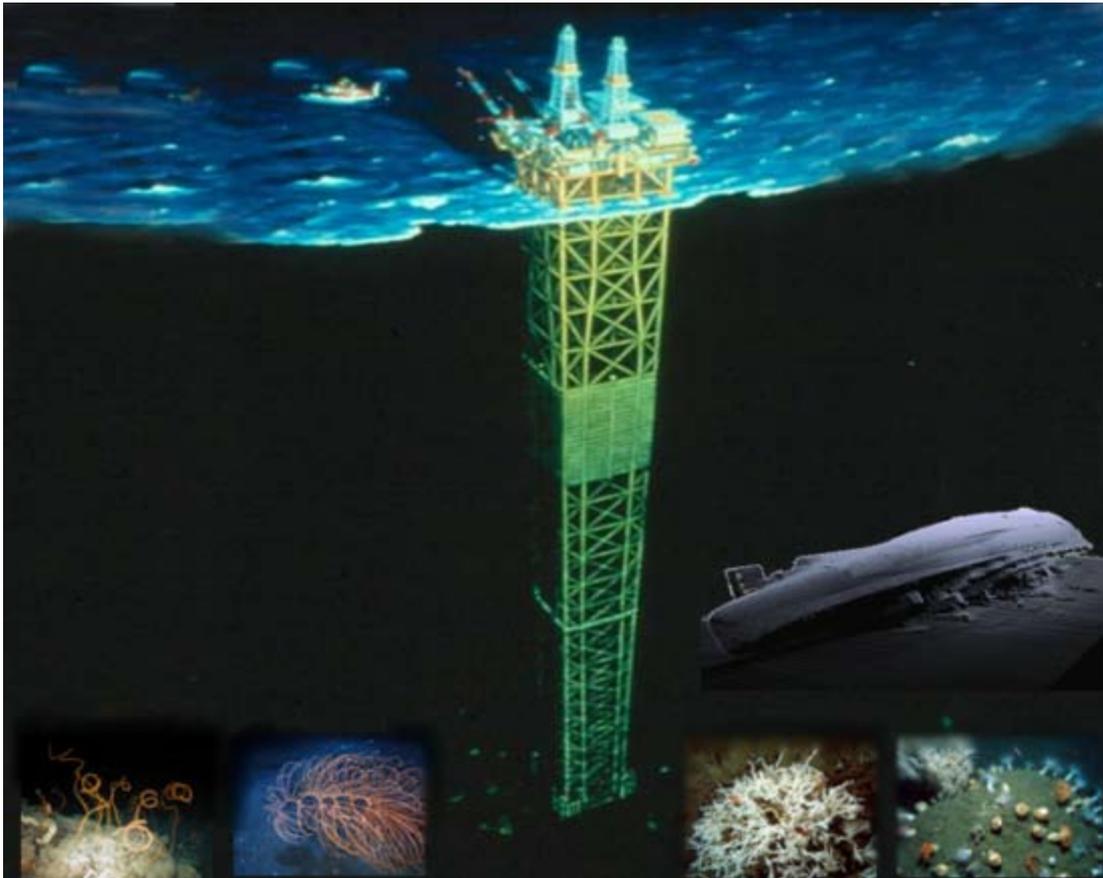


LOPHELIA II: OVERVIEW AND MANAGEMENT
**Deepwater Program: Exploration and Research of
Northern Gulf of Mexico Deepwater Natural and
Artificial Hard-Bottom Habitats with Emphasis on Coral
Communities: Reef, Rigs and Wrecks**



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Program Objectives

Obtain robust predictive capability for the occurrence of rich hard-ground coral communities in the deep Gulf of Mexico

- Discover and describe new locations > 300 m with extensive coral community development including *Lophelia pertusa*
- Gain a more comprehensive understanding of process that controls the occurrence and distribution of *Lophelia* and other coral communities (<300m) through both laboratory and field data collection
- Document and understand the relationship between coral communities on artificial and natural substrates with respect to community composition and function, phylogeographic and population genetics, and growth rates of key foundation species

