Cooperative Institute for Ocean Exploration, Research, & Technology (CIOERT)

Florida Shelf Edge Expedition (FLoSEE)

Principal Investigator & Chief Scientist
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Co-Sponsors & Partners
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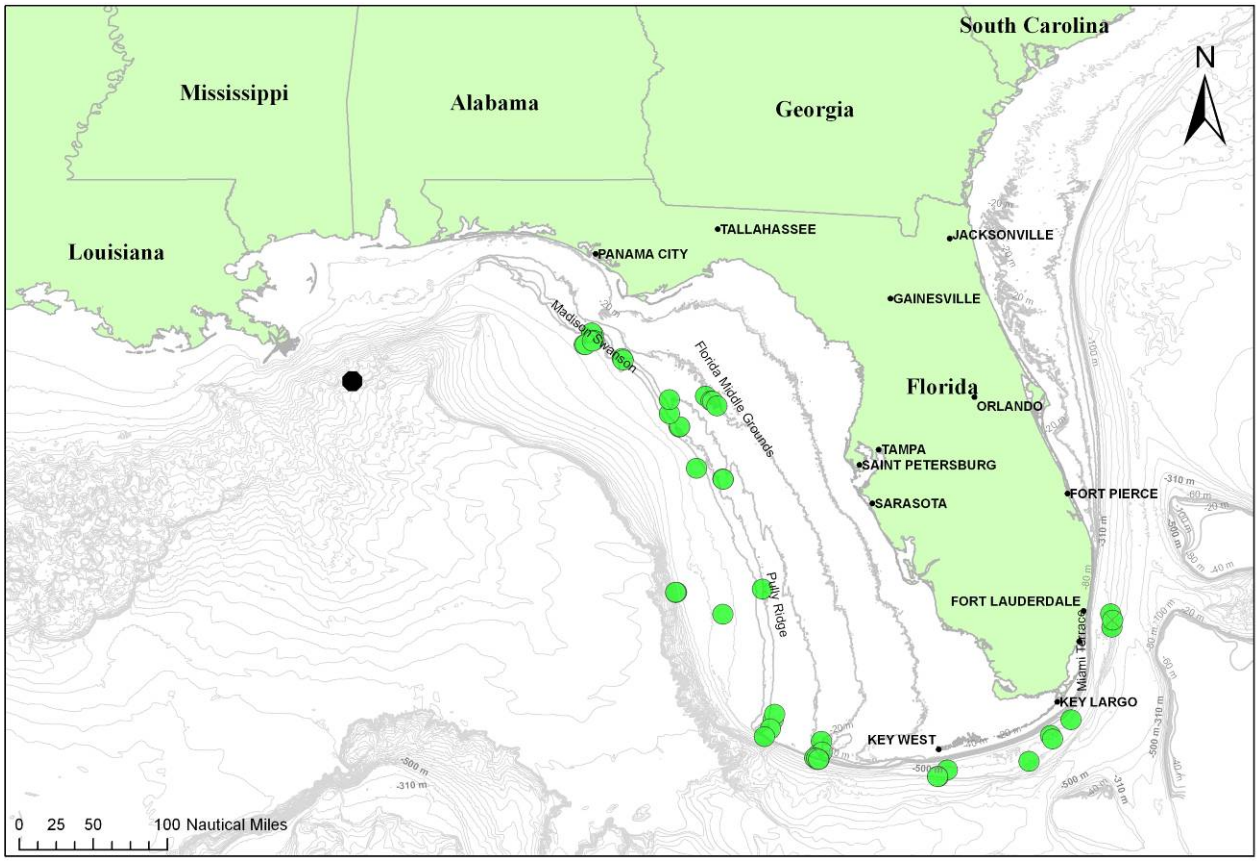


Figure 1. Geographic area of operations: sites of FLoSEE operations are designated in green circles. The location of the *Deepwater Horizon* well-head in the northern Gulf of Mexico is identified by the black circle.

Vessel Identification
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)

Primary Equipment
Johnson-Sea-Link II Human Occupied Vehicle (HOV) (Fig. 2)
Maximum Depth of Operation: 3000 ft (914 m); Occupancy: 4

