CIOERT Cruise Report

Characterization of the Mesophotic Benthic Habitat and Fish Assemblages from ROV Dives on Pulley Ridge and Tortugas during 2014 R/V *Walton Smith* Cruise

R/V *Walton Smith* – Cruise No. WS1412
FGNMS *Mohawk* ROV
August, 14 - 28, 2014

Project Grant: NOAA-NOS-NCCOS-2011-2002586; REPP-Connectivity-Pulley Ridge
Project Title: Connectivity of the Pulley Ridge - South Florida Coral Reef Ecosystem: Processes to Decision-Support Tools

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March 23, 2015

Photo Album- Corals of Pulley Ridge

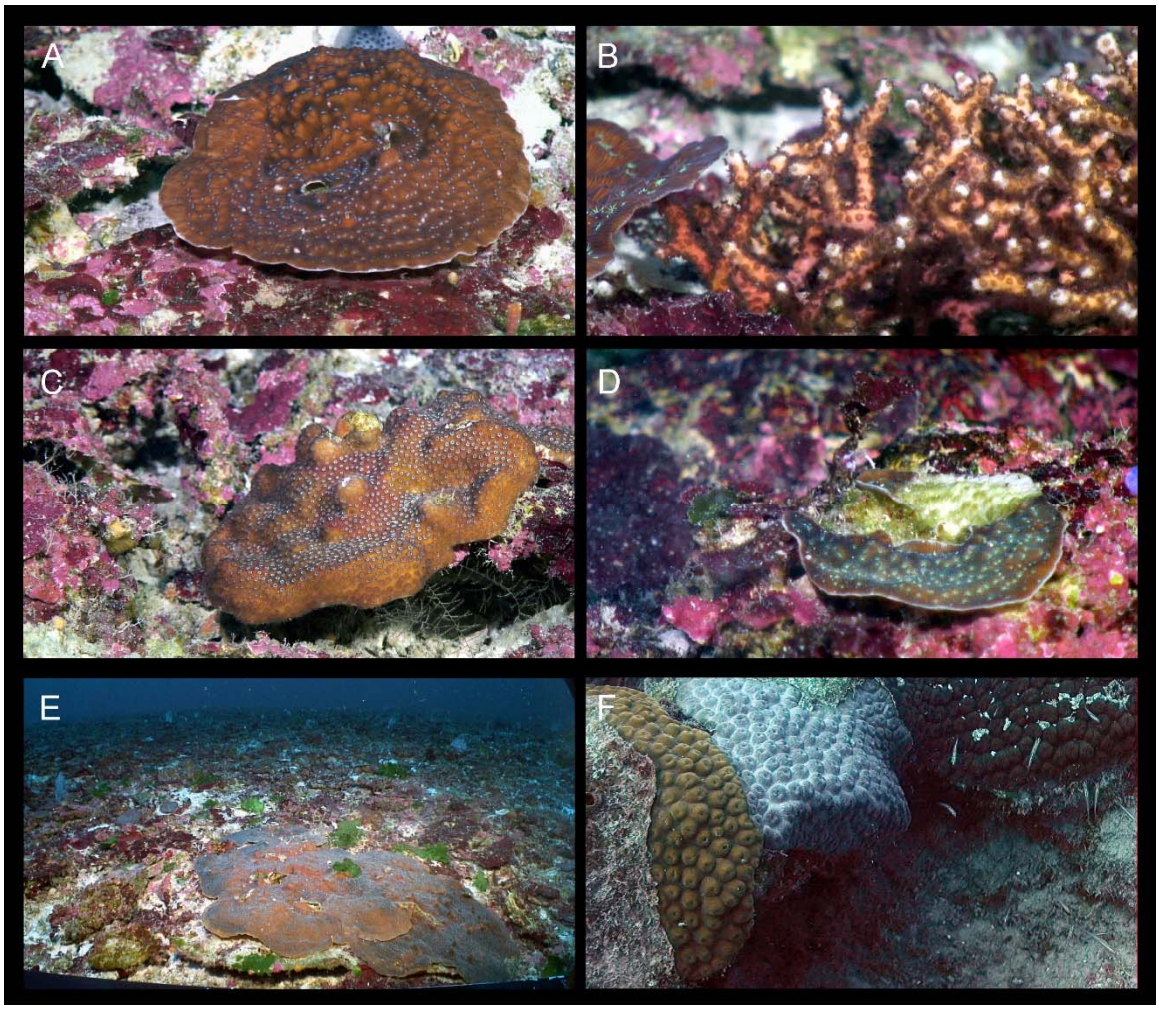

Plate 1. Photo Album- Corals of Pulley Ridge. Images from FGNMS *Mohawk* ROV during 2014 R/V *Walton Smith* Cruise. A. *Helioseris cucullata*, Block 30, depth 74.2 m; B. *Madracis aurentenra*, Block 30, depth 73.8 m; C. *Madracis decactis* f. *pharensis*, Block 76, depth 81.7 m; D. bleached or diseased *Agaricia* sp. coral, Block 31, depth 76.5 m; E. *Agaricia lamarcki*, Block 83, depth 82.5 m; F. three color morphs of *Montastraea cavernosa*, Block 61, 29.2 m, Tortugas.

Photo Album- Sponges of Pulley Ridge

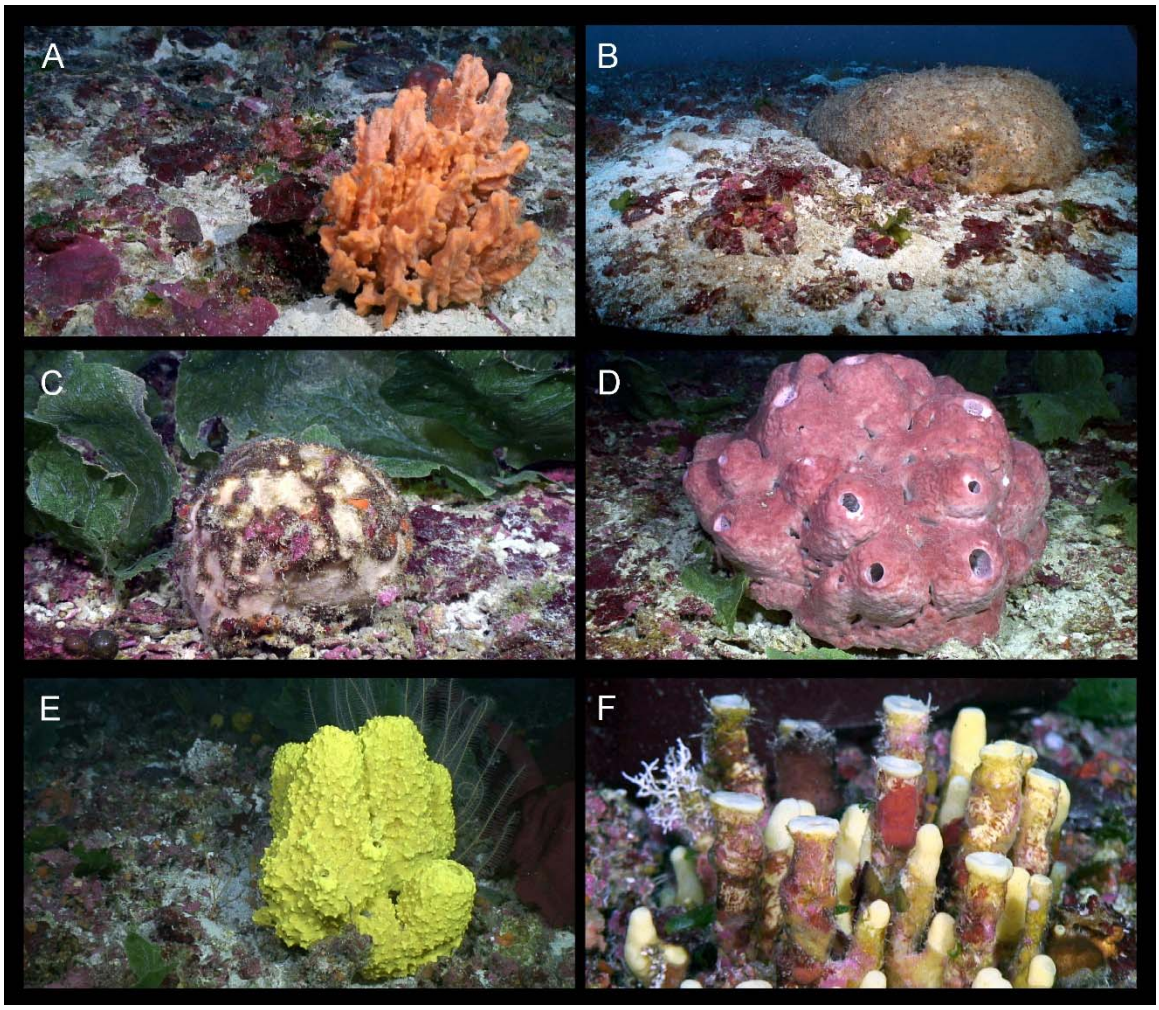

Plate 2. Photo Album- Sponges of Pulley Ridge. Images from FGNMS *Mohawk* ROV during 2014 R/V *Walton Smith* Cruise. A. *Bubaris* sp., Block 25, depth, 79.4 m; B. *Spongosorites siliquaria*, Block 25, depth 77.3 m; C. *Geodia neptuni* complex, Block 30, depth 73.2 m; D. Petrosiidae, Block 30, depth 73.8 m; E. *Aiolochroia crassa*, Block 35, depth 79.3 m; F. *Oceanapia* sp., Block 35, depth 79.2 m.

Photo Album- Soft Corals and Black Corals of Pulley Ridge

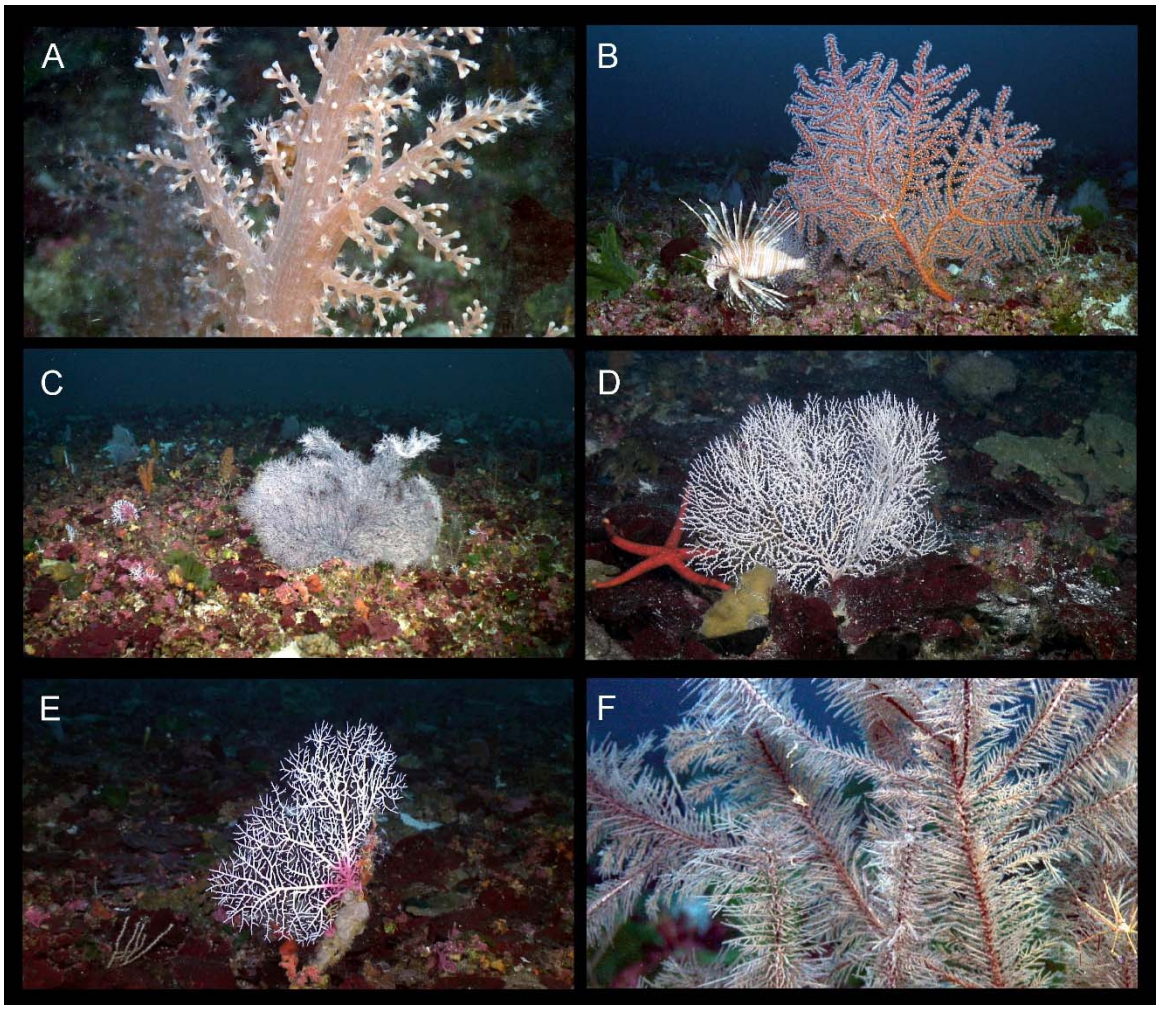

Plate 3. Photo Album- Soft Corals and Black Corals of Pulley Ridge. Images from FGNMS *Mohawk* ROV during 2014 R/V *Walton Smith* Cruise. A. *Chironephthya caribaea*, Block 35, depth 79.6 m; B. *Swiftia exserta* (with lionfish), Block 35, depth 79.3 m; C. *Antipathes atlantica*, Block 34, depth 82.1 m; D. Primnoidae gorgonian, Block 34, depth 83.2 m; E. *Stylaster filogranus*, Block 34, depth 83.7 m; F. Antipatharia, Block 36, depth 79.

Photo Album- Algae of Pulley Ridge

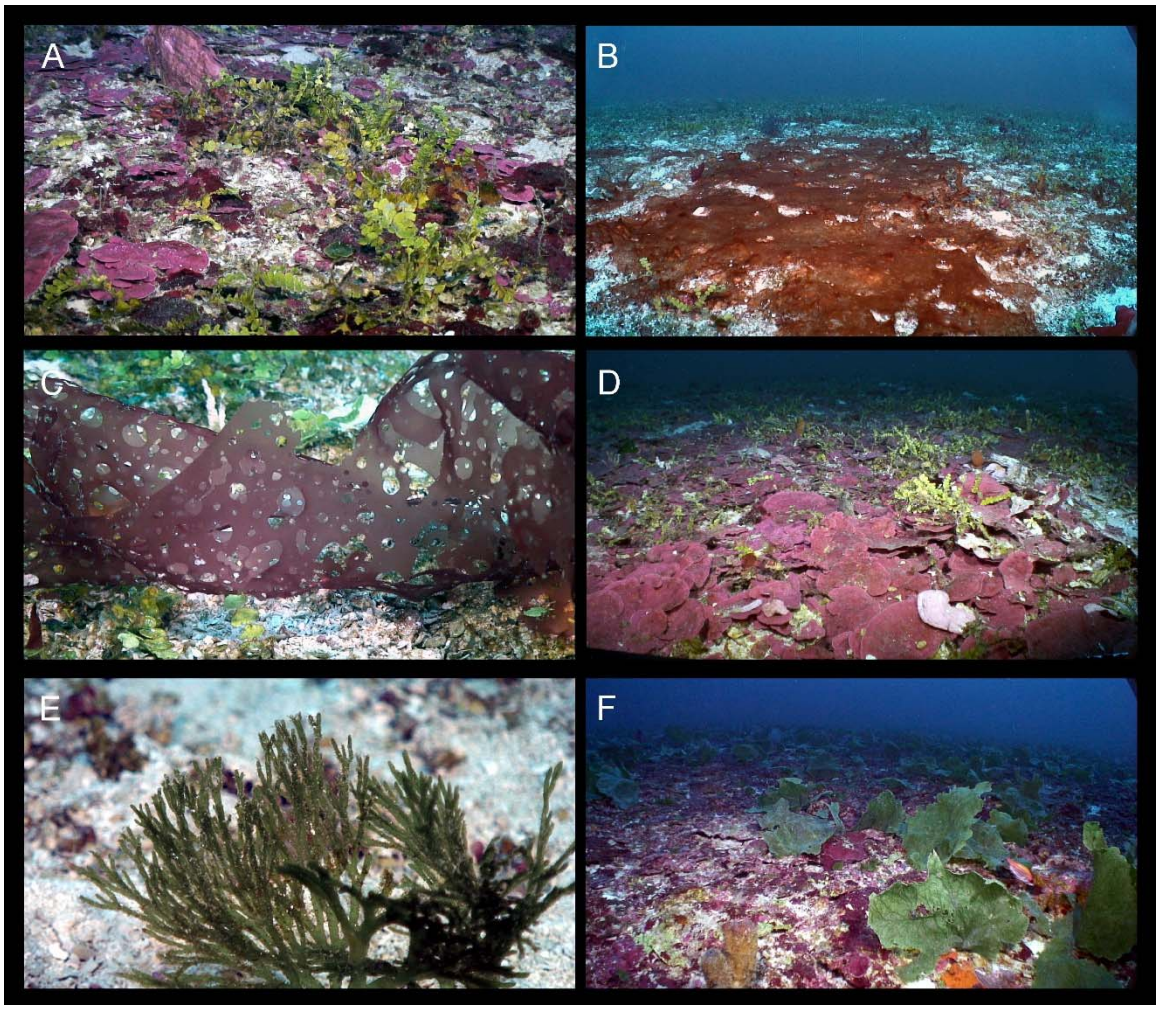

Plate 4. Photo Album- Algae of Pulley Ridge. Images from FGNMS *Mohawk* ROV during 2014 R/V *Walton Smith* Cruise. A. *Halimeda* sp., Block 29, depth 79.1 m; B. Cyanobacterial mat; Block 27, depth 68.6 m; C. *Kallymenia westii*, Block 27, depth 67.9m; D. Crustose coralline algae, Block 28, depth 79.8 m; E. *Codium* sp., Block 32, depth 64 m; F. *Anadyomene menziesii* (leafy green), Block 30, depth 74.1 m.

Photo Album- Fishes of Pulley Ridge

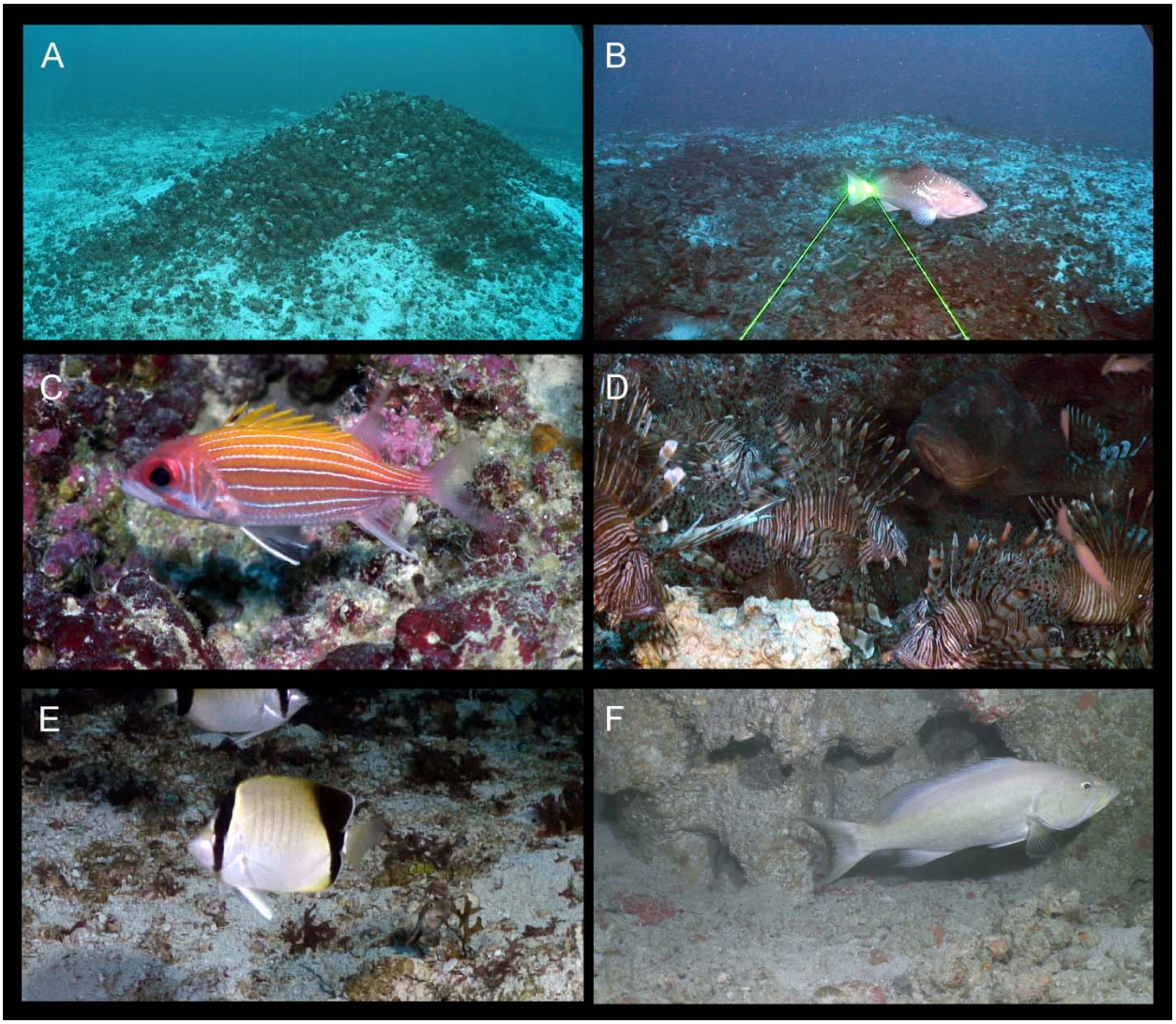

Plate 5. Photo Album- Fishes of Pulley Ridge. Images from FGNMS *Mohawk* ROV during 2014 R/V *Walton Smith* Cruise. A. Sand tilefish burrow, Block 27, depth, 68.6 m; B. large red grouper (*Epinephelus morio*) guarding its burrow, Block 28, depth 79.8 m, laser scale- 10 cm; C. Longspine squirrelfish (*Holocentrus rufus*), Block 28, depth 80.1 m; D. school of lionfish (*Pterois volitans*) in red grouper burrow, Block 34, depth 81.6 m; E. Reef butterflyfish (*Chaetodon sedentarius*), Block 23, depth 67.1; F. Scamp grouper (*Mycteroperca phenax*), Block 75, depth 106.9 m (Miller's Ridge).

Photo Album- Miscellaneous Fauna of Pulley Ridge

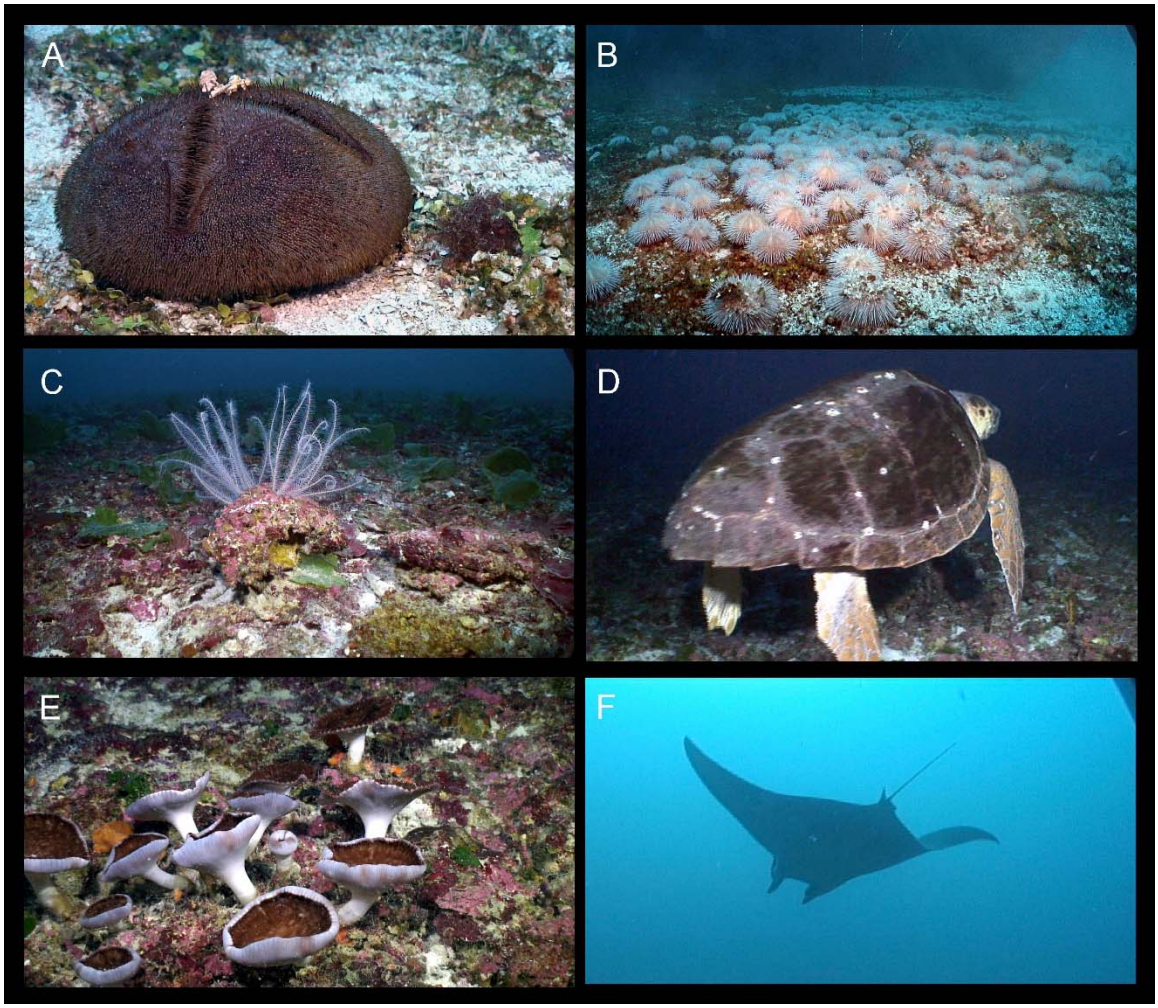

Plate 6. Photo Album- Miscellaneous fauna of Pulley Ridge. Images from FGNMS *Mohawk* ROV during 2014 R/V *Walton Smith* Cruise. A. Sea biscuit (*Meoma ventricosa*), Block 27, depth 69.3 m; B. Aggregation of sea urchins (*Echinus* sp.), Block 27, 66.9 m; C. Long-armed crinoid (*Davidaster discoideus*), Block 30, depth 74.8 m; D. Loggerhead turtle (*Caretta caretta*), Block 79, depth 85.7 m; E. Sea pansies, Corallimorpharia, Block 77, depth 81.1 m; F. Manta ray (*Cephalopterus manta*), Block 76, depth 78.6 m.

Photo Album- Miscellaneous Biota of Tortugas Mesophotic Reefs

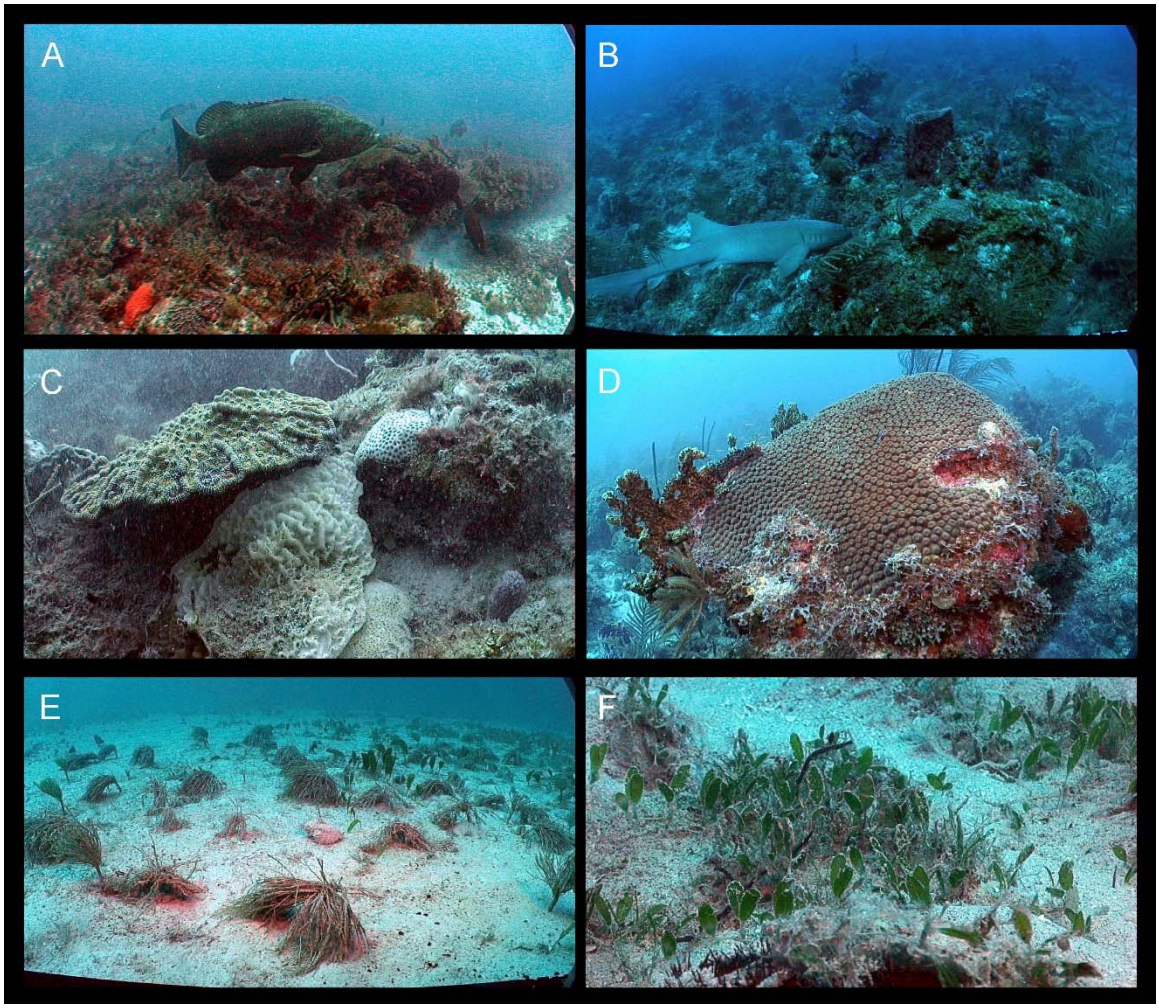

Plate 7. Photo Album- Miscellaneous biota of Tortugas mesophotic reefs. Images from FGNMS *Mohawk* ROV during 2014 R/V *Walton Smith* Cruise. A. Large goliath grouper (*Epinephelus itajara*) with large spawning aggregation of grey snapper on newly discovered patch reef; Block 66, depth 23.5 m; B. Nurse shark, *Montastraea cavernosa* coral, *Xestospongia muta* sponges, and *Pseudoptgerogorgia* gorgonians on fringing reef off north Tortugas Ecological Reserve, Block 46, depth 27.9 m; C. *Mycetophyllia aliciae* and bleached *Undaria* sp. coral on patch reef, Block 61, depth 30.8 m; D. Giant star coral *Montastraea cavernosa* on fringing reef, Block 46, depth 27.9 m; E. soft bottom with field of green algae- bottle brush algae *Penicillus dumetosus*, feather algae *Caulerpa sertularioides*, Block 61, depth 30.7 m; F. seagrass *Halophila decipiens* Block 69, depth 31.2 m.

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EXECUTIVE SUMMARY

Three research cruises were conducted in 2012, 2013 and 2014 to the region of Pulley Ridge and Dry Tortugas to study and survey the mesophotic reef communities and fish populations. Pulley Ridge is the deepest known photosynthetic coral reef in continental U.S. waters and is located in the Gulf of Mexico, 100 miles west of the Dry Tortugas at the far end of the Florida Keys. The University of Miami's R/V *Walton Smith* Cruise No. WS1213 was conducted August 14-25, 2012 (SEADESC I Report, Reed et al. 2012) and Cruise No. WS1312 was conducted August 12-27, 2013. A combined 2012-2013 Cruise Report was submitted October 1, 2014 (Reed et al. 2014). In 2014, cruise WS1412 was conducted August 14-28. This report herein will focus solely on the results of the 2014 cruise and emphasizing the coral cover and health results. A final cruise for this research project is planned for August 2015. Once that is completed, a final report will compile the data from all four cruises and compare to previous research.

This research and cruises were funded by the NOAA-NOS-NCCOS grant titled 'Connectivity of the Pulley Ridge - South Florida Coral Reef Ecosystem: Processes to Decision-Support Tools'. Ship and ROV time was funded in part by the Cooperative Institute for Ocean Exploration, Research, and Technology (CIOERT) at Harbor Branch Oceanographic Institute-Florida Atlantic University (HBOI-FAU). These cruises were conducted in collaboration with the University of Miami, HBOI-CIOERT, NOAA Fisheries, and the University of North Carolina at Wilmington which operates the *Mohawk* ROV, owned by Flower Gardens National Marine Sanctuary.

This 2014 Cruise Report provides a detailed SEADESC II characterization of the benthic habitat, benthic macrobiota, and fish populations for each ROV dive site surveyed in 2014 with the *Mohawk* ROV. Appendix 1 provides a complete species list and percent cover of benthic biota and substrate for each site at Pulley Ridge (PR) and Tortugas (T). Appendix 2 provides the densities of the fish species for each site. Appendix 3 provides the metadata for each ROV dive, multibeam maps with overlay of ROV tracks, images characterizing each site, along with detailed descriptions of each dive site. Prior to the cruises, we pursued a statistically rigorous sampling protocol for the ROV surveys. In ArcGIS a fishnet grid of 1 km x 1 km blocks were overlaid on the available bathymetric maps at both regions. Within each sampling block ("site"), we conducted five random100-m transects with the ROV to characterize that block.

In 2014 a total of 24 ROV dives surveyed 27 random blocks (17 blocks in PR and 10 in Tortugas (Table 2). The 24 ROV dives covered 25.68 km (PR = 15.52 km; T = 10.16 km), at depths from 27 to 115 m (PR = 64- 87 m; T = 27- 115 m). A total of 59 hours of ROV video were recorded and 5,323 *in situ* digital images were taken which included quantitative transect images (4,323), general habitat images, and species documentation images.

All fish were identified for each ROV dive to species level and counted. The total distance (km) of each dive was used to calculate the linear density (# individuals/km) of each fish species. A total of 116 fish taxa were identified from both Pulley Ridge and Tortugas dives in 2014.

A total of 197 benthic macrobiota were identified from the quantitative image analysis at Pulley Ridge and Tortugas. The most diverse taxa by far were sponges (78 taxa). The other sessile benthic taxa included 18 Chlorophyta, 7 Rhodophyta, 6 Phaeophyta, 27 Scleractinia (hard

corals), 19 gorgonian octocorals, 5 Antipatharia, Bryozoa, and Ascidiacea; mobile invertebrates included Annelida, Mollusca, Arthropoda, and Echinodermata. Coverage of biota at Pulley Ridge was dominated by various algae (51.42% cover). Coralline red algae (up to 63% cover) and the lettuce-like green algae *Anadyomene menziesii* (10.1%) were the most common.

The diversity of the scleractinian coral fauna at these mesophotic reef sites is quite rich; a total of 27 coral species were identified at all sites. The dominant species at PR included *Agaricia fragilis, A. lamarcki/grahamae, A. undata, Helioseris cucullata* (previously *Leptoseris cucullata*), *Madracis aurentenra, M. formosa, M. decactis,* and *Oculina diffusa*. In the previous cruises of 2012 and 2013 we found that the overall average coral cover dropped from 11.90% (USGS 2003 data) to 0.85% (2012-2013 data) which is a 92.8% loss of coral cover in 10 years within the Pulley Ridge Habitat Area of Particular Concern (PR HAPC). However, in 2014 more blocks were added outside of the PR HAPC and to the west of the main Pulley Ridge to fill in the relatively unstudied West Ridge, and for the first time, areas of the Central Basin where we discovered some of the highest coral cover that we have seen to date in our cruises. The density in the Central Basin was 5.58 colonies/m^2; Block 83 which is outside the PR HAPC had the greatest density of all the Blocks with 17.05 colonies/m^2. *Agaricia* spp. had the greatest density of 16.82 colonies/m^2. A great majority of these were small plate agariciid coral so it appears that the coral is growing back from whatever die-off occurred after 2003.

At the Tortugas, mesophotic patch reefs were discovered inside three blocks, and an extensive fringing reef was surveyed just west of the North Tortugas Ecological Reserve. Hard corals averaged 3.22% cover on these reefs, and comprised 3.96% cover on the fringing reef (Block 46) and 2.51% on the patch reefs. Gorgonians averaged 9.62% cover, sponges 5.44%, and algae 4.53%. All of these sites are outside of the boundaries of the Florida Keys National Marine Sanctuary and the Tortugas Ecological Reserves.

Ultimately these data from the various cruises will be used to characterize and document the habitat, benthic communities, and fish populations inside and outside the Pulley Ridge HAPC and between the North and South Tortugas Ecological Reserves. These data may then be compared to future research cruises to better understand the long-term health and status of these important mesophotic ecosystems. These data will be of value to the regional Fishery Management Councils, NOAA Fisheries, NOAA Mesophotic Reef Ecosystem Program, NOAA Deepsea Coral Research and Technology Program (DSCRTP), NOAA Coral Reef Conservation Program (CRCP), and NOAA Marine Sanctuaries for management decisions on these habitats and managed key species.

In December 2014, the data compiled from our cruises to Pulley Ridge, including CIOERT cruises of 2010 and 2011 (FloSEE I and II), and the UM cruises of 2012-2104, were presented to the advisory panel of the Gulf of Mexico Fishery Management Council as a proposal to extend the boundaries of the Pulley Ridge HAPC to the west to include the coral rich Central Basin and the West Ridge. Also our data compiled on the mesophotic reefs at Tortugas in 2013-2014 were presented to the Florida Keys National Marine Sanctuary as a proposal for extending the boundaries of the sanctuary to include these areas.

ACKNOWLEDGEMENTS

We thank the NOAA Cooperative Institute for Ocean Exploration, Research, and Technology (CIOERT) at Harbor Branch Oceanographic Institute, Florida Atlantic University (HBOI-FAU), and the Robertson Coral Reef Research and Conservation Program at HBOI. The crew of University of Miami's ship R/V *Walton Smith* provided excellent support. The ROV pilots Lance Horn and Jason White of the *Mohawk* ROV are especially thanked for their support and efforts which made these cruises a success. This research was funded by the National Oceanic and Atmospheric Administration Center for Sponsored Coastal Ocean Research under award NA11NOS4780045 to the University of Miami (Project Title: "Understanding Coral Ecosystem Connectivity in the Gulf of Mexico – Pulley Ridge to the Florida Keys"). Ship and ROV time was funded in part by CIOERT at HBOI-FAU. This cruise was conducted in collaboration with the University of Miami (Drs. Robert Cowen, Peter Ortner), HBOI-CIOERT, NOAA Fisheries (Andy David, Stacey Harter), Florida State University Coastal and Marine Laboratory (Drs. Felicia Coleman and Chris Koenig), the University of North Carolina at Wilmington, the Florida Keys National Marine Sanctuary, the Gulf of Mexico Fishery Management Council, and the Flower Gardens National Marine Sanctuary (provided the *Mohawk* ROV). This is Harbor Branch Oceanographic Institute Technical Report Number 157.

PROJECT OVERVIEW

The Gulf of Mexico Fishery Management Council (GMFMC) and Department of Commerce through the Magnuson-Stevens Fishery Management Act established the Pulley Ridge Habitat area of Particualr Concern (HAPC) in 2005. This project proposes to document and characterize the mesophotic benthic habitat, benthic macrobiota, and fish populations within and adjacent to Pulley Ridge and within mesophotic sites adjacent to the North and South Tortugas Ecological Reserve and the Florida Keys National Marine Sanctuary (FKNMS).

Pulley Ridge is the deepest known photosynthetic coral reef in continental U.S. waters (USGS 2005; Hine et al. 2008; Halley et al. 2013; NOAA 2013). It lies in the Gulf of Mexico, 100 miles west of the Dry Tortugas at the far end of the Florida Keys (Figure 1). Pulley Ridge is a submerged 100 km x 5 km barrier island that was originally discovered in 1950. It has less than 10 m of relief across the 5 km wide ridge at depths of 65 to 75 m. According to USGS (2005), the coral on Pulley Ridge was "considerably healthier then coral from shallow water reefs nearly worldwide". This is of particular interest because research shows that shallow water reefs worldwide are stressed due to climate change, habitat loss, human impact, and coral diseases. It was for this reason that Pulley Ridge HAPC was designated in order to receive protection from targeted fishing activity and specifically bottom longlines. The second area of study was near the Dry Tortugas, west of the western boundary of the FKNMS and adjacent to the North and South Tortugas Ecological Reserves, but outside of both protected areas.

Ultimately these data from the various cruises will be used to characterize and document the mesophotic habitat, benthic communities, and fish populations within the Pulley Ridge HAPC and between the North and South Tortugas Ecological Reserves (TER). These data may then be compared to future research cruises to better understand the long-term health and status of these

important ecosystems. These data will be of value to the regional Fishery Management Councils, NOAA Fisheries, NOAA Mesophotic Reef Ecosystem Program, NOAA Deepsea Coral Research and Technology Program (DSCRTP), NOAA Coral Reef Conservation Program (CRCP), and NOAA Marine Sanctuaries for management decisions on these habitats and managed key species. In addition these data will be of interest to the various agencies by documenting deepwater coral/sponge habitat and Essential Fish Habitat (EFH) that are currently unprotected and may be potential additions to the protected areas.

Pulley Ridge Benthic and Fish Assemblages- Background

Southern Pulley Ridge has an atypical array of photosynthetic hard corals, macroalgae, sponges, and large variety of tropical fishes (Halley et al. 2013). These reefs are termed mesophotic reefs which are relatively deep compared to shallow water reefs. At depths of 50 to about 100 m, mesophotic reefs still receive enough sunlight to support photosynthetic algae and corals with zooxanthellae (algal symbionts). Based on photographs collected by the USGS's SeaBOSS camera system in 2003, Hine et al. (2008) reported that Pulley Ridge is dominated by coralline algae which covers 45-65% of limestone bottom. Pulley Ridge is also home to a wide variety of fleshy macroalgae including *Halimeda* spp, *Dictyota* spp., *Kallymenia* spp., and the endemic species *Anadyomene menziesii*, which look like large heads of lettuce and can be as dense as tens of plants per square meter. Halley et al. (2013) also reported *Agaricia* spp. and *Helioseris cucullata* (*Leptoseris cucullata*) as the two most abundant species of scleractinian coral which form flat plates as large as 50 cm in diameter and make up almost 60% of the live coral cover in some locations. These species are typically found only on the deeper slopes of shallow water reefs in the Caribbean and Florida. *Montastraea cavernosa* (the giant star coral) is another species found on Pulley Ridge but is also common on shallow water reefs. Pulley Ridge is home to more than 60 species of fish including both shallow water and deep reef species. These include the commercially caught species *Epinephelus morio* – the red grouper. Red grouper form large 6-10 m wide pits in the sand and rubble bottom that provide an oasis-like shelter for numerous smaller reef fish. Unfortunately lionfish are also showing up here recently in virtually every red grouper burrow. Since HBOI-CIOERT discovered the first lionfish on Pulley Ridge in 2010, our research cruises in 2011 and 2012 have shown the population to have exploded (Reed et al. 2012).

At the Tortugas sites which are outside of the TERs and FKNMS, no deepwater benthic surveys, fish surveys or multibeam mapping have been conducted previously. However, areas within the TERs such as Miller's Ledge, Riley's Hump, and Sherwood Forest have been mapped and relatively well studied (Lee et al. 1999; Schmidt et al. 1999; Cowie-Haskell and Delaney 2003; Wheaton et al. 2005-2006; Weaver et al. 2006; Ault et al. 2013).

OBJECTIVES

The main objectives of the Community Structure Project for this NOAA-NOS-NCCOS grant "Connectivity of the Pulley Ridge - South Florida Coral Reef Ecosystem: Processes to Decision-Support Tools" are to:

1) Quantify and characterize the benthic habitat, benthic macrobiota, and fish populations at mesophotic reefs sites at Pulley Ridge and Tortugas regions;
2) Estimate the spatial distribution, abundance, and size structure of key economically and ecologically important reef-fish species.

This 5 year grant hopes to supply timely information useful to natural resource managers. These different sub-themes within the grant will produce outputs that are vital to providing managers with knowledge to make informed decisions about the spatial scales of connectivity and functioning of the overall South Florida coral reef ecosystem, and whether specific actions are warranted for the Mesophotic Coral Ecosystem within the area.

PURPOSE

The most important data that can be acquired from Pulley Ridge is on shallow water species which are able to live at such great depths – almost out of the zone of impact from climate change and human contact. The interaction and genetics of the mesophotic and shallow water reef species may provide a baseline denoting impacts of coral bleaching and other effects of climate change (NOAA 2013). This is exactly the research that was conducted by the science team aboard the University of Miami's *R/V Walton Smith* on 2014 Coral Ecosystem Connectivity cruises to Pulley Ridge and the Tortugas regions. This project is a unique collaboration of more than thirty scientists pooling the established expertise from within two NOAA CI's: the Cooperative Institute for Marine and Atmospheric Studies (CIMAS) at the University of Miami, and the Cooperative Institute for Ocean Exploration Research and Technology (CIOERT) at Harbor Branch Oceanographic Institute/Florida Atlantic University, as well as the wider Gulf of Mexico scientific and management communities.

METHODS

ROV video and photographic surveys were made at each site to ground-truth multibeam sonar maps, quantify and characterize the benthic habitats, benthic macrobiota, fish populations, and coral/sponge/algal cover. Prior to each ROV dive, georeferenced sonar maps with overlaid random 1 km^2 blocks were uploaded to the ROV navigation software and 100-m circles were added for the quantitative transects. Typically one 4-hour ROV dive would complete five 100-m transects per random block, and two ROV dives were made each day during daylight hours. A temperature/depth recorder was attached to the ROV for each dive. CTD shipboard casts, ISIS plankton surveys, plankton light trap collections, and grouper traps collections were also part of the cruise operations but are not included in this report.

ROV Operations

The new Flower Gardens National Marine Sanctuary's (FGNMS) *Mohawk* ROV was used for the first time on these cruises. ROV dives ranged from 1 to 4 hours in length, covering an average length of 1.0 km. The ROV was equipped with a high-definition digital video camera

(using fiber optic cable) mounted on tilt bar, a fixed digital still camera, and a temperature/depth recorder. The ROV was not outfitted with a manipulator and no samples were collected.

ROV Video Camera

Video was recorded continuously throughout each dive from surface to surface with a high-definition video camera (Insite Pacific Mini Zeus CMOS color zoom camera with 2,000,000 effective pixels). High-definition video was recorded to external hard drives and used as the primary data source for viewing by the science team and quantitative analysis of the fish populations. A second standard definition copy was also recorded to a hard drive as well as to DVD for backup and easy viewing on any computer's DVD drive. The standard definition format had an On-Screen Display (OSD) video overlay which recorded time, date, ROV heading, and ROV depth, and was used as the "pilot" view. A microphone was used for continuous audio annotations by the PIs.

ROV Digital Still Camera

Still images were taken for quantitative analysis of habitat and benthic macro-biota with a high-definition digital still camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels). Each photo filename was coded with corresponding EDST time and date code (using Stamp 2.8 by Tempest Solutions©) which was imported into MS Access and linked to the ROV navigation data for site specific data of coordinates and depth and then imported into ArcGIS™ 10.0.

ROV Navigation

The *Mohawk* ROV uses an integrated navigation system consisting of Hypack Max 2014 software on a 64-bit, 3.4 GHz, rack-mounted computer running Windows 7. Data from an ORE Offshore 4410C Trackpoint II USBL Acoustic Tracking System, Northstar 951XD differential GPS, Azimuth 1000 digital compass, and the *Mohawk* ROV data feed to this computer. The Trackpoint II system communicates acoustically to an ORE Offshore 4377A transponder with depth telemetry on the ROV to provide slant range, bearing, and depth from the support vessel so that latitude and longitude can be assigned to the ROV. The integrated navigation system provides real time tracking and orientation of the ROV and ship to the ROV pilot and the support vessel's bridge for navigation. Geo-referenced TIFF files obtained with multibeam sonar can be entered into Hypack as background files to display target sites and features of interest to aid in ROV and ship navigation. Hypack can also export ROV position data in real time as a NMEA data string. Ship and ROV positions in addition to the ROV depth, heading and altimeter data, are logged and processed after each dive day and provided to the scientist in an Excel spreadsheet file. All data documentation (digital images, HD video, dive annotations, and specimen collections) are geo-referenced to ROV position by matching the time and date to the ROV navigation files.

ROV Survey Protocol

During each dive the primary objectives were to document benthic habitat, benthic macrobiota, and fish populations, and to conduct photo/video transects which were used for quantitative analyses of the habitat and biota. The general protocol included:

1. Each ROV dive was ~1 km in length, lasting a duration of ~3-4 hours, which documented 1 km x 1 km randomly selected Blocks with continuously recording digital video and

digital still images. Five random 100-m video/photo transects were conducted in each Block.

