Deep Coral and Associated Species Taxonomy and Ecology (DeepCAST) II Expedition Report

Roatán, Honduras. May 21-28, 2011.

Report date: September 2011

NOAA Technical Memorandum NOS NCCOS 137

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Cover Photo. Members of the DeepCAST II Expedition (left to right on cover): Peter Etnoyer, Jerry Harasewych, Thomas Shirley, Anne Chapman Thornton, Karl Stanley, Kathryn Lavelle, Anders Sebastian Troëng, William (Laney) Thornton.

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Expedition Report
Deep Coral and Associated Species Taxonomy and Ecology (DeepCAST) II Expedition, May 21-28, 2011

Deep Coral and Associated Species Taxonomy and Ecology (DeepCAST) II Expedition Report

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[Also see list of other collaborating scientists on the final page of this report]

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Introduction:

NOAA has a mandate to explore and understand deep-sea coral ecology under Magnuson-Stevens Sustainable Fisheries Conservation Act Reauthorization of 2009. Deep-sea corals are increasingly considered a proxy for marine biodiversity in the deep-sea because corals create complex structure, and this structure forms important habitat for associated species of shrimp, crabs, sea stars, brittle stars, and fishes. Yet, our understanding of the nature of the relationships between deep-corals and their associated species is incomplete.

One of the primary challenges of conducting any type of deep-sea coral (DSC) research is access to the deep-sea. The deep-sea is a remote environment that often requires long surface transits and sophisticated research vehicles like submersibles and remotely operated vehicles (ROVs). The research vehicles often require substantial crew, and the vehicles are typically launched from large research vessels costing many thousands of dollars a day.

To overcome the problem of access to the deep-sea, the Deep Coral and Associated Species Taxonomy and Ecology (DeepCAST) Expeditions are pioneering the use of shore-based submersibles equipped to do scientific research. Shore-based subs alleviate the need for expensive ships because they launch and return under their own power. One disadvantage to the approach is that shore-based subs are restricted to nearby sites. The disadvantage is outweighed, however, by the benefit of repeated observations, and the opportunity to reduce the costs of exploration while expanding knowledge of deep-sea coral ecology.

Expedition Summary:

The DeepCAST II Expedition explored depths below the Meso-American Reef in Roatán, Honduras from 21- 28 May 2011. The team explored deep-sea habitats using the Roatán Institute for Deep-sea Exploration submersible *Idabel*, captained by Karl Stanley. The team made six dives between 1200 and 2200 feet deep (365 and 670 meters), conducting photo and video transects to estimate coral and sponge diversity and abundance, characterizing water chemistry, and collecting corals and mollusks to discern the relationships between corals and their epifauna.

Among the highlights of the trip were:

- First confirmed documentation of live *Lophelia pertusa* along the Meso-American Reef.
- Comprehensive sampling of slit shell diversity for genetic and biogeographic studies.
- Live aggregations of very large, presumably very old, deep-sea gorgonian corals.
- Octocoral diversity and biomass exceeding well-known sites in the Gulf of Mexico.
- Numerous species in association with corals, including sea stars, sea urchins, brittle stars, mollusks, crabs, and fishes.
- Evidence of agonistic interactions, including predation on deep-sea coral colonies.
- Photographic data to measure coral recovery rates from prior predation events.
- Evidence of human pollution (trash & fishing gear) degrading coral habitat near 1500 ft (460 m)

Project Description:

The Mesoamerican Reef (MAR) is the Atlantic Ocean's largest coral reef, and the second largest barrier reef in the world. The reef stretches across 1000 km of the continental shelf from Honduras to Mexico (Fig. 1). The continental slope is directly adjacent to the reef, and drops abruptly to bathyal depths of 3500 m and more. The substrate and topography of the deep escarpment are well suited to deep-sea corals, including 'stony' reef building corals, soft corals, cup corals, sea fans, and black corals.

Yet, only 2 or 3 sites along the MAR have been explored using submersibles or sampled using trawls. Where the present study was conducted, rich and abundant assemblages of hard and soft corals were found. Species composition of the deep reef assemblage appears similar to neighboring US reefs, with many shared species. This suggests deep-sea communities along the MAR may be connected to the Gulf of Mexico and Straits of Florida through larval dispersal and exchange.

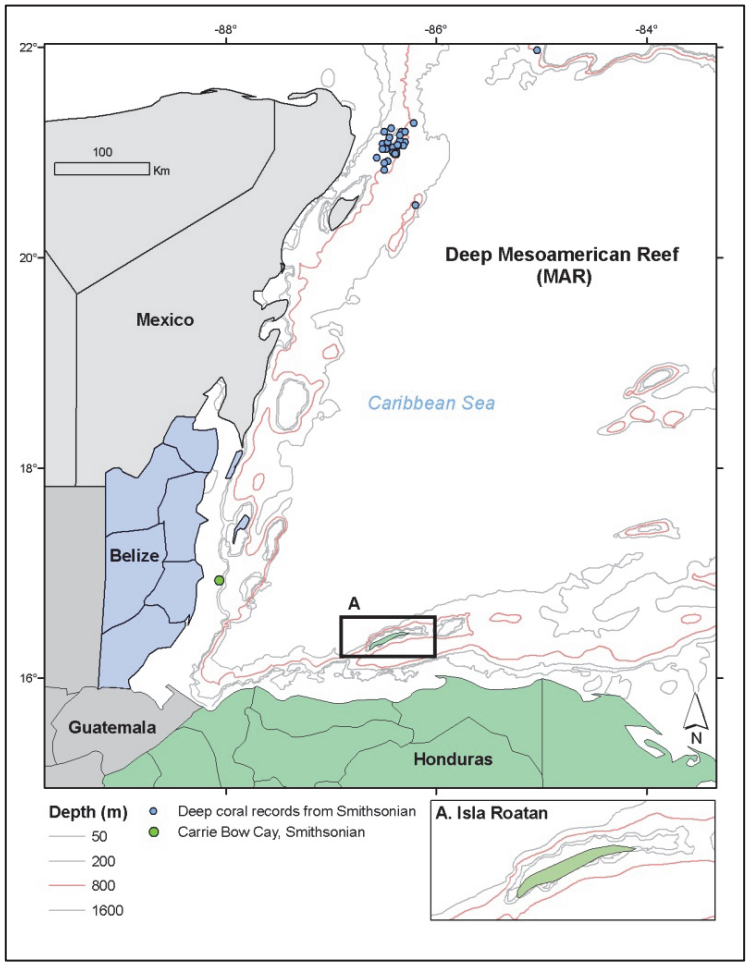

Figure 1. Map of the Western Caribbean Sea showing the extent of the deep Meso-American Reef, from Honduras (bottom) to Yucatan Channel (top). The 800 m isobath is in red, showing the depth limit of our explorations.

Isla de Roatán in the Bay Islands is located at the southern extent of the MAR, 50 km north of mainland Honduras. The island offers ready access to remarkable deep-sea coral aggregations 700 m and deeper. Roatán is home to the *Idabel* submersible and Roatán Institute for Deep-Sea Exploration (RIDE). RIDE was founded by *Idabel* designer, builder, and pilot Karl Stanley.

The **Deep Coral and Associated Species Taxonomy and Ecology (DeepCAST) II Expedition** used the *Idabel* submersible to collect photographic, video, and water chemistry data. The research team included marine biologists from National Oceanic and Atmospheric Administration (NOAA), Smithsonian Institution National Museum of Natural History (NMNH), Texas A&M University- Corpus Christi (TAMU-CC), and Conservation International (CI). Dr. Peter Etnoyer, NOAA, led the research expedition. Dr. Tom Shirley, TAMU-CC, and Dr. Jerry Harasewych, NMNH, served as co-leaders.

Dive Location:

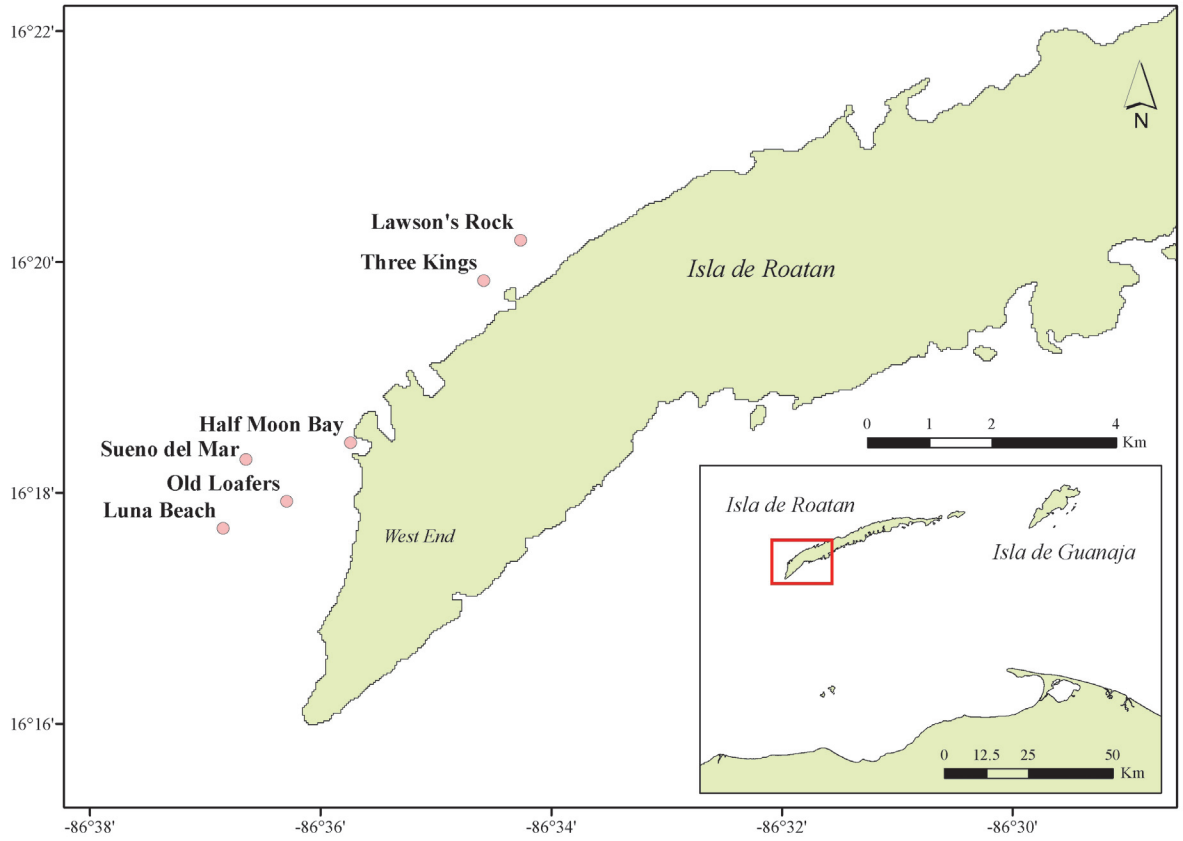

Figure 2. Plan view of Roatán Island, situated 70 kilometers north of mainland Honduras. The pink dots indicate the location of six submersible dives conducted for DeepCAST II Expedition.

Project Goals and Objectives:

The primary goals of the DeepCAST expeditions were to: 1) estimate deep coral and sponge relative abundance, density, and diversity for comparison to other known aggregations in the Western Atlantic; and, 2) discern the nature of the relationships between host corals and their associated species, including epifauna living on the corals, and predators feeding on the corals. To accomplish these goals, the group conducted non-invasive photo and video transects of deep-coral fauna, deployed baited traps, and collected voucher specimens of corals (e.g., *Lophelia pertusa* and *Dendrophyllia alternata*) and associated species (e.g., gastropods and crinoids).

A secondary goal of the DeepCAST research was to characterize water column chemistry in and around *Lophelia pertusa* reefs. This was accomplished by mounting a Conductivity-Temperature-Depth-Dissolved Oxygen (CTD-O) with pH sensor to the *Idabel* submersible. CTD-O data were downloaded to a field laptop daily upon recovery. The data may help to define the "climate envelope" of *Lophelia pertusa* in the Caribbean Sea by providing information on temperature, salinity, oxygen, and pH. These parameters may be correlated to aragonite saturation state through future water sampling efforts.

***Idabel* submersible:**

Idabel was used to gather biological samples, photo, video, CTD-O, and pH data. The sub is equipped with interior and exterior still/video cameras, synchronized exterior strobes, and parallel exterior lasers. The vessel is pressure rated to 1000 m depth by designer, builder, and pilot Karl Stanley. The vehicle has a weight limit of 450 lbs (204 kg) plus the pilot. Two scientists occupied the forward compartment.

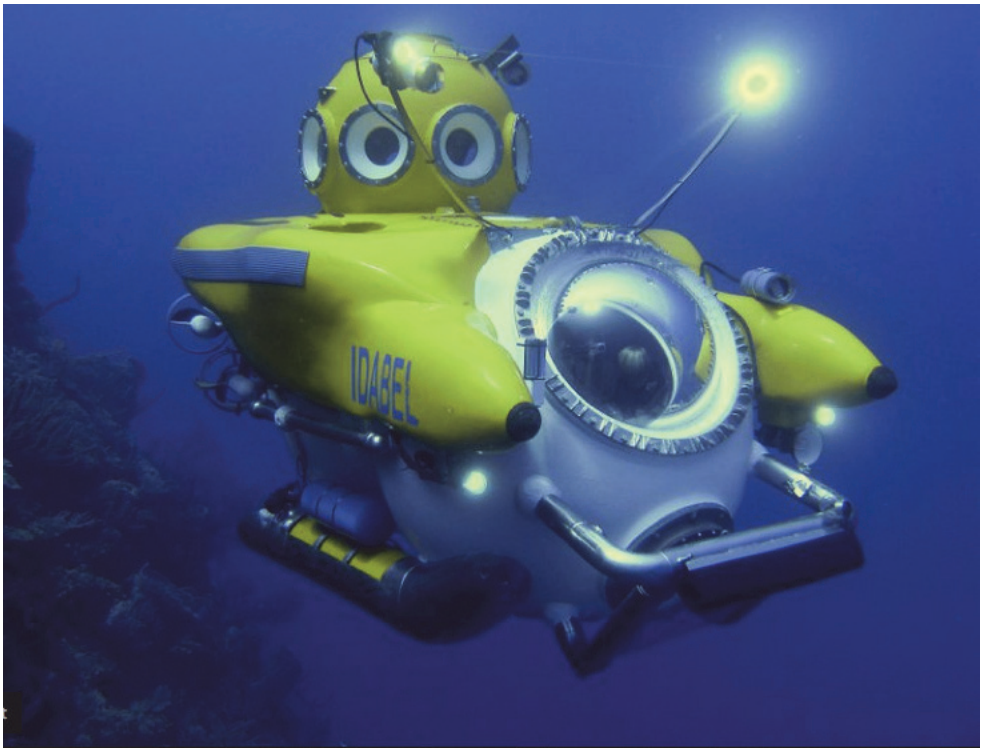

Figure 3. *Idabel* submersible is a three-person sub with a 32in. (81 cm) viewport for scientific observers.