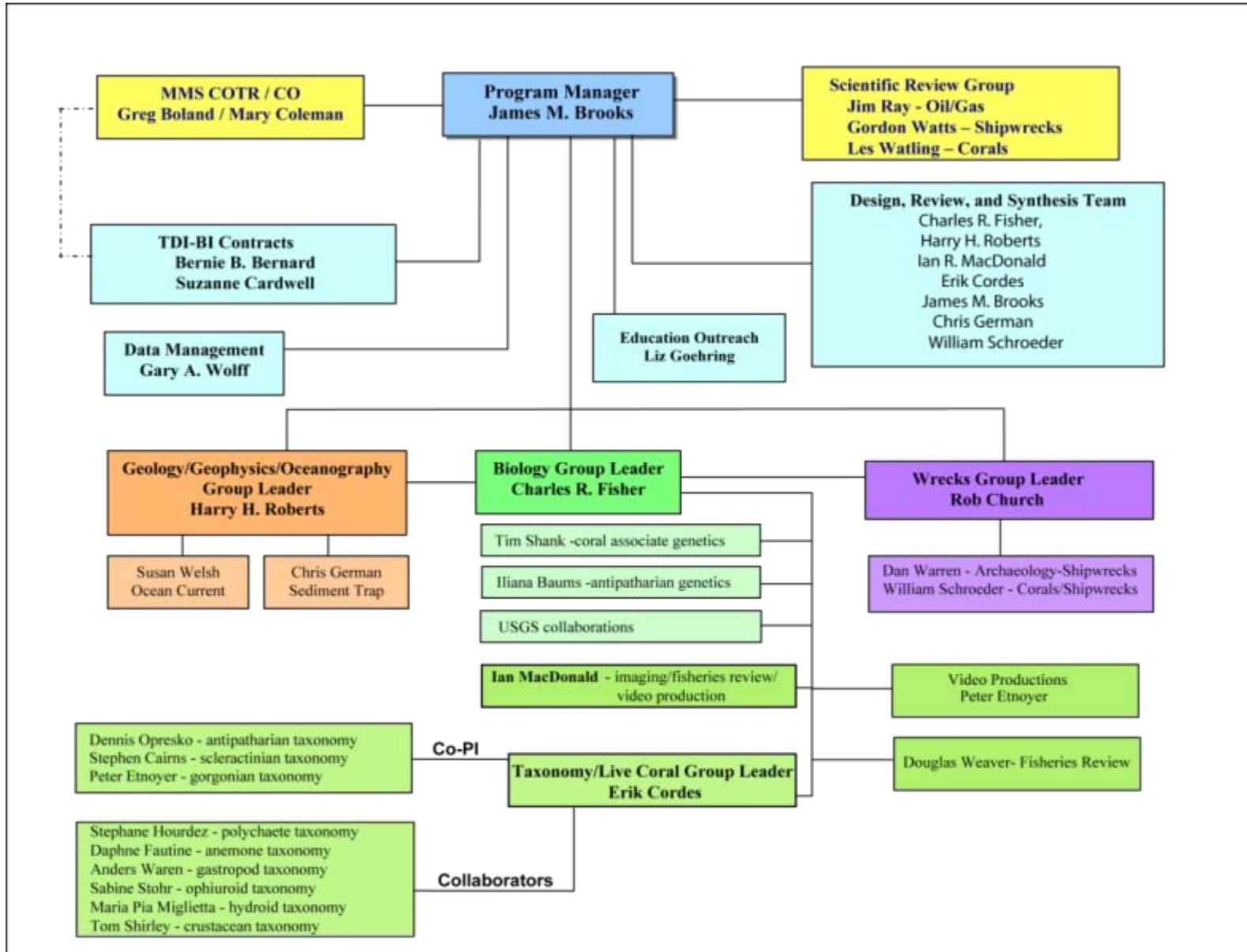
Program Objectives – Biological Objectives

- To discover and characterize new sites
 - Characterize key sites at the largest scale with HR bathymetry, SSS, 3-D seismic data and current models
 - Characterize the coral density at the 10 to 100-m scale with randomized photo transects and general site descriptions
 - Characterize the community composition at the 1 to 10 m scale at significant coral sites (man-made and natural) with analysis of close-up imagery, replicate photomosaics, and quantitative community collections
- Analyze connectivity among man-made & natural sites with comparative community, phylogeographic, and population genetic analysis
- Compare the structure, species richness and diversity of communities tightly associated with *Lophelia* at man-made and natural sites
- Experimentally determine the tolerance and growth response of *Lophelia* to temperature, pH/alkalinity, dissolved oxygen and current
- Characterize and constrain growth rates of key species of colonial cnidarians (pioneer colonies) using analysis of images on man-made structures of known age
- Characterize key variables (temperature, currents, larval seasonal distribution development and sediment quality) at sites with the most significant coral communities over one year at 2 to 4 sites