Itinerary

Leg	Date	Location
1	7/9/2010	FORT PIERCE, PEPPER PARK REEF
	7/10/2010	MIAMI TERRACE
	7/11/2010	POURTALES TERRACE
	7/12/2010	TORTUGAS BANK AND TORTUGAS ECOLOGICAL RESERVE
	7/13/2010	MILLER'S LEDGE (INSIDE AND OUTSIDE TORTUGAS ECOLOGICAL RESERVE)
	7/14/2010	POURTALES TERRACE
	7/15/2010	PORT: KEY WEST, FL
2	7/16/2010	MILLER'S LEDGE (INSIDE AND OUTSIDE TORTUGAS ECOLOGICAL RESERVE)
	7/17/2010	PULLEY RIDGE SOUTH
	7/18/2010	NAPLES SINK HOLE & PULLEY RIDGE NORTH
	7/19/2010	WEST FLORIDA LITHOHERM
	7/20/2010	STICKY GROUNDS
	7/21/2010	PORT: ST. PETERSBURG, FL
MEDIA LEG 1	7/22/2010	WEST FLORIDA SHELF: THE LEDGES
	7/23/2010	PORT: ST. PETERSBURG, FL
MEDIA LEG 2	7/24/2010	FLORIDA MIDDLE GROUNDS
	7/25/2010	PORT: ST. PETERSBURG, FL
3	7/26/2010	STEAMBOAT LUMPS RESERVE
	7/27/2010	MADISON SWANSON FISHERY RESERVE
	7/28/2010	MADISON SWANSON FISHERY RESERVE
	7/29/2010	MADISON SWANSON FISHERY RESERVE
	7/30/2010	TWIN RIDGES
	7/31/2010	NW FLORIDA SHELF: SNYDER RIDGE NORTH
	8/1/2010	FLORIDA MIDDLE GROUNDS
	8/2/2010	PORT: ST. PETERSBURG
4	8/3/2010	WEST FLORIDA LITHOHERM
	8/4/2010	PULLEY RIDGE SOUTH
	8/5/2010	MILLER'S LEDGE (INSIDE AND OUTSIDE TORTUGAS ECOLOGICAL RESERVE)
	8/6/2010	POURTALES TERRACE
	8/7/2010	POURTALES TERRACE
	8/8/2010	MIAMI TERRACE
	8/9/2010	END OF EXPEDITION: HOMEPORT-HARBOR BRANCH OCEANOGRAPHIC INSTITUTE, FORT PIERCE, FL

Introduction

The Florida peninsula sits atop the Florida Platform, a carbonate structure that extends 6 to 60 kilometers offshore on the east and west coasts, respectively. The platform or shelf edge lies around 100 meters in depth, and includes the mesophotic zone, where a multitude of organisms rely on photosynthetic processes for survival. Unburdened by coastal sediments, much of this frontier is exposed hardpan that can be inhabited by reef species, such as corals, sponges, and algae. These "live bottom" reefs attract animals including benthic and pelagic fish, many of commercial importance. Florida's shelf edge is bathed by the Florida Current and Gulf Stream around the Keys and the east coast. These currents enhance the food supply for reef communities. The depth and currents also make the shelf edge frontier difficult to access and study.

Goals

The goal of the FLoSEE Expedition is to further our understanding of where the most productive mesophotic and deep reefs exist and how they may be connected to one another and/or to shallow reef ecosystems around Florida, in terms of gene flow and biogeochemical cycling. The second major goal is to assess the condition of these deep reefs prior to potential impacts from the *Deepwater Horizon* (DWH) oil spill.

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 & 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 are using 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 utilized the *Johnson-Sea-Link II* manned submersible, as well as a variety of midwater samplers and sensors, to collect baseline data on benthic and pelagic communities, water and sediment chemistry. Working with a NRDA (Natural Resource Damage Assessment)-trained technician, water and sediment samples were collected for analysis of presence of oil and dispersants. The expedition is closely integrated with other NOAA missions, complementing them in information collected and areas sampled.

FLoSEE study sites extend 50 to >500 meters in depth, from Fort Lauderdale to the northern Gulf of Mexico (Figure 1). Leg 1 of the FLoSEE expedition ranged from the Miami Terrace to the Dry Tortugas. Leg 2 focused on mesophotic and deep reefs from the Dry Tortugas and Pulley Ridge north to live bottom reefs off Tampa. Media Days focused on mid-shelf reefs off Tampa and the Florida Middle Grounds protected area. Leg 3 targeted mesophotic reefs along the northwest and west Florida shelf-edge paleoshorelines (Madison Swanson Fishery Reserve, Steamboat Lumps, Twin Ridges, Florida Middle Grounds). Leg 4 reversed the tracks from Legs 1 and 2, extending exploration to sites at the newly-discovered *Lophelia* reef on the West Florida Lithoherm, South Pulley Ridge, the Tortugas Ecological Reserve, Pourtales Terrace, and Miami Terrace.

The FLoSEE science and operations team includes over 60 research faculty, technicians, and students from at least 10 different institutions (Appendix A).

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.
    - Partner with major news outlets (NBC, CNN, BBC) to create media day events for TV, radio, and the web.

CIOERT scientific efforts focused 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.

Approach

The primary tools used to address the FLoSEE research objectives are: the *Johnson-Sea-Link* (*JSL*) submersible (Figure 2), equipped with video and still cameras and a variety of sampling equipment; surface operations, including CTD rosettes for water sampling and MOCNESS (Multiple Opening/Closing Net and Environmental Sampling System) for sampling of zooplankton; and scuba diving for observations and sampling of shallower reefs (<30m). Using seafloor maps from previously collected acoustic surveys, *JSL* dives were planned to cover areas that have not been explored during previous dives, areas that have been visited during previous diving expeditions to enable temporal comparisons, and in and outside marine reserves. Chemical sensors on the submersible and CTD rosette casts were used to measure a suite of water quality parameters and to detect the presence of oil.