Dive Schedule:

Table 1. DeepCAST II dive dates, observers, locations, depths, and activities. CTD-O = Conductivity-Temperature-Depth-Oxygen sensor, AKR = Anthony's Key Resort**.**

Date	Dive No.	Obs. 1	Obs. 2	Location	Max. depth (m)	Activity
-	0	none	none	Half Moon Bay	-	deploy baited trap for biology
5/22/2011	1	Tom	Kate	Luna Beach	630	Photo-transect, CTD
5/23/2011	2	Jerry	Sebastian	Sueno del Mar	655	Photo-transect, CTD, samples
5/23/2011	3	Laney	Annie	Half Moon Bay	465	Video transect, CTD, recover trap
5/25/2011	4	Kate	Annie	AKR 1 - Three Kings	660	Photo-transect, CTD, samples
5/26/2011	5	Sebastian	Laney	AKR 2 - Lawson's Rock	640	Photo-transect, CTD, samples
5/27/2011	6	Tom	Jerry	Old Loafers	375	Photo-transect, CTD, samples

Photo and video sampling methodology:

The primary objective of DeepCAST II was to conduct quantitative photo and video transects of deep coral and sponge habitat in at least 4 independent sites in the 100-700 m depth range, using interior cameras synchronized to strobes mounted on the exterior of the submersible. Observers operated one camera continuously throughout the course of each 4-6 hour dive. The still camera operator took approximately 1 photo/minute, shooting wide and medium angle shots of the seafloor with particular attention to coral and sponge colonies. The video operator recorded continuous high-definition video on 1 hour-long Mini-DV tapes. Camera operators tried to frame the images to include the parallel green lasers projected from the sub onto the seafloor. All watches and cameras were synchronized with the CTD. Divers produced one-page summaries of each dive with dive chronologies providing information on dive start time, start coordinates, max depth, min depth, habitat, debris, and animals observed.

CTD-O sampling methodology:

A Seabird Seacat 19 conductivity-temperature-depth-oxygen (CTD-O) sensor with a supplementary pH sensor was mounted on the starboard side rail of *Idabel* submersible to generate continuous, along-track water chemistry profiles for each dive, especially around *Lophelia pertusa* reefs. The unit was activated before each dive, and data were downloaded on recovery. The unit did not record for the whole transit on most dives, but one complete track was recorded on Dive 6.

Biological sampling methodology:

Biological samples from the deep-sea were collected with a baited trap and a dip net mounted on the side of the *Idabel* submersible.

The following items were requested in a sampling permit application to Andrés Alegría, Coordinador de Monitoreo Biológico, Instituto Nacional de Conservación y Desarrollo Forestal, Áreas Protegidas y Vida Silvestre (ICF), Honduras.

Dr. Peter Etnoyer requested up to 5 specimens each of octocorals (sea fans) in the families Primnoidae, Ellisellidae, Isididae, and Paramuriceidae. Voucher specimens will be deposited in the collections of the Smithsonian Institution. If authorized, one or two additional specimens would be collected to be returned to the National University's museum, as requested by Ian Drysdale.

Dr. Jerry Harasewych requested up to 3 specimens each of the deep-sea snails in the families Pleurotomariidae, Buccinidae, and Muricidae that are encountered during the dives. These would be deposited in the collection of the Smithsonian Institution as voucher specimens for anticipated publications. Additional specimens will be collected for the National Univ. museum.

Dr. Marcelo Kitahara could not participate, but requested 5 specimens of deep-water scleractinia *Lophelia pertusa*, *Dendrophyllia alternata*, *Madrepora oculata*, *Javania cailleti, Desmophyllum dianthus* and *Caryophyllia* spp. Voucher specimens will be deposited in the collections of the Smithsonian Institution. Additional specimens will be collected for the National Univ. museum.

Scientific apparatus:

Modifications to *Idabel* submersible for DeepCAST II included an exterior camera mount with parallel lasers for scale, mounted 10 cm apart, and a Seabird Seacat v 19 conductivity-temperature-depth-oxygen (CTD-O) sensor. Camera and lasers were mounted forward on the sub, below the viewport. The CTD-O was on a lower starboard side rail.

Figure 4. The laser mount (in black) is positioned below the camera housing (in yellow).

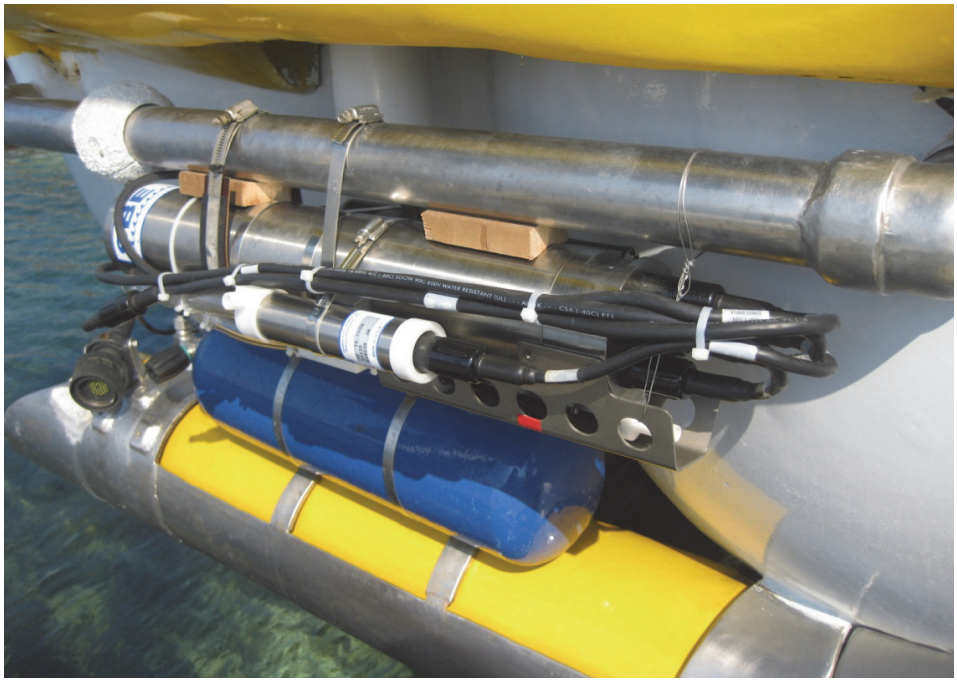

Figure 5. A Seabird Seacat 19 CTD-O water chemistry profiler mounted on the starboard rail.

Sampling apparatus:

Long-pole net: A long, yellow mesh net was weighted with stones to make it hang. The net was attached to a hardened steel hoop on the end of a 14ft (4.3 m) long steel pole. The pole was mounted to the port side rail of *Idabel* and used to collect voucher specimens of scleractinian corals (Fig. 6).

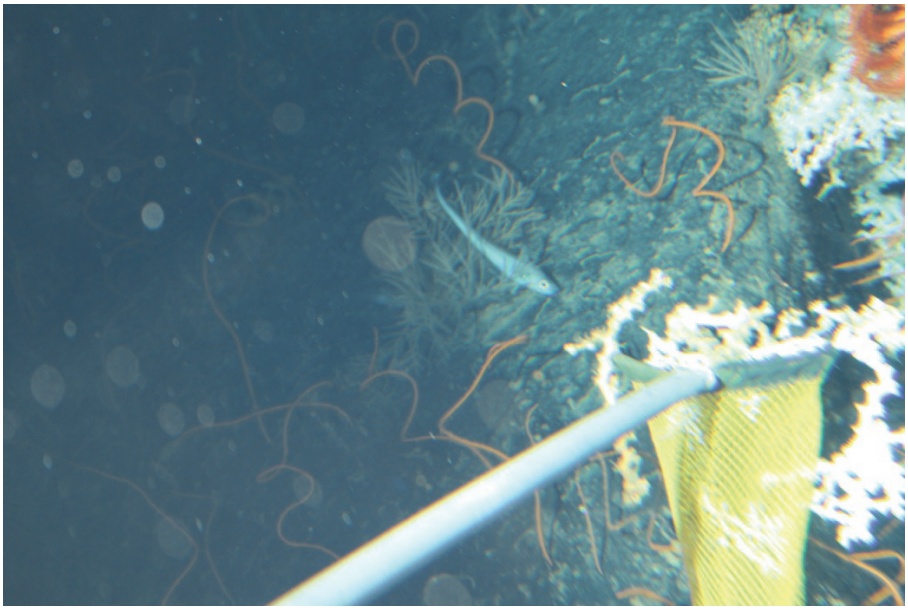

Figure 6. A long-pole net is used to collect *Lophelia pertusa* at 1920 ft (585 m) depth.

Baited trap: A green plastic basket was baited with lionfish heads, wrapped in mesh fabric, and weighted with rebar. Yellow rope was threaded through a block of buoyant syntactic foam and attached to the basket to create a loop for retrieval (Fig. 7). The retrieval operation used a long shepherd's crook device mounted on the port side rail of *Idabel.* The crook successfully recovered the trap to the surface.

Figure 7. A sculptured lobster (*Eunephrops cadenasi*) and shrimp (*Notostomus* sp.) guard the baited trap at 1510 ft (460 m). Lasers are 10 cm, shown above, left of center.

Dive summaries:

DeepCAST II Dive 1 Date: May 22, 2011 Location: Luna Beach

Descent coordinates: 16° 17.691' N, 86° 36.843' W
Observers: Tom Shirley, Kate Lavelle
Left dock: 0941 hr Begin Descent: 1014 hr Return to dock: 1510 hr

Geology: Maximum depth of dive 2090 ft. (637 m) Many large basaltic boulders; one was 105 ft vertical relief. Boulders were interspersed with soft sediment. No patterns were observed between spacing of sediment between boulders; some distances between boulders were long, others were short. Many boulders supported little visible epifauna.

Biology: Soft substrate was occupied by sea urchins, shrimp, stalked crinoids, a few sponges, elasipodid sea cucumbers, and a few sharks. One cucumber was observed (and video-taped and photographed) swimming. Sea cucumbers, crinoids, and erect cnidarians colonies often tipped with sponges or anemones, were most common on soft substrate. Sea cucumbers were usually solitary, often several meters from other cucumbers. Stalked cnidarians colonies occurred in abundance, almost regularly spaced; stalked crinoids occurred in shallower depths (780 ft, 238 m) and also occurred in relatively dense assemblages. Shrimp occurred near some objects on the bottom, either a boulder or anemone. One aggregation of sea urchins, about 30 sea urchins, occurred on soft sediment.

Most common DSC on hard substrate were large Primnoidae, but in places yellow Paramuriceidae were abundant (at 13:44, 1110 ft, 338 m). DSC were usually most common on tops of boulders or on undersides of ledges along the steep slope. At 1400 ft. *Parazooanthus* coral occurred in dense clumps on tops of boulders in shallower water in a few discrete locations. Karl remarked that he had not seen these previously, but I believe that Peter and I observed these in August 2010. A new (for our observations) hemiuralyid brittlestar (*Asteroporpa annulata*) was observed on what appeared to be a yellow Paramuriceidae (but with slightly larger branches) in shallower water (850 ft).

A mass spawning of sharpnose puffers had occurred earlier according to Karl; this rare event had not been observed for 12 years. Many juvenile puffers (1 cm) were observed in shallower water 200-100 m. Lionfish were first observed at 100 m depth (time 14:39). Blue sponges were common on vertical faces of boulders; one green sponge was observed. Large (0.5 m?) glass sponges were commonly observed, as were vase sponges. We need names for sponges, as these are common faunal components.

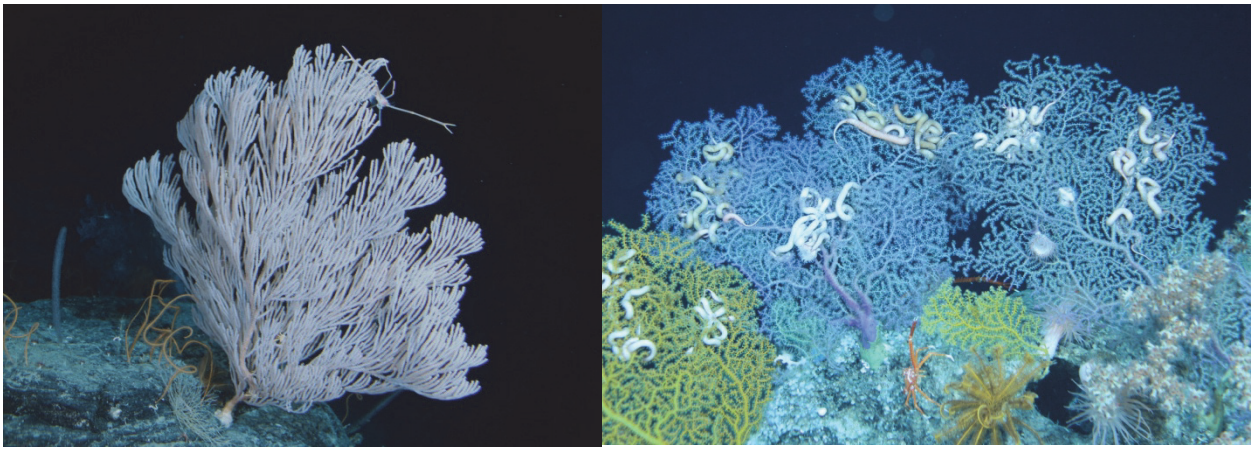

Figure 8. Large Primnoidae at 1900 ft depth (579 m, left) with squat lobsters and Paramuriceidae (right) with *Asteroschema* sp. brittlestars at 1350 ft depth (411 m).

