Submersible investigation of unconfirmed western Miami Terrace habitat

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On June 5, 2015 Nova Southeastern University joined Brownies Global Logistics team on the new Project Baseline vessel, the R/V Baseline Explorer, to conduct submarine reconnaissance operations on the Miami Terrace. Previous mapping data from a variety of projects have limited information on the extent of the western hardbottom edge of the Miami Terrace and the organisms that inhabit the area (Figure 1). A portion of the western hardbottom edge was mapped off Fort Lauderdale in 2006 by Messing et al. (northern classified area in Figure 1). They described the habitat as the following:

> "High-cover hard bottom – This habitat consisted of low- to moderate-relief hard bottom characterized by phosphoritic limestone outcrops, pavement and slabs, each chiefly <2 m across (rarely to 3 m), with varying amounts of rubble and small to large rocks, frequently in patches separated by expanses of sediment and intermixed with low-cover hard-bottom areas of scattered rubble, small rocks and outcrops."

More recently, Messing, Walker, and Reed (2012) characterized a 3 x 9 mile section of the Miami Terrace about one mile south of the 2006 map. This study incorporate high resolution bathymetry which allowed for detailed visualization of the shelf topography (Figure 2). Concomitant with ROV surveys, this topography was characterized into habitat types. The benthic habitat map classification was organized by three main components: geomorphologic zone, substrate type, and slope. The geomorphologic zones were identified by previous research on the Miami Terrace (Mullins and Neumann, 1979). Mullins and Neumann (1979) divided the Miami Terrace into several cross-shelf zones according to their geomorphology as: Upper Terrace, Outer Terrace ridge, and Lower Terrace. This terminology was based on a cross-section across the southern portion of the Miami Terrace; however, it applied to the northern portion with some modifications. Differences in the benthic biological communities were evident between these zones; thus they were utilized as a habitat classifier. Differences in biological communities were also evident between two separate platforms of differing depths along the Upper Terrace, which was therefore divided into Inner and Outer Terrace Platforms to distinguish them as separate biological communities. Differences in biological communities between low and high slope areas within geomorphologic zones were also recognized; therefore a slope layer was calculated from the DOE multibeam geophysical data to distinguish low and high slope areas. Based on the results, areas with >5° were considered High-Slope and those with ≤5° were Low-Slope. The final benthic classification was supported by statistical analysis of species' density between quantitative photostations. Areas outside of the detailed multibeam bathymetry were extrapolated based on the geomorphology present in other datasets. Straight lines were drawn due north or west and the area was designated as a "probable" habitat type.

There presently remains a one mile gap of uncharacterized seafloor between the two mapping effort and the southern area remains "probable". Therefore we conducted a submarine dive in this area to confirm the "probable" habitat and possibly show a connection between the two mapping efforts.

