NOAA CIOERT Cruise Report

Report Title: Characterization of the Mesophotic Benthic Habitat, Benthic Macrobiota, and Fish Assemblages from ROV Dives on Pulley Ridge during the 2015 R/V *Walton Smith* Cruise

R/V *Walton Smith* – Cruise No. WS15234
NMSF *Mohawk* ROV
August 22 to September 4, 2015

NOAA National Centers for Coastal Ocean Science - NA11NOS4780045
"Connectivity of the Pulley Ridge - South Florida Coral Reef Ecosystem"
NOAA/OAR/OER NA14OAR432026: Cooperative Institute for Ocean Exploration, Research, and Technology

John Reed, Stephanie Farrington
Cooperative Institute of Ocean Exploration and Technology
Harbor Branch Oceanographic Institute, Florida Atlantic University (HBOI-CIOERT)

Stacey Harter, Andrew David, Lt. Heather Moe
NOAA/NMFS/Southeast Fisheries Science Center (SEFSC)

Dennis Hanisak
Cooperative Institute of Ocean Exploration and Technology
Harbor Branch Oceanographic Institute, Florida Atlantic University (HBOI-CIOERT)

Citation: Reed J.K., S. Farrington, S. Harter, A. David, H. Moe, D. Hanisak. 2017. Characterization of the Mesophotic Benthic Habitat, Benthic Macrobiota, and Fish Assemblages from ROV Dives on Pulley Ridge during the 2015 R/V *Walton Smith* Cruise. NOAA CIOERT Cruise Report. Submitted to NOAA-NOS-NCCOS, NOAA Office of Ocean Exploration and Research. 221 pp. Harbor Branch Oceanographic Technical Report Number 177.

January 27, 2017

TABLE OF CONTENTS

EXECUTIVE SUMMARY

This cruise was conducted at Pulley Ridge mesophotic reef in the Gulf of Mexico, from August 22 to September 4, 2015, in collaboration with the University of Miami, HBOI-CIOERT, NOAA Fisheries, and the University of North Carolina at Wilmington (UNCW) Undersea Vehicles Program. This is the fourth and final cruise of this grant. The University of Miami ship R/V *Walton Smith* was used along with the National Marine Sanctuary Foundation *Mohawk* ROV.

In 2015, a total of 21 ROV dives surveyed 25 random blocks (Figure 1), and covered 33.64 km at depths from 54.4 to 110.1 m. A total of 58 hours of ROV video were recorded and 4,771 in situ digital images were taken which included quantitative transect images (4,063), and video frame grabs of general habitat images and species documentation images. Sample collections with the ROV included 10 Porifera, 20 algae, 40 Cnidaria (19 Scleractinia, 15 Octocorallia, 1 Antipatharia), 3 Echinodermata, and 2 geological (rock/sediment) specimens.

A total of 132 benthic macrobiota were identified from the quantitative image analysis at Pulley Ridge (Appendix 1). The most diverse taxa by far were sponges (53 taxa). The other sessile benthic taxa included 9 Chlorophyta, 6 Rhodophyta, 4 Phaeophyta, 11 Scleractinia (hard corals), 12 gorgonian octocorals, and 5 Antipatharia. All fish were identified for each ROV dive to species level, counted, and densities determined (Appendix 2). A total of 59 fish taxa were identified from Pulley Ridge dives in 2015. In addition, a SEADESC Level II Report (Appendix 3) provides quantitative analyses of each ROV dive, including: 1) complete species list of benthic macrobiota for each dive; 2) CPCe 4.1© analysis of percent cover of benthic macrobiota and substrate types, 3) complete species list of fish for each dive; and 4) densities of fish species for each dive.

A total of 11 hard coral species were identified from the 2015 cruise. The dominant species at Pulley Ridge included *Agaricia fragilis, A. lamarcki/grahamae, A. undata, Helioseris cucullata, Madracis brueggemanni* (previously identified as *M. 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 and 2015 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 from blocks surveyed in 2015 was 11.38 Agariciidae colonies/m^2 (18,197 corals/1,597.95 m^2); Block 120 which is outside the PR HAPC had the greatest density of all the Blocks with 30.3 Agariciidae colonies/m^2. A great majority of *Agaricia* were <5 cm in diameter, indicating they were relatively recent recruits and may be recovering from whatever die-off occurred after 2003.

Fish and coral densities, diversities and population structures will be reviewed in detail in the final Pulley Ridge Report that will include all four years of ROV data. 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 Deep-sea 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.

ACKNOWLEDGEMENTS

We thank the 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-FAU for continued support of the mesophotic reef research program at HBOI-FAU. The crew of University of Miami's ship R/V *Walton Smith* provided excellent support. ROV pilots Lance Horn and Jason White of the *Mohawk* ROV (owned by National Marine Sanctuary Foundation) are especially thanked for their support and efforts which made this a cruise success. This research was funded by the NOAA National Centers for Coastal Ocean Science under award NA11NOS4780045 to the Cooperative Institute for Marine and Atmospheric Studies (CIMAS) at the University of Miami and the NOAA Office of Ocean Exploration and Research under awards NA09OAR4320073 and NA14OAR4320260 to the Cooperative Institute for Ocean Exploration, Research and Technology (CIOERT) at Florida Atlantic University–Harbor Branch Oceanographic Institute. The cruise was conducted as a collaboration of the University of Miami (Drs. Robert Cowen, Peter Ortner), HBOI-CIOERT (Dr. Shirley Pomponi), 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, and the Gulf of Mexico Fishery Management Council. This is Harbor Branch Oceanographic Institute Technical Report Number 177.

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 (Fig. 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.

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 assemblages, 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 usually two ROV dives were made each day during daylight hours.

ROV Operations

Mohawk ROV dives ranged from 3-4 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 Fastcat CTD recorder. A collection tool skid designed and built by HBOI-FAU was attached to the ROV for sample collections.

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 macrobiota 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. In addition, frame grabs were taken from the high-definition video to document species and habitat.

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 were entered into Hypack as background files to display target sites and features of interest to aid in ROV and ship navigation. Hypack also exports ROV position data in real time as a NMEA data string. Ship and ROV positions, ROV depth, heading and altimeter data, are logged and processed after each dive day and provided to the scientist in an Excel spreadsheet file.

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 ~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. During the video transects, the ROV was kept <1 m off bottom with a speed over ground of ~¼ knot (12.5 cm/s).

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. 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 and counted from the video transects and densities determined, emphasizing commercially and recreationally important species. The total distance (km) of each dive was used to calculate the linear density (# individuals/km) of each fish species. Generally, the field of view for fish identifications was 5 m, so the area of the dive can be calculated length of dive x 5 m width.

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® 10.2. 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 a fishnet grid of 1 km x 1 km blocks were overlaid on the available bathymetry maps at both regions from which random blocks were selected for the surveys over the 4 year period. 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 ~12.5 cm/s 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 the multibeam sonar maps. 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 observed from the multibeam maps. Pulley Ridge (PR): Main Ridge (North, Middle, South), Off Main Ridge (East Base), West Ridge, and Central Basin. Tortugas (T): Mesophotic Reef (patch and fringing reefs), and Soft Bottom.

2. [*MPA Status*]: Block is within a marine protected area (e.g., Pulley Ridge Habitat Area of Particular Concern, or Tortugas Ecological Reserve); or 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 pits were there low to moderate slopes.

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, except inside of the red grouper pits. Low Rugosity consisted of the flat rock pavement and rubble/cobble habitat typically found throughout Pulley Ridge. For the present, this will be an unquantified relative term. The multibeam sonar maps that cover Pulley Ridge (Naar 2000, Fig. 1) are of relatively low resolution (5-10 m) and cannot be used to quantify rugosity at this scale. However, high resolution (<2 m) multibeam maps were collected on the Nancy Foster Cruise in 2010 (Reed 2011), but these only cover 38 km^2 on the main ridge. These high resolution maps are able to show the locations and density of red grouper pits which are not visible in the low resolution multibeam.

7. [*Substrate*]: SEADESC Habitat Categories (Table 1). This is a modified subset of SEADESC Habitat Categories which was developed by the NOAA Office of Ocean Exploration and Research 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). 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).

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, deep-water 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 Menten (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 deep-water and mesophotic surveys. Also, we attempted to take ~30 images per transect, resulting in ~150 images per block. Once poor and purposeful images were removed, in order to keep samples size similar, we randomly selected 120 images from each block for the point count analysis (24/ 100-m transect). Fifty random points overlaid on each image were then identified as substrate type and benthic taxa using CPCe point count. All benthic macrobiota (usually >1 cm) were identified to the lowest taxa level possible.

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; sessile macroinvertebrates including Porifera, Scleractinia, Alcyonacea- gorgonians, 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:

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

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 some cases general descriptive taxa were 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 deep-water species in this region look nearly identical, such as fan sponges which are polyphyletic and may actually include different orders or classes.

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* 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., *Helioserus 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.

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 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 Area Analysis tool was used calculate the maximum diameter of each plate coral. Coral colonies that were only partially visible in a photograph were measured if it 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

2015 was the final of four cruises to characterize and document the benthic habitat, macrobiota and fish on Pulley Ridge and Tortugas. In 2015, 21 dives were conducted at Pulley Ridge and surveyed a total of 25 random 1-km^2 blocks (Fig. 1).

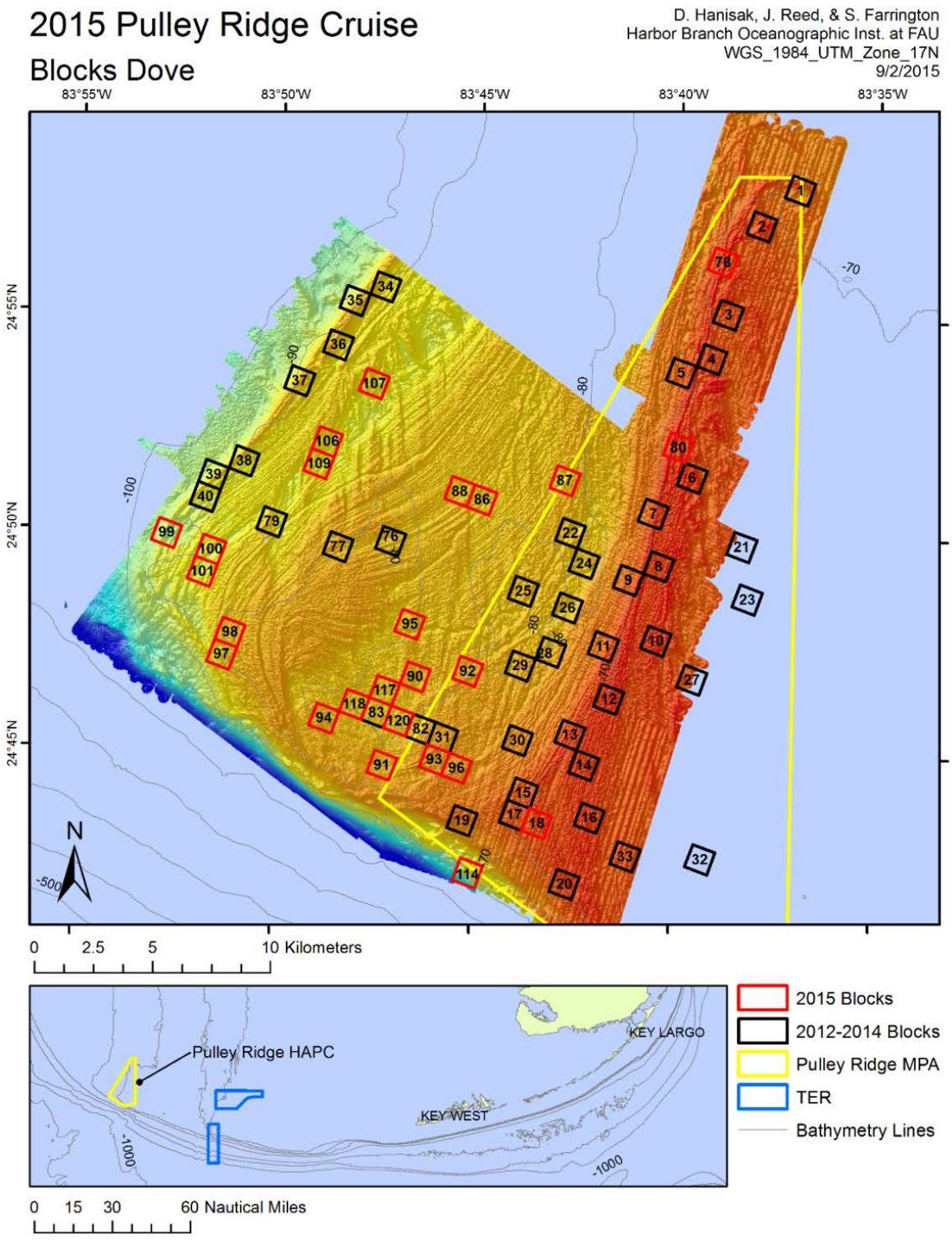


Figure 1. Random 1 km x 1 km blocks surveyed at Pulley Ridge during the 2012-2015 R/V *Walton Smith* cruises. Red blocks surveyed in 2015; black blocks surveyed in 2012, 2013 and 2014. Pulley Ridge Habitat Area of Particular Concern (PR HAPC) boundaries in yellow. Background map: Multibeam Bathymetry Survey, USF (Naar, D.F. 1999).

ROV Dive Summary

In 2015, a total of 21 ROV dives surveyed 25 random blocks (Table 2). The 21 ROV dives covered 33.64 km, at depths from 54.4 to 110.1 m. A total of 58 hours of ROV video were recorded, and 4,771 *in situ* digital images were taken which included quantitative transect images (4,063), general habitat images, and species documentation images. Sample collections included 10 Porifera, 20 algae, 40 Cnidaria (19 Scleractinia, 15 Octocorallia, 1 Antipatharia), 3 Echinodermata, and 2 geological (rock/sediment) specimens.

Table 2. ROV dive sites during 2015 R/V *Walton Smith* cruise at Pulley Ridge mesophotic reef, August 22 to September 4, 2015 (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)
23-VIII-15-1	ROV 15-01	24.7207	-83.7217	24.7276	-83.7231	56.7-68.5	1.39	Block #018 Duplicate	3:41
24-VIII-15-1	ROV 15-02	24.9352	-83.6519	24.9418	-83.6459	56.3-68	1.95	Block #078	3:38
24-VIII-15-2	ROV 15-03	24.8638	-83.6710	24.8713	-83.6598	54.4-70.2	2.22	Block #080	3:50
25-VIII-15-1	ROV 15-04	24.8496	-83.7092	24.8570	-83.7164	73.9-80.2	1.56	Block #087	3:38
25-VIII-15-2	ROV 15-05	25.8417	-83.7441	24.8429	-83.7472	59.2-82.9	0.60	Block #086	1:12
25-VIII-15-3	ROV 15-06	24.8432	-83.7482	24.8494	-83.7594	77.8-83.6	1.91	Block #086, Block #088	3:11
26-VIII-15-1	ROV 15-07	24.7763	-83.7547	24.7783	-24.7783	76.1-79.8	0.36	Block #092	0:46
26-VIII-15-2	ROV 15-08	24.7789	-83.7534	24.7792	-83.7495	74.5-79.8	1.43	Block #092	2:27
26-VIII-15-3	ROV 15-09	24.7407	-83.7564	24.7525	-83.7684	72.2-76.9	3.15	Block #093, Block #096	4:24
27-VIII-15-1	ROV 15-10	24.7740	-86.7750	24.7799	-83.7760	78.3-81.8	1.03	Block #090	2:12
27-VIII-15-2	ROV 15-11	24.7931	-83.7759	24.7982	-83.7774	78.6-82.7	1.02	Block #095	1:50
27-VIII-15-3	ROV 15-12	24.7638	-83.8050	24.7604	-83.8130	76.5-81.5	1.13	Block #094	2:01
27-VIII-15-4	ROV 15-13	24.7392	-83.7856	24.7457	-83.7884	76.3-79.6	1.01	Block #091	1:39
29-VIII-15-1	ROV 15-14	24.7864	-83.8565	24.7922	-83.8570	67-83.7	2.68	Block #097	3:46
31-VIII-15-1	ROV 15-15	24.4141	-83.8703	24.8254	-83.8572	79.6-90.1	2.41	Block #101	4:25
31-VIII-15-2	ROV 15-16	24.8284	-83.8831	24.8266	-83.8765	88-94.8	0.93	Block #099	1:46
1-IX-15-1	ROV 15-17	24.8874	-83.7979	24.8893	-83.7905	73.9-87.6	1.62	Block #107	2:58
1-IX-15-2	ROV 15-18	24.8542	-83.8161	24.8683	-83.8100	77.4-87.8	2.57	Block #106, Block #109	4:07
2-IX-15-1	ROV 15-19	24.7017	-83.7545	24.7005	-83.7464	85.4-110.1	0.93	Block #114	1:08
2-IX-15-2	ROV 15-20	24.7617	-83.7869	24.7614	-83.7755	78.2-82.3	1.16	Block #120	1:48
2-IX-15-3	ROV 15-21	24.7689	-83.8060	24.7704	-83.7830	73.8-82.9	2.57	Block #117, Block #118	3:40

Benthic Macrobiota and Habitat

Appendix 1 lists all of the benthic macro-invertebrates and algal taxa that were identified from the quantitative photo transects for each block surveyed in 2015 and their percent cover based on CPCe Point Count of the photo images. A total of 132 benthic taxa were identified from the 2015 ROV dives at Pulley Ridge. The actual species count 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. Percent cover of benthic macrobiota (Table 3) from the 2015 ROV dives at Pulley Ridge averaged 40.21% cover. Bare hard bottom averaged 53.61% and soft bottom was 6.16%.

Table 3. Percent cover (CPCe Point Count) and number of taxa of benthic macrobiota for ROV sites surveyed at Pulley Ridge during 2015 R/V *Walton Smith* cruise.

	Percent Cover					No. Taxa					
Ridge/Location/ Block	Hard Coral	Gorgo-nacea	Anti-patharia	Por-ifera	Algae	Hard Coral	Gorgo-nacea	Anti-patharia	Por-ifera	Algae	All Biota
Main Ridge	2.70%	0.02%	0.02%	0.75%	45.48%	8	2	1	19	17	66
North	0.07%	0.07%	0.02%	0.72%	31.95%	2	2	1	10	16	44
Block #078	0.07%	0.07%	0.02%	0.72%	31.95%	2	2	1	10	16	44
Middle	0.60%	0.00%	0.03%	0.75%	41.42%	8	0	1	11	15	45
Block #080	0.60%	0.00%	0.03%	0.75%	41.42%	8	0	1	11	15	45
South	7.44%	0.00%	0.00%	0.78%	63.10%	7	0	0	13	13	42
Block #018	7.44%	0.00%	0.00%	0.78%	63.10%	7	0	0	13	13	42
Central Basin	3.56%	0.03%	0.13%	0.50%	38.42%	10	5	5	36	18	97
North	0.95%	0.05%	0.21%	1.04%	26.01%	5	3	2	25	15	61
Block #086	0.79%	0.03%	0.22%	1.06%	31.62%	3	2	2	16	12	41
Block #087	0.50%	0.00%	0.00%	1.42%	22.59%	3	0	0	13	12	37
Block #088	1.57%	0.12%	0.42%	0.65%	23.84%	4	2	2	14	12	40
South	4.34%	0.02%	0.11%	0.33%	42.14%	10	5	5	23	17	81
Block #090	3.83%	0.05%	0.10%	0.32%	35.89%	5	1	3	6	10	36
Block #091	6.71%	0.00%	0.13%	0.27%	46.27%	7	0	2	5	6	28
Block #092	2.89%	0.00%	0.13%	0.23%	35.87%	8	0	2	5	14	34
Block #093	5.62%	0.00%	0.22%	0.53%	45.14%	6	0	3	8	9	33
Block #094	3.37%	0.03%	0.15%	0.37%	44.22%	8	1	3	5	7	30
Block #095	2.18%	0.03%	0.05%	0.60%	34.18%	5	1	2	5	9	30
Block #096	4.40%	0.00%	0.15%	0.42%	46.67%	7	0	2	9	9	35
Block #117	3.90%	0.02%	0.02%	0.17%	39.12%	8	1	1	3	9	27
Block #118	4.54%	0.07%	0.10%	0.23%	46.90%	7	3	3	3	7	30
Block #120	5.95%	0.03%	0.03%	0.18%	47.22%	6	2	1	3	9	28
West Ridge	0.79%	0.19%	0.21%	0.95%	33.16%	7	12	5	42	14	94
North	0.93%	0.07%	0.37%	0.88%	28.82%	6	7	5	29	11	67
Block #106	1.10%	0.02%	0.42%	0.85%	29.60%	4	1	3	15	9	37
Block #107	0.78%	0.17%	0.32%	1.17%	26.55%	4	6	5	20	9	50
Block #109	0.91%	0.03%	0.38%	0.62%	30.34%	4	2	3	12	8	33
South	0.69%	0.28%	0.09%	1.00%	36.39%	6	11	4	35	14	80
Block #097	0.75%	0.65%	0.02%	1.07%	40.87%	5	8	1	16	12	51
Block #099	0.08%	0.13%	0.02%	0.37%	12.91%	2	4	1	7	12	29
Block #100	0.90%	0.15%	0.15%	1.03%	47.81%	4	2	3	16	10	41
Block #101	1.02%	0.20%	0.17%	1.53%	43.87%	4	7	3	19	9	45
S. Escarpment	0.02%	0.12%	0.07%	2.08%	5.38%	1	2	2	5	2	16
Block #114	0.02%	0.12%	0.07%	2.08%	5.38%	1	2	2	5	2	16
Grand Total	2.50%	0.08%	0.14%	0.73%	36.39%	11	12	5	53	20	132

Human debris (mostly discarded or lost fishing lines and long lines, and some lost lobster pots) was observed but relatively rare at sites surveyed in 2015. Coverage of biota at Pulley Ridge was dominated by various algae (36.39% cover overall). Coralline red algae (up to 24.99% cover overall and 43.6% in block 120) and the lettuce-like green algae *Anadyomene menziesii* (4.81% overall and up to 34.55% in block 18) were the most common. Porifera were very species rich with 53 taxa which were dominated by Demospongiae (unid.), *Geodia neptuni* complex, *Xestospongia muta*, *Agelas* sp., *Erylus* sp., Poecilosclerida, *Amphimedon*- PR2, Spirastrellidae, *Discodermia* sp., *Erylus*- PR1, *Spongosorites*- PR1, *Spongosorites siliquaria*, *Geodia gibberosa* complex. Large hemispherical colonies (>100 cm diameter) 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. Overall all dives the cover of sponges ranged from 0.17% to a maximum of 1.53% on the West Ridge (Table 3). The other sessile benthic taxa included 9 Chlorophyta, 6 Rhodophyta, 4 Phaeophyta, 11 Scleractinia (hard corals), 12 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.

Coral Analyses

The diversity of the scleractinian corals is relatively rich for such a deep mesophotic reef; a total of 11 coral species were identified at Pulley Ridge in 2015. The dominant species at PR included *Agaricia fragilis, A. lamarcki/grahamae, A. undata, Helioseris cucullata, Madracis brueggemanni* (previously identified as *M. aurentenra*), *M. formosa, M. decactis*, and *Oculina diffusa*. Coral cover from blocks surveyed in 2015 ranged from 0.02% at the base of the Southern Escarpment to 6.71% in the Central Basin (Block 91). The density in the Central Basin was 11.38 Agariciidae colonies/m^2 (18,197 corals/1,597.95 m^2); Blocks 120 which is outside the PR HAPC had the greatest density of all the Blocks with 30.3 Agariciidae colonies/m^2. *Agaricia* spp. had the greatest overall density of 24.52 colonies/m^2.

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 and 2015 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 in the Central Basin where we discovered some of the highest coral cover that we have seen to date on our cruises.

Size of Plate Corals

The largest plate coral measured was a colony of *Agaricia grahamae* that was 108.24 cm in diameter and located in Block 92 in the Central Basin. The largest dead coral plate was 90 cm in Block 18 on Main Ridge South. However, the majority of the corals observed in 2015 were relatively small, with 17,695 (69.6%) being < 4 cm in diameter and 6,484 (25.5%) being 5-10 cm, possibly indicating they were relatively recent recruits and may be recovering from whatever

die-off occurred after 2003. Coral density and size will be reviewed in detail in the final Pulley Ridge Report that will include all four years of data.

Analysis of Fish Video Surveys

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. Appendix 2 shows the fish densities for each random block from the 2015 cruise. A total of 59 fish taxa were identified from Pulley Ridge dives in 2015. After a basic analysis of the data a few results are evident. The most observed fish were school bass (*Schultzea beta* - [Hildebrand, 1940]), striped grunt (*Haemulon striatum* - [Linnaeus, 1758]), yellowtail reeffish (*Chromis enchrysura* - Jordan & Gilbert, 1882), purple reeffish (*Chromis scotti* - Emery, 1968), chalk bass (*Serranus tortugarum* - Longley, 1935), reef butterflyfish (*Chaetodon sedentarius* - Poey, 1860), roughtongue bass (*Pronotogrammus martinicensis* - [Guichenot, 1868]), cherubfish (*Centropyge argi* - Woods & Kanazawa, 1951), cardinalfish unid. (*Apogon* sp. [Poey, 1875]), sunshinefish (*Chromis insolata* - [Cuvier, 1830]), and unidentified *Chromis* sp. A total of 126 lionfish were observed in 2015. Significantly more lionfish were observed in 2014 compared to either 2012 or 2013. A total of 237 lionfish were seen in 2014 on Pulley Ridge, and 161 in 2012 and 2013 combined. Fish densities and habitat preferences will be reviewed in detail in the final Pulley Ridge Report that will include all four years of data.

SEADESC II Report: Characterization of Benthic Habitat, Benthic Macrobiota, and Fish Populations

A SEADESC Level II Report (Southeastern United States Deep-Sea Corals) is presented in Appendix 3. This provides the following data for each ROV dive at Pulley Ridge in 2015: cruise and ROV dive metadata, map showing each ROV dive track and transects overlaid on multibeam sonar maps, dive track data (start and end latitude, longitude, depth), CTD plots, general description of the habitat and biota, and images of the biota and habitat that characterize the dive site. In addition, this SEADESC Level II Report provides quantitative analyses of each ROV dive, including: 1) complete species list of benthic macrobiota for each dive; 2) CPCe 4.1© analysis of percent cover of benthic macrobiota and substrate types, 3) complete species list of fish for each dive; and 4) densities of fish species for each dive.

DELIVERABLES AND CONCLUSIONS

Fish and coral densities, diversities and population structures will be reviewed in detail in the final Pulley Ridge Report that will include all four years of ROV data. 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 Deep-sea 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.

LITERATURE CITED

Halley RB, Hine AC, Jarret B, Twichell DC. Pulley Ridge [Internet]. Available from: http://coastal.er.usgs.gov/pulley-ridge/index.html

Hine AC, Halley RB, Locker SD, Jarrett BD, Jaap WC, Mallinson DJ, Ciembronowicz KT, Ogden NB, Donahue BT, Naar DF. 2008. Coral reefs, present and past, on the West Florida Shelf and platform margin. *In:* Riegl BM, Dodge RE, editors. Coral Reefs of the USA. Dordrecht: Springer-Verlag. Dordrecht.

Kohler K, Gill S. 2006. Coral Point Count with Excel extensions (CPCe): a visual basic program for the determination of coral and substrate cover using random point count methodology. Comput Geosci 32:1259-1269.

Lumsden SE, Hourigan T, Bruckner A, Dorr G, eds. 2007. The state of deep coral ecosystems of the United States, NOAA technical memorandum CRCP-3. Silver Spring MD, USA. 1-60 pages.

Naar DF. 2000. NOAA National Centers for Environmental Information; Multibeam Bathymetry Database (MBBDB), [USF2000]. NOAA National Centers for Environmental Information. National Geophysical Data Center, NOAA.

NOAA. Pulley Ridge- background information [Internet]. NOAA National Marine Fisheries Service. Available from: http://www.sefsc.noaa.gov/labs/panama/mp/pulleyridge.htm

Partyka ML, Ross SW, Quattrini AM, Sedberry GR, Birdsong TW, Potter J, Gottfried S. 2007. Southeastern United States deep-sea corals (SEADESC) initiative: a collaboration to characterize areas of habitat forming deep-sea corals. Silver Spring, MD. p. 176.

Reed JK. 2011. NOAA National Centers for Environmental Information; Multibeam Bathymetry Database (MBBDB), [NF-11-09-CIOERT]. In: NOAA, editor. Boulder, CO, USA.

SAFMC. 1998. Comprehensive amendment addressing sustainable fishery act definitions and other required provision in fishery management plans of the South Atlantic region. In: NOAA-SAFMC, editor. Amendment 5. p. 311.

USGS. Recently discovered reef is deepest known off Continental U.S. [Internet]. ScienceDaily: U.S. Geological Survey. Available from: http://www.sciencedaily.com/releases/2005/01/050104111943.htm

Vinick C, Riccobono A, Messing C, Walker B, Reed J, Rogers S. 2012. Siting study for a hydrokinetic energy project located offshore southeastern Florida: protocols for survey methodology for offshore marine hydrokinetic energy projects. Golden, CO, USA: United States Department of Energy, Golden Field Office. 93 pages.

APPENDIX 1

Species List and Percent Cover of Benthic Macrobiota

Species list by block and region of the benthic macro-invertebrates and algae that were identified from quantitative photo transects for each ROV dive during 2015 R/V *Walton Smith* cruise to Pulley Ridge. Still images captured from the photo transects were analyzed using CPCe© software to determine relative percent cover of benthic biota and habitat types.