2. Video transects were used for analysis of fish populations and general habitat characterization. The video footage was recorded continuously throughout each dive from surface to surface and recorded to 2 TB hard drives and copies to DVDs. An On-Screen Display (OSD) video overlay recorded time, date, ROV heading, and ROV depth. The camera was typically angled down ~30^{o} to view both near and far to the horizon for fish aggregations and habitat and had 10-cm parallel lasers for scale. During the video transects, the ROV was kept <1 m off bottom with a speed over ground of ~¼ knot. The video was viewed in real time on the support vessel by PIs familiar with the local deep-water biota; audio annotations describing habitat, benthic biota, and fish were recorded onto the video and transcribed into Microsoft Access (2010, CIOERT At-Sea Database). All fish were identified for each ROV dive to species level and counted. The total distance (m) of each dive was used to calculate the linear density (# individuals/m) of each fish species. The video camera angle precludes an accurate calculation of areal density of the fish (i.e., # m^{-2}); however, we estimate that the field of view width was generally about 5 m. So the densities listed in Appendix 2 could be divided by 5 to get an estimate of the number of fish m^{-2} (based on an average 5-m width field of view).
3. Digital still images were used for quantitative analysis of habitat and benthic macrobiota within the 100-m transects throughout the dive. The camera was pointed down 90^{o} with 10-cm parallel lasers for scale. Images were taken every 30 seconds throughout the dive at a height of 1.3 m to provide relatively consistent area for each image (~1-2 m^2). Each photo filename was coded with corresponding EDST time and date code (using Stamp 2.8 by Tempest Solutions©) which was imported into MS Access and linked to the ROV navigation data for site specific data of coordinates and depth and then imported into ArcGIS™ 10.0. Non-transect photos, such as purposeful images to document a specific species, were not included in the quantitative analyses. Poor and unusable photos (blurred, black, off bottom) were also removed from the quantitative analyses. Still images were analyzed using CPCe© 4.1 software to determine relative percent cover of benthic biota and habitat types as well as coral colony diameter and density.
4. All data documentation (digital images, video, and dive annotations) were geo-referenced to ROV position after the cruise by matching the date and time to the ROV navigation files in our CIOERT At-Sea Access Database.

Selection of Random Blocks for ROV Surveys

A statistically rigorous sampling protocol was used for the ROV surveys at Pulley Ridge and Tortugas. In ArcGIS 10.0 a fishnet of 1 km x 1 km blocks were overlaid on the available bathymetry maps at both regions. Within each sampling block ("site"), we conducted five random 100-m transects with the ROV to characterize that block. The direction of each transect was based on flip of coin, and ship's maneuverability due to wind/current. Then a 100-m radius circle was placed on the ROV navigation screen with the ROV in the center. Each 100 m transect was conducted at ~0.25 kn (12.5 cm s^{-1}) until the ROV passed through 100 m radius; usually taking ~15 minutes. Off transects were interspersed between the photo transects, lasting 10-15 minutes, also with the heading determined by flip of coin. The five transects generally covered the length and breadth of the 1 km block.

Protocol for Benthic Habitat Characterization

This following defines the habitat categories that were used to define and characterize the benthic habitats of Pulley Ridge and Tortugas. These data are result of the ROV video observations and multibeam sonar maps where available. These habitat categories were then entered into the CIOERT Microsoft Access At-Sea Database for each ROV dive. These data are used along with the CPCe Point Count data from the photo transects to characterize the benthic habitat and distribution of benthic biota, and also used with the video data for the fish population analyses.

1. *[Habitat_Zone= Geomorphology]*: This describes the geological feature. Pulley Ridge (PR): Main Ridge (North, Middle, South), Off Main Ridge (East Base), West Ridge, Central Basin. Tortugas (T): Mesophotic Reef (patch & fringing reefs), Soft Bottom. This category is used to plot the percent cover of benthic macrobiota for each habitat zone at each dive site and to plot the dive track overlay on multibeam sonar maps in ArcGIS.

2. [MPA Status]: Block is within a marine protected area (e.g., Pulley Ridge Habitat Area of Particular Concern, Tortugas Ecological Reserve, or Florida Keys National Marine Sanctuary); Block is not within any MPA.

3. [Depth]: Depth range (m) of the Block or dive.

4. [*Relief*]: LR= Low Relief (0- <1.0 m), MR= Moderate Relief (1-3 m), HR= High Relief (>3 m). This is modified from the NOAA Southeast Area Monitoring and Assessment Program (SEAMAP) designations of outer continental shelf benthic habitat. This category is dependent on the distance over which the depth change occurs. We define relief as the relative height of rock ledges, boulders, or rock outcrops in the field of view.

5. [Slope]: Slope was estimated from the ROV video: Flat = 0-5^{o}, Low = 5-30^{o}, Moderate = 30-60^{o}, High (Wall) = 60-90^{o}. Pulley Ridge was mostly flat to low slope. Only on the rims of the red grouper burrows was there low to moderate slope. In areas where multibeam was available, we were able to plot slope in ArcGIS.

6. [*Rugosity*]: LRu= Low Rugosity, HRu= High Rugosity. Rugosity here is defined as a degree of ruggedness of the rock bottom. This is relative to the size of rock ledges, holes, crevices, which tend to provide the greatest fish habitat. High Rugosity on Pulley Ridge is rarely observed, if ever, except in the region of red grouper burrows. Low Rugosity would be the flat rock pavement typically found at the top of the ridges or at the base of the mounds and ridges. For the present, this will be an unquantified relative term. Most of the multibeam sonar maps that cover Pulley Ridge (Naar 2000) are of relatively low resolution (5-10 m) and cannot be used to quantify rugosity at this scale; high resolution (<2 m) multibeam maps were collected on the Nancy Foster Cruise in 2010 (Reed 2011) and cover 38 km^2 on the main ridge show the locations of red grouper pits and tilefish mounds. A fairly accurate slope visualization could be created to determine the number

and location of higher rugosity and location of theses pits and mounds in the future, but this is beyond the scope of this research.

7. [*Substrate*]: SEADESC Habitat Categories (Table 1). This is a modified subset of SEADESC Habitat Categories which was developed by the NOAA Deep-Sea Coral Program for use in analysis of deep-sea coral surveys (Partyka et al. 2007). These categories which are useful for characterizing deep coral habitat were modified to make them useful for these mesophotic habitats. The presence of fauna was not included as it is quantified in the Point Count analyses. In the region of this survey, substrate categories included: soft bottom (unconsolidated sand, mud) and hard bottom which was subdivided into rock (pavement, boulder, ledge), and rock rubble/cobble (generally, 5-20 cm diameter). This category is also used to plot the dive track overlay on the multibeam sonar maps in ArcGIS.

Table 1. SEADESC Benthic Habitat Category Codes (modified).

ID	Code	Habitat Name	Habitat Description
1	S	Soft Substrate	Unconsolidated sand/mud, unlithified
2	SR	Soft Substrate/Rubble/Rock	Soft substrate (>50% cover) with rubble and/or rock
3	R	Rubble	Rubble/cobble (~5-20 cm sized rock or coral)
4	RL	Rock/Ledges	Rocks and/or ledges
5	P	Pavement	Rock pavement
6	C	Hard Corals	Live and/or dead colonial scleractinian coral; standing individual colonies, bushes, or thickets.
7	TH	Tilefish (blueline or golden; not sand tile)	Soft bottom with visually identifiable burrows. For Pulley Ridge these are red grouper burrows
8	A	Artificial Substrate	Any artificial structure that provides habitat for fishes and/or invertebrates

Benthic Analyses

Percent cover of substrate type and benthic macrobiota was determined by analyzing the quantitative transect images with Coral Point Count with Excel extensions (CPCe 4.1© (Kohler and Gill 2006), and following protocols established in part by Vinick et al. (2012) for offshore, deepwater surveys in this region. For each random block, a total of 120 images were randomly selected and each was overlaid in CPCe with 50 stratified random dots to identify the substrate and biota.

To determine how many images and points were needed for CPCe point count analysis, we first tested Dive 14 from 2012 which had the most images as well as *Agaricia* coral colonies. Using PRIMER statistical software we plotted the species curves using four different tests: 180

images/50 points, 120/50, 120/25 and 60/50. The data were tested for percentage cover of sessile species only. The two statistical models, analyzed in PRIMER 6® v 6.1.13, CHAO2 and Michaelis Menton (MM) both approached asymptotic values. Although, the results showed no difference in the PRIMER 6 test between 50 and 25 points, and both were asymptotic below 120 images, we decided to use the larger number of images, since we have used that number for several previous deepwater and mesophotic surveys. Also although we attempted to take ~ 30 images per transect, overall nearly all blocks had at least 120 images. So in order to keep samples size similar, we selected 120 random images from each block for the point count analysis (24/ 100-m transect).

Random points overlaid on each image were identified as substrate type and benthic taxa. All benthic macrobiota (usually >1 cm) were identified to the lowest taxa level possible. For this report we used the following terminology: hard bottom is sometimes referred to as live bottom due to the amount of living organisms attached to these substrates (SAFMC 1998). Hard bottom provides anchorage for sessile or semi-sessile organisms (e.g., corals, octocorals, anemones, hydroids). Coral is defined by NOAA (Lumsden et al. 2007) as hard corals (stony corals-Scleractinia) and other taxa with solid calcareous skeletons (e.g., Stylasteridae), as well as non-accreting taxa such as octocorals (Alcyonacea- "gorgonacea") and black corals (Antipatharia).

Prior to point count analysis, all images were reviewed and a species list was made in a Taxonomic Photo Album using Microsoft Access. We tried to identify to the lowest possible level of taxa (in some cases to species, but some only to family, order, or higher taxa). We included all benthic algae; and sessile macroinvertebrates including Porifera, Scleractinia, Octocorallia (Gorgonacea), Antipatharia, Corallimorpharia, Alcyoniina soft corals, other non-coral Cnidaria (hydroids), and ascidians; and all mobile benthic macroinvertebrates including: echinoderms, mollusks, arthropods, and annelids. The following taxonomists have helped with some of the species verifications:

Sponges- S. Pomponi, C. Diaz, P. Cardenas
Cnidaria- S. Cairns, P. Etnoyer, C. Messing, J. Voss, M. Nuttall, D. Opresko, C. Moura
Algae- D. Hanisak, S. Reed, M. and D. Littler
Echinoderms- D. Pawson, C. Messing
Fish- A. David, S. Harter, C. Koenig, K. Rademacher

Some common taxa could be identified to genus or species level but many could only be identified to a higher level such as family, class, order or even phylum. Sponges, gorgonians, and black coral are especially difficult to identify without a specimen in hand. In these cases a general descriptive taxa was used, e.g., "brown lobate sponge" or "unidentified Demospongiae", which could consist of numerous species. These designations should not be considered equivalent to species level and should not be used for diversity (H') indices calculations. Many deepwater species in this region look nearly identical, such as fan sponges which are polyphyletic and may actually include different orders or classes. Once the Microsoft Access Taxonomic Album was completed these were coded for CPCe analysis.

Coral Analyses

In CPCe every point that landed on a scleractinian coral was identified to species level if possible and percent cover calculated for each transect. The agariciids were identified as *Agaricia* sp., *A. fragilis* or the combination of *A. lamarcki* and *A. grahamae*. Example images were sent to various coral experts who all agreed that these species are nearly impossible to tell apart without a specimen in hand. Therefore our analyses simply grouped all *Agaricia* as *A.* spp. *Helioseris cucullata* (i.e., *Leptoseris cucullata*) could usually be distinguished from *Agaricia* by the raised corallites.

Density Analysis of Plate Corals

Density and maximum diameter of all plate corals (i.e., *Agaricia* spp., *Helioseris cucullata* and *Montastraea cavernosa*) were calculated for all the Pulley Ridge transect photos. Branching species such as *Madracis* and *Oculina* were not included in the density analysis. 2014 Tortugas sites were not analyzed for density. Only 4 blocks at Tortugas encountered reef habitat in 2014 and all were typical shallow reef habitat and species. Since these Tortugas sites were primarily shallow water patch reefs (27-32 m), they did not have the same species of *Agaricia* or *Helioseris*, and therefore were not included in the density analysis.

Density was calculated by the following protocol. All transect images were used, and filtered by the 120 random filter; however, any purposeful images or duplicate overlapping images were removed. All visible corals were counted and diameter measured using CPCe. To calculate density, any Block that had even one plate coral was analyzed for density. Of these Blocks, the area of every transect image with lasers was calculated with CPCe Area Analysis Tool (ARA). Then the total number of corals for a Block was divided by the total photo area of the Block to get density (# coral colonies/m^2). Density (ρ) by Block= Sum of Coral Count per Block ÷ Sum of Image Area by Block:

$$\rho = \frac{\sum Count\ of\ Corals\ by\ Block}{\sum Image\ Area\ by\ Block}$$

Size of Plate Corals

To calculate coral size, the CPCe ARA was used to calculate the maximum diameter of each plate coral. Coral colonies that were only partially visible in a photograph were measured if they appeared that >50% of the colony was visible, otherwise they were marked as “cut off” and only used in the density counts and removed from the size analysis.

RESULTS

Study Areas

During the 2014 cruise, 16 ROV dives were conducted at Pulley Ridge which surveyed a total of 17 random 1-km^2 blocks; 8 ROV dives were conducted at Tortugas on 10 Blocks (Figs. 1-4). This year more blocks were added outside of the Pulley Ridge Habitat Area of Particular Concern (PR HAPC) and to the west of the main Pulley Ridge to fill in the relatively unstudied West Ridge, and for the first time, areas of the Central Basin (Fig. 2). This basin is apparent in the multibeam map and is somewhat deeper (78-82 m depth) than the Main Pulley Ridge (~65-70 m). The Tortugas dives added sites along Miller's Ledge outside of Tortugas Ecological Reserve South (TER) to see the western extent of the Ledge. In addition, three mesophotic patch reefs were discovered and a fringing reef that forms the western edge of TER North was surveyed (Fig. 4). These mesophotic reefs are all outside the boundaries of the TER and Florida Keys National Marine Sanctuary (FKNMS).

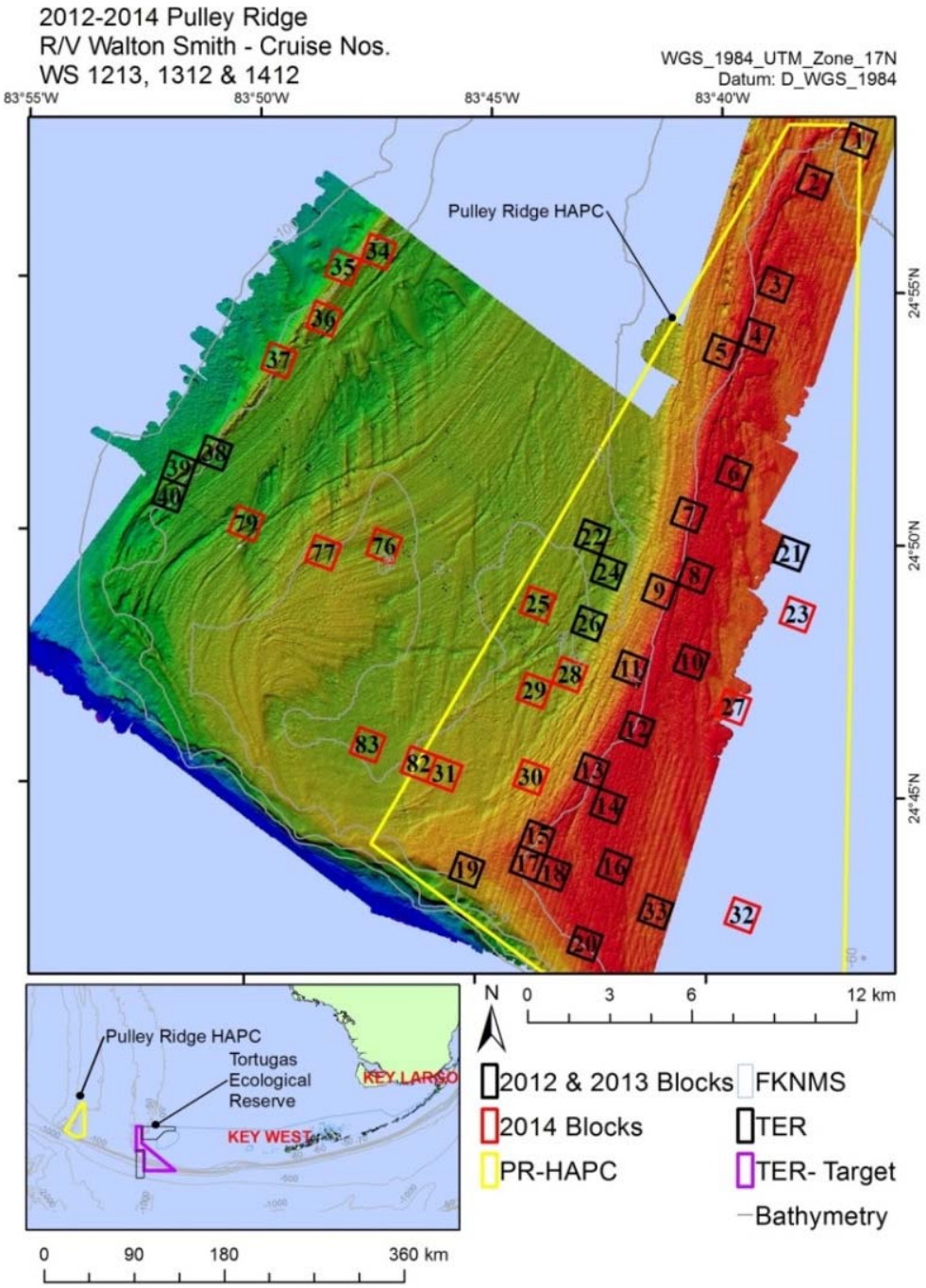

Figure 1. Random 1 km x 1 km blocks surveyed at Pulley Ridge during the 2012-2014 R/V *Walton Smith* cruises. The UNCW *Super Phantom* ROV was used in 2012-2013 (black blocks) and the FGNMS *Mohawk* ROV was used in 2014 (red blocks). Pulley Ridge Habitat Area of Particular Concern (PR HAPC) boundaries in yellow. Background map: Naar, D.F. 1999. Multibeam Bathymetry Survey, USF.

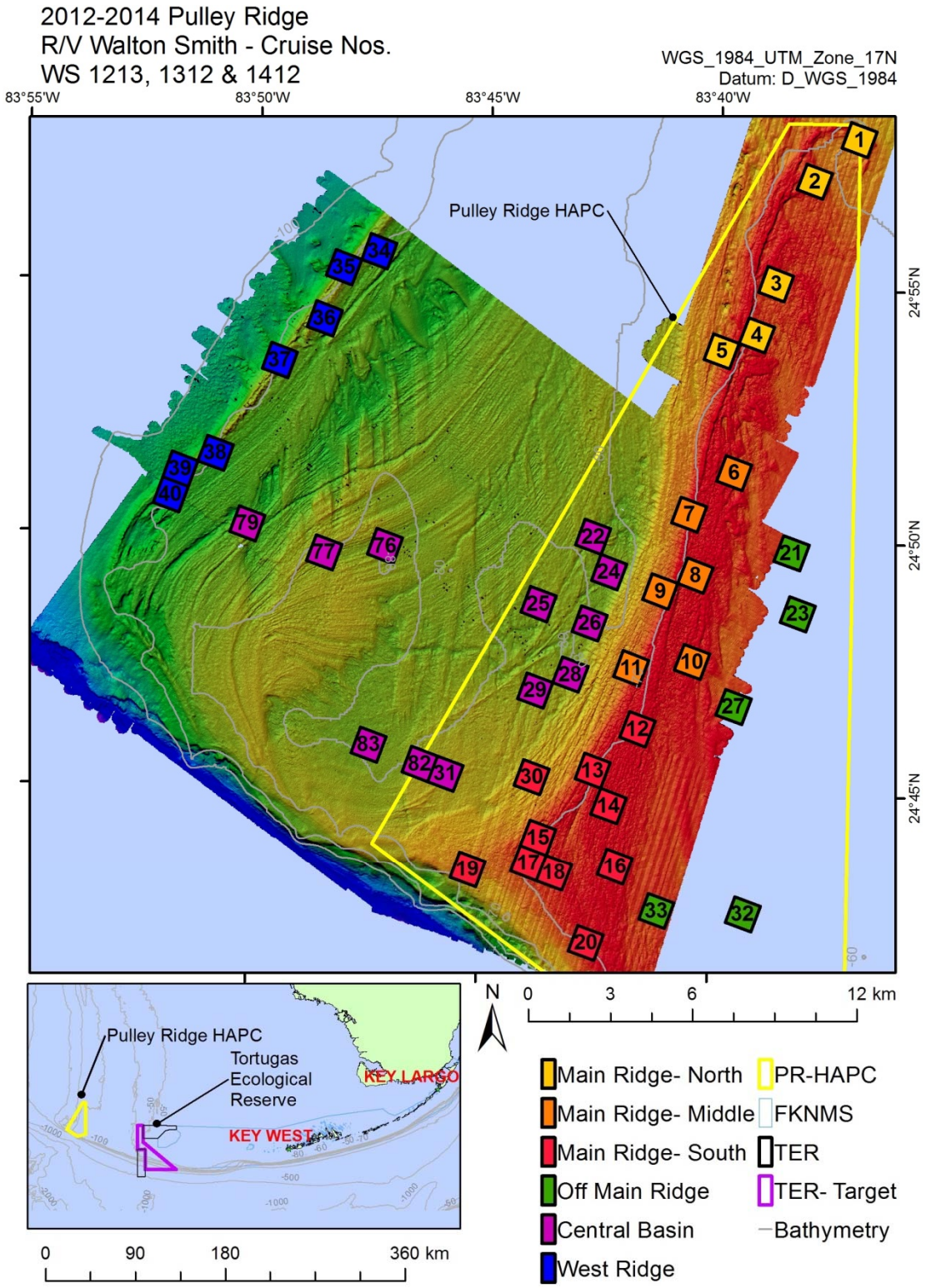

Figure 2. Random Blocks from 2012-2014 R/V *Walton Smith* cruises showing habitat zones based on multibeam map and ROV dives. Pulley Ridge Habitat Area of Particular Concern (PR HAPC) boundaries in yellow. Background map: Naar, D.F. 1999. Multibeam Bathymetry Survey, USF.

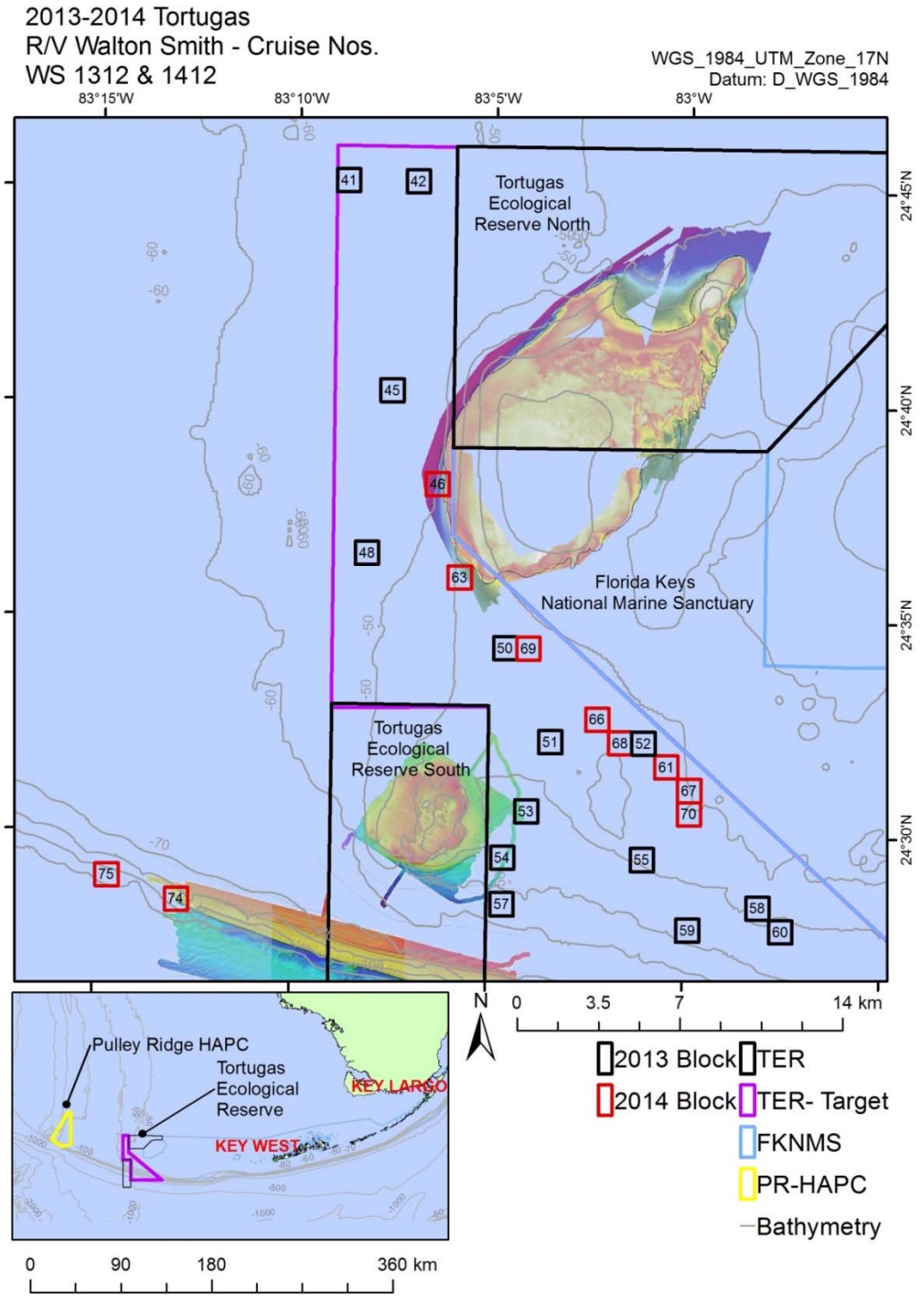

Figure 3. Random 1 km x 1 km blocks surveyed at Tortugas with the UNCW *Super Phantom* ROV and FGNMS *Mohawk* ROV during the 2013-2014 R/V *Walton Smith* cruises. Blocks surveyed during the 2014 cruise are in red. All sites are outside of the boundaries of the Tortugas Ecological Reserves (TER) and the Florida Keys National Marine Sanctuary (FKNMS). Background maps: Miller's Ledge- Robertson E. 2002. Multibeam Bathymetry Survey, USF, 2002; TER- Donahue S. 2011. Multibeam Bathymetry Survey, NF-11-06-FKNMS.

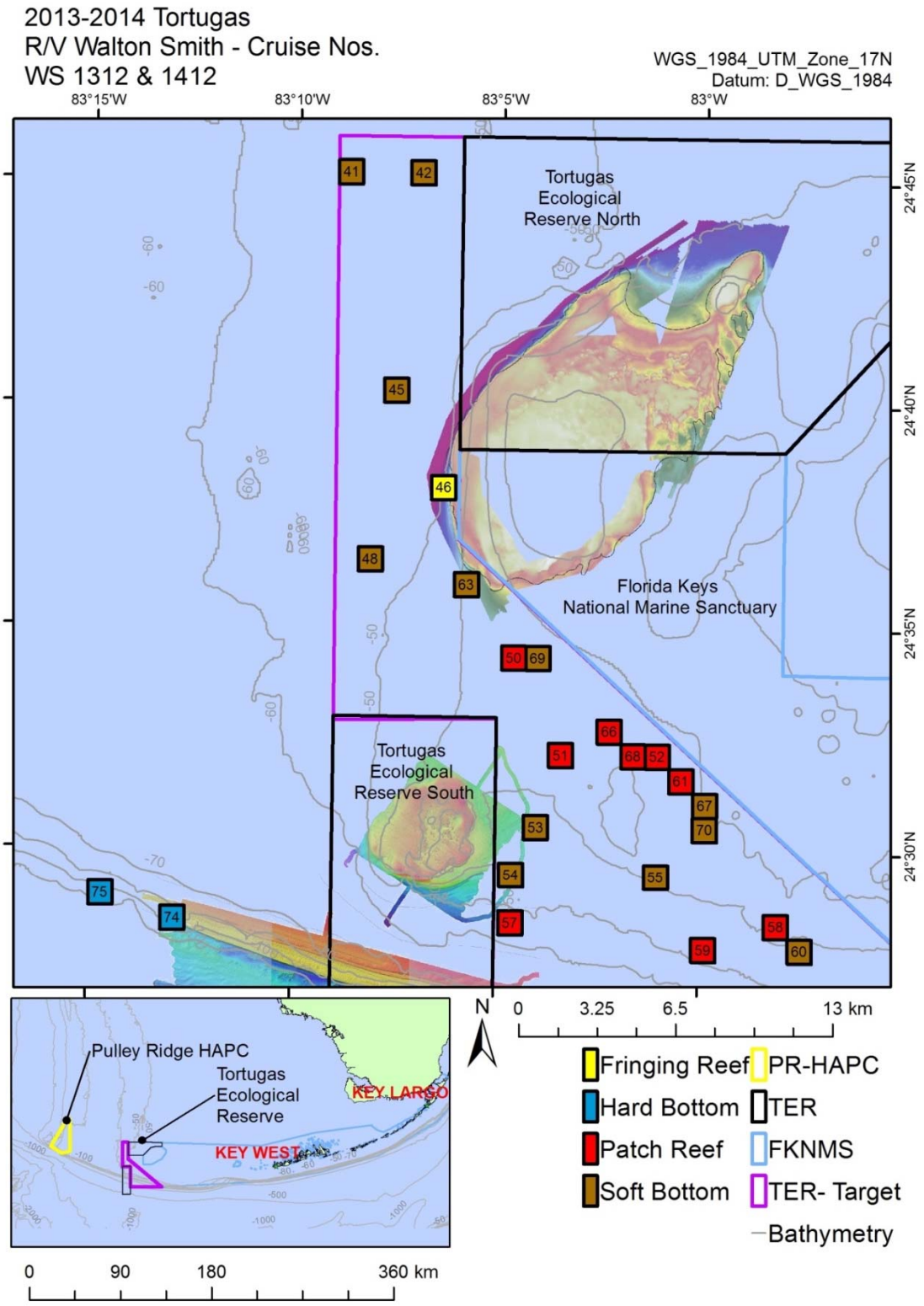

Figure 4. Random Blocks from 2013-2014 R/V *Walton Smith* cruises showing habitat zones based on multibeam maps and ROV dives. Background maps: Miller's Ledge- Robertson E. 2002. Multibeam Bathymetry Survey, USF, 2002; TER- Donahue S. 2011. Multibeam Bathymetry Survey, NF-11-06-FKNMS.

ROV Dive Summary

In 2014 a total of 24 ROV dives surveyed 27 random blocks (17 blocks in PR and 10 in Tortugas (Table 2). The 24 ROV dives covered 25.68 km (PR = 15.52 km; T = 10.16 km), at depths from 27 to 115 m (PR = 64- 87 m; T = 27- 115 m). A total of 59 hours of ROV video were recorded and 5,323 *in situ* digital images were taken which included quantitative transect images (4,323), general habitat images, and species documentation images.

Table 2. ROV dive sites during 2014 R/V *Walton Smith* cruise, August. 14-28, 2014 (Site Number= Day-Month-Year-Site).

Site Number dd-mm-yy-#	Method	Latitude (On Bottom)	Longitude (On Bottom)	Latitude (Off Bottom)	Longitude (Off Bottom)	Depth Range (m)	Distance (km)	Block Number	Bottom Time (h:mm)
16-VIII-14-1	ROV 14-01	24.8163	-83.7326	24.8099	-83.7274	78 - 80	0.88	Block 25	2:27
16-VIII-14-3	ROV 14-02	24.7872	-83.7316	24.7795	-83.7294	78 - 82	0.89	Block 29	1:55
17-VIII-14-1	ROV 14-03	24.7841	-83.6602	24.7773	-83.6552	68.5 - 70.3	0.91	Block 27	2:39
17-VIII-14-3	ROV 14-04	24.8144	-83.6380	24.8079	-83.6373	67.3 - 69.4	0.73	Block 23	1:56
18-VIII-14-1	ROV 14-05	24.7871	-83.7139	24.7939	-83.7200	79 - 80.5	0.97	Block 28	1:56
18-VIII-14-4	ROV 14-06	24.7068	-83.6497	24.7124	-83.6497	64.7 - 65.5	0.62	Block 32	1:50
19-VIII-14-1	ROV 14-07	24.7572	-83.7249	24.7538	-83.7326	74 - 76.4	0.87	Block 30	2:44
20-VIII-14-1	ROV 14-08	24.9176	-83.8035	24.9308	-83.7895	78.8 - 81	2.04	Block 35 & 34	4:29
20-VIII-14-4	ROV 14-09	24.9095	-83.8082	24.8349	-83.8173	78.4 - 82.5	1.25	Block 36	2:10
20-VIII-14-5	ROV 14-10	24.8940	-83.8229	24.8269	-83.8269	80 - 82.5	0.79	Block 37	1:30
21-VIII-14-1	ROV 14-11	24.8321	-84.7819	24.8270	-83.7841	80.8 - 83.2	0.62	Block 76	2:49
21-VIII-14-2	ROV 14-12	24.8294	-83.8022	24.8239	-83.8116	80.1 - 81.9	1.12	Block 77	1:49
21-VIII-14-3	ROV 14-13	24.8391	-83.8295	24.8350	-83.8366	83 - 87	0.85	Block 79	2:19
22-VIII-14-1	ROV 14-14	24.7543	-83.7583	24.7576	-83.7756	77 - 78.6	1.79	Block 31 & NR-82	3:52
22-VIII-14-3	ROV 14-15	24.7617	-83.7866	24.7672	-83.7944	81.7 - 83.5	0.99	NR-Block 83	1:45
22-VIII-14-4	ROV 14-16	24.7110	-83.6543	24.7098	-83.6557	64 - 66.5	0.20	Block 32	0:31
23-VIII-14-1	ROV 14-17	24.4784	-83.2425	24.4868	-83.2433	83 - 112	0.94	Block 75	2:20
23-VIII-14-2	ROV 14-18	24.4689	-83.2126	24.4756	-83.2127	82.5 - 115.2	0.75	Block 74	2:35
24-VIII-14-2	ROV 14-19	24.5344	-83.0236	24.5490	-83.0423	27.5 - 31.8	2.49	Block 68 & 66	3:39
24-VIII-14-4	ROV 14-20	24.5242	-83.0023	24.5285	-83.0101	31 - 32.5	0.92	Block 61	1:37
25-VIII-14-1	ROV 14-21	24.5689	-83.0644	24.5805	-83.0697	31.2 - 32.2	1.39	Block 69	1:44
25-VIII-14-2	ROV 14-22	24.5947	-83.0944	24.6015	-83.1009	31.9 - 34.5	1.00	Block 63	1:58
25-VIII-14-3	ROV 14-23	24.6305	-83.1042	24.6371	-83.1033	27 - 30.8	0.74	Block 46	1:14
26-VIII-14-1	ROV 14-24	24.5218	-82.9970	24.5045	-82.9981	30 - 33	1.93	Block 67 & 70	2:34

Benthic Macrobiota and Habitat

Percent cover of benthic macrobiota from the 2014 ROV dives at Pulley Ridge (PR) was 54.68% whereas the Tortugas TOR) sites had 21.49% cover (Table 3, Fig. 5). Bare hard bottom at PR averaged 34.04% and soft bottom was 11.27%. Although soft bottom dominated many of the sites at TOR (58.75%), several mesophotic patch reefs were discovered which will be analyzed separately below. Human debris (mostly discarded or lost fishing lines and long lines, and some lost lobster pots) was relatively rare at all sites surveyed in 2014. Evidence of trawl tracks were apparent at one site on the West Ridge at 79 m.

Table 3. Percent cover (CPCe Point Count) of benthic macrobiota and bare substrate for ROV sites surveyed at Pulley Ridge and Tortugas during 2014 R/V *Walton Smith* cruise.

Region	No. Blocks	% Bare Hard Bottom	% Bare Soft Bottom	% Human Debris	% Biota	Grand Total	Depth Range (m)
Pulley Ridge	**16**	**34.03%**	**11.27%**	**0.01%**	**54.68%**	**100.00%**	**61.6 - 86.1**
Main Ridge-South	1	46.22%	0.15%	0.00%	53.63%	100.00%	72.2 - 76.3
Off Main Ridge	4	46.45%	30.55%	0.00%	23.00%	100.00%	61.6 - 69.5
Central Basin	8	31.79%	8.42%	0.01%	59.77%	100.00%	72.2 - 86.1
West Ridge	3	29.82%	10.84%	0.00%	59.34%	100.00%	76.7 - 85.3
Tortugas	**10**	**19.74%**	**58.75%**	**0.02%**	**21.49%**	**100.00%**	**22.9 - 114.8**
Reef	4	17.75%	49.27%	0.01%	32.97%	100.00%	27-32.5
Hard Bottom	2	61.47%	33.76%	0.08%	4.69%	100.00%	79.2 - 114.8
Soft Bottom	4	0.83%	80.77%	0.00%	18.40%	100.00%	30.0-34.5
Grand Total	**26**	**28.54%**	**29.53%**	**0.01%**	**41.92%**	**100.00%**	**22.9-114.8**

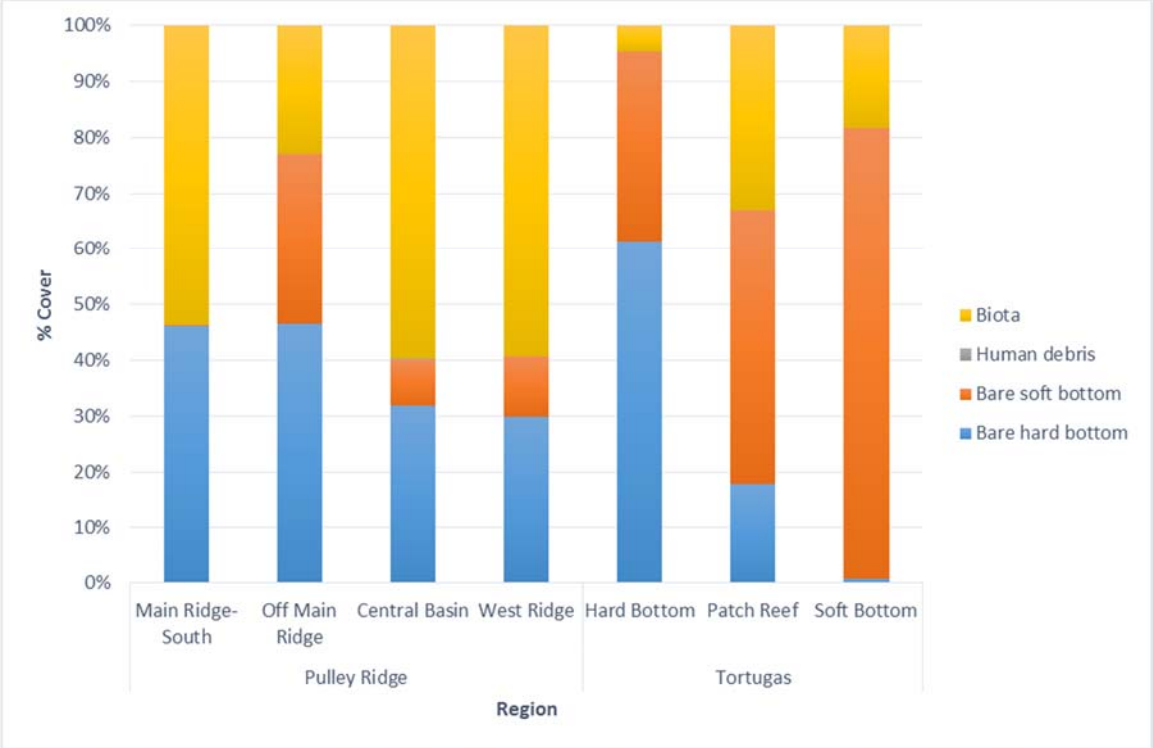

Figure 5. Percent cover (CPCe Point Count) of bare substrate and benthic macrobiota at Pulley Ridge and Tortugas during 2014 R/V *Walton Smith* cruise.

Appendix 1 lists all of the benthic macro-invertebrates and algal taxa that were identified from the quantitative photo transects at each 2014 dive site and their percent cover based on CPCe Point Count of the photo images. A total of 197 taxa were identified from both Pulley Ridge and Tortugas (Table 4). The actual count of species will be much higher than this as many of the

taxa were only identified to genus or higher taxonomic level and are likely to consist of more than one species. Porifera were very species rich with 78 taxa which were dominated by *Agelas* spp., *Amphimedon* spp., Astrophorida, *Callyspongia* spp., Dictyoceratida, *Erylus* spp., *Geodia* spp., *Ircinia* spp., *Niphates* spp., Poecilosclerida, Spirastrellidae, *Verongula* spp., *Iotrochota birotulata* (TOR), *Haliclona*- TER1 (TOR) and *Xestospongia muta*. Large hemispherical colonies (>100 cm diam.) of *Spongosorites siliquaria* were very common on Pulley Ridge. This unusual species is densely embedded with the corkscrew shaped gastropod *Siliquaria* sp. which lives inside the sponge with only the end of the shell exposed on the surface where it filter feeds. The other sessile benthic taxa included 18 Chlorophyta, 7 Rhodophyta, 6 Phaeophyta, 27 Scleractinia (hard corals), 19 gorgonian octocorals, 5 Antipatharia, Bryozoa, and Ascidiacea; mobile invertebrates included Annelida, Mollusca, Arthropoda, and Echinodermata. Of the mobile invertebrates, echinoderms were fairly common; the crinoids *Analcidometra armata* and *Davidaster discoideus* were commonly seen on the *Anadyomene* green algae at Pulley Ridge. Other common species included the blunt-spined urchin *Eucidaris tribuloides* and the mottled seastar *Narcissia trigonaria*.

Table 4. Percent cover (CPCe Point Count) and number of taxa of major benthic macrobiota for 2014 R/V *Walton Smith* cruise.

Region	% Hard Coral	% Gorgon-acea	% Anti-patharia	% Porifera	% Algae	# Taxa Cnidaria	# Taxa Sponges	# Taxa Algae	# Taxa Total
Pulley Ridge	**1.29%**	**0.15%**	**0.23%**	**1.17%**	**51.42%**	**12**	**54**	**24**	**136**
Main Ridge-South	0.73%	0.00%	0.23%	0.58%	51.86%	12	37	20	97
Off Main Ridge	0.03%	0.00%	0.00%	0.32%	22.26%	5	7	11	32
Central Basin	1.72%	0.02%	0.21%	0.92%	56.51%	2	9	20	44
West Ridge	1.09%	0.56%	0.41%	2.28%	54.42%	6	40	17	94
Tortugas	**0.60%**	**1.94%**	**0.00%**	**1.74%**	**12.27%**	**18**	**47**	**22**	**117**
Hard Bottom	0.01%	0.13%	0.00%	2.70%	0.73%	1	12	7	36
Reef	1.49%	4.77%	0.00%	2.76%	18.54%	17	41	22	98
Soft Bottom	0.00%	0.00%	0.00%	0.23%	11.76%	0	7	13	28
Grand Total	**1.02%**	**0.84%**	**0.14%**	**1.39%**	**36.36%**	**27**	**78**	**32**	**197**

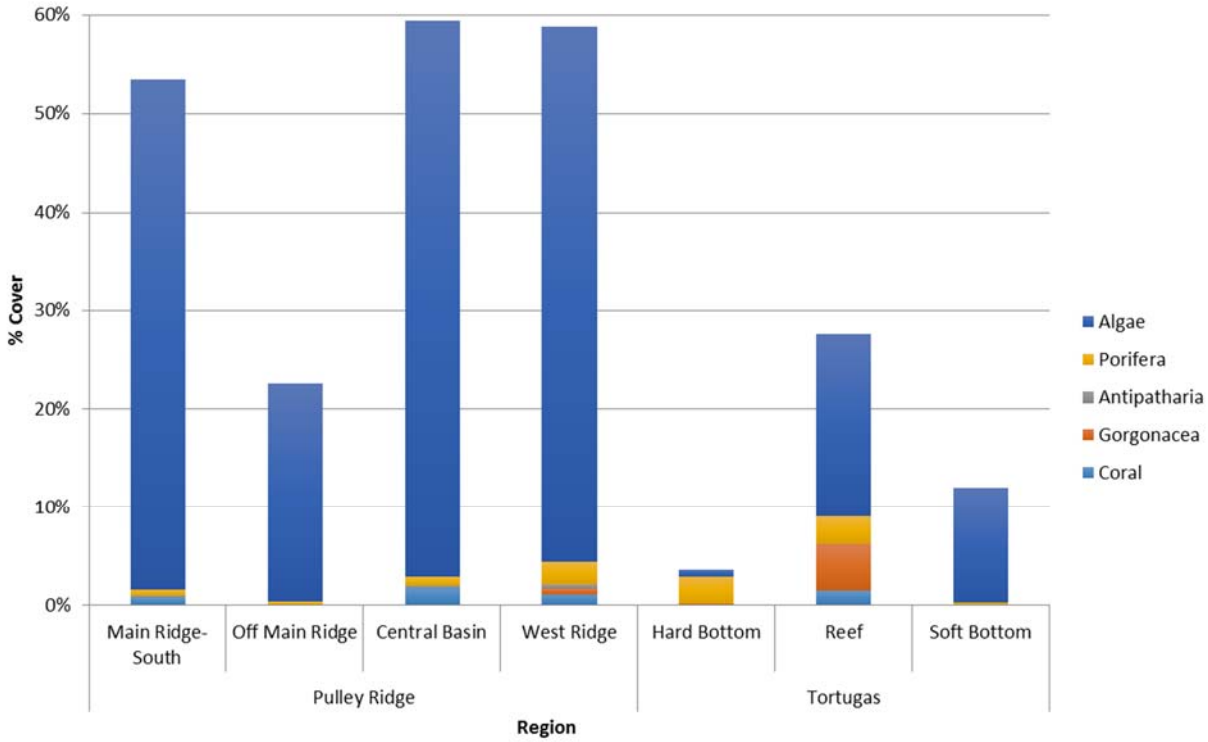

Figure 6. Percent cover (CPCe Point Count) of major benthic macrobiota for 2014 R/V *Walton Smith* cruise.

Coverage of biota at Pulley Ridge was dominated by various algae (51.42% cover). Coralline red algae (up to 63% cover) and the lettuce-like green algae *Anadyomene menziesii* (10.1%) were the most common. In addition to the corallines, the red algae were dominated by *Halymenia* spp. *Kallymenia* spp., *Peyssonnelia* spp., and *Martensia pavonia* (accepted as *Martensia fragilis*). Green algae at PR and Tortugas were dominated by *Halimeda* spp., *Verdigelas peltata*, *Caulerpa sertularioides*, *C. prolifera*, *C. racemosa*, *Codium* spp., *Penicillus dumetosus*, and *Udotea* spp.; there was one seagrass *Halophila decipens* (TOR only). Brown algae were more common at the Tortugas sites (0.45% cover at PR, 2.67% at TOR); the most common taxa included *Lobophora variegata*, *Padina* sp. *Dictyota* spp., and *Sargassum* sp.. Within the Pulley Ridge sites algae was dominant at all regions but showed lower percentage of cover on the Off Main Ridge sites (22.26%) to the east of the Main Ridge where the bottom is more rubbly, and not consolidated hardbottom suitable for macrofauna (Table 4, Fig. 6). Although sponges were species rich and common on Pulley Ridge, they only averaged 1.17% cover, but were most dense on the West Ridge (2.28%). In Tortugas sponges were common both on the hard bottom sites at Miller's Ledge (2.7% cover) and the mesophotic reef sites (2.76%). Gorgonian octocorals were also common at the Tortugas reef sites (4.77%).

Coral Analysis

Coral Cover and Diversity

Corals consisted of 27 Scleractinia (hard corals), 19 Octocorallia (Gorgonacea), and 5 Antipatharia (black corals) from the 2014 ROV dives (Appendix 1, Tables 4, 5). The dominant

hard corals at PR are *Agaricia* spp., *Helioseris cucullata, Montastraea cavernosa*, several species of *Madracis*, and *Oculina diffusa*. The *Agaricia* consist of several species, including *A. fragilis, A. lamarcki* (and/or *grahamae*), and *A. undata*. We could not consistently differentiate these in the photos, especially for the common smaller sizes <10 cm), so we lumped them in the analyses as *Agaricia* spp. *Madracis* is also difficult to impossible to differentiate from photos alone. Several species are differentiated by the number of septa per corallite (8-10), which is not distinguishable in the images. The common branching form found at Pulley Ridge may be *M. brueggemanni* (which is common at comparable depths in the Flower Gardens National Marine Sanctuary in the western Gulf of Mexico, M. Nuttall, pers. comm.) or *M. auretenra*, or *M. formosa*. A flat to mound-like *Madracis* that is common is probably *M. decactis* f. *pharensis.*

Scleractinia averaged 1.29% cover at PR, but had greatest cover at the two new sites outside of the HAPC in the Central Basin (Block 83- 4.98%; Block 82- 2.64%), and one within the HAPC but also in the Central Basin area off the Main Ridge (Block 31- 3.3%) (Appendix 1, Table 5, Figs. 7-8). Figure 9 shows the distribution of plate corals (*Agaricia* spp. and *Helioseris cucullata*) over the entire transect at each of these three sites which had the densest coral cover. Although Block 83 had a mean coral cover of 4.98%, the individual images generally showed 2-4% cover over the entire dive, but 8-12% cover was commonly found, and a maximum of 18% cover was counted in one image. Block 82 (2.64% mean cover), generally had ~2-4% cover over most of the transect and a maximum of 18%. Block 31 (3.3% mean) had a whopping maximum cover ranging from 28-60% and had 3-10% cover over most of the transect.

Octocorals averaged 0.15% cover at Pulley Ridge (maximum on West Ridge, 1.31% at Block 37); but had their greatest cover on the mesophotic reefs at Tortugas (8.82% cover on the fringing reef at Block 46 (Appendix 1). The dominant octocoral taxa at Pulley Ridge were various species of Ellisellidae, *Nicella goreaui*, *Nicella* spp., *Swiftia exserta*, and Primnoidae; the shallower reefs at Tortugas were dominated by *Pseudopterogorgia* spp., *Erythropodium caribaeorum*, *Eunicea* spp., *Icilogorgia schrammi*, *Muricea* spp., Murice*op*sis sp., Pseudoplex*au*ra sp., *Pterogorgia anceps*, *P. citrina*, and *Telesto* spp. Antipatharians were fairly common at Pulley Ridge and more so on the West Ridge (0.62% cover at Block 37). The dominant species included *Antipathes atlantica, A. furcata, Stichopathes lutken*i (may be several spp. per Murissa Nuttall, FGNMS), and *Tanacetipathes* several spp.

