

CRUISE PLAN

Florida Shelf Edge Exploration: Rapid Response to the *Deepwater Horizon* Oil Spill

The Cooperative Institute for Ocean Exploration, Research, and Technology

**Harbor Branch Oceanographic Institute, Florida Atlantic University
5600 US 1 North, Fort Pierce, FL 34946**

Update: July 4, 2010

Prepared by: Shirley A. Pomponi, Ph.D., Chief Scientist

DURATION OF OPERATIONS: July 9 – August 7, 2010

CONTACT PERSON FOR QUESTIONS RELATED TO CRUISE PLAN:

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CONTACT PERSON WITH SUBSURFACE MONITORING UNIT DURING OPERATIONS:

Captain Michael Schoeller
Iridium phone number: 1-480-768-2500 (8816-214-31803)

RESEARCH VESSEL:

R/V SEWARD JOHNSON
Master- Mike Schoeller
Registration Number- FL7833EH
Call Sign- WST9756
Gross Tons- 263 RNT
LOA- 204 ft. (62.2 m)
Draft- 12 ft. (3.6 m)

SUBMERSIBLE:

JOHNSON-SEA-LINK Human Occupied Vehicle (HOV)
Maximum Depth of Operation: 3000 ft (914 m)
Occupancy: 4
Chief Submersible Pilot & Operations Director: Don Liberatore

ITINERARY

The following itinerary is tentative and will remain flexible depending upon the progression of the oil plume, projected trajectories, and collaboration with NOAA, MMS, USGS and other agencies. Additional drop off and pick up of scientists, media, and agency personnel may be required during the cruise.

Date	Leg	Location
9-Jul to 14-Jul	1	Depart HBOI 0715; operations <i>Oculina</i> Reef Miami Terrace, Pourtales Terrace, Tortugas Arrive Key West 14 July in PM
15-Jul	Port	Port Day, Key West, depart evening
16-Jul to 19-Jul	2	Tortugas to West Florida Shelf, including Pulley Ridge
20-Jul	Transit	Transit overnight to port (20 July)
21-Jul	Port/ Media	Arrive St Pete early AM; off-load science crew; re-provision boat; onload media & depart late afternoon/early evening
22-Jul	Media	On site early morning; sub and surface ops; media stay aboard overnight; transit back to port
23-Jul	Media/ Port	Arrive St Pete early AM; offload media; science crew arrives late morning; depart noon
24-Jul to 31-Jul	3	Operations dependent on oil projections: West Florida Shelf to Madison Swanson Area
1-Aug	Port	Arrive port in St Pete in AM; depart PM
2-Aug to 7-Aug 7-Aug	4	Operations dependent on oil projections: West Florida Shelf to Tortugas, south and southeast Florida Arrive HBOI 20:00 (7 Aug,)

MISSION OBJECTIVES

Three months after the *Deepwater Horizon (DWH)* oil spill, and before extensive oil impacts reach shelf-edge reefs in the eastern Gulf of Mexico, NOAA's Cooperative Institute for Ocean Exploration, Research and Technology (CIOERT) is conducting a rapid response, multi-disciplinary, multi-institutional expedition to assess the impacts of the *DWH* oil spill on mesophotic and deepwater ecosystems from the Florida Keys to the Mississippi coast. We will use CIOERT expertise, tools, and technologies to address critical research needs associated with the *DWH* oil spill and the potential impacts on the health of diverse ecosystems throughout the Gulf of Mexico, Florida Keys, and southeastern U.S. continental shelf. The expedition will utilize both manned and unmanned submersibles, as well as a variety of midwater samplers and sensors, to collect baseline data on benthic and pelagic communities, water and sediment

chemistry. Working closely with NRDA-trained technicians, the expedition will characterize sub-surface spill properties and identify impacts on deep-reef resources. The expedition is closely integrated with other NOAA missions, complementing them in information collected and areas sampled.