Fauna/Major/Minor Category	Main Ridge- North Block #078	Main Ridge- Middle Block #080	Main Ridge- South Block #018	Central Basin- North Block #086	Central Basin- North Block #087	Central Basin- South Block #088	Central Basin- South Block #090	Central Basin- South Block #091	Central Basin- South Block #092	Central Basin- South Block #093	Central Basin- South Block #094	Central Basin- South Block #095	Central Basin- South Block #096	West Ridge- North Block #117	West Ridge- North Block #118	West Ridge- North Block #120	West Ridge- North Block #106	West Ridge- North Block #107	West Ridge- South Block #109	West Ridge- South Block #097	West Ridge- South Block #099	West Ridge- South Block #100	Southern Escarpment Block #101	Southern Escarpment Block #114	Grand Total
Biota	34.13%	43.25%	71.64%	34.12%	24.99%	26.95%	40.52%	53.77%	39.39%	51.76%	48.73%	37.37%	52.28%	43.53%	52.18%	53.66%	32.18%	29.30%	32.46%	43.94%	13.93%	50.43%	46.87%	7.80%	40.22%
Coral	0.07%	0.60%	7.44%	0.79%	0.50%	1.57%	3.83%	6.71%	2.89%	5.62%	3.37%	2.18%	4.40%	3.90%	4.54%	5.95%	1.10%	0.78%	0.91%	0.75%	0.08%	0.90%	1.02%	0.02%	2.50%
Agaricia fragilis	0.00%	0.03%	0.27%	0.00%	0.00%	0.00%	0.33%	0.47%	0.17%	0.35%	0.72%	0.12%	0.20%	0.17%	0.13%	0.70%	0.08%	0.02%	0.00%	0.00%	0.00%	0.05%	0.00%	0.00%	0.16%
Agaricia grahamae	0.00%	0.08%	2.60%	0.00%	0.00%	0.58%	0.00%	0.25%	0.37%	0.47%	0.05%	0.00%	0.57%	0.18%	0.17%	0.12%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.23%
Agaricia sp.	0.00%	0.12%	4.22%	0.05%	0.02%	0.15%	2.43%	5.06%	0.98%	4.36%	1.25%	0.83%	3.23%	2.82%	2.99%	4.17%	0.15%	0.00%	0.10%	0.03%	0.00%	0.05%	0.12%	0.02%	1.38%
Helioseris cucullata	0.00%	0.02%	0.07%	0.00%	0.00%	0.00%	0.00%	0.02%	0.02%	0.00%	0.02%	0.00%	0.08%	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	0.05%	0.03%	0.10%	0.72%	0.43%	0.27%	0.27%	0.34%	0.23%	0.05%	0.45%	0.20%	0.08%	0.15%	0.42%	0.32%	0.28%	0.68%	0.15%	0.65%	0.05%	0.57%	0.47%	0.00%	0.29%
Madracis decactis	0.02%	0.07%	0.15%	0.02%	0.00%	0.57%	0.63%	0.52%	1.07%	0.35%	0.77%	0.98%	0.22%	0.47%	0.77%	0.62%	0.58%	0.07%	0.63%	0.02%	0.03%	0.23%	0.38%	0.00%	0.38%
Madracis formosa	0.00%	0.05%	0.03%	0.00%	0.05%	0.00%	0.17%	0.05%	0.03%	0.05%	0.08%	0.05%	0.02%	0.08%	0.05%	0.03%	0.00%	0.02%	0.00%	0.03%	0.00%	0.00%	0.05%	0.00%	0.04%
Madracis 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%	0.02%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Montastraea cavernosa	0.00%	0.20%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
Oculina diffusa	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%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%
Scolymia 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%
Porifera	0.72%	0.75%	0.78%	1.06%	1.42%	0.65%	0.32%	0.27%	0.23%	0.53%	0.37%	0.60%	0.42%	0.17%	0.23%	0.18%	0.85%	1.17%	0.62%	1.07%	0.37%	1.03%	1.53%	2.08%	0.73%
Acanthella 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%	0.03%	0.00%	0.00%	0.00%
Agelas clathrodes	0.00%	0.02%	0.02%	0.00%	0.00%	0.00%	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%	0.02%	0.00%	0.02%	0.00%	0.00%
Agelas conifera	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%	0.05%	0.00%	0.00%
Agelas - PR1	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%	0.02%	0.02%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%
Agelas - PR3	0.00%	0.00%	0.00%	0.02%	0.00%	0.02%	0.00%	0.02%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.01%
Agelas sp.	0.07%	0.02%	0.05%	0.03%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.02%	0.00%	0.02%	0.05%	0.03%	0.10%	0.00%	0.02%	0.13%	0.00%	0.02%
Aiolochroia crassa	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%
Amphimedon - PR1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	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%
Amphimedon - PR2	0.00%	0.00%	0.00%	0.12%	0.18%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.17%	0.00%	0.00%	0.00%	0.07%	0.00%	0.00%	0.02%
Amphimedon sp.	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%	0.02%	0.00%	0.02%	0.00%	0.00%
Aplysina sp.	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%	0.02%	0.00%	0.00%
Auletta sp.	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%	0.05%	0.02%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%
Axinella corrugata	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	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%
Axinellidae	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	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%
Callyspongia 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%	0.02%	0.02%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%
Cinachyrella sp.	0.00%	0.00%	0.00%	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%	0.02%	0.00%	0.00%	0.02%	0.00%	0.00%
Demospongiae	0.43%	0.23%	0.35%	0.22%	0.43%	0.37%	0.17%	0.20%	0.07%	0.22%	0.27%	0.17%	0.17%	0.10%	0.20%	0.15%	0.40%	0.32%	0.26%	0.45%	0.27%	0.52%	0.70%	1.93%	0.36%
Demospongiae- PR01	0.00%	0.00%	0.00%	0.15%	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%	0.02%	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%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.03%	0.00%	0.02%	0.00%	0.00%	0.00%
Demospongiae- PR14	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%
Demospongiae- PR17	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	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%
Demospongiae- PR19	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%
Demospongiae- PR24	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	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%
Dictyoceratida	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%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%
Discodermia 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%	0.02%	0.02%	0.00%	0.02%	0.02%	0.05%	0.18%	0.00%	0.01%
Erylus - PR1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.08%	0.00%	0.05%	0.15%	0.00%	0.02%	0.00%	0.02%	0.01%
Erylus - PR2	0.00%	0.00%	0.00%	0.00%	0.00%	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%
Erylus sp.	0.00%	0.00%	0.02%	0.03%	0.02%	0.02%	0.02%	0.02%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.08%	0.02%	0.05%	0.03%	0.00%	0.05%	0.03%	0.00%	0.02%
Geodia gibberosa complex	0.05%	0.13%	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%	0.00%	0.01%
Geodia neptuni complex	0.00%	0.08%	0.08%	0.03%	0.03%	0.07%	0.08%	0.02%	0.00%	0.07%	0.00%	0.00%	0.08%	0.02%	0.00%	0.00%	0.07%	0.07%	0.02%	0.00%	0.02%	0.02%	0.02%	0.00%	0.03%
Geodia sp.	0.02%	0.00%	0.00%	0.03%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.03%	0.00%	0.00%	0.03%	0.00%	0.01%
Ircinia campana	0.00%	0.05%	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%
Ircinia felix	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%
Ircinia sp.	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%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ircinia strobilina	0.03%	0.03%	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%
Monanchora arbuscula	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%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Neofibularia nolitangere	0.00%	0.00%	0.00%	0.00%	0.00%	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%	0.03%	0.00%	0.00%	0.00%	0.00%
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%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%
Petrosiidae	0.00%	0.03%	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%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Poecilosclerida	0.00%	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.00%	0.03%	0.02%	0.00%	0.02%	0.02%	0.00%	0.00%	0.00%	0.03%	0.05%	0.05%	0.07%	0.00%	0.00%	0.05%	0.02%	0.02%
Poecilosclerida- PR3	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%	0.02%	0.00%	0.03%	0.02%	0.00%	0.00%	0.00%	0.00%
Poecilosclerida- PR4	0.00%	0.00%	0.00%	0.08%	0.03%	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%	0.01%
Polymastia sp.	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.35%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%
Scopalina ruetzleri	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%
Spirastrellidae	0.02%	0.00%	0.07%	0.00%	0.05%	0.03%	0.00%	0.00%	0.05%	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%	0.10%	0.02%
Spongosorites - PR1	0.00%	0.00%	0.00%	0.13%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.13%	0.00%	0.00%	0.00%	0.08%	0.12%	0.00%	0.02%
Spongosorites siliquaria	0.00%	0.00%	0.00%	0.00%	0.52%	0.00%	0.00%	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%	0.03%	0.03%	0.00%	0.03%
Spongosorites sp.	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%	0.03%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%
Tetractinellida	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.12%	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.02%	0.07%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.01%
Tetractinellida- PR2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	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%
Theonella 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%	0.02%	0.00%	0.02%	0.00%	0.00%	0.00%
Xestospongia muta	0.03%	0.12%	0.03%	0.07%	0.02%	0.02%	0.02%	0.00%	0.00%	0.05%	0.03%	0.05%	0.00%	0.05%	0.02%	0.00%	0.00%	0.02%	0.03%	0.00%	0.00%	0.05%	0.00%	0.00%	0.03%
Xestospongia sp.	0.03%	0.00%	0.02%	0.00%	0.03%	0.02%	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%	0.01%
Alcyonacea- gorgonian	0.07%	0.00%	0.00%	0.03%	0.00%	0.12%	0.05%	0.00%	0.00%	0.00%	0.03%	0.03%	0.00%	0.02%	0.07%	0.03%	0.02%	0.17%	0.03%	0.65%	0.13%	0.15%	0.20%	0.12%	0.08%
Alcyonacea- gorgonian	0.00%	0.00%	0.00%	0.02%	0.00%	0.02%	0.05%	0.00%	0.00%	0.00%	0.03%	0.03%	0.00%	0.00%	0.02%	0.02%	0.00%	0.02%	0.00%	0.17%	0.02%	0.05%	0.07%	0.00%	0.02%
Bebryce 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%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%
Carijoa riisei	0.00%	0.00%	0.00%	0.00%	0.00%	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%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%
Diodogorgia 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%	0.02%	0.00%	0.00%
Ellisella sp.	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%	0.02%	0.00%	0.05%	0.00%	0.05%	0.02%	0.00%	0.02%	0.10%	0.01%
Ellisellidae	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	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%	0.02%	0.00%
Hypnogorgia pendula	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%	0.02%	0.00%	0.00%	0.03%	0.02%	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%	0.00%	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%	0.00%
Nicella sp.	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%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.01%
Plexauridae	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	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%	0.08%	0.10%	0.05%	0.00%	0.01%
Primnoidae	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%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.25%	0.00%	0.00%	0.02%	0.00%	0.01%
Thesea 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%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%
Alcyonacea- Alcyoniina	0.00%	0.00%	0.00%	0.00%	0.00%	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%
Antipatharia	0.02%	0.03%	0.00%	0.22%	0.00%	0.42%	0.10%	0.13%	0.13%	0.22%	0.15%	0.05%	0.15%	0.02%	0.10%	0.03%	0.42%	0.32%	0.38%	0.02%	0.02%	0.15%	0.17%	0.07%	0.14%
Antipatharia	0.02%	0.03%	0.00%	0.02%	0.00%	0.20%	0.05%	0.03%	0.12%	0.08%	0.07%	0.03%	0.03%	0.00%	0.00%	0.03%	0.27%	0.08%	0.15%	0.02%	0.00%	0.05%	0.10%	0.02%	0.06%
Antipathes atlantica	0.00%	0.00%	0.00%	0.20%	0.00%	0.22%	0.03%	0.10%	0.02%	0.12%	0.07%	0.00%	0.12%	0.00%	0.07%	0.00%	0.10%	0.17%	0.15%	0.00%	0.00%	0.07%	0.02%	0.00%	0.06%

Antipathes furcata	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.02%	0.02%	0.00%	0.00%	0.00%	0.02%	0.00%	0.05%	0.03%	0.07%	0.00%	0.02%	0.00%	0.05%	0.00%	0.01%
Stichopathes lutkeni	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%	0.03%	0.00%	0.00%	0.00%
Tanacetipathes tanacetum	0.00%	0.00%	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%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.05%	0.00%
Cnidaria non-coral	0.47%	0.02%	0.02%	0.05%	0.12%	0.05%	0.15%	0.12%	0.02%	0.00%	0.33%	0.18%	0.02%	0.13%	0.07%	0.10%	0.08%	0.05%	0.00%	0.17%	0.07%	0.08%	0.05%	0.10%	0.10%
Actiniaria	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%
Condylactis gigantea	0.05%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Corallimorpharia	0.05%	0.00%	0.02%	0.00%	0.12%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
Hydroidolina	0.35%	0.00%	0.00%	0.03%	0.00%	0.03%	0.05%	0.05%	0.02%	0.00%	0.08%	0.02%	0.00%	0.00%	0.00%	0.00%	0.08%	0.00%	0.00%	0.07%	0.07%	0.03%	0.05%	0.08%	0.04%
Stylasteridae	0.00%	0.00%	0.00%	0.02%	0.00%	0.02%	0.10%	0.07%	0.00%	0.00%	0.25%	0.15%	0.00%	0.13%	0.07%	0.10%	0.00%	0.02%	0.00%	0.07%	0.00%	0.05%	0.00%	0.02%	0.04%
Zoanthidae	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	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%
Annelida	0.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	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%	0.02%	0.01%
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%	0.00%	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%	0.00%	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%
Hermodice carunculata	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%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%
Sabellidae	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%
Mollusca	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%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%
Gastropoda	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%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%
Arthropoda	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%	0.02%	0.00%
Anomura	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%
Brachyura	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	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%
Bryozoa	0.00%	0.02%	0.02%	0.00%	0.00%	0.00%	0.03%	0.03%	0.02%	0.03%	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%	0.01%
Bryozoa	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bryozoa- wh fan	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.02%	0.03%	0.02%	0.03%	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%
Schizoporella sp.	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%
Echinodermata	0.07%	0.22%	0.17%	0.18%	0.13%	0.13%	0.08%	0.17%	0.23%	0.15%	0.03%	0.05%	0.48%	0.02%	0.07%	0.03%	0.07%	0.17%	0.15%	0.12%	0.00%	0.12%	0.02%	0.00%	0.12%
Analcidometra armata	0.02%	0.17%	0.12%	0.00%	0.00%	0.00%	0.05%	0.03%	0.17%	0.08%	0.00%	0.00%	0.18%	0.00%	0.03%	0.02%	0.07%	0.02%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.04%
Asteroidea	0.00%	0.00%	0.00%	0.00%	0.03%	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%
Asteroschema 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%
Centrostephanus longispinus	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%
Comatulida	0.05%	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%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Davidaster discoideus	0.00%	0.03%	0.02%	0.18%	0.07%	0.13%	0.02%	0.13%	0.05%	0.05%	0.03%	0.03%	0.30%	0.02%	0.03%	0.00%	0.00%	0.15%	0.10%	0.12%	0.00%	0.12%	0.02%	0.00%	0.07%
Eucidaris tribuloides	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%
Stylocidaris affinis	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%
Chordata	0.42%	0.15%	0.10%	0.03%	0.03%	0.02%	0.02%	0.00%	0.00%	0.02%	0.05%	0.00%	0.07%	0.05%	0.10%	0.03%	0.02%	0.02%	0.02%	0.22%	0.02%	0.02%	0.00%	0.00%	0.06%
Actinopterygii	0.00%	0.02%	0.00%	0.03%	0.02%	0.02%	0.02%	0.00%	0.00%	0.02%	0.02%	0.00%	0.07%	0.05%	0.10%	0.02%	0.02%	0.02%	0.02%	0.20%	0.00%	0.00%	0.00%	0.00%	0.03%
Ascidiacea	0.08%	0.02%	0.07%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.02%	0.02%	0.02%	0.00%	0.00%	0.01%
Ascidiacea- pu	0.30%	0.12%	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%	0.02%
Didemnidae	0.03%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Chlorophyta	7.50%	20.77%	35.47%	1.83%	3.28%	3.49%	3.07%	8.28%	3.71%	12.63%	3.82%	1.67%	16.04%	2.35%	2.48%	2.42%	4.50%	7.45%	3.13%	4.05%	5.19%	2.72%	3.87%	1.77%	6.73%
Anadyomene menziesii	6.82%	20.60%	34.55%	0.50%	2.10%	1.55%	1.22%	6.65%	2.02%	10.86%	1.87%	0.03%	13.22%	0.10%	0.15%	0.20%	1.63%	5.12%	0.67%	2.19%	3.18%	0.05%	0.00%	0.00%	4.81%
Chlorophyta	0.25%	0.03%	0.18%	0.18%	0.02%	0.07%	0.12%	0.03%	0.12%	0.08%	0.05%	0.07%	0.12%	0.05%	0.00%	0.00%	0.02%	0.00%	0.00%	0.07%	0.07%	0.02%	0.02%	0.00%	0.06%
Codium intertextum	0.00%	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%	0.00%	0.00%	0.00%	0.00%	0.00%
Codium sp.	0.15%	0.02%	0.12%	0.00%	0.00%	0.03%	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%	0.01%
Halimeda copiosa	0.00%	0.00%	0.00%	0.00%	0.07%	0.02%	0.00%	0.00%	0.02%	0.00%	0.00%	0.03%	0.02%	0.00%	0.00%	0.02%	0.00%	0.05%	0.00%	0.15%	0.08%	0.02%	0.03%	0.00%	0.02%
Halimeda sp.	0.20%	0.00%	0.05%	0.03%	0.00%	0.00%	0.02%	0.00%	0.02%	0.07%	0.00%	0.00%	0.03%	0.07%	0.00%	0.05%	0.00%	0.00%	0.00%	0.02%	0.40%	0.00%	0.03%	0.00%	0.04%
Ulva sp.	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%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Valonia ventricosa	0.07%	0.02%	0.10%	0.08%	0.03%	0.12%	0.02%	0.00%	0.05%	0.03%	0.00%	0.07%	0.02%	0.00%	0.03%	0.00%	0.00%	0.02%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.03%
Verdigellas peltata	0.02%	0.03%	0.47%	1.02%	1.03%	1.70%	1.68%	1.60%	1.44%	1.59%	1.90%	1.47%	2.63%	2.13%	2.30%	2.15%	2.85%	2.27%	2.46%	1.62%	1.46%	2.64%	3.78%	1.77%	1.75%
Phaeophyceae	1.57%	1.42%	1.80%	0.13%	0.00%	0.52%	0.07%	0.08%	0.18%	0.43%	0.02%	0.07%	1.15%	0.02%	0.02%	0.05%	0.02%	0.00%	0.02%	0.08%	0.25%	0.02%	0.00%	0.00%	0.33%
Dictyota sp.	1.45%	1.32%	1.62%	0.13%	0.00%	0.52%	0.07%	0.08%	0.18%	0.43%	0.02%	0.07%	1.15%	0.00%	0.00%	0.05%	0.02%	0.00%	0.02%	0.08%	0.00%	0.02%	0.00%	0.00%	0.30%
Lobophora variegata	0.08%	0.07%	0.15%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
Phaeophyceae	0.03%	0.03%	0.03%	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%	0.25%	0.00%	0.00%	0.00%	0.00%	0.02%
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%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Rhodophyta	22.74%	19.22%	25.83%	29.47%	18.54%	19.64%	32.72%	37.90%	31.95%	32.07%	40.38%	32.28%	29.49%	36.73%	44.40%	44.72%	25.03%	18.92%	26.91%	36.69%	7.40%	45.05%	40.00%	3.62%	29.24%
Botryocladia sp.	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%
Corallinales (crustose coralline)	8.07%	18.42%	25.23%	24.15%	14.45%	18.66%	32.62%	37.85%	30.56%	31.99%	40.18%	32.07%	29.30%	36.12%	42.98%	43.64%	24.89%	14.50%	26.68%	21.94%	1.19%	23.29%	17.48%	3.62%	24.99%
Halymenia sp.	8.72%	0.15%	0.00%	0.15%	0.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.07%	0.08%	0.02%	0.00%	0.41%
Peyssonnelia sp.	0.58%	0.10%	0.05%	4.82%	2.00%	0.93%	0.10%	0.05%	1.34%	0.03%	0.18%	0.22%	0.18%	0.57%	1.32%	1.07%	0.03%	4.20%	0.07%	14.58%	1.47%	21.63%	22.40%	0.00%	3.25%
Rhodophyta	3.90%	0.22%	0.52%	0.12%	0.55%	0.03%	0.00%	0.00%	0.02%	0.05%	0.00%	0.00%	0.00%	0.05%	0.10%	0.02%	0.07%	0.17%	0.07%	0.08%	4.35%	0.00%	0.08%	0.00%	0.43%
Rhodophyta- fleshy blade	1.40%	0.33%	0.03%	0.23%	0.87%	0.02%	0.00%	0.00%	0.03%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.03%	0.05%	0.09%	0.08%	0.32%	0.05%	0.02%	0.00%	0.15%
Cyanobacteria	0.13%	0.02%	0.00%	0.18%	0.77%	0.20%	0.03%	0.00%	0.03%	0.00%	0.00%	0.17%	0.00%	0.02%	0.00%	0.03%	0.05%	0.18%	0.29%	0.05%	0.07%	0.02%	0.00%	0.00%	0.09%
Natural detritus	0.22%	0.00%	0.00%	0.07%	0.17%	0.10%	0.02%	0.03%	0.00%	0.02%	0.07%	0.03%	0.02%	0.08%	0.07%	0.03%	0.00%	0.08%	0.02%	0.07%	0.33%	0.05%	0.02%	0.00%	0.06%
Unidentified Organism	0.07%	0.03%	0.02%	0.07%	0.03%	0.05%	0.02%	0.02%	0.00%	0.03%	0.00%	0.02%	0.00%	0.03%	0.02%	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.02%
Human debris	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%	0.02%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.10%	0.00%	0.00%	0.01%
Fishing line/long line	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%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	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%	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.10%	0.00%	0.00%	0.00%
Trawl gear	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%
Bare hard bottom	65.12%	56.73%	28.31%	54.87%	46.59%	64.19%	59.16%	46.08%	60.16%	48.21%	50.72%	62.02%	47.67%	56.12%	47.21%	46.24%	64.05%	62.05%	62.34%	54.19%	25.30%	46.96%	50.62%	81.87%	53.61%
Bare hard bottom	65.12%	56.73%	28.31%	54.87%	46.59%	64.19%	59.16%	46.08%	60.16%	48.21%	50.72%	62.02%	47.67%	56.12%	47.21%	46.24%	64.05%	62.05%	62.34%	54.19%	25.30%	46.96%	50.62%	81.87%	53.61%
Bare dead coral plate	0.02%	0.00%	0.38%	0.00%	0.00%	0.00%	0.18%	0.10%	0.10%	0.13%	0.17%	0.12%	0.12%	0.15%	0.20%	0.28%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.08%
Bare rock	0.25%	11.98%	24.59%	0.29%	0.15%	2.14%	3.35%	4.27%	3.41%	7.49%	2.34%	1.20%	6.75%	47.77%	40.54%	1.47%	0.60%	0.15%	1.61%	0.73%	0.07%	0.22%	0.35%	5.22%	6.97%
Bare rubble/cobble	64.85%	44.75%	3.34%	54.58%	46.44%	62.06%	55.63%	41.71%	56.65%	40.58%	48.21%	60.70%	40.81%	8.20%	6.47%	44.49%	63.45%	61.88%	60.74%	53.45%	25.23%	46.74%	50.27%	76.65%	46.57%
Bare soft bottom	0.75%	0.02%	0.05%	11.01%	28.42%	8.86%	0.32%	0.15%	0.45%	0.03%	0.55%	0.62%	0.05%	0.35%	0.60%	0.10%	3.77%	8.65%	5.20%	1.87%	60.77%	2.62%	2.52%	10.33%	6.16%
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%**

APPENDIX 2

Species List and Density of Fish Populations

Species list by block and region of all the fish that were identified and counted from the quantitative video transects for each ROV dive during 2015 R/V *Walton Smith* cruise to Pulley Ridge. The total distance (m) of each dive was used to calculate the linear density (no. 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. 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).

Class/Order/common name- Taxa	Main Ridge- North Block #078	Main Ridge- Middle Block #080	Main Ridge- South :k #018 Duplic	Central Basin- North Block #086	Block #087	Central Basin- South Block #088	Block #090	Block #091	Block #092	Block #093	Block #094	Block #095	Block #096	Block #117	Block #118	Block #120	West Ridge- North Block #106	Block #107	West Ridge- South Block #109	Block #097	Block #099	Block #100	Block #101	Southern Escarpment Block #114
Actinopteri																								
Fish unid. - Actinopteri	0.4800	1.2060	0.6320	0.1500	0.0040	0.0600	0.0020	0.4660	0.0050	0.0017	0.1520	0.0080	0.3020	0.0020	0.0640	0.0640	0.0720		0.0040	0.5033	0.0080	0.0080	0.1560	0.1520
Aulopiformes																								
Lizardfish unid. - *Saurida* sp.						0.0020																		
Lizardfish unid. - *Synodus* sp.																					0.0020			
Beryciformes																								
Blackbar Soldierfish - *Myripristis jacobus*								0.0040							0.0100									
Squirrelfish unid. - *Holocentrus* sp.	0.0040		0.0140	0.0160		0.0080	0.0260	0.0160	0.0017	0.0033	0.0140	0.0060		0.0040	0.0060				0.0020	0.0967			0.0020	
Perciformes																								
Amberjack - *Seriola* sp.	0.0140		0.0020					0.0020			0.0020		0.0040								0.0040		0.0040	0.0020
Bank Butterflyfish - *Prognathodes aya*				0.0040		0.0100	0.0040					0.0020		0.0020			0.0040		0.0020		0.0020			0.0060
Bicolor Damselfish - *Stegastes partitus*	0.0340	0.0240	0.0500																				0.0020	
Bigeye - *Priacanthus arenatus*							0.0040		0.0017			0.0040		0.0020	0.0020	0.0040				0.0033				
Black Grouper - *Mycteroperca bonaci*		0.0020																						
Blue Angelfish - *Holacanthus bermudensis*											0.0020					0.0020			0.0020					
Blue Chromis - *Chromis cyanea*	0.0020		0.0280							0.0017	0.0020					0.0020								
Cardinalfish unid. - *Apogon* sp.	0.1000										0.0020		0.1500				0.0300		0.1600					
Chalk Bass - *Serranus tortugarum*	0.2380	0.2940	0.0920	0.0180	0.1020	0.0080	0.0040	0.0040	0.0133	0.0033	0.0080		0.0040	0.0020	0.0020	0.0060	0.0100		0.0020	0.1167	0.0300	0.0040	0.0040	
Cherubfish - *Centropyge argi*	0.0240	0.0380	0.0440				0.0060	0.0540		0.0133	0.0340	0.0080	0.0020	0.0180	0.0300	0.0220			0.0020	0.2467		0.0080	0.0020	0.0060
Chromis unid. - *Chromis* sp.	0.1020	0.0660	0.0900			0.0020	0.0040	0.0040	0.0083	0.0050	0.0080	0.0140				0.0060		0.0020	0.0060	0.0167			0.0240	
Doctorfish - *Acanthurus chirurgus*																				0.0033				
Gray Angelfish - *Pomacanthus arcuatus*	0.0040																							
Graysby - *Cephalopholis cruentata*								0.0020																
Great Barracuda - *Sphyraena barracuda*																								0.0020
Greenblotch Parrotfish - *Sparisoma atomarium*	0.0040	0.0240	0.0520	0.0040		0.0100	0.0100	0.0120		0.0017	0.0100	0.0020		0.0060				0.0020		0.0167		0.0080	0.0160	
Hogfish - *Lachnolaimus maximus*	0.0020										0.0020													
Jack - *Caranx* sp.																	0.0020					0.0100		
Jack-Knife Fish - *Equetus lanceolatus*						0.0020																		
Longsnout Butterflyfish - *Prognathodes aculeatus*			0.0140	0.0020			0.0040	0.0020	0.0033	0.0050	0.0020	0.0020	0.0020					0.0020						
Ocean Surgeonfish - *Acanthurus tractus*																					0.0040			
Orangeback Bass - *Serranus annularis*			0.0140	0.0040	0.0100	0.0100	0.0080	0.0020		0.0050	0.0220	0.0040		0.0040		0.0020				0.0133		0.0140	0.0120	
Purple Reeffish - *Chromis scotti*	0.2860	0.2260	0.2820			0.0060	0.0060	0.0040	0.0233	0.0233	0.0220	0.0020	0.0260	0.0080	0.0120	0.0180			0.0180	0.0200		0.0040		
Red Grouper - *Epinephelus morio*	0.0020					0.0020				0.0017		0.0020	0.0020	0.0020			0.0020	0.0020	0.0020					
Red Hind - *Epinephelus guttatus*	0.0020																							
Red Hogfish - *Decodon puellaris*							0.0020															0.0020		
Red Porgy - *Pagrus pagrus*																			0.0020					
Reef Butterflyfish - *Chaetodon sedentarius*	0.0220	0.0380	0.1020	0.0040		0.0120	0.0080	0.0160	0.0133	0.0200	0.0260	0.0100	0.0200	0.0540	0.0340	0.0220	0.0080		0.0080	0.1467		0.0160	0.0080	0.0420
Rock Beauty - *Holacanthus tricolor*			0.0220			0.0060		0.0160	0.0050	0.0117	0.0140	0.0060	0.0140	0.0080	0.0100	0.0080	0.0020		0.0040	0.0133				
Roughtongue Bass - *Pronotogrammus martinicensis*																	0.0200							0.5220
Sandtile - *Malacanthus plumieri*	0.0020																			0.0067				
Scamp Grouper - *Mycteroperca phenax*						0.0020			0.0017										0.0100					
School Bass - *Schultzea beta*	1.4000					0.7000		0.0320	0.5833	0.3333	0.2000		0.2000		0.4400		0.1360	0.9560	0.6300	0.8333				
Short Bigeye - *Pristigenys alta*						0.0020														0.0033				
Slippery Dick - *Halichoeres bivittatus*																				0.0033				
Snapper unid. - *Lutjanus* sp.	0.0060	0.0020				0.0020					0.0040					0.0020				0.0033				
Snow Bass - *Serranus chionaraia*																				0.0033			0.0020	
Spotfin Butterflyfish - *Chaetodon ocellatus*						0.0040			0.0033				0.0020		0.0020	0.0020			0.0100	0.0067				
Spotfin Hogfish - *Bodianus pulchellus*		0.0040	0.0080	0.0040		0.0120	0.0040	0.0080	0.0033	0.0017	0.0160	0.0060	0.0060	0.0080	0.0080		0.0040		0.0060	0.0133			0.0040	
Spotted Goatfish - *Pseudupeneus maculatus*																0.0020								
Striped Grunt - *Haemulon striatum*						0.2500	0.1800	0.0020		0.1633			1.0500		0.2500	0.1000				0.0133				
Sunshine Chromis/Sunshinefish - *Chromis insolata*	0.0380	0.0960	0.0540	0.0020		0.0180	0.0120	0.0280	0.0100	0.0017	0.0680	0.0100	0.0180	0.0120	0.0060	0.0080	0.0040	0.0020	0.0460	0.0100				
Tattler - *Serranus phoebe*				0.0040		0.0020		0.0020				0.0020		0.0020	0.0040		0.0020		0.0020		0.0060	0.0020		0.0120
Twospot Cardinalfish - *Apogon pseudomaculatus*																			0.0020					
Wrasse Bass - *Liopropoma eukrines*	0.0020		0.0180	0.0080		0.0160	0.0120	0.0180	0.0017	0.0033	0.0140	0.0140	0.0060	0.0040	0.0200	0.0020	0.0060	0.0040	0.0040	0.0133			0.0040	
Wrasse unid. - *Halichoeres* sp.	0.0040	0.0020		0.0060				0.0020			0.0040			0.0040	0.0020					0.0033		0.0080		0.0080
Yellowtail Reeffish - *Chromis enchrysurus*	0.1000	0.0920	0.0920	0.1140	0.0040	0.1680	0.0800	0.0540	0.0383	0.0217	0.1160	0.0880	0.0340	0.0580	0.0620	0.0620	0.1500	0.0020	0.1300	0.0533	0.1580		0.0040	0.0060
Pleuronectiformes																								
Flounder unid. - Bothidae																					0.0020			
Scorpaeniformes																								
Lionfish - *Pterois volitans*	0.0320			0.0020		0.0140	0.0080	0.0040	0.0050	0.0033	0.0060		0.0260		0.0200	0.0100		0.0160	0.0100	0.0567			0.0220	0.0380
Tetraodontiformes																								
Filefish unid. - Balistidae																					0.0020			
Grey Triggerfish - *Balistes capriscus*			0.0020																	0.0100				
Porcupinefish - *Diodon hystrix*																				0.0033				
Sharpnose Puffer - *Canthigaster rostrata*				0.0020		0.0020	0.0040				0.0020								0.0020			0.0020	0.0020	
Slender Filefish - *Monacanthus tuckeri*								0.0080													0.0040		0.0040	

APPENDIX 3

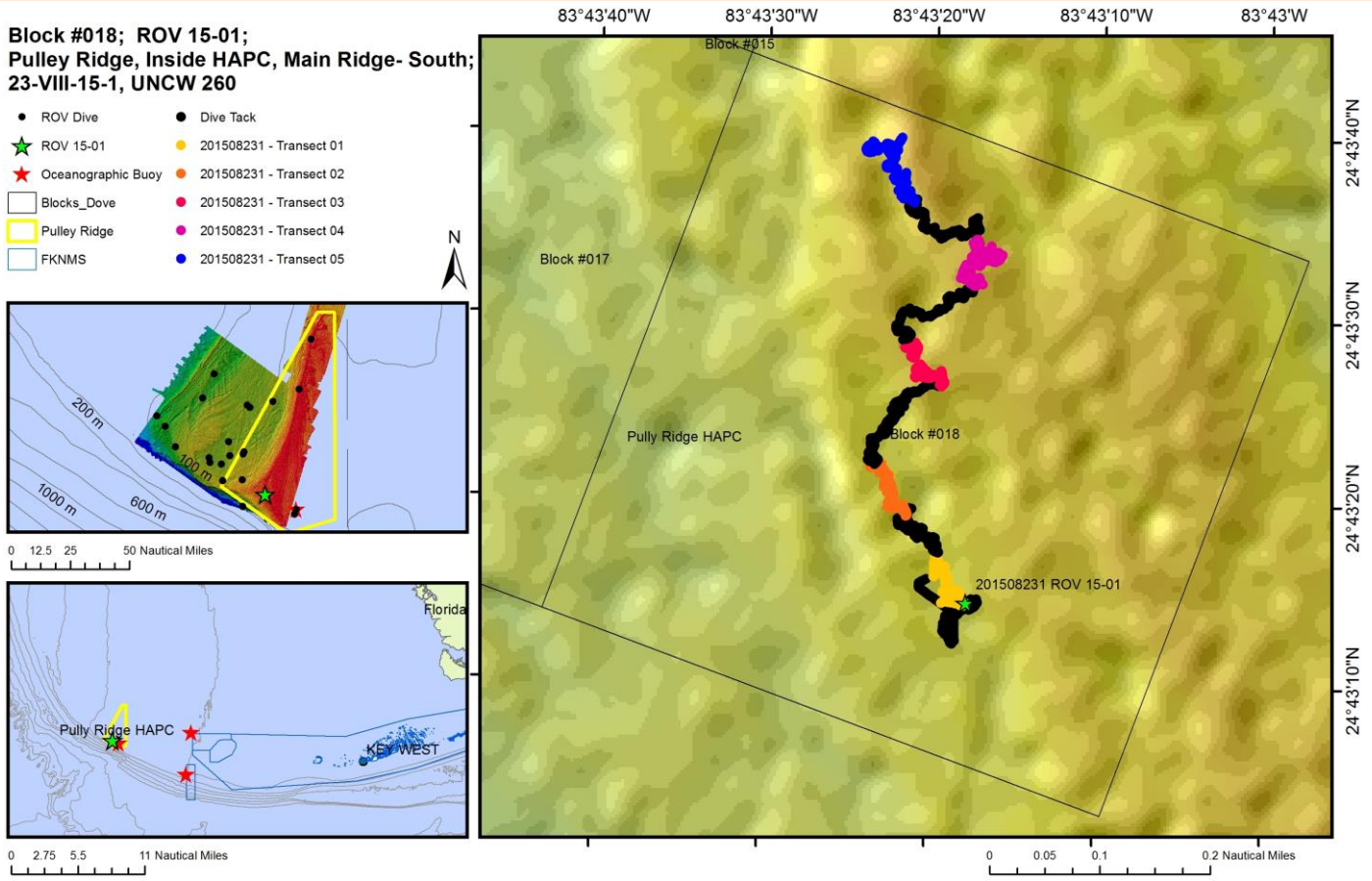
SEADESC II REPORT
Characterizations and Quantitative Analyses of Habitat, Benthic Biota, and Fish Populations

