Cruise Plan for NOAA OE Expedition: November 7-21st 2005

Date: October 12, 2005

To: Tim Askew, Director of Marine Operations

cc: Captain Ralph van Hoek, Scientific Participants, Debbie ???, NOAA OE

From: Sandra Brooke, John Reed, Charles Messing.

Subject: Cruise Plan
R/V SEWARD JOHNSON and *JSL* Submersible
Nov. 7-21, 2005

PROJECT TITLE: "Exploration of Deep-water Coral Ecosystems off the Coast of Florida- Mapping and Habitat Characterization"

DURATION OF PROJECT: Nov. 7-21, 2005

INVESTIGATORS:
Dr. Sandra Brooke- Chief Scientist, University of Oregon
John Reed- Principal Investigator; Harbor Branch Oceanographic Institution
Charles Messing - Principal Investigator, Nova Southeastern University

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RESEARCH VESSEL:
R/V SEWARD JOHNSON
Registration Number- FL7833EH
Call Sign- WST9756
Gross Tons- 263 RNT
LOA- 204 ft. (62.2 m)
Draft- 12 ft. (3.6 m)
Master- Ralph van Hoek

FUNDING SOURCES:
NOAA Office of Ocean Exploration

Budget: November 7-21, 2005 (14 days total)

AREAS OF OPERATION:
US EEZ at depths of 200 to 3000 ft, on continental shelf and slope off Florida, including:

Area 1: Florida Hatteras Slope and Straits of Florida- Jacksonville to Miami Florida; Lophelia lithoherms and bioherms; depths 2000- 2800 ft.

Area 2: Miami Terrace and Escarpment- Boca Raton to South Miami; Miocene rock escarpment, hard bottom community; depths 900- 2400 ft.

Area 3: Pourtales Terrace and Escarpment- Florida Keys, Key Largo to Key West; bioherms and sinkholes, hard bottom community; depths 600- 1800 ft.

Area 4: New Exploration Areas- 1) Agassiz and Tortugas Valleys- Florida Keys, Key West- Tortugas; potential rock escarpments, hard bottom communities; depths 2000- 3000 ft; 2) Straits of Florida- Fort Lauderdale to Florida Keys; potential *Lophelia* bioherms; depths 2000- 2800 ft.

PERMITS FOR COLLECTIONS AND OPERATIONS
A Letter of Acknowledgment has been obtained by the Chief Scientist from NOAA National Marine Fisheries for collections within the US EEZ.

PROJECT SUMMARY:
With the continuing global depletion of coastal fisheries, commercial fishing vessels are moving into deeper water and exploiting fish and crustacean species that are frequently associated with complex coral structures. Deep-sea coral ecosystems (DSCE) exist at numerous locations around the coast of Florida. These coral communities provide habitat for relatively unknown but highly diverse assemblages of fish and invertebrates, many of which are undoubtedly undescribed species. There is therefore an urgent need to identify these coral habitats, map their distribution and abundance, and document any potentially valuable fishery species associated with them. Resource managers can use this information to develop conservation policy and scientists can use it as a foundation for hypothesis driven ecological and physiological research. Since deepwater reefs are not visible to the general public, dissemination of information through the media and the education system is vital in order to create empathy for their protection. The overarching objective of this proposal is to increase the current understanding of deep-water coral habitats along Florida's coasts. Primary objectives use shipboard technology and the JSL submersible to map coral distribution and characterize communities (particularly commercial fisheries' species) found in association with high-relief geological features in four regions of interest: the base of the Florida-Hatteras Slope, the Miami and Pourtalès Terraces, and the SW Florida shelf slope. Secondary objectives address aspects of coral biology, diversity and biogeography of associated fauna, and microbial ecology. The proposed research will not only provide important information about the deepwater coral ecosystems off the Florida coast, but also contains a significant outreach element.

SCIENTIFIC PARTICIPANTS:

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OBJECTIVES:

As its overarching objective, this proposal will increase current understanding of DSCEs along Florida's coasts. Previous explorations have documented that these habitats are widespread in the region, but we still know very little about the extent or distribution of the corals, their ecology or their role as essential fish habitat, which are all substantial justification for further effort. Primary objectives explore the distribution and characterization of communities found in association with lithoherms and other high relief, live-bottom, geological features in the regions of interest. Secondary objectives address aspects of coral biology, diversity of associated fauna, and microbial ecology. Education and public outreach efforts are also a significant aspect of this proposal.