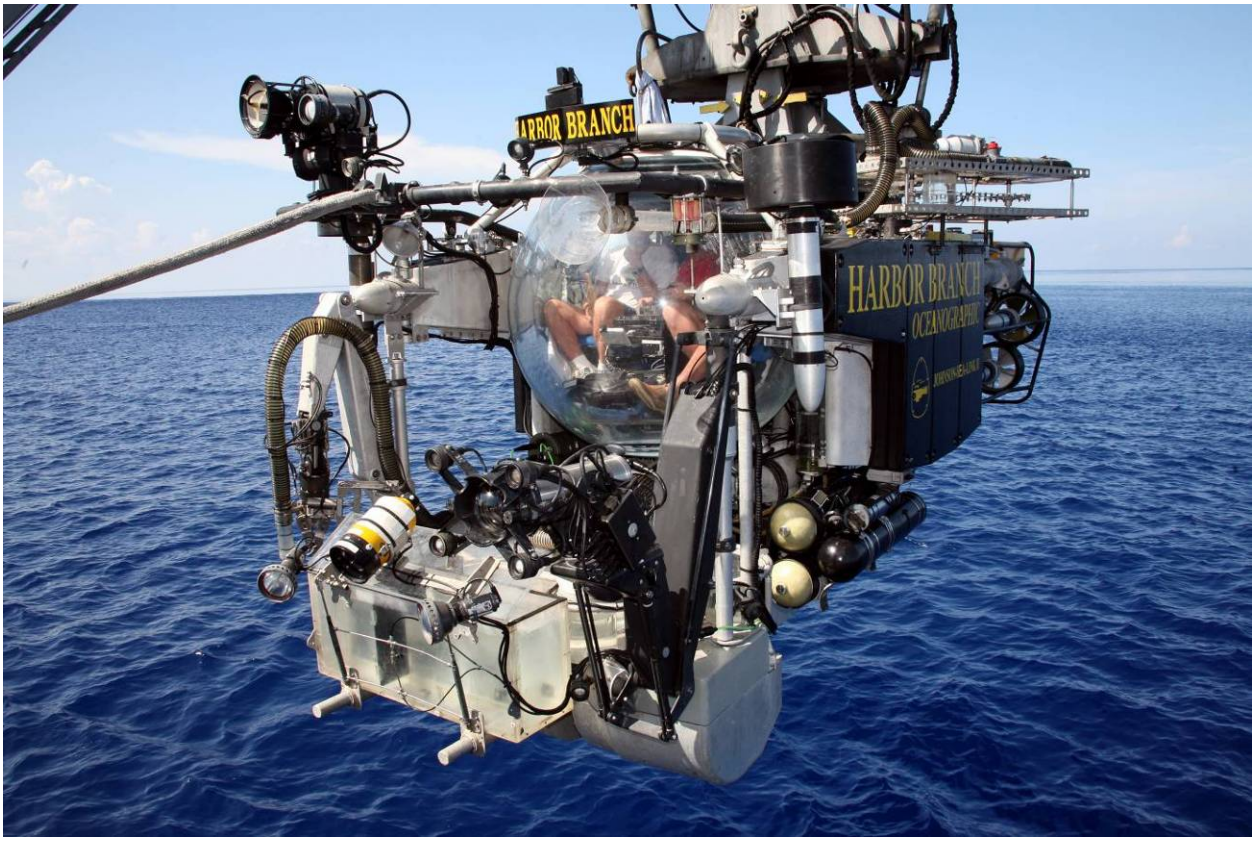


Figure 2. *Johnson-Sea-Link* submersible, owned and operated by Harbor Branch Oceanographic Institute of Florida Atlantic University, is the main FLoSEE asset used to explore Florida's deep reefs.

Submersible operations are critical to the study of mesophotic deep reefs. Currents were often very high at shelf edge locations; only one dive had to be aborted because the sub could not maintain position in the strong currents. Technical divers or ROVs would be seriously challenged in attempting to observe and sample rugged and delicate live bottom areas in these conditions. The power, weight, and payloads of the *JSL* allow us to go places that are inaccessible to other technologies.

Immediate Results and Discoveries

A summary of expedition operations is shown in Appendix B; a sample log entry of daily activities is provided in Appendix C. CTD casts were made at most of the dive locations. MOCNESS tows were made at most of the Leg 3 & 4 dive locations. Video footage, still photographs, biological, chemical, and sediment samples will be analyzed after the expedition.

- No surface or subsurface oil was observed. Water samples, taken according to NRDA protocols, were off-loaded in Key West after Leg 1 and St. Petersburg after Leg 2 and will be analyzed by certified NRDA laboratories. The NRDA Water Sampler was reassigned to the *R/V Bigelow* after Leg 2, so water samples were handled per NRDA protocols for chain-of-custody only during Legs 1 and 2.
- Reefs visited ranged from low-relief hardpan with sparse cover, to high-relief reefs with dense cover of corals, sponges, and other sessile, benthic species. Similarly, fish

populations varied considerably among sites. It was encouraging to see high density of fish populations and some very large groupers in the Tortugas Ecological Reserve (TER), as well as abundant scamp at the Key West bioherms. We observed high relief coral reefs just outside of the western boundary of the southern TER. At this same location, we observed extensive fishing gear, including traps and lines, and related damage to sponges and corals.