Provides the following data for each dive site during the 2015 R/V Walton Smith cruise to Pulley Ridge:

- cruise and ROV dive metadata and objectives
- figures showing each ROV dive track with five 100-m quantitative photo transects overlaid on multibeam sonar maps
- ROV dive data (start and end coordinates, time, and depth)
- CTD plots for each ROV dive
- images characterizing the habitat and biota for each dive site
- characterization of habitat, benthic biota, and fish populations for each dive site
- quantitative analyses of photo transects for each dive site including CPCe 4.1© point count of percent cover of benthic biota and substrate types
- quantitative analyses of video transects for each dive site of fish densities by species

Dive Site: Pulley Ridge, Inside HAPC; Block 18; Main Ridge- South; ROV 15-01, UNCW 260

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html
Scientific Observers:	Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	Naar_pulley_10m1_TIF
Purpose:	Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction
ROV:	Mohawk ROV
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II

ROV Sensors: Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density

Date of Dive:	8/23/2015	**Specimens:**	1
Ship Position System:	DGPS	**Digital Photos:**	221
Report Analyst:	John Reed, Stephanie Farrington	**DVD:**	4
Date Compiled:	1/27/2017	**Hard Drive:**	1

Dive Site: Pulley Ridge, Inside HAPC; Block 18; Main Ridge- South; ROV 15-01, UNCW 260

Dive Data:

Minimum Bottom Depth (m):	56.7	**Total Transect Length (km):**	1.388
Maximum Bottom Depth (m):	68.5	**Surface Current (kn):**	0.4
On Bottom (Time- GMT):	14:12	**On Bottom (Lat/Long):**	24.72°N; -83.72°W
Off Bottom (Time- GMT):	17:53	**Off Bottom (Lat/Long):**	24.73°N; -83.72°W
Physical (bottom); Temp (°C):	20.84	**Salinity:** 36.44 **Visibility (ft):**	60 **Current (kn):**

Physical Environment:

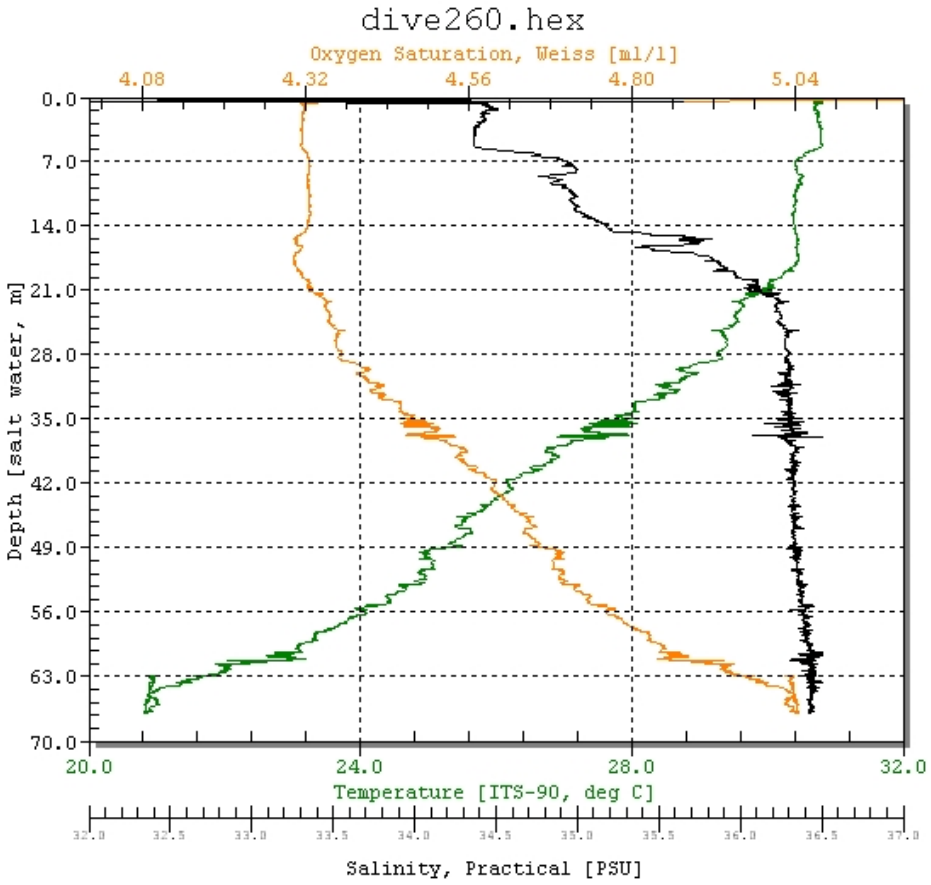


Figure 1: Shows the CTD data during the descent of ROV 15-01. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-01 are as follows: max depth: 67.22 m, temperature: 20.52 °C, conductivity: 50200 µS/cm, pressure: 98.05 PSI, salinity: 36.43 PSU, sound velocity: 1525.64 m/s, oxygen concentration: 5.08 ml/l, density: 1026.01 Kg/m^3, nitrogen saturation: 9.34 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Inside HAPC; Block 18; Main Ridge- South; ROV 15-01, UNCW 260

Dive Imagery:

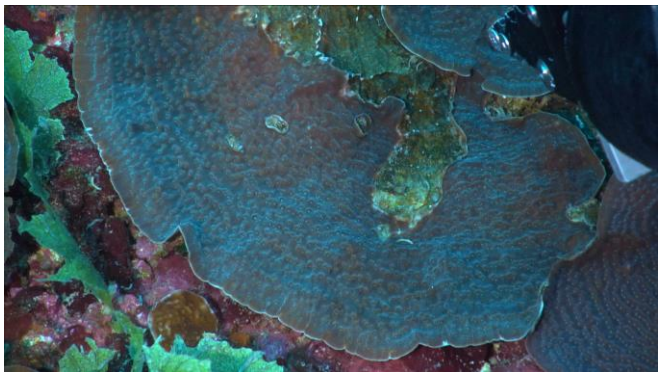


Figure 2: -67.3 m
Agaricia plate coral.

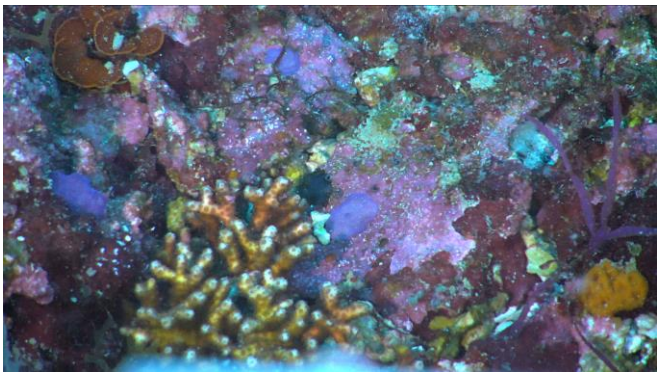


Figure 3: -66.5 m
Madracis brueggemanni pencil coral.

Figure 4: -66 m
Condylactis gigantea anemone.

Figure 5: -66 m
Scamp grouper.

Dive Site: Pulley Ridge, Inside HAPC; Block 18; Main Ridge- South; ROV 15-01, UNCW 260

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 23-VIII-15-1; ROV Dive 15-01; Mohawk UNCW Dive 260. Target Site: Florida, inside Pulley Ridge HAPC, random block #18, southern Main Ridge; 24°43.1055'N, 83°43.1735'W, 64 m.

Objectives- Ground truth MB map; conduct five random 100-m photo/video transects within block. Conduct video transects for fish population characterization and photo transects for habitat and benthic macrobiota characterization. Repeat photo transects (transects 2-6) of Block #18 from 2012 dive, following ArcGIS track lines. Collect benthic macro-organisms for taxonomy voucher specimens.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/125, auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom; photos were taken every 30 seconds. Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. Five random 100 m quantitative transects were conducted in each Block. Each 100 m transect was conducted at ~0.25 kn, for 15-20 minutes until the ROV passed through 100 m circle overlaid on navigation screen; quantitative still images were taken every 30 sec for a minimum of 30 images per transect. Off transects between the quantitative transects were 15-20 minutes for close-up video frame grabs of fish and biota, and for collections. Direction of transects were random, but generally headed NE or NW, depending on the ship's maneuverability with the wind and current.

Site Description/Habitat

Depth range: 66.5 to 67.5 m.

MB sonar map shows relatively flat bottom with no ledges. It appears to be a delta like feature (paleo-shoreline) at the southern terminus of the main Pulley Ridge. The entire dive transected the block from SE to NW. The bottom was very consistent with no obvious changes throughout or between photo transects. The bottom was 100% hard bottom, flat, and predominantly covered with old dead plate coral and coral/rock rubble. There were no ledges or ridges except for occasional red grouper pits, ~5-15 m diameter, 1-2 m deep, which had exposed excavated rock burrows in the bottom. Most grouper pits had 1-2 scamp grouper, lionfish (few to 14), and other reef fish.

Launch- 14:06. Surface- pt./cloudy, seas 2' from NE, current- 0.4 kn from SE. On bottom, depth 65.5 m, 20 m visibility, <1/4 kn bottom current, 20.8°C.

14:24- Start transect 1 (overlay of transect 2 of 2012 dive).

14:46- End xs 1. During off transects, kept ROV low and slow for video frame grabs of fish and benthic biota, and for collections.

14:54- Collect sample 1, *Madracis decactis*, 10 cm diam.

15:10- Start xs 2 (= xs 3 of 2012 dive, etc.).

15:31- End xs 2.

15:45- Attempt to collect sample 2 (*Agaricia*), but jaws broke on manipulator.

16:04- Start xs 3.

16:33- End xs 3.

16:44- Grouper pit, 9 lionfish, 3 scamp, graysby.

16:50- Start xs 4.

17:16- End xs 4.

17:19- Abandoned grouper pit, 2 lionfish.

17:29- Start xs 5.

17:45- End xs 5.
17:46- 10-15 m diameter grouper pit, 2 m deep (top edge 66.5 m, base 67.9 m). School of small (1") fish, numerous reef fish.

Benthic Macrobiota:
The exposed dead coral rock was mostly encrusted with crustose coralline red algae. There was a dense cover (50-80%) of *Anadyomene* green algae, demosponges were common but not abundant, gorgonian octocorals were rare, and black coral (*Antipathes* spp. and *Stichopathes*) were present. *Agaricia* plate coral (5-20 cm) were common to abundant over most of the transect. Patches of larger *Agaricia* coral (possibly *Agaricia lamarcki*), appeared as single colonies of 50 cm->1 m diameter, as well as extensive patches 5+ m diameter of conglomerate coral plates.

Dominant Benthic Macrobiota:
Scleractinia- *Agaricia fragilis*, *A. lamarcki*, *Agaricia* sp., *Helioserus cucullata*, *Madracis decactis* (encrusting), *Madracis brueggemanni* (thin pencil coral), *Madracis formosa* (thick pencil), *Scolymia*? sp.
Antipatharia- *Stichopathes lutkeni*, *Antipathes atlantica*, Antipatharia unid. spp.
Gorgonacea Octocorallia- Unid. spp. (rare)
Actiniaria- *Condylactis gigantea*
Corallimorpharia- *Ricordea floridana*, other spp.
Porifera- Demospongiae unid. spp., *Ircinia campana*, *Ircinia strobilina*, *Niphates* sp., *Polymastia*, Spirastrellidae, *Verongida*, *Xestospongia muta*, *Agelas* spp., *Agelas conifera*, *Cribrochalina* sp., *Aiolochroia crassa*, *Callyspongia vaginalis*.
Crinoidea- Comatulida (abundant), *Davidaster* sp., *Analcidometra* sp.
Chlorophyta- *Anadyomene menziesii* (abundant), *Codium* sp. (rare), *Halimeda* sp. (rare), *Ventricaria* sp., *Verdigellas* sp.
Rhodophyta- crustose coralline algae (abundant). *Peyssonnellia* spp. (common).
Phaeophyta- *Dictyota* spp., *Lobophora variegata*.

Fish- Scamp (7), Amberjack, reef butterfly, purple reef fish, sunshine fish, blue chromis, bicolor damselfish, chalk bass, green blotch parrot, squirrelfish, graysby, greater soapfish, lionfish (45; associated with grouper burrows).

Dive Site: Pulley Ridge, Inside HAPC; Block 18; Main Ridge- South; ROV 15-01, UNCW 260

CPCe Percent Cover Analysis:

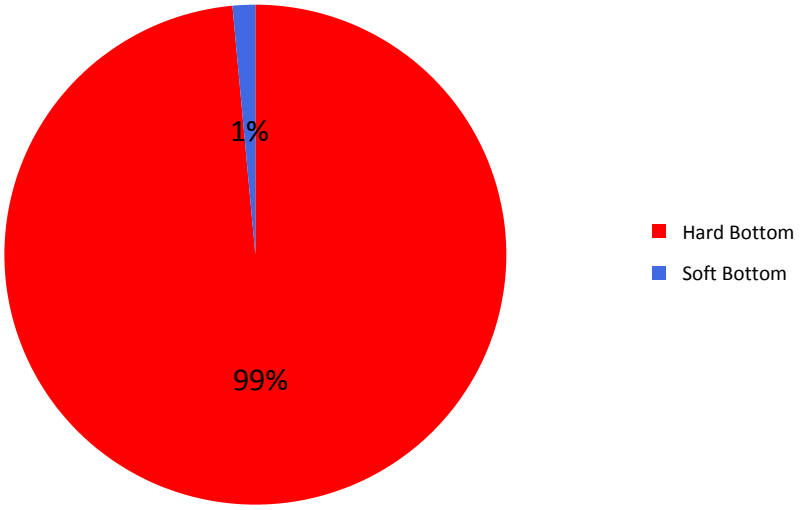
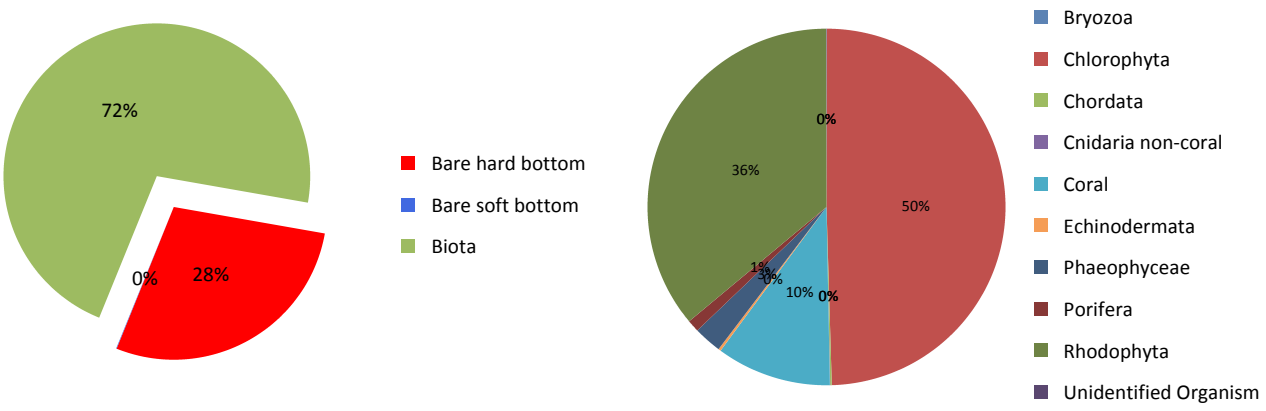


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-01. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-01.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Inside HAPC; Block 18; Main Ridge- South; ROV 15-01, UNCW 260

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-01.

Group/Phylum/Taxa	ROV 15-01
Biota	71.64%
Chlorophyta	35.47%
Anadyomene menziesii	34.55%
Chlorophyta	0.18%
Codium sp.	0.12%
Halimeda sp.	0.05%
Valonia ventricosa	0.10%
Verdigellas peltata	0.47%
Ochrophyta	1.80%
Dictyota sp.	1.62%
Lobophora variegata	0.15%
Phaeophyceae	0.03%
Rhodophyta	25.83%
Corallinales (crustose coralline)	25.23%
Peyssonnelia sp.	0.05%
Rhodophyta	0.52%
Rhodophyta- fleshy blade	0.03%
Porifera	0.78%
Agelas clathrodes	0.02%
Agelas sp.	0.05%
Aiolochroia crassa	0.02%
Demospongiae	0.35%
Erylus sp.	0.02%
Geodia gibberosa complex	0.05%
Geodia neptuni complex	0.08%
Petrosiidae	0.02%
Polymastia sp.	0.05%
Spirastrellidae	0.07%
Spongosorites sp.	0.02%
Xestospongia muta	0.03%
Xestospongia sp.	0.02%
Cnidaria	7.46%
Agaricia fragilis	0.27%
Agaricia grahamae	2.60%
Agaricia sp.	4.22%

Dive Site: Pulley Ridge, Inside HAPC; Block 18; Main Ridge- South; ROV 15-01, UNCW 260

Corallimorpharia	0.02%
Helioseris cucullata	0.07%
Madracis brueggemanni	0.10%
Madracis decactis	0.15%
Madracis formosa	0.03%
Bryozoa	0.02%
Bryozoa- white fan	0.02%
Echinodermata	0.17%
Analcidometra armata	0.12%
Comatulida	0.03%
Davidaster discoideus	0.02%
Chordata	0.10%
Ascidiacea	0.07%
Ascidiacea- purple	0.02%
Didemnidae	0.02%
UNKNOWN	0.02%
Unidentified organism	0.02%
Bare hard bottom	28.31%
Habitat	28.31%
Bare dead coral plate	0.38%
Bare rock	24.59%
Bare rubble/cobble	3.34%
Bare soft bottom	0.05%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Inside HAPC; Block 18; Main Ridge- South; ROV 15-01, UNCW 260

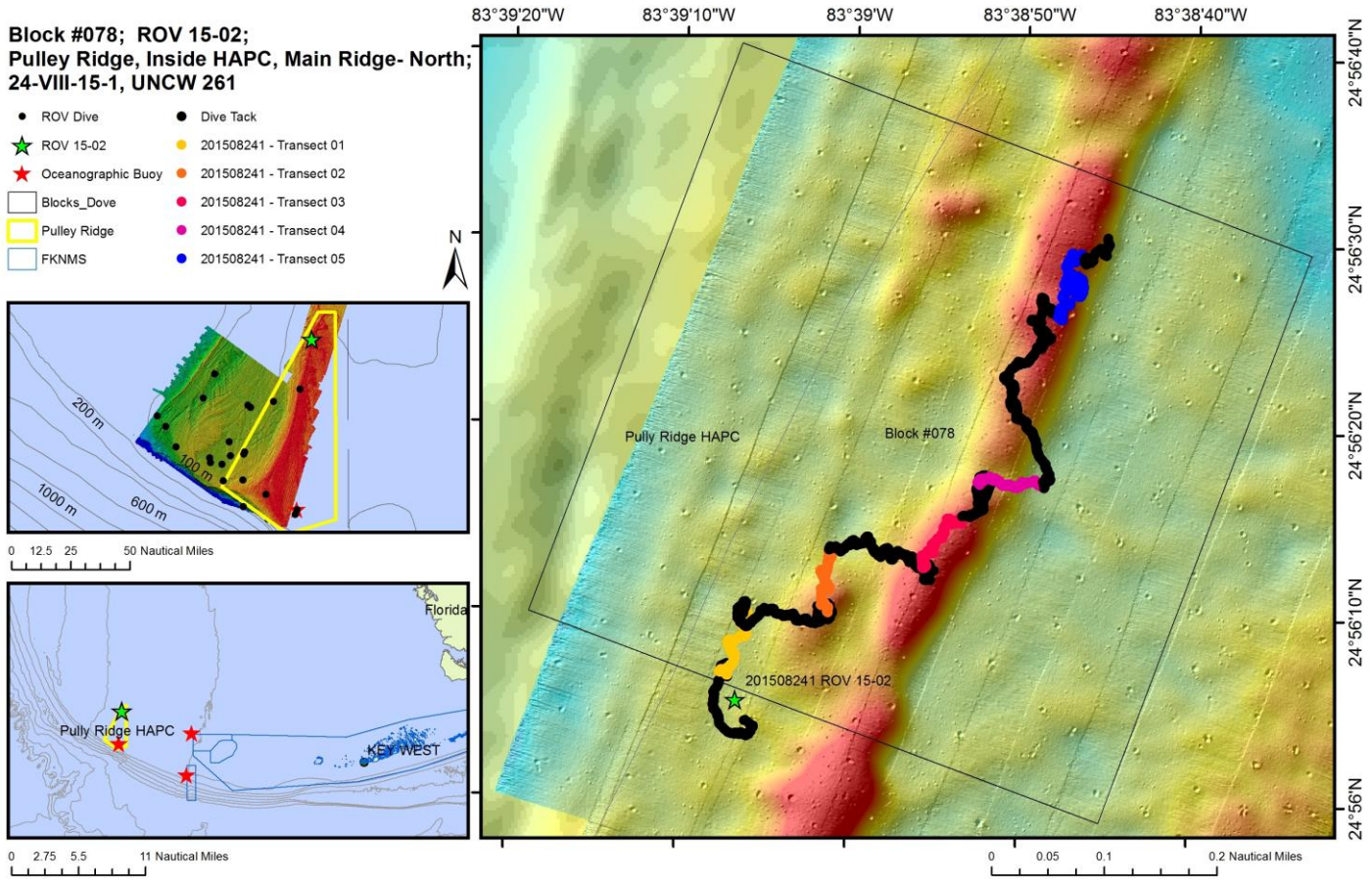
Density of Fish:

Table 2. Density (# individuals/m) of fish from video transects at dive site ROV 15-01.

Class/Order/Family/Common name -Taxa	No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
fish unid.- Actinopteri	316	0.632
Beryciformes		
Holocentridae		
Squirrelfish unid.- *Holocentrus* sp.	7	0.014
Perciformes		
Carangidae		
amberjack- *Seriola* sp.	1	0.002
Chaetodontidae		
Longsnout butterflyfish- *Prognathodes aculeatus*	7	0.014
reef butterflyfish- *Chaetodon sedentarius*	51	0.102
Labridae		
spotfin hogfish- *Bodianus pulchellus*	4	0.008
Pomacanthidae		
cherubfish- *Centropyge argi*	22	0.044
rock beauty- *Holacanthus tricolor*	11	0.022
Pomacentridae		
bicolor damselfish- *Stegastes partitus*	25	0.05
Blue chromis- *Chromis cyanea*	14	0.028
Chromis unid.- *Chromis* sp.	45	0.09
purple reeffish- *Chromis scotti*	141	0.282
sunshine chromis/sunshinefish- *Chromis insolata*	27	0.054
yellowtail reeffish- *Chromis enchrysurus*	46	0.092
Scaridae		
Greenblotch parrotfish- *Sparisoma atomarium*	26	0.052
Serranidae		
chalk bass- *Serranus tortugarum*	46	0.092
orangeback bass- *Serranus annularis*	7	0.014
wrasse bass- *Liopropoma eukrines*	9	0.018
Tetraodontiformes		
Balistidae		
grey triggerfish- *Balistes capriscus*	1	0.002
Grand Total	**806**	**0.632**

Dive Site: Pulley Ridge, Inside HAPC; Block 78; Main Ridge- North; ROV 15-02, UNCW 261

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html
Scientific Observers:	Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	Nancy_Pulley_North_2m_UTM 17n
Purpose:	Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction
ROV:	Mohawk ROV
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II

ROV Sensors: Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density

Date of Dive:	8/24/2015	**Specimens:**	14
Ship Position System:	DGPS	**Digital Photos:**	246
Report Analyst:	John Reed, Stephanie Farrington	**DVD:**	4
Date Compiled:	1/27/2017	**Hard Drive:**	1

Dive Site: Pulley Ridge, Inside HAPC; Block 78; Main Ridge- North; ROV 15-02, UNCW 261

Dive Data:

Minimum Bottom Depth (m):	56.3	**Total Transect Length (km):**	1.954
Maximum Bottom Depth (m):	68	**Surface Current (kn):**	0.2
On Bottom (Time- GMT):	8:06	**On Bottom (Lat/Long):**	24.94°N; -83.65°W
Off Bottom (Time- GMT):	11:44	**Off Bottom (Lat/Long):**	24.94°N; -83.65°W

Physical (bottom); Temp (°C): 19.58 **Salinity:** 36.39 **Visibility (ft):** 45 **Current (kn):** 0.25

Physical Environment:

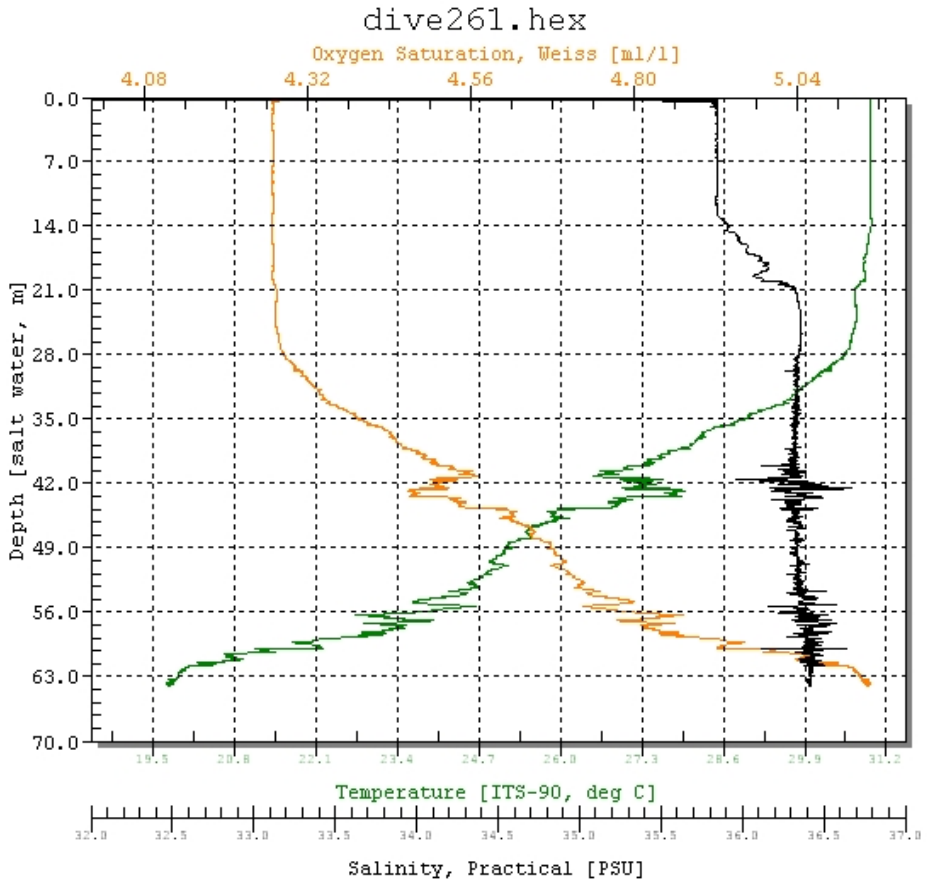


Figure 1: Shows the CTD data during the descent of ROV 15-02. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-02 are as follows: max depth: 66.91 m, temperature: 19.98 °C, conductivity: 49600 µS/cm, pressure: 97.6 PSI, salinity: 36.41 PSU, sound velocity: 1524.13 m/s, oxygen concentration: 5.13 ml/l, density: 1026.13 Kg/m^3, nitrogen saturation: 9.43 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Inside HAPC; Block 78; Main Ridge- North; ROV 15-02, UNCW 261

Dive Imagery:

Figure 2: -63.3 m
Measuring a black grouper (10 cm parallel lasers).

Figure 3: -63.3 m
Red grouper pit approximately 10 m diameter and 2 m deep provides oasis and habitat to numerous other fish species.

Figure 4: -63.2 m
Unidentified demosponge, possibly Verongida.

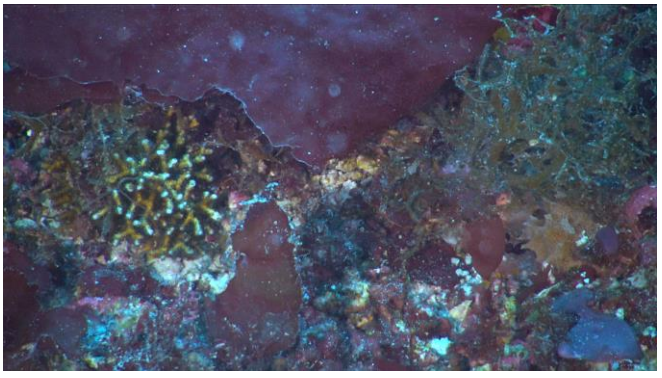


Figure 5: -64.4 m
Pencil coral *Madracis brueggemanni,* red algae *Halymenia* sp., and brown algae *Dictyota* sp.

Dive Site: Pulley Ridge, Inside HAPC; Block 78; Main Ridge- North; ROV 15-02, UNCW 261

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 24-VIII-15-1; ROV Dive 15-02; Mohawk UNCW Dive 261. Target Site: Florida, inside Pulley Ridge HAPC, random block #78, northern Main Ridge; Kraken Dive Site #2-2011; 67 m.

Objectives- Ground truth MB map; conduct five random 100-m photo/video transects within block. Conduct video transects for fish population characterization and photo transects for habitat and benthic macrobiota characterization. Collect benthic macro-organisms for taxonomy voucher specimens.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/125, auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom; photos were taken every 30 seconds. Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. Five random 100 m quantitative transects were conducted in each Block. Each 100 m transect was conducted at ~0.25 kn, for 15-20 minutes until the ROV passed through 100 m circle overlaid on navigation screen; quantitative still images were taken every 30 sec for a minimum of 30 images per transect. Off transects between the quantitative transects were 15-20 minutes for close-up video frame grabs of fish and biota, and for collections. Direction of transects were random, but generally headed NE or NW, depending on the ship's maneuverability with the wind and current.

Site Description/Habitat

Depth range: 60.8 to 68.0 m.

Launch- 8:01, near south edge of block. P/cloudy, seas 1-2' swell, wind 10 kn from N, water 30.95°C, salinity 35.83, surface current 0.2 kn from N.

On bottom- 8:06, 68 m; 15 m visibility, 19.58°C, <1/4 kn current.

8:18- Transect 1, heading NE; depth range 67-67 m, ~ 200 m west of main ridge. Flat, mostly 5 cm rubble. Dominated by *Anadyomene*, and crustose coralline algae; some 5-10 cm *Agaricia*; sand tilefish rubble mounds, *Dictyota* common.

8:32- End XS 1; head NE for off transect toward ridge. *Halymenia* blades common, *Agelas*, some *Agaricia*. 2 m diameter grouper pit- reef fish, large unid. grouper.

8:46- MD sonar grouper pit, 10 m diameter, scamp, large black grouper.