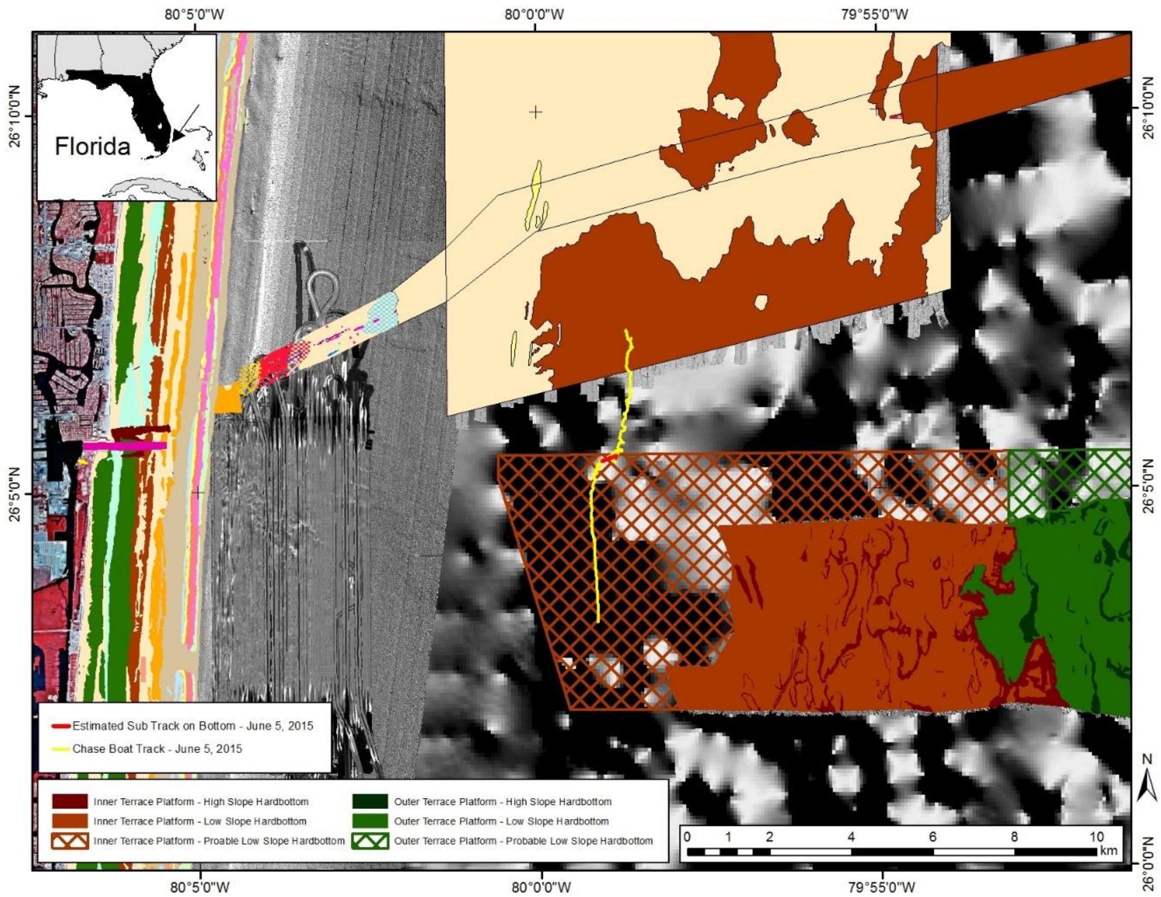

Figure 1. Existing bathymetric data and benthic habitat maps on the northern Miami Terrace. The upper polygons are from Messing et al. (2006). The southern layers are from Messing, Walker, and Reed (2012).

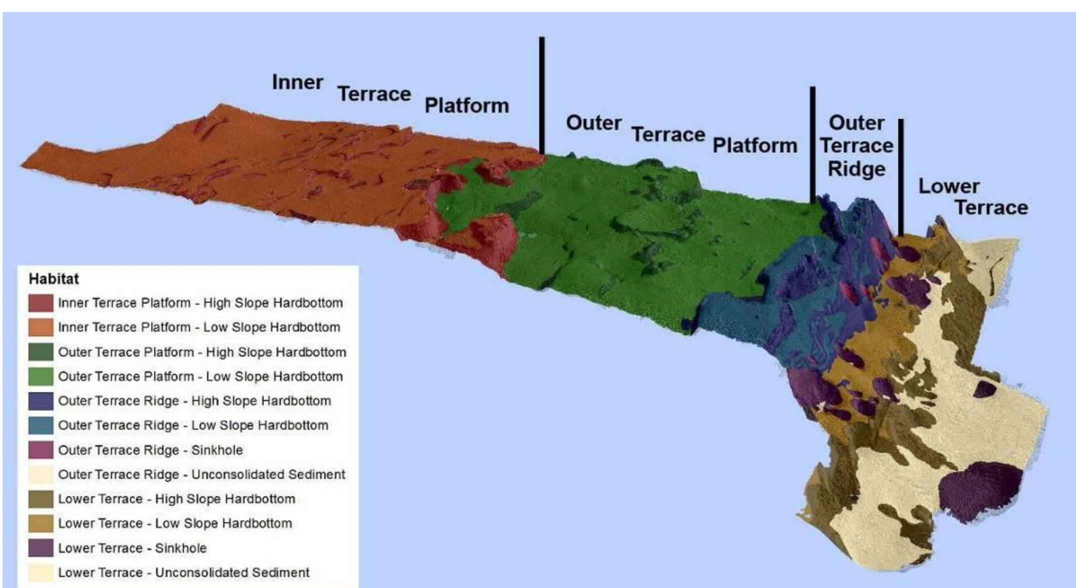

Figure 2. Three-dimensional rendering of multibeam topography overlain by benthic habitats illustrating the four major Miami Terrace geomorphologic zones.