DeepCAST II Dive 1 Date: May 22, 2011 Location: Luna Beach

Dive profile for Dive 1 (timed out after 49 min)

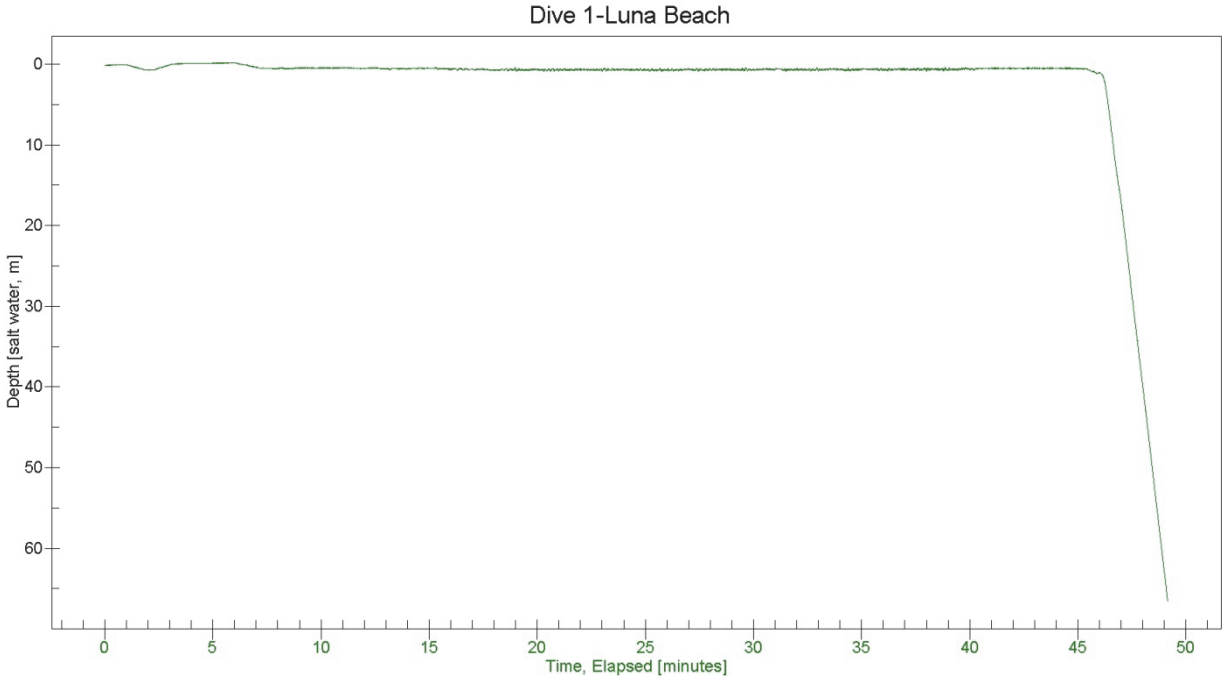

Figure 9. A plot of depth and time showing a 46 minute surface tow and 3 minute descent

Water chemistry profile for Dive 1

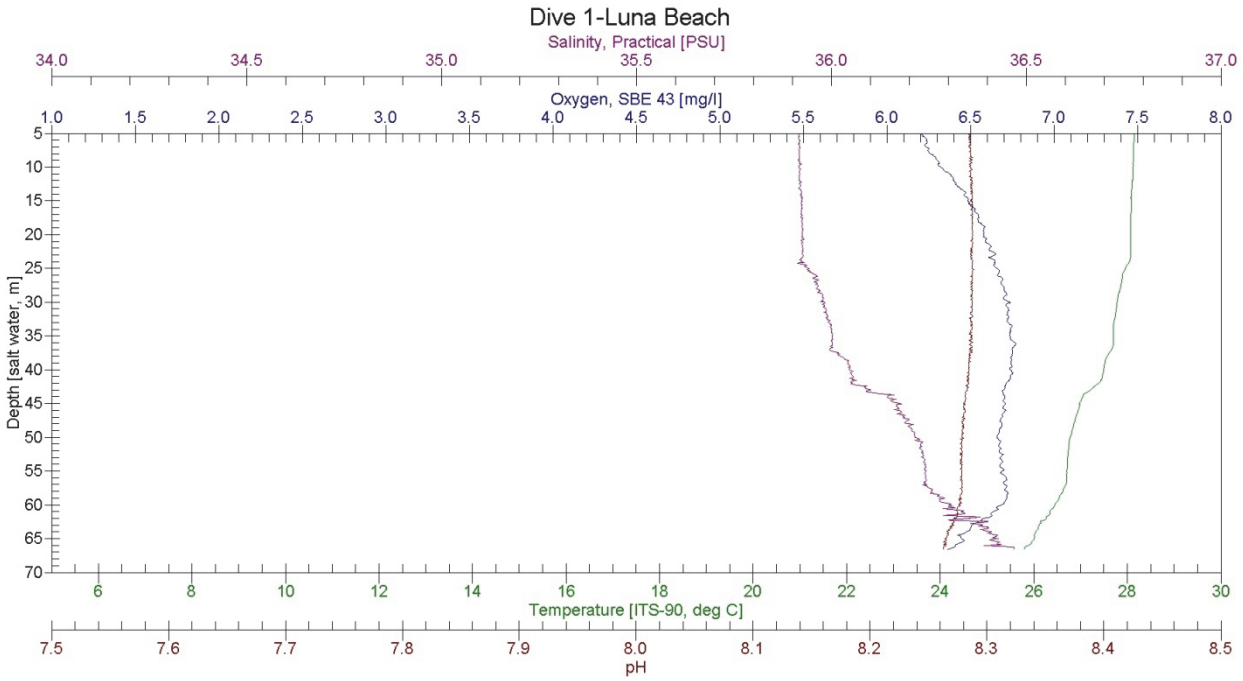

Figure 10. A plot of salinity, dissolved oxygen, temperature and pH for Dive 1 at Luna Beach.

DeepCAST II Dive 1 Date: May 22, 2011 Location: Luna Beach

Dive 1 Chronology:

Time	Depth (ft)	Temperature (°C)	
1014	S	30	
1019	200	28	
	540	21	
	800	18	
	900	17.5	
1031	1000	16	
1032	1100	15	
1034	1240	13.5	
1035	1300	13	
1039	1400		Many small squid (<2 cm) & small hatchet fish.
1042	1485	12.5	No more squid observed
1046	1680	12	
1049	1800	12	Juvenile frost fish observed
	1900	12	
1055	2000	11	
1057	2090	11	
1130	1850	10	Brittlestar with white & pink striped disk.
1200	1640	12	CHANGE TAPE tape 2. *Parazoanthus* occurred in patches.
1208	1500		Six gill shark (3-4 m)
1215	1500		Barren boulder
1237	1290	12	
1309	1200	12	Changed video camera battery
1317	1190	12	Large boulder field
1344	1110	12	Left boulder field; large field of *Paramuricea*.
			Atop the boulder were lots of coral and eipifauna.
1403	990		Started observing light from surface.
	850		*Paramuricea* with *Asteroporpa annulata* brittlestars
1430	380	25	
1439	100		

DeepCAST II Dive 2 Date: May 23, 2011 Location: Sueno del Mar

Descent coordinates: 16° 18.287' N, 86° 36.646' W
Observers: Jerry Harasewych, Sebastian Troeng
Left dock: 10:15 Begin Descent: 10:35 Return to dock: 15:10

Geology: Maximum depth of dive 2150 ft. (655 m) Steep basaltic wall with many large basaltic boulders, with occasional sand pockets. Massive basaltic boulder >100 ft high at 1180 ft, bottom more gently sloped [30-45°] at about 1000 ft (305 m), predominantly sand / sediment with occasional boulders. Travelled horizontally at about 1000 ft. Turned upslope to steeper [70 - 85°] slope with more rocks. Transitioned from basaltic rock to limestone at around 650-700 ft. Limestone wall nearly vertical, with overhangs, ledges and small crevices, until reef edge at about 200 ft (61 m).

Biology: Rocky bottom around 2000 ft (610 m) was only sparsely populated with small corals and large red sea stars, while sandy patches had occasional swimming holothurians, small, dark urchins, and anemones. White branched octocoral collected near 1980 ft (604 m). *Lophelia pertusa* was collected at 1920 ft (585 m). *Dendrophyllia alternata* was also collected. The number of glass sponges began to increase near 1800 ft (549 m), especially on vertical or near-vertical surfaces. Crinoids were present, including stalked, comatulid, and *Holopus*. *Perotrochus midas* was common between 1800 and 1200 ft (366 m). One *Perotrochus cf. charlestonensis* was collected at 1180 ft (360 m). At around 1100 ft (335 m), bottom became more gently sloped and primarily sand covered, with occasional rocky patches.

Octocorals on the rocks included large Primnoidae, smallish purple Paramuriceidae, white *Muriceides* colonies and many *Bathyalcyon* soft corals. Rocks also populated by sponges, *Parazoanthus* colonies and crustaceans [crabs and shrimp]. One clawed lobster seen around 1000 ft. Sandy areas had bluish, swimming holothurians, mostly single but occasionally in groups of 5 to 8. Sea urchins also occurred both singly and in groups. The wall became steeper, with a higher proportion of rocky bottom at depths of 1140-960 ft (350-292 m). Rocks usually covered with sponges, gorgonians, crinoids, crabs and rarely *Perotrochus quoyanus*. Near 600 ft (183 m), the wall became nearly vertical, with cracks, ravines, overhangs and caverns. Fauna quite sparse at the base, becoming denser, mostly sponges, by 400 ft (122 m). Numerous tube sponges by 300 ft (91 m). *Entemnotrochus adansonianus* collected at 260 ft (79 m).

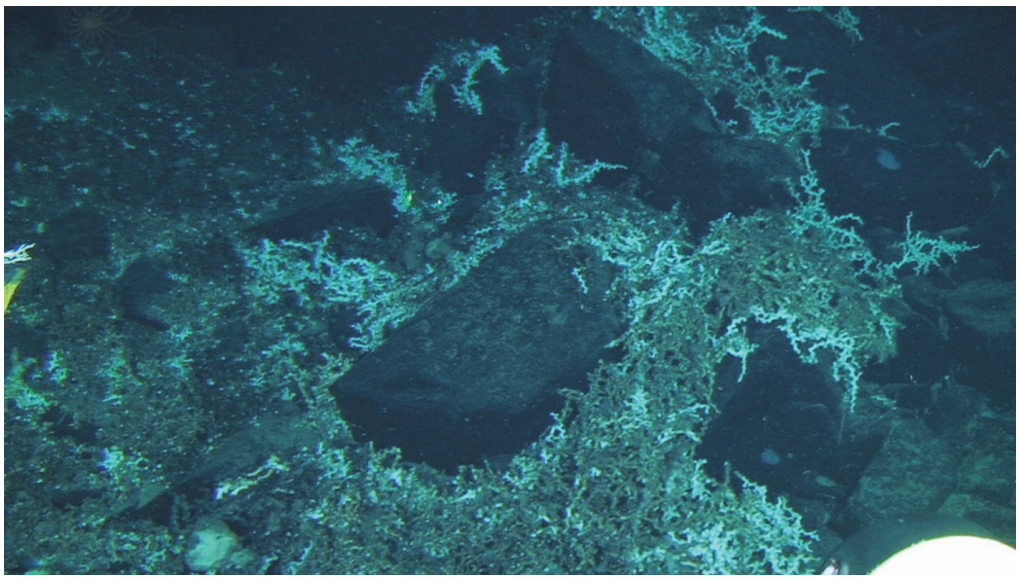

Figure 11. An aggregation of *Lophelia pertusa* at 1920 feet (585 m) depth at Sueno del Mar.

DeepCAST II Dive 2 Date: May 23, 2011 Location: Sueno del Mar

Dive profile for Dive 2 (timed out after 45 min)

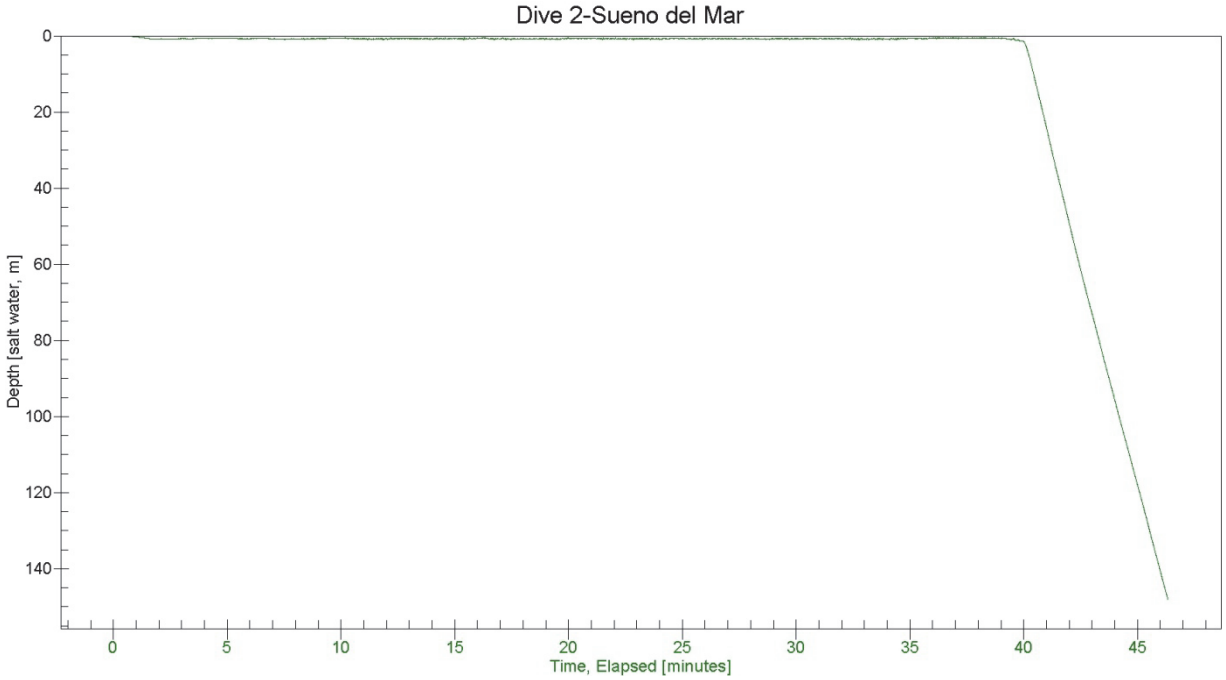

Figure 12. A plot of depth and time showing a 40 minute surface tow and 6 minute descent

Water chemistry profile for Dive 2

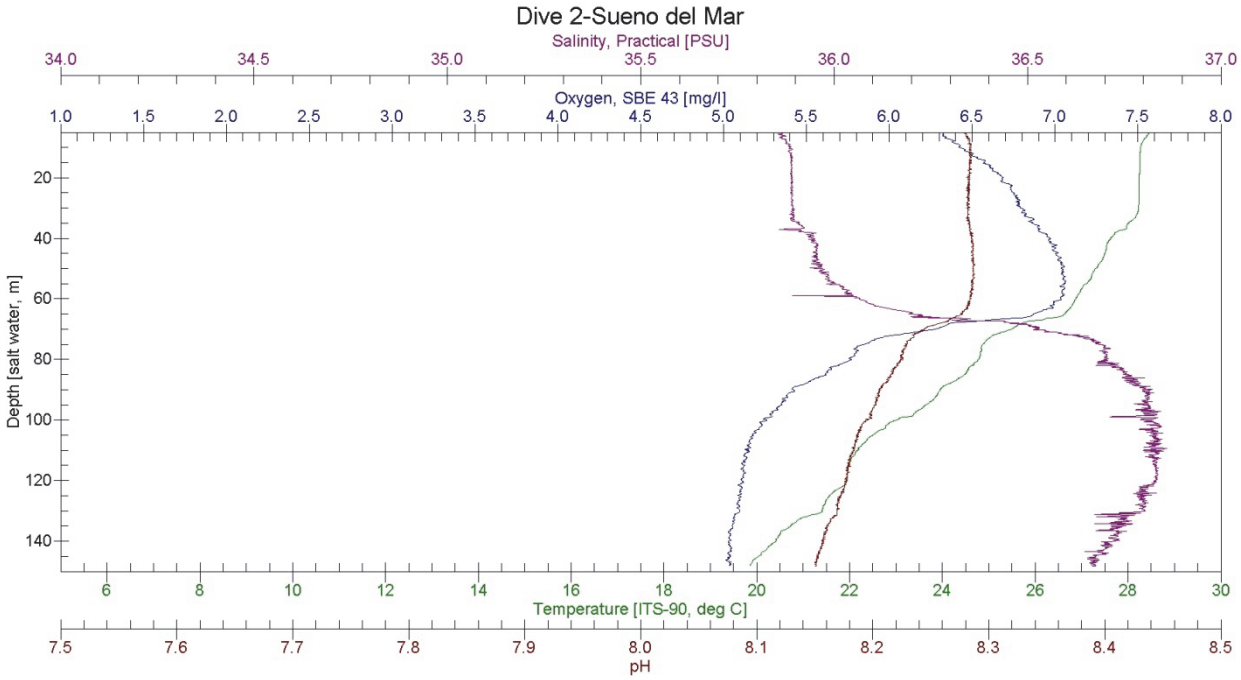

Figure 13. A plot of salinity, dissolved oxygen, temperature and pH for Dive 2 at Sueno del Mar.

