

Characterization of Northern Gulf of Mexico Deepwater Hard-Bottom Communities with Emphasis on *Lophelia* Coral – An Introduction

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MMS Missions and the Deepwater Program

MMS is responsible for managing exploration and development of mineral resources on the Federal OCS. Through its Environmental Studies Program, the MMS collects information for leasing and management decisions. The Deepwater Program was initiated in response to the increase in deep water O&G exploration and development. It consists of a suite of studies specifically designed to gain information on environmental resources and processes offshore of the continental shelf.

MMS Missions and the Deepwater Program

Select studies include:

- Northern Gulf of Mexico Continental Slope Study (1983)
- Northern Gulf of Mexico Continental Slope Habitats and Benthic Ecology
- Gulf of Mexico Sperm Whale Research
- Bluewater Fishing and Deepwater OCS Activity, Interactions Between the Fishing and Petroleum Industries in Deepwaters of the Gulf of Mexico
- Environmental Impacts of Synthetic Based Drilling Fluids
- Fate and Effects of Barium and Radium-Rich Fluid Emissions from Hydrocarbon Seeps on the Benthic Habitats of the Gulf of Mexico Offshore Louisiana
- Effects of Oil & Gas Exploration at Selected Continental Slope Sites in the Gulf of Mexico

MMS Missions and the Deepwater Program

This study of non-chemosynthetic hard-bottom areas of the continental slope represents another logical step for MMS deepwater investigations.

Study Focus

“This Study will focus on the collections and synthesis of samples and data collected from multiple sites on the Gulf of Mexico Continental Slope where hard-bottom biological communities are located, with special emphasis on deepwater *Lophelia* coral aggregations.

“This synthesis will describe environmental conditions that result in the observed distribution and development of high-density communities, particularly extensive areas of *Lophelia* coral.”

Study Objectives

- **Use Results from previous and ongoing related work, in-house MMS seismic data, and hypotheses to define and select study sites that represent both known and probable areas of exposed hard-bottom substrate with associated biological communities that feature high density assemblages of megafauna such as the azooxanthellate scleractinian coral *Lophelia pertusa*;**
- **Design and implement submersible survey and sampling techniques to characterize the types of non-chemosynthetic megafaunal and macroinfaunal communities that live on these deepwater hard-bottom substrate areas;**
- **Investigate and describe environmental conditions that are correlated with the observed distribution and development of these high density biological communities, and particularly extensive areas of *Lophelia pertusa*.**

Minerals Management Service

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Program Design

Physical Oceanography Studies

Dr. Steven Morey

- **Current meter arrays deployed (2)**
- **Numerical modeling studies**

Geological Characterization

Dr. William Schroeder

- **Review of existing data – regional and local scales**
- **Study site descriptions**
 - **Bathymetry**
 - **Geomorphology**
 - **Grain size analyses**
 - **$\delta^{13}\text{C}$ analyses of carbonates**

Biological Characterization and Studies

Dr. Craig Young, Dr. Sandra Brooke

Dr. Chuck Fisher, Dr. Erik Cordes

Biological characterization

- **Video transects (100 m)**
- **Still photomosaics (10 m)**
- **Quantitative collections – Bushmaster**
- **Qualitative collections**
 - **Photographic**
 - **Physical collections**