Messing, Walker, and Reed (2012) described the Inner Terrace Platform as black phosphoritic hard substrates (scattered gravel and rubble and small, low-relief exposed outcrops) of the western reaches of the Miami Terrace interspersed with expanses of either smooth weakly bioturbated sediment or raised rippled sediment. More extensive hard substrates appeared in the form of patches of low aggregated hardbottom, low- to moderate-relief outcrops, fields of gravel and cobbles, sediment-veneered and exposed pavements, and occasional ledges and areas with larger cobbles, slabs or boulders with relief up to ~1 m. Qualitative estimates from video of percent cover of hardbottom substrates ranged from 20 to 80%. Areas to the east were more extensive hard substrates (reaching 100% cover), including rubble-cobble fields, ledges, pavements and boulders with relief up to 1 m, but still with some patches of sediment. Organisms were sparse, with gravel-rubble fields and some low-relief hardbottoms completely or almost devoid of benthic macrofauna.

Our operations supported the descriptions of both Messing et al. (2006) and Messing, Walker, and Reed (2012). The sub landed in 760 ft of water on a flat, black phosphoritic hard bottom with small patches of sediments (Figure 3). This habitat was encountered the entire dive without any large sediment areas. Two fish species were identified: the blackbelly rosefish *Helicolenus dactylopterus* (Sebastidae) (Figure 4) and the blacktailed lingcod *Laemonema melanurum* (Moridae). The benthic fauna encountered were similar to both previous studies and included stylaster coral, bamboo corals *Isidella* sp. (Isididae) various unidentified glass sponges (Hexactinellida), unidentified sponge (Geodiidae), zoanthids, D. Venus flytrap anemone (Hormathiidae), soft corals ?*Capnella nigra* (Nephtheidae), lithistid cup sponge *Corallistes* sp., fan sponge *Phakellia* sp. (Demospongiae), and anemones ?*Actinauge longicornis.*

The largest organism encountered was one Leiopathes black coral colony over one meter tall with several other species (crab, zooanthid, and an unidentified fish) living in the branches. Leiopathes was not documented in this habitat in the previous surveys. This finding is quite significant because it has extremely slow growth rates (<5 µm year $^{-1}$) and the longest known life span of any skeletal accreting marine organism (Roark et al. 2009). Previous studies have shown these corals can live over 4000 years. Given its large size, the coral we found is likely over 1000 years old and possibly much older.

The sub traversed approximately 400 meters along the seafloor at approximately 760 ft and verified that the Low Slope Inner Terrace Platform exists in the “probable” habitat polygon and continues to the north. The benthic communities were not visually different throughout the dive and were similar to both previous studies indicating the habitat likely continues between the two maps. The Leiopathes black coral colony found was likely extremely old and the first documented in that habitat. Its location will be provided to managers for conservation measures and to hopefully be avoided in any future plans.