Primary objectives:

1. Map selected deep-water, high relief ecosystems that support coral communities. These sites include lithoherms and high-relief escarpments along the east coast of Florida from Jacksonville to Miami.
2. Characterize selected sites using *in situ* observations from the JSL Submersible, video transects, digital images and collections of macrofauna. Collect and inventory dominant cnidarians and sponges.
3. Identify dominant fish species associated with coral communities, especially those appropriate for current or future fisheries exploitation. Document aggregations or spawning behavior.
4. Collect and inventory other associated fauna from coral communities, and identify key species common to all regions and endemic to each.
5. Describe the geology (e.g., substrate type, topography) and hydrography (e.g., prevailing current, water temperature) at each site, and identify the characteristic features of each region.

Secondary objectives:

1. Collect samples of *L. pertusa* from each study site for analysis of reproductive status, growth rates, and colony morphology.
2. Collect samples of *L. pertusa* for inclusion in a larger scale population genetic analysis of this species, currently being conducted through USGS.
3. Characterize the microbial communities associated with colonies of *Lophelia pertusa* and other habitat-forming coral species, ambient water and surrounding sediment.
4. Conduct preliminary investigations of the chemical richness of deepwater octocorals by analyzing selected species for concentrations and types of marine natural products.
5. Provide opportunities for area teachers to accompany the research cruise, to learn about these deep-water environments, to develop classroom materials and a video record that will be incorporated into classroom learning experiences throughout the state. Develop a video record of the expedition for public consumption.
6. Investigate population genetics of deepwater Pleurotomariid gastropods

METHODS:

1) Collections- Samples will be collected in deep water (50-1000 m) with the *Johnson-Sea-Link (JSL)* Research Submersible and the support ship R/V *Seward Johnson*. The *JSL* will be equipped with a manipulator arm which includes clam-shell grab, jaws, and suction hose; 12-bin rotating basket; color video camera; digital still camera; and a data recorder to log time, temperature, conductivity, salinity, and depth.

2) Samples- Marine invertebrates (primarily sponges, cnidaria, mollusks, echinoderms) will be collected. At each site, generally two submersible dives are planned for each day of operations. An average of 5-10 samples will be collected during a dive. Average sample size generally will range from 50-500 g.

3) Environmental Impact- Collections will be highly selective and of minimal impact to the environment or species populations. Large colonial organisms (e.g., gorgonians, sponges) should be collected to leave the base and most of the colony intact. CITES species will not be collected without special permits.

4) Permits - National Marine Fisheries (NMF) Letter of Authorization for deep-water collections has been obtained.

5) Ship and Sample Positions- Collection site coordinates will be determined with GPS navigation (Magnavox MX 200 Global Positioning System). Plots of each submersible dive track and specific sample sites will be made with the Integrated Mission Profiler (IMP), a software database developed by Florida Atlantic University that ties into the ship's GPS system.

6) Site and Sample Documentation- Collection site descriptions, including latitude, longitude, habitat, depth, temperature, salinity, current, and weather conditions; along with sample descriptions, including morphology, color, abundance, taxonomy, and photographic reference for each sample will be recorded in a database which will be archived at OIMB, HBOI and NOVA Southeastern University.

7) Photography- Samples will be photographed *in-situ* with the submersible using a Canon Power Shot G2 digital camera, 2272 x 1704 pixels high resolution images (4.1 million pixels). Color videotapes (digital mini DV) will be recorded with the *JSL*'s pan and tilt video camera (Sony DX2 3000A with Canon J8X6B KRS lens, 6-48 mm zoom, and 0.3 m minimum focus), which has two laser dots (25 cm apart) for scale. Each sample will photographed in the ship's laboratory with a ruler and sample number against a gray background using digital media (Nikon Coolpix 990 with Nikon SB-22S strobe) and stored on CD ROM.

8) Museum Specimens- Museum voucher specimens will be subsampled from each sample and stored in 20 ml scintillation vials for small vouchers and in 2-16 oz glass jars for larger vouchers. Specimens will be archived in Reference Museums such as NMNH.

9) Taxonomy- Preliminary field identifications will be made on board the ship and following the cruise by Stephen Cairns and John Reed (gorgonacea, scleractinia, stylasterina), Chuck Messing (crinoidea, misc. invertebrates), Jerry Harasewych (mollusks). Specimens will be shipped to other taxonomic specialists for verification or further work up, as necessary.

10) Microbiology- Samples of each coral (living and dead), ambient water, and adjacent sediment will be preserved in sterile buffer and frozen at -20^{o}C until use. DNA will be extracted from each sample and bacterial DNA will be amplified. Banding patterns obtained from the various samples will be compared and bands that are distinctive to particular environments or samples will be excised, re-amplified, cloned, and sequenced. Sequences will be used for phylogenetic analyses and preliminary taxonomic identifications.