8:54- Transect 2, heading N; depth range 64-67 m, 100 m west of main ridge on MB. 70% hard bottom, 5 cm rubble, 10% cover *Anadyomene*, several spp Rhodophyta, no Octocoral, no sponges, sand tile burrows; 2 5-cm *Agaricia*; grouper pit, no grouper.

9:06- End XS 2, 67 m; head E for off transect. Sand tilefish mound with lots reef fish. 65 m- west base of main ridge.

9:20- 10 m diameter grouper pit, 61.5 m, lots reef fish

Top of ridge, 60.8 m, 70% hard bottom, 5 cm rubble; more Octocorals, *Ellisella*, Primnoids; *Anadyomene* dominant, and CCA.

9:35- Sample 1, 60.8 m, *Madracis brueggemanni*?, 5 cm; common; top of ridge.

9:48- Transect 3, 61 m, heading NE on ridge; no *Agaricia*, sponges rare, *Anadyomene* and CCA dominant. Two grouper pits; one not on MB sonar.

10:02- End XS 2, top of ridge. Grouper pit- 63.5 m, lionfish, scamp, red grouper.

10:14- Samples 3-10, 63.6 m, red algae.

10:36- Transect 4. 63.7-67.5 m; top of ridge to east base; head E. 80-90% hard bottom, 5 cm rubble; *Anadyomene*, red alga blades, *Halymenia*, sand tile mounds.

Dive Site: Pulley Ridge, Inside HAPC; Block 78; Main Ridge- North; ROV 15-02, UNCW 261

67.5 m- base of ridge on MB; 70% hard bottom, 5 cm rubble.
10:50- End XS 4; head NW for off transect.
62.5 m- On ridge, lots of Halymenia, *Xestospongia muta* common, *Verongida rigida*? Two grouper pits shown on MB but not seen in transect.
11:22- Start transect 5, 62-63.5 m, top of ridge, head NE; 80% hard bottom, rubble; dense algae, *Anadyomene*, red blades.
11:40- End XS 5, top of ridge. Grouper pit in MB- red grouper, 16 lionfish, 2 hog snapper.
11:45- End dive, 65 m, east base of ridge.

Dominant Benthic Macrobiota:
Scleractinia- *Agaricia* spp., few 5-10 cm; *Madracis brueggemanni*, common on ridge
Octocorallia- few, sparse, Ellisellidae,
Antipatharia- few, sparse; *Antipathes furcate*, *Stichopathes lutkeni*
Hydroida-
Crinoidea- Comatulida
Porifera- *Agelas* spp., *Agelas clathrodes*?, . *Ircinia campana*, *Xestospongia muta*, Verongida, *Geodia gibberosa*? complex
Chlorophyta- *Anadyomene*, dominant; *Halimeda*, sparse.
Rhodophyta- numerous spp., red blades and branching; *Kallymenia*, *Halymenia*, *Botryocladia*, crustose coralline on rocks.

Fish- few fish on flats; dense fish in grouper pits; several grouper pits; red grouper- several; lionfish- common in pits; scamp, yellowtail reef fish, squirrel fish, black grouper, bicolor damselfish, green blotch parrotfish, cherubfish, reef butterfly, bogas, chalk bass, spotfin hogfish, snapper (grey?), blue angelfish.

Samples: Scleractinia- *Madracis brueggemanni*?; Rhodophyta- 9; rock- 1.

Dive Site: Pulley Ridge, Inside HAPC; Block 78; Main Ridge- North; ROV 15-02, UNCW 261

CPCe Percent Cover Analysis:

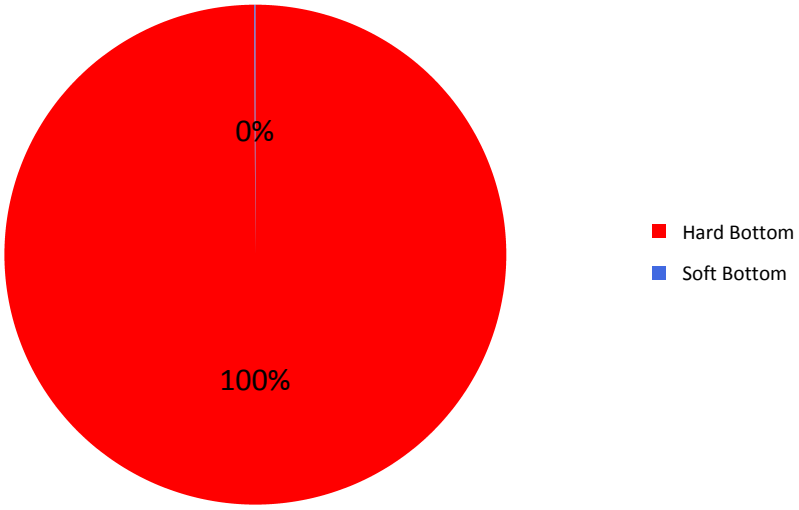
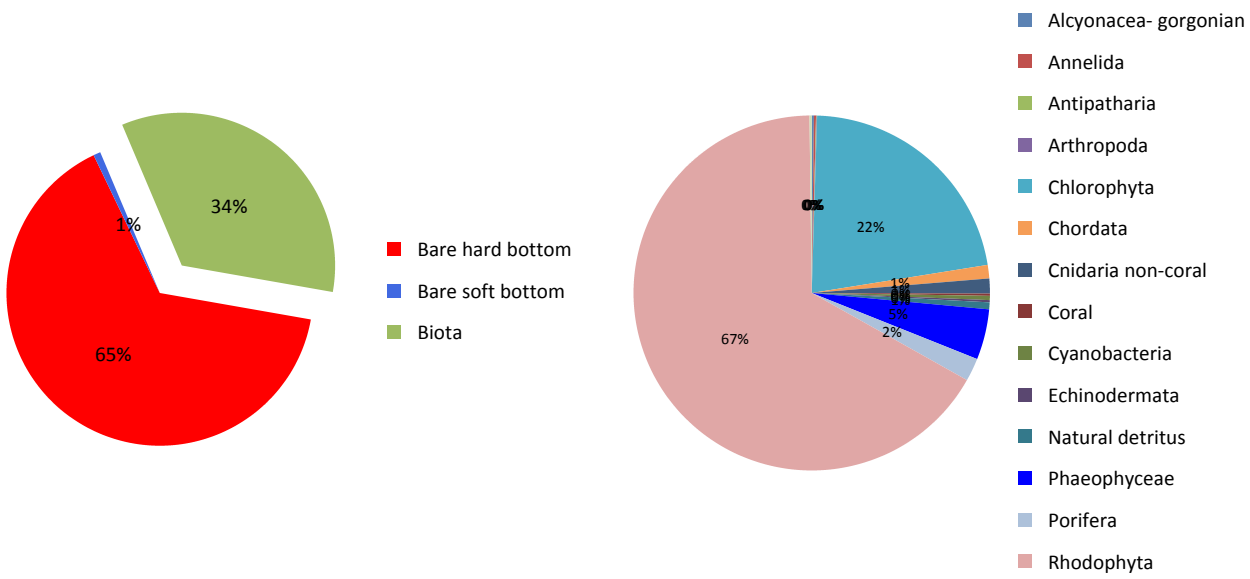


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-02. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-02.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Inside HAPC; Block 78; Main Ridge- North; ROV 15-02, UNCW 261

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-02.

Group/Phylum/Taxa	ROV 15-02
Biota	34.13%
Chlorophyta	7.50%
Anadyomene menziesii	6.82%
Chlorophyta	0.25%
Codium sp.	0.15%
Halimeda sp.	0.20%
Valonia ventricosa	0.07%
Verdigellas peltata	0.02%
Ochrophyta	1.57%
Dictyota sp.	1.45%
Lobophora variegata	0.08%
Phaeophyceae	0.03%
Rhodophyta	22.74%
Botryocladia sp.	0.07%
Corallinales (crustose coralline)	8.07%
Halymenia sp.	8.72%
Peyssonnelia sp.	0.58%
Rhodophyta	3.90%
Rhodophyta- fleshy blade	1.40%
Cyanobacteria	0.13%
Cyanobacteria	0.13%
Porifera	0.72%
Agelas sp.	0.07%
Demospongiae	0.43%
Demospongiae- PR19	0.02%
Geodia gibberosa complex	0.05%
Geodia sp.	0.02%
Ircinia strobilina	0.03%
Monanchora arbuscula	0.02%
Spirastrellidae	0.02%
Xestospongia muta	0.03%
Xestospongia sp.	0.03%
Cnidaria	0.62%
Actiniaria	0.02%
Antipatharia	0.02%
Condylactis gigantea	0.05%

Dive Site: Pulley Ridge, Inside HAPC; Block 78; Main Ridge- North; ROV 15-02, UNCW 261

Corallimorpharia	0.05%
Ellisella sp.	0.02%
Hydroidolina	0.35%
Madracis brueggemanni	0.05%
Madracis decactis	0.02%
Primnoidae	0.05%
Annelida	0.07%
Sabellidae	0.07%
Arthropoda	0.02%
Anomura	0.02%
Echinodermata	0.07%
Analcidometra armata	0.02%
Comatulida	0.05%
Chordata	0.42%
Ascidiacea	0.08%
Ascidiacea- purple	0.30%
Didemnidae	0.03%
detritus	0.22%
Natural detritus	0.22%
UNKNOWN	0.07%
Unidentified organism	0.07%
Bare hard bottom	65.12%
Habitat	65.12%
Bare dead coral plate	0.02%
Bare rock	0.25%
Bare rubble/cobble	64.85%
Bare soft bottom	0.75%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Inside HAPC; Block 78; Main Ridge- North; ROV 15-02, UNCW 261

Density of Fish:

Table 2. Density (# individuals/m) of fish from video transects at dive site ROV 15-02.

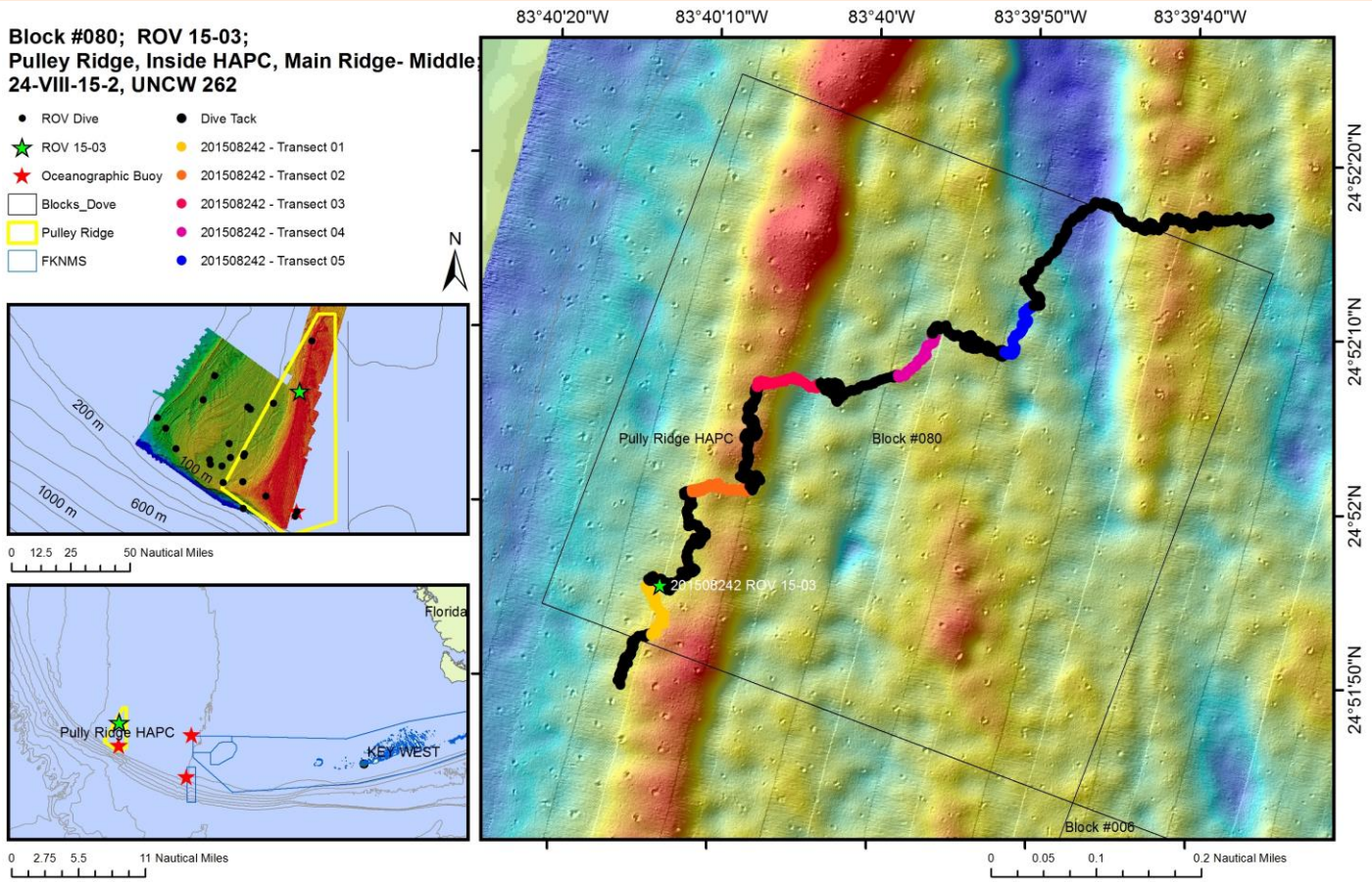
Class/Order/Family/Common name -Taxa	No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
fish unid.- Actinopteri	240	0.48
Beryciformes		
Holocentridae		
Squirrelfish unid.- *Holocentrus* sp.	2	0.004
Perciformes		
Apogonidae		
cardinalfish unid.- *Apogon* sp.	50	0.1
Carangidae		
amberjack- *Seriola* sp.	7	0.014
Chaetodontidae		
reef butterflyfish- *Chaetodon sedentarius*	11	0.022
Labridae		
hogfish- *Lachnolaimus maximus*	1	0.002
Wrasse unid.- *Halichoeres* sp.	2	0.004
Lutjanidae		
Snapper unid.- *Lutjanus* sp.	3	0.006
Malacanthidae		
Sandtile- *Malacanthus plumieri*	1	0.002
Pomacanthidae		
cherubfish- *Centropyge argi*	12	0.024
gray angelfish- *Pomacanthus arcuatus*	2	0.004
Pomacentridae		
bicolor damselfish- *Stegastes partitus*	17	0.034
Blue chromis- *Chromis cyanea*	1	0.002
Chromis unid.- *Chromis* sp.	51	0.102
purple reeffish- *Chromis scotti*	143	0.286
sunshine chromis/sunshinefish- *Chromis insolata*	19	0.038
yellowtail reeffish- *Chromis enchrysurus*	50	0.1
Scaridae		
Greenblotch parrotfish- *Sparisoma atomarium*	2	0.004
Serranidae		
chalk bass- *Serranus tortugarum*	119	0.238
red grouper- *Epinephelus morio*	1	0.002
red hind- *Epinephelus guttatus*	1	0.002

Dive Site: Pulley Ridge, Inside HAPC; Block 78; Main Ridge- North; ROV 15-02, UNCW 261

school bass- *Schultzea beta*	700	1.4
wrasse bass- *Liopropoma eukrines*	1	0.002
Scorpaeniformes		
Scorpaenidae		
lionfish- *Pterois volitans*	16	0.032
Grand Total	**1452**	**1.4**

Dive Site: Pulley Ridge, Inside HAPC; Block 80; Main Ridge- Middle; ROV 15-03, UNCW 262

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html
Scientific Observers:	Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	Nancy_Pulley_Middle_UTM17 N
Purpose:	Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction
ROV:	Mohawk ROV
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II

ROV Sensors: Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density

Date of Dive:	8/24/2015	**Specimens:**	2
Ship Position System:	DGPS	**Digital Photos:**	238
Report Analyst:	John Reed, Stephanie Farrington	**DVD:**	4
Date Compiled:	1/27/2017	**Hard Drive:**	1

Dive Site: Pulley Ridge, Inside HAPC; Block 80; Main Ridge- Middle; ROV 15-03, UNCW 262

Dive Data:

Minimum Bottom Depth (m):	54.4	**Total Transect Length (km):**	2.220
Maximum Bottom Depth (m):	70.2	**Surface Current (kn):**	0.2
On Bottom (Time- GMT):	13:49	**On Bottom (Lat/Long):**	24.86°N; -83.67°W
Off Bottom (Time- GMT):	17:40	**Off Bottom (Lat/Long):**	24.87°N; -83.66°W
Physical (bottom); Temp (°C):	19.61	**Salinity:** 36.41 **Visibility (ft):**	45 **Current (kn):**

Physical Environment:

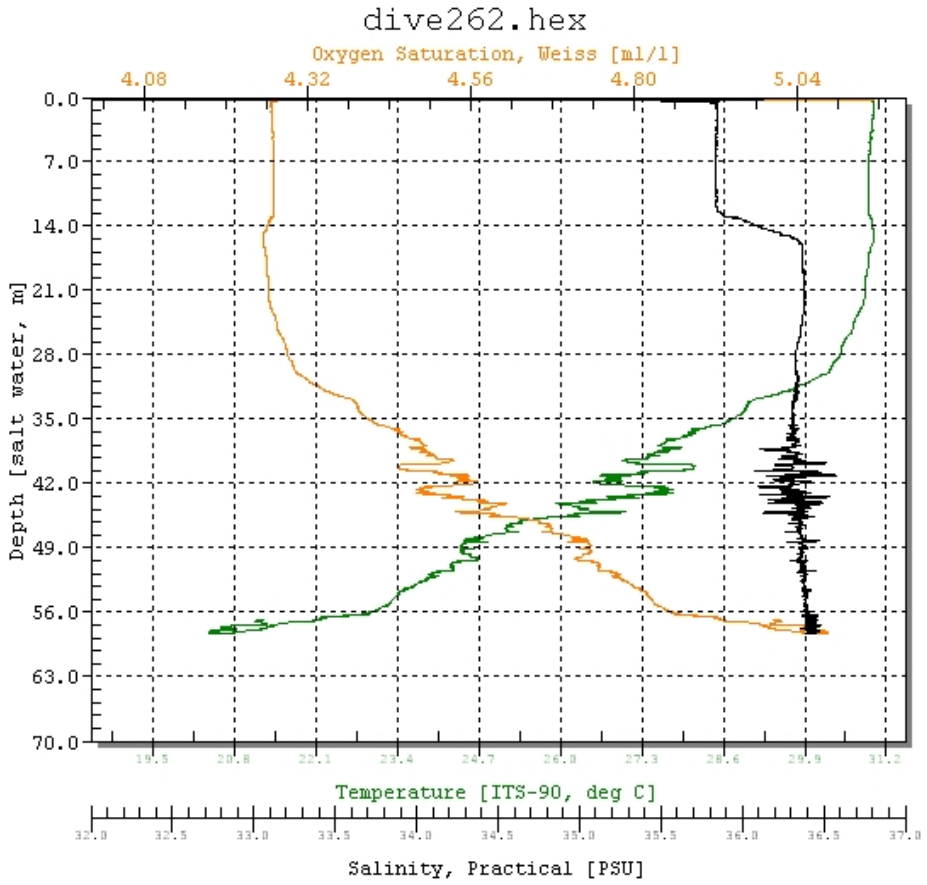


Figure 1: Shows the CTD data during the descent of ROV 15-03. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-03 are as follows: max depth: 69.6 m, temperature: 19.74 °C, conductivity: 49400 µS/cm, pressure: 101.53 PSI, salinity: 36.41 PSU, sound velocity: 1523.49 m/s, oxygen concentration: 5.16 ml/l, density: 1026.21 Kg/m^3, nitrogen saturation: 9.47 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Inside HAPC; Block 80; Main Ridge- Middle; ROV 15-03, UNCW 262

Dive Imagery:

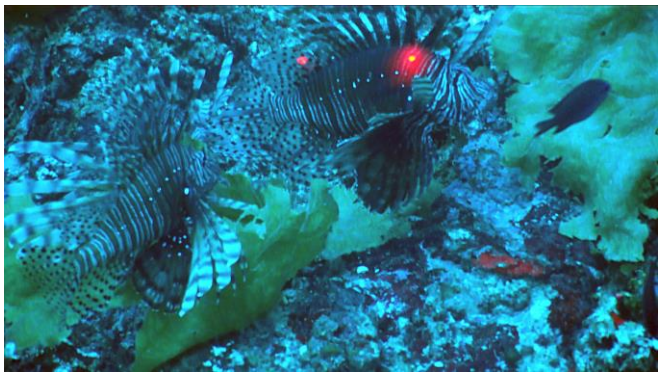


Figure 2: -64.1 m
Lionfish (10 cm lasers).

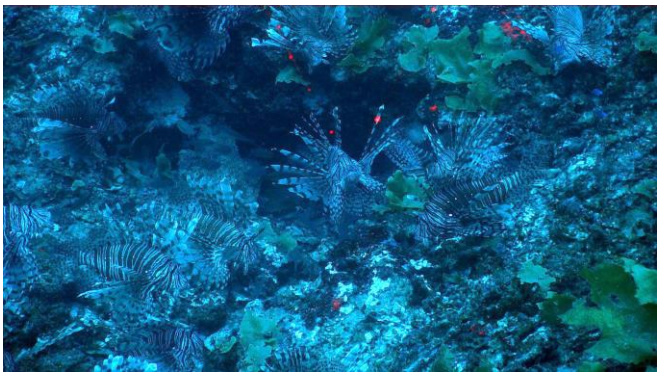


Figure 3: -64.7 m
School of lionfish in red grouper pit.

Figure 4: -62.4 m
Lionfish with lettuce algae *Anadyomene menziesii*.

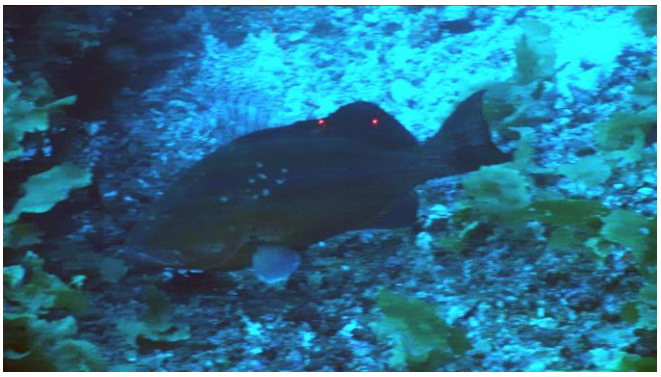


Figure 5: -62.4 m
Red grouper in pit (10 cm lasers).

Dive Site: Pulley Ridge, Inside HAPC; Block 80; Main Ridge- Middle; ROV 15-03, UNCW 262

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 24-VIII-15-2; ROV Dive 15-03; Mohawk UNCW Dive 262. Target Site: Florida, inside Pulley Ridge HAPC, random block #80, northern Main Ridge; 66 m

Objectives- Ground truth MB map; conduct five random 100-m photo/video transects within block. Conduct video transects for fish population characterization and photo transects for habitat and benthic macrobiota characterization. Collect benthic macro-organisms for taxonomy voucher specimens.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/125, auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom; photos were taken every 30 seconds. Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. Five random 100 m quantitative transects were conducted in each Block. Each 100 m transect was conducted at ~0.25 kn, for 15-20 minutes until the ROV passed through 100 m circle overlaid on navigation screen; quantitative still images were taken every 30 sec for a minimum of 30 images per transect. Off transects between the quantitative transects were 15-20 minutes for close-up video frame grabs of fish and biota, and for collections. Direction of transects were random, but generally headed NE or NW, depending on the ship's maneuverability with the wind and current.

Site Description/Habitat

Depth range: 62.4 to 67.0 m.

13:42- Launch; P/cloudy, seas 2'from NE, wind 8 kn from NE; surface water- 30.96°C, salinity 35.85, current 0.2 kn to W.

13:49- On bottom, 66 m, SW corner of block; 15 m visibility, 19.61°C, current <1/4 knot; school of snapper, jacks.

13:42- Grouper pit in MB- red grouper, scamp, lionfish.

14:00- Start transect 1, 63.5 m, west base of main ridge, head N; 90% hard bottom, 5-10 cm rubble/cobble; 50% cover *Anadyomene*, CCA abundant, *Halymenia* common, *Geodia*; *Agaricia*- 10 cm, 20 cm.

14:09- End XS 1, west base of ridge.

14:13- Double grouper pit on MB; not in video; tracking appears off, about 10-20 m; *Agaricia*- 30 cm, three 20 cm.

14:33- 15 m grouper pit in MB; tracking 20 m off. Rubble pit, 10 lionfish, 1 red grouper, reef fish.

14:26- top of ridge, 65.5 m; grouper pit in MB, nav 20 m off- red grouper, cardinalfish, 17 lionfish.

14:34- Start XS 2, 64.5-65.1 m depth range, head E, west base of ridge; 30 cm *Montastraea cavernosa*, several *Agaricia*; 100% hard bottom, rubble/cobble; 50% *Anadyomene*; top of ridge.

14:46- End XS 2. Head NE for off transect and check out grouper pits.

14:50- Grouper pit on MB, top of ridge, 64.0 m- reef fish, 8 lionfish, 1 red grouper.

14:59- Grouper pit on MB, 14 m diameter, 62.4 m- reef fish, 25 lionfish, 60 cm TL red grouper. Another small pit, lionfish.

15:13- Start XS 3, 63.7-67 m depth range, head E on ridge top; same habitat; *Agaricia* 20 cm.

67 m- in blue valley of MB, east of ridge; 70% hard bottom, rubble, sediment; *Anadyomene*, CCA.

15:24- End XS 3, 67 m. Off transect head E.

15:30- Sample 1, 65.8 m, *Agaricia lamarcki*, 30 cm; east of main ridge.

15:37- MB- low relief knolls, east of Main Ridge; dense *Agaricia lamarcki*?, 10-cm; conduct overlapping photo mosaic.

15:49- Start XS 4, 65.3-65.7 m depth range, head NE; MB- low knolls east of Main Ridge; 70% hard bottom, rubble;

50% cover *Anadyomene*, CCA, few sponges.
16:00- End XS 4, MB- knolls east of ridge. Off transect head E to large pits.
16:06- 65.0 m, large pit on MB, 10 m diameter- reef fish, 50 cm TL red grouper, 15 lionfish. Another pit- 7 lionfish, lobster.
16:23- Start XS 5, 66.0-66.6 m depth range, head E, MB- low relief knolls east of ridge; 80% hard bottom, 5 cm rubble; 30-50% *Anadyomene*, CCA; 10 cm Agaricia; 30 cm *Montastraea cavernosa*; *Geodia*.
16:38- End XS 5, 66.6 m; MB- low knolls. Off transect- head N to blue valley on MB.
16:40- Grouper pit on MB- 50 cm TL red grouper, reef fish, eel, 3 lionfish; another pit- lionfish; 20 cm *M. cavernosa*.
16:54- MB shows blue valley, flat; depth 70.1 m; 70% hard bottom, rubble, 30-50% cover Anadyomene; more Halymenia present.
17:00- 64.7 m, grouper pit, nav 30 m west of MB- eel, 2 french angelfish, 20 lionfish, cardinal fish, scamp. Heading E off transect.
17:14- 64.3 m, MB- NS oriented east ridge; 80% hard bottom, rubble, same.
17:15- 64 m, grouper pit on east ridge- hog snapper, blue angelfish, 23 lionfish, red grouper.
Sample 2- 67.2 m, Geodia gibberosa complex, 5 cm.

Dominant Benthic Macrobiota:
Scleractinia- *Agaricia lamarcki*, 10-30 cm common, large patch of 30-50 cm; 3 *Montastraea cavernosa*, 30 cm.
Octocoral- rare
Antipatharia- *Stichopathes lutkeni*
Actiniaria- *Condylactis gigantea*
Porifera- Spirastrellidae, *Xestospongia muta*- common, *Ircinia campana*, *I. strobilina*.
Decapoda- *Panulirus argus*
Chlorophyta- *Anadyomene*, 30-50% cover.
Rhodophyta- *Halymenia*, various spp.

Fish- Reef fish in grouper pits; red grouper in most pits, abundant lionfish in pits, scamp, blue angelfish, trumpetfish, cardinal fish, hog snapper, French angelfish, snapper (grey?), sharpnose puffer, yellowtail reef fish, wrasse bass, stripped grunt.

Samples: 1- *Agaricia lamarcki*; 1- *Geodia gibberosa* complex

Dive Site: Pulley Ridge, Inside HAPC; Block 80; Main Ridge- Middle; ROV 15-03, UNCW 262

CPCe Percent Cover Analysis:

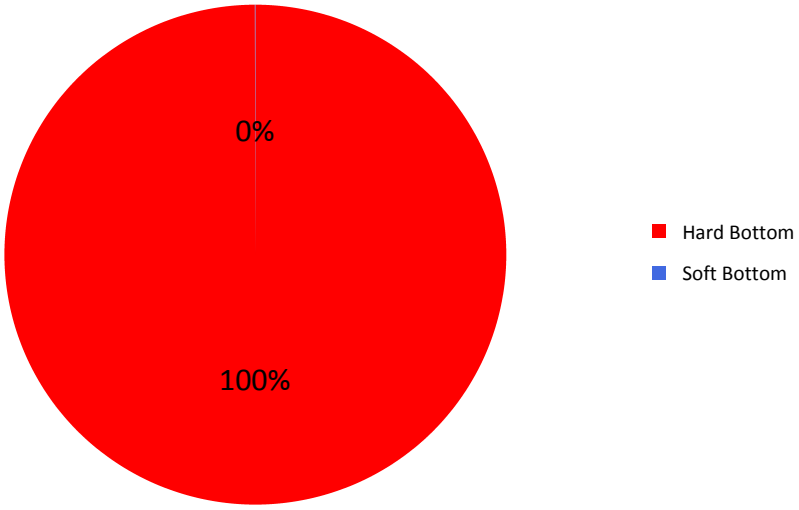
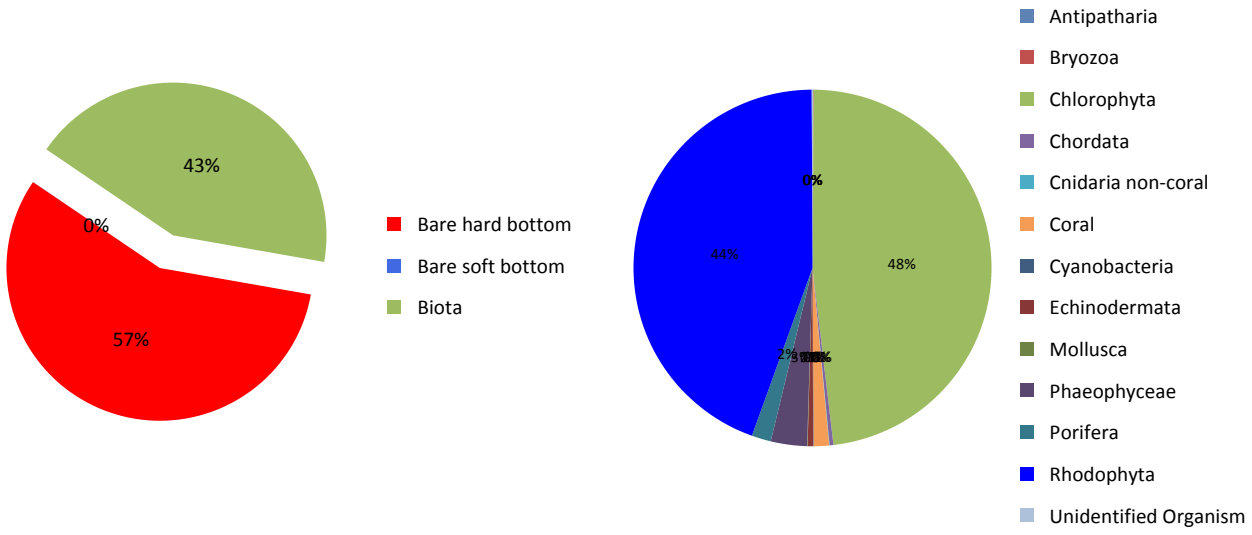


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-03. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-03.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Inside HAPC; Block 80; Main Ridge- Middle; ROV 15-03, UNCW 262

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-03.