Program Objectives – Other Objectives

- Historical shipwreck component. Study of up to six (6) shipwrecks to determine identity, site boundaries, National Register eligibility, preservation state and stability, associated biological communities and artificial reef effects
 - Determine rate of deterioration of test coupons at platforms or shipwrecks
- Coordination with USCG
- Deepwater commercial fisheries review that impact hard-bottom communities

Program Organization



Lophelia II – Cruise 1

September 05–October 02, 2008

Primary Objective

Conduct a reconnaissance of shipwreck sites and site reconnaissance of potential new hard-ground communities

- Conducted on NOAA research vessel *Nancy Foster*
- Mobilized and embarked from Galveston, Texas
- **Leg 1:** September 5–13, 2008
- Staged in Gulfport, Mississippi, for the second leg
- **Leg 2:** September 20–October 2, 2008
- Demobilized in Pascagoula, Mississippi



Cruise 1 – Summary

Leg 1

- Ewing Banks Wreck site confirmed historic 19th century shipwreck site
 - More *Lophelia* on Ewing Banks Wreck than any other 19th century wooden wreck known in the Gulf of Mexico
- Identity of *GulfOil* was confirmed and substantial coral colonies were documented
 - *Lophelia* coverage at *GulfOil* may be more substantial than that documented at *GulfPenn* in 2004
- The dive on *GulfPenn* allowed the identification of the stern section of the tanker
 - Microbial experiment placed on the site in 2004 was reexamined
 - Temperature logger was placed on *GulfPenn's* bow

Leg 2

- Multibeam data was collected at 13 sites
- Ten (10) lowerings of the ROV were completed over eight (8) different sites
 - 50 hours total bottom time, CTD collectons and 61 biological and geological samples collected
- Five (5) sites with adequate visual surveys
 - MC 751 (8 hrs) high abundance of live *Lophelia pertusa* – good candidate for future work
 - GC 140 (17 hrs) high diversity of gorgonians and antipatharians
 - GC 234 (5 hrs) discovered new area of *Lophelia pertusa* colonization north of previous site
 - VK 906 (10 hrs) coral mounds south of previously explored area
 - GB 201 (9 hrs) hard grounds covered in sediment, very low coral abundance
 - Eliminated as a potential site