The Tortugas patch and fringing reefs were found at depths of 27-32 m. These are at the deeper end of shallow reefs; but some consider the upper end of mesophotic reefs to be 30-50 m depths. Except for *M. cavernosa*, and a few *Agaricia lamarcki* and *A. fragilis*, the corals at the mesophotic Tortugas reefs are quite different from Pulley Ridge. The percent cover of hard corals at the Tortugas sites in 2014 averaged 0.6% and were dominated by *M. cavernosa* (2.07% maximum cover) (Table 5, Figs. 7-8). Other common species included *Orbicella faveolata, O. franksi, Colpophyllia natans, Manicina areolata, Meandrina meandrites, Millepora alcicornis* (hydrocoral), *Mycetophyllia aliciae, Porites asteroides, Scolymia* spp., *Siderastrea radians, S. siderea, Stephanocoenia intersepta*, and *Undaria agaricites.*

Table 5. Average percent coral cover (CPCe Point Count) and densities (# colonies m^{-2}) for 2014 R/V *Walton Smith* cruise. Plate corals include agariciids and *Helioseris cucullata. Montastraea cavernosa* were counted separately. *Madracis* included *M. decactis, M. auretenra,* and *M. formosa*. *Orbicella* included *O. franksi* and *O. faveolata*.

Region	*% Plate Corals (Agaricia/ Leptoseris)*	*% Mont-astraea cavernosa*	*% Orbicella* spp.	*% Madracis* spp.	% Other Hard Coral	% All Hard Coral	Density of Plate Coral (#/m^2)
Pulley Ridge	**0.66%**	**0.00%**	**0.00%**	**0.59%**	**0.04%**	**1.29%**	**3.64**
Main Ridge-South	0.70%	0.00%	0.00%	0.03%	0.00%	0.73%	1.02
Off Main Ridge	0.01%	0.00%	0.00%	0.02%	0.00%	0.03%	0.00
Central Basin	1.07%	0.00%	0.00%	0.61%	0.03%	1.72%	5.59
West Ridge	0.05%	0.00%	0.00%	0.97%	0.08%	1.09%	0.09
Tortugas	**0.01%**	**0.33%**	**0.04%**	**0.00%**	**0.22%**	**0.60%**	**-**
Hard Bottom	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%	-
Reef	0.02%	0.82%	0.11%	0.00%	0.54%	1.49%	-
Soft Bottom	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	-
Grand Total	**0.41%**	**0.13%**	**0.02%**	**0.36%**	**0.11%**	**1.02%**	

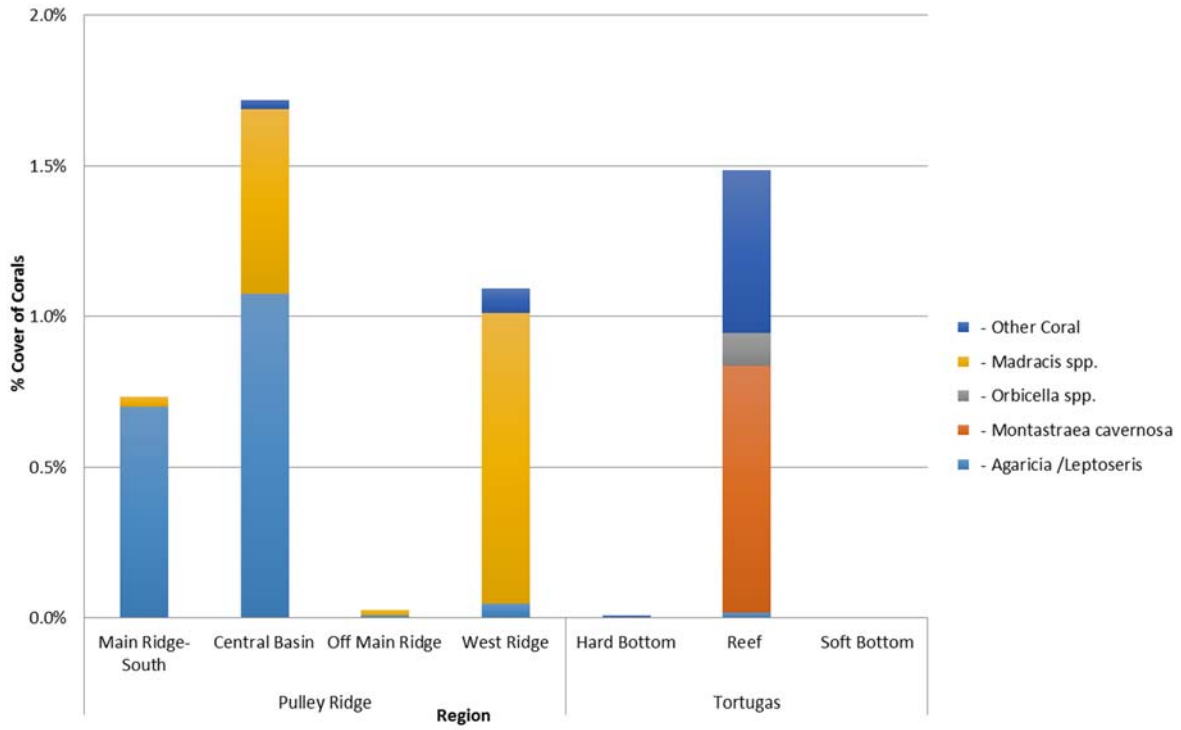

Figure 7. Percent cover (CPCe Point Count) of scleractinian corals at Pulley Ridge and Tortugas sites during 2014 R/V *Walton Smith* cruise.

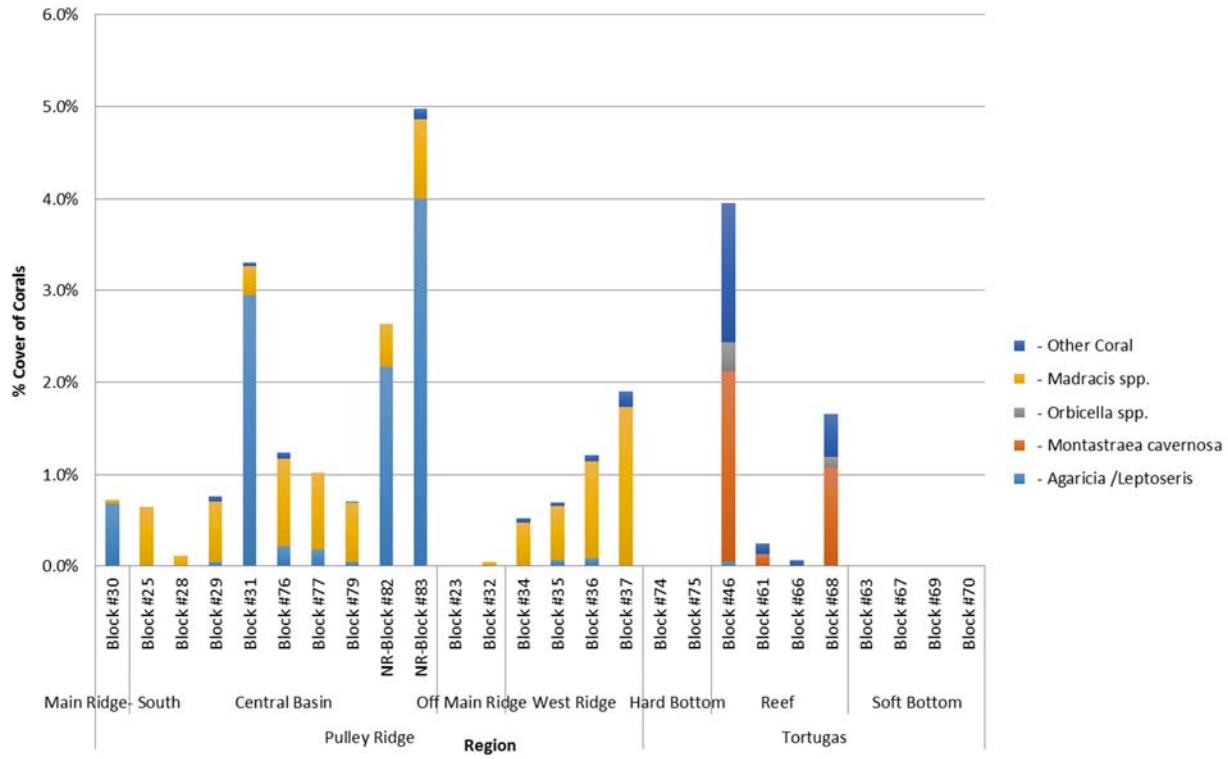

Figure 8. Percent cover (CPCe Point Count) of scleractinian corals by Block and Geographic Area at Pulley Ridge and mesophotic depths at Tortugas during 2014 R/V *Walton Smith* cruise.

A better analysis of the mesophotic reef biota at the Tortugas separated the portions of the transects that were on reef habitat from the soft bottom habitat. Four Blocks from the 2014 cruise had mesophotic reef habitat. These comprised patch reef areas found in Blocks 61, 66 and 68, just outside the western border of the FKNMS, and Block 46 which is an extensive fringing reef just outside of TER North. One hundred percent of Block 46 transect was on reef habitat, 65% of Block 68 was on reef habitat, and 16.7% of Block 61. Analysis of the reef transect photos (excluding the sand bottom images) from these blocks shows the actual reef biota cover (Table 6). Hard corals averaged 3.22% cover on these reefs, and comprised 3.96% cover on the fringing reef (Block 46) and 2.51% at Block 68. Octocorals averaged 9.62% cover, sponges 5.44%, and algae 4.53%. In Block 66 we discovered a large patch reef that had a large apparent spawning aggregation of grey snapper of hundreds to thousand individuals, and also a large 5 ft goliath grouper. Unfortunately the ROV crossed this reef during the 'off transect' portion of the dive, and thus the photos were not part of the overall CPCe analysis. As a result this Block only had a few images on reef habitat during the photo transects.

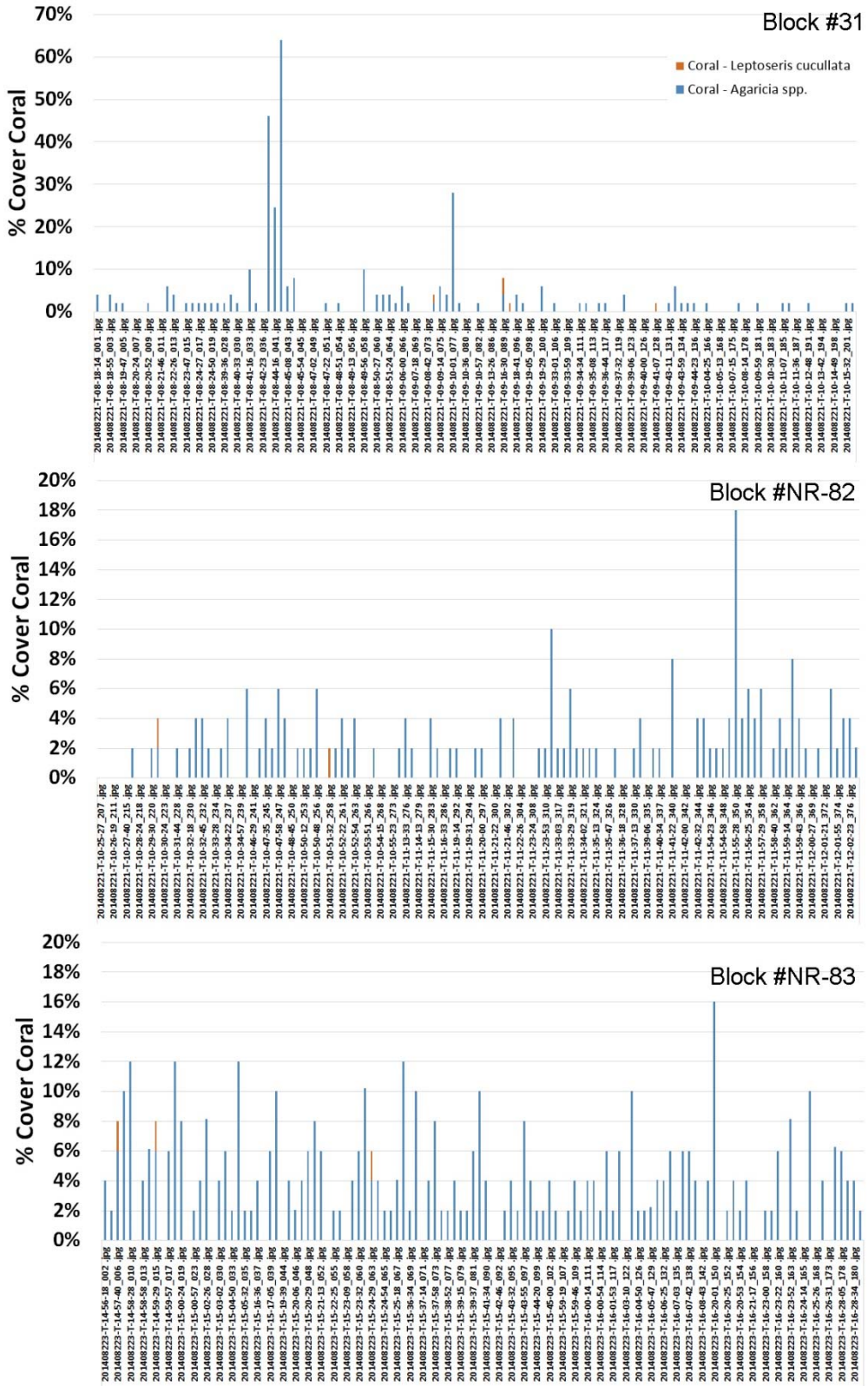

Figure 9. Distribution of percent cover of plate corals for each photo (*Agaricia* spp. and *Helioseris cucullata*) over the entire transect at three Blocks with the densest coral cover (Blocks 31, 82, and 83) within the Central Basin of Pulley Ridge.

Table 6. Percent cover of reef biota on the 2014 mesophotic reef sites at Tortugas. CPCe Point Count analyzed from the transect images on reef habitat only, excluding off-reef images.

Reef/Block	% Coral	% Alcyonacea - gorgonian	% Porifera	% Algae	% Other Biota	% Bare hard bottom	% Bare soft bottom	Grand Total
Reef	**3.22%**	**9.62%**	**5.44%**	**33.64%**	**4.53%**	**30.48%**	**13.07%**	**100.00%**
Block #46	3.96%	8.83%	6.22%	38.74%	0.33%	38.07%	3.84%	100.00%
Block #61	1.50%	6.22%	6.02%	31.80%	7.12%	13.24%	34.10%	100.00%
Block #68	2.51%	11.70%	4.11%	26.28%	10.32%	23.22%	21.86%	100.00%

Coral Density Analysis

Of the 17 Blocks that were surveyed at Pulley Ridge in 2014, 10 Blocks had plate coral (*Agaricia* sp. or *Helioseris cucullata*; Table 7, Fig. 10). Although platy *Montastraea cavernosa* were found in previous years on the Main Pulley Ridge sites, none were found at the 2014 sites. The density of agariciids was greatest in the Central Basin (5.58 colonies/m^2); Block 83 which is outside the PR HAPC had the greatest density of all the Blocks with 17.05 colonies/m^2. *Agaricia* spp. had the greatest density of 16.82 colonies m^{-2} and of *Helioseris cucullata* the maximum density was 0.64.

Table 7. Density (# colonies/m^2) of scleractinian plate corals (agariciids and *Helioseris cucullata*) at Pulley Ridge during 2014 R/V *Walton Smith* cruise. West Ridge and Central Basin Blocks 82 and 83 are outside of the Pulley Ridge HAPC.

Density of Corals Location / Block	Agaricia	*Helioseris*	Grand Total
Central Basin	5.34	0.24	5.58
Block #25	0.28	0.00	0.28
Block #29	0.10	0.01	0.11
Block #31	5.23	0.26	5.49
Block #76	0.86	0.09	0.95
Block #77	0.48	0.03	0.51
NR-Block #82	8.68	0.64	9.32
NR-Block #83	16.82	0.24	17.05
Main Ridge-South	0.92	0.10	1.02
Block #30	0.92	0.10	1.02
West Ridge	0.08	0.02	0.10
Block #35	0.06	0.02	0.08
Block #36	0.27	0.04	0.31
Grand Total	**3.47**	**0.17**	**3.64**

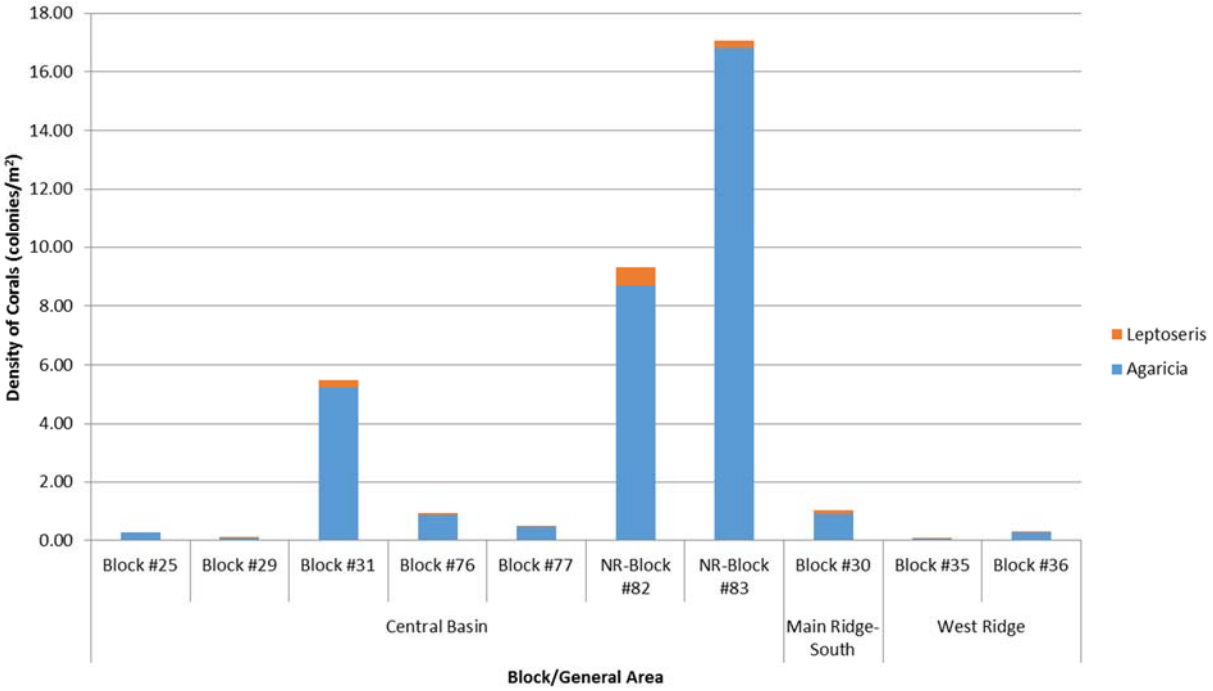

Figure 10. Density (# colonies/m^2) of scleractinian plate corals (agariciids and *Helioseris cucullata*) at Pulley Ridge during 2014 R/V *Walton Smith* cruise.

Coral Size

Using the data set collected above, a histogram was created by counting the number of each plate corals that fell within each 5-cm size class (<5 cm, 5 to 9 cm, 10- 14 cm, 15- 19 cm, etc). The histogram clearly shows the corals are greatly dominated by relatively newly settled colonies; 56.5% were <5 cm diameter, 33% were 5 to 9 cm diameter, but only 10.5% were >10 cm (Fig. 11). Although we do not have growth rates for these corals at mesophotic depths, the growth rate of *Montastraea annularis* in shallow water is 6.6-8.9 mm/yr and *Porites asteroides* is 3.0-3.5 mm/yr (Gladfelter et al. 1978). So if we assume a maximum growth rate of 5-10 mm/yr, these small corals of 5-10 cm diameter could be 5-10 years old. The largest *Agaricia* corals were found mostly in the Central Basin at Blocks 31, 82 and 83. By purposely selecting images of the largest colonies (which were not part of the random photo series), we measured the maximum diameter of these with the Area Analysis tool in CPCe. One area in Block 31 had a huge extent of coral over a distance of ~60 m. Although these coral colonies were not all contiguous they consisted of large and small plates of *Agaricia* (most likely *A. lamarcki*). The two largest contiguous single *Agaricia* corals measured for all of Pulley Ridge since 2012 were 284 and 207 cm maximum diameters; the largest was 16,618 cm^2 in area (Plate 8). Both were in Block 31 in the Central Basin.

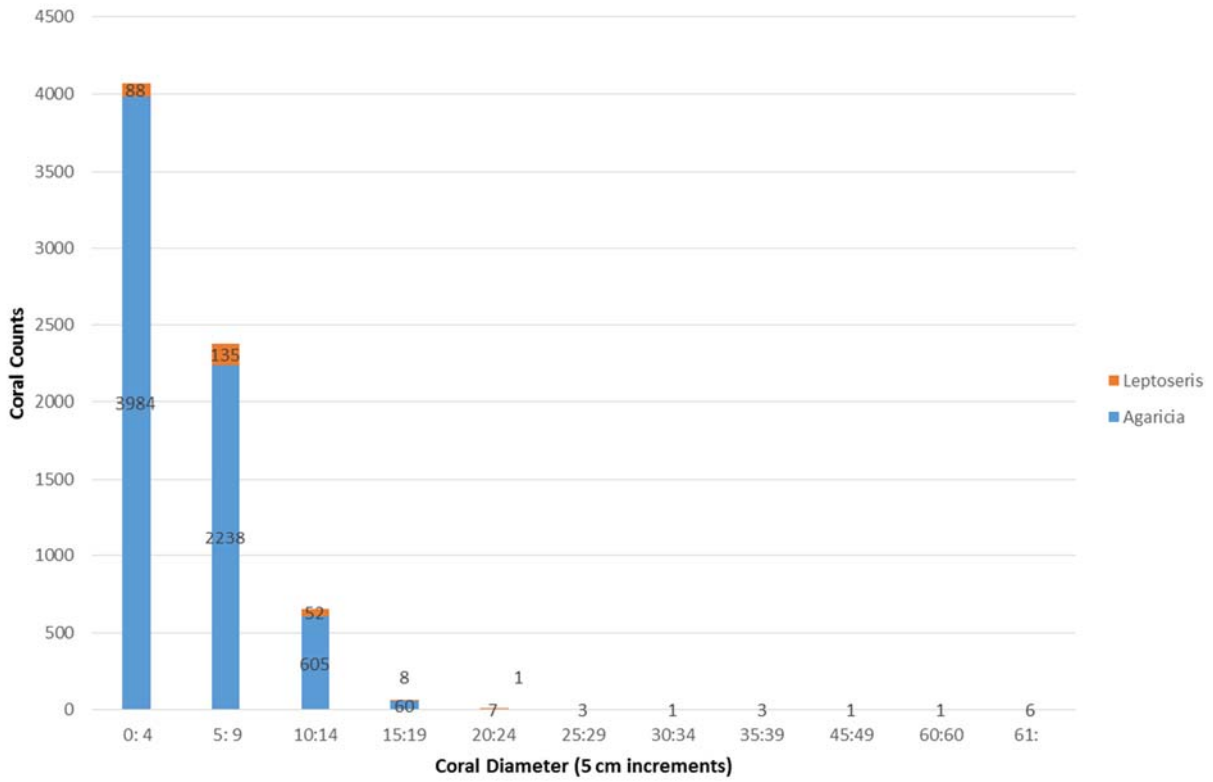

Figure 11. Size distribution of plate corals (agariciids and *H. cucullata*) from Pulley Ridge dives in 2014. Size in cm of maximum diameter.

Model of Predicted Coral Cover and Size

The Kernel Smoothing Model in ArcGIS is a geostatistical method of interpolation which produces a prediction surface with some measure of certainty or accuracy of the predictions. This tool was used to produce a model of the predicted density cover of agariciid plate corals (*Agaricia* spp. and *Helioseris*) using data from all three cruises (R/V *Walton Smith* 2012, 2013 and 2014). Fig.12 clearly shows the highest density of coral is predicted in the Central Basin area southwest of the Main Pulley Ridge. As was discussed in our 2012-2013 Cruise Report (Reed et al., 2014), data compiled in 2012-2013 was compared to USGS photo transects in 2003 and showed that the coral cover has drastically declined on Main Pulley Ridge over this decade. The Main Ridge-Middle region had the greatest overall loss, from an average of 14.15% cover in 2003 to 0.2% in 2013, or a 98.6% loss. However these new data show an apparent shift in the densest coral populations off the Main Ridge and to the deeper basin to the west.

The Kernel Smoothing Model was also used to model the predicted distribution of plate coral sizes at Pulley Ridge using the data set of number of corals for each size class found in each Block. High numbers of small colonies (0-4 cm and 5-9 cm) are predicted in the Central Basin, while a smaller quantity of larger colonies are predicted in the southeastern region of Pulley Ridge (Fig. 13).

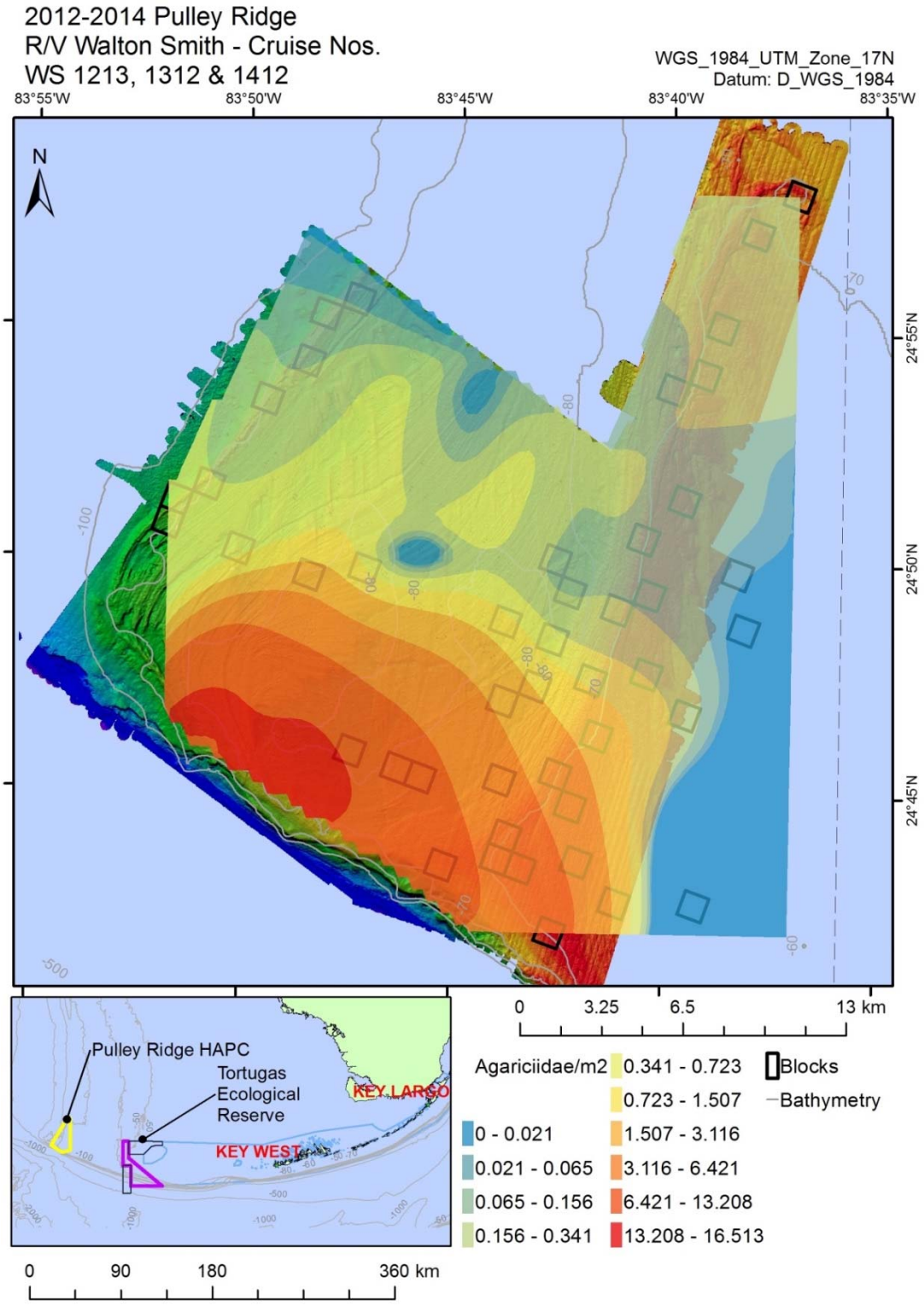

Figure 12. Model of predicted coral cover at Pulley Ridge based on all R/V *Walton Smith* cruise data (2012-2014) using Kernel Smoothing Model in ArcGIS 10.0 (density scale 0-16.5 colonies/m^2).

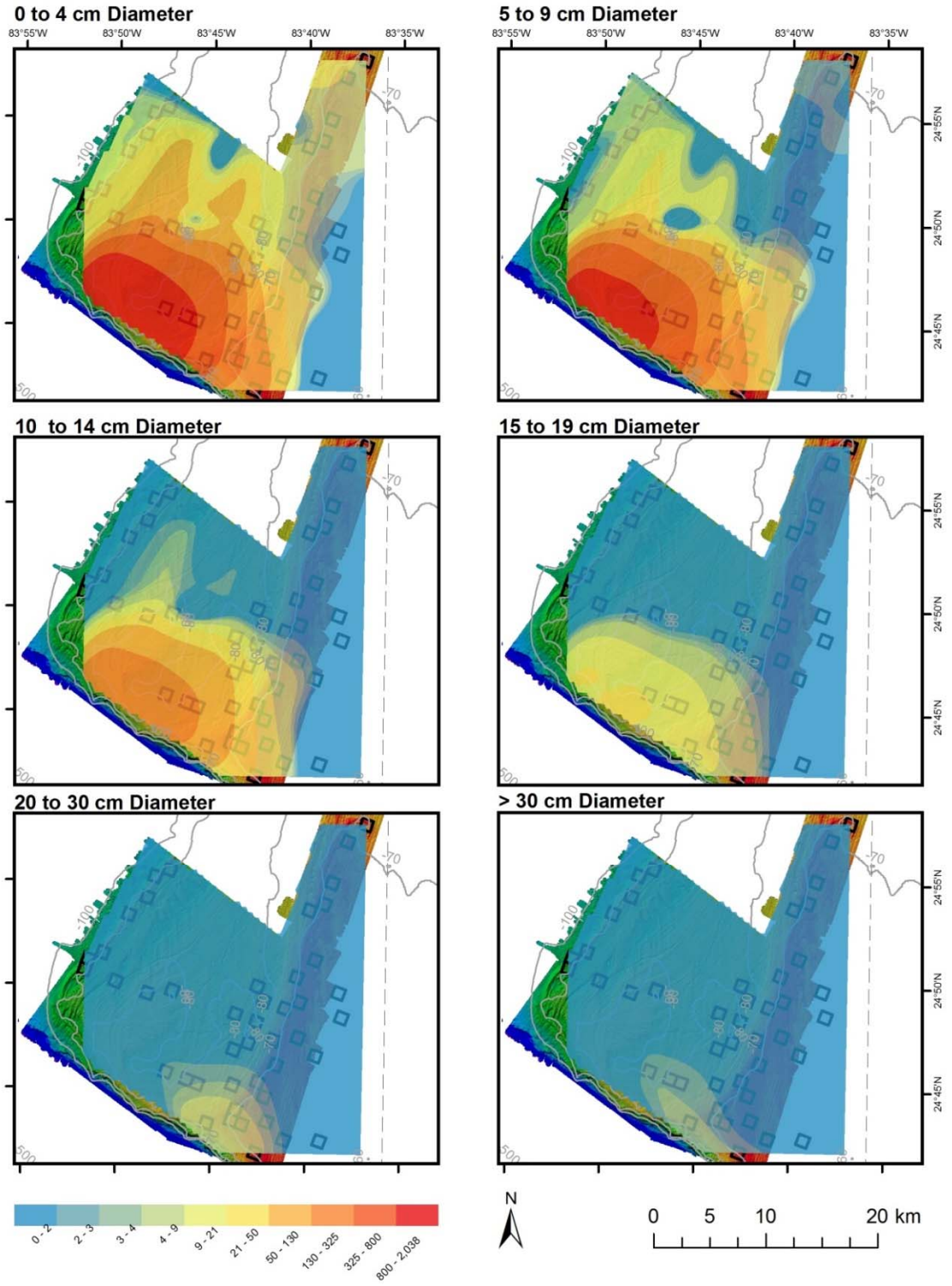

Figure 13. Model of predicted distribution of plate coral sizes at Pulley Ridge based on all R/V *Walton Smith* cruise data (2012-2014) using Kernel smoothing tool in ArcGIS (scale- number of colonies in each size class).

Dead, Bleached and Diseased Coral

In an attempt to determine the degree of coral morbidity, we analyzed all the plate coral images from the 2014 ROV dives at Pulley Ridge. A total of 7,329 individual plate corals (*Agarica* spp. and *Helioseris cucullata*) were counted from the transect photos. Of these, 247 were noted with the following descriptors of morbidity: bleached, partially bleached, totally bleached, partly dead, recently dead, or diseased; resulting in 4.0% morbidity of the total population. Bleaching (partial to total) ranged from 0% to 11.54% per Block. The Central Region had one Block (77) which had 9.26% of the corals with some bleaching (Table 8, Fig. 14). The Blocks with the densest coral cover all had low percentages of bleaching (1.76-2.36%; Blocks 31, 82 and 83). Compared to shallow reefs this does not appear to be unusually high. Plate 8 shows a series of corals that range from newly dead (still white but with no apparent tissue), recently dead (barren of tissue, but light green algae is visible on the skeleta), to older dead coral (coralline algae apparent, but corallites still visible). The time of this transition is unknown, but estimated that the green algal infestation onto the newly dead coral would be a matter of weeks to months, the coralline growth stage could be within months to year, and the completely overgrowth but with coralline ridges still visible (still can tell it is coral from rock) may last for several years.

Table 8. Various types of morbidity of plate corals (*Agaricia* spp. and *Helioseris cucullata*) on Pulley Ridge by Geographical Area and by Block.

Region	Dis-colored	Bleached (partial to 100%)	Broken	Dead (partially)	Diseased	Flipped	Striped	Healthy	Grand Total
Central Basin	**0.01%**	**2.16%**	**0.01%**	**1.24%**	**0.07%**	**0.14%**	**0.34%**	**96.02%**	**100.00%**
Block #25	0.00%	1.96%	0.00%	0.00%	0.00%	0.00%	0.00%	98.04%	100.00%
Block #29	0.00%	5.00%	0.00%	0.00%	0.00%	0.00%	0.00%	95.00%	100.00%
Block #31	0.00%	1.76%	0.00%	2.34%	0.20%	0.29%	0.49%	94.92%	100.00%
Block #76	0.00%	4.04%	0.00%	1.01%	0.00%	0.00%	0.00%	94.95%	100.00%
Block #77	0.00%	9.26%	0.00%	0.93%	0.00%	0.00%	0.00%	89.81%	100.00%
NR-Block #82	0.00%	2.36%	0.05%	2.10%	0.00%	0.21%	0.37%	94.91%	100.00%
NR-Block #83	0.03%	1.85%	0.00%	0.56%	0.08%	0.08%	0.32%	97.09%	100.00%
Main Ridge-South	**0.00%**	**2.34%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**97.66%**	**100.00%**
Block #30	0.00%	2.34%	0.00%	0.00%	0.00%	0.00%	0.00%	97.66%	100.00%
West Ridge	**0.00%**	**9.23%**	**0.00%**	**1.54%**	**0.00%**	**0.00%**	**0.00%**	**89.23%**	**100.00%**
Block #35	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%
Block #36	0.00%	11.54%	0.00%	1.92%	0.00%	0.00%	0.00%	86.54%	100.00%
Grand Total	**0.01%**	**2.23%**	**0.01%**	**1.22%**	**0.07%**	**0.14%**	**0.33%**	**96.00%**	**100.00%**

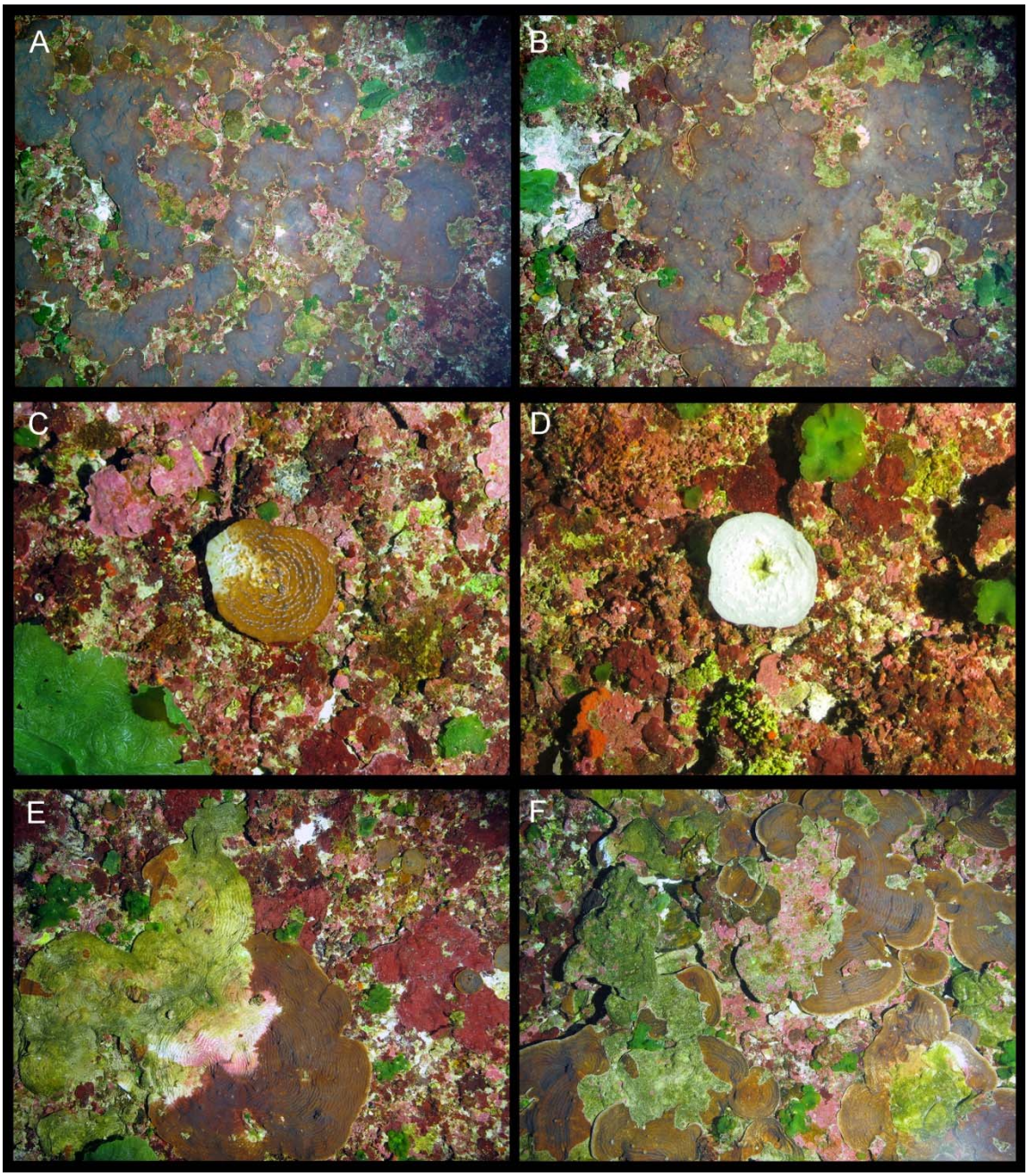

Plate 8. Agariciid corals from the Central Basin of Pulley Ridge. A. The largest plate coral (*Agaricia lamarcki*) documented on Pulley Ridge from the 2012-2014 R/V *Walton Smith* cruises (284 cm maximum diameter, 16,618 cm^2 area; Block 31, Central Basin, depth 75.2 m); B. Second largest *Agaricia*, 207 cm diameter; Block 31, depth 74.8 m; C.to F. Series of coral images showing various stages of morbidity on Pulley Ridge: C. *Agaricia* sp. partially bleached or dying, Block 31, depth 77.1 m; D. *Agaricia* sp. 100% bleached and recently dead with no algal growth, Block 82, depth 77.1 m; E. Large plates of *Agaricia* sp. showing recent dead white skeletal, dead coral with fairly recent infestation of green algae, and older growth of crustose coralline algae; Block 82, depth 78.1 m; F. Large plates of *Agaricia* sp. with parts showing signs of older dead coral, but still recognizable coralline ridges; Block 82, depth 77.7 m.

Causes of Coral Loss

What was the cause(s) for this coral loss on Pulley Ridge in the past decade and the apparent shift of the coral from the Main Pulley Ridge to the Central Basin to the west? The usual predictors of coral death on shallow water reefs are typically, global warming (temperature >30ºC for some period) causing coral bleaching and death, coral disease, coral predators (fish, mollusks, polychaetes), lack of light (turbidity), smothering (dredging), direct human impact (fishing, bottom trawls, traps, oil spill), and natural impact (hurricanes). Part of this research is to better understand mesophotic reefs, their comparative health, and connectivity to shallow water reefs. Mesophotic reefs have been considered in general to be more stable and less impacted by warm temperature, and direct human impacts. The majority of corals we have seen on Pulley Ridge appear to be relatively healthy, although a few (4.0% average) showed signs of recent tissue loss, bleaching, or disease (Plate 8). In 2012 UM deployed an ADCP at the Pulley Ridge site, and now have a year's bottom temperature and current data. Overall the bottom temperature at 69.5 m depth ranged from 19.71 to 27.67ºC and averaged 23ºC. We have never seen temperatures on Pulley Ridge warm enough to cause bleaching. In general, corals become stressed and may begin bleaching at temperatures exceeding 29ºC, but the historical temperature variability is a factor too (Carilli et al. 2012). Also we do not know as yet the genetic connectivity of these mesophotic corals with shallow ones, and their zooxanthellae symbionts may have different stress limitations. There is no evidence of extensive damage from fish traps or trawls, although there have been ghost traps observed primarily along the south drop-off, south of the PR HAPC, and one apparent trawl track was seen on West Ridge. We have not observed any predation by fish or invertebrates causing major damage. At depths of 70-80 m, we do not expect damage from hurricanes but it is a possibility. In 2012 Hurricane Isaac went directly over PR, but last year's dives in 2013 did not indicate any obvious damage; loose-leafed *Anadyomene* algae were as abundant as ever. The Central Basin however is somewhat deeper than the Main Ridge (75-80 m vs. 65-70 m depth, respectively). So if impacted by hurricanes the deeper regions may be less affected. Turbidity and smothering are unlikely in this region that is over 100 miles off the Florida coast. The water is usually crystal clear and usually >20 m visibility on bottom. It is in a region of variable currents, and potential upwelling. The Gulf of Mexico Loop Current meanders along this region and certainly can affect the bottom water conditions and chemistry. Surface currents in the Loop can exceed 3 knots. It is possible a strong, long lasting cold-water upwelling event could impact the coral. Off the Florida east coast, cold water upwelling events often bleach shallow water *Oculina varicosa* coral on the inner shelf (Reed 1980), but we never have seen coral death due to that. However, *O. varicosa* is unusual in that it can live in shallow water with zooxanthellae but in deep water (70-152 m) without zooxanthellae where it can withstand temperatures for brief periods as low as 10ºC. The agariciids and *Montastraea cavernosa* at Pulley Ridge are not likely to survive those temperatures. Could the 2010 oil spill have caused the die off? In the summer of 2010, and during the Deep Horizon oil spill, HBOI-CIOERT conducted a month long research cruise with HBOI-FAU's R/V *Seward Johnson* and the *Johnson-Sea-Link* II submersible to survey the mesophotic reefs all along the west Florida shelf from the Florida Keys to Madison Swanson off Pensacola to see if there was any oil impact on the benthos. We saw no evidence whatsoever. In addition, we saw no recent coral death on Pulley Ridge or any other of the mesophotic reefs that would have been present if the coral had been recently killed by the oil. So this leaves coral disease or upwelling as the most reasonable culprit.

Analysis of Fish Video Surveys

Appendix 2 shows the fish densities in linear meters for the Pulley Ridge and Tortugas blocks from the 2014 cruise. After a basic analysis of the data a few results are evident. The first is that the Tortugas blocks fish populations are distinctly different based on habitat type (soft bottom vs. patch reef). The soft bottom blocks have fewer fish overall and are dominated by scad, wrasse, razorfish, and flounder with a total of 23 different species identified. The patch reef blocks are dominated by damselfish, grunts and wrasse with a total of 67 species identified overall. Also of note is that there is not a perceptible difference between fish populations in the central basin of Pulley Ridge compared to those on the ridges. Further statistical analysis will need to be done to see if there are smaller differences between the different regions of Pulley Ridge.

Table 9 shows the grouper/snapper complex and lionfish for the 2014 cruise. Significantly more lionfish were observed in 2014 compared to either 2012 or 2013 (Table 10). A total of 268 lionfish were seen in 2014 as opposed to 161 in 2012 and 2013 combined. The majority of these lionfish were from Pulley Ridge (n=237) instead of Tortugas (n=31). More snapper were also observed in 2014 especially when including those seen off transects. In block 98 off transect there was what appeared to be a spawning aggregation of gray snapper with an estimated 950 in one location.

Table 9. Grouper, snapper and lionfish counts for 2014 separated by Pulley Ridge and the Tortugas.

Grouper/Snapper	**Pulley Ridge**	**Tortugas**
Black Grouper	0	1
Graysby	3	12
Speckled Hind	0	1
Rock Hind	0	1
Red Grouper	12	5
Scamp	5	8
Total Grouper	**20**	**28**
Mutton Snapper	0	2
Blackfin Snapper	0	1
Red Snapper	4	0
Schoolmaster	0	5
Unid Snapper	5	29
Yellowtail Snapper	0	115
Total Snapper	**9**	**152**
Lionfish	237	31

Table 10. Grouper, snapper and lionfish counts seen on transects during the cruises from 2012, 2013, and 2014.

Grouper/Snapper	**2012**	**2013**	**2014**
Black Grouper	6	0	1
Graysby	4	1	15
Red Grouper	20	10	17
Rock Hind	0	1	1
Scamp	28	1	13
Speckled Hind	0	0	1
Yellowmouth Grouper	1	0	0
Total Grouper	**59**	**13**	**48**
Blackfin Snapper	0	0	1
Cubera Snapper	1	0	0
Gray Snapper	0	1	0
Mahogany Snapper	0	1	0
Mutton Snapper	19	0	2
Red Snapper	0	0	4
Schoolmaster	0	0	5
Unid Snapper	1	4	34
Vermilion Snapper	77	0	0
Yellowtail Snapper	0	0	115
Total Snapper	**98**	**6**	**161**
Lionfish	100	61	268

Grouper Pit Community Analyses

PRIMER was used to analyze fish assemblages in grouper pits during the 2014 Pulley Ridge cruise with factors of grouper presence and location. Each grouper pit was examined for the presence of red grouper and lionfish. If neither species were present, it was designated as "Neither." If both were present, it was designated as "Both." If only one or the other was present, the species present indicated the designation (either "Red Grouper" or "Lionfish"). There were no grouper pits that had a red grouper without lionfish so only 3 groups are present in the following analysis. A non-metric multi-dimensional scaling (MDS) ordination of grouper pits was constructed from a Bray Curtis similarity matrix of fourth root transformed abundances for all fish species (Fig. 14).

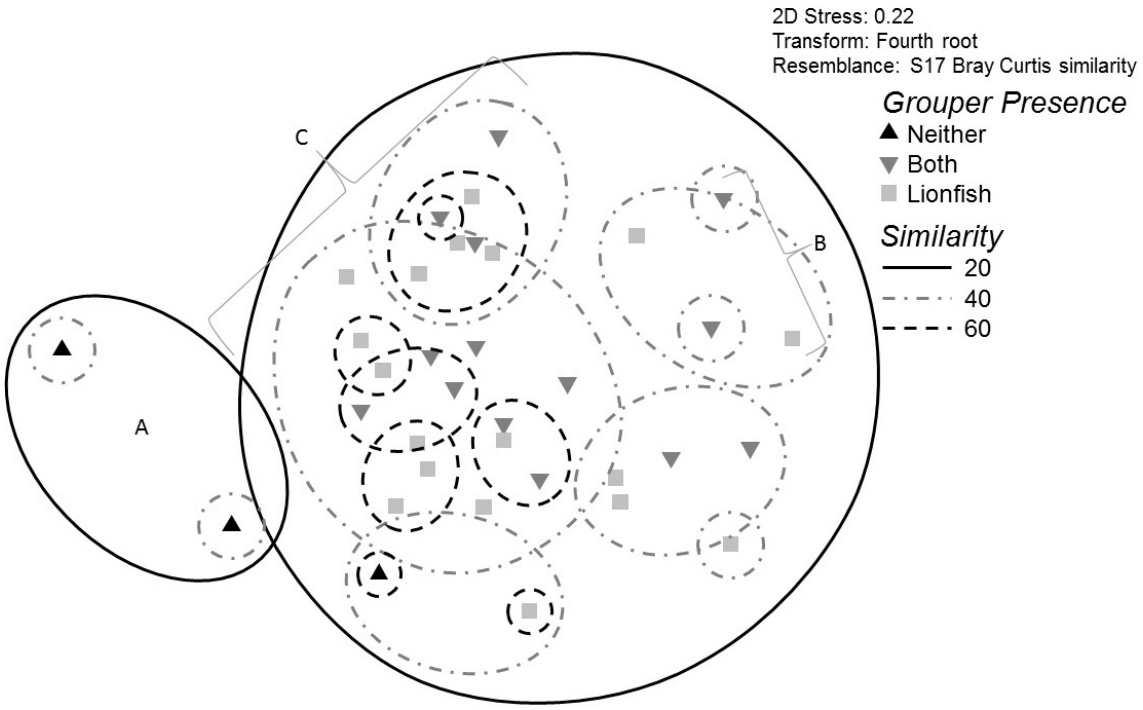

Figure 14. A non-metric multi-dimensional scaling (MDS) ordination of grouper pits constructed from a Bray-Curtis similarity matrix of fourth root transformed abundances for all fish species, displayed by the presence of lionfish and/or grouper, for dives during 2014 cruise.