- We discovered new *Lophelia* reefs at a depth of 500 meters on West Florida Shelf. Research teams are working on other ships in the Gulf to assess condition of known deep coral habitats closer to the *DWH* spill site. Our assessments of the health of the more southern *Lophelia* reefs will be valuable for comparison with the potentially impacted deep reefs closer to the spill. Known *Lophelia* sites are located further west. The discovery of additional deep reefs may factor into consideration by the Gulf of Mexico Fishery Management Council for added protection of these ecologically important habitats.
- While previous ROV operations on Northern Pulley Ridge suggested abundant *Agaricia* corals, targeted collections revealed that 80% of the specimens visually identified as corals were, in fact, coral skeletons covered with *Peyssonnelia*, a red algal genus. This information is important for predicting ecosystem services and developing management strategies for this area.
- The lionfish, an invasive species from the Indo-Pacific, was documented during the submersible dives. New records will be submitted to the USGS lionfish database. (http://nas.er.usgs.gov/taxgroup/fish/lionfishdistribution.aspx).
- In the Steamboat Lumps Marine Reserve, red grouper construct cone-shaped excavations (pits, 6-m across, 2-m deep). The pits act as natural sediment traps, and may also accumulate crude oil particles that settle out from the water column or are transported by currents along the sea bed. Sediment and tissue samples will be analyzed after the expedition.
- The Madison Swanson Fishery Reserve is an extremely productive area. Red snapper were particularly abundant. Other species found in large numbers were snowy grouper, speckled hind, gag grouper, scamp, and amberjacks. A few, very large Warsaw groupers were also observed and photo-documented.
- Although the fish fauna at the Florida Middle Grounds (a protected area since 2001) was diverse—including abundant juveniles, there were no large predators. A large macroalga, *Sporochnus pedunculatus*, was very abundant in the sand areas both on top of and between the reef flats. On the reef flat at one site, the algae appeared to be overgrowing some of the gorgonians.
- Some new—and unusual—species of sponges were discovered at Twin Ridges, and new records of occurrence in the Gulf of Mexico were documented for sponges and cnidarians at several sites along the expedition track.
- A holothurian targeted for biomedical research was re-collected on the Pourtales Terrace. An extract of the holothurian, first collected by the *JSL* in 2002 at this site, has been recently found to have activity in tumor assays being run at HBOI. Only three small individuals were collected in 2002. The dive was successful: the holothurians were abundant, and an adequate supply of the organism will enable purification and continued testing of the active component.

Education & Outreach Activities

Leg 4 of the FLoSEE Expedition includes the first of a series of CIOERT "Ocean Discovery" cruises that will increase "hands-on", at-sea, multi-disciplinary opportunities for university students in the CIOERT region, with each cruise focused on one or more of CIOERT's themes. The goal of this program is to facilitate students to become successful scientists through active participation and immersion in a multi-disciplinary ocean science research and monitoring cruise, followed by a rigorous, laboratory-based oceanographic research course. This year's cruise is a preface to a course *Immersion in Ocean Sciences* that will be taught this fall at HBOI/FAU by Drs. Tammy Frank and Dennis Hanisak. Seven FAU graduate students participated in the cruise during Leg 4. (Figure 3).

Figure 3. Students and lead instructors gather in front of the *JSL* as the *RV Seward Johnson* steams at night at start of Leg 4. From back left, Dr. Dennis Hanisak, Hilde Zenil, Lucas Jennings, Christopher Malinowski, Lindsay Harris, Lorin West, Gabby Barbarite, Kristen Davis, and Dr. Tammy Frank.

"Media Days" were held July 21-25, and provided national and international news media the opportunity to participate in at-sea activities. Two groups of correspondents, producers, and cameramen were taken to the west Florida shelf and afforded the opportunity to dive in the JSL and to observe water sampling with the CTD rosette. Media Days partners included: NBC News/Correspondent Kerry Sanders (*The Today Show, NBC Nightly News*, and *Dateline*), CNN/Correspondent Amber Lyon, BBC/Correspondent David Shukman, and NOAA/OER public relations specialist Keeley Belva. CIOERT and its parent program, NOAA's Ocean Exploration and Research, are science and technology programs that include outreach and education as priority program objectives. Exploration is an

exciting endeavor that captures public attention. Advanced technologies are fascinating. Discoveries are newsworthy. Most importantly, an ocean literate public will care more and do more to support ocean stewardship, which is an important part of NOAA's mission. Media events included: *NBC Today Show*, 2 live links (7/22 and 7/23); *NBC Nightly News* (7/22), live link; *NBC Dateline* (8/1 & 8/6); Weather Channel live link (7/23); CNN production (8/1); BBC production (TBD). Support for Media Days was provided by the news partners and by HBOI/FAU.

On July 22, Dr. Larry Robinson, Assistant Secretary of Commerce for Oceans and Atmosphere, dove in the *Johnson-Sea-Link* sphere—his first submersible dive. On August 8, Dr. Jane Lubchenco, Undersecretary of Commerce and NOAA Administrator, joined the expedition, and participated in two *JSL* dives—her first—on the Miami Terrace. Their participation in the expedition benefited the FLoSEE team by giving us a better sense of how our efforts fit into NOAA's mission and the broader regional and national *DWH* response effort.

Thoughts for the Future

The DWH oil spill highlighted the need for a comprehensive, coordinated, and integrated exploration, observation, research, and monitoring program in the Gulf of Mexico. Specific recommendations will be provided in the full cruise report.