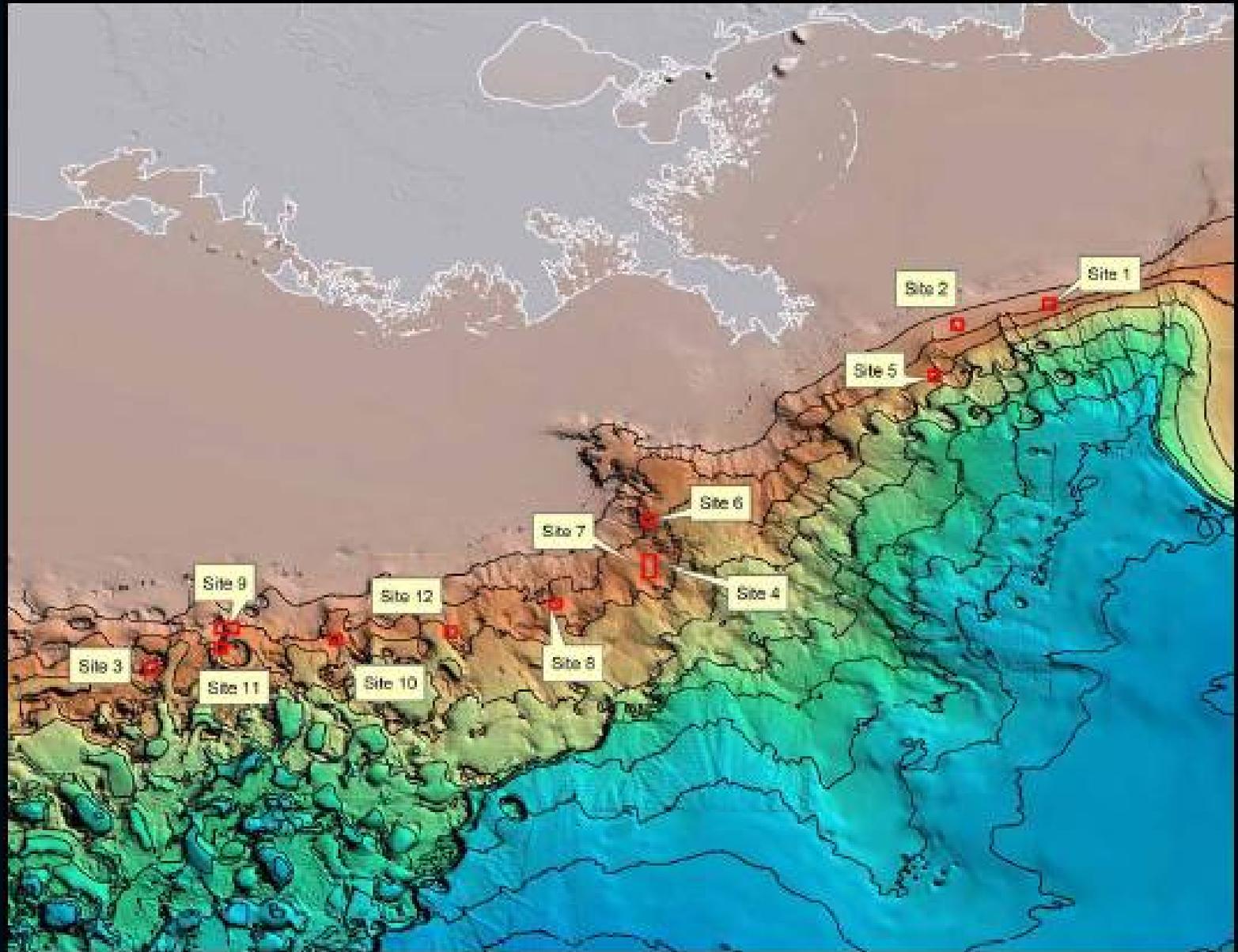
Biological Studies

- **C, N, and S Stable isotope analyses**
- ***Lophelia* $\delta^{13}\text{C}$ skeletal analyses**
- ***Lophelia* tolerance studies**
 - **Temperature**
 - **Food requirements**
 - **Sediment tolerance**
- ***Lophelia* larval advection studies**
- ***Lophelia* transplant survival and growth studies**
- ***Lophelia* growth rate studies**
- **Sediment/zooplankton traps**
- **Total petroleum hydrocarbon analyses**

Candidate Site Selection Criteria

- **Confirmed presence of *Lophelia* and other significant hard-bottom megafaunal assemblages from submersible or ROV Operations.**
- **Sites where unidentified corals and other hard-bottom non-chemosynthetic megafauna have been reported from direct observations or video or still photography obtained during manned submersible dives and ROV operations or other sources.**
- **Records of sites where corals or other megafauna have been collected using conventional sampling gear (e.g., trawling or dredging) from surface ships.**
- **Geophysical data (e.g., side-scan sonographs and 3D-seismic surface amplitude anomaly data).**