There was no significant difference between grouper pits that had only lionfish compared to pits with both lionfish and red grouper. There is, however, a difference between pits that had either lionfish or lionfish and red grouper and those that had neither. This is likely an indication that the pits were no longer active and thus those three pits were excluded from further analysis. Below is the MDS plot excluding the three grouper pits with neither a red grouper nor a lionfish (Fig. 15).

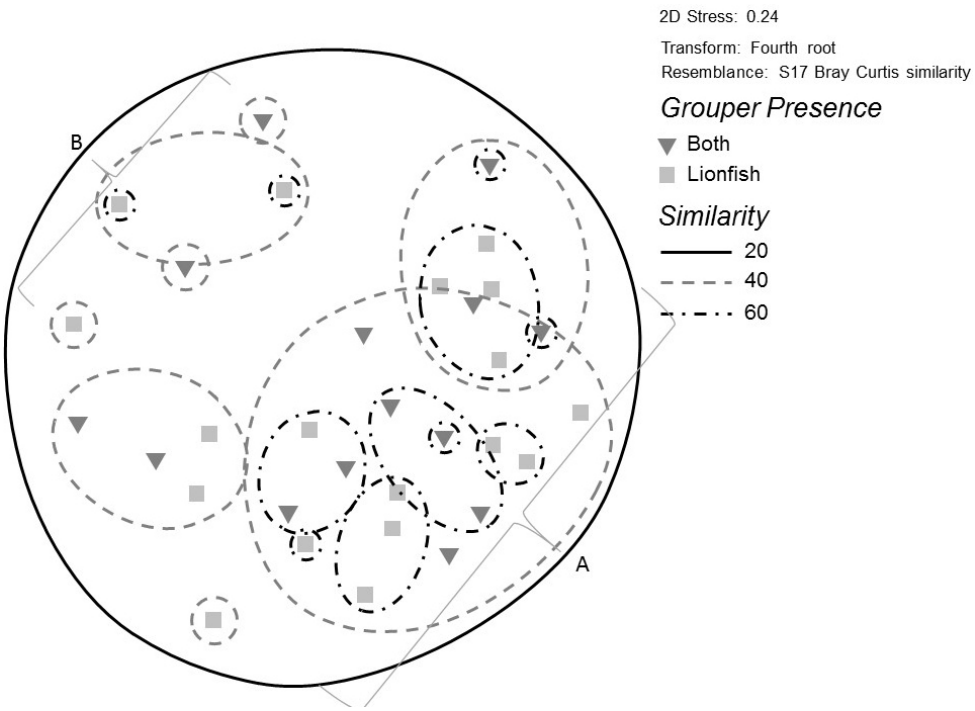

Figure 15. A non-metric multi-dimensional scaling (MDS) ordination of grouper pits constructed from a Bray-Curtis similarity matrix of fourth root transformed abundances for all fish species with the inactive pits removed from analysis, displayed by the presence of lionfish and/or grouper, for dives during 2014 cruise.

An ANOSIM and SIMPER analysis were run to compare grouper pits with both red groupers and lionfish to those with just lionfish. The ANOSIM indicated that the two groups were only slightly different (R=0.122). The SIMPER test similarly supports the conclusion of no significant difference (68.01% dissimilar) with the highest contributing differences being in the abundance of school bass, striped grunt, yellowtail reeffish, and obviously red grouper, but nothing high enough to indicate a distinct difference in the fish communities.

The location of the grouper pit was also analyzed to determine if fish community differences were based on the location within Pulley Ridge. Only grouper pits that had either a red grouper or a lionfish present were used in the analysis and, as before, a non-metric multi-dimensional scaling (MDS) ordination of grouper pits was constructed from a Bray-Curtis similarity matrix of fourth root transformed abundances for all fish species (Fig. 16). During the 2014 Pulley Ridge cruise, grouper pits were observed in three areas of Pulley Ridge: Off West Base (of main ridge), Central Basin, and West Ridge.

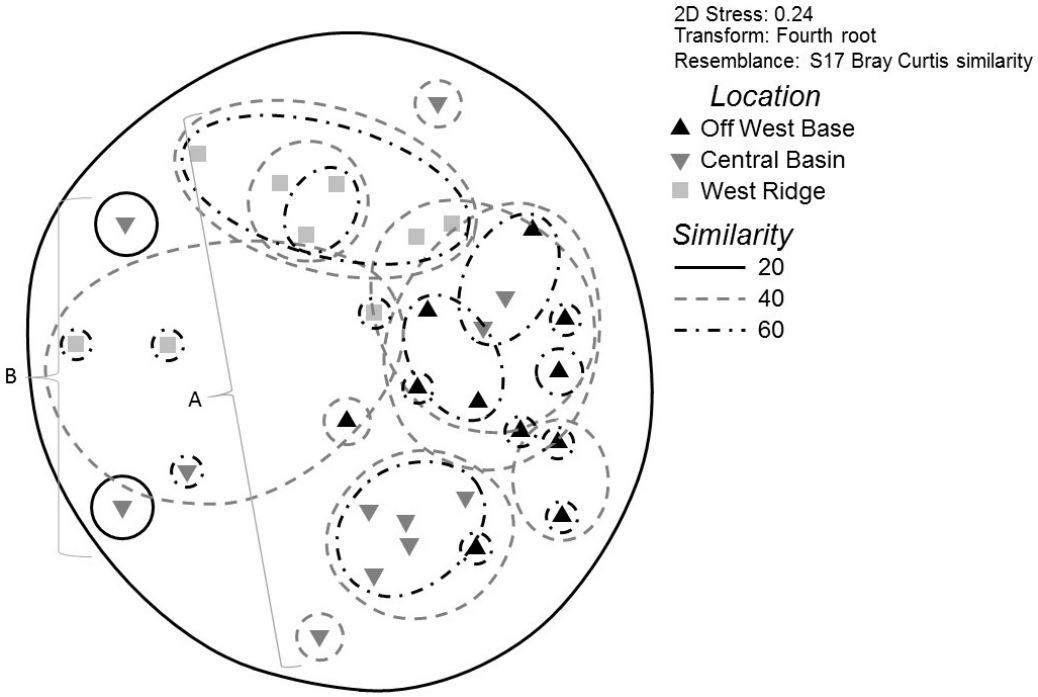

Figure 16. A non-metric multi-dimensional scaling (MDS) ordination of grouper pits constructed from a Bray-Curtis similarity matrix of fourth root transformed abundances for all fish species with the inactive pits removed from analysis, displayed by location on Pulley Ridge, for dives during 2014 cruise.

The MDS plot suggests there might be a slight difference in grouper pit fish communities between the West Ridge and the Off West Base regions; however, ANOSIM analysis indicated there was little difference in fish communities based on pit location (R=0.292). The pairwise R value between West Ridge and Off West Base was 0.496, which may indicate a considerable difference between the regions. The SIMPER analysis supports these findings indicating a dissimilarity of 72.8% between the two regions. The top four species contributing to the difference is the abundance of lionfish, school bass, yellowtail reeffish, and red barbier. With the current sampling size of grouper pits, there does not appear to be a significant difference in fish communities.

DELIVERABLES AND CONCLUSIONS

This cruise and research has resulted in a rich set of new data discovering and characterizing the benthic communities and fish populations at mesophotic sites at Pulley Ridge and Tortugas off the southwestern Florida. New sonar maps, ground-truthed by ROV dives, have provided data for characterizing the Pulley Ridge HAPC and adjacent areas. These data will be important for managers and scientists with NOAA Fisheries, Florida Keys National Marine Sanctuary, South Atlantic Fishery Management Council, Gulf of Mexico Fishery Management Council, NOAA Deep Sea Coral Research and Technology Program, NOAA Coral Reef Conservation Program, and NOAA Mesophotic Reef Ecosystem Program. A final cruise for this research project is scheduled for August 2015. Once that is completed, a final report will compile the data from all

four cruises and will be compared to previous research. These data may then be compared to future research cruises and to areas adjacent to the protected areas to better understand the long-term health and status of these important mesophotic coral/sponge ecosystems.

Marine Protected Areas

In December 2014, the data compiled from our cruises to Pulley Ridge, including CIOERT cruises of 2010 and 2011 (FloSEE I and II), and the UM cruises of 2012-2014, were presented to the Coral Advisory Panel of the Gulf of Mexico Fishery Management Council as a proposal to extend the boundaries of the Pulley Ridge HAPC to the west to include the coral rich Central Basin and the West Ridge. Also our data compiled on the mesophotic reefs at Tortugas in 2013-2014 were presented to the Florida Keys National Marine Sanctuary as a proposal for extending the boundaries of the sanctuary to include these areas.

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Appendix 1. Percent cover (from CPCe Point Count analysis of quantitative ROV photographs) of benthic macrobiota for each Block surveyed during the during the 2014 R/V *Walton* Smith cruise.

Appendix 2. Densities (number/km) of each fish species for each Block observed in ROV video transects during

Appendix 3. SEADESC Report providing metadata for each Mohawk ROV dive the 2014 R/V *Walton* Smith cruise and including plot of dive track overlaid on background multibeam map, photos characterizing the site, and detailed site and transect description.

APPENDIX 1

Species List and Percent Cover of Benthic Macrobiota

Species list of the benthic macro-invertebrates and algae that were identified from quantitative photo transects for each ROV dive during the 2014 R/V *Walton Smith* cruise to Pulley Ridge and Tortugas. Still images captured from the photo transects were analyzed using CPCe© software to determine relative percent cover of benthic biota and habitat types. (Best viewed in PDF format in order to zoom view)

	Pulley Ridge																	Tortugas												
Phylum/Scientific Name	Block #23	Block #25	Block #28	Block #29	Block #30	Block #31	Block #32	Block #34	Block #35	Block #36	Block #37	Block #76	Block #77	Block #79	NR-Block #82	NR-Block #83	Pulley Ridge Total	Block #46	Block #61	Block #63	Block #66	Block #67	Block #68	Block #69	Block #70	Block #74	Block #75	Tortugas Total	Grand Total
Biota	23.89%	37.55%	46.50%	56.48%	53.63%	79.72%	22.12%	69.32%	67.01%	39.15%	61.89%	31.09%	68.09%	64.36%	80.05%	73.97%	54.68%	58.06%	19.91%	28.73%	13.50%	10.49%	40.43%	13.34%	20.98%	5.34%	4.04%	21.49%	41.92%
Chlorophyta	0.77%	2.35%	4.39%	3.37%	13.32%	7.72%	16.73%	8.08%	14.42%	11.71%	5.14%	1.90%	2.44%	4.02%	7.04%	2.81%	6.64%	21.20%	3.76%	27.17%	4.28%	7.51%	8.44%	3.58%	4.82%	0.28%	0.13%	8.12%	7.21%
Anadyomene menziesii	0.02%	0.52%	0.32%	0.95%	11.45%	5.07%	0.00%	5.68%	10.14%	6.78%	0.60%	0.00%	0.38%	1.62%	3.90%	0.20%	2.98%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.83%
Caulerpa prolifera	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.42%	18.83%	0.03%	0.49%	0.00%	0.18%	0.08%	0.00%	0.00%	2.01%	0.77%
Caulerpa racemosa	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.55%	0.00%	0.00%	0.03%	0.00%	0.00%	0.06%	0.02%
Caulerpa sertularioides	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.32%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	1.15%	7.00%	0.13%	2.17%	0.00%	0.12%	0.74%	0.00%	0.00%	1.13%	0.45%
Caulerpa sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Chlorophyta	0.17%	0.60%	0.35%	0.57%	0.38%	0.37%	0.38%	0.27%	0.65%	0.40%	0.40%	0.25%	0.23%	0.27%	0.10%	0.40%	0.36%	0.03%	0.10%	0.33%	0.65%	0.18%	4.88%	0.03%	0.15%	0.25%	0.10%	0.67%	0.48%
Cladophora sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	2.42%	0.00%	0.00%	0.00%	0.00%	0.25%	0.09%
Codium sp.	0.03%	0.00%	0.02%	0.02%	0.00%	0.00%	0.58%	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.04%	0.02%	0.00%	0.00%	0.02%	0.00%	0.02%	0.00%	0.00%	0.02%	0.03%	0.01%	0.03%
Halimeda sp.	0.37%	0.10%	3.00%	1.06%	0.00%	0.03%	15.36%	0.03%	0.30%	0.00%	0.22%	0.08%	0.00%	0.03%	0.00%	0.00%	1.29%	0.03%	0.20%	0.07%	0.23%	0.20%	0.40%	0.13%	0.22%	0.02%	0.00%	0.15%	0.85%
Halimeda tuna	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Halophila decipiens	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	0.35%	0.00%	1.66%	0.00%	2.42%	0.20%	0.00%	0.00%	0.47%	0.18%
Microdictyon sp.	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Penicillus dumetosus	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.57%	0.08%	1.28%	0.74%	0.53%	0.15%	0.91%	0.00%	0.00%	0.43%	0.16%
Turf algae	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	21.12%	1.12%	0.00%	0.00%	0.00%	0.00%	0.28%	0.00%	0.00%	0.00%	2.25%	0.87%
Udotea sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.13%	0.50%	1.82%	1.48%	0.18%	0.25%	2.45%	0.00%	0.00%	0.68%	0.26%
Ulva sp.	0.17%	0.02%	0.03%	0.02%	0.00%	0.00%	0.03%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
Ventricaria ventricosa	0.00%	0.07%	0.03%	0.02%	0.07%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.05%	0.02%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
Verdigellas peltata	0.00%	1.02%	0.64%	0.74%	1.42%	2.25%	0.03%	2.10%	3.31%	4.46%	3.92%	1.52%	1.80%	2.09%	3.04%	2.21%	1.91%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.01%	1.18%
Phaeophyceae	0.77%	0.02%	0.05%	0.07%	0.55%	0.67%	1.58%	0.12%	1.26%	0.03%	0.22%	0.08%	0.18%	0.05%	0.98%	0.50%	0.45%	14.02%	4.63%	0.00%	0.67%	0.02%	7.10%	0.22%	0.00%	0.02%	0.00%	2.67%	1.30%
Dictyota sp.	0.67%	0.00%	0.00%	0.00%	0.52%	0.65%	1.38%	0.08%	1.21%	0.00%	0.00%	0.03%	0.15%	0.03%	0.78%	0.05%	0.35%	9.72%	4.60%	0.00%	0.40%	0.02%	6.43%	0.22%	0.00%	0.00%	0.00%	2.14%	1.04%
Lobophora variegata	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.03%	0.03%	0.02%	0.22%	0.03%	0.00%	0.00%	0.20%	0.38%	0.06%	4.14%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.42%	0.20%
Padina sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.02%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Phaeophyceae	0.08%	0.02%	0.05%	0.07%	0.03%	0.02%	0.18%	0.00%	0.02%	0.02%	0.00%	0.02%	0.00%	0.00%	0.00%	0.05%	0.03%	0.15%	0.02%	0.00%	0.17%	0.00%	0.63%	0.00%	0.00%	0.02%	0.00%	0.10%	0.06%
Phaeophyceae-PR01	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sargassum sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Rhodophyta	20.99%	30.23%	40.64%	50.68%	37.87%	66.73%	3.10%	57.70%	47.54%	21.01%	50.11%	25.14%	62.59%	58.08%	67.87%	64.84%	44.08%	3.27%	0.05%	0.00%	0.43%	0.00%	0.25%	0.00%	0.00%	0.65%	0.37%	0.50%	27.32%
Amphiroa sp.	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Corallinales	1.41%	6.23%	38.33%	27.31%	33.97%	62.12%	0.08%	19.52%	32.72%	17.68%	42.64%	23.89%	60.93%	55.87%	63.25%	61.32%	34.22%	2.82%	0.00%	0.00%	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.22%	0.37%	21.20%
Halymenia sp.	0.70%	1.13%	0.54%	1.09%	0.10%	0.02%	0.52%	1.75%	0.64%	1.27%	0.79%	0.17%	0.02%	0.03%	0.00%	0.00%	0.55%	0.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.01%	0.34%
Kallymenia sp.	1.24%	0.02%	0.00%	0.00%	0.00%	0.00%	1.75%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.19%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.12%
Martensia pavonia	16.83%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	0.00%	1.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.65%
Peyssonnelia sp.	0.02%	11.20%	1.09%	20.54%	3.30%	4.52%	0.07%	36.09%	12.50%	1.60%	5.59%	0.85%	1.63%	2.16%	4.55%	3.53%	6.82%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.20%
Rhodophyta	0.79%	11.64%	0.69%	1.74%	0.50%	0.05%	0.68%	0.33%	1.66%	0.43%	1.07%	0.23%	0.00%	0.02%	0.02%	0.00%	1.24%	0.38%	0.05%	0.00%	0.43%	0.00%	0.20%	0.00%	0.00%	0.02%	0.13%	0.12%	0.81%
Cyanobacteria	0.44%	0.81%	0.17%	0.28%	0.12%	0.07%	0.13%	0.08%	0.08%	0.07%	0.15%	0.72%	0.47%	0.22%	0.15%	0.12%	0.25%	0.23%	1.67%	0.88%	0.83%	0.34%	3.32%	0.23%	2.17%	0.00%	0.00%	0.97%	0.53%
Porifera	0.35%	2.86%	0.77%	0.97%	0.58%	0.60%	0.28%	1.99%	2.15%	3.13%	1.86%	0.92%	0.67%	0.74%	0.45%	0.35%	1.17%	6.22%	1.17%	0.15%	0.80%	0.32%	2.86%	0.13%	0.32%	3.02%	2.38%	1.74%	1.39%
Acanthella sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Agelas citrina	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Agelas clathrodes	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Agelas conifera	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.07%	0.02%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.45%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	0.02%
Agelas- PR3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Agelas- PR6	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Agelas sp.	0.00%	0.00%	0.00%	0.03%	0.03%	0.00%	0.00%	0.00%	0.02%	0.03%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.01%	0.05%	0.02%	0.00%	0.00%	0.00%	0.07%	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%
Agelas wiedenmayeri	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Aiolochroia crassa	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.00%	0.12%	0.00%	0.00%	0.02%	0.00%	0.02%	0.01%
Amphimedon compressa	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.15%	0.03%	0.00%	0.00%	0.00%	0.18%	0.00%	0.00%	0.00%	0.00%	0.04%	0.01%
Amphimedon- PR2	0.00%	0.40%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%
Aplysina cauliformis	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.32%	0.00%	0.00%	0.02%	0.00%	0.13%	0.00%	0.00%	0.00%	0.00%	0.05%	0.02%
Aplysina fulva	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.10%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Aplysina sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Astrophorida	0.00%	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.08%	0.13%	0.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
Astrophorida- PR2	0.00%	0.00%	0.23%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
Auletta sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.07%	0.03%	0.05%	0.03%	0.03%	0.03%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.01%
Axinellidae	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.02%	0.08%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.01%
Axinellidae- PR2	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Callyspongia plicifera	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Callyspongia sp.	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%
Callyspongia vaginalis	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.20%	0.02%	0.00%	0.00%	0.00%	0.02%	0.01%
Chondrosia sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cinachyrella sp.	0.02%	0.03%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.15%	0.07%	0.02%	0.01%
Cliona delitrix	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.22%	0.03%	0.00%	0.00%	0.00%	0.13%	0.00%	0.00%	0.00%	0.00%	0.04%	0.01%
Cliona varians	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	0.02%	0.00%	0.00%	0.00%	0.12%	0.00%	0.00%	0.00%	0.00%	0.02%	0.01%
Demospongiae	0.18%	0.79%	0.28%	0.27%	0.35%	0.35%	0.22%	1.09%	1.14%	1.92%	1.02%	0.55%	0.50%	0.49%	0.27%	0.30%	0.61%	0.58%	0.18%	0.00%	0.13%	0.00%	0.30%	0.00%	0.07%	2.40%	1.37%	0.50%	0.57%
Demospongiae- PR01	0.00%	0.12%	0.00%	0.00%	0.00%	0.00%	0.02%	0.03%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
Demospongiae- PR12	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.08%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Demospongiae- PR13	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Demospongiae- PR17	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.02%	0.00%	0.00%	0.03%	0.00%	0.03%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Desmapsamma anchorata	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.18%	0.00%	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.00%	0.02%	0.01%
Dictyoceratida	0.00%	0.02%	0.02%	0.03%	0.00%	0.00%	0.00%	0.03%	0.02%	0.02%	0.02%	0.02%	0.00%	0.02%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.10%	0.02%	0.01%	0.01%
Discodermia sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Dysidea etheria	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Erylus- PR1	0.00%	0.10%	0.00%	0.02%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
Erylus- PR2	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Erylus sp.	0.00%	0.02%	0.02%	0.08%	0.00%	0.00%	0.02%	0.02%	0.02%	0.02%	0.00%	0.00%	0.03%	0.02%	0.02%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
Geodia gibberosa complex	0.00%	0.00%	0.00%	0.03%	0.02%	0.00%	0.00%	0.02%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Geodia neptuni complex	0.00%	0.02%	0.00%	0.02%	0.02%	0.03%	0.00%	0.08%	0.00%	0.10%	0.00%	0.00%	0.03%	0.02%	0.05%	0.00%	0.02%	0.15%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.02%
Geodia- PR1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Geodia sp.	0.00%	0.03%	0.00%	0.02%	0.00%	0.00%	0.00%	0.15%	0.07%	0.08%	0.03%	0.00%	0.00%	0.02%	0.00%	0.00%	0.03%	0.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.02%
Hadromerida	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Halichondriidae	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Haliclona- TER1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.15%	0.03%	0.32%	0.00%	0.02%	0.25%	0.00%	0.00%	0.08%	0.03%

	Pulley Ridge																		Tortugas													
Phylum/Scientific Name	Block #23	Block #25	Block #28	Block #29	Block #30	Block #31	Block #32	Block #34	Block #35	Block #36	Block #37	Block #76	Block #77	Block #79	NR-Block #82	NR-Block #83	Pulley Ridge Total	Block #46	Block #61	Block #63	Block #66	Block #67	Block #68	Block #69	Block #70	Block #74	Block #75	Tortugas Total	Grand Total
Haplosclerida	0.00%	0.02%	0.00%	0.02%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Iotrochota birotulata	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.38%	0.15%	0.00%	0.00%	0.00%	0.30%	0.00%	0.00%	0.00%	0.00%	0.08%	0.03%
Ircinia campana	0.05%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ircinia sp.	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.07%	0.07%	0.00%	0.05%	0.00%	0.08%	0.00%	0.00%	0.05%	0.07%	0.04%	0.02%
Ircinia strobilina	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.08%	0.00%	0.07%	0.02%	0.00%	0.00%	0.00%	0.02%	0.01%
Monachora arbuscula	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Mycale laxissima	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.12%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Neofibularia nolitangere	0.00%	0.05%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.05%	0.05%	0.02%	0.03%	0.00%	0.00%	0.02%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
Niphates digitalis	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.08%	0.00%	0.00%	0.02%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Niphates erecta	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.27%	0.00%	0.00%	0.07%	0.00%	0.05%	0.02%	0.00%	0.00%	0.00%	0.04%	0.02%
Niphates sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.33%	0.22%	0.00%	0.17%	0.00%	0.30%	0.03%	0.00%	0.02%	0.00%	0.11%	0.04%
Niphatidae	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.03%	0.00%	0.22%	0.00%	0.00%	0.00%	0.00%	0.03%	0.01%
Oceanapia sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Petrosiidae	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.02%	0.02%	0.03%	0.02%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Placospongia sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Poecilosclerida	0.05%	0.00%	0.00%	0.00%	0.00%	0.03%	0.02%	0.05%	0.13%	0.13%	0.10%	0.00%	0.02%	0.02%	0.00%	0.00%	0.03%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.13%	0.03%	0.02%	0.03%
Poecilosclerida- PR3	0.00%	0.02%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Poecilosclerida-TER1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%
Polymastia sp.	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Scopalina ruetzleri	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Spheciospongia vesparium	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.05%	0.03%	0.00%	0.00%	0.00%	0.01%	0.00%
Spirastrella hartmani	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.03%	0.02%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Spirastrellidae	0.03%	0.00%	0.02%	0.13%	0.00%	0.10%	0.00%	0.05%	0.15%	0.10%	0.28%	0.00%	0.05%	0.02%	0.03%	0.00%	0.06%	0.32%	0.03%	0.00%	0.02%	0.00%	0.03%	0.00%	0.00%	0.10%	0.80%	0.13%	0.09%
Spongosorites	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.08%	0.00%	0.02%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Spongosorites- PR1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Spongosorites siliquaria	0.00%	1.14%	0.17%	0.07%	0.02%	0.00%	0.00%	0.00%	0.00%	0.05%	0.05%	0.00%	0.00%	0.02%	0.00%	0.00%	0.09%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.06%
Svenzea zeai	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.08%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Tethya crypta	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Verongula rigida	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Verongula sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.10%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%
Verongula-TER01	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Xestospongia muta	0.00%	0.03%	0.00%	0.00%	0.12%	0.07%	0.00%	0.00%	0.07%	0.08%	0.03%	0.20%	0.00%	0.02%	0.07%	0.03%	0.04%	2.09%	0.12%	0.00%	0.05%	0.00%	0.12%	0.00%	0.00%	0.00%	0.00%	0.24%	0.12%
Xestospongia sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Coral	0.00%	0.66%	0.12%	0.77%	0.73%	3.30%	0.05%	0.53%	0.70%	1.22%	1.91%	1.25%	1.03%	0.72%	2.64%	4.98%	1.29%	3.96%	0.25%	0.00%	0.07%	0.00%	1.67%	0.00%	0.00%	0.02%	0.00%	0.60%	1.02%
Agaricia fragilis	0.00%	0.00%	0.00%	0.00%	0.40%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.03%	0.00%	0.02%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%
Agaricia lamarcki/grahamae	0.00%	0.00%	0.00%	0.00%	0.02%	1.90%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.82%	0.90%	0.23%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.14%
Agaricia sp.	0.00%	0.02%	0.00%	0.05%	0.25%	0.95%	0.02%	0.02%	0.07%	0.08%	0.02%	0.13%	0.10%	0.05%	1.30%	3.06%	0.38%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.24%
Colpophyllia natans	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Leptoseris cucullata	0.00%	0.00%	0.00%	0.00%	0.03%	0.08%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	0.03%	0.00%	0.03%	0.05%	0.02%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
Madracis brueggemanni	0.00%	0.64%	0.12%	0.64%	0.00%	0.05%	0.03%	0.32%	0.54%	0.90%	1.71%	0.17%	0.32%	0.42%	0.08%	0.27%	0.39%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.24%
Madracis decactis	0.00%	0.00%	0.00%	0.02%	0.03%	0.27%	0.00%	0.15%	0.07%	0.17%	0.02%	0.77%	0.53%	0.23%	0.38%	0.59%	0.20%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.12%
Madracis formosa	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Manicina areolata	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Meandrina meandrites	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.05%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Millepora alcicornis	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.10%	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%
Montastraea cavernosa	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.07%	0.12%	0.00%	0.00%	0.00%	1.09%	0.00%	0.00%	0.00%	0.00%	0.33%	0.13%
Mycetophyllia aliciae	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.08%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Mycetophyllia sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Oculina diffusa	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Orbicella faveolata	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.22%	0.00%	0.00%	0.00%	0.00%	0.12%	0.00%	0.00%	0.00%	0.00%	0.03%	0.01%
Orbicella franksi	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Porites asteroides	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.07%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Scleractinia- unid colonial	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Scleractinia- unid solitary	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%
Scolymia sp.	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Siderastrea radians	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	0.00%	0.00%	0.02%	0.00%	0.12%	0.00%	0.00%	0.00%	0.00%	0.02%	0.01%
Siderastrea siderea	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.87%	0.10%	0.00%	0.00%	0.00%	0.10%	0.00%	0.00%	0.00%	0.00%	0.11%	0.04%
Solenastrea bournoni	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Stephanocoenia intersepta	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.25%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.01%
Stylasteridae	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.05%	0.02%	0.05%	0.17%	0.05%	0.00%	0.02%	0.00%	0.12%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%
Undaria agaricites	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.10%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Alcyonacea- gorgonian	0.00%	0.03%	0.02%	0.02%	0.00%	0.00%	0.00%	0.07%	0.39%	0.50%	1.31%	0.05%	0.00%	0.00%	0.00%	0.07%	0.15%	8.82%	1.27%	0.00%	0.92%	0.00%	8.07%	0.02%	0.00%	0.03%	0.23%	1.94%	0.84%
Alcyonacea- gorgonian	0.00%	0.00%	0.02%	0.02%	0.00%	0.00%	0.00%	0.03%	0.18%	0.25%	0.32%	0.03%	0.00%	0.00%	0.00%	0.03%	0.06%	0.00%	0.03%	0.00%	0.10%	0.00%	0.02%	0.00%	0.00%	0.02%	0.00%	0.02%	0.04%
Ellisella barbadensis	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ellisella sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	0.15%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
Ellisellidae	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.08%	0.00%	0.17%	0.02%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
Erythropodium caribaeorum	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.85%	0.03%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.19%	0.07%
Eunicea sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.22%	0.32%	0.00%	0.15%	0.00%	0.85%	0.00%	0.00%	0.00%	0.00%	0.15%	0.06%
Iciligorgia schrammi	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Leptogorgia sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Muricea sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.15%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.02%	0.01%
Muriceopsis sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.42%	0.00%	0.07%	0.00%	1.05%	0.00%	0.00%	0.00%	0.00%	0.15%	0.06%
Nicella goreaui	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.08%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Nicella sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.07%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Primnoidae	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.59%	0.00%	0.00%	0.00%	0.00%	0.00%	0.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%
Pseudoplexaura sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Pseudopterogorgia sp.	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	6.72%	0.27%	0.00%	0.40%	0.00%	6.10%	0.02%	0.00%	0.00%	0.00%	1.35%	0.52%
Pterogorgia anceps	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.15%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.01%
Pterogorgia citrina	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Swiftia exerta	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Telesto sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.05%	0.00%	0.00%	0.00%	0.00%	0.03%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.23%	0.03%	0.01%
Alcyonacea- Alcyoniina	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	0.03%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.01%

	Pulley Ridge																	Tortugas													
Phylum/Scientific Name	Block #23	Block #25	Block #28	Block #29	Block #30	Block #31	Block #32	Block #34	Block #35	Block #36	Block #37	Block #76	Block #77	Block #79	NR-Block #82	NR-Block #83	Pulley Ridge Total	Block #46	Block #61	Block #63	Block #66	Block #67	Block #68	Block #69	Block #70	Block #74	Block #75	Tortugas Total	Grand Total
Alcyonacea- Alcyoniina	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%
Chironephthya caribaea	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Antipatharia	0.00%	0.02%	0.00%	0.07%	0.23%	0.18%	0.00%	0.22%	0.25%	0.55%	0.62%	0.55%	0.52%	0.23%	0.27%	0.02%	0.23%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.14%
Antipatharia	0.00%	0.00%	0.00%	0.05%	0.13%	0.05%	0.00%	0.02%	0.05%	0.10%	0.08%	0.38%	0.07%	0.08%	0.00%	0.00%	0.06%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.04%
Antipathes atlantica	0.00%	0.02%	0.00%	0.02%	0.10%	0.10%	0.00%	0.17%	0.20%	0.27%	0.44%	0.08%	0.38%	0.10%	0.23%	0.02%	0.13%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.08%
Antipathes furcata	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.03%	0.00%	0.15%	0.08%	0.07%	0.03%	0.05%	0.03%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%
Stichopathes lutkeni	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.02%	0.03%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Tanacetipathes	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cnidaria non-coral	0.10%	0.22%	0.08%	0.03%	0.02%	0.08%	0.07%	0.25%	0.05%	0.43%	0.33%	0.15%	0.03%	0.07%	0.15%	0.03%	0.13%	0.02%	0.07%	0.00%	0.03%	0.00%	0.00%	0.02%	0.02%	0.40%	0.18%	0.07%	0.11%
Actinaria	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Condylactis gigantea	0.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Corallimorpharia	0.02%	0.08%	0.08%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.02%	0.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
Hydroidolina	0.02%	0.13%	0.00%	0.03%	0.02%	0.08%	0.03%	0.23%	0.05%	0.40%	0.23%	0.15%	0.03%	0.07%	0.15%	0.03%	0.10%	0.00%	0.07%	0.00%	0.03%	0.00%	0.00%	0.02%	0.02%	0.38%	0.15%	0.07%	0.09%
Hydroidolina- TER1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.02%	0.00%	0.00%
Palythoa caribaeorum	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Zoanthidea	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%
Annelida	0.00%	0.02%	0.00%	0.00%	0.03%	0.03%	0.03%	0.00%	0.00%	0.03%	0.00%	0.02%	0.03%	0.03%	0.05%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.32%	0.00%	0.00%	0.32%	0.02%	0.00%	0.04%
Annelida	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Filograna sp.	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.30%	0.00%	0.00%	0.32%	0.02%	0.00%	0.06%	0.03%
Hermodice carunculata	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.03%	0.03%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sabellidae	0.00%	0.02%	0.00%	0.00%	0.02%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Mollusca	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%
Bivalvia	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gastropoda	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%
Arthropoda	0.00%	0.03%	0.02%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.02%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%
Brachyura- crab	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%
Pyncogonida	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Stenorhynchus seticornis	0.00%	0.02%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bryozoa	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.02%	0.02%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%
Bryozoa	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.02%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%
Bryozoa- wh fan	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Schizoporella sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%
Echinodermata	0.42%	0.10%	0.10%	0.13%	0.10%	0.25%	0.10%	0.08%	0.05%	0.22%	0.10%	0.20%	0.08%	0.13%	0.37%	0.13%	0.16%	0.02%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.17%	0.20%	0.04%	0.11%
Analcidometra armata	0.00%	0.00%	0.00%	0.03%	0.07%	0.00%	0.00%	0.00%	0.00%	0.02%	0.02%	0.05%	0.03%	0.05%	0.02%	0.10%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
Asteroidea	0.00%	0.02%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Comatulida	0.02%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	0.18%	0.02%	0.01%
Davidaster discoideus	0.00%	0.05%	0.10%	0.10%	0.02%	0.25%	0.03%	0.08%	0.03%	0.20%	0.07%	0.15%	0.05%	0.07%	0.33%	0.03%	0.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.12%	0.00%	0.01%	0.06%
Echinoidea	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.01%	0.00%
Echinus sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Eucidaris tribuloides	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gorgonocephalus sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Narcissia trigonaria	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Stylocidaris affinis	0.37%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
Chordata	0.02%	0.03%	0.00%	0.00%	0.00%	0.02%	0.00%	0.02%	0.03%	0.05%	0.02%	0.05%	0.03%	0.00%	0.00%	0.02%	0.02%	0.02%	0.03%	0.02%	0.00%	0.12%	0.03%	0.00%	0.29%	0.40%	0.28%	0.12%	0.06%
Ascidiacea	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.02%	0.00%	0.05%	0.00%	0.00%	0.00%	0.02%	0.01%	0.00%	0.00%	0.02%	0.00%	0.12%	0.00%	0.00%	0.27%	0.37%	0.13%	0.09%	0.04%
Didemnidae	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.15%	0.02%	0.01%	
Eudistoma sp.	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Fish	0.02%	0.02%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.02%	0.03%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.01%	0.02%	0.03%	0.00%	0.00%	0.00%	0.03%	0.00%	0.02%	0.00%	0.00%	0.01%	0.01%
Unidentified Organism	0.00%	0.03%	0.02%	0.02%	0.07%	0.02%	0.00%	0.07%	0.03%	0.17%	0.07%	0.03%	0.02%	0.03%	0.00%	0.02%	0.04%	0.05%	0.12%	0.00%	0.07%	0.00%	0.02%	0.02%	0.02%	0.05%	0.05%	0.04%	0.04%
Natural detritus	0.03%	0.15%	0.13%	0.05%	0.00%	0.05%	0.02%	0.07%	0.00%	0.00%	0.05%	0.00%	0.00%	0.03%	0.07%	0.08%	0.05%	0.22%	6.86%	0.52%	5.40%	1.87%	8.67%	9.13%	13.02%	0.27%	0.15%	4.61%	1.80%
Human debris	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.12%	0.00%	0.00%	0.00%	0.01%	0.03%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.07%	0.10%	0.02%	0.01%
Human debris	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.12%	0.00%	0.00%	0.00%	0.01%	0.03%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.07%	0.10%	0.02%	0.01%
Fishing line/long line	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%
Human debris- Other	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.12%	0.00%	0.00%	0.00%	0.01%	0.03%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.10%	0.02%	0.01%
Substrate	76.11%	62.45%	53.50%	43.51%	46.37%	20.28%	77.88%	30.68%	32.99%	60.85%	38.11%	68.91%	31.79%	35.64%	19.95%	26.03%	45.31%	41.90%	80.09%	71.25%	86.50%	89.51%	59.57%	86.66%	79.02%	94.60%	95.86%	78.49%	58.07%
Bare hard bottom	36.41%	43.48%	49.58%	29.15%	46.22%	16.53%	56.45%	19.35%	21.73%	56.48%	21.69%	65.19%	21.85%	22.46%	16.45%	21.48%	34.03%	38.06%	4.16%	0.15%	8.47%	0.64%	20.33%	1.34%	1.19%	61.46%	61.47%	19.74%	28.54%
Bare dead coral plate	0.00%	0.02%	0.02%	0.05%	0.20%	0.67%	0.00%	0.00%	0.00%	0.03%	0.00%	0.05%	0.05%	0.00%	0.68%	0.47%	0.14%	0.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.09%
Bare rock	1.19%	0.08%	12.46%	13.97%	25.47%	12.09%	0.45%	10.37%	11.01%	1.20%	8.72%	13.15%	15.45%	15.01%	12.66%	16.32%	10.61%	29.16%	2.71%	0.03%	1.95%	0.15%	12.36%	0.02%	0.54%	20.38%	11.22%	7.86%	9.55%
Bare rubble/cobble	35.22%	43.38%	37.11%	15.13%	20.55%	3.77%	56.00%	8.98%	10.72%	55.25%	12.97%	51.98%	6.36%	7.45%	3.10%	4.70%	23.29%	8.84%	1.45%	0.12%	6.52%	0.49%	7.97%	1.32%	0.66%	41.09%	50.24%	11.87%	18.90%
Bare soft bottom	39.71%	18.96%	3.92%	14.36%	0.15%	3.75%	21.43%	11.34%	11.26%	4.36%	16.42%	3.72%	9.94%	13.19%	3.50%	4.55%	11.27%	3.84%	75.92%	71.10%	78.03%	88.88%	39.24%	85.32%	77.83%	33.13%	34.39%	58.75%	29.53%
Grand Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**

APPENDIX 2

Species List and Density of Fish Populations

Species list all of fish that were identified and counted from the quantitative video transects for each ROV dive during the 2014 R/V *Walton Smith* cruise to Pulley Ridge and Tortugas. The total distance (m) of each dive was used to calculate the linear density (# individuals/m) of each fish species. The estimated field of view width was ~5 m, and most fish were identified within a 5 m distance. So the densities listed in Appendix 2 could be divided by 5 to get an estimate of the number of fish m^{-2} (based on an average 5-m width field of view).
(Best viewed in PDF format in order to zoom view)

		Pulley Ridge																	Tortugas									
Scientific Name	Common Name	Block #23	Block #25	Block #27	Block #28	Block #29	Block #30	Block #31	Block #32	Block #34	Block #35	Block #36	Block #37	Block #76	Block #77	Block #79	Block #NR82	Block #NR83	Block #46	Block #61	Block #63	Block #66	Block #67	Block #68	Block #69	Block #70	Block #74	Block #75
Acanthostracion	Cowfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000
Acanthurus coeruleus	Blue Tang	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.012	0.000	0.000	0.000	0.000
Acanthurus sp.	Doctorfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.186	0.014	0.000	0.036	0.000	0.058	0.016	0.000	0.000	0.000
Aluterus schoepfi	Scrawled Filefish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000
Anisotremus virginicus	Porkfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Anthias tenuis	Threadnose bass	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Antiddae	unid antiide	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.030	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.630	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.206	0.000
Apogon affinis	Bigtooth Cardinalfish	0.000	0.000	0.700	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Apogon pseudomaculatus	Twospot Cardinalfish	0.002	0.000	0.000	0.004	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.004
Apogon sp.	Unid Cardinalfish	0.002	0.000	0.000	0.030	0.002	0.060	0.000	0.000	0.000	0.000	0.000	0.050	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Aulostomus maculatus	Trumpetfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Balistes vetula	Queen Triggerfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Balistidae	Unid Filefish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000
Bodianus pulchellus	Spotfin Hogfish	0.010	0.000	0.000	0.002	0.002	0.016	0.020	0.000	0.000	0.000	0.002	0.004	0.002	0.028	0.010	0.016	0.010	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.008
Bodianus rufus	Spanish Hogfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Bothidae	Unid Flounder	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.000	0.002	0.000	0.000	0.000	0.000	0.000
Calamus sp.	Calamus Porgy	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.016	0.002	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000
Canthigaster rostrata	Sharpnose Puffer	0.002	0.000	0.002	0.002	0.000	0.010	0.000	0.022	0.004	0.006	0.002	0.002	0.010	0.008	0.004	0.002	0.002	0.008	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.016	0.012
Carangidae	Unid Jack	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.000	0.000	0.000	0.000	0.088	0.000	0.030	0.000	0.000	0.000	0.000	0.018	0.000	0.000
Caranx ruber	Bar Jack	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Centropyge argi	Cherubfish	0.000	0.000	0.000	0.002	0.000	0.006	0.028	0.000	0.000	0.000	0.008	0.000	0.004	0.016	0.006	0.038	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000
Chaetodon aculeatus	Longsnout Butterflyfish	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Chaetodon capistratus	Foureye Butterflyfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.036	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.000
Chaetodon ocellatus	Spotfin Butterflyfish	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.018	0.004	0.000	0.008	0.000	0.006	0.000	0.000	0.000	0.000
Chaetodon sedentarius	Reef Butterflyfish	0.018	0.004	0.000	0.004	0.004	0.028	0.026	0.000	0.002	0.002	0.030	0.000	0.022	0.020	0.010	0.012	0.016	0.028	0.004	0.000	0.000	0.000	0.020	0.002	0.000	0.012	0.020
Chromis cyanea	Blue Chromis	0.002	0.000	0.000	0.000	0.000	0.006	0.006	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.020	0.004	5.454	0.288	0.000	0.000	0.000	0.526	0.000	0.000	0.000	0.000
Chromis enchrysurus	Yellowtail Reeffish	0.170	0.042	0.010	0.152	0.102	0.088	0.040	0.006	0.012	0.002	0.088	0.000	0.176	0.288	0.086	0.084	0.034	0.008	0.008	0.000	0.010	0.000	0.012	0.002	0.000	0.222	0.084
Chromis insolatus	Sunshinefish	0.000	0.036	0.000	0.012	0.034	0.046	0.076	0.000	0.000	0.002	0.090	0.002	0.044	0.130	0.018	0.052	0.018	0.040	0.002	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.036
Chromis scotti	Purple Reeffish	0.012	0.000	0.000	0.000	0.000	0.018	0.032	0.000	0.000	0.000	0.000	0.000	0.044	0.032	0.000	0.046	0.008	0.124	0.030	0.000	0.004	0.000	0.178	0.000	0.000	0.004	0.002
Chromis sp.	Unid Chromis	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.004	0.002	0.020	0.000	0.010	0.004	0.000	0.400	0.014	0.000	0.004	0.000	0.302	0.000	0.000	0.000	0.000
Decapterus sp.	Unid Scad	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.090	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.840	0.000	0.732	0.000	0.000	0.174	0.000	0.000
Decodon puellaris	Red Hogfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.020
Diplectrum bivittatum	Dwarf Sand Perch	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.038	0.004	0.000	0.000
Diplectrum formosum	Sand Perch	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Epinephelus cruentatus	Graysby	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.016	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.002	0.000
Epinephelus drummondhayi	Speckled Hind	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
Epinephelus guttatus	Rock Hind	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Epinephelus morio	Red Grouper	0.004	0.004	0.002	0.002	0.004	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000
Equetus lanceolatus	Jack-Knife Fish	0.022	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
Ginglymostoma cirratum	Nurse Shark	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gobiidae	Unid Goby	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.002	0.000	0.000	0.000	0.002	0.000	0.000
Gymnothorax moringa	Spotted Moray	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000
Haemulon plumieri	White Grunt	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.024	0.000	0.000	0.002	0.000	0.018	0.002	0.000	0.000	0.000
Haemulon sciurus	Bluestriped Grunt	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Haemulon sp.	Unid Grunt	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.042	0.004	0.000	0.000	0.000	0.400	0.000	0.000	0.000	0.000
Haemulon striatum	Striped Grunt	0.244	0.000	0.160	0.700	0.000	0.030	0.082	0.000	0.000	0.000	0.000	0.008	0.000	0.006	0.000	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.414	0.000	0.000	0.740	0.000
Haemulon vittata	Boga	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Halichoeres bathyphilus	Greenband Wrasse	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004
Halichoeres garnoti	Yellowhead Wrasse	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.088	0.002	0.000	0.004	0.000	0.066	0.016	0.000	0.000	0.000
Halichoeres sp.	Unid Wrasse	0.040	0.000	0.006	0.002	0.000	0.002	0.000	0.036	0.002	0.002	0.006	0.000	0.002	0.012	0.000	0.000	0.000	1.234	0.120	0.000	0.224	0.002	0.868	0.116	0.018	0.008	0.002
Hemanthias vivanus	Red Barbier	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hemipteronotus martinicensis	Rosy Razorfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.062	0.002	0.000	0.000
Hemipteronotus novacula	Pearly Razorfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.004	0.000	0.000
Hemipteronotus sp.	Unid Razorfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.000
Holacanthus bermudensis	Blue Angelfish	0.002	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.004	0.002	0.002	0.000	0.000	0.000	0.032	0.000	0.000	0.002	0.000	0.008	0.000	0.000	0.000	0.002
Holacanthus tricolor	Rock Beauty	0.000	0.000	0.000	0.002	0.000	0.008	0.018	0.000	0.000	0.000	0.000	0.000	0.010	0.014	0.010	0.026	0.010	0.046	0.002	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.006
Holanthias martinicensis	Roughtounge Bass	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.160	0.836
Holocentrus sp.	Unid Squirrelfish	0.016	0.000	0.000	0.016	0.006	0.036	0.014	0.002	0.002	0.000	0.002	0.000	0.020	0.022	0.002	0.004	0.004	0.052	0.004	0.000	0.000	0.000	0.006	0.000	0.000	0.030	0.008
Hypoplectrus unicolor	Barred Hamlet	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000
Hypoplectrus unicolor	Butter Hamlet	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.056	0.002	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.000
Hypoplectrus unicolor	Unid Hamlet	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.020	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000
Ioglossus calliurus	Blue Goby	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Kyphosus sp.	Chub	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lachnolaimus maximus	Hogfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.002	0.000	0.004	0.000	0.002	0.000	0.000	0.000	0.000
Lactophrys sp.	Cowfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Liopropoma eukrines	Wrasse Bass	0.000	0.002	0.000	0.002	0.000	0.036	0.012	0.000	0.006	0.000	0.004	0.002	0.020	0.012	0.010	0.014	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.012
Lutjanus analis	Mutton Snapper	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000
Lutjanus buccanella	Blackfin Snapper	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000
Lutjanus campechanus	Red Snapper	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lutjanus jocu	Schoolmaster	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lutjanus sp.	Unid Snapper	0.000	0.000	0.002	0.004	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.052	0.002	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.002
Malacanthus plumieri	Sandtile	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000
Mobula hypostoma	Devil Ray	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Monacanthus tuckeri	Slender Filefish	0.000	0.000	0.000	0.000	0.000	0.022	0.004	0.000	0.004	0.016	0.002	0.000	0.000	0.000	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Muraenidae	Moray eel	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mycteroperca bonaci	Black Grouper	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
Mycteroperca phenax	Scamp	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.004	0.002	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.010
Myripristis jacobus	Blackbar Soldierfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ocyurus chrysurus	Yellowtail Snapper	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.228	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pagrus pagrus	Red Porgy	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Plectranthias garrupellus	Apricot Bass	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000
Pomacanthus arcuatus	Gray Angelfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000
Pomacanthus paru	French Anglefish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pomacentrus leucostictus	Beaugregory	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.002	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000
Pomacentrus variabilis	Cocoa Damselfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Priacanthus arentatus	Bigeye	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.002	0.006
Pristigenys alta	Short Bigeye	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

		Pulley Ridge																Tortugas									
Scientific Name	Common Name	Block #23	Block #25	Block #27	Block #28	Block #29	Block #30	Block #31	Block #32	Block #34	Block #35	Block #36	Block #37	Block #76	Block #77	Block #79	Block #NR82	Block #NR83	Block #46	Block #61	Block #63	Block #66	Block #67	Block #68	Block #69	Block #70	Block #74	Block #75
Prognathodes aya	Bank Butterflyfish	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.012	0.000	0.002	0.000	0.008	0.004	0.006	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.018	0.020
Pseudupeneus maculatus	Spotted Goatfish	0.000	0.000	0.004	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.156	0.004	0.000	0.000	0.000	0.018	0.006	0.000	0.000	0.000
Pterois volitans	Lionfish	0.058	0.032	0.148	0.018	0.020	0.042	0.018	0.046	0.002	0.002	0.004	0.020	0.024	0.012	0.002	0.010	0.016	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.016	0.044
Remora remora	Remora	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rypticus saponaceus	Greater Soapfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Scaridae	Unid Parrotfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.172	0.006	0.000	0.000	0.000	0.016	0.000	0.000	0.000	0.000
Scarus coeruleus	Blue Parrotfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Scarus croicensis	Striped Parrotfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.050	0.006	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000
Scarus sp.	Striped or princess parrotfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.120	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Schultzea beta	School Bass	0.000	0.600	0.000	0.214	0.000	0.800	0.100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.202	0.290	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Scorpaenidae	Scorpionfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Seriola dumerili	Greater Amberjack	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
Seriola rivoliana	Almaco Jack	0.002	0.000	0.100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000
Seriola sp.	Unid Amberjack	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.020	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000
Serranus annularis	Orangeback Bass	0.002	0.000	0.000	0.004	0.000	0.024	0.006	0.000	0.008	0.018	0.024	0.000	0.016	0.008	0.012	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.008	0.006
Serranus baldwini	Lantern Bass	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000
Serranus chionaraia	Snow Bass	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Serranus notospilus	Saddle Bass	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.016
Serranus phoebe	Tattler	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.024	0.018
Serranus tortugarum	Chalk Bass	0.014	0.022	0.016	0.000	0.000	0.088	0.004	0.002	0.008	0.064	0.018	0.012	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.003	0.000	0.000	0.002	0.000	0.000	0.000	0.004
Sparisoma atomarium	Greenblotch Parrotfish	0.008	0.010	0.002	0.000	0.000	0.138	0.028	0.000	0.000	0.020	0.006	0.000	0.012	0.046	0.022	0.008	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
Sphyraena barracuda	Great Barracuda	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Stegastes partitus	Bicolor Damselfish	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.736	0.098	0.000	0.030	0.000	0.480	0.022	0.000	0.000	0.000
Synodus intermedius	Sand diver	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002
Synodus sp.	Unid Lizardfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000
Synodus synodus	Red Lizardfish	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Thalassoma bifasciatum	Blueheaded Wrasse	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.056	0.006	0.000	0.004	0.000	0.034	0.000	0.000	0.000	0.000
Trachinotus falcatus	Permit	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Unidentified Fish	0.052	0.002	0.018	0.002	0.062	0.114	0.004	0.038	0.002	0.006	0.000	0.000	0.008	0.300	0.556	0.002	0.032	7.586	0.600	0.117	0.004	0.000	0.812	0.006	0.006	1.564	0.002

APPENDIX 3

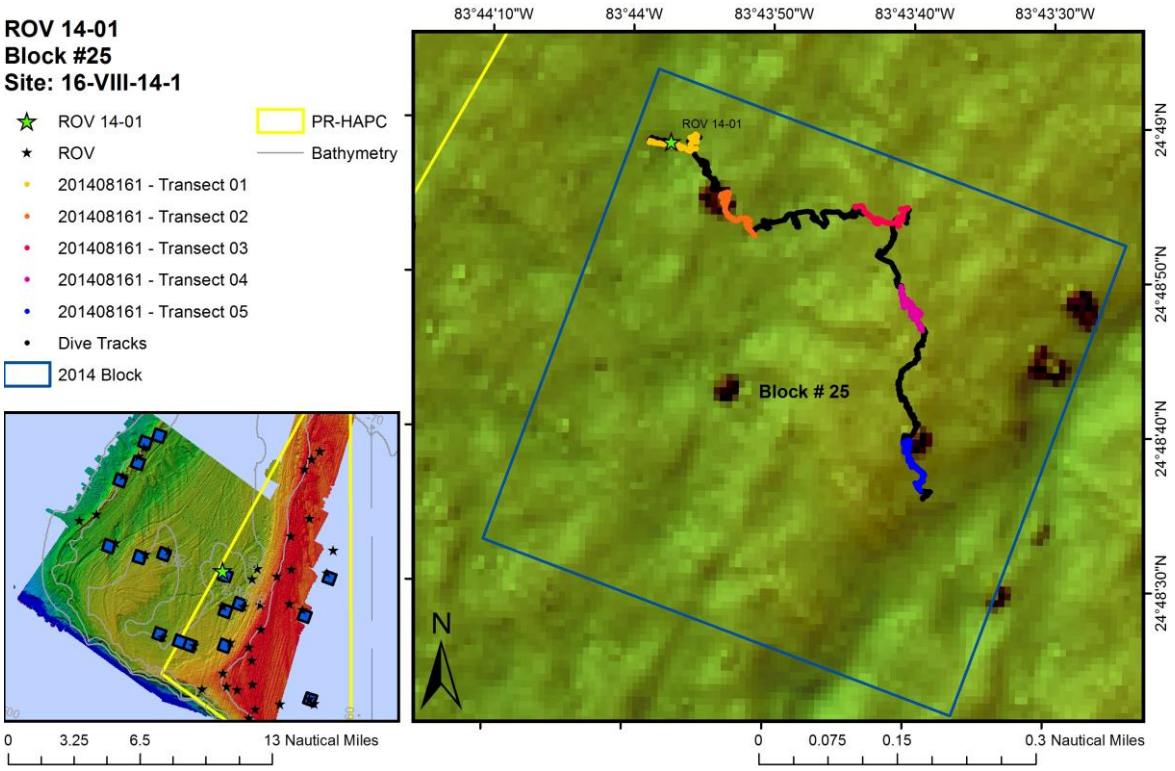
SEADESC II REPORT
Characterizations and Quantitative Analyses of Habitat, Benthic Biota, and Fish Populations

Provides the following data for each dive site during the 2014 R/V *Walton Smith* cruise to Pulley Ridge and Tortugas: ROV dive metadata, figure of ROV dive track and habitat zone overlaid on multibeam sonar maps, dive track data (start and end latitude, longitude, depth), objectives, detailed description of the habitat and biota for each ROV transect, and images of the biota and habitat that characterize the dive site.