DeepCAST II Dive 2 Date: May 23, 2011 Location: Sueno del Mar

Dive 2 Chronology:

Time	Depth (ft)	Temperature (°C)	Comment
10:35	0	30.5	
10:43	400	25.0	
10:46	500	22.0	
10:48	680	20.0	
10:52	1000	16.0	
10:58	1420	12.5	
11:02	1540	12.0	
11:06	1980	11.5	
11:17	2150	10.5	bottom
11:26	2000	11.5	
11:35	1920	11.5	Lophelia
11:45	1780	12.0	midas 1 [large]
11:53	1680	12.0	
11:57	1660	12.0	midas 2 [small]
12:07	1560	12.0	frogfish
12:11	1500	12.0	midas [not collected]
12:14	1480	12.0	CHANGE TAPE
12:21	1440	12.5	midas 3 & not collected
12:32	1300	13.0	blue holothurians
12:38	1180	14.0	giant basaltic boulder
12:48	1180	14.0	cf. charlestonensis
12:53	1160	14.0	midas 4
13:08	1140	14.0	midas [not collected]
13:16	1060	15.0	sea fan w/ crinoids
13:37	1000	15.5	boulder
13:49	1000	15.5	jack
13:58	980	15.5	sand bottom w/ rocks
14:10	960	15.5	quoyanus [not collected]
14:15	940	15.5	sponges
14:25	920	16.0	quoyanus 1
14:34	700	18.5	last basaltic rock
14:37	600	20.0	steep, limestone slope
14:40	460	22.5	limestone wall
14:43	360	25.5	3 jacks
14:47	260	27.0	adansonianus 1
14:50	200	29.5	reef flat edge
14:52	0	30.5	surfaced

DeepCAST II Dive 3 Date: May 23, 2011 Location: Half Moon Bay

Descent coordinates: Slightly north of buoy. Buoy is 16° 18.434 N, 86° 35.740 W
Observers: Laney Thornton, Annie Thornton
Left dock: 1900 Begin Descent: 1907 Return to Surface: 2054

No boat tow. Submersible left and returned under her own power.

Geology: Maximum depth of dive was 1530 ft.
Biology: Scientists were not present on this dive. No biological description is provided.

Dive 3 Chronology:

Time	Depth (ft)	Temperature (°C)	
1909	S	30	
1912	150	29	
1916	350	25	
1918	500	22	
1922	700	19	
1928	1100	15	
1935	1400	14	
1939	1530	13	bottom camera on
1942	1530	13	coral rubble
1947	1510	13	sand
1948	1500	13	Limestone boulder
2002	1510	13	Collecting trap located
2005	1510	13	Trap picked up
2010	1430	13	Basalt
2014	1360	13	Limestone boulders
2020	1200	15	
2021	1180	15	Water column
2026	1000	17	Sand
2035	700	18	coral rubble/old trap
2043	520	23	Going up vertical wall
2048	300	27	Going up wall
2054	S	33	

DeepCAST II Dive 3 Date: May 23, 2011 Location: Half Moon Bay

Dive profile for Dive 3 (timed out after 45 min)

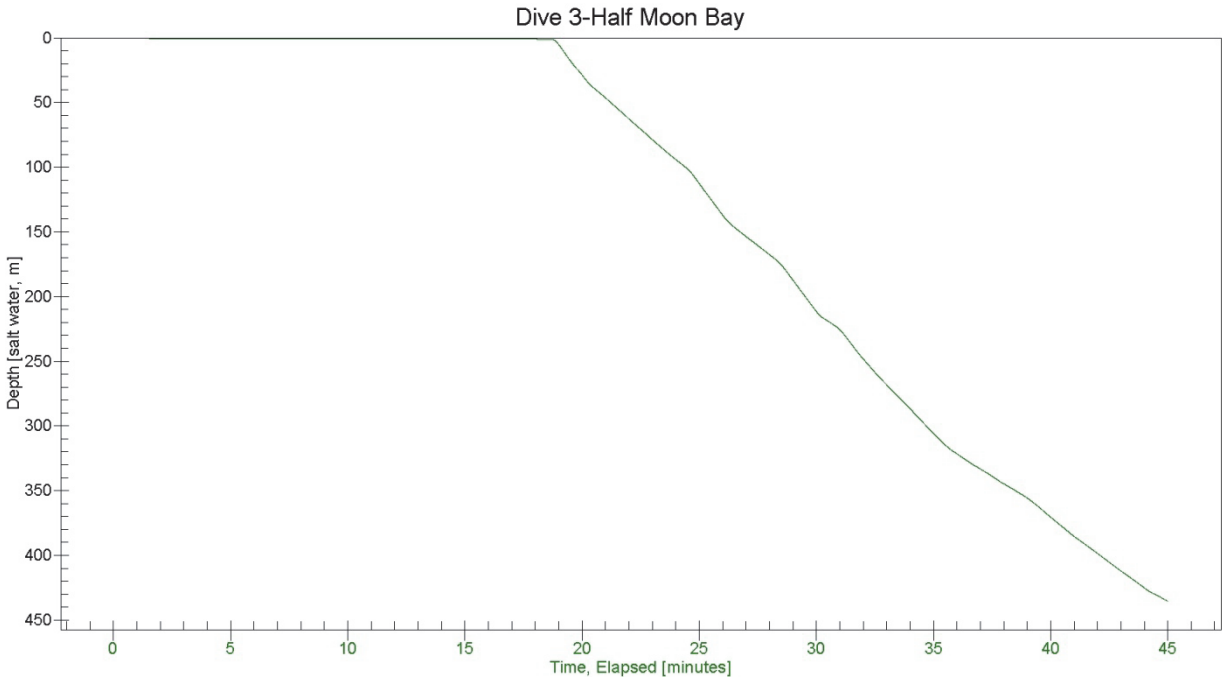

Figure 14. A plot of depth and time showing a 19 minute surface tow and a 26 minute descent

Water chemistry profile for Dive 3

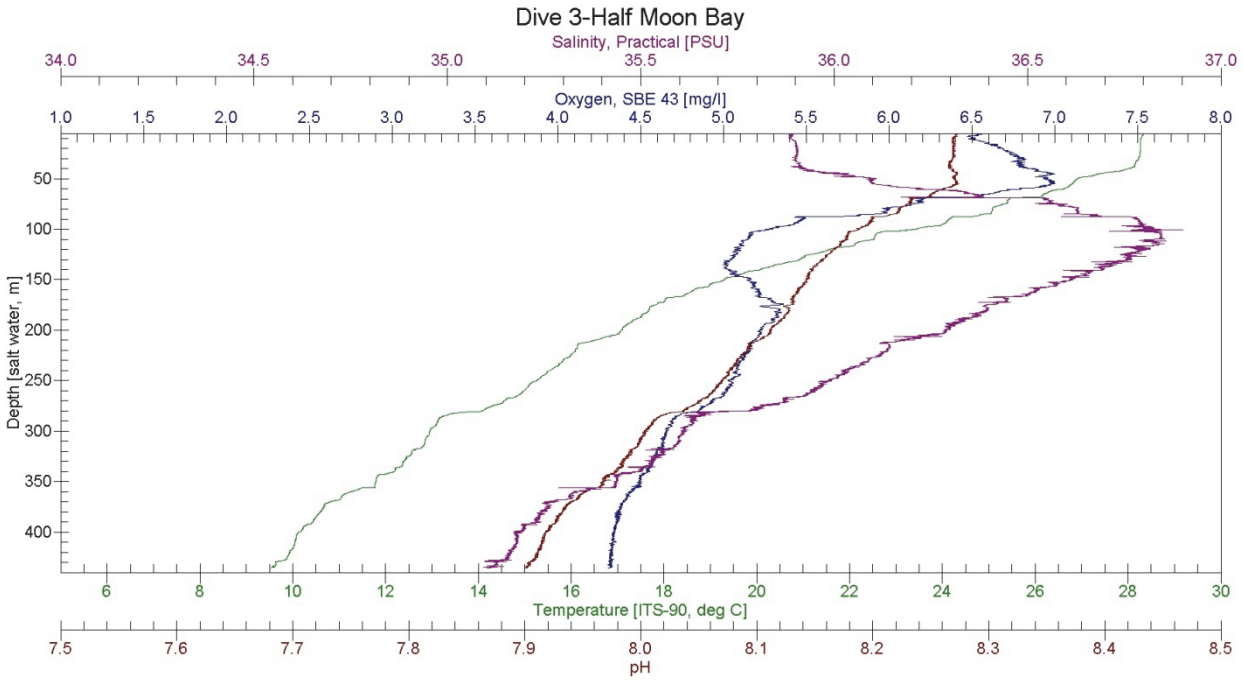

Figure 15. A plot of salinity, dissolved oxygen, temperature and pH for Dive 3 at Half Moon Bay.

DeepCAST II Dive 4 Date: May 25, 2011 Location: Three Kings (AKR)

Descent coordinates: 16° 21.026' N, 86° 34.348' W
Observers: Kate Lavelle, Annie Thornton
Depart dock: 08:47 Begin descent: 09:10 Return to dock: 12:58
No CTD cast.

Geology: Maximum depth of dive 2160 ft (658 m). Many large basaltic boulders, fewer limestone boulders. Boulders recently moved by earthquake activity had fewer sessile organisms. No patterns in boulder distribution were observed. Soft sediment filled the space between boulders.

Biology: The most abundant corals on hard substrate were primnoids, which were observed at a maximum depth of 1800 ft (548 m). Other corals included sea whips, bamboo corals, *Bathypathes*, *Corallium*, *Paramuricea*, *Dendrophyllia alternata*, and *Plumapathes*. Juvenile galatheoid crabs were seen on bamboo corals and primnoids. Adult galatheoids were observed primarily on primnoids.

Several species of sponges were observed including glass and vase sponges, with the majority occurring on boulder faces or the tops of boulders. Two species of cidaroid urchins were seen on *Corallium* and *Bathypathes* corals. Elasipodid sea cucumbers, brittle stars, anemones, and crinoids were observed on soft sediment. The most conspicuous invertebrates were large brisingid seastars, which were often in close proximity to corals and on boulders. Epifauna of primnoid colonies included venus flytrap anemones, galatheoids, brittle stars, brisingids, and crinoids.

Two wahoo were seen above the sub while descending (680 ft, 207 m). Two large pyrosomes were seen in the water column at 1900 ft (579 m). An unknown red jellyfish was observed at 2000 ft (610 m, possibly *Periphylla*). Two midas slit shells were seen at 1940 ft (591 m). Trash bags, bottles, and plastics were observed in a sand channel beginning at 1880 ft (573 m). Five lionfish were seen at 250 ft (76 m).

Dive 4 chronology:

Time	**Depth (ft)**	**Comment**
9:10	surface	
9:11	200	temperature was not recorded on this dive
9:13	300	
9:15	400	
9:17	600	still see surface light
9:19	680	2 wahoo above sub
9:21	790	
9:23	900	
9:25	1000	no more light
9:27	1090	
9:29	1250	
9:31	1290	
9:33	1450	
9:35	1500	

Dive 4 chronology (continued)

Time	**Depth (ft)**	**Comment**
9:37	1600	2’ cutlass fish
9:39	1690	squid eggs and squid
9:41	1800	salps, siphonophores
9:43	1890	1.5’ pyrosome
9:45	2000	lights out, some bioluminescence
9:47	2100	
9:49	2160	
9:53	2120	siphonophore, steep incline
9:57	2100	
9:59	2060	
10:01	2000	lots of bare boulders, from recent earthquakes
10:03	2000	sea urchin, bathypathes
10:05	2000	red jelly, unknown
10:07	2000	clear jelly, maybe ctenophore
10:09	2000	very steep rockface
10:11	2000	large siphonophore
10:13	2000	
10:15	2000	
10:17	2000	huge pyrosome
10:19	2000	bamboo coral with juvenile crabs
10:21	2000	
10:23	2000	
10:25	2000	
10:27	2000	starting to see more corals, steep
10:31	2060	goosefish, *Plumapathes*, primnoid, *Corallium*, bamboo
10:33	2000	
10:35	2000	
10:37	2000	
10:39	2000	
10:41	2000	
10:43	2000	
10:45	2000	
10:49		bare *Bathypathes*, chirostylid nearby
10:53	2020	CHANGE TAPE tape 2 begins
10:57	2020	
10:59		coasting
11:03	2020	sandy bottom, sand channels
11:05	2000	
11:07	2000	some bamboo corals, green *Plumapathes*
11:11	2020	turned around back to where we saw coral

Dive 4 chronology (continued)

Time	Depth (ft)	Comment
11:19	1940	two large midas
11:21	1880	trash bags, rusting metal
11:27	1800	
11:29	1780	
11:31	1640	steep slope
11:33	1600	12 C
11:35	1520	
11:37	1500	can see ledge 70 ft above us
11:39	1490	cleared ledge
11:41	1460	large limestone rock
11:43	1400	small colonies *Dendrophyllia*
11:45	1380	
11:47	1300	*Paramuricea*
11:49	1200	sponges cover boulders
11:51	1180	
11:55	1100	
11:59	1080	
12:01	1040	garbage, cans, bottles
12:03	1040	garbage, four large unidentified fish
12:05	900	
12:09	800	CHANGE TAPE tape 3, rope hanging at 800-850 ft
12:11	780	
12:13	700	wall 250’ away
12:15	680	
12:17	600	
12:19	560	
12:21	500	
12:23	480	
12:25	470	
12:27	420	
12:29	410	
12:33	310	large Ellisellidae, presumably *Nicella* sp., five lionfish
12:35	250	current now moving opposite direction than current at 2000’
12:37	200	visible thermocline
12:41		surfaced

DeepCAST II Dive 4 Date: May 25, 2011 Location: Three Kings (AKR)

Large sea fans in the families Primnoidae and Ellisellidae. Green lasers are 10 cm apart.

Figure 16. A large primnoid colony in the subfamily Calyptrophorinae at 1800 ft (548 m) depth.

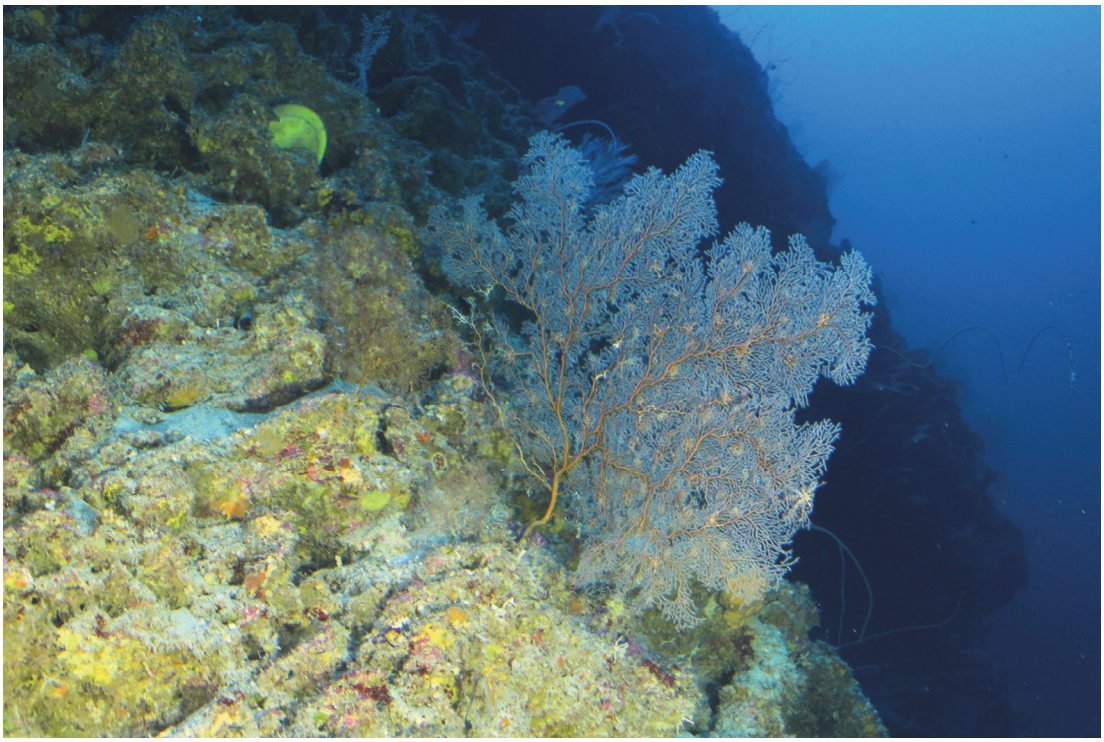

Figure 17. A sea fan in family Ellisellidae with many brittlestars and trash (yellow) at 310 ft (94 m) depth.