Mission objectives are to:

- perform benthic and mid-water habitat baseline and oil impact assessments related to the *DWH* oil spill, targeting deep-water and shelf-edge reefs, and hard-bottom essential fish habitat; these include:
 - Deep-water Coral and Mesophotic Reef Ecosystems
 - Stress Responses of Corals and Other Marine Invertebrates Exposed to Oil and Chemical Dispersants
 - Quantitative Assessment of Zooplankton
 - Chemical Analysis of Sessile Benthic Taxa and Biomedical Resources
- document oil and dispersant impact on benthic and mid-water habitats and marine organisms within these target areas;
- document location of submerged oil plumes, if encountered; and
- conduct education and outreach activities; these include:
 - An education leg during which university students, working with members of each of the research teams, will collect samples and analyze data to understand and characterize selected benthic and pelagic habitats
 - Daily logs and other cruise resources on www.cioert.org.

CIOERT scientific efforts will focus on biological impacts of the oil spill. A high priority for additional expertise to be provided by NOAA or other invited scientists is detection of sub-surface plumes of oil and data collection needed for developing and inputting into physical oceanographic models.

Data and samples will be provided to NOAA for inclusion in their programs to:

- measure immediate ecological impacts,
- plan for longer-term environmental monitoring, mitigation of impacts resulting from the *Deepwater Horizon* spill, and restoration of impacted areas, and
- develop physical oceanographic models to help predict the movement of submerged oil.

AREAS OF OPERATION

The areas of operations will focus on the deep and shelf-edge reefs (mesophotic reefs) and hard grounds along the east, south, and west Florida shelf and slope. These habitats extend from central eastern Florida through the Straits of Florida to the Tortugas; and eastern Gulf of Mexico along the west Florida shelf and slope. A primary focus will be on documenting impacts and gathering baseline data in non-impacted areas for the deep and mesophotic reefs in the Tortugas, Pulley Ridge, Florida Middlegrounds and Madison & Swanson. All of these represent essential fish habitats, marine protected areas or other unique habitats that may be adversely affected by the spill. Additional sites may be added off Alabama and Mississippi (to Viosca Knolls deep-water *Lophelia* reefs, 29°N 88°W). Selection of specific sites within this region will remain flexible depending upon the progression of the oil

plume, projected trajectories, and collaboration with NOAA, MMS, USGS and other agencies. We will avoid the 72-hr oil forecast for ship and JSL operations, as well as scuba diving, per recommended NOAA diving protocol. If we encounter crude oil on the surface or in subsurface plumes during operations, we will move out of the area.

TARGET SITES

The *Deepwater Horizon* oil spill will have both immediate ecological impacts that are currently occurring rapidly and others that are destined to continue for a very long time. Given the rapidly changing situation and the many unknowns (e.g., the magnitude and duration of the spill, the magnitude, extent and uncertain path of surface and sub-surface plumes of the oil, the complexities and vagaries of the Loop Current), CIOERT recognizes that the final cruise track is likely to change from what is proposed in this plan but will stay within the region of the areas of operation listed above.

For cruise planning and initial site selection, we need the most up-to-date information on surface currents, the position of the surficial oil plumes, and modeling data (and real data where available) of mid-water and bottom currents and of projected oil trajectories for the region of northern central and eastern Gulf of Mexico (GOM). This may also be needed for the Florida Keys, the Straits of Florida and the SE USA coast. During the cruise we will need daily access to the position of surface currents, oil plumes, and any tracking data of mid- and bottom water currents and projected oil trajectories.

Site Selection:

Initially the primary sites of concern in the Gulf of Mexico will be determined from analysis of known and proposed trajectories of surface currents, oil plumes, and bottom currents. The deep-water and mesophotic reefs in the Florida Keys and SE USA [*Oculina* Coral Habitat of Particular Concern (HAPC), and SAFMC proposed 23,000 nm² Deep Coral HAPC] will also be considered as potential research sites if and when the plume reaches the Gulf Stream (Florida Current),

Initially the primary sites of concern for oil spill impact analysis in the Gulf of Mexico are the following (Figures 1 and 2).