Candidate Study Sites

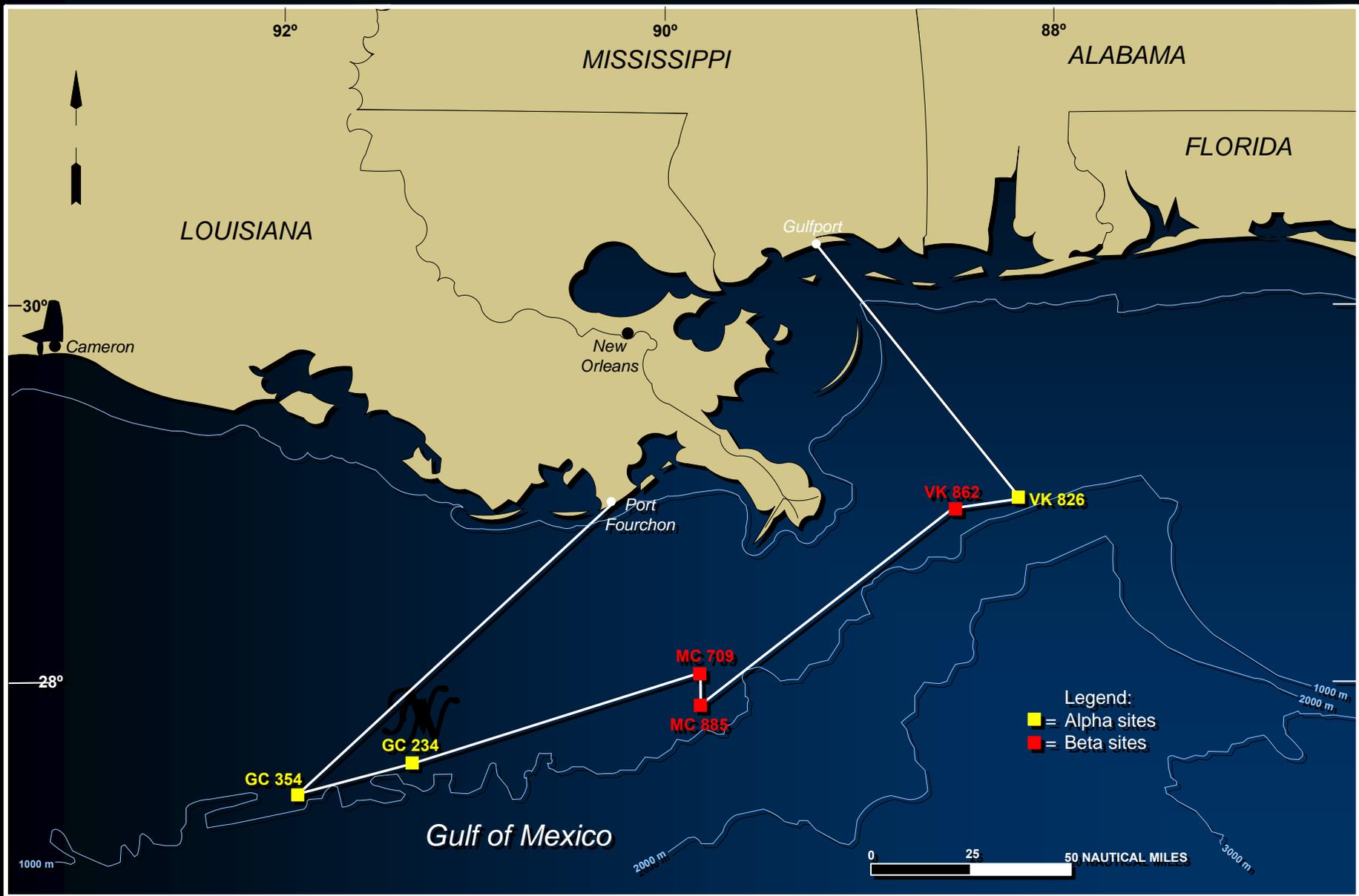


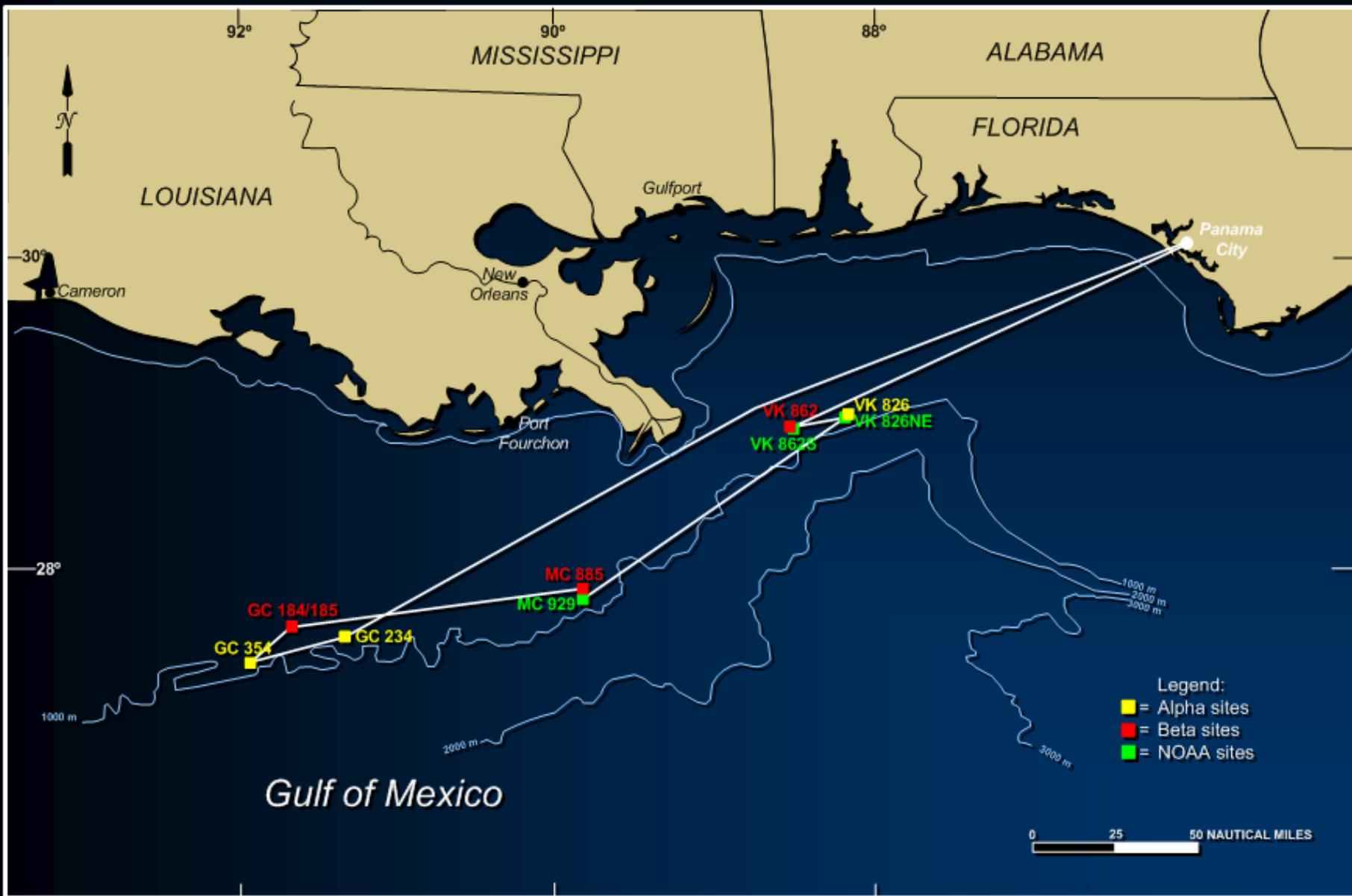
Johnson Sea Link Submersible



Alpha and Beta Study Site Tasks

Tasks	Alpha Sites	Beta Sites
Video Transects	√	√
Photo Documentation	√	√
Bushmaster Collections	√	
Site Marker Deployment	√	
Sediment Trap Deployment	√	√
Temperature Probe Deployment	√	√
Current Meter Deployment	√	
Water Sample Collections	√	√
Substrate Collections	√	√
<i>Lophelia</i> Transplants (VK 826)	√	





Task	Alpha Sites			Beta Sites			NOAA-OE Sites			
	GC234	GC354	VK826	MC709*	MC885	VK862	GC184/185	VK826NE	VK862S	MC929
Physical Oceanography										
Long-term current meters (deployed, retrieved)	1,1	--	1,1	--	--	--	--	--	--	--
Short-term current meters (deployed, retrieved)	1,1	--	1,1	--	--	--	--	--	--	--
Water Chemistry										
Water samples for hydrocarbon analysis	2,1	1,1	2,0	--	1,1	2,0	0,1	--	--	0,1