Acknowledgments

The success of this mission is due to the outstanding efforts of many individuals, working together as a team. We particularly thank Captain Michael Schoeller and the crew of the R/V *Seward Johnson*, Chief Submersible Pilot Don Liberatore and the crew of the *Johnson-Sea-Link* II, and Miami Technical Operations staff, Chip Maxwell and Don Cucchiara. Finally, we acknowledge the support of NOAA Ocean Exploration and Research for support of the Cooperative Institute for Ocean Exploration, Research, and Technology.

APPENDIX A: FLoSEE Expedition Team

Science Team:

Last Name	First Name	Affiliation	Role	Leg			
Adornato	Lori	SRI International	Ocean chemistry			x	
Ash	Craig	CEPEMAR	Water sampling		x		
Barbarite	Gabby	HBOI/FAU	Plankton			x	
Cohen	Lisa	HBOI/FAU	Coral ecology			x	
Cousin	Brian	HBOI/FAU	Videography, photography	x	x	x	x
Cucchiara	Don	Univ. of Miami	CTD rosette, ship flow-through sensors	x	x	x	x
Easley	Regina	Univ. of S. Florida	NRDA Water sampling	x	x		
Edge	Sara	HBOI/FAU	Coral genomics		x	x	x
Ferreira	Andre	CEPEMAR	Water sampling	x			
Fonseca	Carlos	CEPEMAR	Water sampling			x	x
Frank	Tammy	HBOI/FAU	Plankton			x	x
Garceau	Jennifer	HBOI/FAU	Natural products			x	
Gardner	Chris	NOAA NMFS	Fish ecology	x			
Gordon	Denise	NOAA/NCDDC	Data management	x	x	x	
Grasela	Jim	HBOI/FAU	Sponge cell culture		x		
Grima	Jenny	HBOI/FAU	Student, sponge cell culture	x			
Guzman	Esther	HBOI/FAU	Natural products			x	x
Hanisak	Dennis	HBOI/FAU	Coral reefs/algae, water sampling, education	x	x	x	x
Harter	Stacey	NOAA Fisheries	Fish ecology		x		
Janda	Kathleen	HBOI/FAU	Microbiology, natural products	x	x		
Keith	Ryan	NOAA/OER	Data management				x
Kloske	John	SRI International	GIS, mapping	x			
Koenig	Chris	FL State Univ.	Fish ecology			x	
Maxwell	Walter Chip	Univ. of Miami	CTD rosette, ship flow-through sensors	x	x	x	x
Pitts	Tara	HBOI/FAU	Microbiology, natural products	x	x		
Pomponi	Shirley	HBOI/FAU	Chief scientist, natural products	x	x	x	x
Reed	John	HBOI/FAU	Deep coral reef ecology	x	x		
Rogers	Stephanie	HBOI/FAU	Data management, GIS	x	x	x	x
Rowan	Dan	HBOI/FAU	Student, coral biology	x			
Shepard	Andrew	UNCW	Water sampling, outreach	x	x		
Talas	Brynne	HBOI/FAU	Natural products			x	
Voss	Joshua	HBOI/FAU	Coral ecology and health, molecular ecology	x	x		
Winder	Priscilla	HBOI/FAU	Natural products		x		
Wood	Sara	HBOI/FAU	Natural products chemistry	x			
Wood	Michelle	NOAA/AOML	Ocean chemistry, phytoplankton			x	
Wright	Amy	HBOI/FAU	Natural products chemistry				x

Students (Leg 4): Gabby Barbarite, Kristen Davis, Lindsay Harris, Lucas Jennings, Christopher Malinowski, Lorin West, Hilde Zenil (FAU)

Operations Team (All Legs, unless noted):

Ship Crew:
Mike Schoeller, Captain
Erik Bergendahl
Gerard Bilquin (Leg 4)
Dick Curran
James Hart
Kimberly Heine
Loren Lange
Christopher Keene
Pete Knight
Tyler Thayer
Brandon Walton
Edward Wells (Legs 1-3)

Sub Crew:
Don Liberatore, Operations Director
Steve Black (Legs 3-4)
Craig Caddigan
Frank Lombardo
Jimmy Nelson (Legs 1-2)
Phil Santos
Jim Sullivan