Mesophotic and Shelf-edge Reefs (30-200 m): Various hard-bottom sites that are essential fish habitat along the shelf edge from Mississippi to Florida could be impacted by mid-water and bottom oil/dispersant plumes. Also to the west of the location of the plume (as of today) are numerous shelf-edge banks off Texas that are HAPCs and marine sanctuaries including the Flower Garden Banks National Marine Sanctuary. Other banks in the path of the oil plume (both surface and subsurface) are the shelf-edge paleoshorelines along the Alabama shelf ('The Alps'), West Florida shelf ('Madison and Swanson Marine Protected Area', 'Twin Ridges', 'Florida Middle Grounds'), and SW Florida shelf ('Pulley Ridge', Tortugas Ecological Reserve Preserve). Our priority will be the west Florida shelf sites.

Deepwater Sites (>200 m): Various deep-water sites of high biodiversity that could be threatened by bottom oil/dispersant impact include deepwater *Lophelia* coral habitat

(Viosca Knolls, Mississippi Canyon, DeSoto Canyon), west Florida shelf lithoherms (500 m). These would be second priority for this initial assessment unless otherwise requested by NOAA.

1) Northeastern Gulf of Mexico and West Florida Shelf (Fig. 1):

Deep-water coral reefs (Viosca Knolls, West Florida Lithoherms), shelf-edge mesophotic reefs and other shelf-edge hard-bottom essential fish habitat including grouper-snapper Habitat Areas of Particular Concern (HAPCs) (Alabama Alps, Madison Swanson, Twin Ridges, Steamboat Lumps, Florida Middle Grounds, Pulley Ridge, Tortugas Ecological Reserve)

2) South and East Florida, Straits of Florida, and Blake Plateau (Fig. 2):

Deep-water reefs, shallow and mesophotic reefs, shelf-edge hard-bottom essential fish habitat including new southeastern U.S. MPAs, *Oculina* coral reefs (Florida Keys National Marine Sanctuary, Pourtales Terrace, Miami Terrace, Straits of Florida, *Oculina* Coral HAPC, Deep Coral HAPC (proposed by South Atlantic Fishery Management Council)

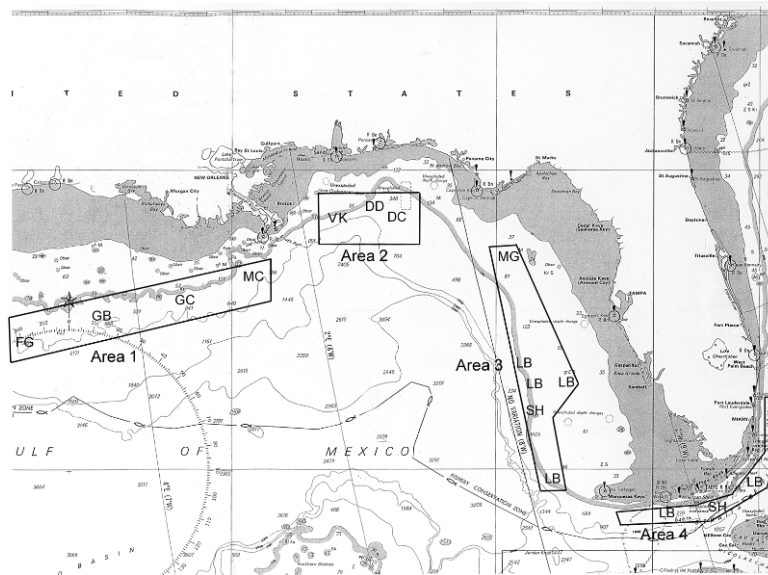


Figure 1. Regions of concern: Deep-water and shelf-edge (mesophotic) coral and hard bottom habitats in Gulf of Mexico and Straits of Florida: Area 1- FG= Flower Garden, GB= Garden Bank, GC= Green Canyon, MC= Mississippi Canyon; Area 2- VK= Viosca Knoll, DD= Destin Dome, DC= Desoto Canyon; Area 3- MG= Middle Grounds (Madison Swanson HAPC, Forty Fathom Ledge, Twin Ridges, Steamboat Lumps, Florida Middle Grounds, Pulley Ridge); Area 4- Florida Keys National Marine Sanctuary, Tortugas Ecological Reserve, Pourtales Terrace, Miami Terrace, proposed Deep Coral HAPC, (SH= Sinkhole, LB= Live Bottom Reef, SH= deepwater Sinkhole, LB= Live Bottom).