Lophelia II – Cruise 2

2nd Site Reconnaissance Cruise: June 06–30, 2009

R/V BROOKS McCALL

WHOI's-AUV *SENTRY*



Lophelia II – Cruise 2

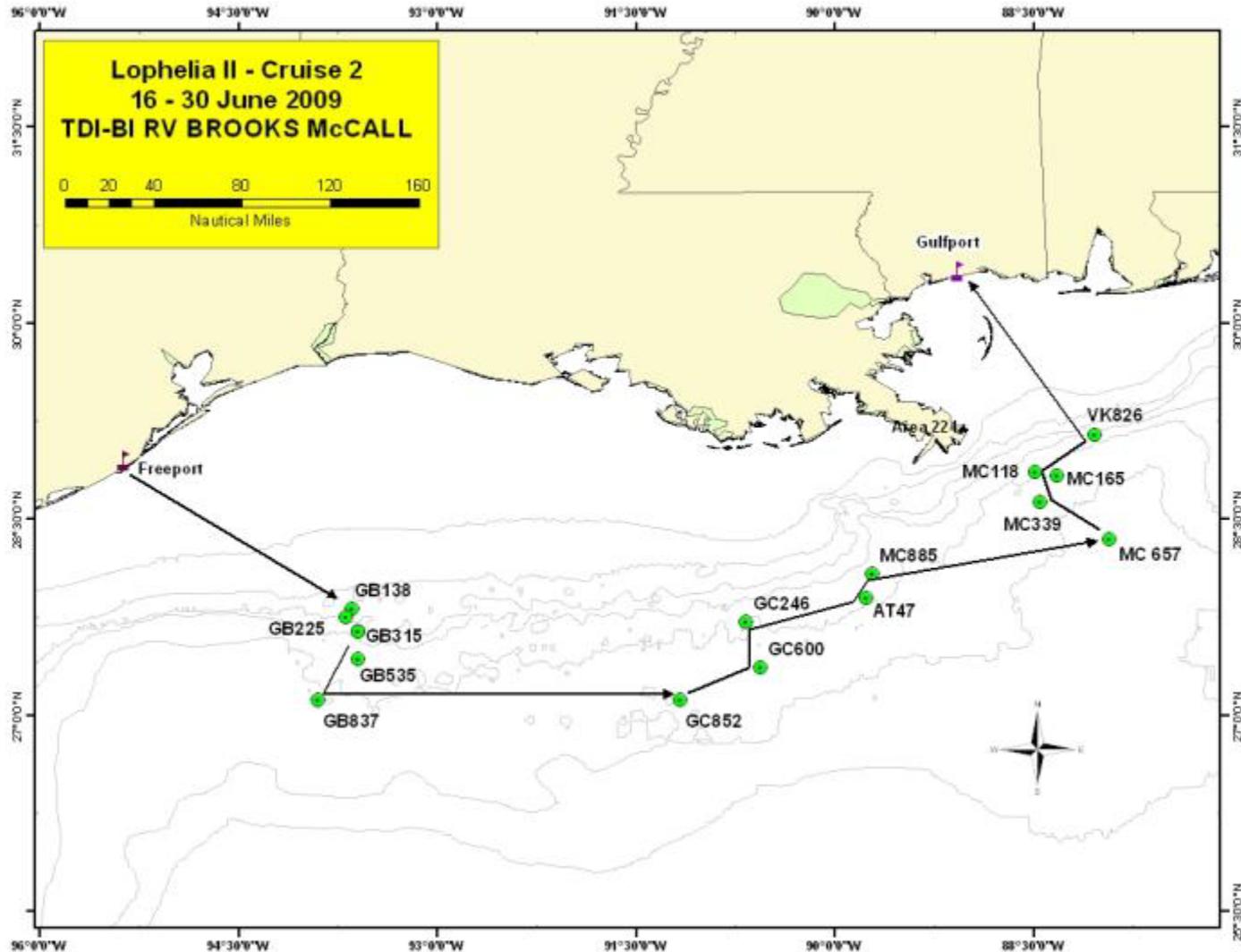
Second Site Reconnaissance Cruise: June 06–30, 2009

R/V *BROOKS McCALL* and WHOI's-AUV *SENTRY*

- Cruise duration: 14 days
- Somewhat similar activities as first cruise
- Survey remaining sites from Cruise 1 list
- Focus on site recon of unexplored sites and wrecks
- Increased sample capabilities greater than 1,000-m in such sites as GC-852 and other areas
- Based on data collection during the first two cruises, the key sites (both natural and artificial) for in-depth study during the subsequent cruises will be identified