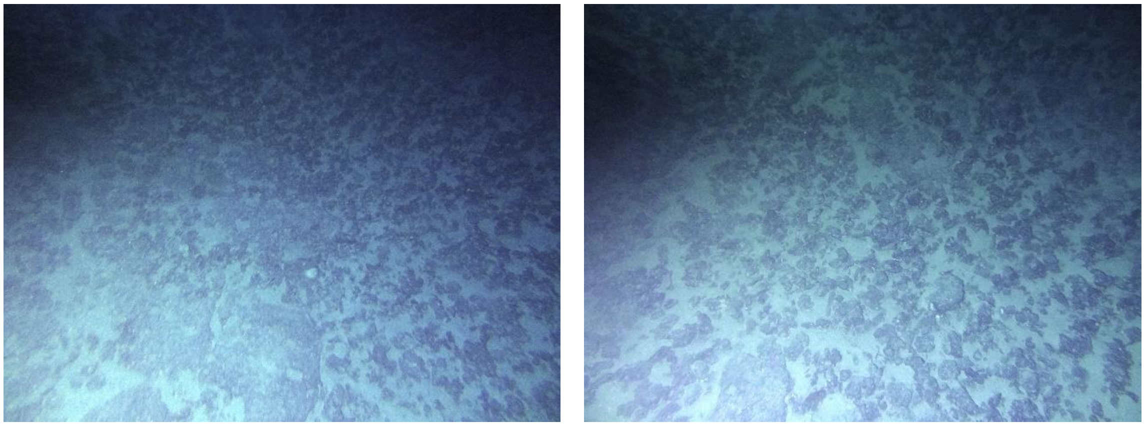

Figure 3. Images of the initial visual contact of the bottom.

Figure 4. Image of blackbelly rosefish *Helicolenus dactylopterus* (Sebastidae) and urchins on western Miami Terrace.

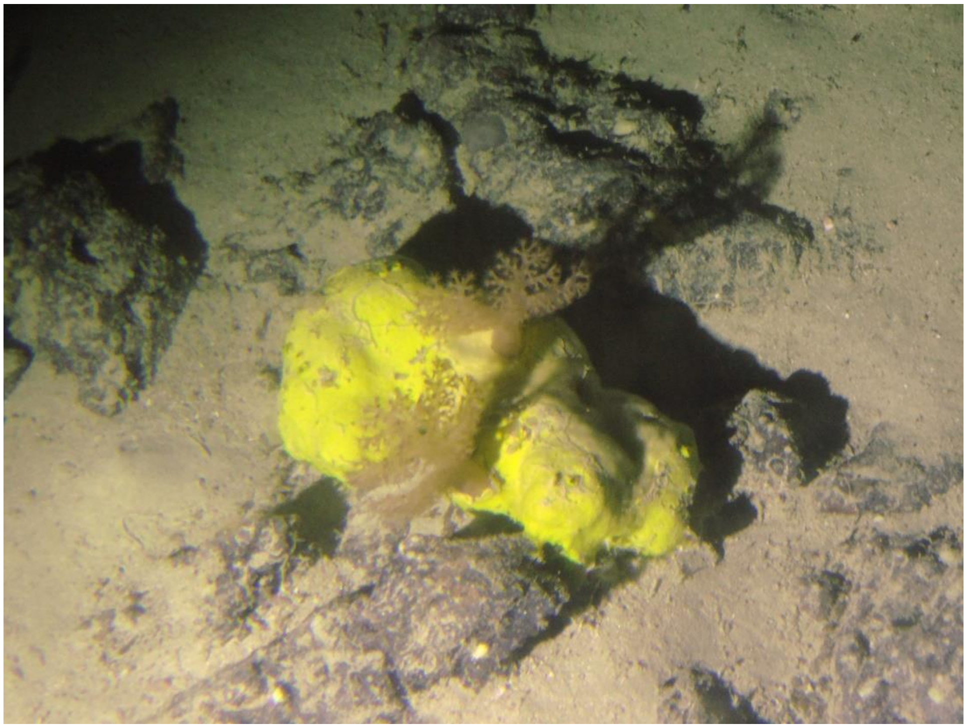

Figure 5. Small yellow sponge and two soft corals.


Figure 6. A >1 m tall Leiopathes black coral found at ascent location that is likely thousands of years old.