11) Chemical Ecology Specimens of the most abundant species of octocorals collected in the four regions will be immediately frozen for subsequent analysis of their marine natural products. Shallow water octocorals produce high concentrations of diverse types of secondary metabolites; however, similar studies of the chemical diversity of deep-water octocorals have not been conducted. Dr. Paul's research group will isolate and characterize major metabolites in the octocorals that are most abundant and examine within- and between-colony variation in the compounds. Results for the deep-water octocorals will be compared with their closest shallow water relatives to begin to understand the chemical diversity of octocorals in these deep-water habitats.

CRUISE LOGISTICS:
Areas of operation may include the east and south coast of Florida within US EEZ to depths of 3000 feet from Jacksonville to Dry Tortugas, including Florida Hatteras Slope, Straits of Florida, Miami Terrace, Pourtales Terrace, Agassiz Valley and Tortugas Valley. Dive sites may include the following habitats: deep-water *Lophelia* coral reefs, lithoherms, bioherms and pinnacles; deep water sinkholes.

Distances

Site	Distance (~nm)	Time (~hr@10kn)
HBOI-> Ft. Pierce Inlet		2
Ft. Pierce (FP)-> Ft. Laud, Miami Terrace (MT)	90	9
MT, Miami-> Pourtales Terrace (PT), Marathon	90	9
PT, Key West-> SW Florida lithoherms	120	12

Itinerary
Scientific personnel plan to operate in two legs and switch personnel in Dania Beach Ft Lauderdale on November 13th. In general, two sub dives are planned each non-transit day, with scientific personnel alternating dives. Pilot training dives (~every 10 dives) will be part of the scientific dive rotation.

Leg 1 (November 7- 13) Principal Investigators- Brooke, Reed, Messing; Florida Hatteras Slope, Straits of Florida, Jacksonville to Jupiter; Lophelia mounds. Dive sites will be selected daily with consideration of transit times to next day's dive site and weather conditions. In general, the first few days will be spent in region of northeastern and central Florida from Jacksonville to Jupiter, working down to Fort Lauderdale in time for an exchange of 4-6 personnel on November 13th in Dania Beach.

Leg 2 (November 13-21) Principal Investigators- Brooke, Reed, Messing; Straits of Florida, Miami Terrace, Pourtales Terrace, Agassiz and Tortugas Valleys. Dive sites will be selected daily with consideration of transit times to next day's dive site and weather conditions. In general, the first few days will be spent in region of Miami Terrace, working south to Florida Keys, then working way back north with final dives in time for transit to and arrival at HBOI on Nov. 21.

Nov. 4, Friday	HBOI load ship; secure gear; all gear must be secured by 1700 on Nov. 6
Nov. 7, Monday	All personnel on board ship by 07:00 am. Depart HBOI at high tide (approx 12:30 pm); transit to east Florida Lophelia sites (~4 hr)
Nov. 8-11	Conduct sub ops at base of Florida Hatteras Slope and Straits of Florida from Jacksonville to Jupiter; Lophelia lithoherms and bioherms, 2400-2800 ft
Nov. 12-13	Miami Terrace Escarpment and Straits of Florida; 900- 2400 ft
Nov. 14-17	Pourtales Terrace and Agassiz/Tortugas Valleys; 600- 3000 ft; dives may include sites as far south and west as Tortugas Valleys, then working back toward Pourtales Terrace, and ending off Miami Terrace by Nov. 18.
Nov. 18-19	Miami Terrace Escarpment and Straits of Florida; 900- 2400 ft
Nov. 20	Straits of Florida, East Florida Lophelia bioherms
Nov. 21	Arrive HBOI (high tide 12:29 pm); off load gear

Specific cruise track subject to change: If PIs decide to spend more time in one specific region, then other sites would be deleted. All sites are weather dependent.

Port Call

Nov. 13	The ship will not need to dock; personnel will be transferred by small boat at Dania Beach Underwater Weapons Facility.

EQUIPMENT REQUIRED:

1) *JSL* submersible benthic work package including:
   a) Manipulator with bucket grab, claw and suction hose
   b) Lower work platform with rotating buckets
   c) Data logger system for depth, temperature, and salinity
   d) Color video camera with parallel lasers for scale
   e) Digital still camera with strobe and parallel lasers for scale
   f) Penetrator to take water samples from aft compartment
2) Lab van w/ fresh water and AC (Marine Ops supplied)

3) Environmental room w/ running seawater- for aquaria
4) Two (empty) lab freezers and one full size lab refrigerator will be required for storage of samples (Marine Ops supplied)
5) Fume hood for chemical handling.
6) Note: the Kellog *in situ* sampling device will be used during the second leg.

Use of radioisotopes:
Radioisotopes will not be used.

Cruise Track