Lophelia II – Cruise 2

Second Site Reconnaissance Cruise: June 06–30, 2009



Third and Fourth Science Cruises – ROV

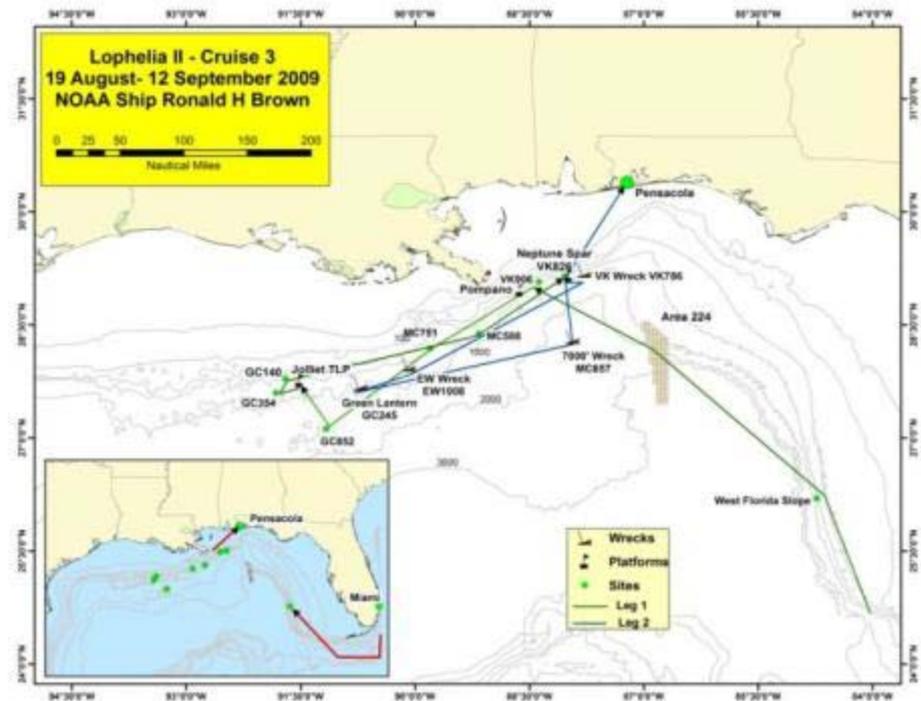
- Cruise 3: August–September 2009: NOAA Ship *Ron Brown* and *Jason II*
- Anticipate about 20+ dive days in 2009 and 2010 with *Jason*
- Sites selected from first and second reconnaissance cruises, plus other known sites (VK826 & GC852)
- Compromise the intensive *in situ* field work (time lapsed cameras, sediment traps, current meters, temperature recorders, quantitative collections of corals, population genetics, coral sediment collections, live corals collections, faunal inventories)
- Visit 6 to 7 sites with extensive collections at potentially three (3) sites
- Some wreck and platform works as well



Lophelia II – Cruise 3

ROV Science Cruise: August 19–September 12, 2009

- Mapping out coral distribution
- Collecting the data necessary to fully describe the habitats of the corals, the communities associated with them, and the levels of genetic connectivity among the coral communities
- Collecting live corals, and transporting them back to the laboratory to conduct experiments, and to better understand the factors controlling their distribution
- Surveying shipwrecks in order to examine the coral communities in the wrecks, as well as to describe and preserve these potentially historic sites



Lophelia II – Cruise 3

ROV Science Cruise: August 19–September 12, 2009

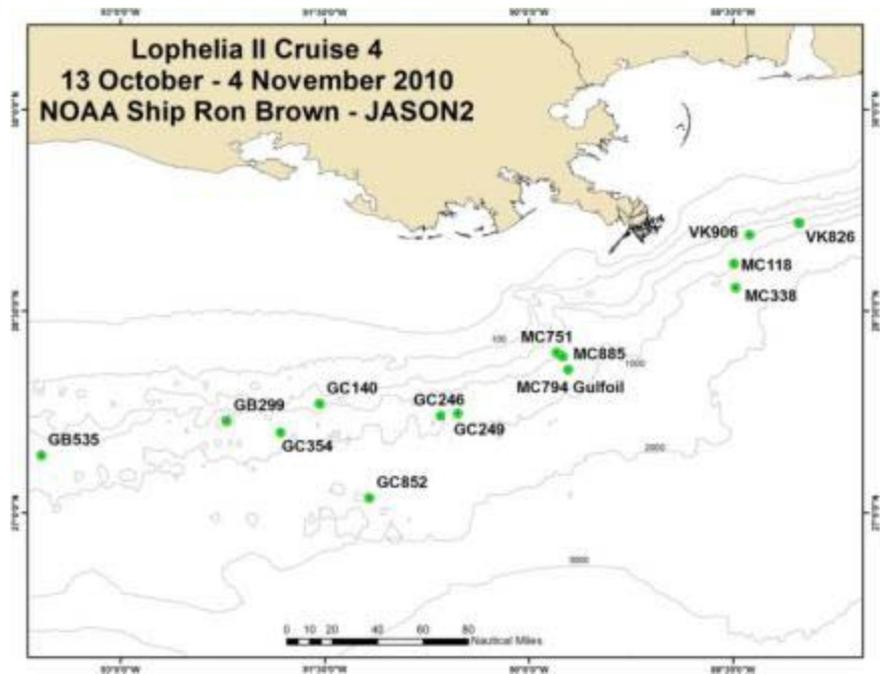
Accomplishments

- 20 dives with the ROV *Jason II* at 17 sites (including 5 shipwrecks), and an incredible 356 hours of bottom time
- Mapped out about 20 km² of seafloor for the first time
- Using *Jason* we obtained high resolution maps of the seafloor in which we could identify individual coral colonies
- Found some new *Lophelia* sites, including the “Roberts’ Reef” site in Viosca Knoll 906
 - Contained huge, uninterrupted fields of *Lophelia* and also contained a high level of diversity of black corals that contributed to the heterogeneity of the habitat
 - This site is also the first reported cold-water carbonate mound in the Gulf, a feature that is quite common at the *Lophelia* sites of the Atlantic. The features of this site will change the way we look for *Lophelia* in the future
- Confirmed a previous sighting of *Lophelia* about 200 km further west in the Gulf than it had ever been reported, in Green Canyon 535. This site will provide a wealth of information on the population genetics and larval dispersal of *Lophelia* as we begin to work up our samples