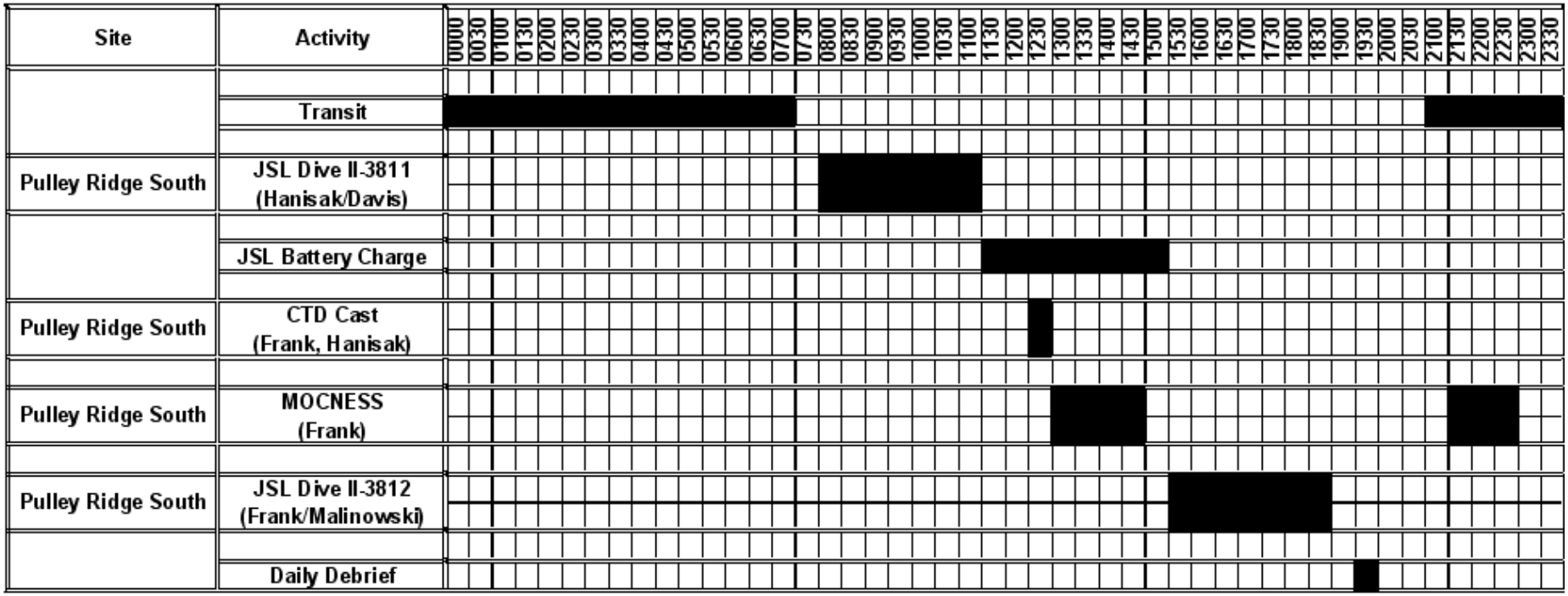
Appendix B. Summary of Expedition Operations.

LEG	DATE	SAMPLING TYPE	LOCATION	DEPTH (ft)
LEG 1	7/9/2010	SCUBA	FORT PIERCE, N. BEACH, PEPPER PARK 3RD REEF	22
		SCUBA	FORT PIERCE, N. BEACH, PEPPER PARK 2ND REEF	12
	7/10/2010	JSL II	MIAMI TERRACE, BU-6	1446
		CTD	MIAMI TERRACE, BU-6 - AWAY FROM SLOPE	1276
		JSL II	MIAMI TERRACE, SITE BU-7, EAST WALL OF WEST RIDGE	1363
	7/11/2010	JSL II	POURTALES TERRACE, ALLIGATOR BIOHERM 3, "THE HUMPS"	729
		SCUBA	FLORIDA KEYS NMS, EAST OF TENNESSEE REEF	85
		CTD	FLORIDA KEYS NMS, ALLIGATOR BIOHERM #3	1271
		JSL II	POURTALES TERRACE, REED PEAK 311, PRISCILLA'S BUMP	603
		CTD	POURTALES TERRACE, REED PEAK 311, PRISCILLA'S BUMP	756
	7/12/2010	JSL II	TORTUGAS BANK, WEST SLOPE, OUTSIDE TER NORTH	171
		SCUBA	TORTUGAS BANK, WEST SLOPE, TER NORTH, MOORING BUOY 13	71
		CTD	TORTUGAS BANK, WEST SLOPE, WEST OF TER NORTH	156
		SCUBA	SOUTH OF TORTUGAS RESERVE, WP JSL II-3775, N. BLACK BAND SITE	77
		JSL II	TORTUGAS ECOLOGICAL RESERVE SOUTH, WEST SIDE "RILEY'S HUMP"	201
		SCUBA	TORTUGAS ECOLOGICAL RESERVE NORTH, BAT CAVES	50
		CTD	WEST OF TORTUGAS ECOLOGICAL RESERVE SOUTH	301
	7/13/2010	JSL II	TORTUGAS ECOLOGICAL RESERVE SOUTH, "RILEY'S HUMP"	122
		CTD	TORTUGAS ECOLOGICAL RESERVE SOUTH	164
		SCUBA	TORTUGAS ECOLOGICAL RESERVE SOUTH	90
		JSL II	1 MI WEST OF TORTUGAS ECOLOGICAL RESERVE, SOUTH, MILLER'S LEDGE	400
		CTD	TORTUGAS ECOLOGICAL RESERVE SOUTH	313
	7/14/2010	JSL II	POURTALES TERRACE, S. OFF KEY WEST, SINKHOLE B, REED PEAK 380	1362
		CTD	POURTALES TERRACE, S. OF KEY WEST, SINKHOLE B	1102
		CTD	POURTALES TERRACE, S. OF KEY WEST, JORDAN SINKHOLE F	646
		JSL II	PORTALES TERRACE, JORDAN SITE, REED PEAK 382	840
	7/15/2010	Snorkel	KEY WEST, TRUMAN ANNEX, NAVY PIER, UNDERNEATH PIER	20
TOTALS	**LEG 1**	**27 EFFORTS**	**FT PIERCE TO KEY WEST**	
LEG 2	7/16/2010	JSL II	TORTUGAS RESERVE SOUTH, 2NMI W OF TER SITE 2	408
		CTD	TORTUGAS RESERVE SOUTH, MILLERS LEDGE	311
		JSL II	TORTUGAS RESERVE SOUTH, MILLERS RIDGE SITE 3	351
		CTD	TORTUGAS RESERVE SOUTH, MILLERS LEDGE	339
	7/17/2010	JSL II	WEST FLORIDA SHELF	219
		CTD	WEST PULLEY RIDGE, SITE 1	142
		JSL II	WEST PULLEY RIDGE SOUTH, SITE 2	221