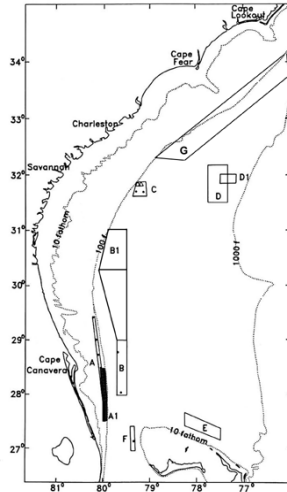


Figure 2. Proposed deepwater coral HAPC (South Atlantic Fishery Management Council, 2010) and *Oculina* HAPC in the northern Straits of Florida and South Atlantic Bight: Area A= *Oculina* Banks and HAPC, Area B= Florida *Lophelia* coral reefs, Area C= *Lophelia* and lithoherm sites (Reed 2006), Area D= Stetson Reefs (Reed 2002, 2006, Reed and Ross 2006, SAFMC 2009).

PERMITS FOR COLLECTIONS AND OPERATIONS

The following permits are in process:

1. NOAA National Marine Fisheries- Letter of Acknowledgment for collections within the US EEZ. (Received June 20, 2010)
2. Florida Keys National Marine Sanctuary and Tortugas Ecological Reserve- for collections and ship operations within their boundaries.
3. South Atlantic and Gulf of Mexico Fisheries Management Councils- for collections within various shelf-edge HAPCs and MPAs within each councils jurisdiction.

OIL HAZMAT PROCEDURES

Ship crew personnel will be trained for hazmat of oil/dispersant contact in accordance NOAA and FAU Environmental Health & Safety requirements. Materials for cleaning sub, nets, other submerged equipment and personnel will be on board.

Contacts for Gulf of Mexico:

During operations in the Gulf of Mexico, the ship's captain will maintain contact with the Subsurface Monitoring Unit (SMU): ops.smu@noaa.gov (Currently Chad Smith and/or LT Eric Johnson) and chief.smu@noaa.gov (Currently CDR Eric Berkowitz). SMU will provide daily information regarding oil positions.

Ship Protocol:

The entire crew will read, then review and discuss the NIEHS/OSHA publication "Oil Spill Cleanup Initiative- Safety and Health Awareness For Oil Spill Cleanup Workers" with an

emphasis on site specific requirements and integrating it into our standard safety plan and practices. It is available at the following web address:

[http://www.deepwaterhorizonresponse.com/posted/2931/OSHA Pub 3388 Safety Awareness Oil Spills English.562287.pdf](http://www.deepwaterhorizonresponse.com/posted/2931/OSHA_Pub_3388_Safety_Awareness_Oil_Spills_English.562287.pdf). We will also utilize other tools/publications as they become available for crew training. Since our operations are so specialized we will obviously tailor our PPE, decontamination, and HAZMAT handling procedures to the vessel and the specific operations we plan on conducting.

Submersible and Scuba Diving Protocol:

We will follow NOAA protocol for diving operations (<http://topside-ndp.blogspot.com/>). For submersible and scuba diving operations, we will use the current NOAA dive exclusion zone extending 30 nm beyond the boundary shown in the 72 Hour Surface Forecast of the main spill area. This does not include the filaments to the south and east of the main spill around BP 252. HBOI will have access to this web site during the cruise to determine this no-dive zone and will follow these standards of no-dive zones. This may be revised accordingly by NOAA.