DeepCAST II Dive 4 Date: May 25, 2011 Location: Three Kings (AKR)

Water chemistry profile for Dive 4

Profile unavailable due to software conflict.

DeepCAST II Dive 5 Date: May 26, 2011 Location: Lawson's Rock

Descent coordinates: 16˚ 20.188' N, 86˚ 34.267' W
Observers: Sebastian Troëng, Laney Thornton
Depart dock: 09:05 Begin descent: 09:48 Back at surface: 14:27 Return to dock: 14:39

Geology: Maximum depth of dive 2,090 ft (637 m). Upon reaching sea bottom there were large basaltic boulders of volcanic origin that appeared striated. We observed a couple of cinderblocks with a rope stretching in a slight slope as far as we could see. Karl mentioned these may be from the Roatán Marine Park staff's effort to install a buoy but underestimating the depth of the water and only having 1,500 ft of rope for the 2,000 ft depth. After the initial basaltic boulders there were large areas of soft bottom with occasional basaltic boulders and after the middle of the dive there were occasional calcium carbonate boulders including some very large ones. Two boulders in particular stood out, one that was separated by a small distance from the main basaltic boulders (observed at 11:13) and a second that was towards the end of the dive (observed 13:41), in front of the channel leading to Anthony's Key Resort and that was covered in sea fans and epifauna. For much of the dive (the duration of the two first videotapes) we remained at depths exceeding 1,800 ft (549 m) followed by a slow ascent lasting two hours.

Biology: The amount of material in the water column varied considerably during the dive. Initially there were lots of materials in the water and the bottom fauna appeared more ample with soft bottom fauna dominated by lobsters, worms and brittlestars. Later during the dive the water was clearer with less material in the water column (and less rich bottom fauna) followed a little later by more material and finally by clearer water again. We observed a giant isopod when arriving at the sea bottom. Other noteworthy fauna includes a frostfish (photographed) and an unidentified shark (approx. 16 in. long) that we filmed but could not photograph (autofocus would not lock). We collected a midas slitshell and three coral genera (*Dendrophyllia, Madrepora, Enallopsammia*). During the ascent we observed large groups of urchins at 1,000 ft (305 m) and on a sandy slope at 200 ft (61 m) we observed numerous garden eels.

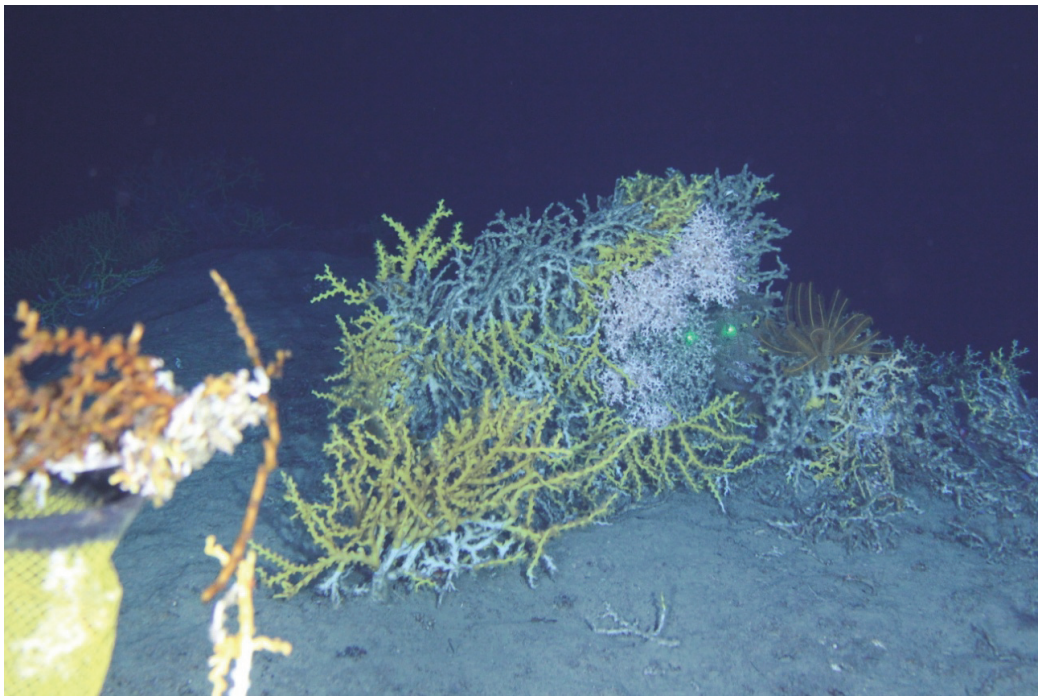

Figure 18. Sample collection of *Dendrophyllia alternata* from Lawson's Rock.

DeepCAST II Dive 5 Date: May 26, 2011 Location: Lawson's Rock

Dive 5 chronology:

Time	Depth (ft)	Temp (°C)	Comment
9:48	S	31	
9:51	200	29	
9:53	400	24	
9:56	600	20.5	
9:58	800	18	
10:01	1000	16	
10:04	1200	14	
10:06	1400	13	
10:10	1600	12.5	
10:14	1800	12	
10:17	2000	12	
10:20	2090	11.5	bottom, volcanic rock, striation rock may be sedimentary
10:22		11.5	giant isopod
10:28	2040	11.5	volcanic rock, some with striation, black corals
10:30	2040	11.5	sandy bottom with lobster and cinderblocks with rope from Roatán Marine Park (according to Karl)
10:37	2060	11.5	volcanic rock with gorgonians and *Madrepora*
10:45	2040	11.5	another volcanic rock with gorgonians, black corals, *Madrepora*
10:53	2040	12	frostfish
10:58	2020	12	sandy bottom, lobsters, worms, brittlestars
11:13	1960	11.5	steep cliff to left with limestone slab to right, less fish life
11:23	1940	12	changed to tape 2
11:35	2040	12	sediment w/ occasional volcanic ridge, less material in water
11:47	2010	12	seafans with sea stars
12:02	1940	12	small overhang, more material in water column
12:08	1910	12	changed battery
12:20	1980	12	midas slitshell collected, volcanic rock
12:26	1930	12	*Enallopsammia* coral collected
12:27	1960	12	tube sponge photographed, changed to tape 3
12:37	1820	12	midas on sand, midas on rock
12:45	1680	12.5	ascending volcanic boulder, slope with corals and garbage
12:53	1560	12.5	green sponges, volcanic slope
12:58	1460	12.5	yellow coral collected
13:05	1400	12.5	*Dendrophyllia* collected, midas on coral
13:12	1340	13	midas on rock
13:18	1300	13.5	*Dendrophyllia*
13:25	1230	13.5	coral sampled, shelled mollusk on wall
13:41	1160	14	calcium carbonate rock
13:46	1100	14	rock covered in seafans
13:53	1020	14	back on sandy slope, numerous urchins together
14:01	820	18	sandy slope with garbage
14:06	680	19.5	airplane part in sand
14:11	500	22	going up steep calcium carbonate drop-off
14:14	400	24	
14:21	200	30	garden eels
14:27	surface	31	
14:39	surface	33	dock

DeepCAST II Dive 5 Date: May 26, 2011 Location: Lawson's Rock

Large sea fans in the families Primnoidae and Paramuriceidae. Green lasers are 10 cm apart.

Figure 19. A large sea fan in family Primnoidae, with many squat lobsters at 1100 ft/335 m depth.

Figure 20. Sea fans in family Paramuriceidae with *Asteroschema* sp. brittlestars at 1230 ft/374 m depth.

DeepCAST II Dive 5 Date: May 26, 2011 Location: Lawson's Rock

Dive profile for Dive 5 (timed out after 45 min)

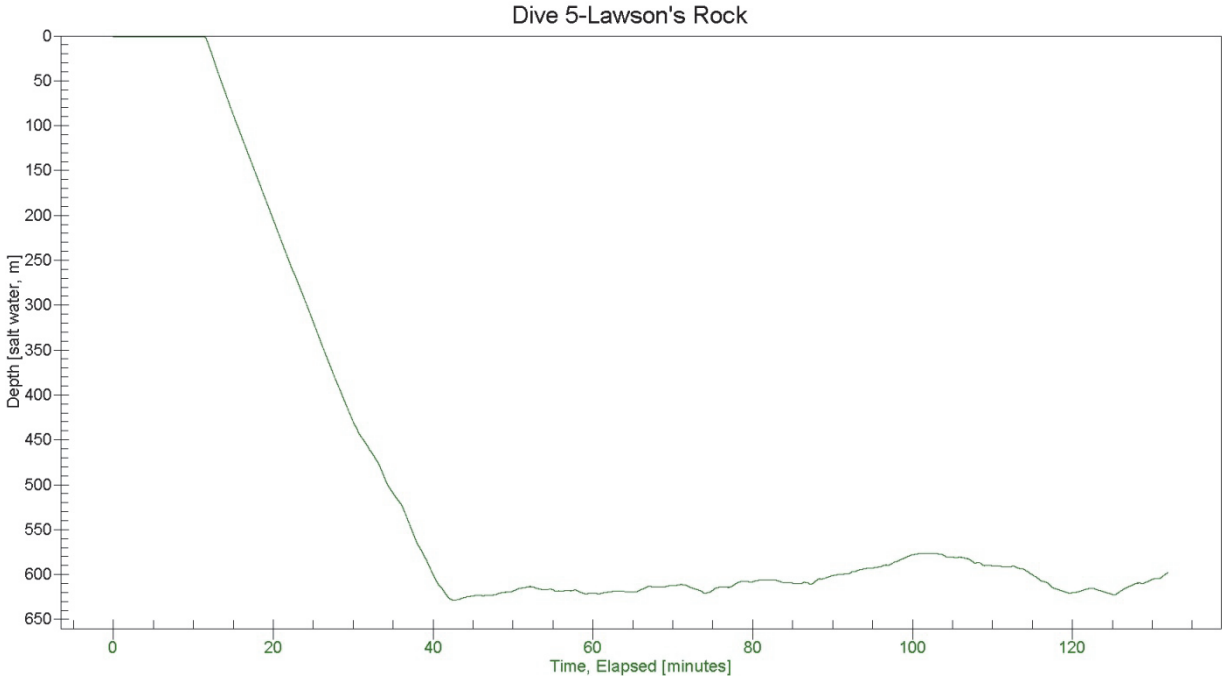

Figure 21. A plot showing a 15 min. surface tow, a 26 min. descent, and 90 min. of along-track data.

Water chemistry profile for Dive 5

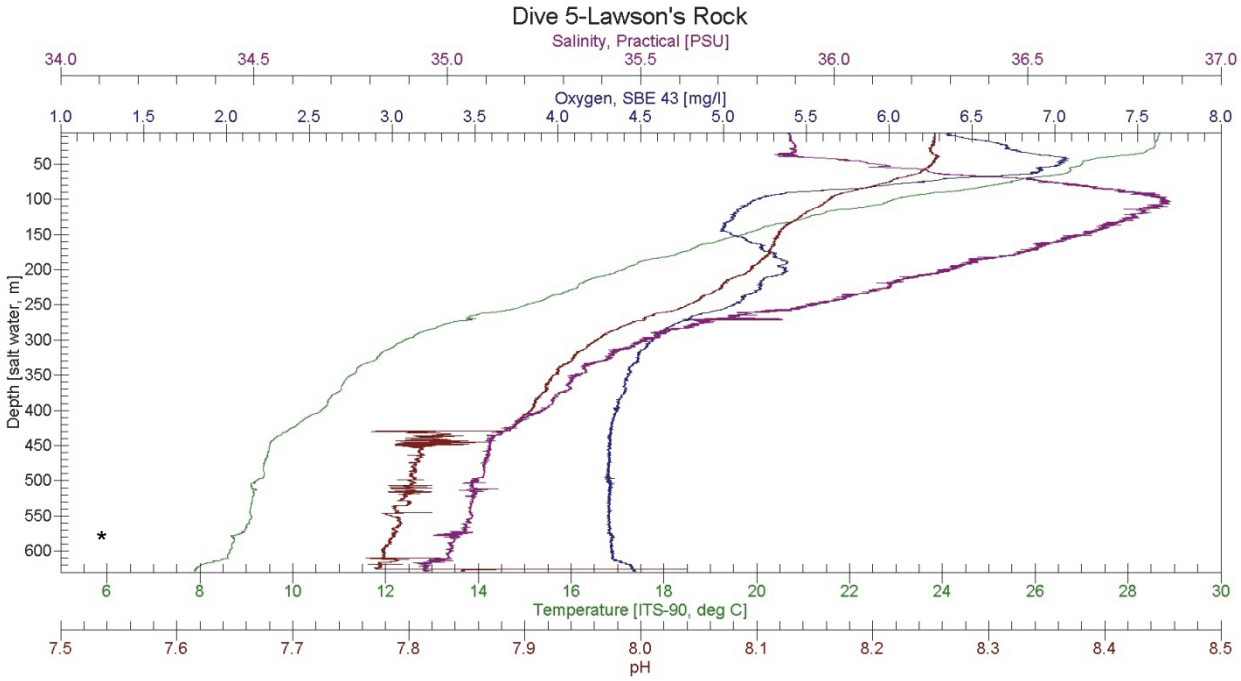

Figure 22. A plot of salinity, dissolved oxygen, temperature and pH for Dive 5 at Lawson's Rock. An asterisk (*) indicates observed depth of *Lophelia* on Dive 2: depth - 585 m, pH - 7.78, oxygen - 4.35 mg/l.

DeepCAST II Dive 6 Date: May 27, 2011 Location: Old Loafers

Descent coordinates: 16° 17.924' N, 86° 36.292' W
Observers: Tom Shirley, Jerry Harasewych
Left dock: 1415 Begin Descent: 1448 Return to Surface: 1833

Geology: Maximum depth of dive was 1220 ft (372 m). Sub release point from boat was too shallow, only 700 ft (213 m) deep and sub had to drive offshore, near bottom, to find deeper depths. Many large boulders (limestone?) were interspersed with soft sediment. Many boulders were sediment-covered and supported few epifauna. At depths of about 500 ft (152 m), the slope became nearly vertical, a limestone wall that was deeply eroded [like a meteorite] in areas, with the top of the wall at around 200 ft (61 m).