SEADESC Report - R/V Walton Smith Cruise 14-12

Location: Pulley Ridge, Central Basin, Inside Pulley Ridge HAPC; Block 25; ROV 14-01, UNCW #80

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov
Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	2010_pulley_10m
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/16/2014
Specimens:	0
Digital Photos:	174
DVD:	3
Hard Drive:	1

Location: Pulley Ridge, Central Basin, Inside Pulley Ridge HAPC; Block 25; ROV 14-01, UNCW #80

Dive Data:

Minimum Bottom Depth (m):	78.0	**Total Transect Length (km):**	0.88
Maximum Bottom Depth (m):	80.0	**Surface Current (kn):**	0.2
On Bottom (Time- EDST):	9:55	**On Bottom (Lat/Long):**	24°48.9777'N 83°43.9551'W
Off Bottom (Time- EDST):	12:22	**Off Bottom (Lat/Long):**	24°48.5940'N 83°43.6447'W
Physical (bottom); Temp (°C):	19.6	**Salinity:** N/A	**Visibility (ft):** 25 m **Current (kn):** N/A

Dive Imagery:

Figure 1: *Bubaris* sp. sponge and crustose coralline algae on flat hardbottom.

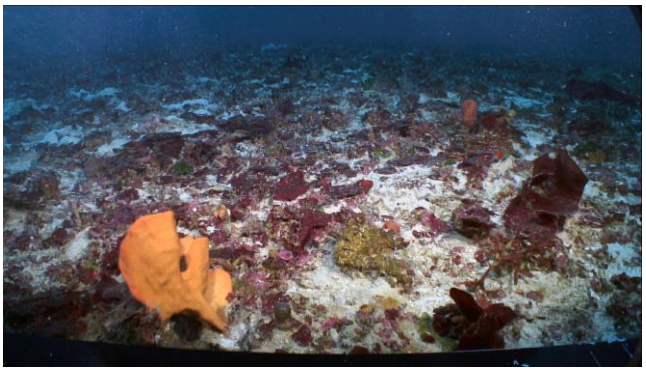


Figure 2: Fan Axinellidae sponge on typical Pulley Ridge habitat

Dive Notes:

Site/Objectives:

ROV 14-01, Site #- 16-VIII-14-1, UNCW Dive #80. Target Site -Pulley Ridge, Off Ridge, West Base, Block 25. Ground truth: NOAA Regional Bathymetric Chart: 2010_pulley_10m.tif, Live GPS Log- 201408161.shp; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set to fixed 1/125S, F-8, and Auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Both cameras had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT. **The HD Video is 1-2 minutes behind the site notes, the SD video is spot on.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~ 30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were

Location: Pulley Ridge, Central Basin, Inside Pulley Ridge HAPC; Block 25; ROV 14-01, UNCW #80

determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Site Description/Habitat/Biota:
The NOAA Bathy chart shows 80 m bathy lines circling the Block 25.
Five transects were conducted in Block 25, starting at NW corner and headed SSE. The five transects ranged from 78 - 80 m depth.

XS 1: HD SE: Start: 10:00:49 AM, 80 m; end: 10:13:24 AM PM, 80 m. 50 % cover of rubble/cobble, 0° slope, low relief, low rugosity; biota was dominated by red algae, primarily Peysonnellia, crustose corallines, and large red blade algae (*Halymenia?* Sp.); Chlorophyta- Verdigellas, sparse Anadyomene; sponges- large 50-75 cm diameter grey cake sponges (Spongosorites siliquaria), Cinachyrella, yellow creeping branching (Amphimedon sp.), and some axinellids; comatulid crinoiids (Davidaster sp.). No gorgonians, no antipatharians and very few fish.
Off Transect: HD SE for 15 min. Appears to be a 75 m wide mound on MB- ground truthed showed it to be MB artifact. Rubble/cobble, 0° slope, low relief, low rugosity.

XS 2: HD SE: Start: 10:27:23 AM, 80 m; end: 10:41:12 AM PM, 80 m. Similar to XS 1.
Off Transect: HD E for 15 min. Rubble/cobble, 0° slope, low relief, low rugosity.

XS 3: HD E: Start: 10:59:24 AM, 79.3 m; end: 11:10:46 AM, 78.7 m. Similar to XS 1.
Off Transect: HD S for 15 min. Rubble/cobble, 0° slope, low relief, low rugosity.

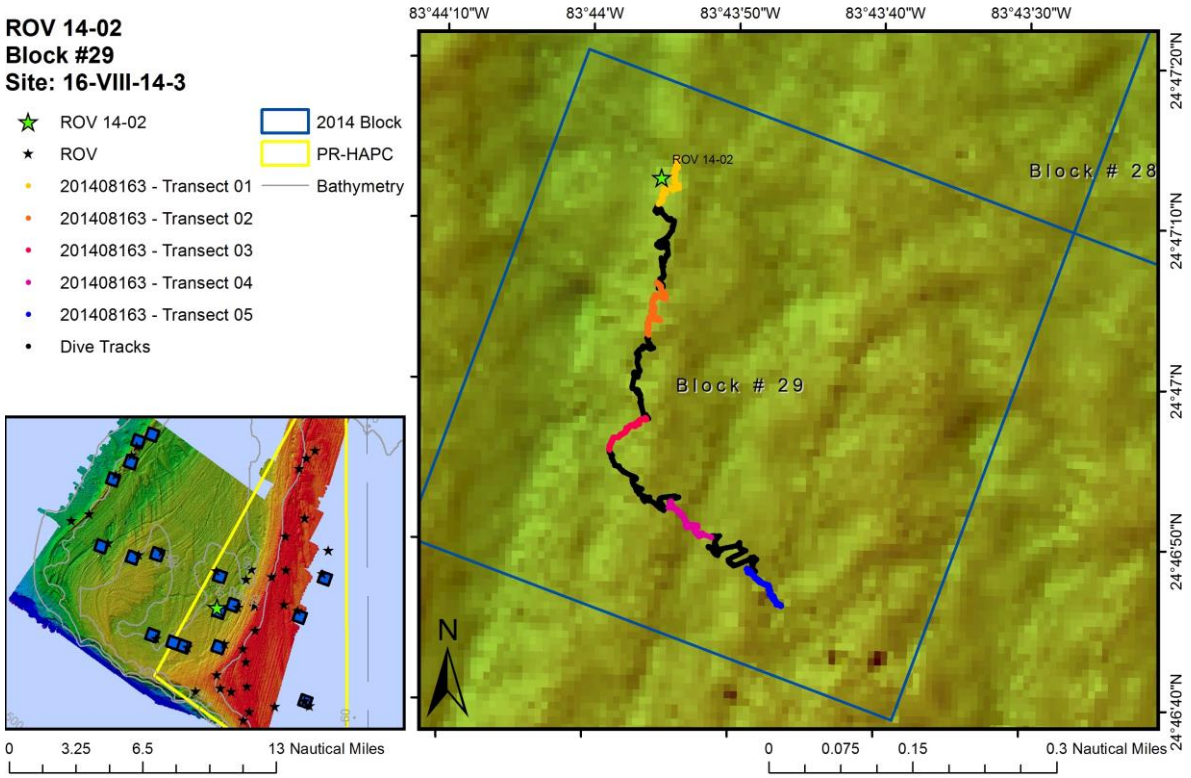
XS 4: HD S: Start: 11:26:30 AM, 78.4 m; (pause mid XS because of a grouper pit- 11:34:58 to 11:37:59) end: 11:42:59 AM, 78 m. Similar as previous xs except for grouper pit. Two ~50 cm red grouper with double pit and lots of small reef fish and ~12 lionfish.
Off Transect: HD S for 15 min. Rubble/cobble, 0° slope, low relief, low rugosity. Came across grouper pit with 50 cm red grouper at 11:56:48 AM; with reef fish and 4-5 lionfish.

XS 5: HD X: Start: 12:04:58 PM, 78 m; end: 12:20:29 PM, 78m. Similar as previous xs.
Off Transect: Ran a photo test at 1.3 m off bottom running .25 kts without stopping to see if images would be clear; images to be removed from CPCe.

Dominant Fish: 15 lionfish, 3 red groupers around burrows, small reef fish.

Location: Pulley Ridge, Central Basin, Inside Pulley Ridge HAPC; Block #29; ROV 14-02, UNCW #81

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov
Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	2010_pulley_10m
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/16/2014
Specimens:	0
Digital Photos:	191
DVD:	2
Hard Drive:	1

Location: Pulley Ridge, Central Basin, Inside Pulley Ridge HAPC; Block #29; ROV 14-02, UNCW #81

Dive Data:

Minimum Bottom Depth (m):	78.0	**Total Transect Length (km):**	0.89
Maximum Bottom Depth (m):	82.0	**Surface Current (kn):**	0.1
On Bottom (Time- EDST):	15:16	**On Bottom (Lat/Long):**	24°47.2328'N 83°43.8974'W
Off Bottom (Time- EDST):	17:11	**Off Bottom (Lat/Long):**	24°46.7682'N 83°43.7652'W
Physical (bottom); Temp (°C):	19.6	**Salinity:** N/A	**Visibility (ft):** **Current (kn):** N/A

Dive Imagery:

Figure 1: *Davidaster discoideus* crinoid on crustose coralline dominated rock

Figure 2: Close up of *Madracis* sp.

Dive Notes:

Site/Objectives:

ROV 14-02, Site #- 16-VIII-14-3, UNCW Dive #81. Target Site -Pulley Ridge, Off Ridge, West Base, Block 29. Ground truth: NOAA Regional Bathymetric Chart: 2010_pulley_10m.tif and Naar_PulleyRidge_Main_Grid, Live GPS Log- 201408163.shp; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set to fixed 1/125S, F-8, and Auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Both cameras had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT. **The HD Video is 1-2 minutes behind the site notes, the SD video is spot on.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~ 30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were

Location: Pulley Ridge, Central Basin, Inside Pulley Ridge HAPC; Block #29; ROV 14-02, UNCW #81

determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Site Description/Habitat/Biota:
The Naar_PulleyRidge_Main_Grid shows slight dips and slopes within Block 29. This MB only partially covers both blocks.
Five transects were conducted in Block 29, starting at NW corner and headed SSE. The five transects ranged from 78 to 82 m depth.

XS 1: HD S: Start: 3:16:19 PM, 82.7 m; end: 3:29:22 PM, 82 m. Low relief, 0° slope, 30-50% of rock rubble and cobble, low rugosity; biota was dominated by crustose coralline algae (most of the bottom - very frilly edges, plate like- looks like A. fragilis from a distance). Dominant biota- crustose coralline algae- pink frilly, Peyssonnelia sp., Halimeda, Verdegellus, Anadyomene menziesii- sparse, Halymenia sp; Davidaster discoideus; few sighting of Madracis aurentenra. No sponges, black corals, or gorgonians and no fish.
Off Transect: HD S for 10 min. Found 1 1.5 m unoccupied grouper pit, and 1 larger pit with red grouper, reeffish, and 3 lionfish. Low relief, 0° slope, 80% of rock rubble and more pavement and cobble, low rugosity, increase in Halimeda and sponges- X. Muta and orange CB Amphimedon.

XS 2: HD S: Start: 3:44:01 PM, 80.3 m; end: 3:57:40 PM, 80 m. Low relief, 0° slope, 80% of rock rubble and more pavement and cobble, low rugosity. Came across a red grouper in pit with 2 lionfish; paused XS 3:51:11 to 3:52:25. Similar habitat and biota as previous xs.
Off Transect: HD S for 15 min. 80% of rock rubble and more pavement and cobble, low rugosity

XS 3: HD S/SW: Start: 4:00:00 PM, 81.3 m; end: 4:21:26 PM, 80.3 m. 80% HB with CCA pavement, cobble/rubble. Similar to XS 2. 1 red grouper in pit, reeffish, and 6 lionfish at 4:16:16 PM. Madracis aurentenra.
Off Transect: HD SE for 10 min. 3 sightings of A. lamarcki/grahamae (30-100 cm diam)- healthy, brown.

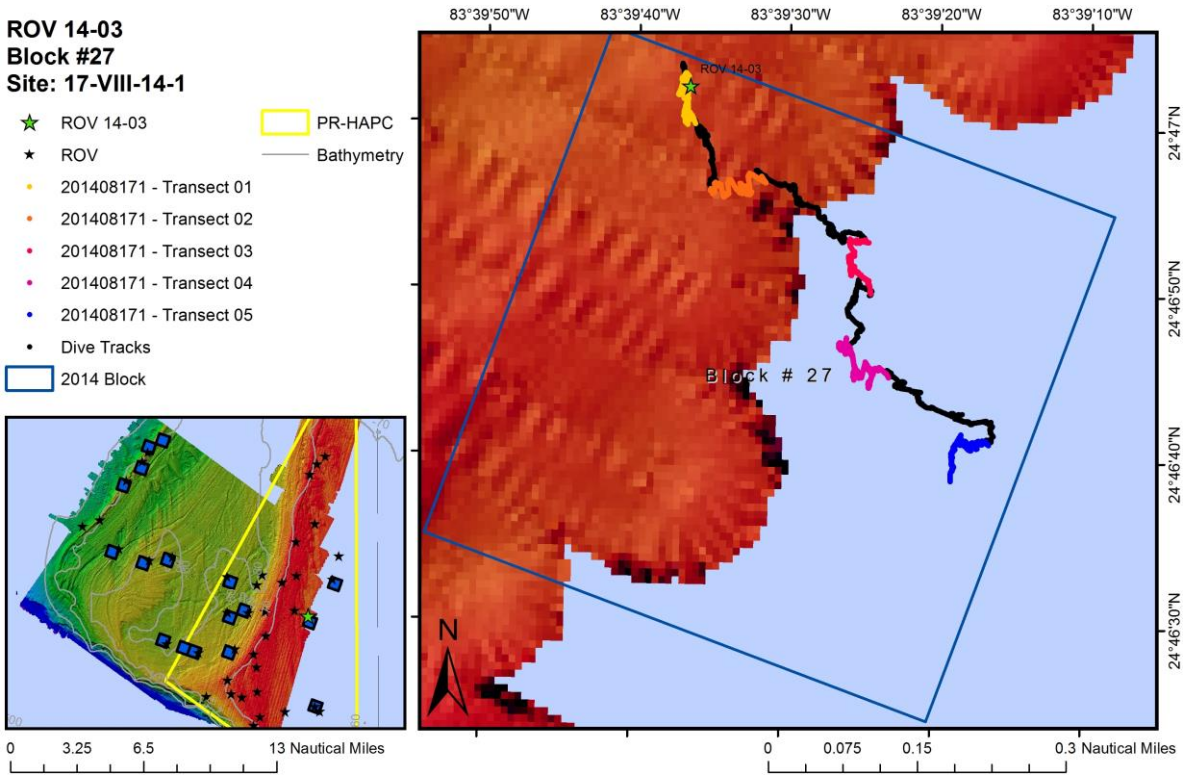
XS 4: HD SE: Start: 4:32:58 PM, 79.2 m; end: 4:46:37 PM, 78.8 m. 50% cover rubble cobble and CCA plates, Low relief, 0° slope, low rugosity. Similar biota as previous transect; but A. menziesii becomes common. Zoom in on two Oculina diffusa.
Off Transect: HD E for 15 min. Same bottom, Antipathes mesh fans become common.

XS 5: HD SE: Start: 4:55:40 PM,78.8 m; end: 5:11:34 PM, 78.6 m. 80% cover rubble cobble and CCA plates, low relief, 0° slope, low rugosity. Analcidometra armata on Antipatharia- white fan are common; one A. lamarcki/grahamae sighted- purposeful images taken; some Xestospongia muta, small.

Dominant Fish: No fish except in red grouper pits- yellowtail reeffish, cardinalfish, lionfish, squirrelfish, others.

Location: Pulley Ridge, Off Main Ridge, Inside Pulley Ridge HAPC; Block 27; ROV 14-03, UNCW #82

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov
Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	2010_pulley_10m
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/17/2014
Specimens:	0
Digital Photos:	213
DVD:	3
Hard Drive:	1

Location: Pulley Ridge, Off Main Ridge, Inside Pulley Ridge HAPC; Block 27; ROV 14-03, UNCW #82

Dive Data:

Minimum Bottom Depth (m):	68.5	**Total Transect Length (km):**	0.91
Maximum Bottom Depth (m):	70.3	**Surface Current (kn):**	0.4
On Bottom (Time- EDST):	11:00	**On Bottom (Lat/Long):**	24°47.0437'N 83°39.6114'W
Off Bottom (Time- EDST):	13:39	**Off Bottom (Lat/Long):**	24°46.6388'N 83°39.3099'W
Physical (bottom); Temp (°C):	21.3	**Salinity:** N/A	**Visibility (ft):** **Current (kn):** N/A

Dive Imagery:

Figure 1: At least 55 lionfish were counted around this red grouper's outcrop.

Figure 2: A field of *Echinus* sp. on a typical soft bottom habitat

Dive Notes:

Site/Objectives:

ROV 14-03, Site #- 17-VIII-14-1, UNCW Dive #82. Target Site -Pulley Ridge, Off Ridge, East Base, Block 27. Ground truth: NOAA Bathy Chart: NOAA_Bathy_Chart_Tortugas_Bank, 2010_pulley_10m.tif, Naar_PulleyRidge_Main_Grid, Live GPS Log- 201408171.shp; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set to fixed 1/200 S, F-8, ISO 100 and Auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Both cameras had a pair of parallel 10 cm green lasers for scale. There was an additional triple laser on the video; 10 cm parallel lasers with a cross laser that crosses the left laser at 5 m distance, and 10 m for the right laser. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~

Location: Pulley Ridge, Off Main Ridge, Inside Pulley Ridge HAPC; Block 27;
ROV 14-03, UNCW #82

30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Site Description/Habitat/Biota:
The Naar_PulleyRidge_Main_Grid shows a small mound just outside the SW corner of Block 27, the NOAA bathy chart shows no features.
Five transects were conducted in Block 27, starting at NW corner and headed S/SE. The five transects ranged from 68.5 m to 70.3 m depth.

XS 1: HD S: Start: 11:04:35 AM, 70.3 m; end: 11:33:00 AM, 69.5 m. 100% soft bottom with 50-80% of green algae, bioturbated with 10 cm mounds and Meoma seabiscuit trails in the sediment; biota was dominated by Halimeda sp. (H. copiosa), Kallymenia sp., Ulva sp., sparse Caulerpa sertularioudes, some Corallimorpharia. No sponges, gorgonians, antipatharia. Virtually no fish on the flats except in red grouper pits.
Off Transect: Sat still and ran a photo speed test, HD SE for 15 min. Similar habitat.

XS 2: HD SE: Start: 11:53:05 AM, 69.3 m; end: 12:08:27 PM, 69 m. Similar to XS 1.
Off Transect: HD E for 15 min. Similar habitat.

XS 3: HD S: Start: 12:23:53 PM,68.5m; end: 12:38:27 PM 70 m. Similar to XS 1. School of almaco amberjack following ROV for most of rest of dive.
Off Transect: HD SW for 10 min. Similar habitat.

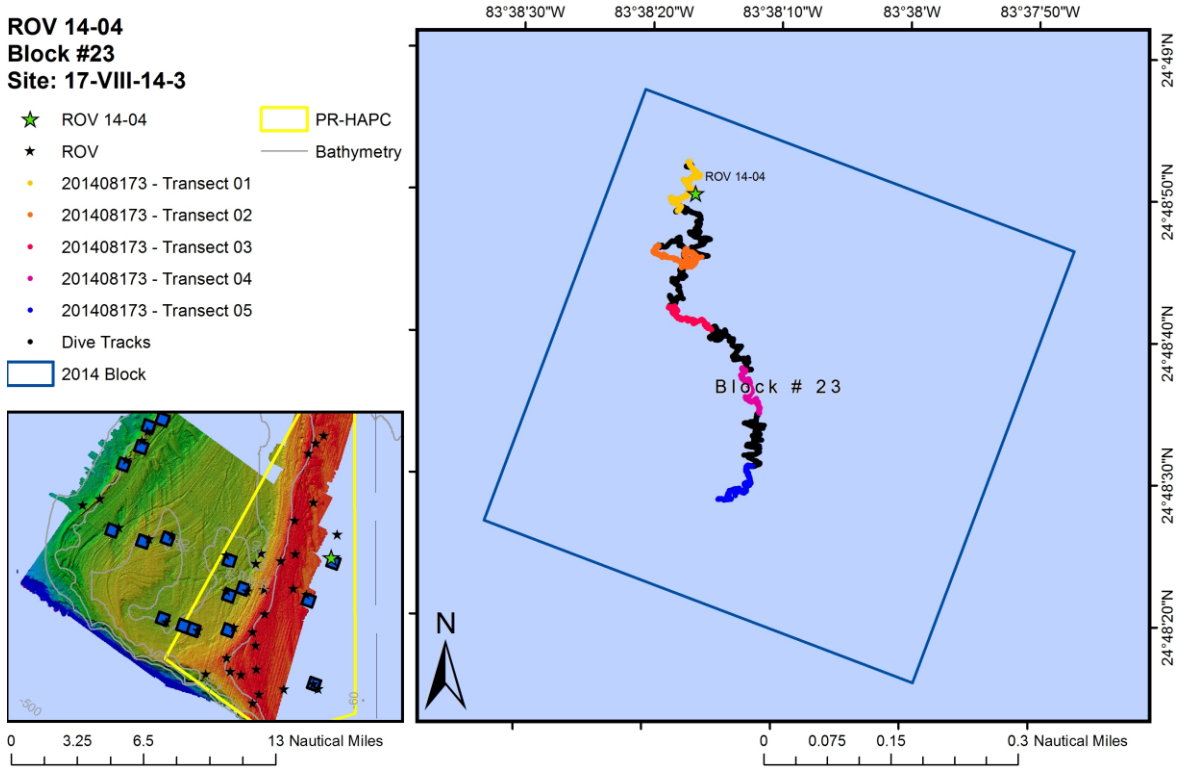
XS 4: HD S: Start: 12:49:51 PM, 69 m; end: 1:10:04 PM, 69 m. 100% SB, 50% cover of algae. Bioturbated with 10-15 cm mounds. Came across 65+ lionfish in a red grouper pit with the grouper.
Off Transect: HD E for 15 min. Similar habitat.

XS 5: HD SW: Start: 1:26:16 PM, 68.5 m; end: 1:39:54 PM, 68.8 m. 100 soft bottom, flat, 30-50% cover algae, primarily Halimeda, Kallymenia; bioterbation with 10 cm mounds. School of almaco jacks following ROV.

Dominant Fish: came across 65 lionfish and one grouper in a single pit during XS 4 at 12:57.

Location: Pulley Ridge, Off Main Ridge, Inside Pulley Ridge HAPC; Block 23; ROV 14-04, UNCW #83

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov
Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	2010_pulley_10m
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/17/2014
Specimens:	0
Digital Photos:	182
DVD:	2
Hard Drive:	1

Location: Pulley Ridge, Off Main Ridge, Inside Pulley Ridge HAPC; Block 23; ROV 14-04, UNCW #83

Dive Data:

Minimum Bottom Depth (m):	67.3	**Total Transect Length (km):**	0.73
Maximum Bottom Depth (m):	69.4	**Surface Current (kn):**	0.4
On Bottom (Time- EDST):	16:05	**On Bottom (Lat/Long):**	24°48.8649'N 83°38.2810'W
Off Bottom (Time- EDST):	18:02	**Off Bottom (Lat/Long):**	24°48.4763'N 83°38.2353'W

Physical (bottom); Temp (°C): 21.3 **Salinity:** N/A **Visibility (ft):** 25m **Current (kn):** N/A

Dive Imagery:

Figure 1: Grouper pit with reeffish and lone lionfish

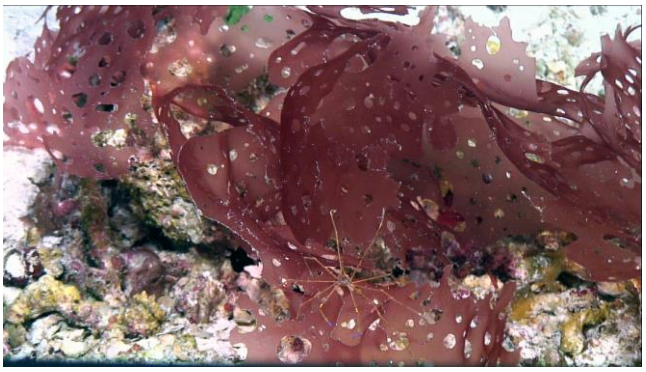


Figure 2: *Kallymenia* alga and *Stenorhynchus* arrow crab on rubble bottom

Dive Notes:

Site/Objectives:

ROV 14-04, Site #- 17-VIII-14-3, UNCW Dive #83. Target Site - Pulley Ridge, Off Ridge, East Base, Block 23. Ground truth: No Availble bathymetry data; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set to fixed 1/125S, F-8, and Auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Both cameras had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~ 30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Location: Pulley Ridge, Off Main Ridge, Inside Pulley Ridge HAPC; Block 23;
ROV 14-04, UNCW #83

Site Description/Habitat/Biota:
No Availible Bathymetry Data for Block 23.
Five transects were conducted in Block 23, starting at NW corner and headed S/SE. The five transects ranged from 69.4 to 67.3 m depth.

XS 1: HD S: Start: 4:07:58 PM, 69.4 m; end: 4:28:21 PM, 68. m. 100% soft bottom with ~30% cover of algae; biota was dominated by Kallymenia sp., fleshy red blades algae, Ulva sp., Eucidaris tribuloides, sighted 1st gorgonian- Bebryce sp. No Halimeda, no sponges, and no fish except in grouper pits. (Lasers in down shots were turned on at 4:15), came across Grouper pit with 3 lionfish at 4:16.
Off Transect: HD SE for 15 min. Soft bottom, dense Martensia sp. patches with few sponges, Ircinia campana, Erylus; Davidaster.

XS 2: HD SE: Start: 4:38:53 PM, 68 m; end: 4:52:19 PM, 68 m. 100% SB with 30% algae, Rhodophyta blades, Martensia sp., patches of Cyanobacteria; bioturbation with sea biscuit tracks, probably from Meoma sp. Came across grouper pit, no grouper present, but 16 lionfish.
Off Transect: HD SE for 10 min. Came across same pit as earlier.

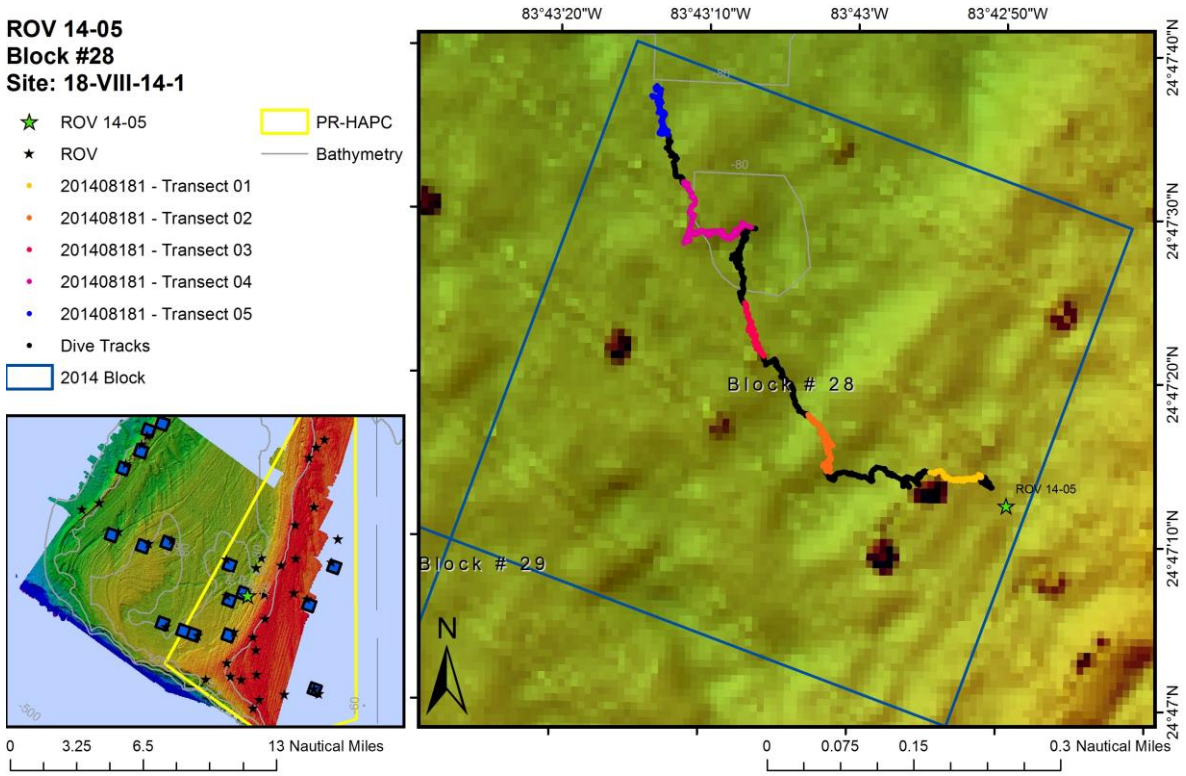
XS 3: HD SE: Start: 5:07:03 PM, 68 m; end: 5:16:10 PM, 68m. 100% sediment, 20% cover of algae (*Martensia pavonia* & Cyanobacteria).
Off Transect: HD SE for 10 min. <10 % cover of algae --> increase in *Martensia*

XS 4: HD SE: Start: 5:28:11 PM, 67.7 m; end: 5:39:10 PM, 67.5 m. Similar to XS 3.
Off Transect: HD S for 10 min. Similar habitat.

XS 5: HD : Start: 5:50:35 PM, 67.5 m; end: 6:02:40 PM, 67.3 m. 100% soft bottom, 30% cover of algae, mostly *Martensia*, bioturbation, 10 cm mounds; decrease in algal cover to about 10% with more bioturbation. Came across grouper pit with red grouper present and no lionfish for the first time.

Location: Pulley Ridge, Central Basin, Inside Pulley Ridge HAPC; Block 28; ROV 14-05, UNCW #84

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov
Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	2010_pulley_10m
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/18/2014
Specimens:	0
Digital Photos:	209
DVD:	2
Hard Drive:	1

Location: Pulley Ridge, Central Basin, Inside Pulley Ridge HAPC; Block 28; ROV 14-05, UNCW #84

Dive Data:

Minimum Bottom Depth (m):	79.0	**Total Transect Length (km):**	0.97
Maximum Bottom Depth (m):	80.5	**Surface Current (kn):**	0.3
On Bottom (Time- EDST):	9:56	**On Bottom (Lat/Long):**	24°47.2264'N 83°42.8366'W
Off Bottom (Time- EDST):	11:52	**Off Bottom (Lat/Long):**	24°47.6359'N 83°43.1980'W
Physical (bottom); Temp (°C):	19.6	**Salinity:** N/A	**Visibility (ft):** 50 **Current (kn):** N/A

Dive Imagery:

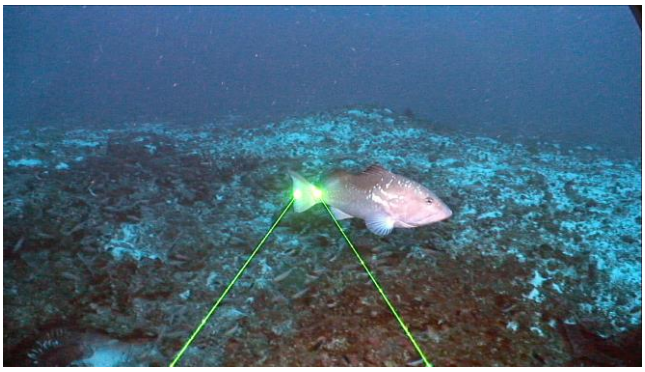


Figure 1: A red grouper swims above grouper pit (10 cm lasers).

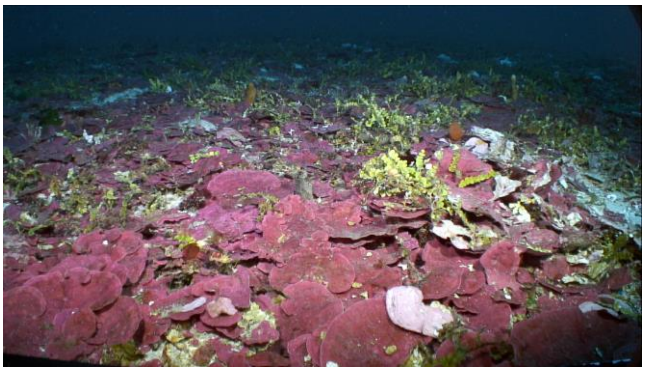


Figure 2: Typical peyssonnelioid and *Halimeda* covered hard bottom

Dive Notes:

Site/Objectives:

ROV 14-05, Site #- 18-VIII-14-1, UNCW Dive #84. Target Site -Pulley Ridge, Off Ridge, West Base, Block 28. Ground truth: 2010_pulley_10m.tif and Naar_PulleyRidge_Main_Grid, Live GPS Log- 201408181.shp; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set digital still camera to Tv Mode, fixed S1/125, with auto F-Stop, ISO 100, auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Both cameras had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~ 30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were

Location: Pulley Ridge, Central Basin, Inside Pulley Ridge HAPC; Block 28; ROV 14-05, UNCW #84

determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Site Description/Habitat/Biota:
Multibeam and geotiff shows NE/SW rippled bottom with 0.1m relief and within the 80 m bathy line in the middle of Block 28.
Five transects were conducted in Block 28, starting at E edge and headed NW. The five transects ranged from 79 to 80.5 m depth.

Off Transect: Ran photo test- see dive notes: Tv fixed S125, S250, and Auto mode.
XS 1: HD W: Start: 10:03:37 AM, 78.5 m; end: 10:14:12 AM, 79 m. 90% pavement/rubble, 10-15 cm cobble, Flat , Low Rugosity; biota was dominated by CCA, Peyssonnelia, Verdigellas, Stichopathes, red blade Rhodophyta, white fan Antipathes, sparse Anadyomene, sparse Xestospongia muta, 1-red grouper.
Off Transect: HD W for 15 min. Same bottom, increase in Axinellid sponges and A. menziesii, and Analcidometra armata common -->increase in Halimeda sp., halimeda hash, and sediment.

XS 2: HD N: Start: 10:30:33 AM, 80 m; end: 10:40:20 AM, 80 m. Similar to XS 1, 80% cover CCA pink frilly, and red blades, Halimeda sp. Dense, Amphiimedon yellow creeping branching.
Off Transect: HD NW for 15 min. Ranges between Rubble/CCA bottom and ediment rubble bottom

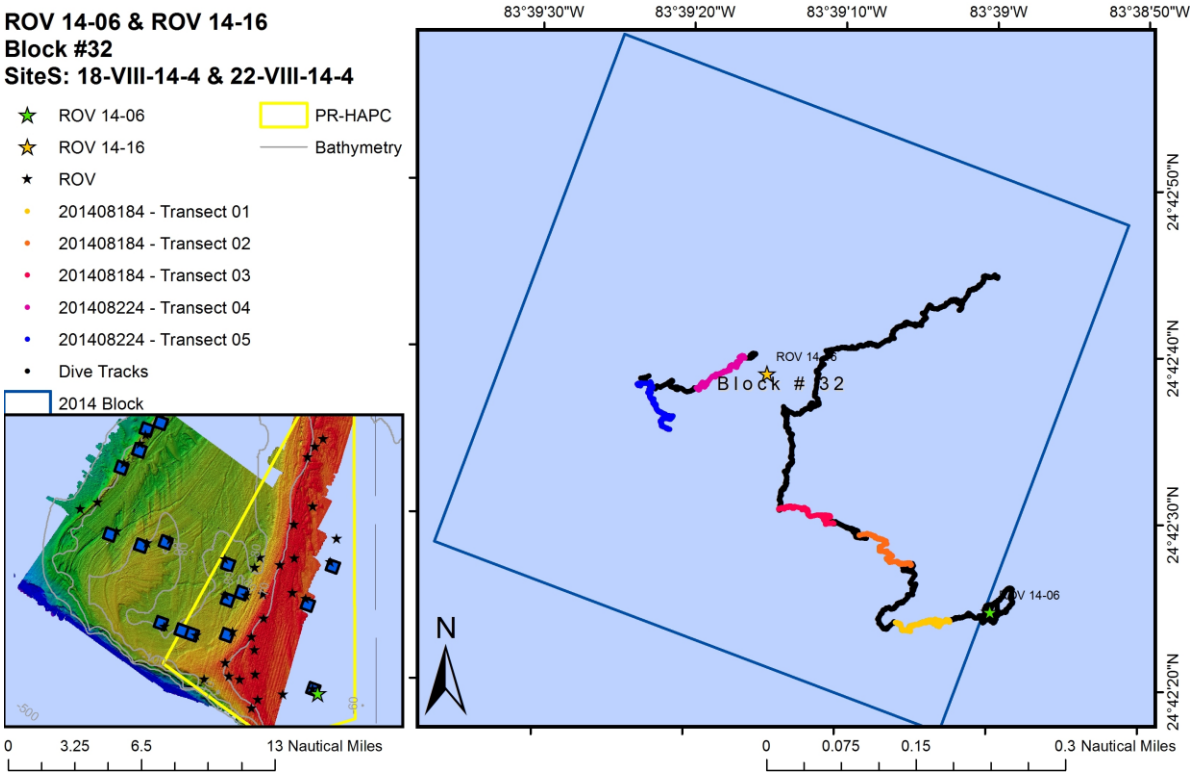
XS 3: HD N: Start: 10:49:37 AM, 79.8 m; end: 11:01:16 AM, 80 m. Similar to XS 2.
Off Transect: HD N for 10 min. Similar habitat.

XS 4: HD W: Start: 11:11:13 AM, 80.3m; end: 11:28:22 AM, 80 m. 50% rubble/cobble, and 50% sediment patchy CCA, and large Rhodophyta. One 0.5 m deep grouper pit at 11:12; 1 red grouper, dense stripped grunt, 5 lionfish.
Off Transect: HD NW for 10 min. Similar habitat.

XS 5: HD N : Start: 11:42:58 AM, 80.5 m; end: 11:52:58 AM, 80.5m. Similar to XS 4.

Location: Pulley Ridge, Off Main Ridge, Inside Pulley Ridge HAPC; Block 32; ROV 14-06, UNCW #85

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov
Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	2010_pulley_10m
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/18/2014
Specimens:	0
Digital Photos:	144
DVD:	2
Hard Drive:	1

Location: Pulley Ridge, Off Main Ridge, Inside Pulley Ridge HAPC; Block 32; ROV 14-06, UNCW #85

Dive Data:

Minimum Bottom Depth (m):	64.7	**Total Transect Length (km):**	0.62
Maximum Bottom Depth (m):	65.5	**Surface Current (kn):**	0.10
On Bottom (Time- EDST):	15:52	**On Bottom (Lat/Long):**	24°42.4060'N 83°38.9841'W
Off Bottom (Time- EDST):	17:43	**Off Bottom (Lat/Long):**	24°42.7423'N 83°38.9816'W
Physical (bottom); Temp (°C):	20.7	**Salinity:** N/A	**Visibility (ft):** **Current (kn):** N/A

Dive Imagery:

Figure 1: Conglomerate of reefish surround a grouper pit.

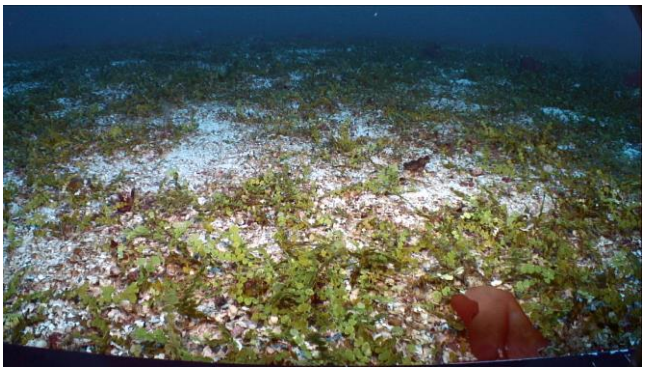


Figure 2: Field of *Halimeda* on soft bottom.

Dive Notes:

Site/Objectives:

ROV 14-06, Site #-18-VIII-14-4, UNCW Dive #85. Target Site -Pulley Ridge, Off Ridge, East Base, Block 32. Ground truth: NOAA Regional Bathymetric Chart; live GPS Log- 201408184.shp; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set digital still camera to Tv Mode, fixed S1/125, with auto F-Stop, ISO 100, auto focus.Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Both cameras had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT. Only three transects were conducted Ship steering failed and had to abort dive. The salinity sensor on the ship is reading 32 at the surface. ISIS CTD on 8/22 confirmed that surface water had dropped salitinity to 32 down to 5 m depth.

Only three of the five 100-m random transects were completed to characterize each randomly selected 1 km x 1 km block. Transects 4 and 5 of Block 32 were copleted during dive ROV 14-16. Each 100 m transect was

Location: Pulley Ridge, Off Main Ridge, Inside Pulley Ridge HAPC; Block 32;
ROV 14-06, UNCW #85

conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Site Description/Habitat/Biota:
The NOAA Bathy chart shows 66 m bathy lines passing through Block 32. No multibeam available.
Three transects were conducted in Block 32 starting at SE corner and headed N-NW. The three transects ranged from 64.7 m to 65.5 m depth. Dive was cut short because of ship steering malfunction.

XS 1: HD W: Start: 4:08:51 PM, 65.5 m; end: 4:21:12 PM, 65.2m. 100 % soft sediment, halimeda hash; abundant Eucidaris tribuloides. Dense bioturbation with 10 m mounds and seabiscuit tracks (Meoma sp.). Dense Halimeda sp.; Kallymenia sp., Cyanobacteria, Caulerpa sertulariodes
Off Transect: HD NW for 10 min. Same bottom. Ircinia strobilina rare, grouper pit with porgy, 1 red grouper, lionfish; pit with 3 triggerfish, eels, barracuda.

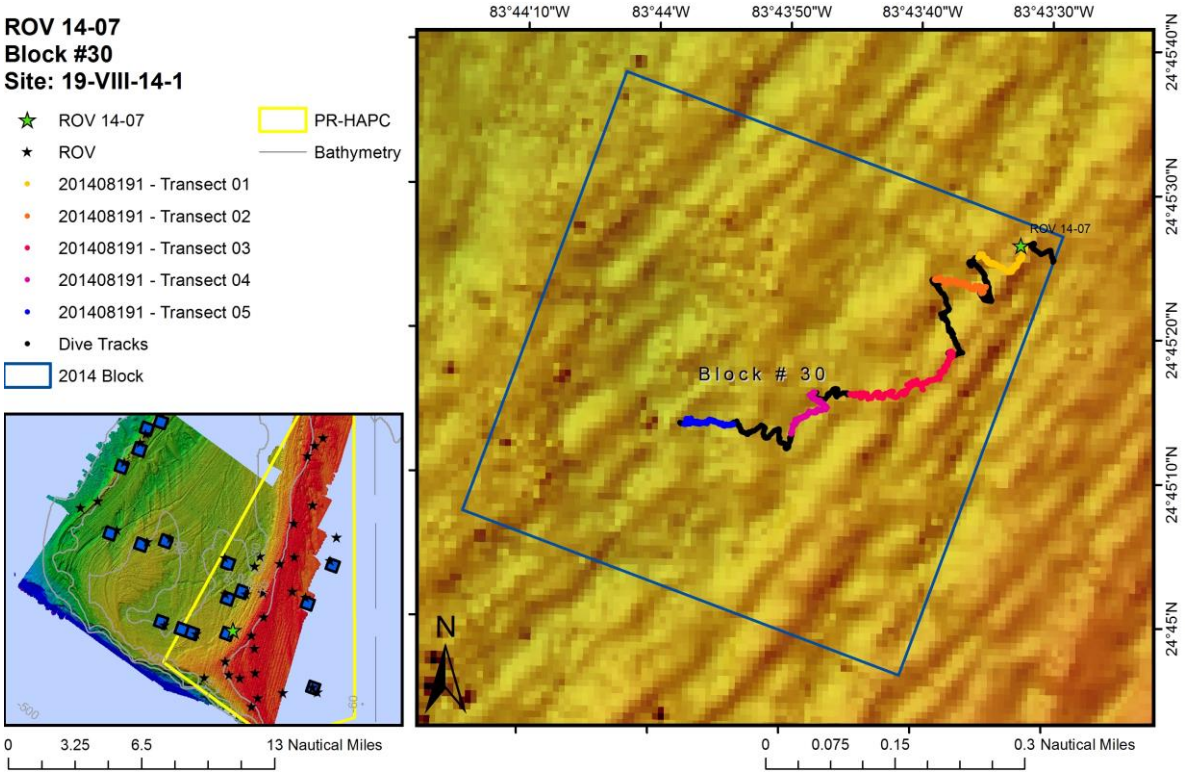
XS 2: HD NW: Start: 4:31:14 PM, 65.1 m; end: 4:42:20 PM, 65 m. 100% soft sediment. Same fauna, and Codium sp.; ended Halimeda zone later on.
Off Transect: HD NW for 10 min. Same bottom with Phaeophyceae comon, less green algae- Spirochnus, Dictyota.