		CTD	WEST PULLEY RIDGE SOUTH	187
	7/18/2010	JSL II	WEST FLORIDA SHELF, NAPLES SINK HOLE	746
		JSL II	WEST FLORIDA SHELF, PULLEY RIDGE, SITE 2	278
		CTD	WEST FLORIDA SHELF, PULLEY RIDGE NORTH, SITE 2	240
	7/19/2010	JSL II	WEST FLORIDA LITHOHERM ESCARPMENT, REED SITE 32	1511
		CTD	WEST FLORIDA LITHOHERM	1384
		JSL II	WEST FLORIDA LITHOHERM, LOPHELIA LITHOHERM, NEW REED SITE 33	1644
		CTD	WEST FLORIDA LITHOHERM	1545
	7/20/2010	JSL II	WEST FLORIDA SHELF, STICKY GROUNDS, PATCH REEFS	414
		CTD	WEST FLORIDA SHELF, STICKY GROUNDS	357
		JSL II	WEST FLORIDA SHELF, 70M RIDGE, NEW REED SITE	236
		CTD	WEST FLORIDA SHELF, OFF TAMPA	172
TOTALS	**LEG 2**	**19 EFFORTS**	**PULLEY RIDGE TO WEST FLORIDA SHELF**	
MEDIA	7/22/2010	JSL II	WEST FLORIDA SHELF, THE LEDGES	212
LEG 1		CTD	WEST FLORIDA SHELF, THE LEDGES	237
		JSL II	WEST FLORIDA SHELF, THE LEDGES	238
MEDIA	7/24/2010	CTD	WEST FLORIDA SHELF, FLORIDA MIDDLE GROUNDS	151
LEG 2		JSL II	WEST FLORIDA SHELF, FLORIDA MIDDLE GROUNDS	130
		JSL II	WEST FLORIDA SHELF, FLORIDA MIDDLE GROUNDS	123
TOTALS	**MEDIA LEGS**	**6 EFFORTS**	**WEST FLORIDA SHELF**	
LEG 3	7/26/2010	JSL II	WEST FLORIDA SHELF, STEAMBOAT LUMPS, KOENIG SITES	227
		MOCNESS	WEST FLORIDA SHELF, STEAMBOAT LUMPS	230
		CTD	WEST FLORIDA SHELF, STEAMBOAT LUMPS	236
		JSL II	WEST FLORIDA SLOPE, STEAMBOAT LUMPS, KOENIG SITES	227
		CTD	WEST FLORIDA SHELF, STEAMBOAT LUMPS	230
		HOOK & LINE	WEST FLORIDA SHELF, STEAMBOAT LUMPS, KOENIG SITE, WP2	227
	7/27/2010	JSL II	NW FLORIDA SHELF, MADISON SWANSON, SITE 1	233
		MOCNESS	NW FLORIDA SHELF, MADISON SWANSON, SITE 1	243
		CTD	NW FLORIDA SHELF, MADISON SWANSON, SITE 1	256
		JSL II	NW FLORIDA SHELF, MADISON SWANSON SITE 2	260
		CTD	NW FLORIDA SHELF, MADISON SWANSON SITE 2	207
	7/28/2010	JSL II	NW FLORIDA SHELF, MADISON SWANSON SITE 3	263
		MOCNESS	NW FLORIDA SHELF, MADISON SWANSON SITE 3	285
		CTD	NW FLORIDA SHELF, MADISON SWANSON SITE 3	180
		JSL II	NW FLORIDA SHELF, MADISON SWANSON SITE 4	430
		CTD	NW FLORIDA SHELF, MADISON SWANSON SITE 4	259
		MOCNESS	NW FLORIDA SHELF, MADISON SWANSON SITE 4	289
	7/29/2010	JSL II	NW FLORIDA SHELF, MADISON SWANSON SITE 5	407
		MOCNESS	NW FLORIDA SHELF, MADISON SWANSON SITE 5	573