Group/Phylum/Taxa	ROV 15-03
Biota	43.25%
Chlorophyta	20.77%
Anadyomene menziesii	20.60%
Chlorophyta	0.03%
Codium intertextum	0.07%
Codium sp.	0.02%
Valonia ventricosa	0.02%
Verdigellas peltata	0.03%
Ochrophyta	1.42%
Dictyota sp.	1.32%
Lobophora variegata	0.07%
Phaeophyceae	0.03%
Rhodophyta	19.22%
Corallinales (crustose coralline)	18.42%
Halymenia sp.	0.15%
Peyssonnelia sp.	0.10%
Rhodophyta	0.22%
Rhodophyta- fleshy blade	0.33%
Cyanobacteria	0.02%
Cyanobacteria	0.02%
Porifera	0.75%
Agelas clathrodes	0.02%
Agelas sp.	0.02%
Demospongiae	0.23%
Geodia gibberosa complex	0.13%
Geodia neptuni complex	0.08%
Ircinia campana	0.05%
Ircinia strobilina	0.03%
Monanchora arbuscula	0.02%
Petrosiidae	0.03%
Scopalina ruetzleri	0.02%
Xestospongia muta	0.12%
Cnidaria	0.65%
Agaricia fragilis	0.03%
Agaricia grahamae	0.08%
Agaricia sp.	0.12%

Dive Site: Pulley Ridge, Inside HAPC; Block 80; Main Ridge- Middle; ROV 15-03, UNCW 262

Antipatharia	0.03%
Condylactis gigantea	0.02%
Helioseris cucullata	0.02%
Madracis brueggemanni	0.03%
Madracis decactis	0.07%
Madracis formosa	0.05%
Montastraea cavernosa	0.20%
Mollusca	0.02%
Gastropoda	0.02%
Bryozoa	0.02%
Bryozoa	0.02%
Echinodermata	0.22%
Analcidometra armata	0.17%
Asteroschema sp.	0.02%
Davidaster discoideus	0.03%
Chordata	0.15%
Actinopterygii	0.02%
Ascidiacea	0.02%
Ascidiacea- purple	0.12%
UNKNOWN	0.03%
Unidentified organism	0.03%
Bare hard bottom	56.73%
Habitat	56.73%
Bare rock	11.98%
Bare rubble/cobble	44.75%
Bare soft bottom	0.02%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Inside HAPC; Block 80; Main Ridge- Middle; ROV 15-03, UNCW 262

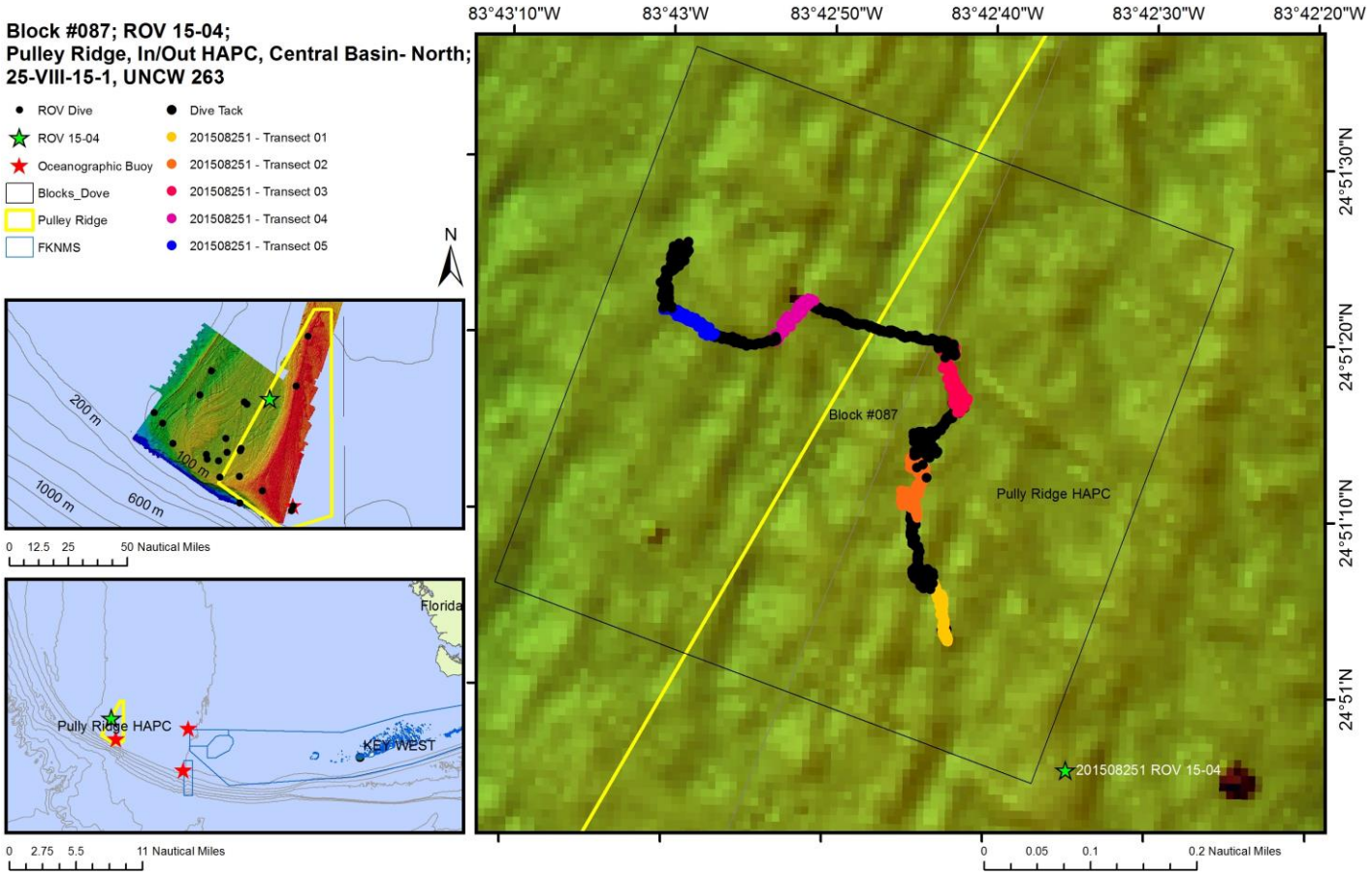
Density of Fish:

Table 2. Density (# individuals/m) of fish from video transects at dive site ROV 15-03.

Class/Order/Family/Common name -Taxa	ROV 15-03 No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
fish unid.- Actinopteri	603	1.206
Perciformes		
Chaetodontidae		
reef butterflyfish- *Chaetodon sedentarius*	19	0.038
Labridae		
spotfin hogfish- *Bodianus pulchellus*	2	0.004
Wrasse unid.- *Halichoeres* sp.	1	0.002
Lutjanidae		
Snapper unid.- *Lutjanus* sp.	1	0.002
Pomacanthidae		
cherubfish- *Centropyge argi*	19	0.038
Pomacentridae		
bicolor damselfish- *Stegastes partitus*	12	0.024
Chromis unid.- *Chromis* sp.	33	0.066
purple reeffish- *Chromis scotti*	113	0.226
sunshine chromis/sunshinefish- *Chromis insolata*	48	0.096
yellowtail reeffish- *Chromis enchrysurus*	46	0.092
Scaridae		
Greenblotch parrotfish- *Sparisoma atomarium*	12	0.024
Serranidae		
black grouper- *Mycteroperca bonaci*	1	0.002
chalk bass- *Serranus tortugarum*	147	0.294
Grand Total	**1057**	**1.206**

Dive Site: Pulley Ridge, Inside/Outside HAPC; Block 87, Central Basin- North; ROV 15-04, UNCW 263

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html
Scientific Observers:	Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	Naar_pulley_10m1_TIF
Purpose:	Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction
ROV:	Mohawk ROV
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II

ROV Sensors: Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density

Date of Dive:	8/25/2015	**Specimens:**	3
Ship Position System:	DGPS	**Digital Photos:**	206
Report Analyst:	John Reed, Stephanie Farrington	**DVD:**	4
Date Compiled:	1/27/2017	**Hard Drive:**	1

Dive Site: Pulley Ridge, Inside/Outside HAPC; Block 87, Central Basin- North; ROV 15-04, UNCW 263

Dive Data:

Minimum Bottom Depth (m):	73.9	**Total Transect Length (km):**	1.560
Maximum Bottom Depth (m):	80.2	**Surface Current (kn):**	0.4
On Bottom (Time- GMT):	8:21	**On Bottom (Lat/Long):**	24.85°N; -83.71°W
Off Bottom (Time- GMT):	12:00	**Off Bottom (Lat/Long):**	24.86°N; -83.72°W

Physical (bottom); Temp (°C): 19.50 **Salinity:** 36.39 **Visibility (ft):** 66 **Current (kn):** 0.75

Physical Environment:

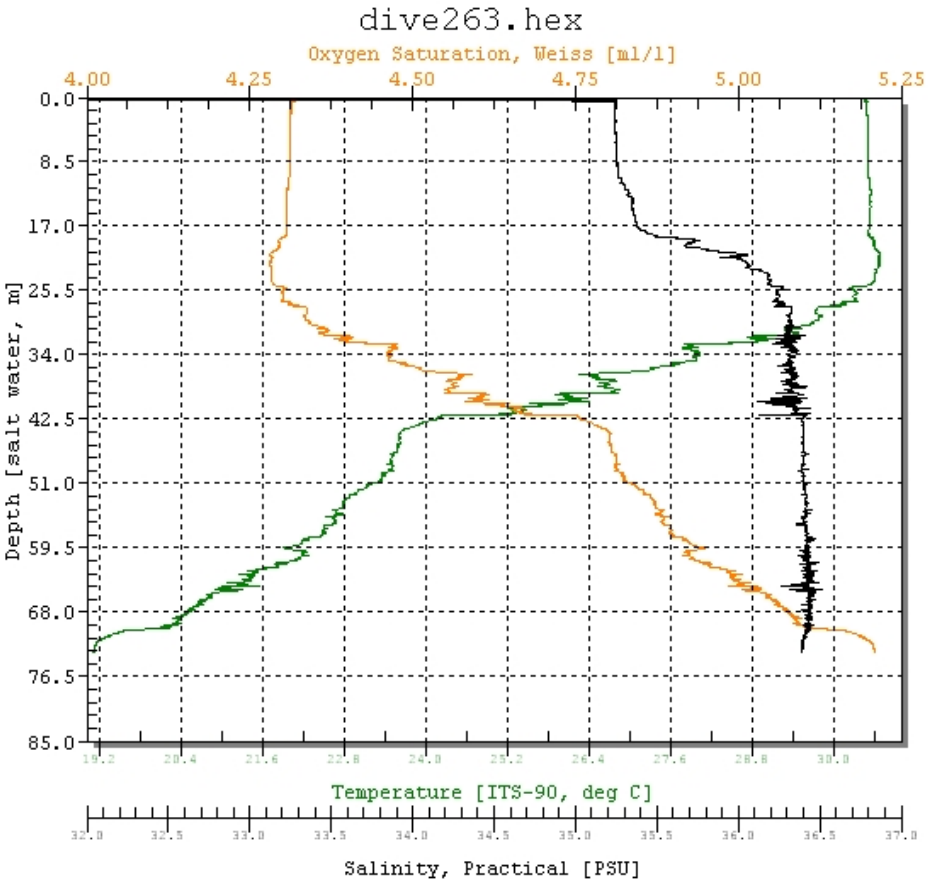


Figure 1: Shows the CTD data during the descent of ROV 15-04. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-04 are as follows: max depth: 79.08 m, temperature: 19.1 °C, conductivity: 48700 µS/cm, pressure: 115.35 PSI, salinity: 36.39 PSU, sound velocity: 1521.84 m/s, oxygen concentration: 5.22 ml/l, density: 1026.4 Kg/m^3, nitrogen saturation: 9.57 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Inside/Outside HAPC; Block 87, Central Basin- North; ROV 15-04, UNCW 263

Dive Imagery:

Figure 2: -79.1 m
Yellow asteroid.

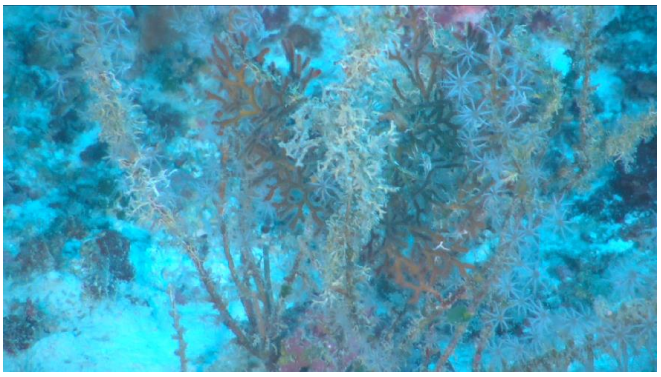


Figure 3: -79.5 m
Carijoa riisei gorgonian.

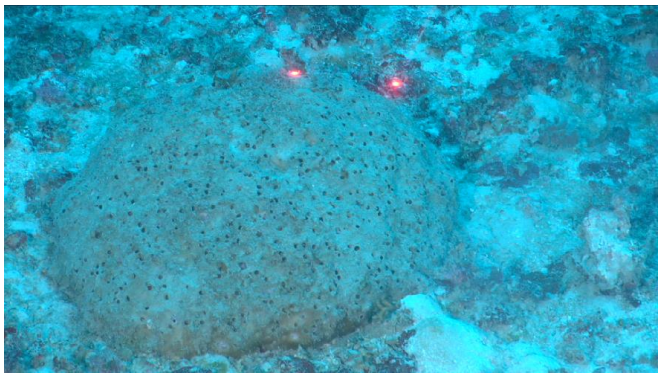


Figure 4: -79.1 m
Spongosorites siliquaria cake sponge which is filled with spiral gastropods *Siliquaria* sp. (10 cm lasers).

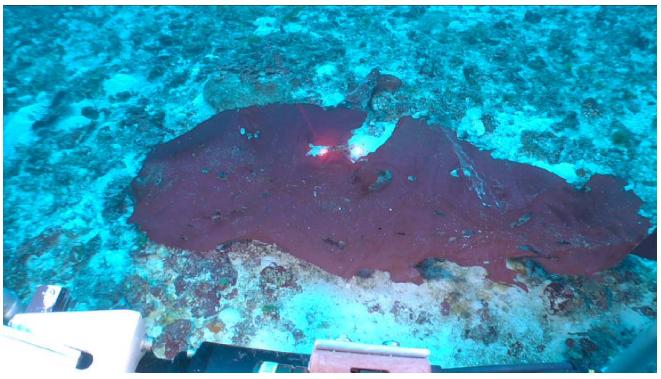


Figure 5: -79.8 m
Large red blade algae *Halymenia* sp.

Dive Site: Pulley Ridge, Inside/Outside HAPC; Block 87, Central Basin- North; ROV 15-04, UNCW 263

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 25-VIII-15-1; ROV Dive 15-04; Mohawk UNCW Dive 263. Target Site: Florida, inside/outside Pulley Ridge HAPC, random block #87, northern Central Basin; 79 m.

Objectives- Ground truth MB map (low resolution USGS); conduct five random 100-m photo/video transects within block. Conduct video transects for fish population characterization and photo transects for habitat and benthic macrobiota characterization. Collect benthic macro-organisms for taxonomy voucher specimens.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/125, auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom; photos were taken every 30 seconds. Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. Five random 100 m quantitative transects were conducted in each Block. Each 100 m transect was conducted at ~0.25 kn, for 15-20 minutes until the ROV passed through 100 m circle overlaid on navigation screen; quantitative still images were taken every 30 sec for a minimum of 30 images per transect. Off transects between the quantitative transects were 15-20 minutes for close-up video frame grabs of fish and biota, and for collections. Direction of transects were random, but generally headed NE or NW, depending on the ship's maneuverability with the wind and current.

Site Description/Habitat

Depth range: 79.2 to 80.0 m.

MB shows flat, relatively featureless habitat; geologically, possibly an offshore lagoon or bay offshore of the Main Ridge barrier island. Start transects at SE corner of block.

8:07- Launch. Pt/cloudy, stormy, seas 1-2' from NE, 10 kn from NE, water 30.48°C, salinity 35.23, surface current 0.4 kn to N.

8:20- On bottom, 79.4 m; 20 m visibility, 19.10°C, current <1/8 kn from N.

8:47- Transect 1, 79.4 m, inside HAPC, head NW; 70% hard bottom, 5-10 cm rubble/cobble; dominated by CCA on rubble, 10% cover *Anadyomene*, *Halymenia* large sheets, *Antipathes atlantica*, Corallimorpharia, large 30-50+ cm *Spongosorites siliquaria* common, sponges common and diverse- *Agelas*, Clathriidae, *Amphimedon* orange CB, *Antipathes furcate*, *Stichopathes lutkeni*.

8:57- ROV tracking problems, tracking not accurate. Stop XS.

8:58- Redo XS 1, 79.7m, inside HAPC, heading NW; 70% hard bottom, rubble/cobble; CCA. Pit with ledge- lionfish. *Xestospongia muta*, *Verdigellas*, various Rhodophyta, *Madracis brueggemanni*, *Davidaster*.

9:05- Navigation out again. Stop transect. Navigation bad. Reset Hypack.

9:12- Redo XS 1 again, 79.5 m, inside HAPC, heading NW; 70% hard bottom, 5-10 cm rubble/cobble; same biota, <5% *Anadyomene*, *M. brueggemanni*, *Codium*, *Geodia neptuni*, *S. siliquaria* common. 10 m diameter grouper pit.

9:31- End XS 1, 79.2 m; 50-70 rubble/cobble. Head N 100 m for off transect. Navigation is out again.

9:39- Navigation back on.

9:53- Found problems with ROV GPS cable; replace.

10:03- Start XS 2, 79.3 m, inside HAPC, heading N; 50% hard bottom, 5-10 cm rubble/cobble; dominated by CCA on rubble, sparse *Anadyomene*, CB *Amphimedon*, *S. siliquaria*, *Astrophorida*, *Antipathes*.

14:20- End XS 2, 79.0 m, 50% rubble/cobble; off transect head NE 100 m; *M. brueggemanni*.

10:41- Start XS 3, 79.2 m, inside HAPC, head N; 50% hard bottom, 5-10 cm rubble/cobble; 5% *Anadyomene*, CCA, *M. brueggemanni*, sponges common and diverse.

End XS 3, 78.8 m; same habitat, biota. Head W off transect 100 m.
11:10- Start XS 4, 79.3 m, outside HAPC; 50% rubble/cobble; CCA, <5% *Anadyomene*, *A*. *atlantica*, red blade algae.
11:24- End XS 4, 79.6 m; head W off transect 100 m.
11:29- Start XS 5, 79.7 m, outside HAPC, head NW; 50% hard bottom, 5 cm rubble; CCA, <5% *Anadyomene*, *M*. *brueggemanni*, sponges common and diverse.
11:44- End XS 5, 80 m; 30% 5 cm rubble; same biota; off transect head N, look for large *Halymenia*.
11:56- Sample 3, 79.9 m, *Halymenia*? sp., 130 cm long blade, unattached on rubble.
11:59- End dive.

Dominant Benthic Macrobiota:
Mostly CCA on rock rubble, large blade *Halymenia* red algae common, sparse *Anadyomene*, *Antipathes atlantica* common; no *Agaricia*, *Madracis brueggemanni* common; no grouper pits, no sand tilefish mounds; few fish.

Species List from Dive Notes:
Cnidaria: *Telesto* sp.
Antipatharia: *Antipathes atlantica*, *Antipathes furcata*, *Stichopathes lutkeni* - black sea whip
Scleractinia: *Agaricia* sp., *Madracis brueggemanni*, *Madracis* sp., *Montastraea cavernosa*,
Porifera: Demospongiae- PR01, *Agelas*- PR3, *Spongia* sp., *Xestospongia muta*, *Amphimedon*- PR2, Clathriidae, Poecilosclerida, *Spongosorites siliquaria*, *Geodia gibberosa*, *Erylus* sp., *Geodia neptuni* complex, Tetractinellida
Fish: Holocentrus sp. - Squirrelfish unid., *Chaetodon sedentarius* - reef butterflyfish, *Chromis enchrysurus* - yellowtail reeffish, *Chromis scotti* - purple reeffish, *Chromis* sp. - *Chromis* unid., Labridae - wrasse unid., *Liopropoma eukrines* - wrasse bass, *Serranus annularis* - orangeback bass, *Serranus tortugarum* - chalk bass, *Apogon* sp. - cardinalfish unid., *Pterois volitans* - lionfish

Samples Collected:
Sample 1- *Amphimedon*-PR 3, orange creeping branching demosponge; Sample 2- Demosponge PR 11, erect orange fingers; Sample 3- 130 cm long red blade, *Halymenia* sp.

Dive Site: Pulley Ridge, Inside/Outside HAPC; Block 87, Central Basin- North; ROV 15-04, UNCW 263

CPCe Percent Cover Analysis:

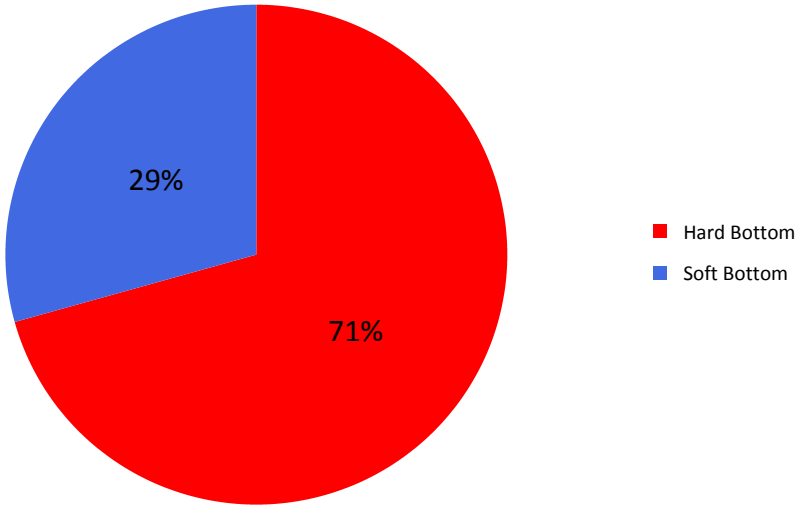
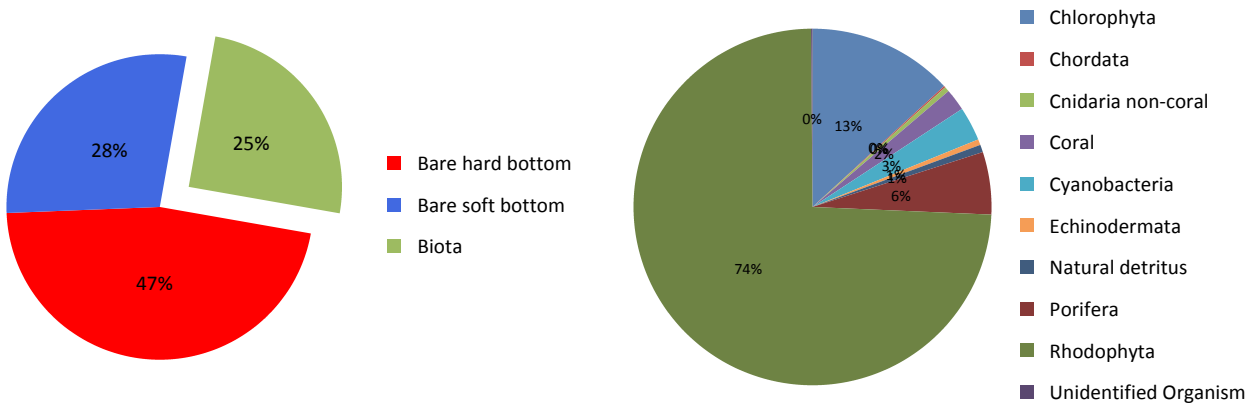


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-04. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-04.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Inside/Outside HAPC; Block 87, Central Basin- North; ROV 15-04, UNCW 263

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-04.

Group/Phylum/Taxa	ROV 15-04
Biota	24.99%
Chlorophyta	3.28%
Anadyomene menziesii	2.10%
Chlorophyta	0.02%
Halimeda copiosa	0.07%
Ulva sp.	0.03%
Valonia ventricosa	0.03%
Verdigellas peltata	1.03%
Rhodophyta	18.54%
Corallinales (crustose coralline)	14.45%
Halymenia sp.	0.67%
Peyssonnelia sp.	2.00%
Rhodophyta	0.55%
Rhodophyta- fleshy blade	0.87%
Cyanobacteria	0.77%
Cyanobacteria	0.77%
Porifera	1.42%
Amphimedon- PR2	0.18%
Amphimedon sp.	0.02%
Cinachyrella sp.	0.03%
Demospongiae	0.43%
Erylus sp.	0.02%
Geodia neptuni complex	0.03%
Poecilosclerida- PR3	0.03%
Poecilosclerida- PR4	0.03%
Spirastrellidae	0.05%
Spongosorites siliquaria	0.52%
Spongosorites sp.	0.02%
Xestospongia muta	0.02%
Xestospongia sp.	0.03%
Cnidaria	0.62%
Agaricia sp.	0.02%
Corallimorpharia	0.12%
Madracis brueggemanni	0.43%
Madracis formosa	0.05%
Echinodermata	0.13%

Dive Site: Pulley Ridge, Inside/Outside HAPC; Block 87, Central Basin- North; ROV 15-04, UNCW 263

Asteroidea	0.03%
Centrostephanus longispinus	0.02%
Davidaster discoideus	0.07%
Stylocidaris affinis	0.02%
Chordata	0.03%
Actinopterygii	0.02%
Ascidiacea	0.02%
detritus	0.17%
Natural detritus	0.17%
UNKNOWN	0.03%
Unidentified organism	0.03%
Bare hard bottom	46.59%
Habitat	46.59%
Bare rock	0.15%
Bare rubble/cobble	46.44%
Bare soft bottom	28.42%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Inside/Outside HAPC; Block 87, Central Basin- North; ROV 15-04, UNCW 263

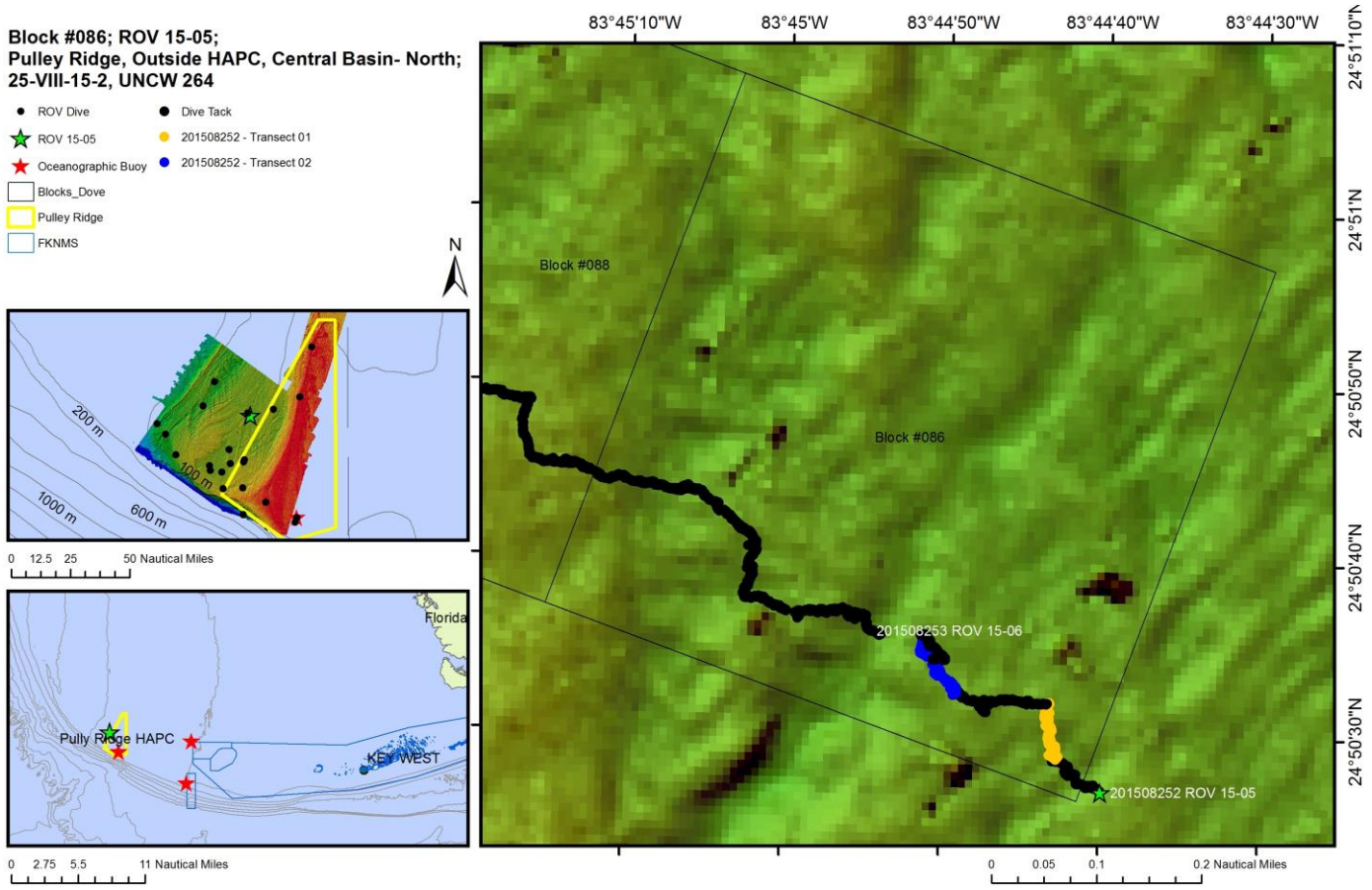
Density of Fish:

Table 2. Density (# individuals/m) of fish from video transects at dive site ROV 15-04.