XS 3: HD NW: Start: 4:55:38 PM, 64.8 m; end: 5:06:54 PM, 64.7m. 100% soft sediment with Halimeda hash and bioturbation.
Off Transect: HD NW for 15 min. 100% sediment, ranges between dominated by dense Eucidaris tribuloides and dominated by algae. Becomes barren; pit with dense fish- jacknife fish, spotfin butterfly, lionfish, no grouper observed; sand tile burrows and small cobble mounds common.

XS 4 and XS 5: Not started - had to abort dive early, lost variable control of ship.

Location: Pulley Ridge, Main Ridge- South, Inside Pulley Ridge HAPC; Block 30; ROV 14-07, UNCW #86

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
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Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	2010_pulley_10m
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/19/2014
Specimens:	0
Digital Photos:	198
DVD:	3
Hard Drive:	1

Location: Pulley Ridge, Main Ridge- South, Inside Pulley Ridge HAPC; Block 30; ROV 14-07, UNCW #86

Dive Data:

Minimum Bottom Depth (m):	74.0	**Total Transect Length (km):**	0.87
Maximum Bottom Depth (m):	76.4	**Surface Current (kn):**	0.4
On Bottom (Time- EDST):	17:18	**On Bottom (Lat/Long):**	24°45.4337'N 83°43.4936'W
Off Bottom (Time- EDST):	20:03	**Off Bottom (Lat/Long):**	24°45.2272'N 83°43.9540'W
Physical (bottom); Temp (°C):	20.2	**Salinity:** N/A	**Visibility (ft):** 60 **Current (kn):** N/A

Dive Imagery:

Figure 1: Small *Leptoseris* sp. coral.

Figure 2: Unidentified yellow demosponge surrounded by *Anadyomene menziesii* algae.

Dive Notes:

Site/Objectives:

ROV 14-07, Site #- 19-VIII-14-1, UNCW Dive #86. Target Site -Pulley Ridge, Off Ridge, West Base, Block 30. Ground truth: 2010_pulley_10m.tif & Naar_PulleyRidge_Main_Grid, Live GPS Log- 201408191.shp; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set digital still camera to Tv Mode, fixed S1/125, with auto F-Stop, ISO 100, auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Both cameras had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT. The salinity sensor on the ship is reading 32 at the surface. ISIS CTD on 8/22 confirmed that surface water had dropped salitinity to 32 down to 5 m depth.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed

Location: Pulley Ridge, Main Ridge- South, Inside Pulley Ridge HAPC; Block 30; ROV 14-07, UNCW #86

through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~ 30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Site Description/Habitat/Biota:
The Naar_PulleyRidge_Main_Grid shows low relief NE/SW ridges and a "basin" (76 m) on the SW side and a shallower area on the SE and NE (73 m) side of the block.
Five transects were conducted in Block 30, starting at NE corner and headed S/SW. The five transects ranged from 74 to 76.4 m depth.

XS 1: HD SW: Start: 5:22:17 PM, 75 m; end: 5:50:02 PM, 74 m. 100% CCA encrusted CCA pavement and loose rubble-cobble; 0 slope, low rugosity, low relief; biota was dominated by Anadyomene menziesii, crustose coralline algae, Peyssonnelia sp., 25+ Agaricea sp. corals sighted (mostly 5-10 cm and few 15 cm); Xestospongia muta, Antipathes white fan, Davidaster crinoid. Came across inactive grouper pit with lobster.
Off Transect: HD SW for 10 min. Similar bottom. Came across inactinve grouper pit.

XS 2: HD W: Start: 6:00:12 PM, 75m; end: 6:22:41 PM, 74.5 m. 100% hard bottom, rubble, dense cover of CCA plates, rubble and cobble, dominated by Anadyomene; sponges common- Geodia gibberosa, Agelas sp., Astrophorida, Agaricia sp. (5-10 cm) common.
Off Transect: HD S for 15 min. Similar bottom. Came across active grouper pit.

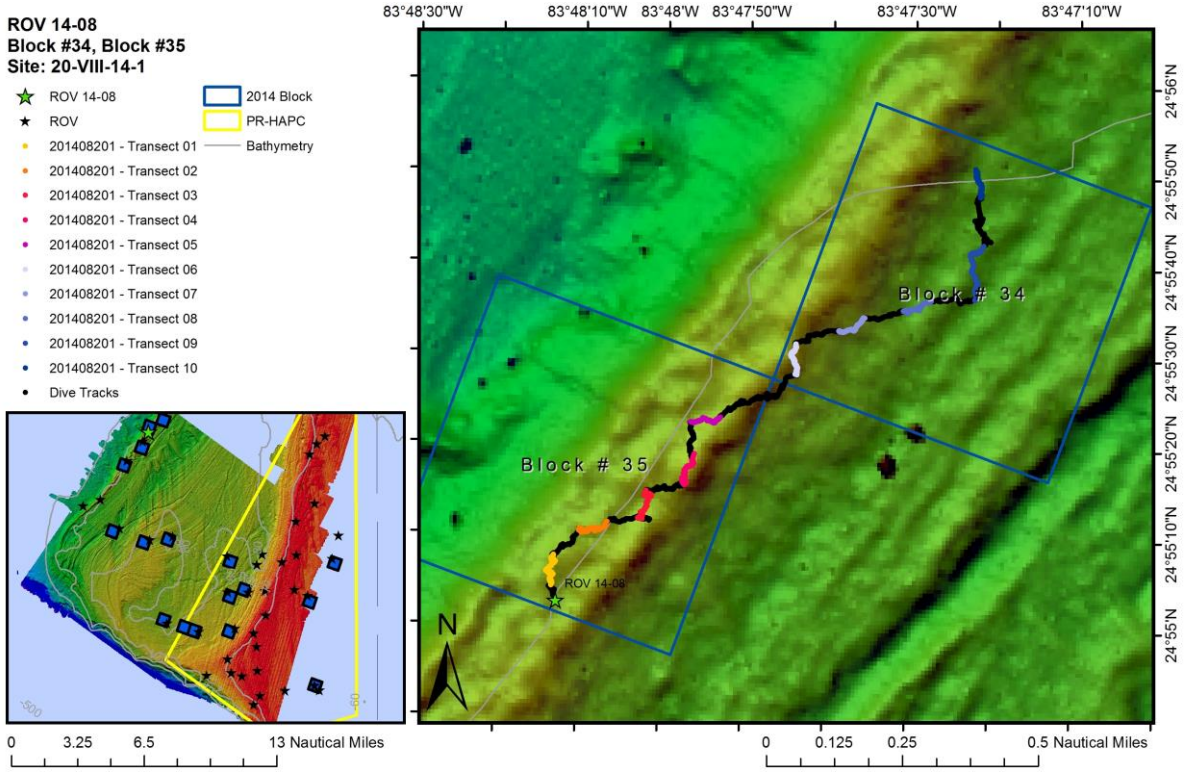
XS 3: HD SW: Start: 6:33:28 PM, 74 m; end: 6:58:20 PM, 74.2m. Similar to XS 1. Came across 2 active grouper pits- red grouper, 13 lionfish, reef butterflyfish, anthiids.
Off Transect: HD W for 15 min. Similar bottom. Came across active grouper pit with 1 red grouper.

XS 4: HD SW: Start: 7:15:49 PM, 74.8 m; end: 7:34:29 PM, 75 m. Similar to XS 1 with an incease in sand half way through. Came across active grouper pit with 1red grouper.
Off Transect: HD w for 15 min. Similar bottom

XS 5: HD W: Start: 7:44:03 PM, 76.4 m; end: 8:00:59 PM, 76m. Ground truth the MB, western "depression" went from 75 m to 76.4 habitat; similar habitat; 95% HB. Dominated by same species througout, may be a reduction in corals, they are getting difficult to see in the video (getting dark out). Fish starting to disappear during transect 4. A mensizzi is getting less abundant about 1/2 way through. Verdigellus common.

Location: Pulley Ridge, West Ridge, Outside Pulley Ridge HAPC; Blocks 35 & 34; ROV 14-08, UNCW #87

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov
Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	2010_pulley_10m
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/20/2014
Specimens:	0
Digital Photos:	430
DVD:	5
Hard Drive:	1

Location: Pulley Ridge, West Ridge, Outside Pulley Ridge HAPC; Blocks 35 & 34; ROV 14-08, UNCW #87

Dive Data:

Minimum Bottom Depth (m):	78.8	**Total Transect Length (km):**	2.04
Maximum Bottom Depth (m):	81.0	**Surface Current (kn):**	0.2
On Bottom (Time- EDST):	7:57	**On Bottom (Lat/Long):**	24°55.0583'N 83°48.2084'W
Off Bottom (Time- EDST):	12:26	**Off Bottom (Lat/Long):**	24°55.8490'N 83°47.3698'W
Physical (bottom); Temp (°C):	19.1	**Salinity:** N/A **Visibility (ft):** 60	**Current (kn):** N/A

Dive Imagery:

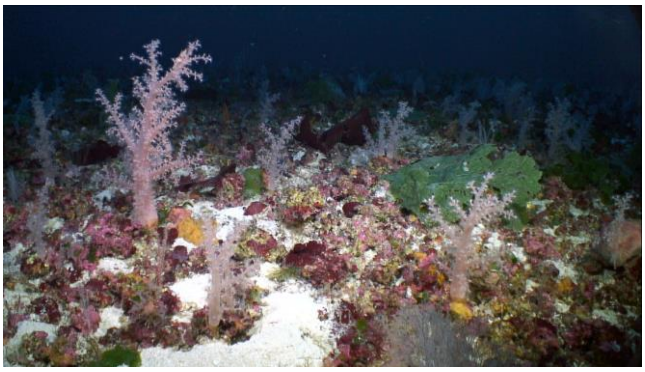


Figure 1: Field of *Chironephthya caribaea* nidaliids.

Figure 2: Stylasteridae growing on a dead coral branch

Dive Notes:

Site/Objectives:

ROV 14-08, Site #-20-VIII-14-1, UNCW Dive #86. Target Site -Pulley Ridge, West Ridge, Block 35 & 34. Ground truth: Nancy_Pulley_North_2m_UTM17n- grid; live GPS Log- 201408201.shp; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set digital still camera to Tv Mode, fixed S1/125, with auto F-Stop, ISO 100, auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Both cameras had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT. The salinity sensor on the ship is reading 32 at the surface. ISIS CTD on 8/22 confirmed that surface water had dropped salitinity to 32 down to 5 m depth.

Ten 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~

Location: Pulley Ridge, West Ridge, Outside Pulley Ridge HAPC; Blocks 35 & 34; ROV 14-08, UNCW #87

30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

BLOCK 35

Site Description/Habitat/Biota:

Nancy_Pulley_North_2m_UTM17n grid shows a 79 m NE-SW ridge on the western side of PR outside the HAPC. West side of ridge flattens out around 95 m. Top of ridge 79-80 m, east base ~83 m. Five transects were conducted in Block 35, starting at S Edge and headed N/NE. The five transects ranged from 78.8 m to 81 m depth.

XS 1: HD N: Start: 8:00:52 AM, 80 m; end: 8:15:33 AM, 81 m. West slope of main ridge. 80-90% cover of rubble/cobble. Fine white sediment between the rubble; biota was dominated by A. menziesii, CCA encrusted rubble, Peysonnellia sp., demosponges (unid) common and diverse, ye and or demo common; Antipatharia white fan and Ellisellidae common.
Off Transect: HD NW for 15 min. Similar bottom, black corals are abundant, Swiftia exerta, Nicella goreauii, Cryptochyra sp. Soft coral.

XS 2: HD NE: Start: 8:25:24 AM, 80.8 m; end: 8:39:47 AM, 80.3 m. West slope of main ridge. Similar to XS 1. Geodia neptuni, Agelas conifera, Oceanapia sp.
Off Transect: HD E for 15 min. Similar habitat.

XS 3: HD NE: Start: 8:49:46 AM, 79.8 m; end: 9:04:42 AM, 80.7 m. Top of main West Ridge: 80% cover of hard bottom; cobble rubble; CCA encrusted rubble, Anadyomene, Pesonnellia, Aplysina, Ellisellidae, Stylaster coral, Nicella goreauii, Davidaster, Madracis auretenra,, Geodia neptuni, Antipathes white fan. High density and diversity of sponges, dense Antiphathes and gorgonians.
Off Transect: HD E for 10 min. Top and western slope of the ridge.

XS 4: HD NE: Start: 9:14:48 AM, 80.5 m; end: 9:26:06 AM, 78.8 m. On top of main West Ridge, 80-90% hard bottom, with CCA and Peysonnelliam, Anadyonome, red blade rhodophyta; 2-3 spp antipatharia, and many spp of demosponges.
Off Transect: HD N for 10 min. in the hightest point of the ridge. Ircinia sp., Auletta sp.

XS 5: HD E: Start: 9:36:11 AM, 80.4 m; end: 9:48:45 AM, 79.5 m. West slope of the West Ridge, 90+% hard bottom, rubble, dominated by Anadyomene, Nicellla goreauii, Peysonnellia, Amphimedon orange creeping branching, Xestospongia muta.
Off Transect: HD NE till we get to SW corner of Block 34. Top of West Ridge, 79,5 m. Aiming for 3 grouper pits on the MB. Grouper pit 1 on MB, 17 m diam. on top of ridge- location directly on in video; pit 1 m deep; spotfin hogfish, spotfin butterfly,, 15 lionfish, dense small fish, anthiids, yellowtail reeffish. Pit #2 on MB, on east slope of ridge; MB shows 17m diam- video shows pit in correct location but only appears to be 5-10 m diam, 1 m deep; 81.5 m at bottom; filled with cobble, 22 lionfish. Pit 3 on MB, base of West Ridge; 17 m diameter- pit is circular hole, with scoured circular ledge at bottom, 82.6 m at bottom; large danforth anchor in hole; 1 red grouper, 70+ lionfish, dense reef fish, anthiids, blue angelfish.
10:17 out of Block 35, head N to block 34. One Agaricia/Leptoseris 5 cm. Only plate coral seen on entire dive, but Madracis common.

BLOCK 34

Location: Pulley Ridge, West Ridge, Outside Pulley Ridge HAPC; Blocks 35 & 34; ROV 14-08, UNCW #87

Site Description/Habitat/Biota:

Nancy_Pulley_North_2m_UTM17n grid shows a 79 m NE-SW ridge on the western side of PR outside the HAPC. Block 34.

Five transects were conducted in Block 34, starting at SW corner and headed N-NE. The five transects ranged from 80 to 85.3 m depth; along east slope and base of West Ridge.

XS 1 (6): HD NE: Start: 10:23:01 AM, 81.5 m; end: 10:36:50 AM, 80 m. East base of West Ridge. 80-90% cover of rock cobble and CCA encrusted rubble; biota was dominated by Peyssonnelia sp., Anadyomene menziesii is less dense, crustose coralline algae, red blade algae, Antipathes white fan, Stylaster, Verdigellas,, Astrophorida cake sponge, Madracis aurentenra common (see septa), gorgonians sparse, Ellisellidae, Agelas conifera, Nicella goreauii.

Off Transect: HD NE for 15 min. HD NE towards grouper pit at east base of ridge. Pit on MB- Pit 5 m diameter, 1 m deep, dense fish, blue angelfish, dozens of lionfish, 1 red grouper.

XS 2 (7): HD E: Start: 10:51:55 AM, 82.2 m; end: 11:05:36 AM, 82.5 m. East base of West Ridge. Similar to XS 1. 90% cover CCA on rubble, dense Peysonnellia, Anadyonome, Antipathes fine mesh, Discodermia finger? Or Erylus- 1. Red blade algae, diverse sponges, Ircinia strobilina, Telesto, Chaetodon aya.

Off Transect: HD E for 10 min. Similar bottom on eastern base of the West Ridge. 1st sighting of Madracis pharensis?

XS 3 (8): HD E: Start: 11:15:15 AM, 84 m; end: 11:28:01 AM, 84m. East base of West Ridge. Similar to XS 1. Madracis common.

Off Transect: HD E for 19 min. Similar habitat.

XS 4 (9): HD N: Start: 11:37:30 AM 85.3 m; end: 11:49:35 AM, 84.4 m. East base, 200 m east of West Ridge. Similar to XS 1.

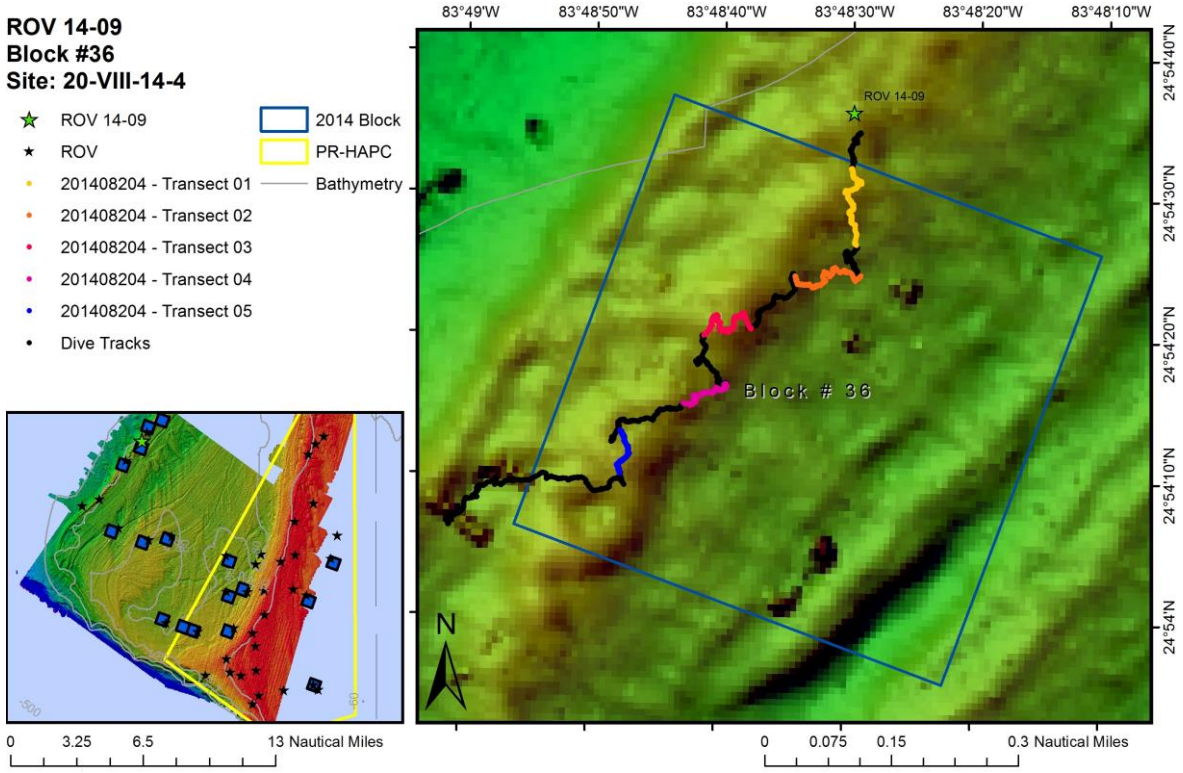
Off Transect: HD N-NE for 15 min. Head for grouper pit on MB; 20 m diameter on MB- Measure pit diameter with ROV position at each side, measured at least 15 m and not at widest point, so could be 20 m diameter; Means 20 m field of view at mid camera view; 1 ft ledge along bottom. 1 red grouper, porgy, numerous lionfish, blue angelfish, 2 scamp.

XS 5 (10): HD N: Start: 12:15:14 PM, 84.7 m; end: 12:26:49 PM, 84m. Flats east of West Ridge. Similar to XS 1. 90% hard bottom, CCA encusted cobble, Peysonnellia, Anadyomene, Demospongia.

End dive 12:26, 84 m depth.

Location: Pulley Ridge, West Ridge, Outside Pulley Ridge HAPC; Block 36; ROV 14-09, UNCW #88

General Location and Dive Track:



Site Overview:

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Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
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Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	2010_pulley_10m
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/20/2014
Specimens:	0
Digital Photos:	197
DVD:	2
Hard Drive:	2

Location: Pulley Ridge, West Ridge, Outside Pulley Ridge HAPC; Block 36; ROV 14-09, UNCW #88

Dive Data:

Minimum Bottom Depth (m):	78.4	**Total Transect Length (km):**	1.25
Maximum Bottom Depth (m):	82.5	**Surface Current (kn):**	N/A
On Bottom (Time- EDST):	15:47	**On Bottom (Lat/Long):**	24°54.5670'N 83°48.4922'W
Off Bottom (Time- EDST):	17:58	**Off Bottom (Lat/Long):**	24°54.1098'N 83°49.0404'W
Physical (bottom); Temp (°C):	18.5	**Salinity:** N/A **Visibility (ft):**	**Current (kn):** N/A

Dive Imagery:

Figure 1: Close up of a saddleback bass with an antipatharian.

Figure 2: *Geodia* sponge on typical hard bottom habitat

Dive Notes:

Site/Objectives:

ROV 14-09, Site #- 20-VIII-14-4, UNCW Dive #88. Target Site -Pulley Ridge, West Ridge, Block 36. Ground truth: 2010_pulley_10m.tif, Live GPS Log- 201408204.shp; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set digital still camera to Tv Mode, fixed S1/125, with auto F-Stop, ISO 100, auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Both cameras had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT. The salinity sensor on the ship is reading 32 at the surface. ISIS CTD on 8/22 confirmed that surface water had dropped salitinity to 32 down to 5 m depth. Lost 1 laser during dive.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~ 30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were

Location: Pulley Ridge, West Ridge, Outside Pulley Ridge HAPC; Block 36; ROV 14-09, UNCW #88

determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Site Description/Habitat/Biota:

BLOCK 36

2010_pulley_10m.tif shows western ridge passing through western side of Block 36.
Five transects were conducted in Block 36, starting at North edge and HD S-SW. The five transects ranged from 78.4 m to 82.5 m depth.

XS 1: HD SE: Start: 3:53:35 PM, 80.3 m; end: 4:08:26 PM, 81 m. Top of West RIdge. 90% cover rubble/cobble; biota was dominated by CCA and Anadyomene, Antipatharia: white mesh fan, Ellisellide, Peysonellia, diverse demosponges are common, red blade algae, Stichopathes, pit with lionfish, 1-2 m diam., Stylaster.
Off Transect: HD S for 15 min. moving along the east base of the western ridge, 81 m. Pit on MB- inactive, rubble filled in bottom, no fish.

XS 2: HD SW: Start: 4:18:39 PM, 82.5m; end: 4:30:53 PM, 80 m. East base of the western ridge (note: only one laser in the down images). Similar to XS 1; 70-80% co/rubble with CCA. Anadyomene disappears towards the end of XS 2. Pit with scamp, 35 lionfish, no red grouper.
Off Transect: HD S for 10 min. Similar habitatt, 80 m.

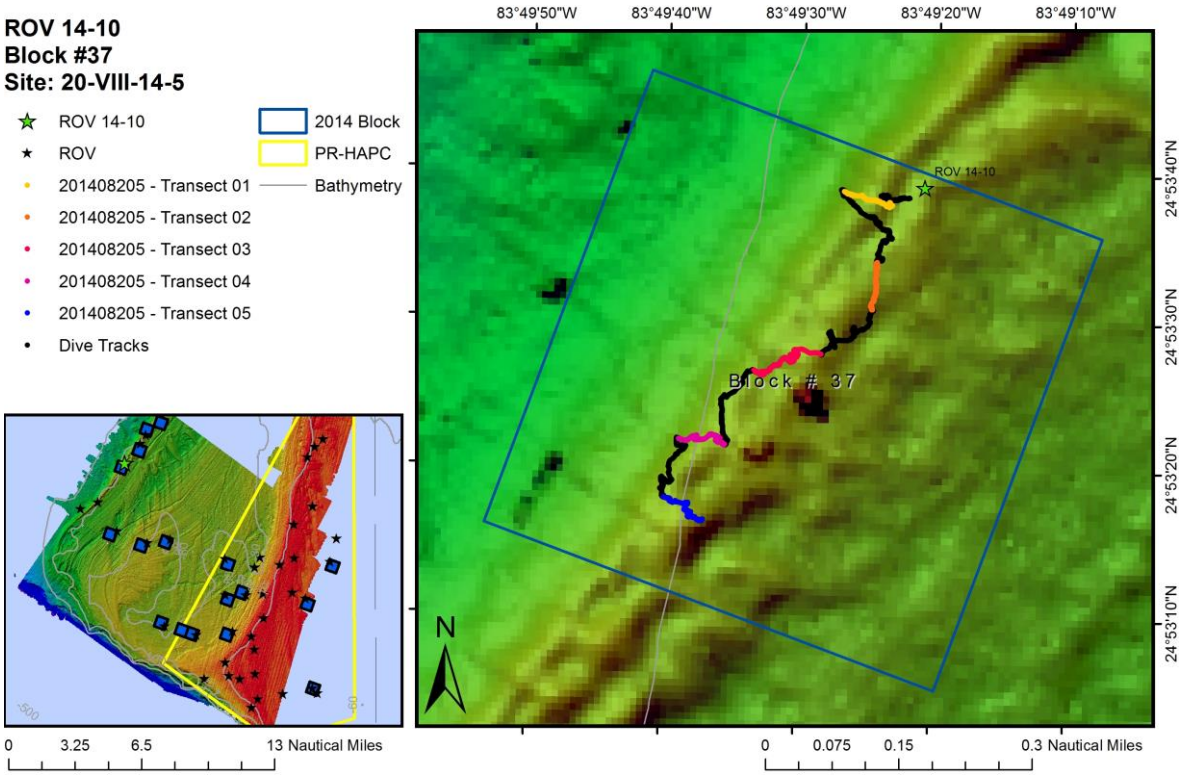
XS 3: HD SW: 4:40:50 PM, 79 m; end: 4 4:55:54 PM, 79.7 m. West Ridge top transect. Similar to XS 1; 90% hard bottom, cobble/rubble with CCA, Rhodophyta blades, Ellisellidae, Antipathes mesh, Swiftia exerta, dense and diverse sponges, lots Axinellids, yellow and orange, Tanacetipathes hirta, sand tile mound.
Off Transect: HD S for 15 min. Top of western ridge. 1/2 m wide grooves on bottom like trawl/dredge and sediment silted on rocks and Anadyomene; not likely the ROV based on the track line.

XS 4: HD SE: Start: 5:06:21 PM, 81.8 m; end: 5:17:10 PM, 80 m. East base of West Ridge. Similar to XS 1, 80-90% cover rubble/cobblewith CCA and Peysonnellia, Anadyomene, Antipathes mesh less common; patches of larger 10-15 cm cobble with numerous reef fish, Cinachyrella; visibility has dropped; saw 1 Agaricia coral in video.
Off Transect: HD SW for 15 min. Similar bottom; nice grouper pit with small 3" black brotulid fish under the ledge; Madracis decactis? (thicker branches).

XS 5: HD SW: Start: TIME, 78.4 m; end: 5:38:59 PM, 79.1 m. Top of West Ridge. Similar to XS 1; 90% cover of cobble/rubble with CCA, red blades, Anadyomene, Antipathes mesh, Xestospongia muta, Stichopathes lutkeni, Verdigellas, Hydroids.
Off Transect: HD SW for towards the top of the ridge, to speed down into block 37; 80% cover, cobble and rubble; not collecting much data between the 2 transects unless there is something totally awesome. Decided to pull up ROV and move to next transect. End dive @ 5:58

Location: Pulley Ridge, West Ridge, Outside Pulley Ridge HAPC; Block 37; ROV 14-10, UNCW #89

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov
Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	2010_pulley_10m
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/20/2014
Specimens:	0
Digital Photos:	189
DVD:	2
Hard Drive:	1

Location: Pulley Ridge, West Ridge, Outside Pulley Ridge HAPC; Block 37; ROV 14-10, UNCW #89

Dive Data:

Minimum Bottom Depth (m):	80.0	**Total Transect Length (km):**	0.79
Maximum Bottom Depth (m):	82.5	**Surface Current (kn):**	0.2
On Bottom (Time- EDST):	18:56	**On Bottom (Lat/Long):**	24°53.6393'N 83°49.3716'W
Off Bottom (Time- EDST):	20:26	**Off Bottom (Lat/Long):**	24°53.2728'N 83°49.6147'W
Physical (bottom); Temp (°C):	18.9	**Salinity:** N/A **Visibility (ft):**	**Current (kn):** N/A

Dive Imagery:

Figure 1: *Ircinia campana* sponge on Pulley Ridge.

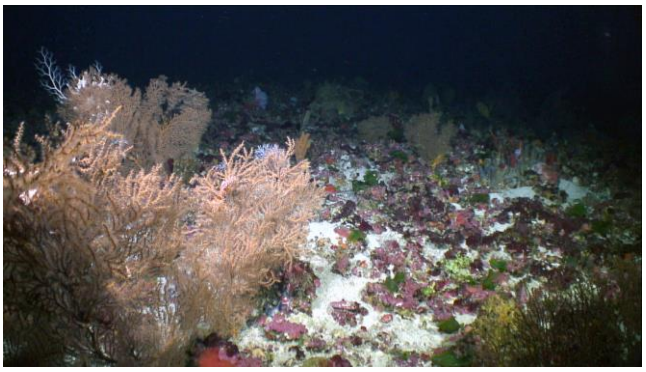


Figure 2: A field of Alcyonacea (gorgonians)

Dive Notes:

Site/Objectives:

ROV 14-10, Site #- 20-VIII-14-5, UNCW Dive #89. Target Site -Pulley Ridge, West Ridge, Block 37; Ground truth: NOAA Regional Bathymetric Chart: 2010_pulley_10m.tif, Live GPS Log- 201408205.shp; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set digital still camera to Tv Mode, fixed S1/125, with auto F-Stop, ISO 100, auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Both cameras had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT. **Note: no lasers. The salinity sensor on the ship is reading 32 at the surface. ISIS CTD on 8/22 confirmed that surface water had dropped salitinity to 32 down to 5 m depth.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~ 30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were

Location: Pulley Ridge, West Ridge, Outside Pulley Ridge HAPC; Block 37;
ROV 14-10, UNCW #89

determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Site Description/Habitat/Biota:
2010_pulley_10m.tif shows western ridge passing through the center of block 37.
Five transects were conducted in Block 37, starting at North edge and HD S-SW. The five transects ranged from 80 m to 82.5 m depth.

XS 1: HD W: Start: 7:01:04 PM, 82.5 1m; end: 7:09:10 PM, 82.4m. Top of West Ridge. 80-90% CCA encrusted rubble, cobble; biota was dominated by CCA, Antipatharia: white fan, Verdigellas, Halymenia sp., Ellisella sp., Peyssonnelia sp., sponges sparse.
Off Transect: HD ESE for 15 min. West base of west ridge, getting late so the visibility is getting poor, 5-10 m. Xestospongia with lionfish, Nicella goreauii, 5 cm Leptoseris cucullata.

XS 2: HD S: Start: 7:23:58 PM, 82.4 m; end: 7:33:45 PM, 81.7 m. Top of West Ridge. Similar to XS 1; 90% cover rubble/cobble with CCA, seeing more corallimophs (they are closed up, diurnal?), sponges common and diverse.
Off Transect: HD SW for 10 min. Similar habitat, 81.7 m, on ridge.

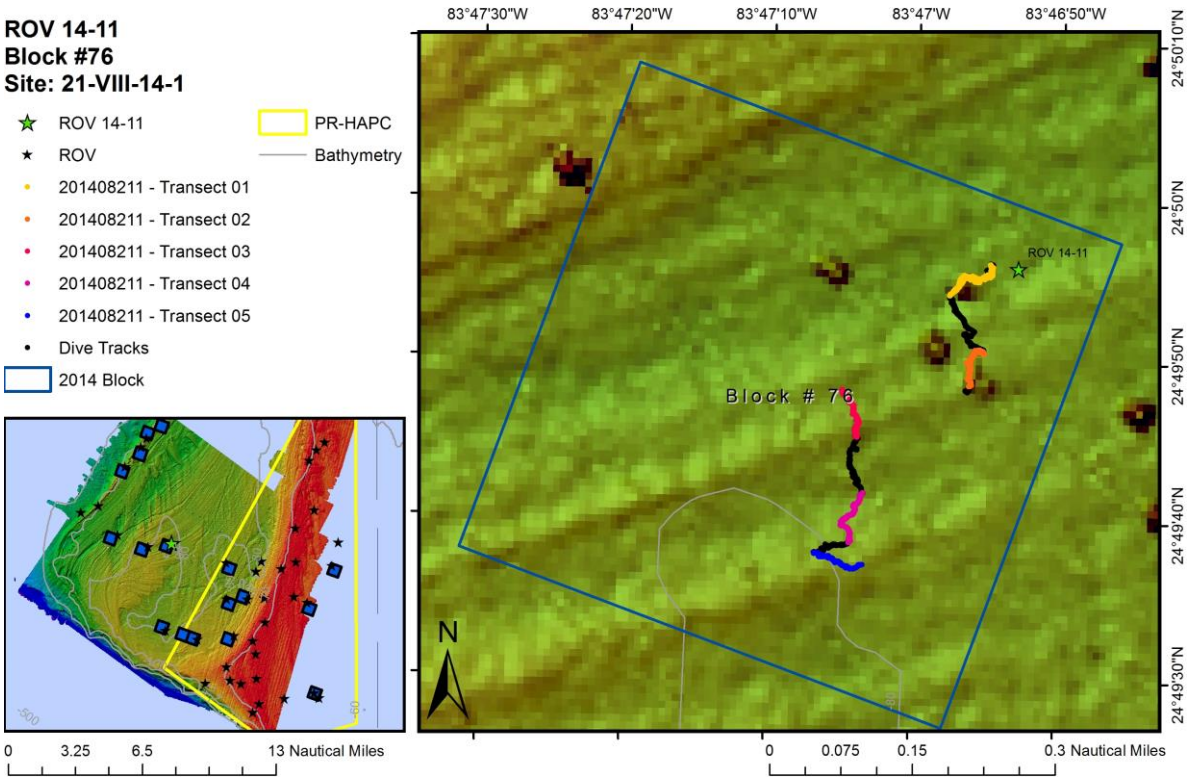
XS 3: HD SW: Start: 7:42:54 PM, 80 m; end: 7:53:16 PM, 80.8 m. Top of West Ridge and west slope. 70-80% cover of rubble and cobble with CCA, Peysonnellia, Agelas spp., Antipathes mesh, Antipathes pine, red blade, Xestospongia muta, Anadyomene sparse, Corallimorpharia. On west slope- 70% cover, active grouper pit-ledge at bottom, 2 blue angelfish, 10 lionfish, anthiids, roughtongue bass.
Off Transect: HD S for 10 min; 7:53 pm.. West base of west ridge; lost all the natural day light; visibility with lights about 5 m.

XS 4: HD W: Start: 8:02:38 PM, 81 m; end: 8:10:12 PM, 8:10:12 PM. Top of West Ridge. Similar to XS 3; 70-80% cobble/rubble with CCA, no Anadyomene, no gorgonians, sparse sponges, Primnoid, Antipatharia fan, frilly pink CCA, Amphimedon cb ye.
Off Transect: HD S for 10 min; Off western ridge on the west slope. Ellisella sp.

XS 5: HD SE: Start: 8:19:29 PM, 80.9 m; end: TIME, 8:26 pm, 80.2 m. West base of West Ridge. Similar to XS 1; 90% cobble/rubble. CCA, Verdigellas, Peysonnellia, no Andyomene, white whip Ellisella sp., Primnoidae. Top of ridge, 79.7 m.

Location: Pulley Ridge, Central Basin, Outside Pulley Ridge HAPC; Block 76; ROV 14-11, UNCW #90

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov
Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	2010_pulley_10m
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/21/2014
Specimens:	0
Digital Photos:	186
DVD:	2
Hard Drive:	2

Location: Pulley Ridge, Central Basin, Outside Pulley Ridge HAPC; Block 76; ROV 14-11, UNCW #90

Dive Data:

Minimum Bottom Depth (m):	80.8	**Total Transect Length (km):**	0.62
Maximum Bottom Depth (m):	83.2	**Surface Current (kn):**	0.3
On Bottom (Time- EDST):	8:41	**On Bottom (Lat/Long):**	24°49.9314'N 83°46.9080'W
Off Bottom (Time- EDST):	11:31	**Off Bottom (Lat/Long):**	24°49.6206'N 83°47.0449'W
Physical (bottom); Temp (°C):	19.2	**Salinity:** N/A	**Visibility (ft):** **Current (kn):** N/A

Dive Imagery:

Figure 1: Unidentifed branching demosponge

Figure 2: Manta ray over typical flat bottom

Dive Notes:

Site/Objectives:

ROV 14-11, Site #-21-VIII-14-1, UNCW Dive #90. Target Site -Pulley Ridge, Central Basin, Block 76; Ground truth: 2010_pulley_10m.tif, Live GPS Log- 201408211a.shp (partially lost due to power failure); conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set digital still camera to Tv Mode, fixed S1/125, with auto F-Stop, ISO 100, auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Video cameras pair of parallel 10 cm green lasers for scale were moved to the down camera because the still camera lasers died yesterday. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT. **Note: Lasers in down camera working again. The salinity sensor on the ship is reading 32 at the surface. ISIS CTD on 8/22 confirmed that surface water had dropped salitinity to 32 down to 5 m depth.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~

Location: Pulley Ridge, Central Basin, Outside Pulley Ridge HAPC; Block 76; ROV 14-11, UNCW #90

30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Site Description/Habitat/Biota:
Pulley Ridge MB shows fairly featureless, flat bottom in central basin.
Five transects were conducted in Block 76, starting at NE corner and headed S. The five transects ranged from 80.8 m to 83.2 m depth.

XS 1: HD E: Start: 8:45:45 AM, 83.2 m; end: 9:06:25 AM, 82.5 m. 80-90% cover of rubble/cobble (10-15 cm), low relief, low rugosity 1-2 small areas with increased rugosity and higher relief; biota was dominated by CCA, Peysonnellia, Anadyomene rare, sponges sparse, Cyanobacteria patches, Stylaster, dense Antipatharia, Madracis pharensis very common, Madracis aurentenra, and Agaricea spp also common throughout the entire dive. 1 red grouper without pit, 30 cm, in small ledge.
Off Transect: HD S for 15 min. 30 cm ledges and small boulders; same species. Ledge with rock beauty, bigeye, reef butterfly; 5 cm Agaricia sp., Madracis pharensis (10 septa), Axinella, Geodia neptuni, Davidaster crinoid, Bubaris, Ventricaria, 5 cm Leptoseris cucullata, recently dead Madracis pharensis, 5 scamp, 1 m boulder w/ ledges, lionfish, squirrelfish.

XS 2: HD E: Start: 9:28:00 AM, 81.7 m; end: 9:50:21 AM, ?? m. Similar to XS 1. Ship lost power to the ship at the end of the XS. Missed the depth
Off Transect: Ship power lost during off tranect time- no data, no track, no video, no photos.

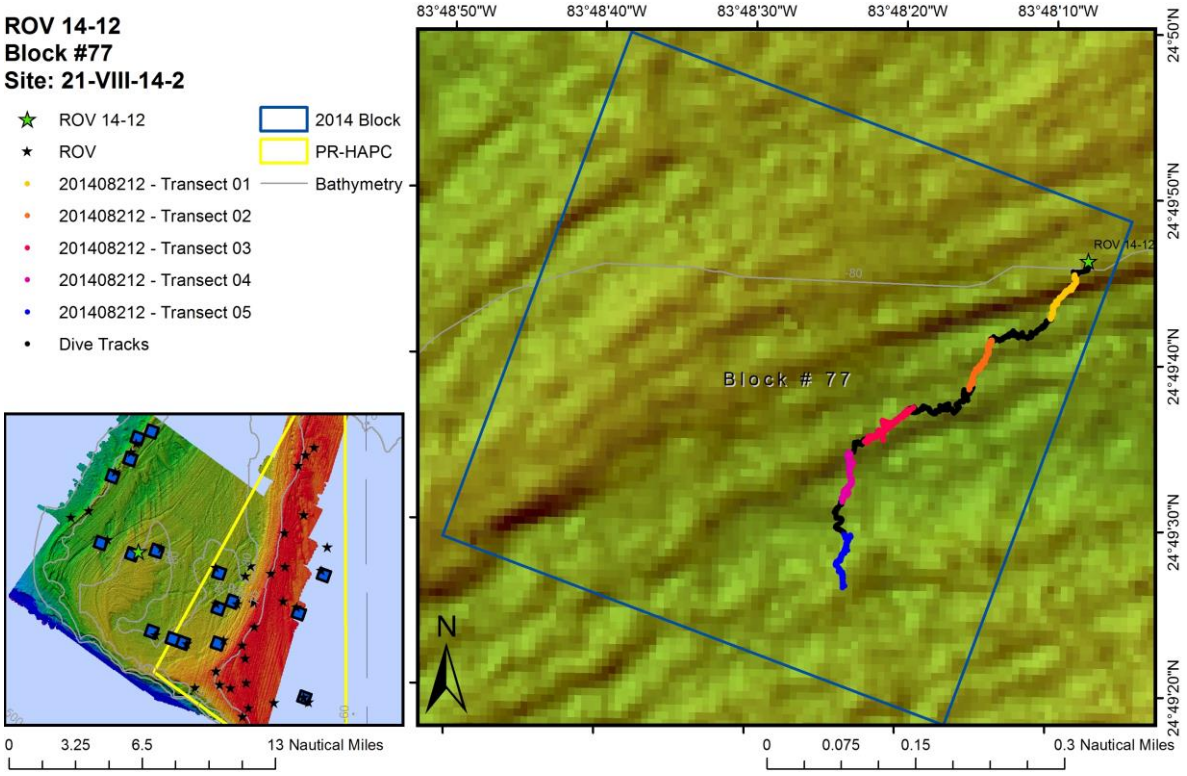
XS 3: HD S: Start: 10:12:16 AM, 81.4 m; end: 10:32:28 AM, 81.2m. Similar to XS 1. Xestospongia muta, Madracis pharensis common,, Filograna, Stichopathes, 2 Leptoseris, 2 Madracis, 1 m rock with 7 lionfish.
Off Transect: HD SW for 10 min. Habitat similar. 10 cm Agaricia, Agelas, 10 cm Agaricia fragilis.

XS 4: HD SW: Start: 10:43:22 AM, 81.4 m; end: 11:04:27 AM, 80.8 m. Similar to XS 1. Gorgonacea sparse, Madrepora pharensis common, pale green Agaricia- sick?, rock ledge w/ dense reef fish, Manta ray with remora flies overhead on video. Hole with 4 lionfish.
Off Transect: HD SW for 15 min. Similar habitat. Agelas or fingers, 10 cm Agaricia, Aplysina lacunosa,, Madracis pharensis- recently dead, diseased, 1 Leptoseris 10 cm, frilly pink CCA.

XS 5: HD SE: Start: 11:13:46 AM, 80.5 m; end: 11:31:27 AM, 80.5 m. 90% cover of rock encrusting CCA, cobble, 10-20 cm, low ledges 10-20 cm tall. Crustose coralline algae, Verdigellas sp., Antipatharia: white fan, Anadyomene sparse, Madracis pharensis very common, and Agaricea spp also common, 5 cm Agaricia fragilis, Stylaster, 10 cm Agaricia/Leptoseris.

Location: Pulley Ridge, Central Basin, Outside Pulley Ridge HAPC; Block 77; ROV 14-12, UNCW #91

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
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Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	2010_pulley_10m
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/21/2014
Specimens:	0
Digital Photos:	168
DVD:	2
Hard Drive:	1

Location: Pulley Ridge, Central Basin, Outside Pulley Ridge HAPC; Block 77; ROV 14-12, UNCW #91

Dive Data:

Minimum Bottom Depth (m):	80.1	**Total Transect Length (km):**	1.12
Maximum Bottom Depth (m):	81.9	**Surface Current (kn):**	N/A
On Bottom (Time- EDST):	12:25	**On Bottom (Lat/Long):**	24°49.7610'N 83°48.1339'W
Off Bottom (Time- EDST):	14:14	**Off Bottom (Lat/Long):**	24°49.4347'N 83°48.6944'W

Physical (bottom); Temp (°C): 19.6 **Salinity:** N/A **Visibility (ft):** 60 **Current (kn):** N/A

Dive Imagery:

Figure 1: Cluster of Corallimorpharia folding from ROV thruster turbulence.

Figure 2: *Agelas conifera* sponge on rock/rubble bottom.

Dive Notes:

Site/Objectives:

ROV 14-12, Site #-21-VIII-14-2, UNCW Dive #91. Target Site -Pulley Ridge, Western Basin, Block 77; Ground truth: 2010_pulley_10m.tif, Live GPS Log- 20140812.shp; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set digital still camera to Tv Mode, fixed S1/125, with auto F-Stop, ISO 100, auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Down camera (only) had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT. The salinity sensor on the ship is reading 32 at the surface. ISIS CTD on 8/22 confirmed that surface water had dropped salitinity to 32 down to 5 m depth.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~ 30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were

Location: Pulley Ridge, Central Basin, Outside Pulley Ridge HAPC; Block 77; ROV 14-12, UNCW #91

determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Site Description/Habitat/Biota:
Pulley Ridge low resolution MB shows relatively featureless, flat bottom.
Five transects were conducted in Block 77, starting at N border and headed S/SW. The five transects ranged from 80.1 m to 81.9 m depth.

XS 1: HD SW: Start: 12:27:40 PM, 81.8 m; end: 12:46:09 PM, 81.2 m. 95% rock, 10-20 cm cobble with CCA; not as rugose as last dive, fewer ledges. Peysonnellia, Verdigellas, Antipatharia fans dense, sparse Anadyomene, frilly plate CCA, Stichopathes, Davidaster crinoid, 1 gorgonian, Xestospongia muta, small sponges, Geodia neptuni, Madracis pharensis common, thick finger coral- had at least 12 septa- Porites porites?; 8 cm 100% bleached white dead Agaricia, 5 cm Madracis pharensis 50% bleached, 10 cm Madracis pharensis partially bleached. Can't tell if bleached parts have tissue. Bubaris.
Off Transect: HD SW for 15 min. Simiilar habitat. 1 m diam Agaricia lamarcki, Aplysina lacunosa.

XS 2: HD SW: Start: 12:56:24 PM, 80.8 m; end: 1:13:57 PM, 81 m. 90% cover of rock cobble/rubble., CCA, less ledges then this AM dive (block 76), Agelas conifera.
Off Transect: HD SW for 15 min. Simiilar habitat.

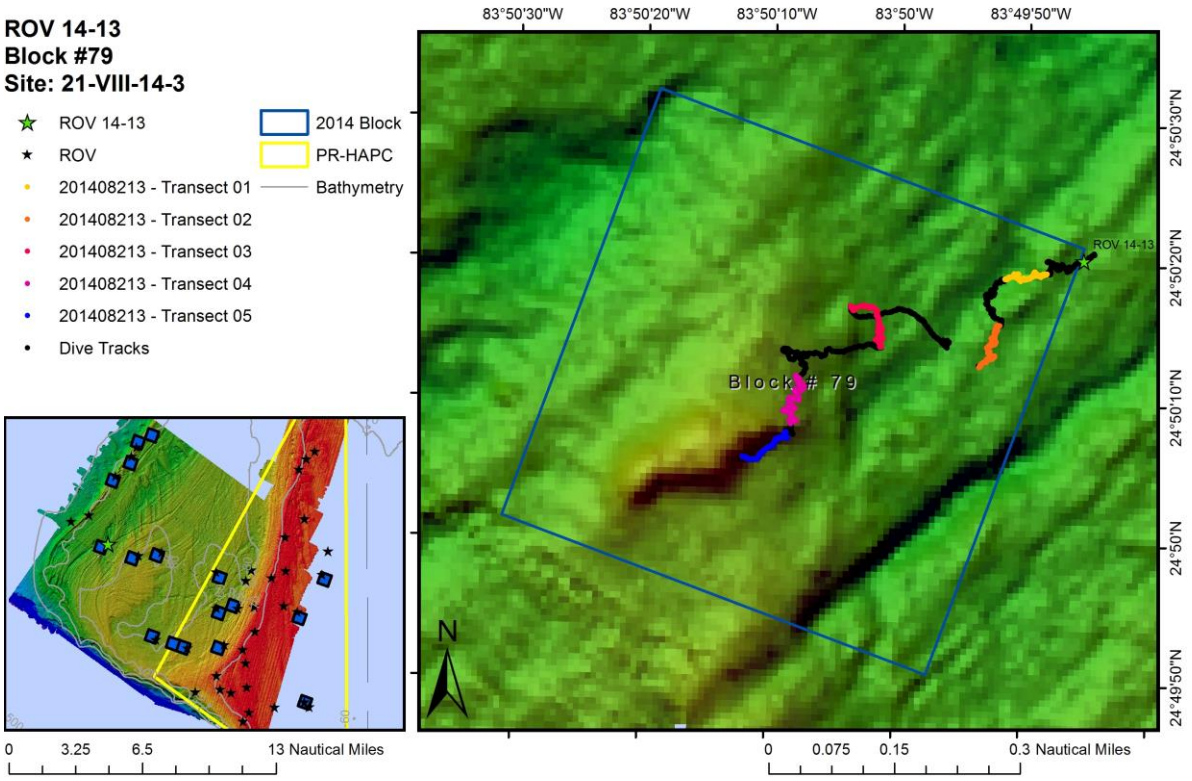
XS 3: HD SW: Start: 1:25:59 PM, 80.1 m; end: 1:44:22 PM, 81m. Similar to XS 1. Madracis pharensis, few Anadyomene, Madracis aurentenra, 3 larger non- active Grouper pits (1 10m+), 10 cm Madracis pharensis 20% bleached and dead, some green algae on new dead area. Pit with 4 lionfish, blue angelfish, spotfin hogfish, 10 cm Madracis pharensis, 10 m pit- 1 m deep, yellowtail reeffish, another pit- spotfin butterfly, rock beauty.
Off Transect: HD SW for 1 min. 90% cover of HB, low ledges 10-30 cm. Started next XS after 1 min because foul weather approaching..