Biology: Soft substrate was occupied by sea urchins, a few sponges, and elasipodid sea cucumbers. One cat shark was observed, perhaps 1 m in total length; sub traveled directly over it and we had a good view through the bottom view port. Octocorals were relatively uncommon, mainly the purple/grey sea fans that I refer to as *Paramuricea*, and always on hard substrate, usually on tops of boulders. Crinoids were among the most conspicuous animals on this dive, occurring on a variety of different substrates: boulder, sponges, and on the few octocorals.

One site near the beginning of the dive had a natural arch and was covered with sea lilies, more than Karl had previously observed. We named this site "Sea Lily City." Brisingid seastars (*Novodinia antillensis*) occurred on many substrates, but were not as common as on previous dives. Elasipodid sea cucumbers were usually solitary, often several meters from other cucumbers on soft sediment. A small (20-39) school of shrimp was observed on the bottom near an anemone. One small aggregation of sea urchins, about 10 sea urchins, occurred on soft sediment in a group, near the beginning of the dive. Two species of slit shells were observed – one on tops of boulders, the other on near vertical walls. A new species of turrid shell was collected.

A bamboo coral (*Lepidisis*) occurred in solitary stalks commonly, and was more common in shallower depths. Galatheoid crabs occurred on some of the *Lepidisis*. A new, small brittlestar species was observed on what appeared to be a yellow *Paramuricea* (but with slightly larger branches) in much shallower water (450 ft, 137 m). These brittlestars blended in almost perfectly with the coral and were difficult to distinguish. Many juvenile sharpnose puffers (1-2 cm in length) were observed in shallower waters (400-200 ft). Three lionfish were first observed at 400 ft (122 m) depth, but then lionfish were observed continuously to the surface. Blue sponges were common on vertical faces of some boulders.

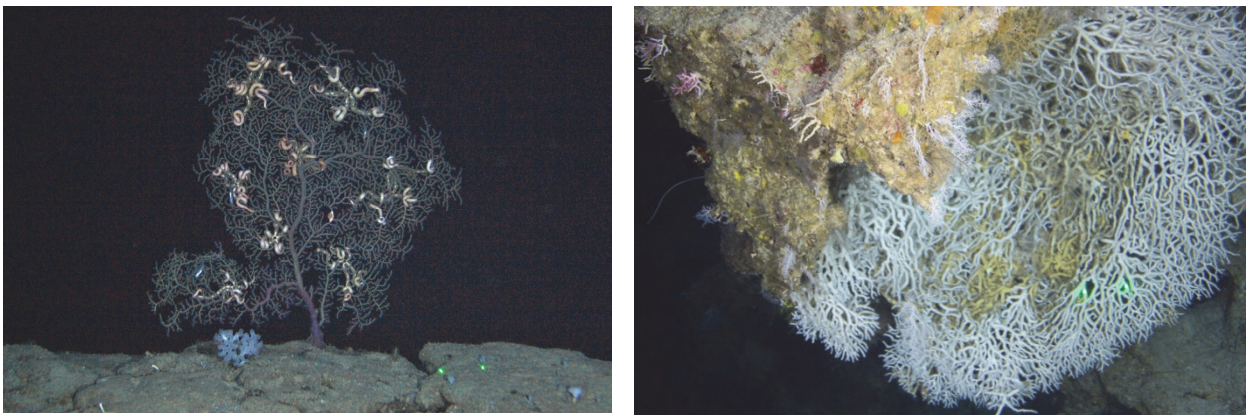

Figure 23. Corals at Old Loafers included sea fans in family Paramuriceidae (1200 ft/366 m, left) and large thickets of the scleractinian coral *Madracis myriaster* (400 ft/122 m, right). Green lasers are 10 cm apart.

DeepCAST II Dive 6 Date: May 27, 2011 Location: Old Loafers

Dive 6 chronology:

Time	Depth (ft)	Temperature (°C)	
1420	S	33	
1435	S	32	
1445	S	32	
1448	40	30	Beginning dive
1450	100	30	
1451	200	29.5	
1452	300	28	
1453	400	24	
1455	500	23	
1456	600	22	
1458	700	20	Near bottom, heading offshore to deeper water
1501	800	19	
1504	900	18	
1506	1000	16	Can see bottom
1508	1100	15.5	Temperatures are almost identical to Dive 1 (at same depths)
1509	1150	15	Soft sediment bottom – fine sand/silt
1512	1220	14	Lots of lebenspuren visible: tracks, ruts, mounds, burrows, depressions
1520	1240	13	Moving across sand bottom, around large boulder.
1525	1200	13	Several small, silvery fish hanging upside down under *Paramuricea*
1535	1180	14	Limestone rx with galatheoid
1542	1180	14	Silty bottom with limestone rx
1547	1100		"Sea Lilly City" on large boulder with arch
1555	1100	15	carrier shell, *Parazoanthus*
1602	1100	14	Black Rock (Karl's name for site) – Large *Antipathes* sp black coral
1610	1100	14	Level bottom, pits and mounds
1611	1100	14	*Bathypathes* (black coral resembling a feather-shape) w/ large galatheoid
1615	1100	16	CHANGED TAPE;
1625	1110	16	Collected slit shell
1638	1060		Collected turrid shell
1643	1000	16	Large boulders, lots of sediment
1645	900	17	Large boulders, lots of sediment
1654	890		Cat shark; squat lobster
1700	840		Switched camera to AC power; battery ran out; lizard fish
1705	800	18	*Calliostoma* sp. collected; 1.5 inches (?) in diameter
1715	740		Large vase sponges on large boulders; sediment covered
1722	650	18	CHANGED TAPE; Engine block & 100 ft. of line; little coral observed
1730	500	21	Drum fish (like a high hat); steep slope
1735	400	24	Steep slope; French angel; short bigeye; *Madracis myriaster*
1738	400-380		3 lionfish;
1745	390		One very large lionfish
1757	390	26	Steep wall, barren
1801	320	27	Slit shell collected (*Entemnotrochus adansonianus*); 2 large lionfish
1810	400	26	CHANGED TAPE; tape 4; collected *Madracis*; lots of Lionfish, ~14"
1815	380	26	Collected more *Madracis*
1825	300	28	Collected another slit shell (*Entemnotrochus adansonianus*); another slit shell was within a few cm; on steep wall, near sponge
1833	Surfaced		

DeepCAST II Dive 6 Date: May 27, 2011 Location: Old Loafers

Dive profile for Dive 6 (complete profile)

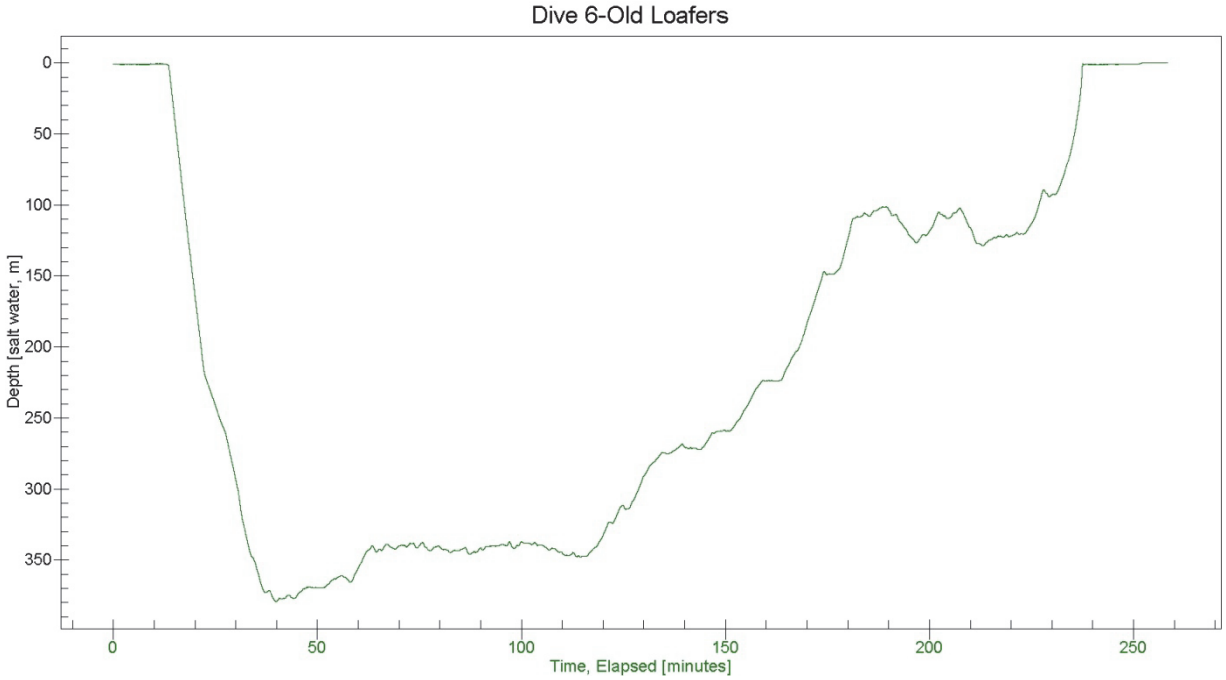

Figure 24. A plot showing a 20 min. surface tow, a 15 min. descent, and 190 min. of along-track data.

Water chemistry profile for Dive 6

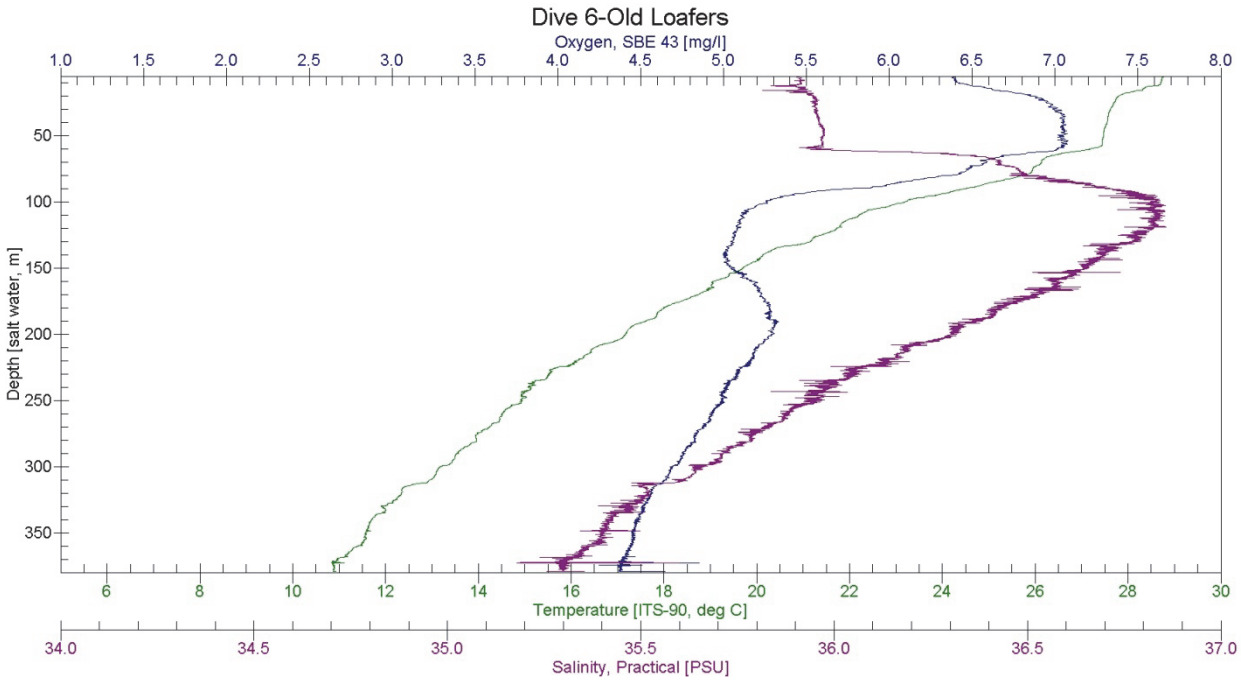

Figure 25. A plot of salinity, dissolved oxygen, and temperature during the 15 min. descent at Old Loafers.

Conclusion:

The DeepCAST II Expedition represented this research team's second scientific foray onto the deep-reefs of Roatán, Honduras. Research methods and techniques improved substantially since the first three day expedition in May 2010 (now referred to as DeepCAST I). Notable improvements include exterior mounts for cameras and lasers, along-track water chemistry from NOAA's Seabird CTD-O, and two new methods of sample collecting, the long-pole net and the baited trap. The primary significance of the research was enhanced knowledge of the deep-sea diversity present in the deep reaches of the MAR, and new baseline information on the environment, health and condition of deep-sea corals off Roatán, Honduras.

Biological sampling was identified as the first research priority after DeepCAST I. We were highly successful in this regard. The long-pole net retrieved 19 of 20 specimens (see Appendix 1 and 2), including five species of constructional scleractinians, four species of slit shells, one precious octocoral (genus *Corallium*), and one new species of turrid shell. Photo samples documented many more species (Appendix 3). We collected more photographic evidence of coral depredation, but have yet to identify the predator. Slit shells and cidaroid pencil urchins are currently the primary suspects, so future sampling efforts will target these animals.

The research team has grown to include new partners (e.g., Dr. Jerry Harasewych from Smithsonian NMNH), and new members from established partners (e.g., master's student Kate Lavelle from TAMU-CC, Dr. Sebastian Troeng from Conservation International). Results of our fieldwork have also opened the door to future collaborations with research partners in other taxa, like fishes and crinoids.

The next steps for field work are: 1) to improve the duration and performance of the along-track water chemistry profiler so every photo-transect can be cross-referenced to environmental parameters (e.g., depth and temperature), 2) to collect more samples of corals and associated invertebrates, and 3) to explore new habitats for better quantification of alpha and beta diversity on Roatán's deep-reefs.

Long term goals include: 1) high-resolution multibeam mapping of the Roatán Escarpment, 2) baseline characterization of aragonite saturation to 1000 m depth, and 3) more intensive biological sampling for population genetics, to understand patterns of connectivity between deep-reef assemblages along the Meso-American Reef and deep-reef assemblages in the adjacent Gulf of Mexico.

Acknowledgements:

This research would not have been possible without the generous support of Dr. Jeff Hyland at NOAA's Coastal Center for Environmental Health and Biomolecular Research; and Drs. Steven Cairns and Jerry Harasewych at Smithsonian National Museum of Natural History. Conservation International's (CI) Sojourns Program contributed greatly to our success. Rod Mast, Levi Norton, and Karl Egloff were instrumental to our success, along with Laney Thornton and Anne Chapman-Thornton. Dr. Sebastian Troeng of CI contributed important notes and insights. Schmidt Ocean Institute and Dr. Fred Boltz of CI helped catalyze the research through their participation in DeepCAST I.

Karl Stanley's efforts, ideas, and generosity were largely responsible for much of what we were able to accomplish during the expeditions. Research Fellowship funds from Schmidt Ocean Institute provided new tools, including new cameras and lasers. Dr. Steve W. Ross of University of North Carolina-Wilmington provided fish identifications. Dr. Cairns identified the scleractinians. Andrés Alegría, Coordinador de Monitoreo Biológico, Instituto Nacional de Conservación y Desarrollo Forestal, Áreas Protegidas y Vida Silvestre (ICF), Honduras kindly assisted with sample processing, as did Dr. Steve Box of Utila Ecology. Thanks to everyone involved for their generous support.