		CTD	NW FLORIDA SHELF, MADISON SWANSON SITE 5	541
		JSL II	NW FLORIDA SHELF, MADISON SWANSON SITE 6	264
		CTD	NW FLORIDA SHELF, MADISON SWANSON SITE 6	213
		MOCNESS	NW FLORIDA SHELF, MADISON SWANSON SITE 6	574
	7/30/2010	JSL II	NW FLORIDA SHELF, TWIN RIDGES	246
		CTD	NW FLORIDA SHELF, TWIN RIDGES	236
		MOCNESS	NW FLORIDA SHELF, TWIN RIDGES	302
		JSL II	NW FLORIDA SHELF, TWIN RIDGES, MAGIC MOUNTAIN, C. KOENIG SITE	228
		CTD	NW FLORIDA SHELF, TWIN RIDGES, "MAGIC MOUNTAIN"	242
		MOCNESS	NW FLORIDA SHELF, TWIN RIDGES	257
	7/31/2010	JSL II	NW FLORIDA SHELF, SNYDER RIDGE NORTH, C. KOENIG SITE	244
		CTD	NW FLORIDA SHELF, SNYDER RIDGE NORTH, C. KOENIG SITE	248
		MOCNESS	NW FLORIDA SHELF, SNYDER RIDGE NORTH, C. KOENIG SITE	248
		JSL II	NW FLORIDA SHELF, SNYDER RIDGE NORTH, C. KOENIG SITE "SSEGAGAG"	176
		CTD	NW FLORIDA SHELF, SNYDER RIDGE NORTH, C. KOENIG SITE	182
		MOCNESS	NW FLORIDA SHELF, SNYDER RIDGE NORTH	215
	8/1/2010	JSL II	NW FLORIDA SHELF, FLORIDA MIDDLE GROUNDS	17
		SCUBA	NW FLORIDA SHELF, FLORIDA MIDDLE GROUNDS, SITE 3	97
		CTD	NW FLORIDA SHELF, FLORIDA MIDDLE GROUNDS	132
		PLANKTON TOW	NW FLORIDA SHELF, FLORIDA MIDDLE GROUNDS	3
		JSL II	NW FLORIDA SHELF, FLORIDA MIDDLE GROUNDS	135
		CTD	NW FLORIDA SHELF, FLORIDA MIDDLE GROUNDS	102
TOTALS	**LEG 3**	**40 EFFORTS**	**WEST FLORIDA SHELF TO NW FLORIDA SHELF**	
LEG 4	8/3/2010	JSL II	WEST FLORIDA LITHOHERM, LOPHELIA LITHOHERM, NEW REED SITE 33	1694
		MOCNESS	WEST FLORIDA LITHOHERM, LOPHELIA LITHOHERM, NEW REED SITE 33	1762
		JSL II	WEST FLORIDA LITHOHERM, LOPHELIA LITHOHERM, NEW REED SITE 33	1640
		DIP NET	WEST FLORIDA LITHOHERM, LOPHELIA LITHOHERM, NEW REED SITE 33	0
		CTD	WEST FLORIDA LITHOHERM, LOPHELIA LITHOHERM, NEW REED SITE 33	1568
	8/4/2010	JSL II	WEST FLORIDA SHELF, PULLEY RIDGE SOUTH	211
		CTD	WEST FLORIDA SHELF, PULLEY RIDGE SOUTH	409
		MOCNESS	WEST FLORIDA SHELF, PULLEY RIDGE SOUTH	561
		JSL II	WEST FLORIDA SHELF, PULLEY RIDGE SOUTH, ledge	314
		MOCNESS	WEST FLORIDA SHELF, PULLEY RIDGE SOUTH	924
	8/5/2010	JSL II	TORTUGAS, MILLER'S LEDGE, OUTSIDE TORTUGAS ECOLOGICAL RESERVE	267
		CTD	TORTUGAS, MILLER'S LEDGE, OUTSIDE TORTUGAS ECOLOGICAL RESERVE	792
		MOCNESS	TORTUGAS, MILLER'S LEDGE, OUTSIDE TORTUGAS ECOLOGICAL RESERVE	710
		JSL II	TORTUGAS, MILLER'S LEDGE, INSIDE TORTUGAS ECOLOGICAL RESERVE	379
		MOCNESS	TORTUGAS, MILLER'S LEDGE, OUTSIDE TORTUGAS ECOLOGICAL RESERVE	706

	8/6/2010	JSL II	PORTALES TERRACE, OFF KEY WEST, SINKHOLE B, REED PEAK 380	1399
		CTD	PORTALES TERRACE, OFF KEY WEST, OFF SINKHOLE B, REED PEAK 380	1716
		MOCNESS	PORTALES TERRACE, OFF KEY WEST	1066
		JSL II	PORTALES TERRACE, OFF KEY WEST, SINKHOLE B, REED PEAK 380	1297
		MOCNESS	PORTALES TERRACE, S. OFF KEY WEST	1742
	8/7/2010	JSL II	PORTALES TERRACE, ALLIGATOR BIOHERM	708
		CTD	PORTALES TERRACE, ALLIGATOR BIOHERM	619
		MOCNESS	PORTALES TERRACE, ALLIGATOR BIOHERM	1320
		JSL II	PORTALES TERRACE, ALLIGATOR BIOHERM	690
	8/8/2010	JSL II	MIAMI TERRACE, WRECK FISH SITE	1073
		CTD	MIAMI TERRACE	957
		MOCNESS	MIAMI TERRACE	990
		JSL II	MIAMI TERRACE, BU-6	1263
TOTALS	**LEG 4**	**28 EFFORTS**	**WEST FLORIDA LITHOHERMS TO MIAMI TERRACE**	
TOTALS FOR CRUISE		**141 EFFORTS**	**FT PIERCE TO FT PIERCE - SURVEYING ~ 800 MILES OF COAST LINE**	

Appendix C. Sample log entry of daily activities.

CIOERT 2010 Cruise Daily Operations Schedule
Wednesday, August 04, 2010