Class/Order/Family/Common name -Taxa	ROV 15-04 No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
fish unid.- Actinopteri	2	0.004
Perciformes		
Pomacentridae		
yellowtail reeffish- *Chromis enchrysurus*	2	0.004
Serranidae		
chalk bass- *Serranus tortugarum*	51	0.102
orangeback bass- *Serranus annularis*	5	0.01
Grand Total	**60**	**0.102**

Dive Site: Pulley Ridge, Outside HAPC; Block 86, Central Basin- North; ROV 15-05, UNCW 264

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html
Scientific Observers:	Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	Naar_pulley_10m1_TIF
Purpose:	Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction
ROV:	Mohawk ROV
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II

ROV Sensors: Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density

Date of Dive:	8/25/2015	**Specimens:**	1
Ship Position System:	DGPS	**Digital Photos:**	89
Report Analyst:	John Reed, Stephanie Farrington	**DVD:**	2
Date Compiled:	1/27/2017	**Hard Drive:**	1

Dive Site: Pulley Ridge, Outside HAPC; Block 86, Central Basin- North; ROV 15-05, UNCW 264

Dive Data:

Minimum Bottom Depth (m):	59.2	**Total Transect Length (km):**	0.604
Maximum Bottom Depth (m):	82.9	**Surface Current (kn):**	0.3
On Bottom (Time- GMT):	13:05	**On Bottom (Lat/Long):**	25.84°N; -83.74°W
Off Bottom (Time- GMT):	14:18	**Off Bottom (Lat/Long):**	24.84°N; -83.75°W

Physical (bottom); Temp (°C): 19.30 **Salinity:** 36.40 **Visibility (ft):** 33 **Current (kn):**

Physical Environment:

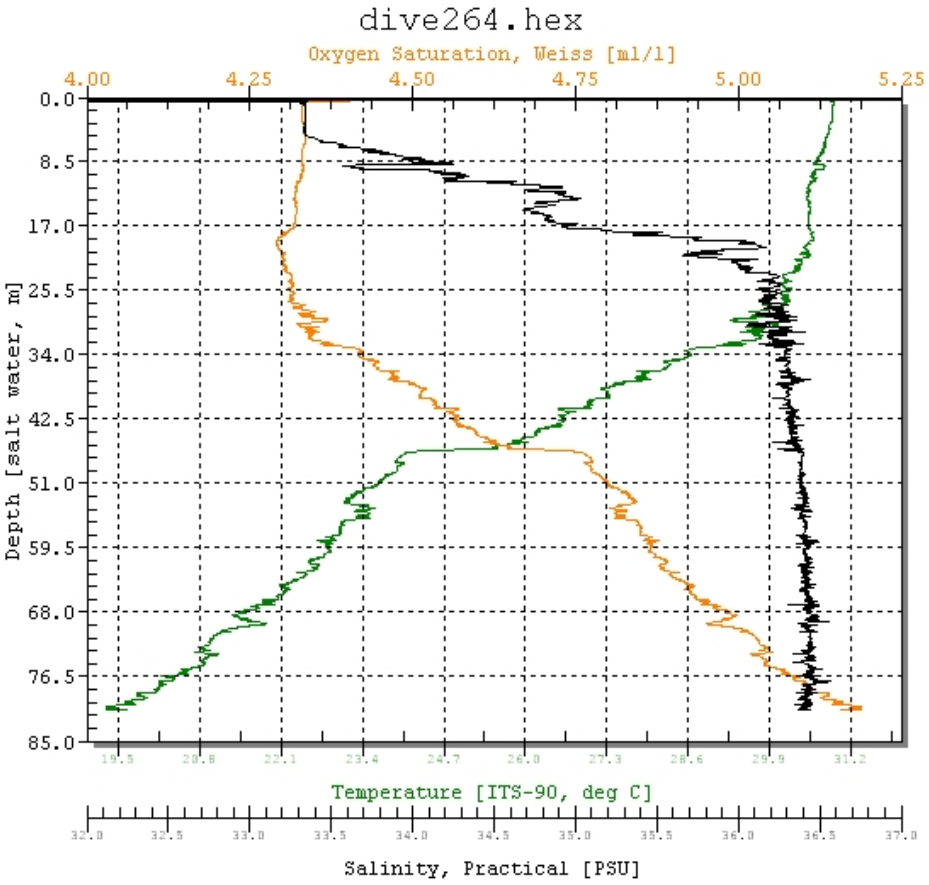


Figure 1: Shows the CTD data during the descent of ROV 15-05. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-05 are as follows: max depth: 81.24 m, temperature: 19.31 °C, conductivity: 48900 µS/cm, pressure: 118.51 PSI, salinity: 36.4 PSU, sound velocity: 1522.47 m/s, oxygen concentration: 5.2 ml/l, density: 1026.37 Kg/m^3, nitrogen saturation: 9.53 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Outside HAPC; Block 86, Central Basin- North; ROV 15-05, UNCW 264

Dive Imagery:

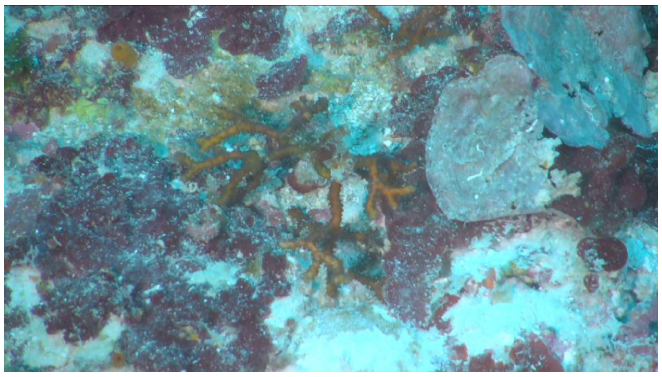


Figure 2: -82.5 m
Pencil coral *Madracis brueggemanni.*

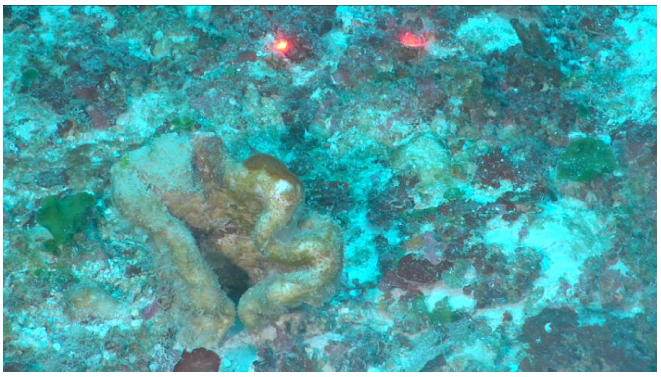


Figure 3: -81.3 m
Astrophorida folded plate sponge (10 cm lasers).

Figure 4: -81.3 m
Large barrel sponge *Xestospongia muta (10 cm lasers).*

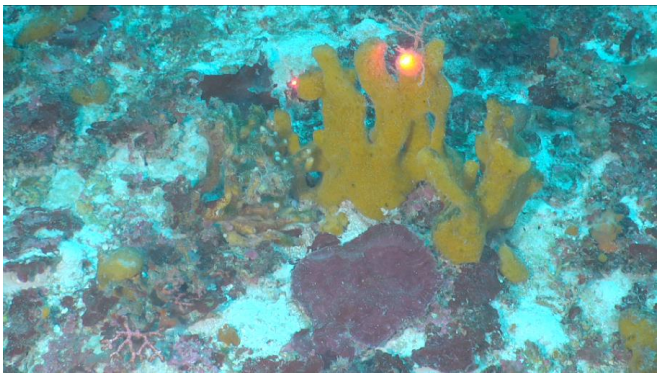


Figure 5: -81.6 m
Yellow erect branching demosponge, possible Poecilosclerida.

Dive Site: Pulley Ridge, Outside HAPC; Block 86, Central Basin- North; ROV 15-05, UNCW 264

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 25-VIII-15-2; ROV Dive 15-05; Mohawk UNCW Dive 264. Target Site: Florida, outside Pulley Ridge HAPC, random block #86, northern Central Basin; 79 m.

Objectives- Ground truth MB map (low resolution USGS); conduct five random 100-m photo/video transects within block. Conduct video transects for fish population characterization and photo transects for habitat and benthic macrobiota characterization. Collect benthic macro-organisms for taxonomy voucher specimens.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/125, auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom; photos were taken every 30 seconds. Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. Five random 100 m quantitative transects were conducted in each Block. Each 100 m transect was conducted at ~0.25 kn, for 15-20 minutes until the ROV passed through 100 m circle overlaid on navigation screen; quantitative still images were taken every 30 sec for a minimum of 30 images per transect. Off transects between the quantitative transects were 15-20 minutes for close-up video frame grabs of fish and biota, and for collections. Direction of transects were random, but generally headed NE or NW, depending on the ship's maneuverability with the wind and current.

Site Description/Habitat

Depth range: 79.0 to 82.2 m.

MB- flat, featureless bottom. Only conducted 2 transects then had to abort dive due to ship engine steering problems.

13:00- Launch. Pt/cloudy, 2' seas from NE, 6 kn from NE, surface water- 30.899°C, salinity 33.327 (this was verified by ROV CTD), current 0.3 kn from SE.

13:06- On bottom, 82.2 m; temperature 19.304°C, 15 m visibility, current <1/8 kn.

13:21- Start XS 1, 82.2 m, outside HAPC, head N; 70% hard bottom, 5-10 cm rubble/cobble; dominated by CCA on rubble, Peyssonnelia, sparse Anadyomene, red blade algae, Halymenia, Madracis brueggemanni common, demosponges common and diverse, Davidaster crinoids common, Antipathes atlantica common.

13:29- End XS 1, 81.3 m. Off transect, head W 100 m.

13:53- Start XS 2, 81.6 m, head ?; 80% hard bottom,5-10 cm rubble/cobble; similar biota, but no Spongosorites siliquaria. 5% Anadyomene, M. brueggemanni common.

14:10- End XS 2, 81.6 m; off transect, head S 100 m.

14:10- Ship's steering out on one engine; abort dive; end dive.

Dominant Benthic Macrobiota:

dominated by CCA on rubble, Peyssonnelia, sparse *Anadyomene*, red blade algae, *Halymenia*, *Madracis brueggemanni* common; Demosponges common and diverse- *Geodia*, *Agelas*, *Amphimedon* PR 3, *Agelas* PR 3, *Petrosia*, *Xestospongia muta*, *Astrophorida* vase, *Geodia neptuni*; *Davidaster* crinoids common, *Antipathes atlantica* common.

Species List:

Cnidaria: Antipatharia- *Antipathes atlantica*, *Antipathes furcata*, *Antipathes* sp., *Stichopathes lutkeni* - black sea whip

Dive Site: Pulley Ridge, Outside HAPC; Block 86, Central Basin- North; ROV 15-05, UNCW 264

Scleractinia- Madracis sp., Montastraea cavernosa
Porifera: *Agelas conifera*, *Agelas*- PR3, *Amphimedon*- PR2, *Petrosia* sp., *Xestospongia muta*, *Spongosorites siliquaria*, *Geodia neptuni* complex, *Geodia* sp.

Fish: *Chromis enchrysurus* - yellowtail reeffish, *Chromis scotti* - purple reeffish, Labridae - wrasse unid., *Liopropoma eukrines* - wrasse bass, *Serranus annularis* - orangeback bass, *Serranus phoebe* - tattler, *Serranus tortugarum* - chalk bass, *Sparisoma atomarium* - Greenblotch parrotfish, *Canthigaster* sp. - sharpnose puffer

Samples Collected:
Sample 1- *Bubaris* sp., 10 cm corrugated, erect branching, red-orange sponge.

Dive Site: Pulley Ridge, Outside HAPC; Block 86, Central Basin- North; ROV 15-05, UNCW 264

CPCe Percent Cover Analysis:

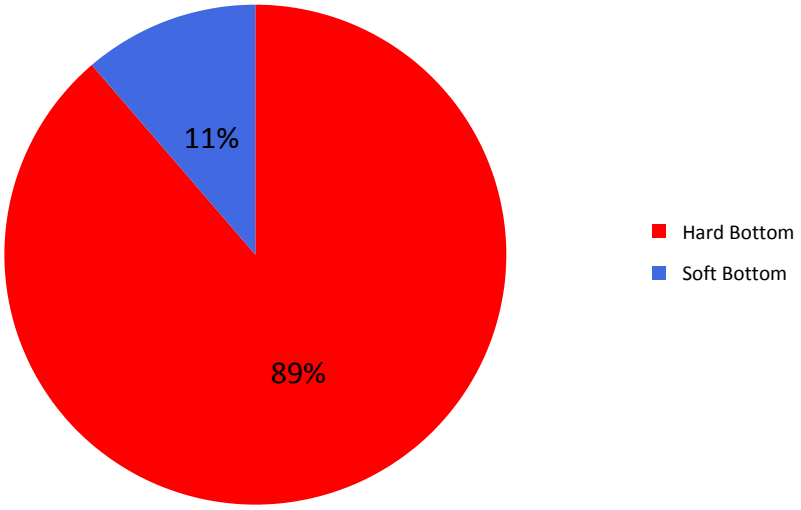
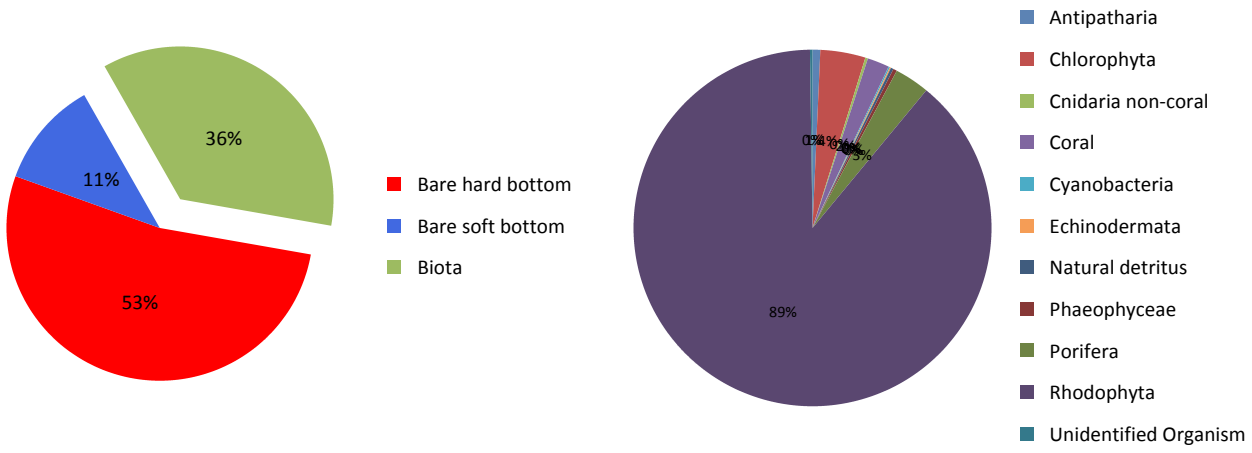


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-05. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-05.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Outside HAPC; Block 86, Central Basin- North; ROV 15-05, UNCW 264

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-05.

Group/Phylum/Taxa	ROV 15-05
Biota	35.99%
Chlorophyta	1.47%
Anadyomene menziesii	0.67%
Chlorophyta	0.08%
Halimeda sp.	0.04%
Valonia ventricosa	0.08%
Verdigellas peltata	0.59%
Ochrophyta	0.13%
Dictyota sp.	0.13%
Rhodophyta	31.96%
Corallinales (crustose coralline)	24.04%
Halymenia sp.	0.29%
Peyssonnelia sp.	7.01%
Rhodophyta	0.17%
Rhodophyta- fleshy blade	0.46%
Cyanobacteria	0.04%
Cyanobacteria	0.04%
Porifera	1.13%
Amphimedon- PR2	0.17%
Cinachyrella sp.	0.04%
Demospongiae	0.17%
Demospongiae- PR01	0.25%
Erylus sp.	0.08%
Geodia neptuni complex	0.04%
Geodia sp.	0.08%
Petrosiidae	0.04%
Poecilosclerida	0.08%
Poecilosclerida- PR4	0.04%
Xestospongia muta	0.13%
Cnidaria	1.05%
Agaricia sp.	0.04%
Antipatharia	0.04%
Antipathes atlantica	0.21%
Hydroidolina	0.08%
Madracis brueggemanni	0.63%
Madracis decactis	0.04%

Dive Site: Pulley Ridge, Outside HAPC; Block 86, Central Basin- North; ROV 15-05, UNCW 264

Echinodermata	0.04%
Davidaster discoideus	0.04%
detritus	0.08%
Natural detritus	0.08%
UNKNOWN	0.08%
Unidentified organism	0.08%
Bare hard bottom	52.73%
Habitat	52.73%
Bare rock	0.55%
Bare rubble/cobble	52.18%
Bare soft bottom	11.28%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Outside HAPC; Block 86, Central Basin- North; ROV 15-05, UNCW 264

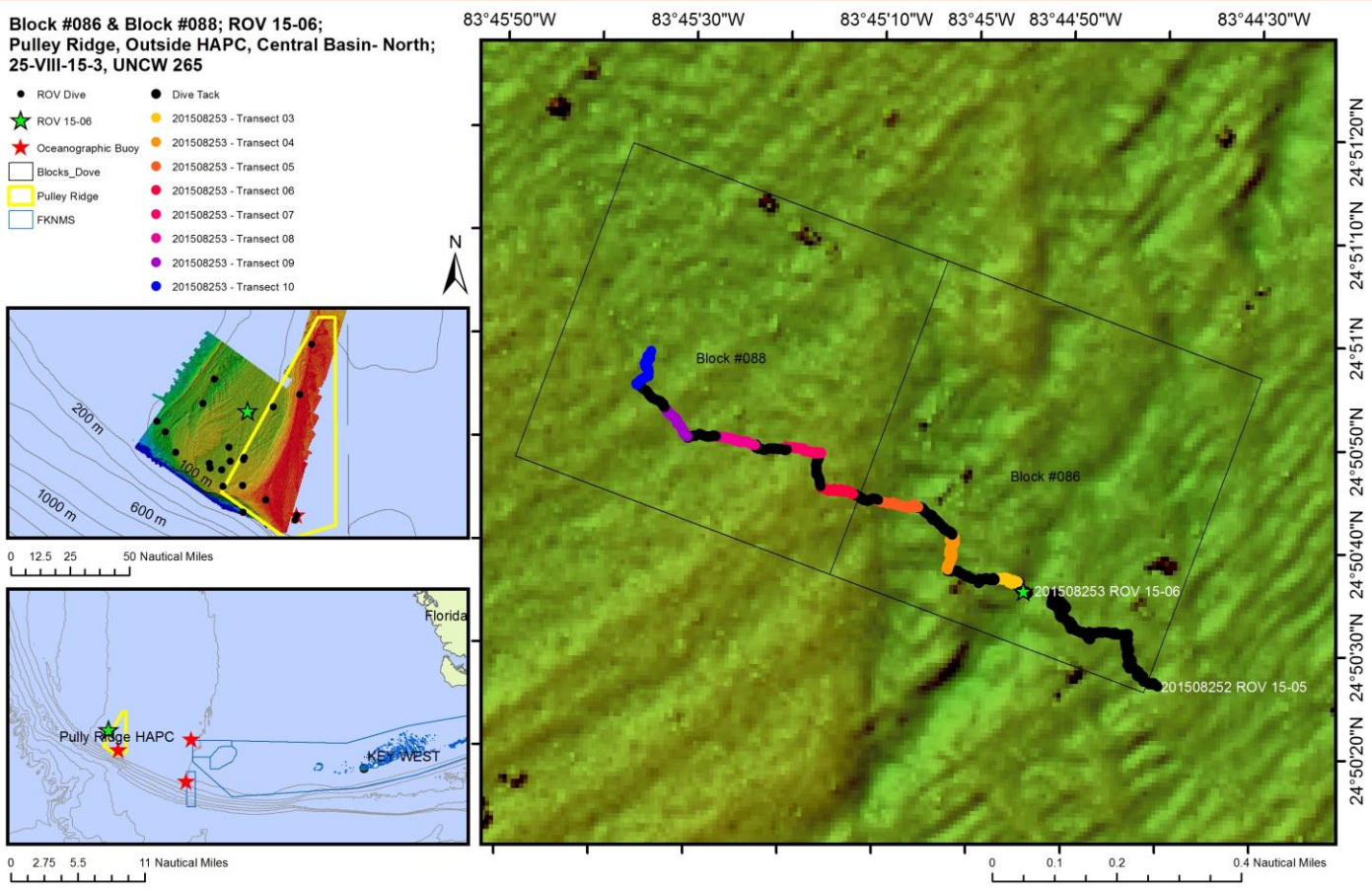
Density of Fish:

Table 2. Density (# individuals/m) of fish from video transects at dive site ROV 15-05.

Class/Order/Family/Common name -Taxa	ROV 15-05 No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
Perciformes		
Pomacentridae		
yellowtail reeffish- *Chromis enchrysurus*	57	0.285
Scaridae		
Greenblotch parrotfish- *Sparisoma atomarium*	2	0.01
Serranidae		
chalk bass- *Serranus tortugarum*	9	0.045
tattler- *Serranus phoebe*	2	0.01
wrasse bass- *Liopropoma eukrines*	4	0.02
Grand Total	**74**	**0.285**

Dive Site: Pulley Ridge, Outside HAPC; Block 86 Cont. and 88, Central Basin- North; ROV 15-06, UNCW 265

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html
Scientific Observers:	Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	Naar_pulley_10m1_TIF
Purpose:	Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction
ROV:	Mohawk ROV
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II

ROV Sensors: Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density

Date of Dive:	8/25/2015	**Specimens:**	1
Ship Position System:	DGPS	**Digital Photos:**	309
Report Analyst:	John Reed, Stephanie Farrington	**DVD:**	3
Date Compiled:	1/27/2017	**Hard Drive:**	1

Dive Site: Pulley Ridge, Outside HAPC; Block 86 Cont. and 88, Central Basin- North; ROV 15-06, UNCW 265

Dive Data:

Minimum Bottom Depth (m):	77.8	**Total Transect Length (km):**	1.913
Maximum Bottom Depth (m):	83.6	**Surface Current (kn):**	0.3
On Bottom (Time- GMT):	15:24	**On Bottom (Lat/Long):**	24.84°N; -83.75°W
Off Bottom (Time- GMT):	18:36	**Off Bottom (Lat/Long):**	24.85°N; -83.76°W

Physical (bottom); Temp (°C): 19.39 **Salinity:** 36.40 **Visibility (ft):** **Current (kn):** 0

Physical Environment:

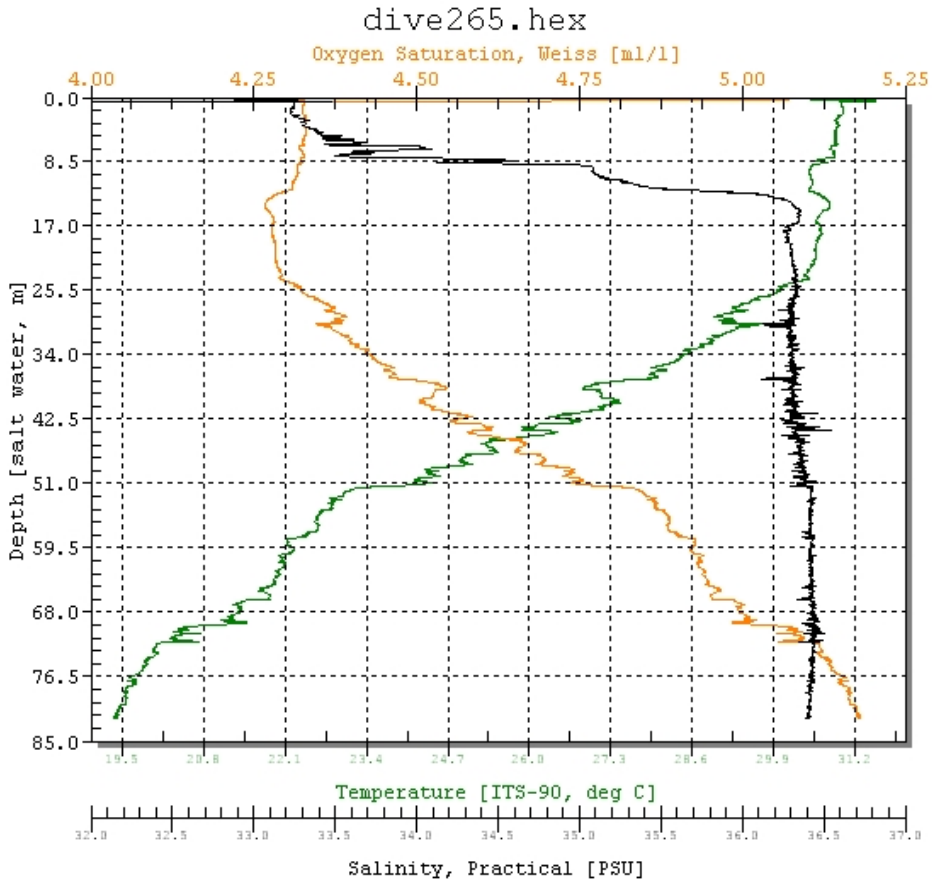


Figure 1: Shows the CTD data during the descent of ROV 15-06. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-06 are as follows: max depth: 81.94 m, temperature: 19.38 °C, conductivity: 49000 µS/cm, pressure: 119.53 PSI, salinity: 36.4 PSU, sound velocity: 1522.7 m/s, oxygen concentration: 5.19 ml/l, density: 1026.36 Kg/m^3, nitrogen saturation: 9.52 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Outside HAPC; Block 86 Cont. and 88, Central Basin- North; ROV 15-06, UNCW 265

Dive Imagery:

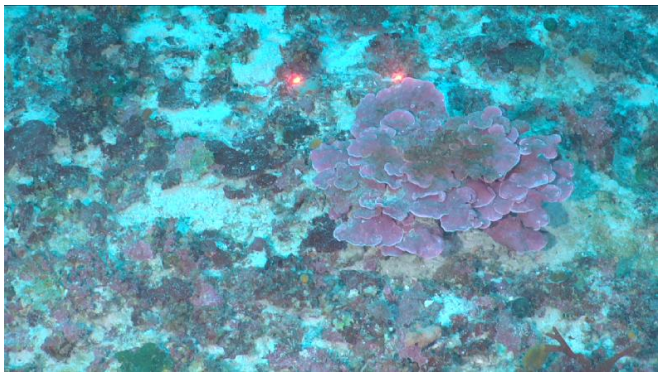


Figure 2: -81.3 m
Red peyssonnelioid alga.

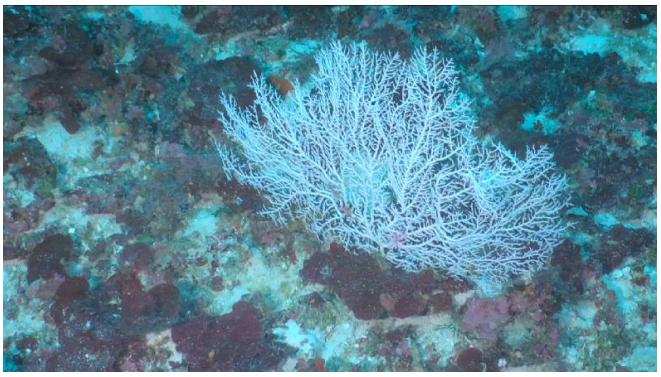


Figure 3: -81.3 m
Stylaster filograna hydrocoral.

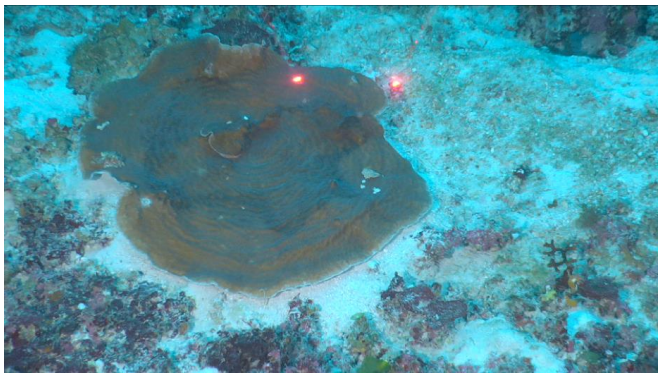


Figure 4: -79.6 m
Agaricia sp. plate coral (10 cm lasers).

Figure 5: -81.3 m
Yellow fan sponge *Agelas* sp. (specimen collected).

Dive Site: Pulley Ridge, Outside HAPC; Block 86 Cont. and 88, Central Basin- North; ROV 15-06, UNCW 265

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 25-VIII-15-3; ROV Dive 15-06; Mohawk UNCW Dive 265. Target Site: Florida, outside Pulley Ridge HAPC, random block #86 and#88, northern Central Basin; 79 m. Continuation of Dive 264.

Objectives- Ground truth MB map (low resolution USGS); conduct five random 100-m photo/video transects within block. Conduct video transects for fish population characterization and photo transects for habitat and benthic macrobiota characterization. Collect benthic macro-organisms for taxonomy voucher specimens.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/125, auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom; photos were taken every 30 seconds. Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. Five random 100 m quantitative transects were conducted in each Block. Each 100 m transect was conducted at ~0.25 kn, for 15-20 minutes until the ROV passed through 100 m circle overlaid on navigation screen; quantitative still images were taken every 30 sec for a minimum of 30 images per transect. Off transects between the quantitative transects were 15-20 minutes for close-up video frame grabs of fish and biota, and for collections. Direction of transects were random, but generally headed NE or NW, depending on the ship's maneuverability with the wind and current.

Site Description/Habitat

Depth range: 79.4 to 83.3 m.
MB- flat, featureless bottom. Continuation of previous dive; completed transects 3-5.
15:17- Launch. Sunny, seas calm, 3 kn from NE; surface water- 31.394°C (hot), salinity 33.146 (verified by ROV CTD), current 0.3 kn to N.
15:23- On bottom, 83.3 m. Visibility 15 m, current 0, temperature 19.39°C.
15:29- Start XS 3, 82.9 m, head W; 70-80% hard bottom, 5-10 cm rubble/cobble; dominated by CCA and Peyssonnelia on rubble, Rhodophyta blades, sparse *Anadyomene*, sponges common and diverse, *Davidaster crinoids*, *Stylaster* common, *Madracis brueggemanni* common.
15:46- End XS 3, 81.7 m. Off transect, head W 100 m.
16:03- Start XS 4, 81.7 m, head N; 70% hard bottom, 5-10 cm rubble/cobble; same biota, but no *Anadyomene*; no grouper pits, no sand tile mounds.
16:17- End XS 4, 81.6 m. Off transect, head W 100 m. 1 lionfish in scoured rock.
Start XS 5, 81.9 m, head W; 80% hard bottom, 5-10 cm rubble/cobble, some pavement, 10 cm relief scoured rock; similar biota, but no *Anadyomene*, no *Halymenia*.
16:48- End XS 5, 80.9 m. Off transect, head W to Block 88; 10 m diameter grouper pit- spotfin hogfish, stripped grunt, rock beauty, yellow tail reef fish, no lionfish, no grouper seen.
16:55- Start XS 1, Block 88, 80.7 m, head W; 80% hard bottom, pavement, rubble/cobble; same biota, <5% *Anadyomene*. 10 m diameter grouper pit- 3 lionfish, no grouper. *Agaricia lamarcki*- 20 cm, 79.9 m, 19.54°C.
End XS 1- 79.4 m. Off transect, head N 100 m.
17:16- Start XS 2, 80.1 m, head W; 80% hard bottom, 5-10 cm rubble/cobble, pavement. Same biota- CCA, Peyssonnelia, 5% *Anadyomene*, *Antipathes atlantica*, sponges- *Geodia neptuni*, *Agelas* spp., Stylaster, *Telesto*, 1 scamp. 1- 20 cm *A. lamarcki*.
17:33- End XS 2, 80.5 m. Off transect, head W 100 m. 10 m grouper pit- 7 scamp, 8 lionfish, reef fish. 50 cm A. lamarcki, 80.5 m, 19.67°C. 10 m grouper pit- no grouper, no lionfish, some reef fish. *Madracis decactis*, 10 cm; 3

cm *Agaricia*.
XS 3- 80.6 m, head W; 80% hard bottom, 5-10 cm rubble/cobble, some small boulders, scoured rock 5-10 cm relief. CCA, Peyssonnelia, sponges not common. 1 m diameter *A*. *lamarcki*. Large 20 m grouper pit, 2 m deep, high rugosity rock at bottom- Reeffish, 3 lionfish, no grouper seen. 15 m grouper pit. 10 m grouper pit, exposed rock at bottom- no lionfish, no grouper.
17:58- End XS 3, 80.7 m. Off transect, head W 100 m.
18:02- Start XS 4, 81.0 m, head NW; 80% hard bottom, rubble/cobble, pavement; same biota, sparse *Anadyomene*. *Agaricia*- 3 cm, 5 cm, 20 cm, 10 cm, 1 m *A*. *lamarcki*; *M*. *brueggemanni*, *M*. *decactis* 10 cm; *A*. *atlantica* common.
18:17- End XS 4, 80.8 m. Off transect, head NW 100 m.
18:22- Start XS 5, 81.0 m, head N; 70% rubble/cobble, pavement; same biota, CCA, Peyssonnelia, *Verdigellas*, *Codium*, sparse *Halimeda*, one large patch; 1 *Nicella* fan, *A*. *atlantica* common; 10 cm *M*. *decactis*; few sponges; scamp. 15 cm *Agaricia*.
18:36- End XS 5, 81.1 m; 70% hard bottom, rubble/cobble, pavement; same biota. End dive.

Dominant Benthic Macrobiota:
CCA, Peyssonnelia on rubble, some *Halimeda*, *Codium*, *Anadyomene* sparse, absent on some transects, *Verdigellas peltata*; 1- Octocoral- *Nicella*; *Antipathes atlantica* common; sponges diverse but not dense- *Agelas*, *Amphimedon*, *Astrophorida*, *X*. *muta*, *Geodia neptuni*, *Ircinia campana*, *Auletta*; *Davidaster* crinoid; *Stylaster filogranus* common. *Agaricia* 3-20 cm common, but patchy; several large 50-100 cm *A*. *lamarcki*; *Madracis brueggemanni* common; *M*. *decactis* common.