Appendix 1. DeepCAST II Biological Sample Inventory

The following specimens were collected as part of the Deep Coral and Associated Species Taxonomy and Ecology (DeepCAST) Expedition in Roatán, Honduras, May 21-28, 2011. Specimens were collected under the authority of Resolucion DE-MP-074-2011 from Instituto Nacional de Conservacion y Desarollo Forestal, Areas Protegidas y Vida Silvestre.

Scleractinia are regulated under the Convention for International Trade of Endangered Species (CITES). Other marine invertebrates listed in the collecting permit are exempt from CITES.

Specimens collected that are regulated by CITES:

IDA-11-01 *Dendrophyllia alternata* – 1 tube in ethanol, 1 bag dry
IDA-11-04 *Lophelia pertusa* – 1 tube in ethanol, 1 bag dry
IDA-11-05 *Madrepora oculata* - 1 tube in ethanol, 1 bag dry
IDA-11-06 *Enallopsammia rostrata* - 1 tube in ethanol, 1 bag dry
IDA-11-07 *Dendrophyllia alternata* – 1 tube in ethanol
IDA-11-10 *Madracis myriaster* – 1 bag dry

Specimens that are not regulated under CITES:

Miscellaneous Invertebrate samples:
IDA-11-03 Tube 10 - Octocoral, Corallidae, white
IDA-11-09 Tube 11 - Sponge, white, thin
IDA-11-02 Tube 12 – Bryozoa
IDA-11-08 Tube 13 – *Holopus* crinoids
IDA-11-11 2 specimens of lithodid crab *Paralomis cubensis*; a female and larger male

Mollusk samples [FM = foot muscle]
Tube 01 = *Perotrochus cf. chalestonensis* FM ex living animal.
Tube 02 = *Perotrochus midas* FM smallest specimen ex living animal.
Tube 03 = *Perotrochus midas* FM second smallest specimen ex living animal.
Tube 04 = *Perotrochus midas* FM medium sized, broken specimen ex living animal.
Tube 05 = *Perotrochus midas* FM largest specimen ex living animal.
Tube 06 = *Perotrochus quoyanus* FM ex living animal.
Tube 07 = *Perotrochus cf. chalestonensis* FM ex tissue provided by Karl Stanley
Tube 08 = *Entemnotrochus adansonianus* Dive 2 FM ex living animal.
Tube 09 = *Perotrochus quoyanus* FM from tissue sample provided by Karl Stanley.

As per the collecting permit application, up to three samples per species will be deposited into the collections of the National Museum of Natural History, Smithsonian Institution, where the collecting information, catalog number and images of specimens will be available on line. For those samples that result in successful sequencing, the sequence data will be made available on GenBank. Specimens additional to those permitted to be retained at SI will be returned to the Museo Nacional in Honduras.

Appendix 2. DeepCAST II Biological Sample Photo Inventory

Figure A1. Sample IDA-11-01 *Dendrophyllia alternata*

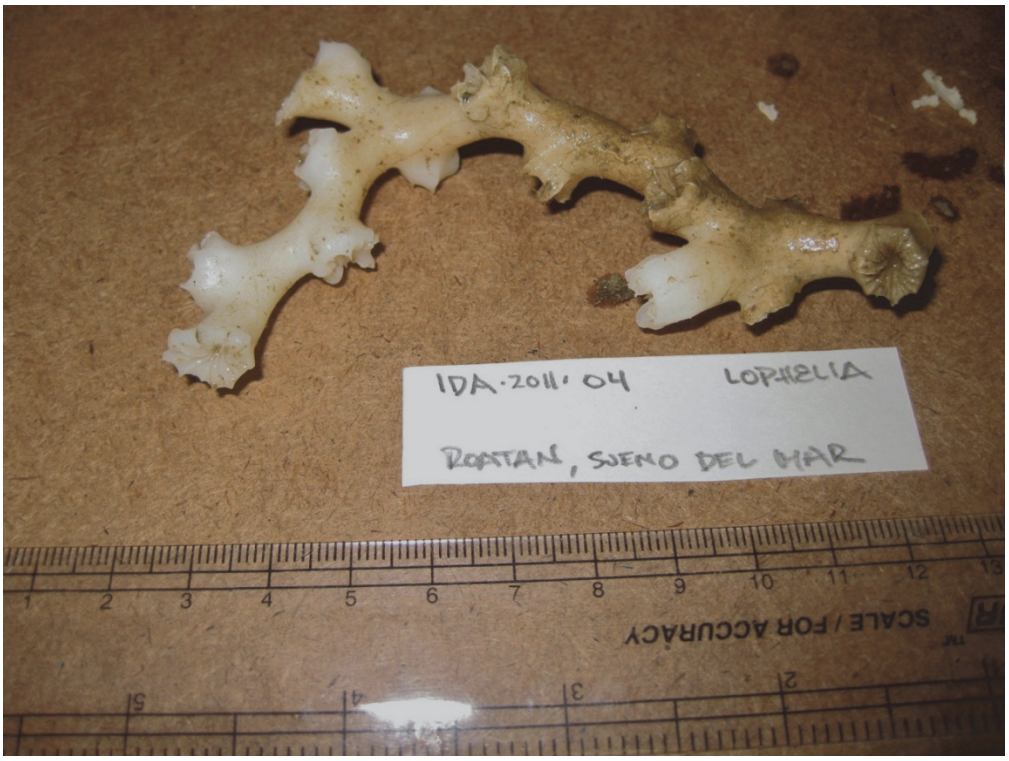

Figure A2. Sample IDA-11-04 *Lophelia pertusa*

Appendix 2. DeepCAST II Biological Sample Photo Inventory (cont.)

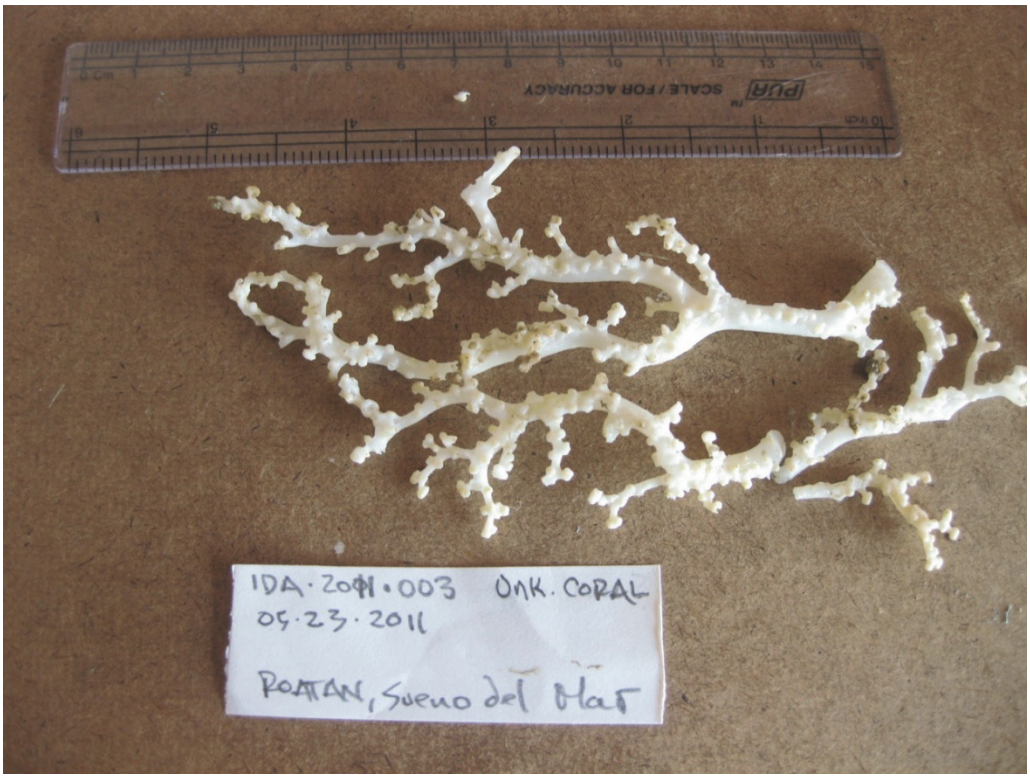

Figure A3. Sample IDA-11-03 *Corallium* sp. USNM 1155189

Figure A4. Sample IDA-11-03 *Corallium* sp. USNM 1155189

Appendix 2. DeepCAST II Biological Sample Photo Inventory (cont.)

Figure A5. Sample IDA-11-05 *Madrepora oculata*

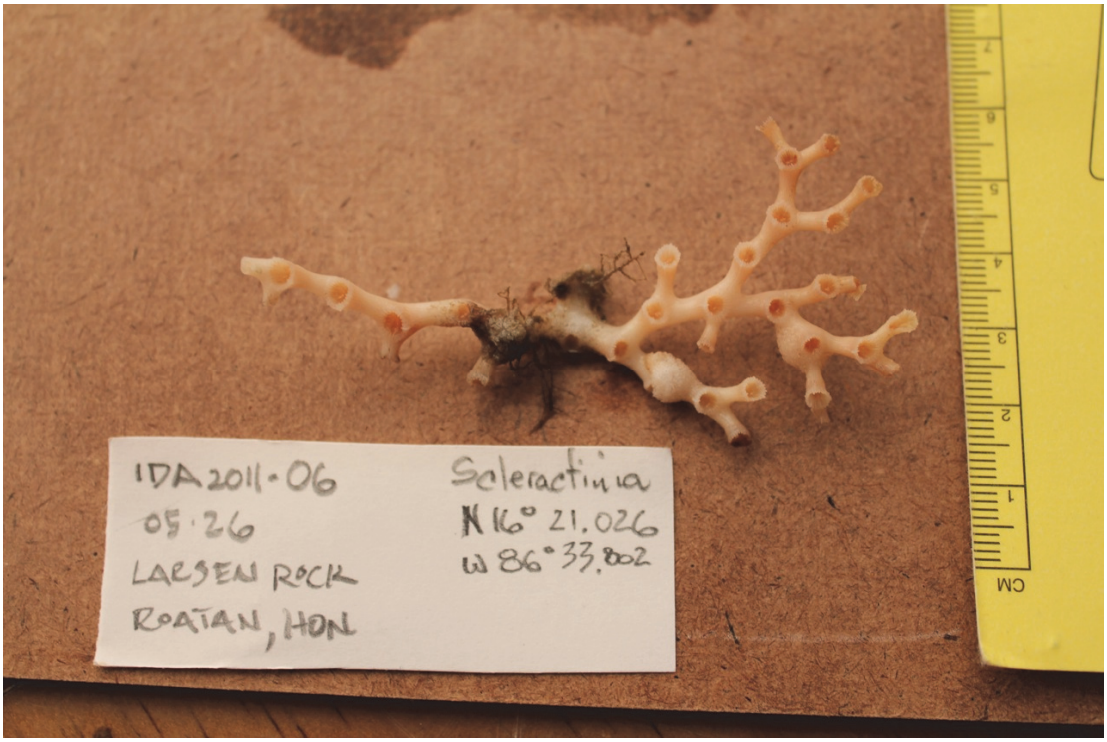

Figure A6. Sample IDA-11-06 *Enallopsammia rostrata*

Appendix 2. DeepCAST II Biological Sample Photo Inventory (cont.)

Figure A7. Sample IDA-11-07 *Dendrophyllia alternata*

Figure A8. Sample IDA-11-09 *Farrea occa* sponge USNM 1155710

Appendix 2. DeepCAST II Biological Sample Photo Inventory (cont.)

Figure A9. Sample IDA-11-10 *Madracis myriaster* from Old Loafer's (see Figure 23, right).

Figure A10. *Bayerotrochus midas* (Bayer, 1965). Specimen collected on Dive 5, in 1980 ft. Left = in situ, right = voucher specimen. Shell diameter = 134 mm.

Appendix 2. DeepCAST II Biological Sample Photo Inventory (cont.)

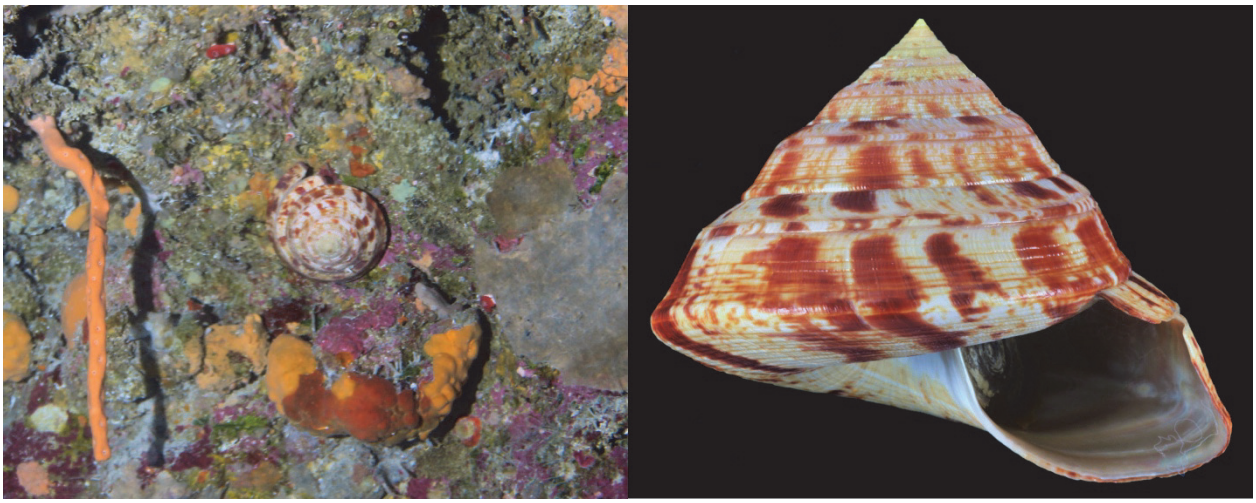

Figure A11. *Entemnotrochus adansonianus* (Crosse & Fischer, 1861) USNM 1155024, Specimen collected on Dive 2, in 260 ft.. Left = in situ, right = voucher specimen. Shell diameter = 114.3 mm.

Figure A12. *Perotrochus quoyanus* (Fischer & Bernardi, 1856) USNM 1155016, Specimen collected on Dive 2, in 920 ft.. Left = in situ, right = voucher specimen. Shell diameter = 31.0 mm.

Appendix 2. DeepCAST II Biological Sample Photo Inventory (cont.)