Geological Characterization										
Geological reconnaissance	●	●	●	●	●	●	●	●	●	●
Sediment samples for grain size analysis	5,0	6,0	5,0	--	0,3	3,0	0,3	--	--	--
Rock samples for isotope analysis	--	--	0,5	--	--	3,5	0,1	--	0,3	0,2
Biological Characterization and Studies										
Video transects	3,0	1,4	5,0	--	1,5	2,0	0,0	0,8	--	--
Photomosaics	3,0	2,1	2,0	--	1,1	1,1	0,2	0,2	--	--
Bushmaster collections	3,0	1,0	2,1	--	--	--	--	0,1	--	--
Organisms for stable isotope analyses	●	●	●	--	●	●	●	●	●	●
<i>Lophelia</i> live colony collections	●	●	●	--	●	●	●	●	●	●
Voucher specimen collections	●	●	●	--	●	●	●	●	●	●
<i>Lophelia in situ</i> staining	--	--	●	--	--	--	--	--	--	--
<i>Lophelia</i> transplants	--	--	●	--	--	--	--	--	--	--
Sediment traps (deployed, retrieved)	6,6	6,3	12,8	--	3,0	3,3	--	--	--	--
Temperature probes (deployed, retrieved)	--	1,1	--	--	--	1,1	--	--	--	--