XS 4: HD S: Start: 1:46:38 PM, 81.5m; end: 2:00:38 PM, 81.9 m. Similar to XS 1. Ircinia strobina, Hermodice carunculata eating (?) a salp. 10 m pit, 1 m deep, lionfish.
Off Transect: HD S. Started next XS after 1 min because foul weather approaching. Came across 20 m diam GP.

XS 5: HD S: Start: 2:04:37 PM, 80.8 m; end: 2:14:28 PM, 80 m. Similar to XS 1.

Location: Pulley Ridge, Central Basin, Outside Pulley Ridge HAPC; Block 79; ROV 14-13, UNCW #92

General Location and Dive Track:



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Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	2010_pulley_10m
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/21/2014
Specimens:	0
Digital Photos:	179
DVD:	2
Hard Drive:	1

Location: Pulley Ridge, Central Basin, Outside Pulley Ridge HAPC; Block 79; ROV 14-13, UNCW #92

Dive Data:

Minimum Bottom Depth (m):	83.0	**Total Transect Length (km):**	0.85
Maximum Bottom Depth (m):	87.0	**Surface Current (kn):**	0.3
On Bottom (Time- EDST):	15:10	**On Bottom (Lat/Long):**	24°50.3440'N 83°49.7700'W
Off Bottom (Time- EDST):	17:29	**Off Bottom (Lat/Long):**	24°50.0991'N 83°50.1970'W
Physical (bottom); Temp (°C):	19.0	**Salinity:** N/A **Visibility (ft):**	**Current (kn):** N/A

Dive Imagery:

Figure 1: loggerhead sea turtle (*Caretta caretta*) swims over Pulley Ridge

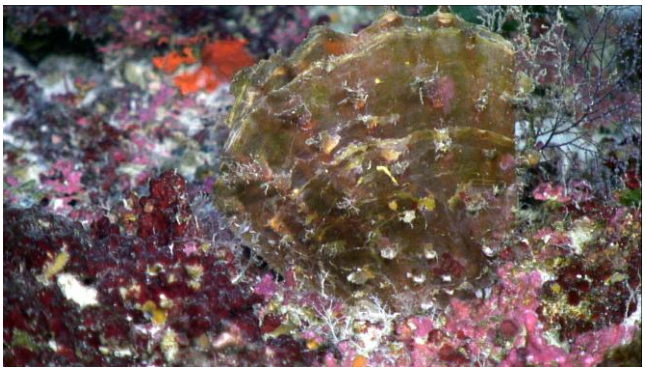


Figure 2: Pinnidae pen shell grows out of the substrate

Dive Notes:

Site/Objectives:

ROV 14-13, Site #- 21-VIII-14-3, UNCW Dive #92. Target Site -Pulley Ridge, Central Basin, Block 79. Ground truth: NOAA Regional Bathymetric Chart: 2010_pulley_10m.tif, Live GPS Log- 201408213.shp; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, < set digital still camera to Tv Mode, fixed S1/125, with auto F-Stop, ISO 100, auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Down camera (only) had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT. The salinity sensor on the ship is reading 32 at the surface. ISIS CTD on 8/22 confirmed that surface water had dropped salitinity to 32 down to 5 m depth.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~

Location: Pulley Ridge, Central Basin, Outside Pulley Ridge HAPC; Block 79; ROV 14-13, UNCW #92

30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Site Description/Habitat/Biota:
2010_pulley_10m.tif shows NE-SW Ridge and a mound in the lower left corner of Block 79.
Five transects were conducted in Block 79, starting at NE corner and headed S/SW. The five transects ranged from 83 m to 87 m depth.

Off XS- video of loggerhead c/u., 5 cm Agaricia fragilis.
XS 1: HD SW: Start: 3:24:10 PM, 86.4 m; end: 3:41:38 PM, 87 m. 80% cover of rubble/cobble, white sand between, CCA covered HB; biota was dominated by CCA, Peyssonnelia sp., Anadyomene menziesii common, Agaricea is present, as is M. pharensis, Verdigellas, Antipathes fans common, sponges present, orange Diodogorgia (?) with fireworm, Pen shell, Discodermia(?) fingers, Madracis pharensis.
Off Transect: HD SW for 10 min. Same bottom. Red grouper in small ledge.

XS 2: HD SW: Start: 3:52:02 PM, 86 m; end: 4:07:23 PM, 86.3 m. . Similar to XS 1. Madracis pharensis, 1 gorgonian, 10 cm Madracis pharensis, 10 cm M. Pharensis, 70% old dead, Tanacetipathes hirta, M. Pharensis common.
Off Transect: HD SW for 15 min. Ship power cut out after XS 2. Drifted ~100 m to the WNW. C/u of seahorse.

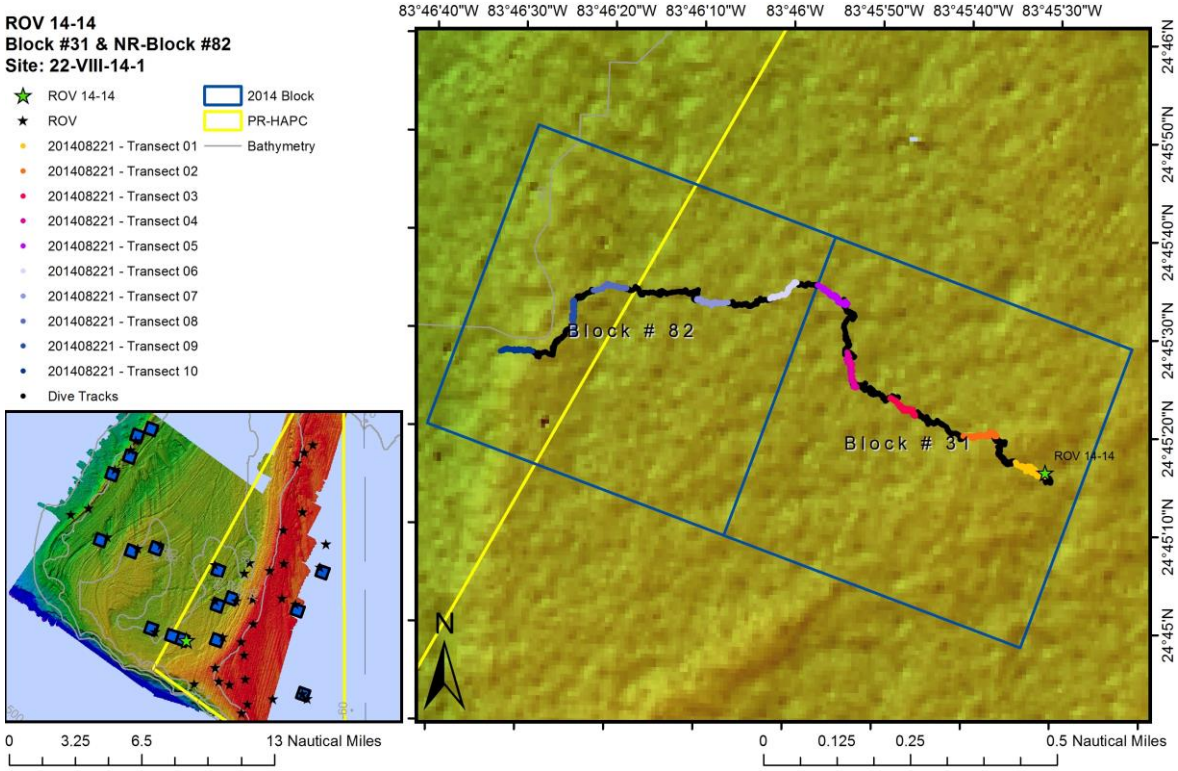
XS 3: HD SW: Start: 4:28:54 PM, 85.5 m; end: 4:43:34 PM, 86.3 m. ~ 200 m north of the oval shaped mound on the MB, similar to XS 1. Longsnout butterfly, Madracis pharensis.
Off Transect: HD SW for 15 min. Similar habitat. Large pit, with apparent solution hole, 1 red grouper, sunshine fish, cornet fish, 3 scamp, 4 lionfish.

XS 4: HD S: Start: 5:00:56 PM, 83 m; end: 5:17:03 PM, 83 m. Just N of Bat shaped mound on MB; similar to XS 1; 80% rubble/cobble, 10-20 cm, Xestospongia muta, Axinella sponges, sand tilefish mound.. Half way through, storm rolled in, stayed at 1.3 m height to finish quickly.
Off Transect: HD SW for just a minute because of weather. At south base of mound on MB; nothing visiible in video.

XS 5: HD SSW: Start: 5:19:56 PM, 83.3 m; end: 5:29:49 PM, 82.7 m. At south base of mound on MB; nothing visiible in video. Similar to XS 1.
Off Transect: 5:29 pm, 82.7 m. S base of mound, nothing visible. End of dive due to weather. Never got on top of mound if there.

Location: Pulley Ridge, Central Basin, In & Outside Pulley Ridge HAPC; Block 31 and NR-82; ROV 14-14, UNCW #93

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov
Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	2010_pulley_10m
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/22/2014
Specimens:	0
Digital Photos:	403
DVD:	3
Hard Drive:	2

Location: Pulley Ridge, Central Basin, In & Outside Pulley Ridge HAPC; Block 31 and NR-82; ROV 14-14, UNCW #93

Dive Data:

Minimum Bottom Depth (m):	77.0	**Total Transect Length (km):**	1.79
Maximum Bottom Depth (m):	78.6	**Surface Current (kn):**	0.1
On Bottom (Time- EDST):	8:11	**On Bottom (Lat/Long):**	24°45.2555'N 83°45.4998'W
Off Bottom (Time- EDST):	12:03	**Off Bottom (Lat/Long):**	24°45.4579'N 83°46.5376'W

Physical (bottom); Temp (°C): 19.5 **Salinity:** N/A **Visibility (ft):** 60 **Current (kn):** N/A

Dive Imagery:

Figure 1: Small bleached *Agaricia* coral

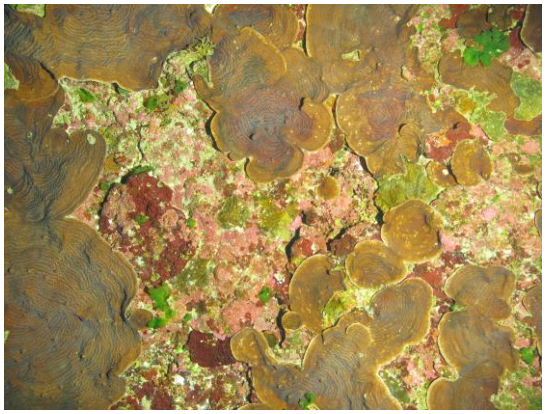


Figure 2: *Agarica* corals were found on this dive

Dive Notes:

Site/Objectives:

ROV 14-14, Site #- 22-VIII-14-1, UNCW Dive #93. Target Site -Pulley Ridge, Central Basin, Block 31 & NR-82; Ground truth: 2010_pulley_10m.tif, Live GPS Log- 201408221.shp; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set digital still camera to Tv Mode, fixed S1/125, with auto F-Stop, ISO 100, auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Down camera (only) had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT. The salinity sensor on the ship is reading 32 at the surface. ISIS CTD on 8/22 confirmed that surface water had dropped salitinity to 32 down to 5 m depth.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~ 30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Location: Pulley Ridge, Central Basin, In & Outside Pulley Ridge HAPC; Block 31 and NR-82; ROV 14-14, UNCW #93

BLOCK 31: Inside HAPC

Site Description/Habitat/Biota:

2010_pulley_10m.tif shows flat bottom, <80 m bathy lines outside of Block 31.

Five transects were conducted in Block 31, starting at E Edge and headed W. The five transects ranged from 77 m to 78.6 m depth.

XS 1: HD NW: Start: 8:13:56 AM, 78.6 m; end: 8:25:08 AM, 77.5 m. 95-100% hard bottom, CCA covered pavement, rubble/cobble, flat, low rugosity. CCA, Anadyomene abundant, dark purple and light pink CCA, Antipathes fans, Xestospongia muta, Verdigellas, Xestospongia muta, Davidaster. Agaricea corals ~most 5-10 cm, common to abundant; most photos with coral, healthy and brown.

Off Transect: HD W for 15 min. Similar Bottom, 1 large 1-m coral sighted, most Agaricia corals are <10 cm, few had signs of partial bleaching; Madracis aurentenra, M. pharensis. 1- 1 to 2 ft ledge with large fish- scamp, hog snapper, blue angelfish, 1 lionfish.

XS 2: HD W: Start: 8:39:23 AM, 77.5 m; end: 8:51:44 AM, 77.5 m. Similar to XS 1, CCA pavement. Agaricia corals in almost every photo, small <10 cm. 2 areas with extemly large coral spots (~5 m wide) went off XS for a few far away Images of a 2-3 m diameter colony of Agaricia lamarki (the 1st and last coral pictures were on a timer)

Off Transect: HD NW for 15 min. Same bottom, stopped for many screen grabs of corals, passsed 1 inactive grouper pit; sparse sponges, no gorgonians, some X. muta, Geodia neptuni, Scolymia lacera.

XS 3: HD NW: Start: 9:05:41 AM, 77.7 m; end: 9:20:25 AM, 77.9 m. Similar to XS 1. CCA, Anadyomene less common, Antipathes atlantica; Agaricid (5-10 cm) corals are abundant; 1 every few meters, and in almost every picture. Came across 1 inactive small pit, rock ledge at bottom- 2 lionfish, anthiids, reef butterfly. These pits are not red grouper pits; most scoured depression around 1 m flat boulder, with 20-30 cm relief and undercut for the fish. No red fish seen entire day. Two 5 cm Agaricia side by side- one bleached, one brown.

Off Transect: HD NW for 15 min. Same habitat, dense Agaricia. 1- Polymastia, 1 Agaricia 50% bleached and newly dead.

XS 4: HD NW: Start: 9:31:54 AM, 78 m; end: 9:44:55 AM, 77 m. Similar to XS 1. No gorgonians, sparse sponges, Agaricia abundant. Antipathes atlantica, Anadyomene not abundant. Scoured ledge with 6 lionfish, spotfin hogfish, rock beauty, yellowtail reeffish.

Off Transect: HD NW for 15 min. Came across VERY large area of Agaricia coral, we imaged it randomly but they will not be used as part of the random images, the area was about 60 m in diameter between the start and end location, 78 m; second patch nearby.

XS 5: HD NNW: Start: 10:04:16 AM, 78.1 m; end: 10:15 am, 78.1 m. Similar to XS 1, CCA, Verdigellas, sparse sponges, few Anadyomene, 3 scamp; Agaricid (5-10 cm) corals are abundant; 1 every few meters, and in almost every picture

Off Transect: HD W for 15 min. Added another block to the west to continue dive to the west.

Block NR- 82- non-random block, added; Transects 6, 7 are inside HAPC and Transets 8, 9, & 10 are outside HAPC

Site Description/Habitat/Biota:

Location: Pulley Ridge, Central Basin, In & Outside Pulley Ridge HAPC; Block 31 and NR-82; ROV 14-14, UNCW #93

2010_pulley_10m.tif shows flat bottom, <80 m bathy lines outside of NR-Block 82.
Five transects were conducted in NR-Block 82, starting at ENE Edge and headed WSW. The five transects ranged from 78 to 79 m depth. .

XS 1(6): HD SW: Start: 10:23:40 AM, 78 m; end: 10:35:29 AM, 78 m. Similar to Block 31 XS 1, 95% hard bottom, CCA pavement, rubble, cobble, flat, low rugosity, few pits with scoured rock. CCA, Anadyomene common, Antipathes fan, no gorgonians, sparse sponges, Agaricid (5-10 cm) corals are abundant; 1 every few meters, and in almost every picture. Scoured rock boulder- rock beauty, spotfin hog, blue cherubfish.
Off Transect: HD W for 15 min. Same habitat. Agaricia common-abundant.

XS 2(7): HD W: Start: 10:46:21 AM, 78.5 m; end: 10:55:44 AM, 78.5 m. 95% CCA pavement, CCA, Anadyomene, white Antipathes; Agaricid (5-10 cm) corals are abundant; 1 every few meters, and in almost every picture. Scour rock with rock beauty, bicolor damsel (first seen).
Off Transect: HD W for 15 min. Came across seeping sediment coming out of a small hole, 30 cm diameter; water seep???

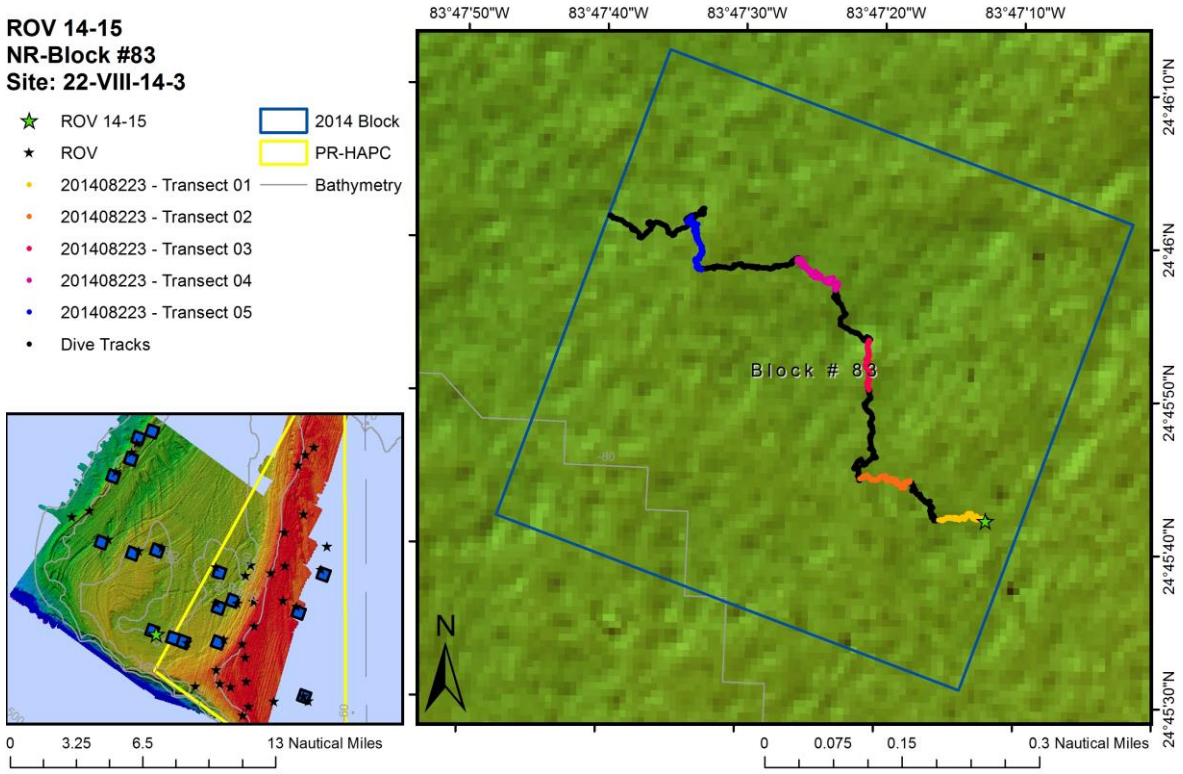
XS 3(8): HD W: Start: 11:13:06 AM, 78.6 m; end: 11:24:30 AM, 78.6 m. Outside the HAPC, 2m clumps of Sargassum, 95% cover of CCA pavement and cobble; several bleached Agaricia - tissue still present, more smaller Agaricia In each photo then then other XS; Leptoseris cucullata, 8 cm, totally bleached, no tissue, white; Agaricia- 100% bleached and dead.
Off Transect: HD SW for 10 min. Same habitat. 1- 3' bushy Antipatharia- largest one seen so far.

XS 4(9): HD S: Start: 11:32:36 AM, 78.6 m; end: 11:43:20 AM, 78.5m. Outside the HAPC, Similar to XS 1. Scoured rock patch with 2 scamp and 2 red snapper.
Off Transect: HD SW for 15 min. Same habitat. Pile of steel cable.

XS 5(10): HD W: Start: 11:54:11 AM, 78.5m; end: 12:03:30 PM, 79 m. Outside the HAPC, Similar to XS 1; 95% cover CCA pavement, rubble/cobble. Several 5-10 cm Agaricia in each Image (upwards of 10 corals/image).

Location: Pulley Ridge, Central Basin, NR-Block 83 outside HAPC; ROV 14-15, UNCW #94

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov
Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	2010_pulley_10m
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/22/2014
Specimens:	0
Digital Photos:	196
DVD:	2
Hard Drive:	1

Location: Pulley Ridge, Central Basin, NR-Block 83 outside HAPC; ROV 14-15, UNCW #94

Dive Data:

Minimum Bottom Depth (m):	81.7	**Total Transect Length (km):**	0.99
Maximum Bottom Depth (m):	83.5	**Surface Current (kn):**	0.3
On Bottom (Time- EDST):	14:54	**On Bottom (Lat/Long):**	24°45.7016'N 83°47.1960'W
Off Bottom (Time- EDST):	16:39	**Off Bottom (Lat/Long):**	24°46.0294'N 83°47.6621'W
Physical (bottom); Temp (°C):	19.3	**Salinity:** N/A	**Visibility (ft):** **Current (kn):** N/A

Dive Imagery:

Figure 1: Stripped *Agaraica* coral

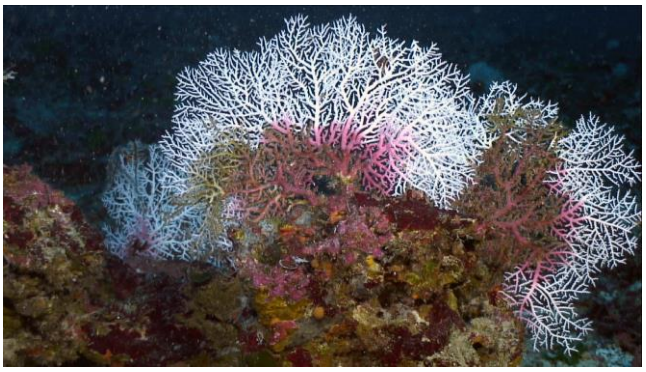


Figure 2: Stylasteridae growing off a rock outcrop

Dive Notes:

Site/Objectives:

ROV 14-15, Site #- 22-VIII-14-3, UNCW Dive #94. Target Site -Pulley Ridge, Central Basin, NR-Block 83 outside HAPC; Ground truth: 2010_pulley_10m.tif, Live GPS Log- 201408223.shp; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set digital still camera to Tv Mode, fixed S1/125, with auto F-Stop, ISO 100, auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Both cameras had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT. The salinity sensor on the ship is reading 32-33 at the surface. ISIS CTD on 8/22 confirmed that surface water had dropped salitinity to 32 down to 5 m depth.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~ 30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were

Location: Pulley Ridge, Central Basin, NR-Block 83 outside HAPC; ROV 14-15, UNCW #94

determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Site Description/Habitat/Biota:

2010_pulley_10m.tif shows flat bottom, 80 m NR-Block 83 (opted to do this block to fill in the lower half of the central basin. The last 2 Blocks (NR-82 and block 31 were so loaded with corals that we needed to fill in the data set across the south half.

Five transects were conducted in Block 82, starting at east side and headed W-NW. The five transects ranged from 81.7 to 83.5 m depth.

XS 1: HD W: Start: 2:56:14 PM, 83.5 m; end: 3:05:57 PM, 82.2 m. 95% CCA covered pavement and rubble/cobble, flat, low rugosity. CCA, Verdigellas, no Anadyomene, no gorgonacea, few sponges. Loaded with Agaricia (some may be Leptoseris; mostly 5-10 cm A.fragilis type); often >5/ image, one large 1 m A. Lamarki. Scamp in scour, anthiids, rock beauty.

Off Transect: HD NW for 15 min. Similar habitat. Madracis pharensis? (mound), 15 cm, 30% dead, Leptoseris light green, dense Agaricia 5-10 cm; some Leptoseris. 10 cm Agaricia with green stripes; no Anadyomene.

XS 2: HD W: Start: 3:15:28 PM, 81.9 m; end: 3:25:41 PM, 81.9 m. Similar to XS 1, 95% CCA pavement, rubble/cobble. Agaricia coral is abundant, 5-15 cm in almost all photos; Stylaster common; rock hole with 3 lionfish.

Off Transect: HD N for 15 min. Similar habitat.

XS 3: HD N: Start: 3:36:19 PM, 82; end: 3:45:55 PM, 82.5m. Similar habitat; CCA, Stylaster, Verdigellas, X. muta, Stichopathes. Large amounts of 5-15 cm corals in the down shots continue to occur. Scatterd large 2 m clumps of drift Sargassum.

Off Transect: HD NW for 15 min. Similar habitat. 3 ft bushy black coral- largest seen.

XS 4: HD NW: Start: 3:55:56 PM, 82.2 m; end: 4:09:03 PM, 82m. Similar to XS 1, 95% CCA encrusted pavement, rubble/cobble. Agaricia corals continue to occur in the down images at the same abundance (12+ in some images), Madracis pharensis common, 2 m pile Sargassum detritus.

Off Transect: HD W for 10 min. Similar habitat., 1 m Agaricia lamarki, another 1 m A. lamarki.

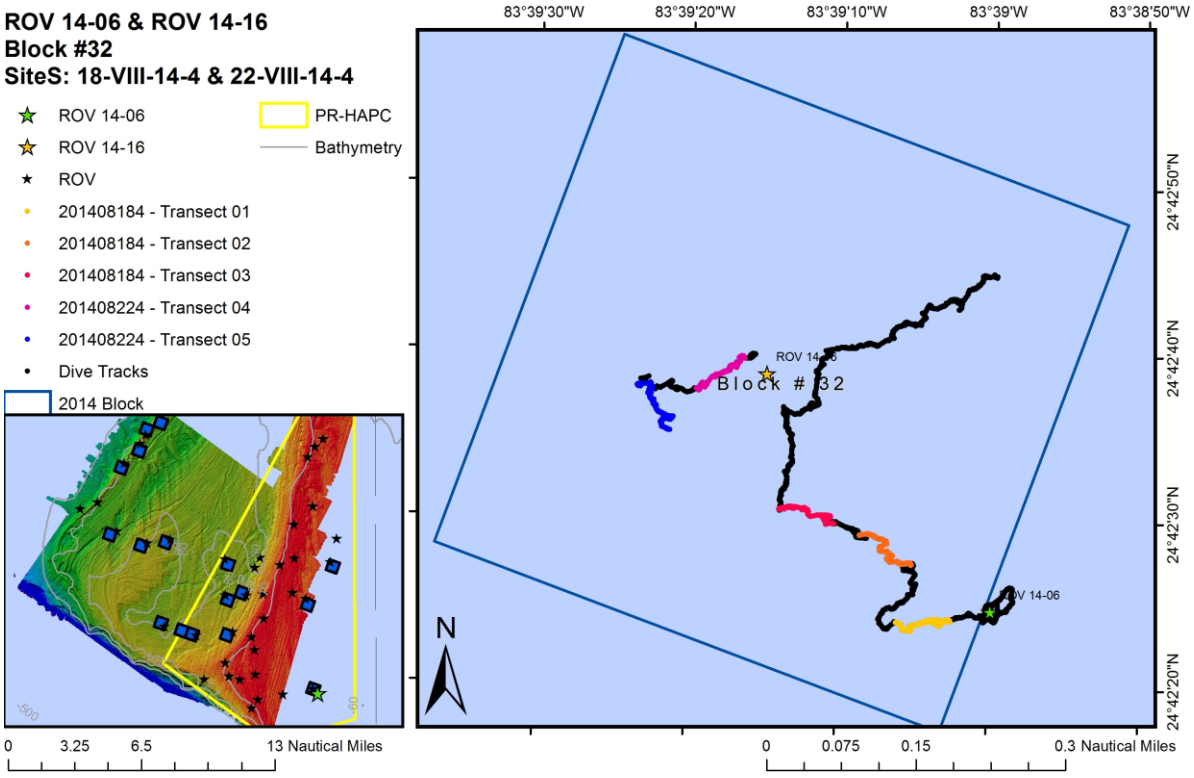
XS 5: HD N: Start: 4:19:01 PM, 81.7 m; end: TIME, 81.7 m. Similar to XS 1, still dominated by CCA, Vertagellas and Agaricia corals.

35 corals in 8 images = 12 m2 = 2.91 corals / m2 initial density calculation.

Off Transect: HD W for 10 min. Similar habitat. Head W to border of Block. All same density of small Agaricia.

Location: Pulley Ridge, Off Main Ridge, Inside HAPC, Block 32 (remaining 2 xs); ROV 14-16, UNCW #95

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov
Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	2010_pulley_10m
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/22/2014
Specimens:	0
Digital Photos:	79
DVD:	1
Hard Drive:	1

Location: Pulley Ridge, Off Main Ridge, Inside HAPC, Block 32 (remaining 2 xs); ROV 14-16, UNCW #95

Dive Data:

Minimum Bottom Depth (m):	64.0	**Total Transect Length (km):**	0.20
Maximum Bottom Depth (m):	66.5	**Surface Current (kn):**	0.1
On Bottom (Time- EDST):	18:34	**On Bottom (Lat/Long):**	24°42.6621'N 83°39.2566'W
Off Bottom (Time- EDST):	19:05	**Off Bottom (Lat/Long):**	24°42.5893'N 83°39.3409'W
Physical (bottom); Temp (°C):	20.7	**Salinity:** N/A **Visibility (ft):**	**Current (kn):** N/A

Dive Imagery:

Figure 1: Lionfish on rock outcrop

Figure 2: *Erylus* sponge on soft bottom

Dive Notes:

Site/Objectives:

ROV 14-16, Site #- 22-VIII-14-4, UNCW Dive #95. Target Site Pulley Ridge, Off Main Ridge, East Base Block 32 (remaining 2 xs). Ground truth: NOAA Regional Bathymetric Chart: 2010_pulley_10m.tif, Live GPS Log-201408224.shp; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set digital still camera to Tv Mode, fixed S1/125, with auto F-Stop, ISO 100, auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Both cameras had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT. The salinity sensor on the ship is reading 32 at the surface. ISIS CTD on 8/22 confirmed that surface water had dropped salitinity to 32 down to 5 m depth.

Two 100-m random transects (XS-4 & 5) were completed to characterize each randomly selected 1 km x 1 km block. Transects 1 -3 for Block 32 were completed on dive 14-06. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~30 sec. Off transects between

Location: Pulley Ridge, Off Main Ridge, Inside HAPC, Block 32 (remaining 2 xs); ROV 14-16, UNCW #95

the photo transects were 10-15 minutes. Heading of transects were determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

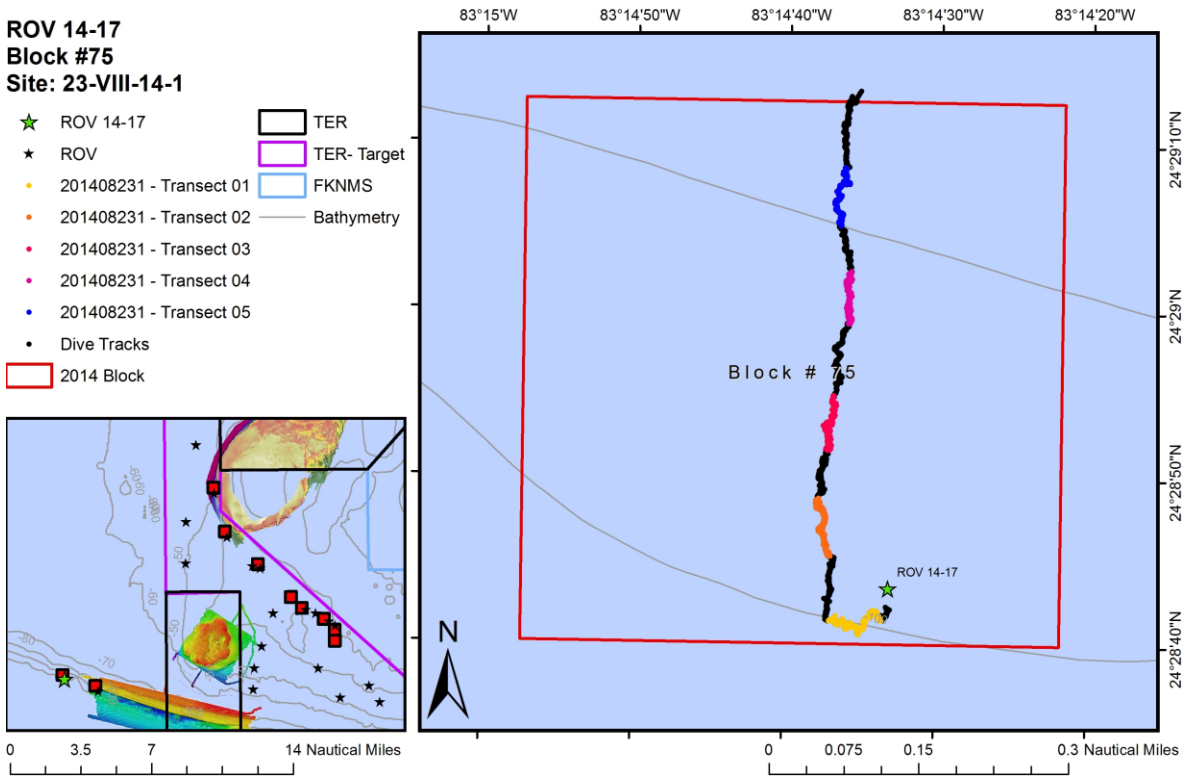
Site Description/Habitat/Biota:
Finishing remaining 2 transects in Block 32
The NOAA Bathy chart shows 66 m bathy lines passing through Block 32. No multibeam available.
Two transects were conducted in Block 32, starting center and headed W. The two transects ranged from 64 to 66.5 m depth.

XS 4: HD SW: Start: 6:36:13 PM, 66.5 m; end: 6:44:53 PM, 65.3m. 100% cover of soft bottom and bioturbation with 10 cm mounds and Meoma tracks. Dominated by algae- Red blade algae (several spp.), Caulerpa sertulariodes, Codium, Kallymenia, and Halimed; small macro sponges - rare. Came across large field of 80% cover of Halimeda copiosa?
Off Transect: HD W for 15 min. Large field of Halimeda with scattered Kallymenia, other red blade algae, and Codium. Few tilefish mounds and 10 m diameter, 1 m deep sand pit with small ledge at bottom- 8 lionfish; triggerfish, eel. Another pit 5m x 1 m deep, with ledge, 2 lionfish; 3 m pit empty; Dictyota, 1 sponge- Erylus, Eucidaris tribuloides, black urchin, sand tile burrow. C. Keonig said the large sand pits did not look like red grouper- that reds have an even berm of sand around top edge; these pits usually had 3 large piles of sand at top.

XS 5: HD S: Start: 6:55:18 PM, 65 m; end: 7:05:59 PM, 64.08m. 100% soft bottom with detritus, sparse algae. Changes to dense algae, Halimeda copiosa?, red blade algae, Kallymenia, Codium, Meoma ventricosa. 8 m pit, 1 m deep, with small ledge; 5 lionfish; another pit with rubble pile at edge- saw sand tile go in hole, cowfish.

Location: Tortugas, Miller's Ledge, Block 75; ROV 14-17, UNCW #96

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov
Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	None Available
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/23/2014
Specimens:	0
Digital Photos:	191
DVD:	3
Hard Drive:	1

Location: Tortugas, Miller's Ledge, Block 75; ROV 14-17, UNCW #96

Dive Data:

Minimum Bottom Depth (m):	83.0	**Total Transect Length (km):**	0.94
Maximum Bottom Depth (m):	112.0	**Surface Current (kn):**	0.5
On Bottom (Time- EDST):	7:53	**On Bottom (Lat/Long):**	24°28.7024'N 83°14.5482'W
Off Bottom (Time- EDST):	10:13	**Off Bottom (Lat/Long):**	24°29.2094'N 83°14.5998'W
Physical (bottom); Temp (°C):	18.1	**Salinity:** N/A	**Visibility (ft):** 45 **Current (kn):** N/A

Dive Imagery:

Figure 1: Typical Miller's Ledge habitat; bank butterflyfish (*Prognathodes aya*)

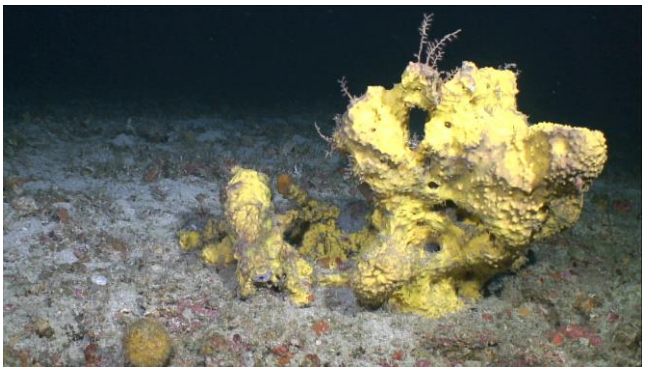


Figure 2: *Aiolochroia crassa* sponge on Miller's Ledge

Dive Notes:

Site/Objectives:

ROV 14-17, Site #- 23-VIII-14-1, UNCW Dive #96. Target Site -Tortugas, Millers Ledge, Block 75. Ground truth: NOAA Regional Bathymetric Chart: NOAA_Bathy_Chart_Tortugas_Valleys_IMG & NOAA_Bathy_Chart_Tortugas_Bank, Live GPS Log- 201408231.shp; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set digital still camera to Tv Mode, fixed S1/125, with auto F-Stop, ISO 100, auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Both cameras had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~ 30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were

determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Block 75

Site Description/Habitat/Biota:

The NOAA Bathy chart shows 100 m bathy lines running east and west Block 75. (likely the NOAA chart is shifted to the SW from reality, 110 m bathy line = 107 m)

Five transects were conducted in Block 75, starting at SE corner and headed NW. The five transects ranged from 112 at base of slope to 83 m depth at top of slope.

XS 1: HD NW: Start: 7:58:42 AM, 110 m; 8:19:26 AM: TIME, 105.5m. Attempting to run xs parallel to the depth contour several hundred meters south of the apparent Millers Ledge. 30% hard bottom, low relief, cobble and rubble with scattered 0.5 m boulders. Dominated by small encrusting sponges, Spirastrellidae, scattered white comatulids and Stylocidaris urchins. Tatler, roughtongue bass, anthiids, lizard fish.

Off Transect: HD N for 15 min. HD North to get closer to the base of the wall, sand dunes with rolling bottom covered on ribble/cobble and small boulders. Hydroids, demosponges, orange gorgonian. Chaetodon aya.

XS 2: HD N: Start: 8:31:09 AM, 107 m; end: 8:48:03 AM, 112 m. Similar to XS 1, 50% cover of rock pavement, boulder, rubble, flat and oval boulders, 50-100 cm, < 1/2 m relief. Crab, orange starfish, Spirasteridae, Davidaster crinoid. Pile of longline, Heiniken bottle, Sargassum detritus.

Off Transect: HD N for 15 min. Sediment with rock boulders changing to rock mounds (108.5 m), moderate relief, highly rugose, low slope (overall -up to the north). Boulder with 2 lionfish, longline.

XS 3: HD N: Start: 8:59:11 AM, 109.2 m; end: 9:12:54 AM, 107.5m. Near base of slope; 70% hard bottom, boulders 1-2 m diameter, eroded, rugged; large rolling hummoky bottom, rock mounds are 1-2 m tall; moderate relief, higly rugose, low slope (overall -up to the north). Scamp eating and caching fish, anthiids, 1- speckled hind (species critically endangered), more scamp.

Off Transect: HD N for 15 min; 9:12 am, depth 107.5 m. Still at base of wall.

XS 4: HD N: Start: 9:23:56 AM, 101 m; end: 9:36:32 AM, 89 m. Transect up slope although not apparent in video, <10o. 70% hard bottom, rubble/cobble bottom is variable from rock rub/cob to rock boulders and ledges and erroded ledges, 1/2 m relief. Longline, Spirastrellidae, 1 m boulder with roughtongue bass, rock beauty, lionfish- 2.

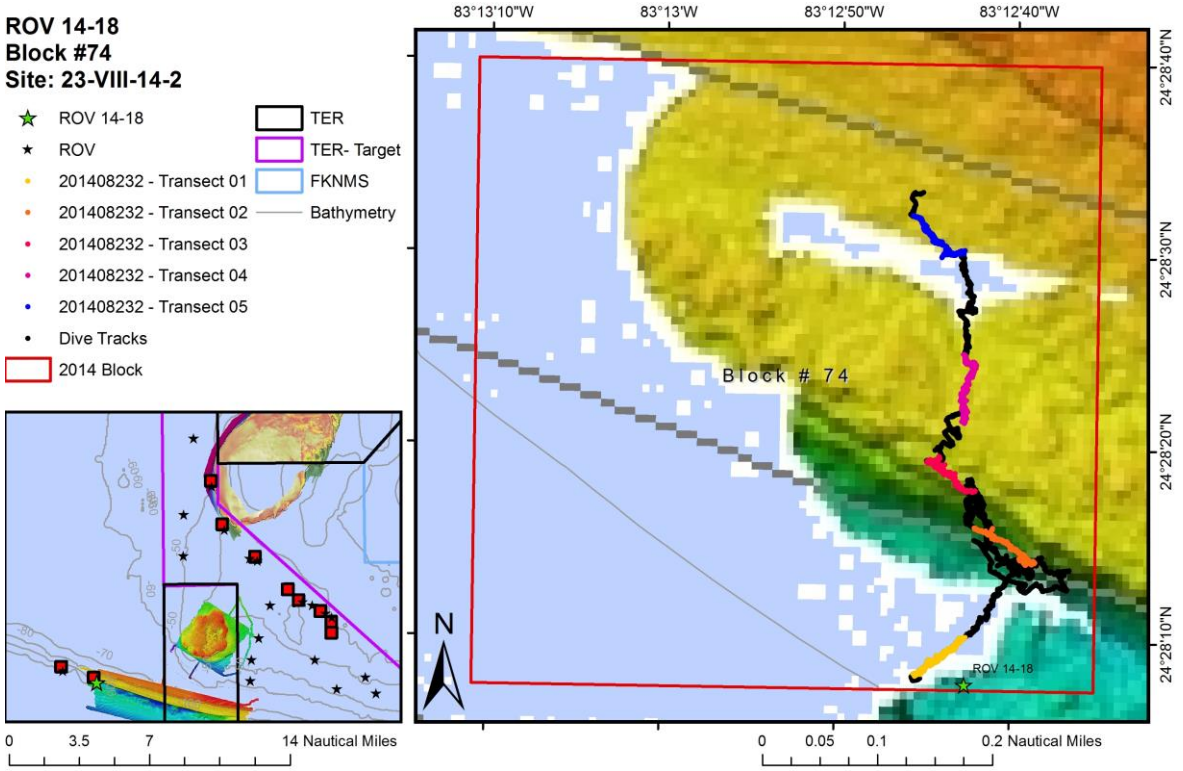
Off Transect: HD N for 15 min; 9:36 am, 89 m. At 86 m deep which was the top of the wall on dives to the east, there was no slope > 10 deg. Pavement, scattered 1/2 m boulders, flat. Yellow Verongida, demospongia common, Auletta, Placospongia, Ircinia strobilina.. Reef butterfly, squirrelfish.

XS 5: HD N: Start: 9:47:08 AM, 85.5 m; end: 10:03:45 AM, 83 m. Top of what is left of Millers' Ledge. 70% hard bottom, pavement with sediment veneer, 25-50 cm boulders scatttered, rubble/cobble. Dense sponges, Davidaster, Astrophorid massive w/ encrusting yellow sponge, Auiletta, Telesto. 81 pavement. Ledge at 82 m, 1 m rock slabs. Black grouper, scamp, spotfin hogfish, few lionfish,

Off Transect: HD N for to edge of block; Start 10:03 am, 83 m; end- 10:12 am, 79.2 m. Sand and rubble, sand ridges. Two spot flamefish, basketstar.

Location: Tortugas, Miller's Ledge, Block 74; ROV 14-18, UNCW #97

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov
Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	millers ridge_2
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/23/2014
Specimens:	0
Digital Photos:	170
DVD:	3
Hard Drive:	1

Location: Tortugas, Miller's Ledge, Block 74; ROV 14-18, UNCW #97

Dive Data:

Minimum Bottom Depth (m):	82.5	**Total Transect Length (km):**	0.75
Maximum Bottom Depth (m):	115.2	**Surface Current (kn):**	0.5
On Bottom (Time- EDST):	11:10	**On Bottom (Lat/Long):**	24°28.1330'N 83°12.7542'W
Off Bottom (Time- EDST):	13:45	**Off Bottom (Lat/Long):**	24°28.5345'N 83°12.7639'W
Physical (bottom); Temp (°C):	18.6	**Salinity:** N/A	**Visibility (ft):** **Current (kn):** N/A

Dive Imagery:

Figure 1: *Mithrax* sp. spider crab on rubble bottom

Figure 2: Close-up of *Madrepora oculata* scleractinian coral.

Dive Notes:

Site/Objectives:

ROV 14-18, Site #- 23-VIII-14-2, UNCW Dive #97. Target Site -Tortugas, Millers Ledge, Block 74;. Ground truth: NOAA Regional Bathymetric Chart: NOAA_Bathy_Chart_Tortugas_Valleys_IMG, & geotif- millers ridge_2.jpg, Live GPS Log- 201408232.shp; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set digital still camera to Tv Mode, fixed S1/125, with auto F-Stop, ISO 100, auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Both cameras had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~ 30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were

Location: Tortugas, Miller's Ledge, Block 74; ROV 14-18, UNCW #97

determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Site Description/Habitat/Biota:
geotif- millers ridge_2.jpg shows Millers Ledge passing midway through Block 74.
Five transects were conducted in Block 74, starting at SE corner and headed NNW. The five transects ranged from 115.2 to 82.5 m depth.

XS 1: HD NE: Start: 11:12:19 AM, 113 m; end: 11:25:45 AM, 115.2 m. ~100 meters south of Millers' Ledge; 6 km west of South TER border. 10-90% cover hard bottom, 5-10 cm cobble, rock pavement, rock slabs, < 1/2 m relief. Later sand with rock rubble/cobble, 30-50% cove. Biota was dominated by encrusting sponges; majid crab. Madrepora oculata, 3-5 cm, white, sighted scattered throughout; cup coral, Stylocidaris. Lizardfish.
Off Transect: HD NE for 15 min; start 11:25 am, 114.2 m; end- 11:32 am, 102.9 m. 100 m SW of ledge; 50% hard bottom, sediment with rubble/cobble, rolling rock hills and boulders

XS 2: HD NW: 11:37:00 AM, 102m; end: 11:52:11 AM, 103.5 m. Base of Miller's ledge starting upslope and running parallel to slope. Low slope, low rugosity, 70% hard bottom, cobble/rubble, small boulders rock slabs, <.5 m relief. Barren with some encrusting sponges and anthiids. Sponges sparse, no gorgonians. Chaetodon aya, anthiids.
Off Transect: HD NNE for 15 min; start- 11:52 am, 103.5 m. Continue upslope, same bottom. 93 m near top, rock pavement, slope <10o. Tanacetipathes hirta, encrusting sponges,Narcissia trigonaria. Top of slope at 88m; flat rock slabs, <1/2 m relief, 50-70% cover, scamp.

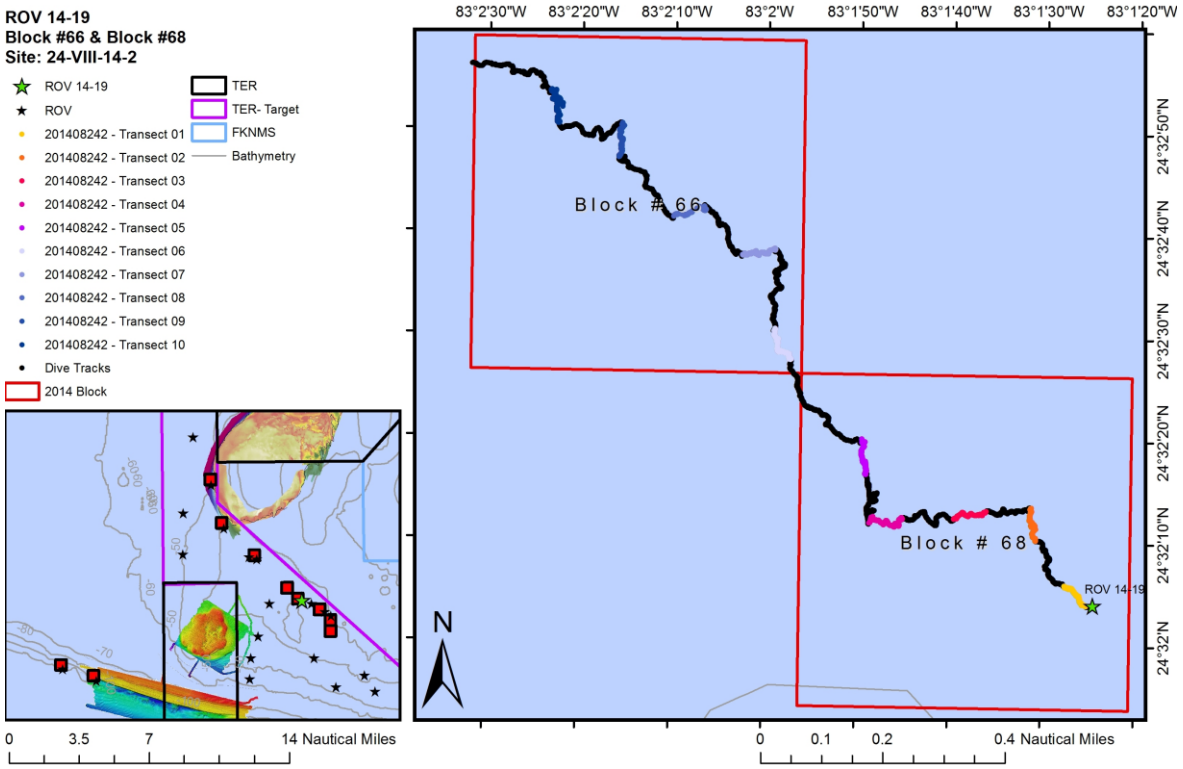
12:03 to 12:38- Squaw came through, 25 kn winds, ROV off bottom.
XS 3: HD NW: Start: 12:38:37 PM, 92 m; end: 12:52:57 PM, 86.7 m. Transect along and parallel to top edge of slope. 88 m top of slope. Cobble/rubble 10-20 cm, boulders 30-50 cm, rock slabs wth <1/2 m relief, upper edge about 30o slope, but no large ledges. Sponges dominant, no algae, no gorgonians, Auletta. Squirrel fish, anthiids, yellowtaiil reeffiish. Changes to flat top at the upper ridge, 88 m, pavment/rubble; Cinachyrella common, Antipathes fans.
Off Transect: HD NW for 15 min. 86.7 m, on top terrace. 90% pavement w/ sediment veneer, fractures with 10-20 cm ledges, stripped grunt. 83 m end.