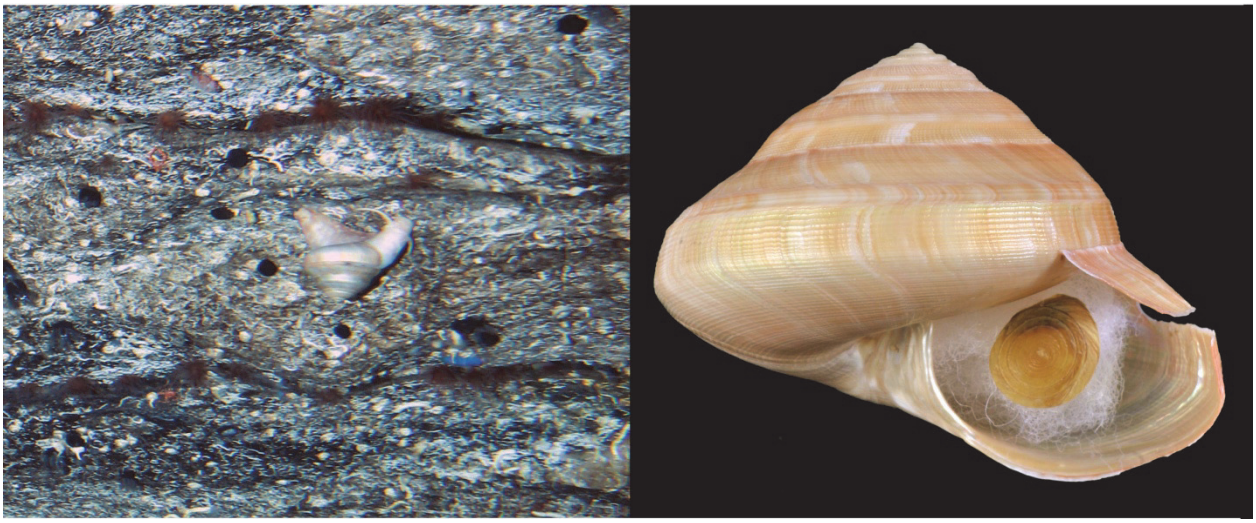

Figure A13. *Perotrochus* cf. *charlestonensis* Askew, 1988 USNM 1155019. Specimen collected on Dive 2, in 1180 ft.. Left = in situ, right = voucher specimen. Shell diameter = 71.6 mm

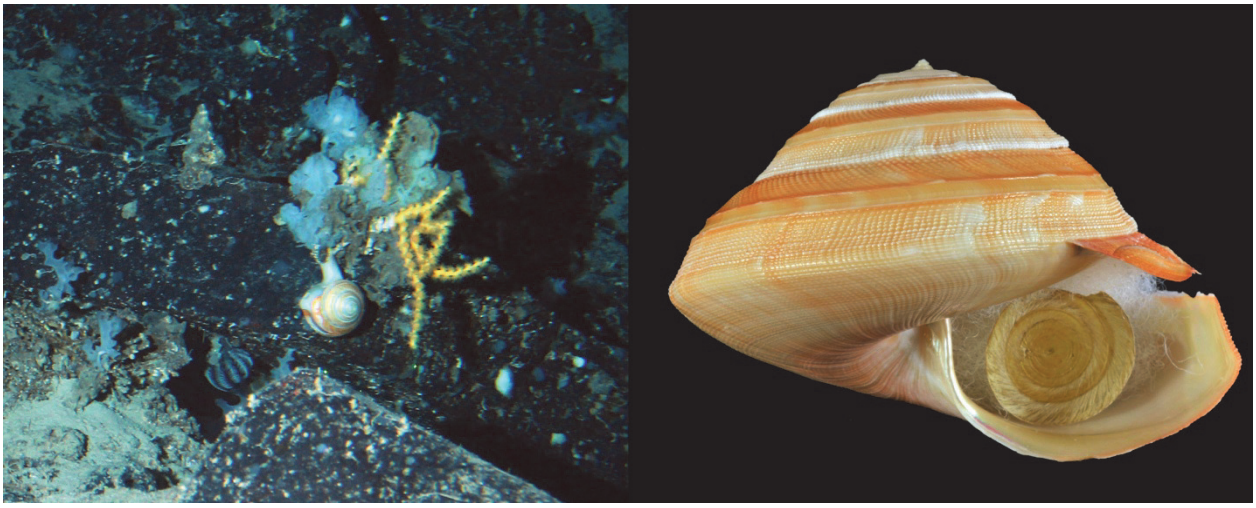

Figure A14. *Bayerotrochus midas* (Bayer, 1965) USNM 1155021. Specimen collected on Dive 2, in 1440 ft. Left = in situ, right = voucher specimen. Shell diameter = 72.5 mm.

Appendix 3: DeepCAST II Photo Samples, Inventory of Fishes

All fish identifications provided courtesy Dr. Steve W. Ross, University of North Carolina-Wilmington.

Figure A15. *Chaunax pictus*

Figure A16. *Cirrhigaleus asper*

Appendix 3: DeepCAST II Photo Samples, Inventory of Fishes (cont.)

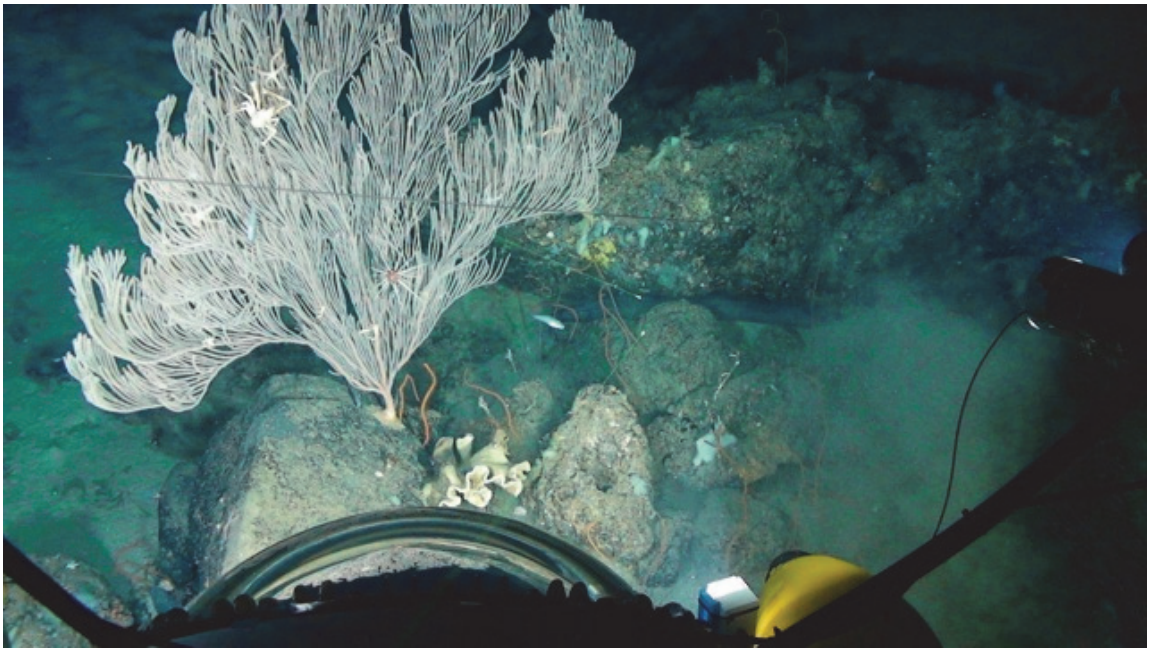

Figure A17. Conger eel & bythidid fish

Figure A18. Epigonid A & bythidid fish

Appendix 3: DeepCAST II Photo Samples, Inventory of Fishes (cont.)

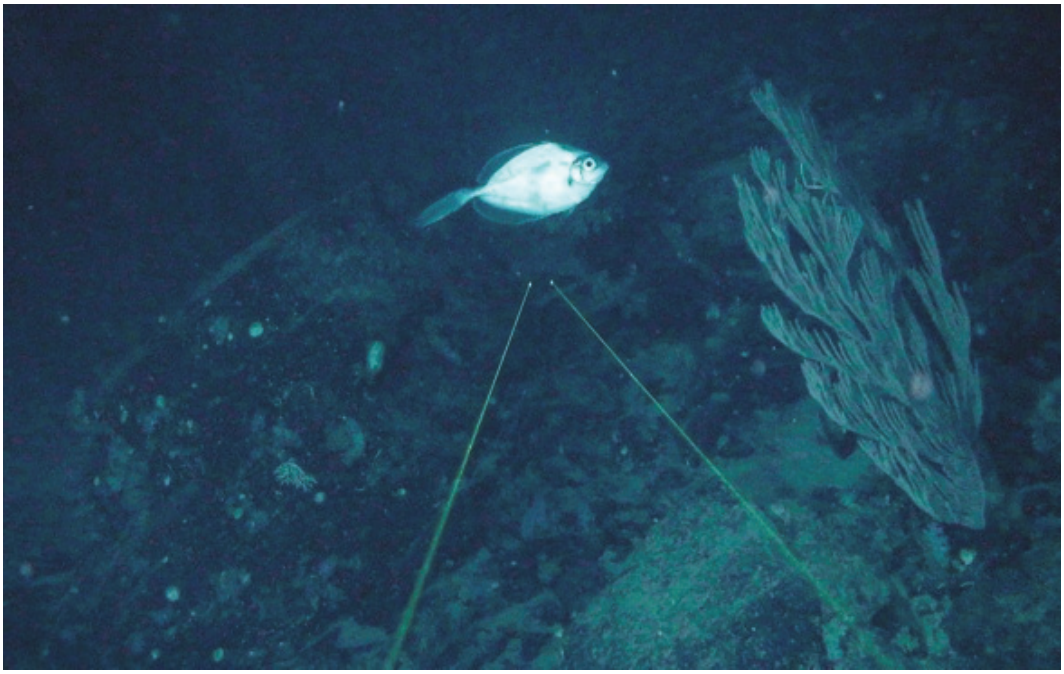

Figure A19. *Grammicolepis brachiusculus*

Figure A20. *Hexanchus griseus,* at 1500 ft, 457 m depth.

Appendix 3: DeepCAST II Photo Samples, Inventory of Fishes (cont.)

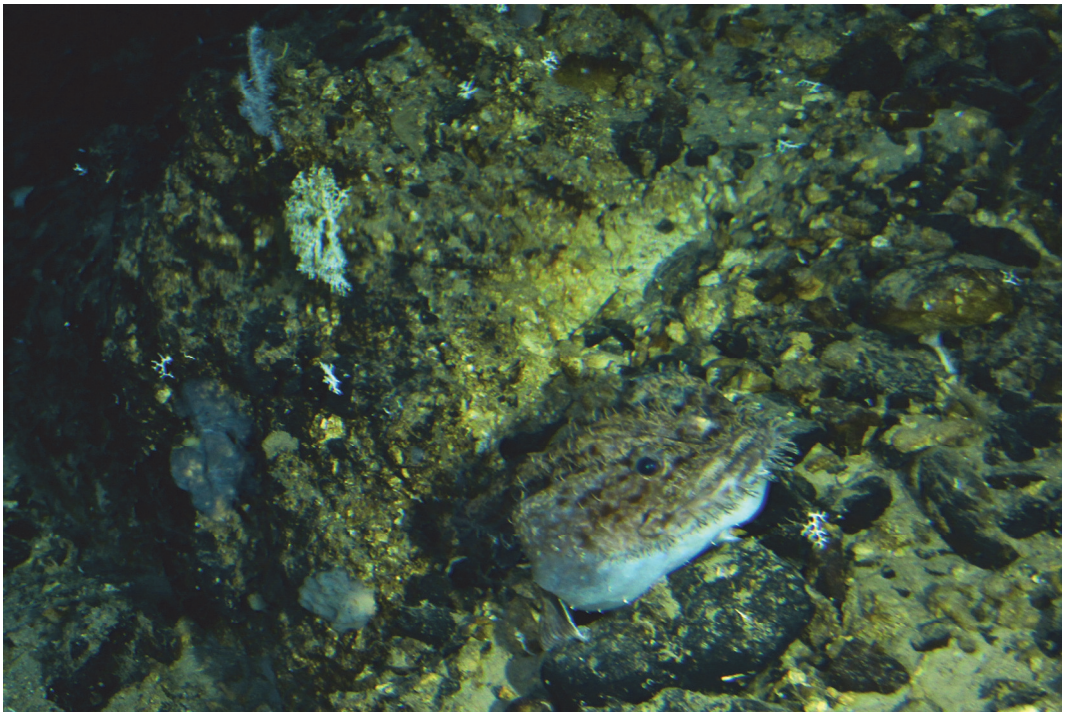

Figure A21. *Lophiodes* cf *beroe*

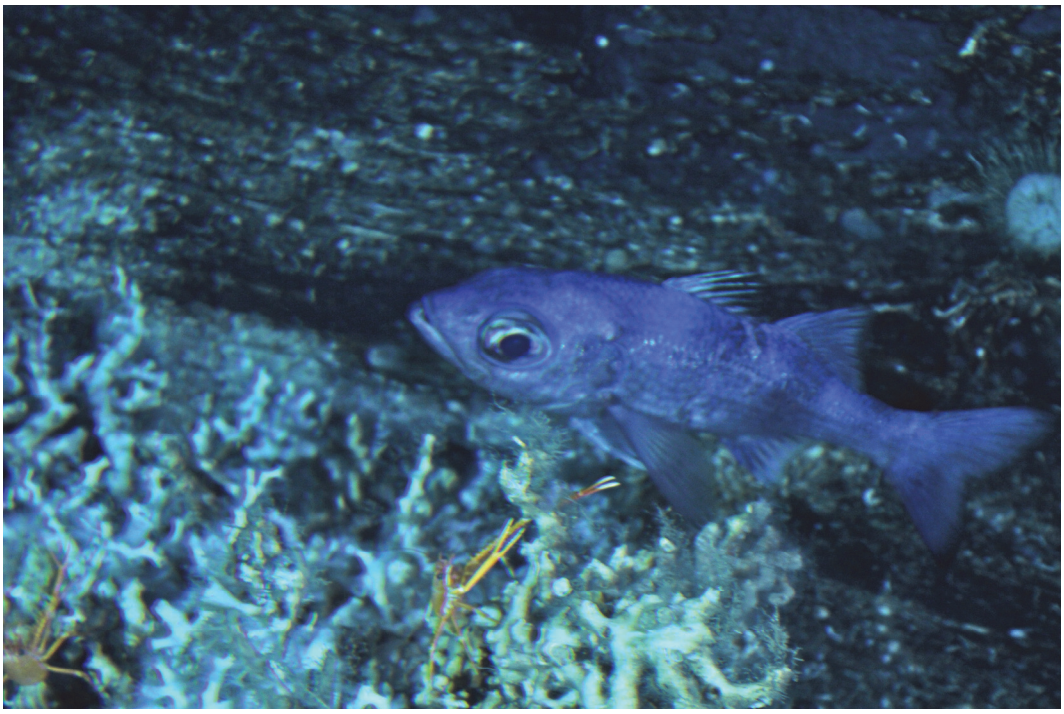

Figure A22. *Synagrops* sp.

Appendix 3: DeepCAST II Photo Samples, Inventory of Fishes (cont.)

Figure A23. Epigonid B

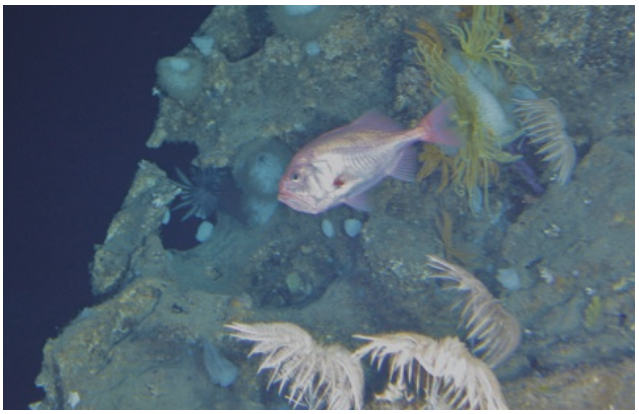

Figure A24. *Gephyroberyx darwini*

Not pictured:

Caranx lugubris cf
Chaunax sp.
Nezumia cf sp. (see Fig. 6)
Paralepididae (baracudina) called 'cutlass fish', probably *Notolepis* sp.
Pterois volitans

Appendix 4. DeepCAST II Participant List

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