Species List from Dive Notes:
Cnidaria:
Alcyonacea- *Nicella goreaui*, *Telesto* sp.
Anthoathecata- *Stylaster filogranus* - , *Stylaster* sp. - hydrocoral - unidentified
Antipatharia- *Antipathes atlantica*, *Antipathes furcata*, *Antipathes* sp., *Stichopathes lutkeni* - black sea whip
Scleractinia- *Agaricia lamarcki* - plate coral - *Agaricia lamarcki*, *Agaricia* sp., *Madracis brueggemanni*, *Madracis decactis*, *Madracis* sp.
Porifera: *Agelas*- PR3, *Agelas* sp., *Auletta* sp., *Ircinia strobilina*, *Amphimedon*- PR2, *Xestospongia muta*, *Geodia neptuni* complex
Fish: Actinopteri - fish unid., Synodontidae - Lizardfishes unid, *Holocentrus* sp. - Squirrelfish unid., *Apogon* sp. - cardinalfish unid., *Bodianus pulchellus* - spotfin hogfish, *Chaetodon ocellatus* - spotfin butterflyfish, *Chaetodon sedentarius* - reef butterflyfish, *Chromis enchrysurus* - yellowtail reeffish, *Chromis insolata* - sunshine chromis/sunshinefish, *Chromis scotti* - purple reeffish, *Equetus lanceolatus* - jack-knife fish, *Haemulon striatum* - striped grunt, *Haemulon vittata* - Boga, *Holacanthus* tricolor - rock beauty, Labridae - wrasse unid., *Liopropoma eukrines* - wrasse bass, *Mycteroperca phenax* - scamp grouper, *Pristigenys alta* - short bigeye, *Prognathodes aculeatus* - Longsnout butterflyfish, *Prognathodes aya* - bank butterflyfish, *Serranus annularis* - orangeback bass, *Serranus phoebe* - tattler, *Serranus tortugarum* - chalk bass, *Sparisoma atomarium* - Greenblotch parrotfish, *Sphyraena* sp. - barracuda, *Pterois volitans* - lionfish, *Canthigaster* sp. - sharpnose puffer

Samples Collected:
Sample 1- *Agelas* PR 3, 10 cm vertical plate, partial vase, orange, rubbery.

Dive Site: Pulley Ridge, Outside HAPC; Block 86 Cont. and 88, Central Basin- North; ROV 15-06, UNCW 265

CPCe Percent Cover Analysis:

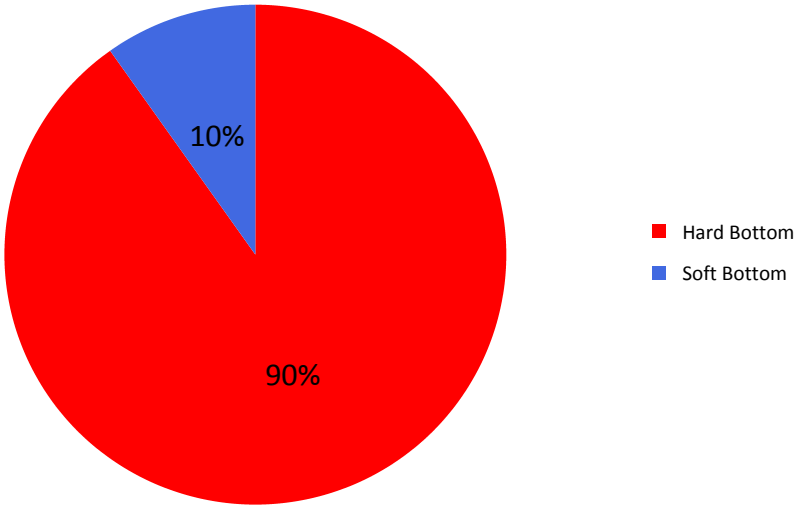
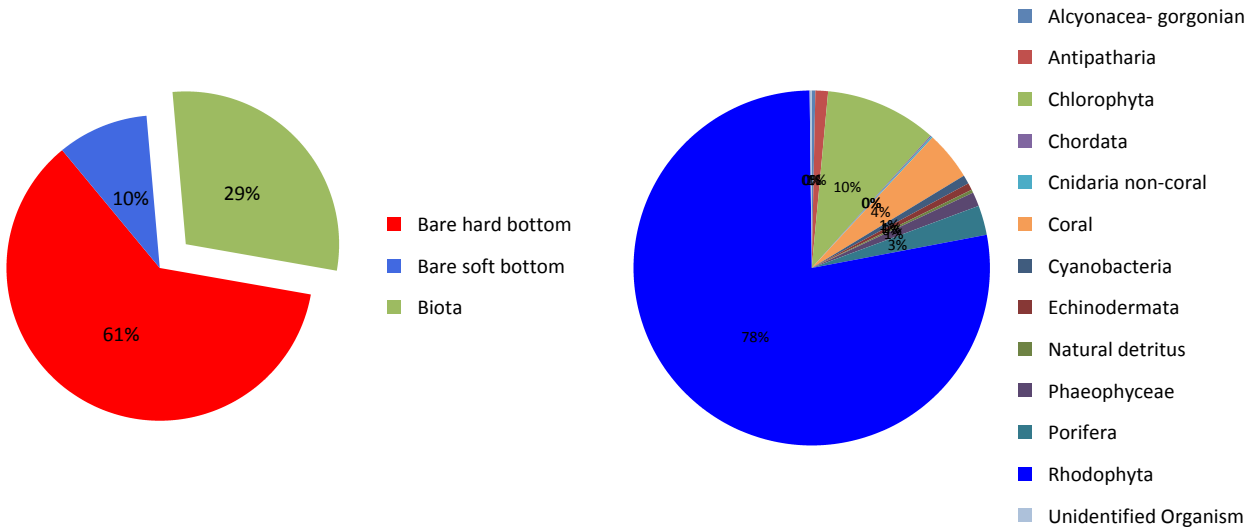


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-06. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-06.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Outside HAPC; Block 86 Cont. and 88, Central Basin- North; ROV 15-06, UNCW 265

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-06.

Group/Phylum/Taxa	ROV 15-06
Biota	29.16%
Chlorophyta	2.96%
Anadyomene menziesii	1.12%
Chlorophyta	0.14%
Codium sp.	0.02%
Halimeda copiosa	0.01%
Halimeda sp.	0.01%
Valonia ventricosa	0.10%
Verdigellas peltata	1.56%
Ochrophyta	0.38%
Dictyota sp.	0.38%
Rhodophyta	22.69%
Corallinales (crustose coralline)	20.74%
Halymenia sp.	0.02%
Peyssonnelia sp.	1.84%
Rhodophyta	0.05%
Rhodophyta- fleshy blade	0.04%
Cyanobacteria	0.23%
Cyanobacteria	0.23%
Porifera	0.78%
Agelas- PR1	0.01%
Agelas- PR3	0.02%
Agelas sp.	0.03%
Amphimedon- PR2	0.03%
Aplysina sp.	0.01%
Demospongiae	0.32%
Demospongiae- PR01	0.04%
Erylus sp.	0.01%
Geodia neptuni complex	0.05%
Geodia sp.	0.01%
Ircinia felix	0.02%
Ircinia sp.	0.01%
Monanchora arbuscula	0.01%
Poecilosclerida	0.01%
Poecilosclerida- PR4	0.05%
Spirastrellidae	0.02%

Dive Site: Pulley Ridge, Outside HAPC; Block 86 Cont. and 88, Central Basin- North; ROV 15-06, UNCW 265

Spongosorites- PR1	0.08%
Xestospongia muta	0.02%
Xestospongia sp.	0.01%
Cnidaria	1.77%
Agaricia grahamae	0.37%
Agaricia sp.	0.11%
Alcyonacea- gorgonian	0.02%
Antipatharia	0.13%
Antipathes atlantica	0.21%
Hydroidolina	0.02%
Hypnogorgia pendula	0.01%
Madracis brueggemanni	0.46%
Madracis decactis	0.36%
Nicella sp.	0.06%
Stylasteridae	0.02%
Echinodermata	0.19%
Davidaster discoideus	0.19%
Chordata	0.03%
Actinopterygii	0.03%
detritus	0.08%
Natural detritus	0.08%
UNKNOWN	0.05%
Unidentified organism	0.05%
Bare hard bottom	61.24%
Habitat	61.24%
Bare rock	1.38%
Bare rubble/cobble	59.86%
Bare soft bottom	9.60%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Outside HAPC; Block 86 Cont. and 88, Central Basin- North; ROV 15-06, UNCW 265

Density of Fish:

Table 2. Density (# individuals/m) of fish from video transects at dive site ROV 15-06.

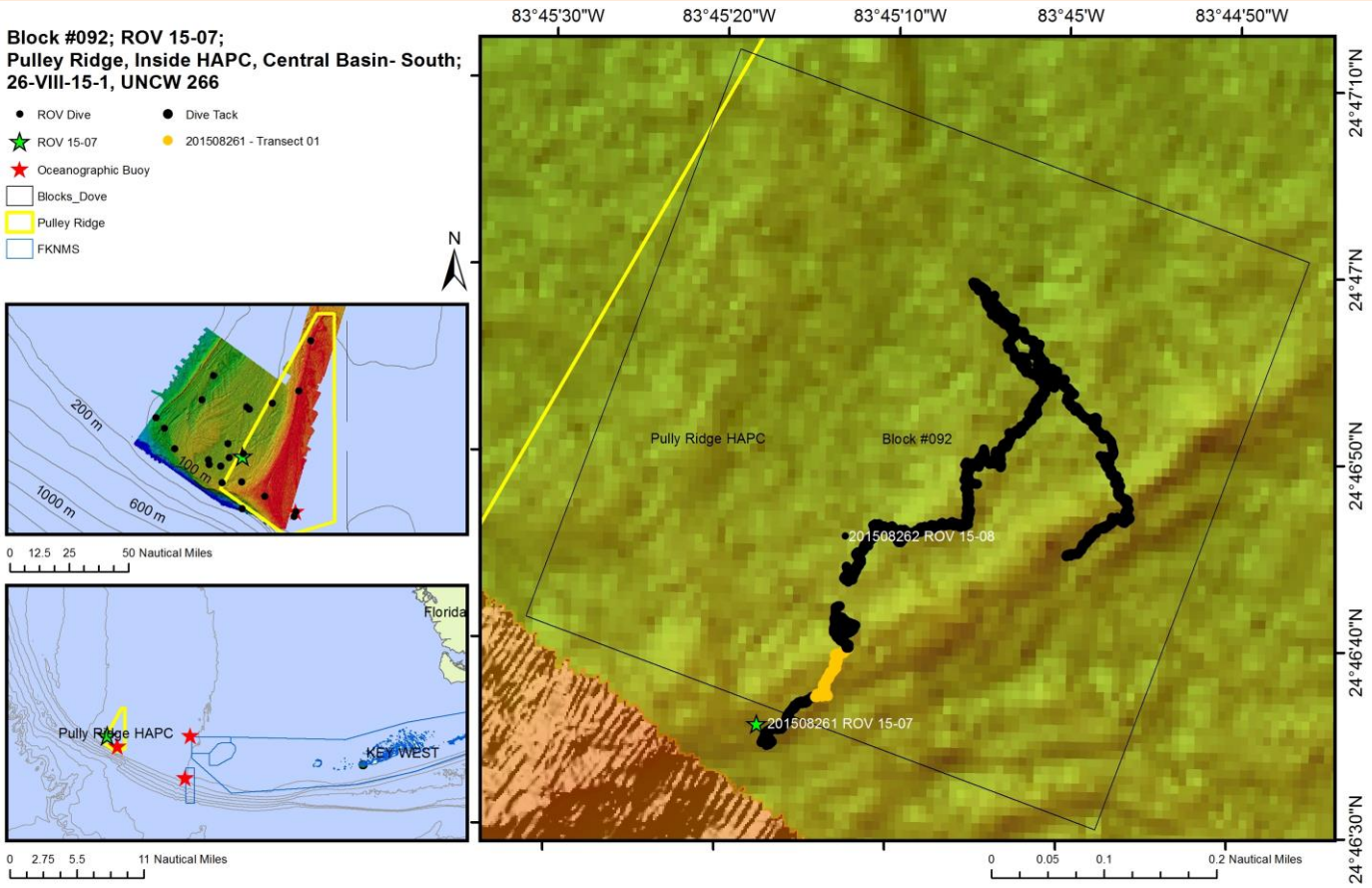
Class/Order/Family/Common name -Taxa	ROV 15-06 No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
fish unid.- Actinopteri	105	0.13125
Aulopiformes		
Synodontidae		
Lizardfish unid.- *Saurida* sp.	1	0.00125
Beryciformes		
Holocentridae		
Squirrelfish unid.- *Holocentrus* sp.	12	0.015
Perciformes		
Chaetodontidae		
bank butterflyfish- *Prognathodes aya*	7	0.00875
Longsnout butterflyfish- *Prognathodes aculeatus*	1	0.00125
reef butterflyfish- *Chaetodon sedentarius*	8	0.01
spotfin butterflyfish- *Chaetodon ocellatus*	2	0.0025
Haemulidae		
striped grunt- *Haemulon striatum*	125	0.15625
Labridae		
spotfin hogfish- *Bodianus pulchellus*	8	0.01
Wrasse unid.- *Halichoeres* sp.	3	0.00375
Lutjanidae		
Snapper unid.- *Lutjanus* sp.	1	0.00125
Pomacanthidae		
rock beauty- *Holacanthus tricolor*	3	0.00375
Pomacentridae		
Chromis unid.- *Chromis* sp.	1	0.00125
purple reeffish- *Chromis scotti*	3	0.00375
sunshine chromis/sunshinefish- *Chromis insolata*	10	0.0125
yellowtail reeffish- *Chromis enchrysurus*	84	0.105
Priacanthidae		
short bigeye- *Pristigenys alta*	1	0.00125
Scaridae		
Greenblotch parrotfish- *Sparisoma atomarium*	5	0.00625
Sciaenidae		
jack-knife fish- *Equetus lanceolatus*	1	0.00125

Dive Site: Pulley Ridge, Outside HAPC; Block 86 Cont. and 88, Central Basin- North; ROV 15-06, UNCW 265

Serranidae		
chalk bass- *Serranus tortugarum*	4	0.005
orangeback bass- *Serranus annularis*	7	0.00875
red grouper- *Epinephelus morio*	1	0.00125
scamp grouper- *Mycteroperca phenax*	1	0.00125
school bass- *Schultzea beta*	350	0.4375
tattler- *Serranus phoebe*	1	0.00125
wrasse bass- *Liopropoma eukrines*	8	0.01
Scorpaeniformes		
Scorpaenidae		
lionfish- *Pterois volitans*	8	0.01
Tetraodontiformes		
Tetraodontidae		
Sharpnose Puffer- *Canthigaster rostrata*	2	0.0025
Grand Total	**763**	**0.4375**

Dive Site: Pulley Ridge, Inside HAPC; Block 92, Central Basin- South; ROV 15-07, UNCW 266

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html
Scientific Observers:	Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	Naar_pulley_10m1_TIF
Purpose:	Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction
ROV:	Mohawk ROV
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II

ROV Sensors: Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density

Date of Dive:	8/26/2015	**Specimens:**	4
Ship Position System:	DGPS	**Digital Photos:**	56
Report Analyst:	John Reed, Stephanie Farrington	**DVD:**	1
Date Compiled:	1/27/2017	**Hard Drive:**	1

Dive Site: Pulley Ridge, Inside HAPC; Block 92, Central Basin- South; ROV 15-07, UNCW 266

Dive Data:

Minimum Bottom Depth (m):	76.1	**Total Transect Length (km):**	0.362
Maximum Bottom Depth (m):	79.8	**Surface Current (kn):**	0.4
On Bottom (Time- GMT):	8:10	**On Bottom (Lat/Long):**	24.78°N; -83.75°W
Off Bottom (Time- GMT):	8:56	**Off Bottom (Lat/Long):**	24.78°N; -24.78°W

Physical (bottom); Temp (°C): 19.51 **Salinity:** 36.40 **Visibility (ft):** 66 **Current (kn):** 0.5

Physical Environment:

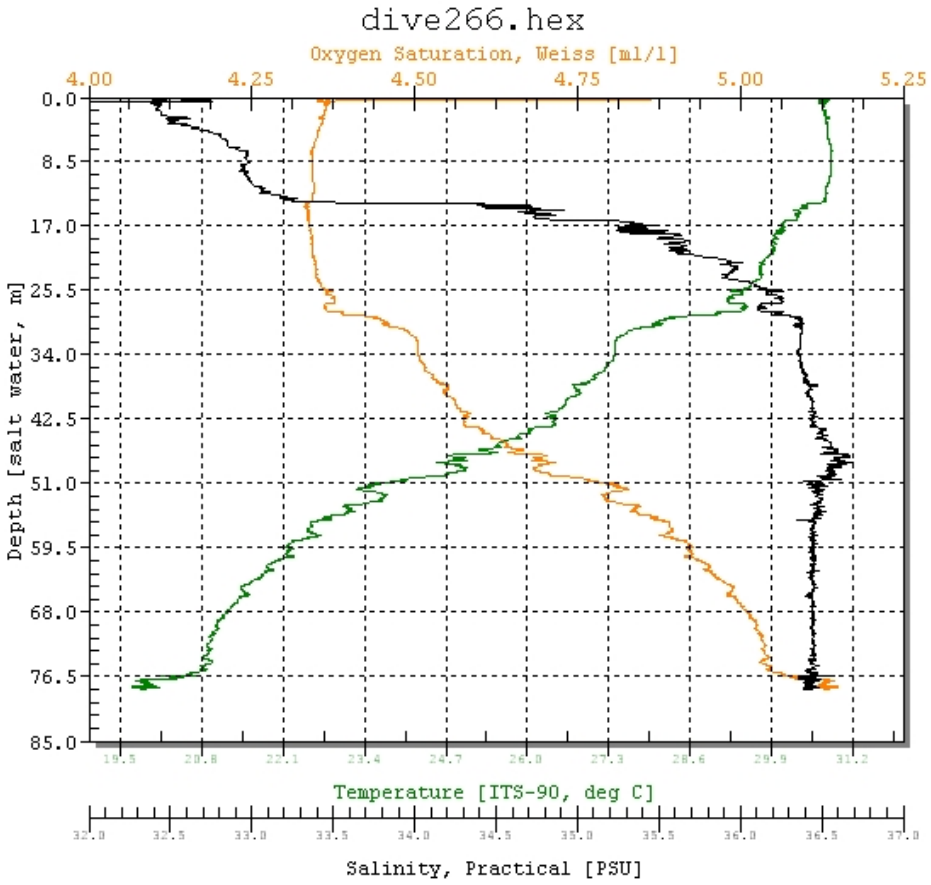


Figure 1: Shows the CTD data during the descent of ROV 15-07. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-07 are as follows: max depth: 78.21 m, temperature: 19.71 °C, conductivity: 49400 µS/cm, pressure: 114.08 PSI, salinity: 36.41 PSU, sound velocity: 1523.56 m/s, oxygen concentration: 5.16 ml/l, density: 1026.26 Kg/m^3, nitrogen saturation: 9.47 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Inside HAPC; Block 92, Central Basin- South; ROV 15-07, UNCW 266

Dive Imagery:

Figure 2: -78.7 m
Helioserus cucullata plate coral.

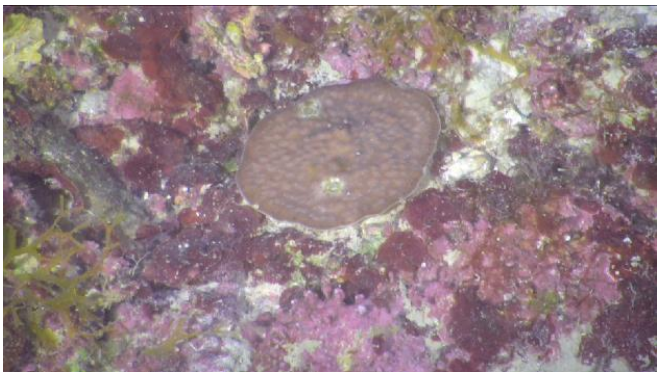


Figure 3: -78.7 m
Agaricia sp. plate coral.

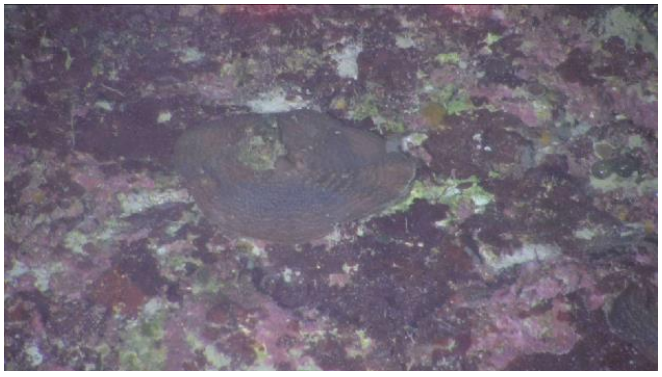


Figure 4: -79.7 m
Agaricia sp. plate coral on rock pavement covered with coralline algae.

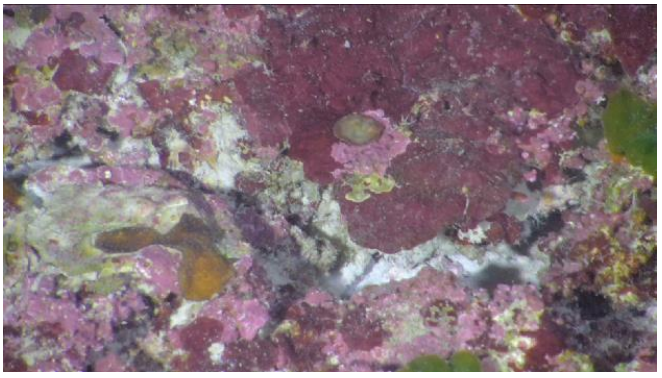


Figure 5: -78.7 m
Agaricia sp., new recruits <5 cm diameter, surrounded by purple and pink coralline algae.

Dive Site: Pulley Ridge, Inside HAPC; Block 92, Central Basin- South; ROV 15-07, UNCW 266

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 26-VIII-15-1; ROV Dive 15-07; Mohawk UNCW Dive 266. Target Site: Florida, inside Pulley Ridge HAPC, random block #92, southern Central Basin; 77 m. Conducted transect 1.

Objectives- Ground truth MB map (low resolution USGS); conduct five random 100-m photo/video transects within block. Conduct video transects for fish population characterization and photo transects for habitat and benthic macrobiota characterization. Collect benthic macro-organisms for taxonomy voucher specimens.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/125, auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom; photos were taken every 30 seconds. Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. Five random 100 m quantitative transects were conducted in each Block. Each 100 m transect was conducted at ~0.25 kn, for 15-20 minutes until the ROV passed through 100 m circle overlaid on navigation screen; quantitative still images were taken every 30 sec for a minimum of 30 images per transect. Off transects between the quantitative transects were 15-20 minutes for close-up video frame grabs of fish and biota, and for collections. Direction of transects were random, but generally headed NE or NW, depending on the ship's maneuverability with the wind and current.

Only one transect was completed; dive aborted due to weather.

Site Description/Habitat

Depth range: 78.5 to 79.7 m.
MB- Low resolution (USGS) shows low relief, relatively featureless bottom, with low relief (1-2 m) NE-SW oriented ridge.
8:05- Launch. Pt/cloudy, storms, seas calm, 4 kn from NE, surface water- 30.719°C, salinity 32.456 (NOAA satellite imagery- Virdis chlorophyll) shows a plume of high chlorophyll water coming from Mississippi River and down the west Florida shelf. Current 0.4 kn from W.
8:10- On bottom, 79.7 m. Visibility 5 m, dark, temperature 19.7, salinity 36.+.
8:19- Start Transect 1, 78.7 m, head NE; 90% hard bottom, pavement/rubble/cobble, some small boulders with 20 cm relief; dominant species- CCA/Peyssonnelia on pavement, <5% *Anadyomene*, *Agaricia* <10 cm common, *Antipathes* sp .
78.3 m- top of small NE-SW ridge. Grouper pit with scamp and reef fish.
8:30- End XS 1, 78.5 m. Off transect, head N 100 m. *Agaricia* common.
8:56- 78.7 m; end dive, in squall, 20 kn wind, lightning.

Dominant Benthic Macrobiota:

CCA/Peyssonnellia on rubble and pavement, <5% *Anadyomene*, *Antipathes* sp. common, *Madracis brueggemanni*, *Agaricia* common to abundant 5-10 cm, *Helioserus cucullata* common 10 cm, *Halimeda*, *Verdigellas peltata*, *Dictyota*.

Species List from Dive Notes:

Cnidaria-
Antipatharia: *Antipathes atlantica*, *Stichopathes lutkeni* - black sea whip

Dive Site: Pulley Ridge, Inside HAPC; Block 92, Central Basin- South; ROV 15-07, UNCW 266

Scleractinia: *Agaricia* sp., *Madracis decactis*, *Madracis myriaster*
Fish: *Holocentrus* sp. - Squirrelfish unid., *Bodianus pulchellus* - spotfin hogfish, *Centropyge argi* - cherubfish, *Chaetodon ocellatus* - spotfin butterflyfish, *Chaetodon sedentarius* - reef butterflyfish, *Chromis enchrysurus* - yellowtail reeffish, *Chromis scotti* - purple reeffish, *Chromis* sp. - *Chromis* unid., *Haemulon vittata* - Boga, *Holacanthus tricolor* - rock beauty, *Liopropoma eukrines* - wrasse bass, *Mycteroperca phenax* - scamp grouper, *Prognathodes aculeatus* - Longsnout butterflyfish, *Serranus tortugarum* - chalk bass, *Sparisoma atomarium* - Greenblotch parrotfish

Samples Collected:
Sample 1- *Helioserus cucullata*, 10 cm, brown, 78.7 m; Sample 2- *Agaricia fragilis*?, 8 cm, brown, 78.7 m; Sample 3- *Helioserus cucullata*?, 3 cm, brown border with greenish interior, 78.7 m.

Dive Site: Pulley Ridge, Inside HAPC; Block 92, Central Basin- South; ROV 15-07, UNCW 266

CPCe Percent Cover Analysis:

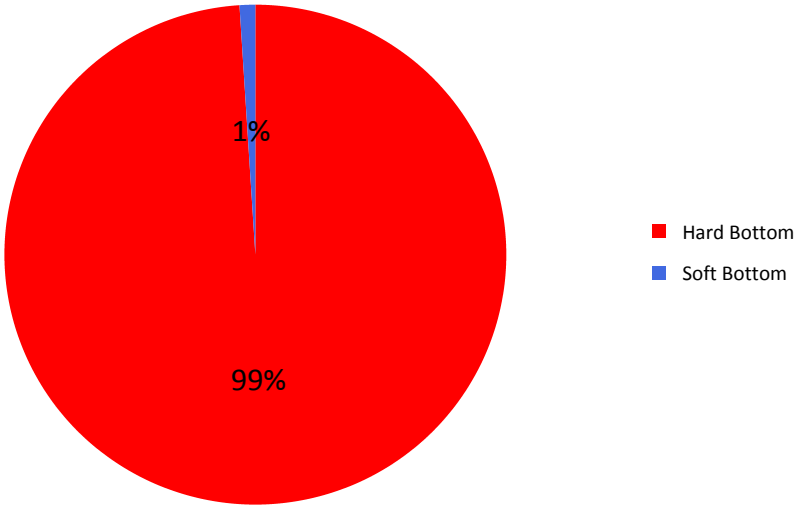
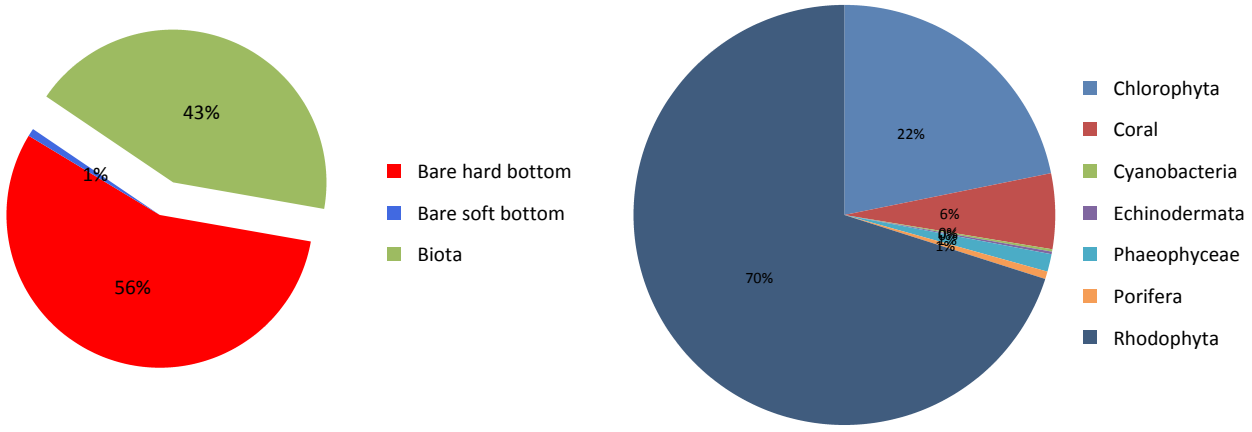


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-07. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-07.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Inside HAPC; Block 92, Central Basin- South; ROV 15-07, UNCW 266

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-07.

Group/Phylum/Taxa	ROV 15-07
Biota	43.27%
Chlorophyta	9.44%
Anadyomene menziesii	7.35%
Chlorophyta	0.17%
Codium intertextum	0.08%
Verdigellas peltata	1.84%
Ochrophyta	0.58%
Dictyota sp.	0.58%
Rhodophyta	30.33%
Corallinales (crustose coralline)	29.74%
Peyssonnelia sp.	0.58%
Cyanobacteria	0.08%
Cyanobacteria	0.08%
Porifera	0.25%
Demospongiae	0.08%
Xestospongia sp.	0.17%
Cnidaria	2.51%
Agaricia fragilis	0.08%
Agaricia sp.	1.59%
Madracis brueggemanni	0.08%
Madracis decactis	0.75%
Echinodermata	0.08%
Analcidometra armata	0.08%
Bare hard bottom	55.89%
Habitat	55.89%
Bare dead coral plate	0.08%
Bare rock	6.60%
Bare rubble/cobble	49.21%
Bare soft bottom	0.84%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Inside HAPC; Block 92, Central Basin- South; ROV 15-07, UNCW 266

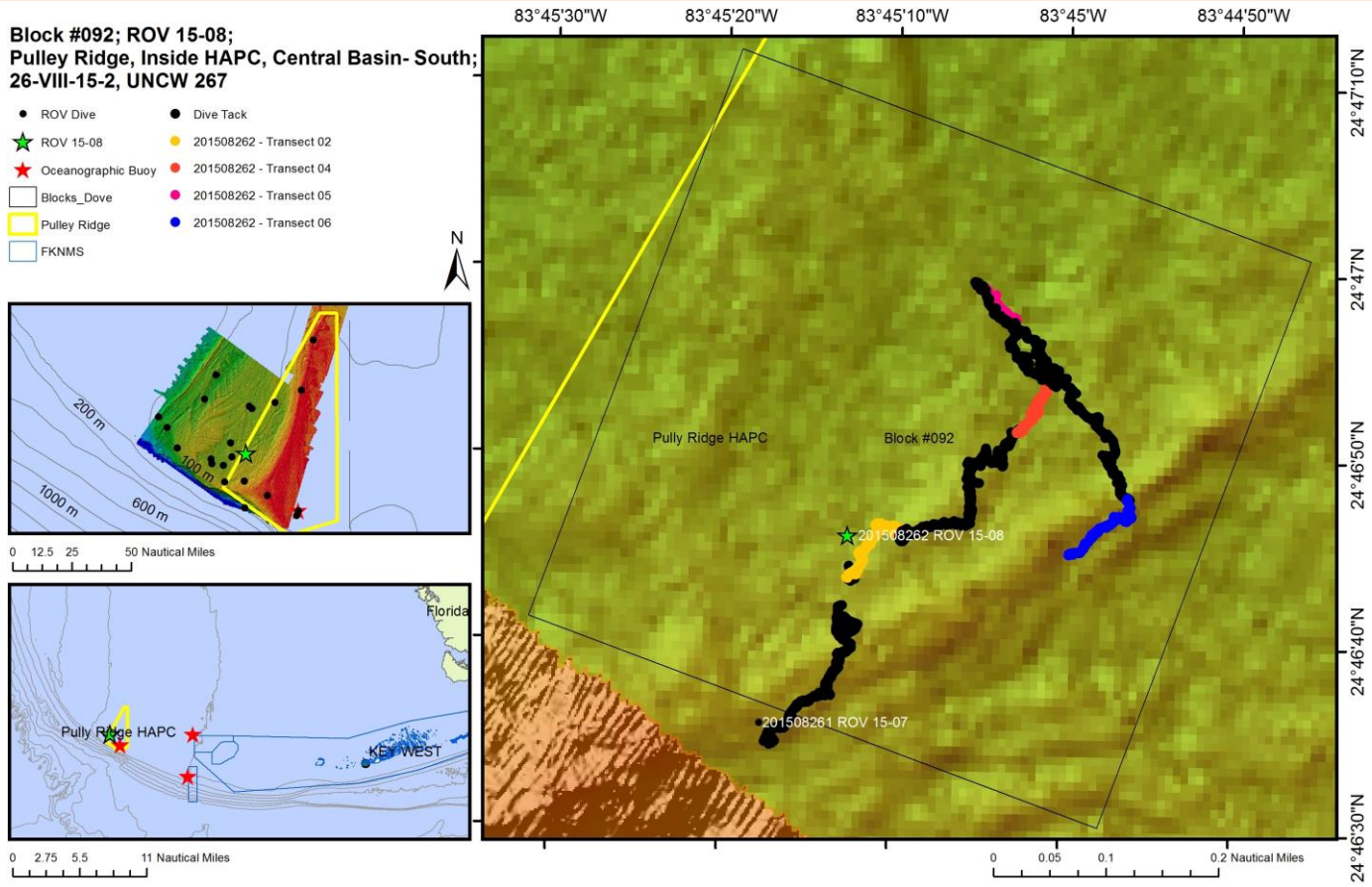
Density of Fish:

Table 2. Density (# individuals/m) of fish from video transects at dive site ROV 15-07.