XS 4: HD N: Start: 1:00:45 PM, 83.6 m; end: 1:16:22 PM, 84 m. LR rock outcrops 10-20 cm. Terrace top. 70-100% hard bottom, pavement, sediment veneer, 10-20 cm relief ledges. Cinachyrella common, Aplysina, Astrophorida barrel w/ yellow encrusting sponge, Stylaster, orange gorgonians. Scamp, graysby, few lionfish. Two longlines.
Off Transect: HD N for 15 min. Flat sediment with rubble/cobble; changing between rock pavement w/ sediment mounds and larger rock boulders. Dominagted by sponges, Oceanapia, Nidalia, Eucidaris, Ascidiacea.

XS 5: HD NW: Start: 1:27:33 PM, 83 m; end: 1:44:06 PM, 82.5m. Similar to XS 4. Top of terrace, 50-70% hard bottom, pavement, rubble, boulders 30-50 cm with 30 cm relief. Demosponges dominant, hydroids, Cinachyrella, Ircinia, Davidaster, Antipatharia, Didemnidae. No gorgonians. FIrst algae sighted- pink CCA on cobble, 83 m. End 82.5 m.

Location: Tortugas, Reef; Block 68 & 66; ROV 14-19, UNCW #98

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov
Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	None Available
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/24/2014
Specimens:	0
Digital Photos:	350
DVD:	4
Hard Drive:	1

Location: Tortugas, Reef; Block 68 & 66; ROV 14-19, UNCW #98

Dive Data:

Minimum Bottom Depth (m):	27.5	**Total Transect Length (km):**	2.49
Maximum Bottom Depth (m):	31.8	**Surface Current (kn):**	0.2
On Bottom (Time- EDST):	10:44	**On Bottom (Lat/Long):**	24°32.0660'N 83°01.4158'W
Off Bottom (Time- EDST):	14:24	**Off Bottom (Lat/Long):**	24°32.9396'N 83°02.5358'W

Physical (bottom); Temp (°C): 28.9 **Salinity:** N/A **Visibility (ft):** 20 **Current (kn):** N/A

Dive Imagery:

Figure 1: Atlantic goliath grouper (*Epinephelus itajara*) swims on a reef

Figure 2: *Pseudodiploria strigosa* brain coral grows on the edge of the reef.

Dive Notes:

Site/Objectives:

ROV 14-19, Site #- 24-VIII-14-2, UNCW Dive #98. Target Site -Tortugas, Block 68 & 66. Ground truth: NOAA Regional Bathymetric Chart: 2010_pulley_10m.tif, live GPS Log- 201408173.shp; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set digital still camera to Tv Mode, fixed S1/125, with auto F-Stop, ISO 100, auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Only the digital still camera had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT. Low salinity of shipboard CTD was verifiied in the evening CTD cast down to 5 m.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block (block 68 & 66). Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~30 sec. Off transects between the photo transects were 10-15 minutes. Heading of

transects were determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Block 68

Site Description/Habitat/Biota:

The NOAA Bathy chart shows 26 m bathy lines in the western side of Block 68.

Five transects were conducted in Block 68, starting at SE corner and headed W/NW. The five transects ranged from 27.5 to 31.8 m depth.

XS 1: HD NW: Start: 10:46:12 AM, 31.8 m; end: 10:57:49 AM, 28.2 m. Sand at beginning then large patch reef entire dive and off transect, so about 200 m long; with 1 m relief, high rugosity, flat. Biota was dominated by Xestospongia muta, Pseudopterogorgia sp., Callyspongia vaginalis, Pseudopterogorgia americana, Montastraea cavernosa- abundant, Aplysina cauliformis, Undaria (Agaricia) agaricites, Niphates, Gorgonia ventalina, Agelas clathrodes, Eunicea spp.

Off Transect: HD NW for 15 min. Patchy patch reefs, <1 m relief. Same biota; also Iotrochota birotulata, Aiochoroia crassa, Microdictyon? filamentous green common on the rock, Penicillus, Dictyota. End of reef.

XS 2: HD NW: Start: 11:09:18 AM, 29 m; end: 11:17:22 AM, 28.5 m. Patch reef petered out on sediment with few scattered hard bottom patches; 90% soft bottom; barren except on small boulders, low relief, with same reef species but in a lot less abundance, sand tile mounds, Plexaura sp. Patch reef reappears for a short distance 3/4 of the way through.

Off Transect: HD W for 15 min. Patch reef peters out again, same species; also Eusmilia fastigiata coral.

XS 3: HD W: Start: 11:26:29 AM, 28.5 m; end: 11:36:33 AM, 28 m. Similar to XS 1, patch reef, <1 m relief. Similar biota; M. cavernosa; also Pseudodiploria strigosa, Ellisella barbadensis. Good place for diver collections of M. cavernosa at 11:33:40 AM- 24°32.2154'N, 83°01.6390'W; 28.5 m.

Off Transect: HD W for 15 min; 28 m. Same bottom; also Pterogorgia anceps, sand tillefish mounds, Udotea cups common on sand, Siderastrea siderea, Agaricia fragilis?, Callyspongia plicifera, Scolymia, Niphates erecta.

XS 4: HD W: Start: 11:47:12 AM, 28.2 m; end: 11:59:00 AM, 28 m. Similar to XS 1; low reilief patch reefs. Biota similar; also 2 red grouper. Good place for diver collections of M. cavernosa at 11:57:51 AM- 24° 32.2020'N, 83°01.8025'W; 30-50 cm diameter, all healthy

Off Transect: HD N for 15 min; 28 m. Patchy patch reefs, < 1 m. Coral - Meandrina meandrites, Montastraea cavernosa - common; 30 cm M. Cavernosa appears slightly bleached, 4 adjacent M. Cavernosa brown; rock with 5 M. Cavernosa; another rock w/ 5 M.c.

XS 5: HD N: Start: 12:08:51 PM, 27.5 m; end: 12:19:24 PM, 28m. Similar to XS 1; patch reefs <1 m relief. Good place for diver collections of M. cavernosa at 12:14:30 PM- 24°32.3061'N,, 83°01.8221'W; 28 m. Meandrina, 30-50 cm M. Cavernosa common, red grouper in hole, P. Strigosa. Bleached coral in photo, 1 m Agaricia cuculata? partially bleached.

Off Transect: HD NW 300 m to Block 66. Patch reef disappearing and becomes sand with algae.

Block 66

Site Description/Habitat/Biota:

The NOAA Bathy chart shows 26 & 28 m bathy lines on the west side of Block 66.

Five transects were conducted in Block 66, starting at SE corner and headed N/NW. The five transects

ranged from 24.8 to 27.5 m depth.

XS 1 (6): HD NW: Start: 12:32:51 PM, 27.7 m; end: 12:41:55 PM, 27.5 m. 100% sediment; biota was dominated by algae: Udotea cups, Caulerpa sertulariodes.
Off Transect: HD N for 15 min. Sediment with sand tile mounds and green alga; some rock with Spheciospongia vesparium loggerhead sponge.

XS 2 (7): HD NW: Start: 12:56:35 PM, 27 m; end: 1:03:31 PM, 26.1 m. Similar to XS 1 (6); 100% soft bottom; sparse rock with sponges. Same biota.
Off Transect: HD NW for 15 min. Soft bottom at the beginning, changes to increase off rubble/cobble/boulders with reef species, gorgonians and sponges; M. Cavernosa reappears, X.muta, I. strobiliina, C.vaginalis. Ghost lobster trap-empty.

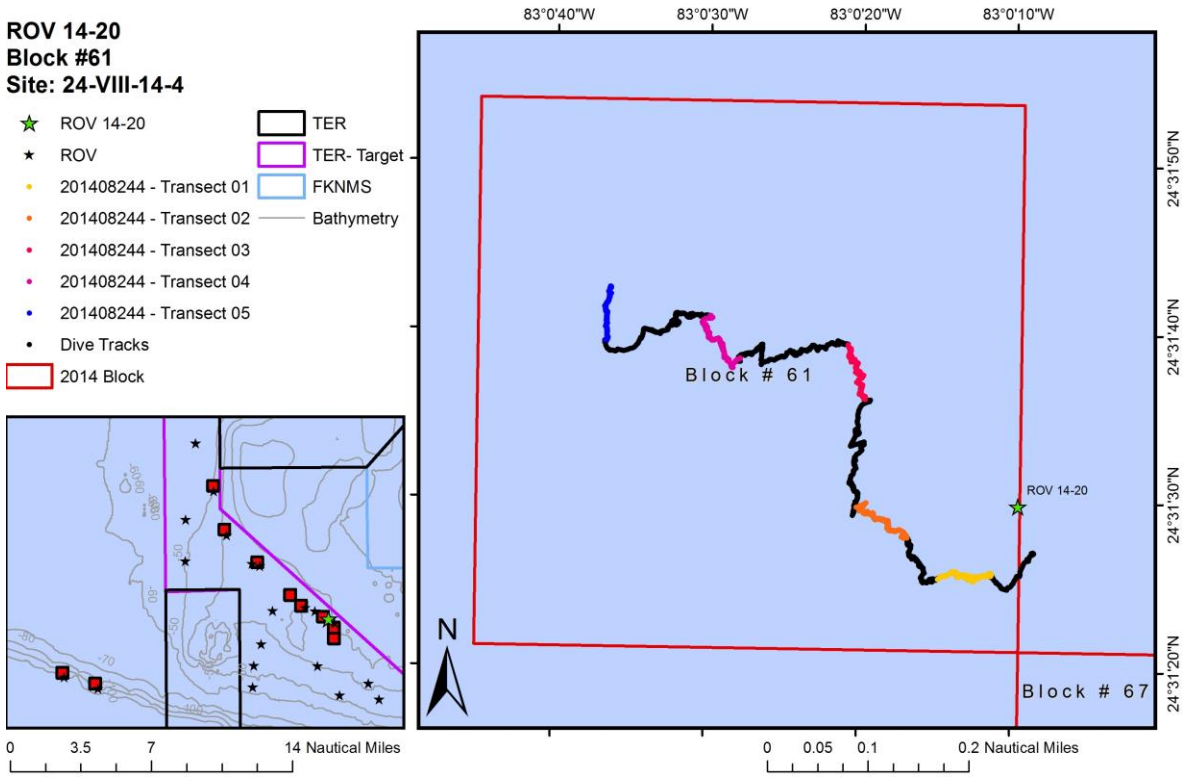
XS 3 (8): HD W: Start: 1:13:00 PM, 25 m; end: 1:21:16 PM, 24.8 m. 100 pavement with sediment veneer, X. muta, S. Vesparium, dense Udotea on sediment, I. campana.
Off Transect: HD NW for 15 min, 24.5 m. 100% pavement w\ sediment veneer. Came across a (15 m diam) reef with 1 m relief, with a 4' goliath, hundreds of grey snapper (spawning aggregation?), scamp groupers, few lionfiish (only ones seen on entire dive), dense corals 24°32.7815'N, 83°02.2330'W- 30-50 cm M. cavernosa common, 1-2 m P. strigosa.

XS 4 (9): HD N: Start: 1:37:18 PM, 24.8 m; end: 1:48:03 PM, 25 m. Low relief patch reef, pavement, mostly sediment. Gorgonacea, sponges, Udotia, Ircinia, S. vesparium, X. muta.
Off Transect: HD W for 15 min, 25 m. 100% hard bottom reef habitat, flat pavement with dense biota, same shallow reef species.

XS 5 (10): HD NW: Start: 1:59:03 PM, 25.7 m; end: 2:11:12 PM, 25 m. Patchy flat hard bottom with reef species and soft bottom patches; 50% exposed pavement. Sponges and gorgonacea common but not dense. On sand- Penicillus, Udotea, Sargassum attached.
Off Transect: HD N to edge of block. Similar hard bottom. Ghost lobster pot, no line, empty; 3 hogfish, 1 red grouper.

Location: Tortugas, Reef; Block 61; ROV 14-20, UNCW #99

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov
Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	None Available
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/24/2014
Specimens:	0
Digital Photos:	154
DVD:	2
Hard Drive:	1

Location: Tortugas, Reef; Block 61; ROV 14-20, UNCW #99

Dive Data:

Minimum Bottom Depth (m):	31.0	**Total Transect Length (km):**	0.92
Maximum Bottom Depth (m):	32.5	**Surface Current (kn):**	N/A
On Bottom (Time- EDST):	16:23	**On Bottom (Lat/Long):**	24°31.4512'N 83°00.1403'W
Off Bottom (Time- EDST):	18:01	**Off Bottom (Lat/Long):**	24°31.7104'N 83°00.6035'W

Physical (bottom); Temp (°C): 28.7 **Salinity:** N/A **Visibility (ft):** 30 **Current (kn):** N/A

Dive Imagery:

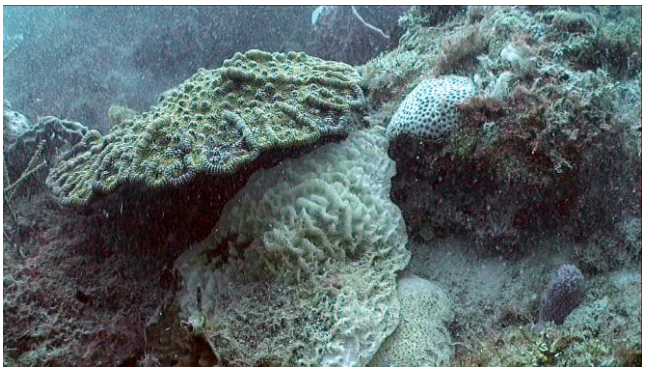


Figure 1: *Mycetophyllia aliciae*, recently dead Agariciids coral and *Siderastrea radians* on the reef.

Figure 2: Field of shaving-brush green algae (*Penicillus dumetosus*) on soft bottom.

Dive Notes:

Site/Objectives:

ROV 14-20, Site #- 24-VIII-14-4, UNCW Dive #99. Target Site -Tortugas, Block 61;. Ground truth: NOAA Regional Bathymetric Chart: 2010_pulley_10m.tif, Live GPS Log- 201408244.shp; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set digital still camera to Tv Mode, fixed S1/125, with auto F-Stop, ISO 100, auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Only digital still camera had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~

Location: Tortugas, Reef; Block 61; ROV 14-20, UNCW #99

30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Site Description/Habitat/Biota:
The NOAA Bathy chart shows 32 m bathy lines inside Block 61.
Five transects were conducted in Block 61, starting at SE corner and headed W/NW. The five transects ranged from 31 to 32.5 m depth.

XS 1: HD W: Start: 4:27:40 PM, 31.5 m; end: 4:40:25 PM, 32.2 m. 100% soft sediment bottom, silty, thin layer of flocculant detritus on surface; bioturbation with 5-10 cm mounds, depressions, and dense 2-3 mm holes. Barren at first, sand tilefish mound.
Off Transect: HD W for 10 min, 32.2. M. 100% soft bottom then came across small patch reef, < 1m relief; Eudistoma, Montastraea cavernosa, Dictyota sp., Pseudopterogorgia, Eunicia sp., Xestospongia muta, Niphates digitalis, filamentous Chlorophyta on rock, Aplysina cauliformis. 20 cm M. Cavernosa, 10 cm Dichocoenia, 1/2-1 m round boulders with reef biota scattered on sediment.

XS 2: HD NW: Start: 4:49:06 PM, 32 m; end: 4:59:36 PM, 32.5 m. 100% soft sedimnent, small bioterbation pits. Few scattered boulders 0.5-1 m diameter w/ reef fauna, patch with 1-2 m tall boulders with reef fauna. M. cavernosa.
Off Transect: HD N for 10 min, 32.5 m. 1/2 to 1 m rock boulders on soft sediment. N. Erecta, iciligorgia schrammi common 2--3', X. muta, M. cavernosa, C. vaginalis, Elliisella barbadensis, Porites asteroides, 20 cm Undaria agaricites 100% bleached, 10 cm Siderastrea siderea bleached, 20 cm Meandrites danae- green.

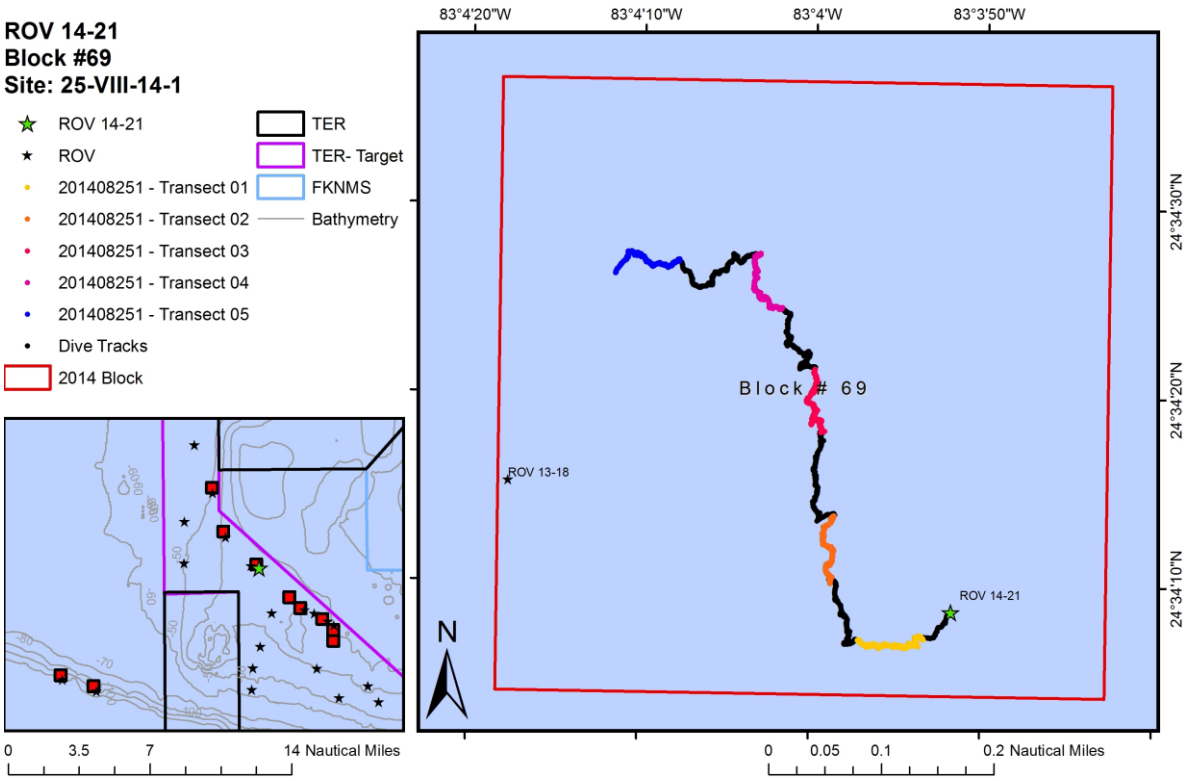
XS 3: HD N: Start: 5:11:10 PM, 31.6 m; end: 5:23:41 PM, 32 m. Patchy patch reefs, <1m boulders covered in typical reef fauna, silty bottom. 50 cm M. cavernosa, Mussa angulosa. 3 M.cav (brown, green and bleacheds side by side, or same colony), red boring sponge Cliona. Most Agaricia of entire dive were partially of completely bleached.
Off Transect: HD W for 15 min 32 m. Soft bottom w/ 1/2-`1 m boulders and patch reefs. Changes to soft bottom

XS 4: HD NW: Start: 5:33:43 PM, 32.2 m; end: 5:45:33 PM, 32 m. 100% sediment with flocculant detritus on surfaces. Alage starts to appear: dense Caulerpa sertulariodes, Halimeda, Udotea cups, Caulerpa prolifera.
Off Transect: HD NW for 15 min, 32 m. 100% sediment with algae.

XS 5: HD N: Start: 5:54:59 PM, 31.2 m; end: 6:01:13 PM, 31 m. 100% soft bottom w/ algae: Caulerpa, Udotea cups- Cyathiformis sp.

Location: Tortugas, Soft Bottom; Block 69; ROV 14-21, UNCW #100

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov
Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	None Available
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/25/2014
Specimens:	0
Digital Photos:	155
DVD:	2
Hard Drive:	1

Location: Tortugas, Soft Bottom; Block 69; ROV 14-21, UNCW #100

Dive Data:

Minimum Bottom Depth (m):	31.2	**Total Transect Length (km):**	1.39
Maximum Bottom Depth (m):	32.2	**Surface Current (kn):**	0.3
On Bottom (Time- EDST):	11:26	**On Bottom (Lat/Long):**	24°34.1369'N 83°03.8650'W
Off Bottom (Time- EDST):	13:11	**Off Bottom (Lat/Long):**	24°34.8304'N 83°04.1810'W

Physical (bottom); Temp (°C): 26.7 **Salinity:** N/A **Visibility (ft):** **Current (kn):** N/A

Dive Imagery:

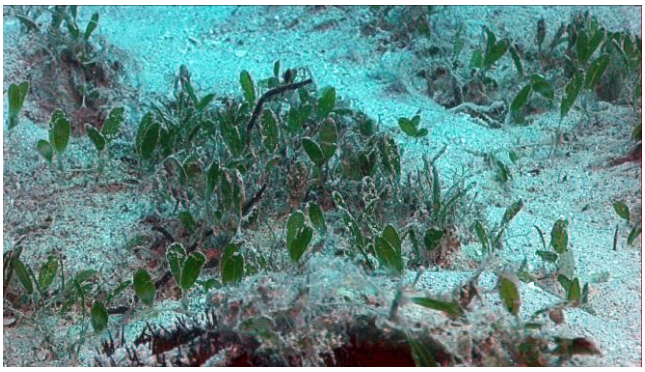


Figure 1: *Halophila decipiens* seagrass.

Figure 2: *Triplofusus giganteus* on soft bottom

Dive Notes:

Site/Objectives:

ROV 14-21, Site #- 25-VIII-14-1, UNCW Dive #100. Target Site -Tortugas, Block 69, 4 km west of FKNMS boundary; Ground truth: NOAA Regional Bathymetric Chart:NOAA_Bathy_Chart_Tortugas_Bank, Live GPS Log- 201408251.shp; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set digital still camera to Tv Mode, fixed S1/125, with auto F-Stop, ISO 100, auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Only digital still camera had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~ 30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Location: Tortugas, Soft Bottom; Block 69; ROV 14-21, UNCW #100

Site Description/Habitat/Biota:
The NOAA Bathy chart shows 28 m bathy lines circling the outside of the Block 69.
Five transects were conducted in Block 69, starting at SE corner and headed N/NW. The five transects ranged from 31.2 to 32.2 m depth.

XS 1: HD W: Start: 11:28:08 AM, 31.5 m; end: 11:44:43 AM, 31.9 m. 100% sediment with 10-30 cm mounds and depressions bioturbation, ~10% algal cover; biota was domithgnated by C. prolifera, Penicillus dumentosus, Udotea cyathiformis, Halophila decipens sea grass sparse; several small 10 cm conch- fighting conch?
Off Transect: HD N for 15 min. Same habitat; MOL - Gastropoda - Strombus atlanticus, fighting conch?

XS 2: HD N: Start: 11:55:15 AM, 32.2 m; end: 12:07:48 PM, 31.5m. Similar to XS 1 with Udotea fans, snapper, Halimeda incrassata.
Off Transect: HD N for 15 min. Same Bottom

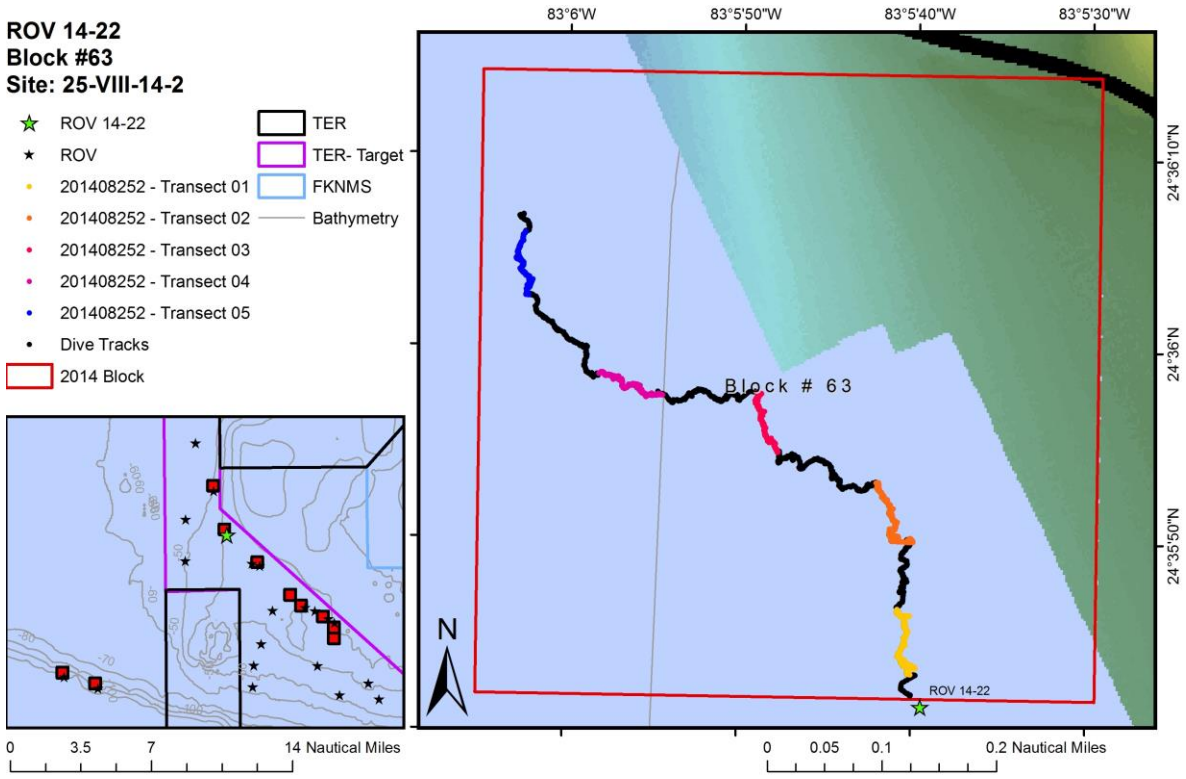
XS 3: HD N: Start: 12:16:23 PM, 31.5 m; end: 12:28:26 PM, 31.2m. Similar to XS 1.
Off Transect: HD N for 10 min. Soft bottom with Meoma ventricosa sea biscuits and tracks.

XS 4: HD NW: Start: 12:38:14 PM, 31.2 m; end: 12:51 pm, 31.0 m. Similar to XS 1.
Off Transect: HD W for 15 min. Same habitat and biota.

XS 5: HD W: Start: 12:59:56 PM, 31.7 m; end: 13:11 pm, 31.5 m. Similar to XS 1, Udotea cups and fans, cyanobacteria patches. Came across small area of patchy hard bottom reef with typical reef habitat: Callyspongia vaginalis, Dictyota, Halimeda, Niphates erecta, Ircinia campana, Pseudopterogorgia, sand tilefish burrows.

Location: Tortugas, Soft Bottom; Block 63; ROV 14-22, UNCW #101

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov
Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	NCCOS&FKNMS_multibeam .tif
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/25/2014
Specimens:	0
Digital Photos:	159
DVD:	2
Hard Drive:	1

Location: Tortugas, Soft Bottom; Block 63; ROV 14-22, UNCW #101

Dive Data:

Minimum Bottom Depth (m):	31.9	**Total Transect Length (km):**	1.00
Maximum Bottom Depth (m):	34.5	**Surface Current (kn):**	0.2
On Bottom (Time- EDST):	13:58	**On Bottom (Lat/Long):**	24°35.6820'N 83°05.6620'W
Off Bottom (Time- EDST):	15:56	**Off Bottom (Lat/Long):**	24°36.0890'N 83°06.0510'W

Physical (bottom); Temp (°C): 26.0 **Salinity:** N/A **Visibility (ft):** **Current (kn):** N/A

Dive Imagery:

Figure 1: Mixed *Caulerpa* spp. and *Halophila decipiens*

Figure 2: *Caulerpa prolifera* on sediment

Dive Notes:

Site/Objectives:

ROV 14-22, Site #- 25-VIII-14-2, UNCW Dive #101. Target Site -Tortugas, Block 63, west of FKNMS. Ground truth: NOAA Regional Bathymetric Chart: NOAA_Bathy_Chart_Tortugas_Bank and edge of NCCOS&FKNMS_multibeam.tif, Live GPS Log- 201408252.shp; conduct ROV video/photo transects. The NOAA chart appears to have shifted 0.5 km to the west.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set digital still camera to Tv Mode, fixed S1/125, with auto F-Stop, ISO 100, auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Both cameras had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT. ****Only the DVD got recorded; the high def and standard def video did not get saved somehow.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed

Location: Tortugas, Soft Bottom; Block 63; ROV 14-22, UNCW #101

through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~ 30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Site Description/Habitat/Biota:
The NOAA Bathy chart shows 32 -42 m bathy lines increaseing east to west in Block 63.
Five transects were conducted in Block 66, starting at SE corner and headed N add W. The five transects ranged from 31.9 to 34.5 m depth.

XS 1: HD N: Start: 2:01:20 PM, 32.5 m; end: 2:16:43 PM, 32 m. 100% soft bottom, 100% covered with Caulerpa spp. and bioturbated with 10-30 cm mounds and depressions. Caulerpa prolifera, C. sertulariodes, Udotea cyanthiformis, Penicillus, P. mucosus, Dysidea etheria.
Off Transect: HD N for 15 min. Soft bottom; same habitat.

XS 2: HD NW: Start: 2:27:48 PM, 31.9 m; end: 2:41:26 PM, 32 m. Similar to XS 1, same biota, some large patches of Cyanobacteria.
Off Transect: HD NW for 15 min. Same habitat and biota.

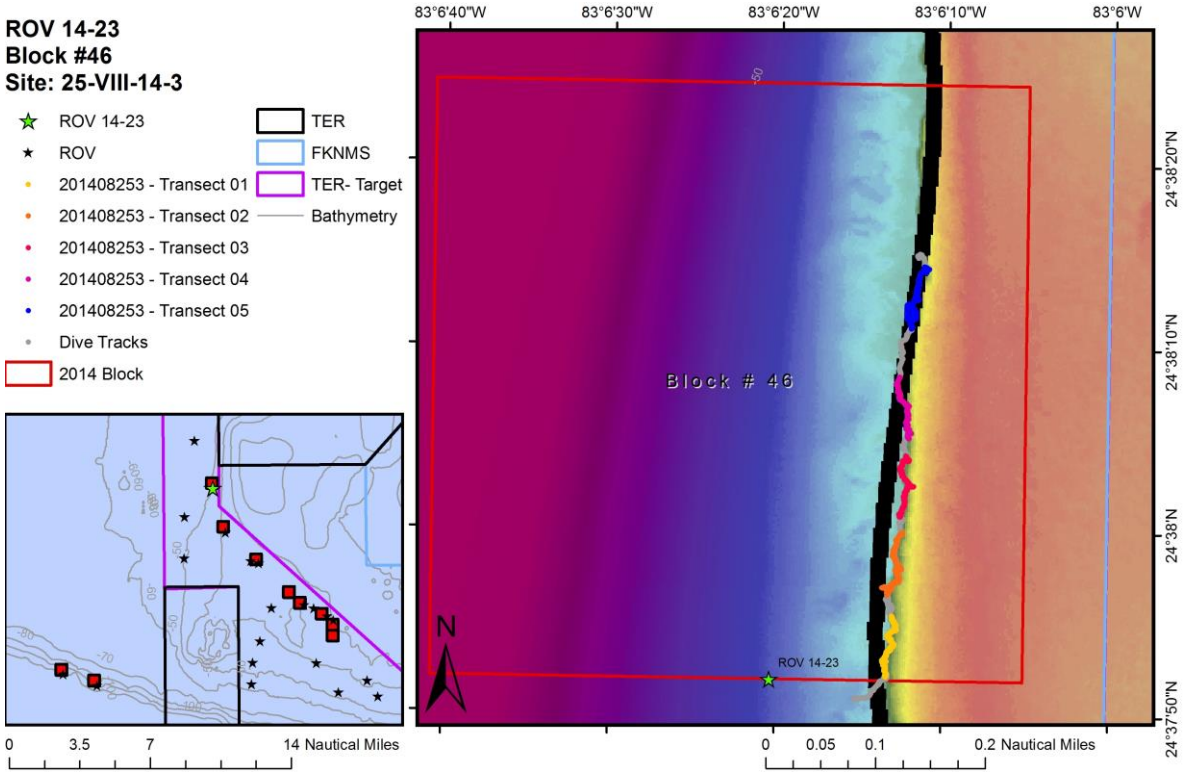
XS 3: HD NW: Start: 2:55:16 PM, 32.6 m; end: 3:08:28 PM, 32.6m. Similar to XS 1; same habitat and biota.
Off Transect: HD W for 15 min. Soft bottom

XS 4: HD W: Start: 3:17:42 PM, 33.5m; end: 3:31:09 PM, 33.9 m. Similar to XS 1; same habitat and biota.
ff Transect: HD W for 15 min. Soft bottom

XS 5: HD N: Start: 3:40:07 PM, 34.5 m; end: 3:55:07 PM, 34.5 m. Similar to XS 1; same habitat and biota.

Location: Tortugas, Reef, West of FKNMS. Block 46; ROV 14-23, UNCW #102

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investigator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov
Scientific Observers:	Dennis Hanisak, Heather Moe, Jason White, John Reed, Lance Horne, Stephanie Farrington
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II
Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	NCCOS&FKNMS_multibeam .tif
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/25/2014
Specimens:	0
Digital Photos:	179
DVD:	2
Hard Drive:	1

Location: Tortugas, Reef, West of FKNMS. Block 46; ROV 14-23, UNCW #102

Dive Data:

Minimum Bottom Depth (m):	27.0	**Total Transect Length (km):**	0.74
Maximum Bottom Depth (m):	30.8	**Surface Current (kn):**	0.3
On Bottom (Time- EDST):	16:54	**On Bottom (Lat/Long):**	24°37.8320'N 83°06.2530'W
Off Bottom (Time- EDST):	18:08	**Off Bottom (Lat/Long):**	24°38.2280'N 83°06.1950'W

Physical (bottom); Temp (°C): 27.7 **Salinity:** N/A **Visibility (ft):** **Current (kn):** N/A

Dive Imagery:

Figure 1: *Montastraea cavernosa* on a healthy reef outside of the FKNMS

Figure 2: A nurse shark (*Ginglymostoma cirratumI*) rest on the fringing reef

Dive Notes:

Site/Objectives:

ROV 14-23, Site #- 25-VIII-14-3, UNCW Dive #102. Target Site -Tortugas, Block 46, ~200 m west of FKNMS boundary. Ground truth: NOAA Regional Bathymetric Chart: NOAA_Bathy_Chart_Tortugas_Bank and edge of NCCOS&FKNMS_multibeam.tif, Live GPS Log- 201408253.shp; conduct ROV video/photo transects. The NOAA chart appears to have shifted 0.5 km to the west.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set digital still camera to Tv Mode, fixed S1/125, with auto F-Stop, ISO 100, auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled ~20° down. Both cameras had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~

Location: Tortugas, Reef, West of FKNMS. Block 46; ROV 14-23, UNCW #102

30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Site Description/Habitat/Biota:
Geotiff shows ridge at 30 m outside the FKNMS in Block 46.
Five transects were conducted in Block 46, starting at SE corner and headed N along west ridge of Tortugas bank. Entire dive coverd 500 m along the top edge of the fore reef. Base of reef is flat sand at 33.4 m; 20-30o slope of fore reeff to top at 27.0 m over ~ 15 m width; 1 m rock relief, rugose and rugged surface; dense biota and coral. Fiive transects from 27 to 30.8 m depth; mostly along the top edge of the fore reef slope.

XS 1: HD NE: Start: 5:00:13 PM, 30.8 m; end: 5:13:38 PM, 28 m. Typical reef habitat 30.8 m in the sand with 30o slope on fore reef to the east; top 27.7 m; rugged eroded rock on slope with 1-1.5 m relief. Biota was dominated by M. cavernosa, Pseudopterogorgia americana, Xestospongia muta, Plexaura sp., Pseudoplexaura, Euniicea, Plexaurella, Aplysina cauliformis or fulva, Niphates digitalis, Pseudodiploria strigosa, Iotrochota birotulata, Cliona delitrix. Very abundant M. cavernosa, 10 cm to 50 cm, possibly 100 cm; various colors but some appear very light, possibly bleached. Abandoned long line along top of reef. 5' nurse shark.
Off Transect: HD N for 15 min. Top of reef on fore reef slope; 1 m M. cavernosa, Lobophora, lite M. cavernosa.

XS 2: HD N: Start: 5:20:05 PM, 28m; end: 17:20 cm, 28.2 m. Fore reef and top edge; reef flattens out, 28 m on top. Loads of M. cavernosa in light browm, grey, and white/green, Undaria agaricites- white, 1 m Orbicella, flat encrusting; 30 cm M. cavernosa- lite bleached?, conical pagoda like M. cavernosa common on top of reef; Aplysina cauliformis, 1 lionfish, hog snapper common.
Off Transect: HD N for 3 min (running low on bottom time). Continue north along top edge of reef. Fishing boat laying lobster pots to the east of us.

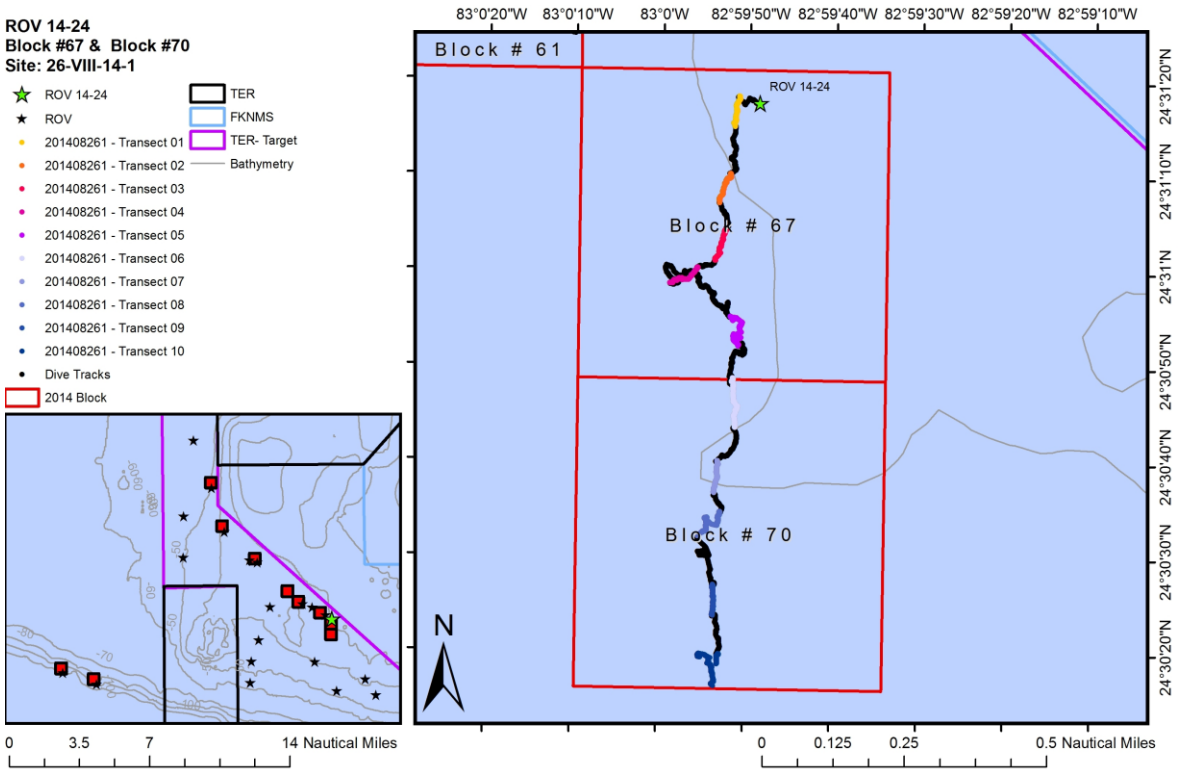
XS 3: HD xx: Start: 5:33:49 PM, 29.6 m; end: 5:43:38 PM, 29 m. Similar to XS 1, fore reef, 30o slope, eroded rock, 1 m relief, high rugosity. Loads of M. cavernosa, Orbicella flat plates common, some 1 m diameter, Porites porites? (thick branches), Pseudodiploria strigosa, Mycetophyllia; some corals with signs of bleaching. Black grouper.
Off Transect: HD N for 3 min. Transect along base, depth 32.0 m in sand.

XS 4: HD xx: Start: 5:45:54 PM, 32 m; end: 5:54:13 PM, 28 m. Similar to XS 1; continue transect along top edge of reef; 1.5 m relief, 30o slope, high rugoisty,. Mycetophyllia sp., Montastraea cavernosa- very abundant, Agaricia or Undaria partially bleached; Aplysina fulva; scamp.
Off Transect: HD N for 3 min. Continue transect along fore reef.

XS 5: HD N: Start: 5:58:30 PM, 27.5 m; end: 6:06:39 PM, 27 m. Similar to XS 1, continue transect along top edge of fore reef. Pagoda like M. cavernosa, 50-100 cm on top of eroded pillars of rock on top of the reef- many of these are light colored or lightly bleached. 3' bushy black coral.

Location: Tortugas, Soft Bottom; Blocks 67 and 70; ROV 14-24, UNCW #103

General Location and Dive Track:



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Ship Position System:	DGPS
Report Analyst:	John Reed, Stephanie Farrington
Date Compiled:	3/23/2015

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	None Available
Purpose:	Conduct ROV video/photo transects; collect grouper for tagging and genetic samples; light traps, CTD, and ISIS plankton tows
ROV:	Mohawk ROV
ROV Sensors:	Temperature (°C), Depth (m)
Date of Dive:	8/26/2014
Specimens:	0
Digital Photos:	332
DVD:	3
Hard Drive:	1

Location: Tortugas, Soft Bottom; Blocks 67 and 70; ROV 14-24, UNCW #103

Dive Data:

Minimum Bottom Depth (m):	30.0	**Total Transect Length (km):**	1.93
Maximum Bottom Depth (m):	33.0	**Surface Current (kn):**	0.3
On Bottom (Time- EDST):	15:52	**On Bottom (Lat/Long):**	24°31.3060'N 82°59.8205'W
Off Bottom (Time- EDST):	18:26	**Off Bottom (Lat/Long):**	24°30.2688'N 82°59.8842'W
Physical (bottom); Temp (°C):	29.2	**Salinity:** N/A	**Visibility (ft):** **Current (kn):** N/A

Dive Imagery:

Figure 1: *Luidia alternata* on sediment

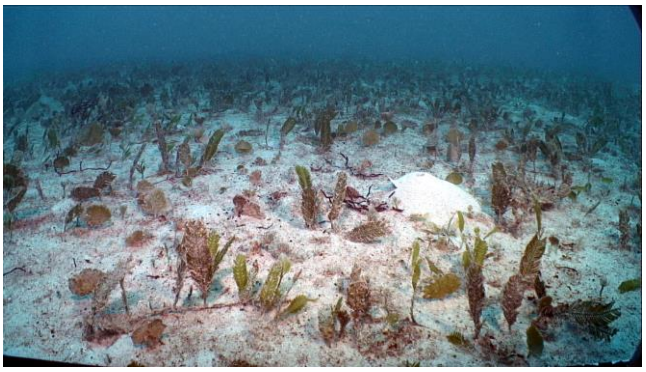

Figure 2: Mixed *Caulerpa* spp. field

Dive Notes:

Site/Objectives:

ROV 14-24, Site #- 26-VIII-14-1, UNCW Dive #103. Target Site -Tortugas, Block 67 & 70. Ground truth: NOAA Regional Bathymetric Chart: 2010_pulley_10m.tif, Live GPS Log- 201408261.shp; conduct ROV video/photo transects.

ROV Setup/Dive Events:

Video time ESDT. Dive Notes depth were recorded as total depth (ROV altitude + ROV depth in meters). COG is ROV heading. Events, habitat and fauna were recorded directly into Access database. Fish data were recorded by H. Moe (NOAA NMFS) in separate Access database which was added to the Access habitat database. Quantitative photos were taken every 30 seconds with a fixed digital camera (Kongsberg OE14-408, with resolution of 3648x2736 pixels) pointing 90° down, 1.3 m off the bottom, set digital still camera to Tv Mode, fixed S1/125, with auto F-Stop, ISO 100, auto focus. Forward looking Video camera (Insite Pacific Mini Zeus high definition CMOS color zoom camera with 2,000,000 effective pixels) was angled 15° down. Both cameras had a pair of parallel 10 cm green lasers for scale. Seabird 39 temperature recorder was attached to the ROV. Date/time of video and digital still camera, ROV CTD and ROV Nav were set to ESDT.

Five 100-m random transects were made to characterize each randomly selected 1 km x 1 km block. Each 100 m transect was conducted at ~0.25 kn at an altitude of ~1.3 m, for 15-20 minutes until the ROV passed through a 100-m radius circle overlaid on the navigation screen; quantitative still images were taken every ~ 30 sec. Off transects between the photo transects were 10-15 minutes. Heading of transects were determined by flip of coin, depending in part on ship's maneuverability due to wind/current.

Location: Tortugas, Soft Bottom; Blocks 67 and 70; ROV 14-24, UNCW #103

Block 67

Site Description/Habitat/Biota:

The NOAA Bathy chart shows nothing.

Five transects were conducted in Block 67, starting at North edge headed S. The five transects ranged from 28.5 to 30.5 m depth.

XS 1: HD S: Start: 3:54:50 PM, 28.5 m; end: 4:01:14 PM, 29m. 100 % soft bottom sediment with algae, moderate bioturbation. Biota was dominated by Caulerpa prolifera, C. Sertulariodes, Penicillus dumentosus, Udotea cyathiformis, Halimeda incrasata. Heavy line on bottom.

Off Transect: HD S for 15 min. Same habitat and biota. Also black spagetti sponge- Haliiclona? sp.

XS 2: HD S: Start: 3:54:50 PM, 28.5 m; end: 4:14:30 PM, 29.5 m. Similar to XS 1.

Off Transect: HD S for 4 min. Same habitat and biota.

XS 3: HD S: Start: 4:18:53 PM, 29.5 m; end: 4:25:02 PM, 29.8m. Similar to XS 1. Also Halophila decipens.

Off Transect: HD SW for 5 min. Same habitat and biota.

XS 4: HD S: Start: 4:29:08 PM, 30 m; end: 4:37:37 PM, 30.5 m. Similar to XS 1.

Off Transect: HD SW for 20 min. Same habitat and biota.

XS 5: HD SE: Start: 4:56:27 PM, 29.8 m; end: 5:03:31 PM, 29.8 m. Similar to XS 1.

Off Transect: HD S to block 70. Same habitat and biota. Also Filograna sp.

Block 70

Site Description/Habitat/Biota:

The NOAA Bathy chart shows nothing.

Five transects were conducted in Block 70, starting at North edge headed S. The five transects ranged from 30 to 33 m depth.

XS 1(6): HD S: Start: 5:17:14 PM, 30 m; end: 5:24:12 PM, 29 m. 100% soft bottom with cover of algae; biota was dominated by same species as previous box: Caulerpa sertularioides, Caulerpa prolifera, Udotea cyathiformis, Halimeda incrassata. Also Dictyota sp.and brown encrusting ascidians on algae. Algae less dense.

Off Transect: HD S for 5 min. Same habitkat; filamentous red algae common. Dead Udotea common, Haliclona spagetti sponge, schools of scad fish.

XS 2(7): HD S: Start: 5:32:37 PM, 30 m; end: 5:38:32 PM, 31m. Similar to XS 1. Also Halophila decipens.

Off Transect: HD S for 5 min. Same habitat. Also Filograna sp.

XS 3(8): HD S: Start: 5:43:45 PM, 31.3 m; end: 5:52:47 PM, 31.5 m. Similar to XS 1.

Off Transect: HD S for 5 min. Same habitat, also white with spots Holothurian, dense filamentous red algae, Penicillus dumentosus.

XS 4(9): HD S: Start: 6:00:10 PM, 31.8 m; end: 6:05:54 PM, 32.0 m. Similar to XS 1.

Off Transect: HD S for 5 min. Same bottom plus Luidia alternata.

Location: Tortugas, Soft Bottom; Blocks 67 and 70; ROV 14-24, UNCW #103

XS 5(10): HD S: Start: 6:11:02 PM, 32.7m; end: 6:26:09 PM, 33 m. Similar to XS 1. Loss of power to ROV for 5 minutes, then contd. Transect. Halophila decipens.
Last dive of cruise.