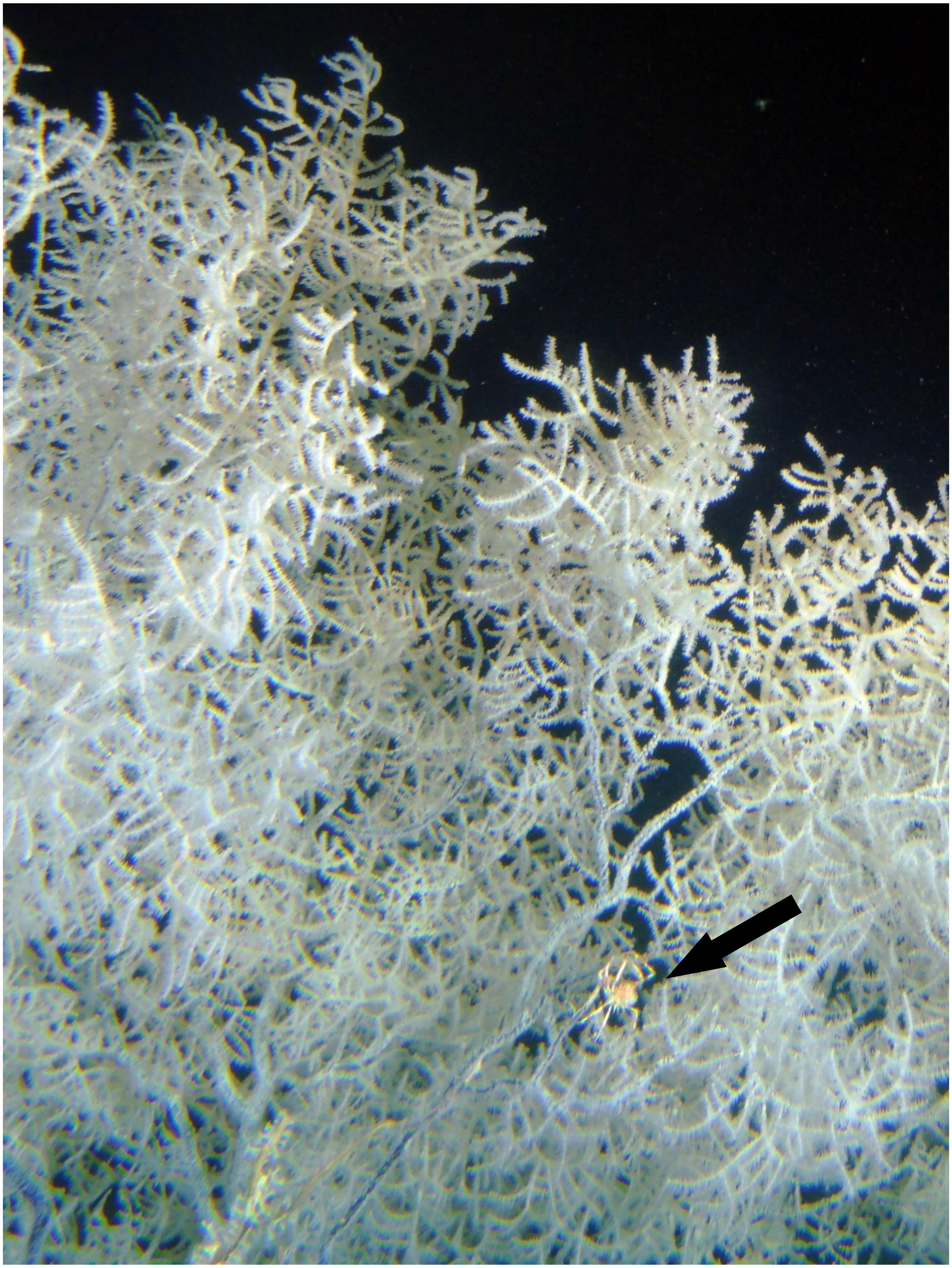

Figure 7. Crab living on the Leiopathes black coral.

Literature Cited

Messing, C., Walker, B., Dodge, R., Reed, J., & Brooke, S. (2006). Calypso LNG Deepwater Port Project, Florida Marine Benthic Video Survey: Technical Report submitted to Ecology and Environment, Inc. & SUEZ Energy North America, Inc, June 2006.

Messing, C., Walker, B., & Reed, J. (2012). Deep-Water Benthic Habitat Characterization and Cable Impact Assessment for the South Florida Ocean Measurement Facility (SFOMF) (pp. 130). West Bethesda, MD, Prepared for Commander Naval Surface Warfare Center, Carderock Division.

Mullins, H. T., & Neumann, A. C. (1979). Geology of the Miami terrace and its paleo-oceanographic implications. *Marine Geology, 30*, 205-232.

Roark, E. B., Guilderson, T. P., Dunbar, R. B., Fallon, S. J., & Mucciarone, D. A. (2009). Extreme longevity in proteinaceous deep-sea corals. Proceedings of the National Academy of Sciences, 106(13), 5204-5208.