Lophelia II – Cruise 4

ROV Science Cruise: October 13–November 04, 2010

- Deepwater coral focus
- Returned to existing and new sites likely to host lush core or seep fauna
- Collecting small pieces of coral for genetic studies to explore connectivity, how corals respond to stress
- Sampling associated with DW Horizon incident
- These “baseline” data include 18 photomosaics that cover between 20 and 100 m² portions of 8 different coral community sites between 300 and 1,500 m depth in the Gulf
- Each site is well marked and the mosaics so well navigated that we can return to specific corals to see if they are still alive, if they have grown and if there are any visible signs of damage since our last visit



Lophelia II – Cruise 4

ROV Science Cruise: October 13–November 04, 2010

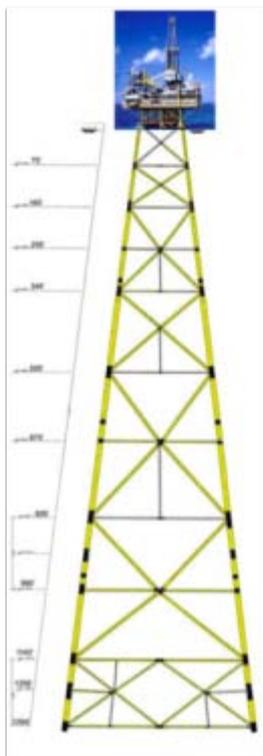
Accomplishments

- 17 dives with the ROV [*Jason II*](#) at 17 sites
- Detailed and methodical imaging of the site and fauna
- Dive to an area 7 miles to the SW of the site of the *Deepwater Horizon* disaster; collected a variety of samples that may help us to understand what happened here. Sampled small pieces of coral from each apparently different species for genetic identification
- Fixed some of the samples on the sea floor in a fixative that will allow investigation of the proteins the corals were expressing on the sea floor and investigations of genetic damage they may have incurred
- Sampled both dead and live corals, brittle stars, anemones, and even mud for laboratory analyses and fingerprinting of hydrocarbons
- Analyses will include tests to determine if there is still evidence of whatever chemicals may have impacted these animals in their tissues or the sediment beneath them

Remaining Field Sampling

Oil Platform ROV Survey Effort using R/V *Brooks McCall* and NOAA-OE provided ROV: 3rd quarter 2011 (?)

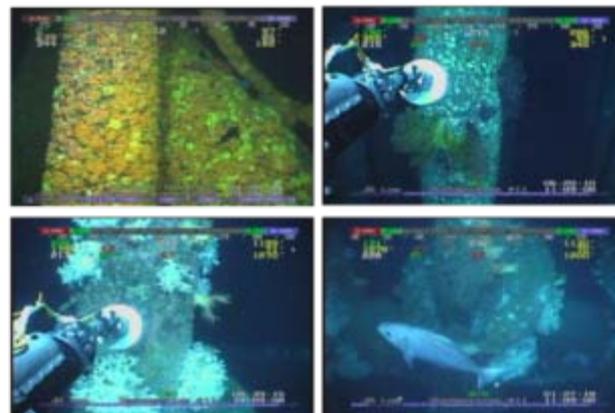
- At least six (6) platforms to be selected for live coral colonization surveys/sampling
- Selected in areas of special interest to our studies of population connectivity amount known and potential deep coral communities
- Represent a range of ages in order to generate a range of growth rates for pioneer colonies



BP's Pompano Platform

Vertical Zonation of Fishes and Invertebrates

with emphasis on *Lophelia pertusa*



Figures and Still Captures by D. Weaver, TAMU-CC.

DVD Footage and Diagrams provided by T. Rooney and K. Sajdak, BP.