[http://response.restoration.noaa.gov/topic_subtopic_entry.php?RECORD_KEY\(entry_subtopic_topic\)=entry_id,subtopic_id,topic_id&entry_id\(entry_subtopic_topic\)=809&subtopic_id\(entry_subtopic_topic\)=2&topic_id\(entry_subtopic_topic\)=1#downloads](http://response.restoration.noaa.gov/topic_subtopic_entry.php?RECORD_KEY(entry_subtopic_topic)=entry_id,subtopic_id,topic_id&entry_id(entry_subtopic_topic)=809&subtopic_id(entry_subtopic_topic)=2&topic_id(entry_subtopic_topic)=1#downloads)

Submersible Protocol:

The intention is to minimize exposure of all personnel to the spill or dispersants, minimize the amount of cleaning necessary post dive, prevent damage to equipment resulting in extra costs and delays and maximize dive time. We can minimize the problems and their impact by following the guidelines below.

- 1) Prior to any operation the NOAA satellite imagery shall be checked for proximity of any oil slick to the dive site.
- 2) Visual observations shall be made and noted by the ships company of any surface oil encountered on the way to or from a selected dive site. An estimation of the thickness of the oil, the size of the slick along with any noticeable surface current should be logged and passed along to the Captain, Sub Ops Coordinator and Chief Scientist for consideration.
- 3) The weather forecast and sea surface conditions shall be evaluated with regard to how it might move any surface oil while the sub is submerged.
- 4) A determination shall be made based on items 1-3 if there is a good chance the sub can be launched and recovered without encountering the thick oil "Mousse". In general if the slick is thick and bigger than one third of a mile square a new site will be selected.
- 5) If a sizeable slick is spotted near the recovery area an appropriate amount of time shall be left for the sub to transit to a clear area before surfacing. Utilizing the ships prop wash or fire hoses to assist in making a larger clear area will be attempted, if necessary.
- 6) The dive times in areas where slicks are sighted shall be adjusted to daylight only
- 7) The swimmer shall wear a dive skin, mask or goggles, booties, gloves and a hood in areas where any oil slick is visible and shower off as soon as possible. If oil is

observed on the surface a small boat will be launched to carry the diver to the submersible.

- 8) Any equipment contaminated with oil shall be cleaned post dive using the appropriate solvent including, Hot Water, Soap, WD40, Heptane and Nu-tri- Clean as soon as possible paying particular attention to the Oxygen filling or delivery systems and sensors.
- 9) Insure that all clothing going into the sub are clean and free of oil contamination.
- 10) Fabricate and install protective covers on the camera lenses that can be removed by the manipulator if necessary.
- 11) If a heavy oil plume is encountered while submerged and causes reduced visibility resulting in the compromised safety of the vehicle and crew the dive shall be aborted.

SCUBA DIVING OPERATIONS

All scuba diving operations will be under the authority of the HBOI Dive Safety Program and in compliance with AAUS scientific diving standards.

PERSONNEL

Lead CIOERT Scientific Personnel for Expedition:

- Shirley Pomponi, Executive Director, Cooperative Institute for Ocean Exploration, Research, and Technology - biology and systematics of deep, mesophotic, and shallow coral reef sponges throughout the Gulf of Mexico, Florida Keys, southeast US continental shelf, and Caribbean
- Dennis Hanisak, Research Professor - mesophotic algal communities of the Gulf of Mexico, Florida Keys, southeast US continental shelf, and Caribbean; monitoring reef recovery following major impacts (ship groundings); effects of oil on marine plants (algae and seagrasses)
- Amy Wright, Research Professor - biomedical resources, chemical and microbiological analyses of benthic sessile taxa
- Tamara Frank, Associate Research Professor - ecology, behavior, and visual physiology of zooplankton and micronekton, predator-prey interactions, effects of light on behavior, vertical migrations in the mesopelagic realm, water column sampling techniques, electrophysiology
- John Reed, Research Professor - biology of deep-water coral reefs and taxonomy of reef organisms, including mapping and habitat characterization of shallow, mesophotic, and deep reef environments throughout the Gulf of Mexico, Florida Keys, southeast US continental shelf, and Caribbean
- Sara Edge, Assistant Research Professor - use of advanced molecular diagnostics (microarray analysis) to detect and characterize environmental stress responses in corals and to identify the mechanisms behind coral bleaching and disease infection
- Joshua Voss, Assistant Research Professor - coral reef ecology and community dynamics, molecular profiling of bacterial communities and the development of

advance molecular technologies to identify environmental drivers and impacts of coral diseases

- Support Staff - The lead scientists above will be supported by several technicians, graduate students, and summer interns.

Scientific Participants (listed by research theme or support function) (20 max. per leg)

Mesophotic Reefs:	John Reed, Dennis Hanisak, Joshua Voss, Sara Edge, Dan Rowan, Stephanie Rogers, Lisa Cohen (All HBOI/FAU)
Water Column:	Tammy Frank (HBOI/FAU), Drew Remson (USF, invited), Sandra Brooke (OIMB), Tracey Sutton (VIMS, invited), Gabby Barbarite (HBOI/FAU), Michelle Wood (NOAA/AOML)
Biomedical Resources:	Amy Wright, Shirley Pomponi, Esther Guzmán, Priscilla Winder, Kathleen Janda, Tara Pitts, Sara Wood, Brynne Talas, Jennifer Garceau, Jennifer Grima, Jim Grasela (All HBOI/FAU)
Fisheries:	Chris Gardner (NMFS), Chris Koenig (FSU)
Education/Outreach:	Dennis Hanisak, Brian Cousin, Tammy Frank, students (TBD)(All HBOI/FAU), Andy Shepard (UNCW)
Support:	Water samples-Regina Easley (USF); GIS-John Kloske (SRI); Mass Spec-Tim Short (SRI); Data Management-Denise Gordon, Emily McDonald (NOAA/OER)
Observer:	TBD (Cepemar and/or Petrobras)

ADDITIONAL INFORMATION

Capabilities of R/V Seward Johnson and Johnson-Sea-Link II Submersible

The R/V *Seward Johnson* (RVSJ) is a 204-foot oceanographic and submersible-support research vessel that has full berthing for 40, including 11 ship's crew, 6 submersible crew, 2 marine technicians, and 18 science personnel. Wet lab, dry lab, environmental chamber, machine shop, and portable specialty laboratories are available. Full specifications can be found at: http://wise.fau.edu/hboi/OceanTechnology/rvsj_specs2008.pdf. The RVSJ will support the following activities during this mission:

- Support of JSL submersible for benthic and midwater habitat baseline and longer-term health assessments.
- 3-dimensional current profiling down to 1000 m using hull-mounted ADCP
- Submerged oil plume location using low-frequency acoustic backscatter techniques (<30kHz)
- Surface and over the side data collection for measurement of salinity, temperature, chlorophyll fluorescence, dissolved oxygen, and water clarity.
- Water sampling using CTD Rosette (Niskin and Go-Flo bottles)
- MOCNESS (and possibly SIPPER) sampling of zooplankton

The *Johnson-Sea-Link II* (JSL II) is a scientific research submersible capable of carrying 4 persons (2 crew, 2 scientists) to 910 m. The JSL II has an extensive suite of scientific

sampling tools, sensors, video equipment, and a dexterous manipulator arm. Full specifications can be found at: <http://wise.fau.edu/hboi/OceanTechnology/OTsubops.php>. The JSL II will enable scientists to get an up-close view of the health of mesophotic and deep reefs, the deep sea benthos, and mid-water environments, and will allow delicate collection of specimens for petroleum stress and toxicity studies, as well as water samples at precise, documented reef locations. In addition, the JSL will be instrumented for subsurface oil detection (simultaneous fluorescence and droplet size measurement).

The Phantom 300 ROV (UNCW) will also be used for site surveys. The ROV can dive to 100-m, and is equipped with a video camera. The Spectrophotometric Elemental Analysis System (SEAS) (SRI) is a compact, laboratory grade spectrophotometer that measures chemical species with a resolution in the parts per trillion to depths of 1,500 m. It will be available for use during part of the mission.