Class/Order/Family/Common name -Taxa	ROV 15-07 No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
fish unid.- Actinopteri	3	0.03
Perciformes		
Chaetodontidae		
Longsnout butterflyfish- *Prognathodes aculeatus*	2	0.02
reef butterflyfish- *Chaetodon sedentarius*	8	0.08
spotfin butterflyfish- *Chaetodon ocellatus*	2	0.02
Pomacentridae		
purple reeffish- *Chromis scotti*	14	0.14
yellowtail reeffish- *Chromis enchrysurus*	23	0.23
Serranidae		
chalk bass- *Serranus tortugarum*	8	0.08
scamp grouper- *Mycteroperca phenax*	1	0.01
Grand Total	**61**	**0.23**

Dive Site: Pulley Ridge, Inside HAPC; Block 92 Cont. Central Basin- South; ROV 15-08, UNCW 267

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html
Scientific Observers:	Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	Naar_pulley_10m1_TIF
Purpose:	Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction
ROV:	Mohawk ROV
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II

ROV Sensors: Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density

Date of Dive:	8/26/2015	**Specimens:**	1
Ship Position System:	DGPS	**Digital Photos:**	207
Report Analyst:	John Reed, Stephanie Farrington	**DVD:**	3
Date Compiled:	1/27/2017	**Hard Drive:**	1

Dive Site: Pulley Ridge, Inside HAPC; Block 92 Cont. Central Basin- South; ROV 15-08, UNCW 267

Dive Data:

Minimum Bottom Depth (m):	74.5	**Total Transect Length (km):**	1.431
Maximum Bottom Depth (m):	79.8	**Surface Current (kn):**	0.3
On Bottom (Time- GMT):	9:41	**On Bottom (Lat/Long):**	24.78°N; -83.75°W
Off Bottom (Time- GMT):	12:09	**Off Bottom (Lat/Long):**	24.78°N; -83.75°W

Physical (bottom); Temp (°C): 19.68 **Salinity:** 36.41 **Visibility (ft):** **Current (kn):** 0.25

Physical Environment:

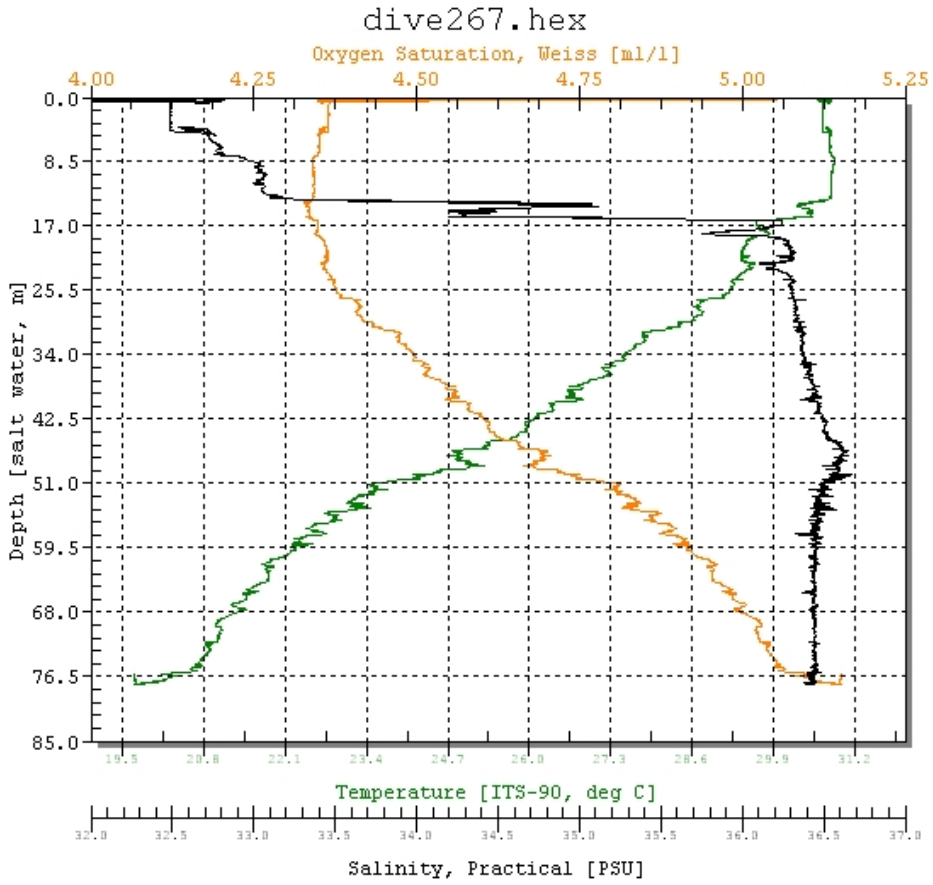


Figure 1: Shows the CTD data during the descent of ROV 15-08. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-08 are as follows: max depth: 79.16 m, temperature: 19.65 °C, conductivity: 49200 µS/cm, pressure: 115.47 PSI, salinity: 36.36 PSU, sound velocity: 1523.35 m/s, oxygen concentration: 5.17 ml/l, density: 1026.24 Kg/m^3, nitrogen saturation: 9.48 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Inside HAPC; Block 92 Cont. Central Basin- South; ROV 15-08, UNCW 267

Dive Imagery:

Figure 2: -78.9 m
Scamp grouper on flat rock bottom.

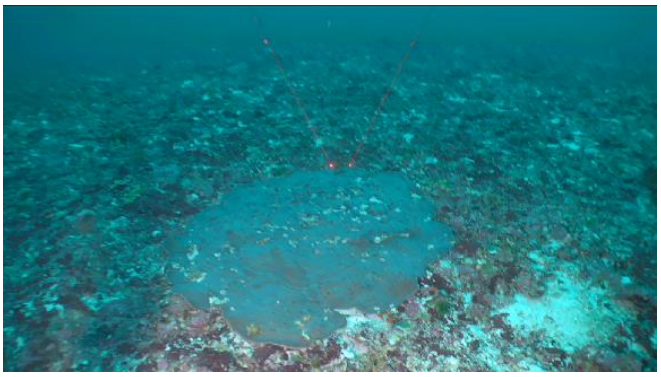


Figure 3: -79.3 m
Large 1-m diameter *Agaricia* sp.plate coral (10 cm lasers).

Figure 4: -79.3 m
Lobster *Panularis argus* (10 cm lasers).

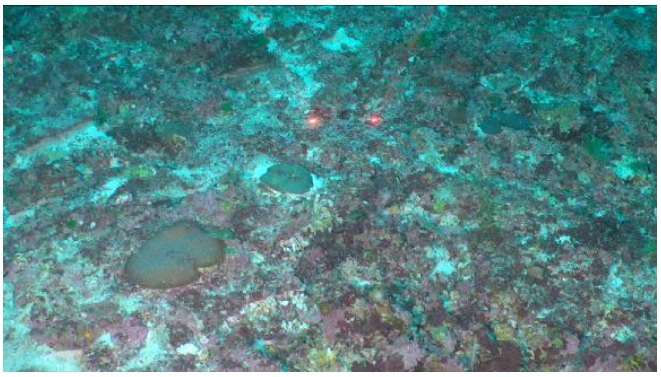


Figure 5: -77.8 m
Small 10-cm diameter *Agaricia* sp. plate corals (10 cm lasers).

Dive Site: Pulley Ridge, Inside HAPC; Block 92 Cont. Central Basin- South; ROV 15-08, UNCW 267

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 26-VIII-15-2; ROV Dive 15-08; Mohawk UNCW Dive 267. Target Site: Florida, inside Pulley Ridge HAPC, random block #92, southern Central Basin; 77 m. Continuation of Dive 266; transects 2-5.

Objectives- Ground truth MB map (low resolution USGS); conduct five random 100-m photo/video transects within block. Conduct video transects for fish population characterization and photo transects for habitat and benthic macrobiota characterization. Collect benthic macro-organisms for taxonomy voucher specimens.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/125, auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom; photos were taken every 30 seconds. Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. Five random 100 m quantitative transects were conducted in each Block. Each 100 m transect was conducted at ~0.25 kn, for 15-20 minutes until the ROV passed through 100 m circle overlaid on navigation screen; quantitative still images were taken every 30 sec for a minimum of 30 images per transect. Off transects between the quantitative transects were 15-20 minutes for close-up video frame grabs of fish and biota, and for collections. Direction of transects were random, but generally headed NE or NW, depending on the ship's maneuverability with the wind and current.

Site Description/Habitat

Depth range: 77.8 to 79.8 m.

MB- Low resolution (USGS) shows low relief, relatively featureless bottom, with low relief (1-2 m) NE-SW oriented ridge.

9:35- Launch. P/cloudy, seas 1-2' from NE, 12 kn from NE, seawater- 30.66°C, salinity 32.493, current 0.3 kn from NW.

9:41- On bottom, 79.7 m; visibility 5-10 m, dark from green surface water (Mississippi plume), bottom current <1/8 kn, 19.68°C, 36.41 salinity.

9:43- Start Transect 2, 79.8 m, head?; 90% hard bottom, pavement/rubble/cobble; CCA/Peyssonnelia on pavement, <5% *Anadyomene*, few demosponges, few *Antipatharia*, no octocorals, *Agaricia* 5-10 cm abundant (in most photos).

9:33- End XS 2, 79.3 m. Head E, off transect 100 m. *Madracis decactis* 10 cm common. 10 m diameter grouper pit- 4 scamp, 3 lionfish, reef fish.

10:24- Start XS 3, 78.4 m, head N; 90% hard bottom, pavement/rubble/cobble; same biota, <5% *Anadyomene*, *Antipathes atlantica*, sponges uncommon.

10:35- End XS 3, 78.7 m. Head NE 100 m for off transect.

10:51- Start XS 4, 79.0 m, head NE; 90% rubble/ cobble/sparse pavement, low rugosity; CCA/Peyssonnelia, sparse *Anadyomene*. MB sonar- west of ridge. *Agaricia* not abundant.

11:00- End XS 4, 79.4 m. Head NW 100 m off transect.

11:12- Start XS 5, 79.6 m, head NW; 90% rubble/cobble; same biota; small *Agaricia* present. One large 1 m diameter *Agaricia lamarcki*; first large one seen.

11:23- End XS 5, 79.8 m. Off transect, head to NE-SW ridge in middle of block for one extra transect on top of ridge. Two more 1 m *Agaricia*. Red grouper in small hole. 20 m grouper pit- red grouper, 3 lobster, 6 lionfish, reef fish.

11:57- Top of ridge, 77.8 m. Start XS 6 (extra), head SW along top of ridge. 90% hard bottom, pavement/rubble/cobb le; CCA/*Peyssonnelia*, 10% *Anadyomene*; *Agaricia* <10 cm not as common as XS 1 on same

ridge.
12:09- End XS 6, 77.8 m. End dive.

Dominant Benthic Macrobiota:
CCA/*Peyssonnelia* on all rock, 5-10% cover *Anadyomene*, *Antipathes atlantica* and spp., sparse demosponges, no octocorals; *Agaricia* <10 cm common but not abundant, few 1 m diameter *A*. *lamarcki*. Fish uncommon except in grouper pits; several red grouper, scamp, lionfish.

Species List from Dive Notes:
Cnidaria: *Ellisella* sp., *Stylaster* sp. - hydrocoral - unidentified
Antipatharia: *Antipathes atlantica*, *Antipathes* sp., *Stichopathes lutkeni* - black sea whip
Scleractinia: *Agaricia lamarcki* - plate coral, *Agaricia lamarcki*, *Agaricia* sp., *Madracis brueggemanni*, *Madracis decactis*, *Scolymia* sp.
Porifera: *Agelas conifera*, *Xestospongia muta*, *Geodia neptuni* complex, *Geodia* sp., *Aplysina* sp.
Fish: *Holocentrus* sp. - Squirrelfish unid., *Apogon* sp. - cardinalfish unid., *Bodianus pulchellus* - spotfin hogfish, *Centropyge* argi - cherubfish, *Chaetodon sedentarius* - reef butterflyfish, *Chromis enchrysurus* - yellowtail reeffish, *Chromis insolata* - sunshine chromis/sunshinefish, *Chromis scotti* - purple reeffish, *Epinephelus morio* - red grouper, *Epinephelus* sp. - graysby, *Haemulon striatum* - striped grunt, *Haemulon vittata* - Boga, *Holacanthus tricolor* - rock beauty, *Liopropoma eukrines* - wrasse bass, Lutjanidae - Snappers, *Mycteroperca phenax* - scamp grouper, *Priacanthus arenatus* - bigeye, *Prognathodes aculeatus* - Longsnout butterflyfish, *Prognathodes aya* - bank butterflyfish, *Serranus annularis* - orangeback bass, *Sparisoma atomarium* - Greenblotch parrotfish, *Pterois volitans* - lionfish, *Canthigaster* sp. - sharpnose puffer

Samples Collected:
Sample 1- *Agaricia* sp., 10 cm, brown with green stripes, 78.8 m

Dive Site: Pulley Ridge, Inside HAPC; Block 92 Cont. Central Basin- South; ROV 15-08, UNCW 267

CPCe Percent Cover Analysis:

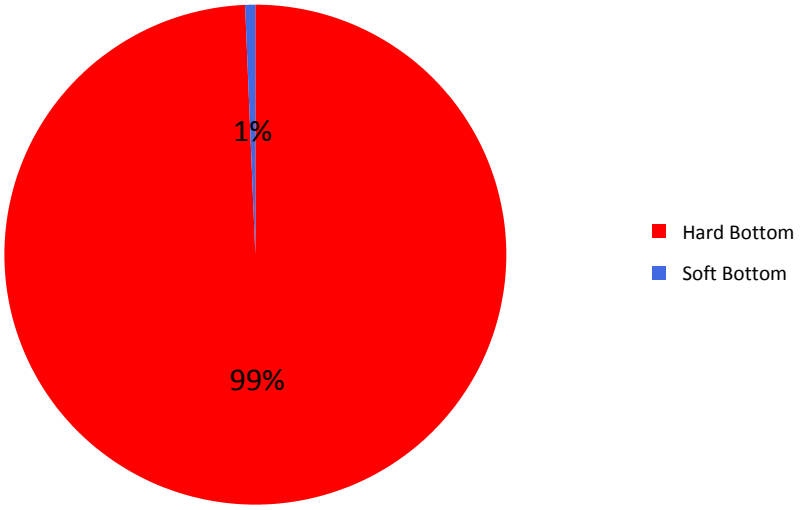
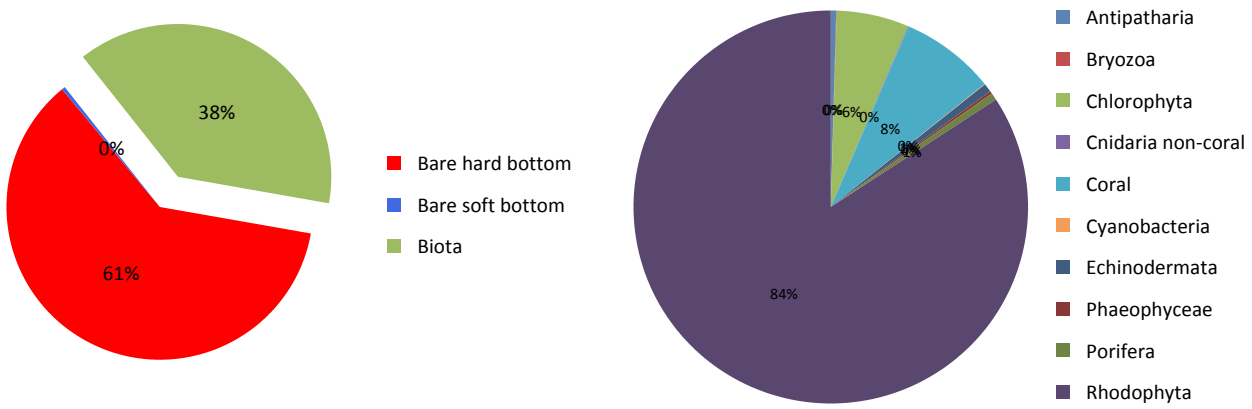


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-08. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-08.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Inside HAPC; Block 92 Con't, Central Basin- South; ROV 15-08, UNCW 267

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-08.

Group/Phylum/Taxa	ROV 15-08
Biota	38.42%
Chlorophyta	2.27%
Anadyomene menziesii	0.69%
Chlorophyta	0.10%
Codium sp.	0.04%
Halimeda copiosa	0.02%
Halimeda sp.	0.02%
Valonia ventricosa	0.06%
Verdigellas peltata	1.34%
Ochrophyta	0.08%
Dictyota sp.	0.08%
Rhodophyta	32.35%
Corallinales (crustose coralline)	30.77%
Peyssonnelia sp.	1.52%
Rhodophyta	0.02%
Rhodophyta- fleshy blade	0.04%
Cyanobacteria	0.02%
Cyanobacteria	0.02%
Porifera	0.23%
Demospongiae	0.06%
Dictyoceratida	0.02%
Poecilosclerida	0.04%
Spirastrellidae	0.06%
Xestospongia sp.	0.04%
Cnidaria	3.17%
Agaricia fragilis	0.19%
Agaricia grahamae	0.46%
Agaricia sp.	0.83%
Antipatharia	0.15%
Antipathes atlantica	0.02%
Helioseris cucullata	0.02%
Hydroidolina	0.02%
Madracis brueggemanni	0.27%
Madracis decactis	1.15%
Madracis formosa	0.04%
Scolymia sp.	0.02%

Dive Site: Pulley Ridge, Inside HAPC; Block 92 Con't, Central Basin- South; ROV 15-08, UNCW 267

Bryozoa	0.02%
Bryozoa- white fan	0.02%
Echinodermata	0.27%
Analcidometra armata	0.19%
Comatulida	0.02%
Davidaster discoideus	0.06%
Bare hard bottom	61.22%
Habitat	61.22%
Bare dead coral plate	0.10%
Bare rock	2.61%
Bare rubble/cobble	58.51%
Bare soft bottom	0.35%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Inside HAPC; Block 92 Con't, Central Basin- South; ROV 15-08, UNCW 267

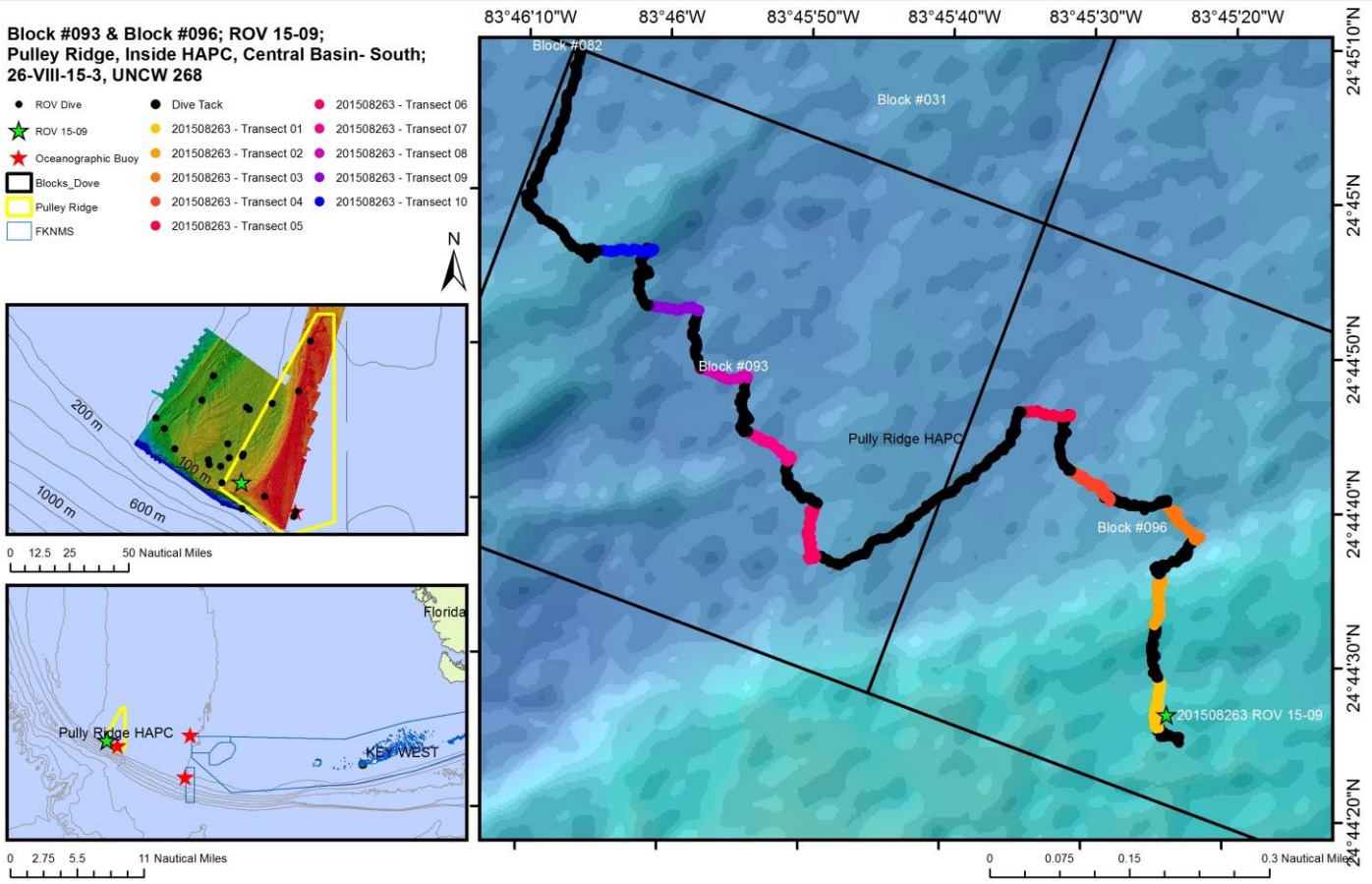
Density of Fish:

Table 2. Density (# individuals/m) of fish from video transects at dive site ROV 15-08.

Class/Order/Family/Common name -Taxa	ROV 15-08 No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
Beryciformes		
Holocentridae		
Squirrelfish unid.- *Holocentrus* sp.	1	0.002
Perciformes		
Labridae		
spotfin hogfish- *Bodianus pulchellus*	2	0.004
Pomacanthidae		
rock beauty- *Holacanthus tricolor*	3	0.006
Pomacentridae		
Chromis unid.- *Chromis* sp.	5	0.01
sunshine chromis/sunshinefish- *Chromis insolata*	6	0.012
Priacanthidae		
bigeye- *Priacanthus arenatus*	1	0.002
Serranidae		
school bass- *Schultzea beta*	350	0.7
wrasse bass- *Liopropoma eukrines*	1	0.002
Scorpaeniformes		
Scorpaenidae		
lionfish- *Pterois volitans*	3	0.006
Grand Total	**372**	**0.7**

Dive Site: Pulley Ridge, Inside HAPC; Blocks 96 & 93, Central Basin- South; ROV 15-09, UNCW 268

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html
Scientific Observers:	Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	Naar_pulley_10m1_TIF
Purpose:	Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction
ROV:	Mohawk ROV
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II

ROV Sensors: Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density

Date of Dive:	8/26/2015	**Specimens:**	2
Ship Position System:	DGPS	**Digital Photos:**	439
Report Analyst:	John Reed, Stephanie Farrington	**DVD:**	4
Date Compiled:	1/27/2017	**Hard Drive:**	1

Dive Site: Pulley Ridge, Inside HAPC; Blocks 96 & 93, Central Basin- South; ROV 15-09, UNCW 268

Dive Data:

Minimum Bottom Depth (m):	72.2	**Total Transect Length (km):**	3.154
Maximum Bottom Depth (m):	76.9	**Surface Current (kn):**	0.8
On Bottom (Time- GMT):	13:15	**On Bottom (Lat/Long):**	24.74°N; -83.76°W
Off Bottom (Time- GMT):	17:39	**Off Bottom (Lat/Long):**	24.75°N; -83.77°W

Physical (bottom); Temp (°C): 20.08 **Salinity:** 36.34 **Visibility (ft):** **Current (kn):** 0.25

Physical Environment:

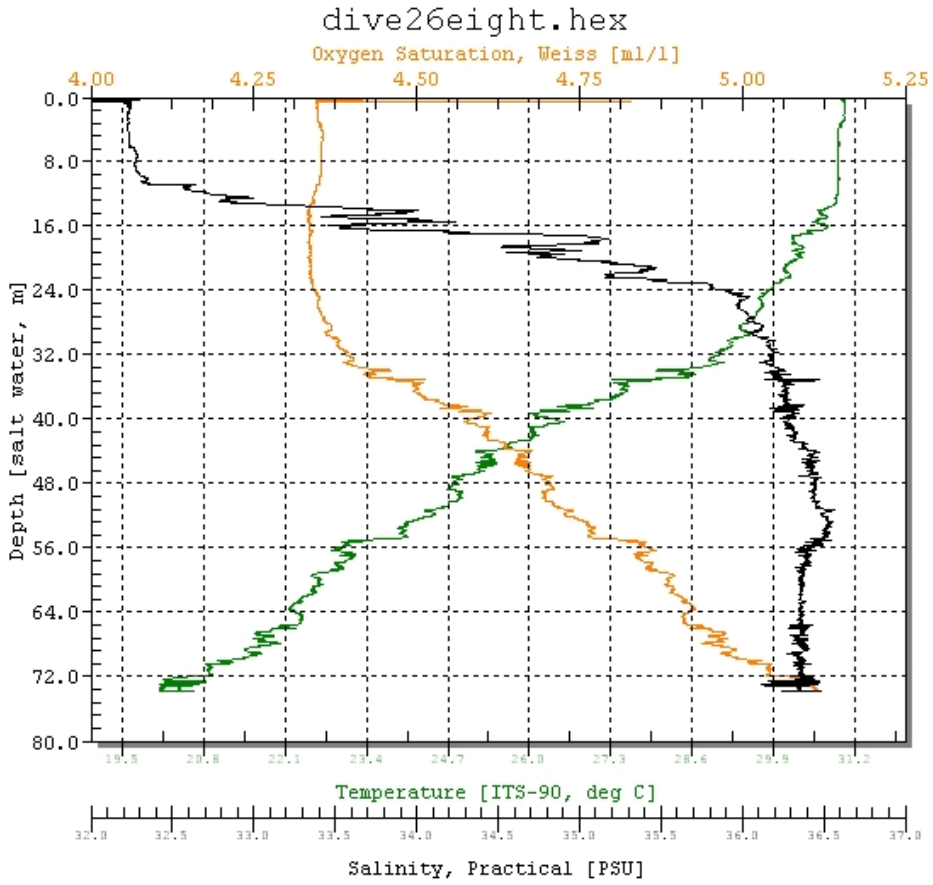


Figure 1: Shows the CTD data during the descent of ROV 15-09. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-09 are as follows: max depth: 76.28 m, temperature: 19.96 °C, conductivity: 49500 µS/cm, pressure: 111.27 PSI, salinity: 36.33 PSU, sound velocity: 1524.14 m/s, oxygen concentration: 5.14 ml/l, density: 1026.13 Kg/m^3, nitrogen saturation: 9.44 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Inside HAPC; Blocks 96 & 93, Central Basin- South; ROV 15-09, UNCW 268

Dive Imagery:

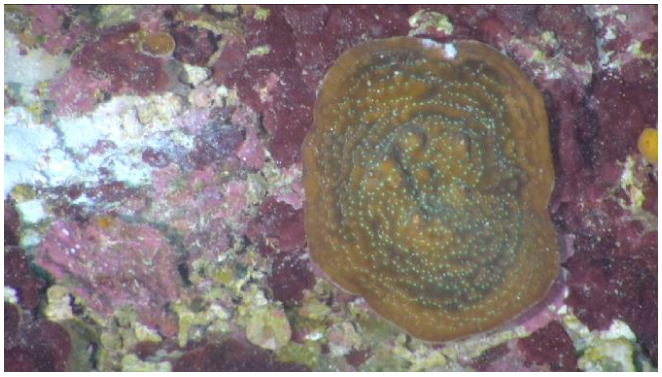


Figure 2: -76.2 m
Agaricia fragilis plate coral (sample 2).

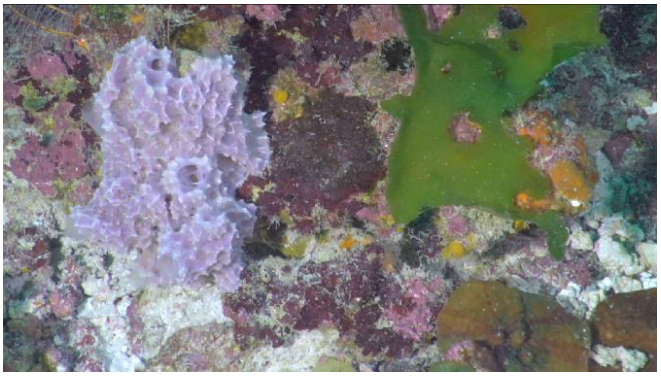


Figure 3: -75.4 m
Pink *Callyspongia* sp. Sponge and *Verdigellas* sp.green algae.

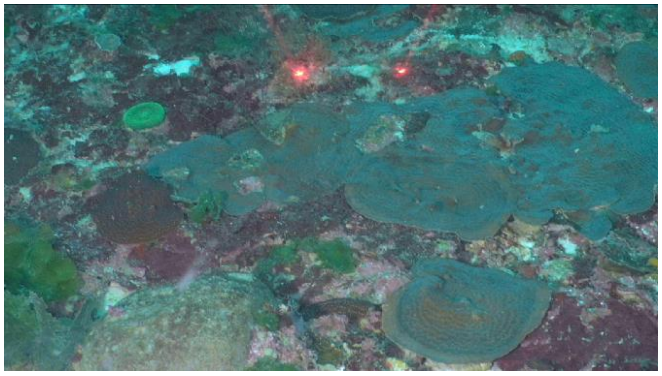


Figure 4: -74.4 m
Field of large 1-m *Agaricia* sp.coral and *Scolymia* sp. (green round) (10 c m lasers).

Figure 5: -76.2 m
Red grouper on a field of *Anadyomene menziesii* lettuce algae (10 cm lasers).

Dive Site: Pulley Ridge, Inside HAPC; Blocks 96 & 93, Central Basin- South; ROV 15-09, UNCW 268

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 26-VIII-15-3; ROV Dive 15-09; Mohawk UNCW Dive 268. Target Site: Florida, inside Pulley Ridge HAPC, random blocks #96 and 93, southern Central Basin; 75 m.

Objectives- Ground truth MB map (low resolution USGS); conduct five random 100-m photo/video transects within block. Conduct video transects for fish population characterization and photo transects for habitat and benthic macrobiota characterization. Collect benthic macro-organisms for taxonomy voucher specimens.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/125, auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom; photos were taken every 30 seconds. Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. Five random 100 m quantitative transects were conducted in each Block. Each 100 m transect was conducted at ~0.25 kn, for 15-20 minutes until the ROV passed through 100 m circle overlaid on navigation screen; quantitative still images were taken every 30 sec for a minimum of 30 images per transect. Off transects between the quantitative transects were 15-20 minutes for close-up video frame grabs of fish and biota, and for collections. Direction of transects were random, but generally headed NE or NW, depending on the ship's maneuverability with the wind and current.

Site Description/Habitat

Block 96-

Depth range: 74.0 to 76.6 m.

MB- Low resolution (USGS) shows low relief, relatively featureless bottom.

13:09- Launch. Pt/cloudy, seas 1-2' from NE, 7 kn from NE, seawater- 31.064°C, salinity 32.322 (Mississippi outflow), current 0.8 kn from NW.

13:15- On bottom, 75.0 m; visibility 10 m, 20.08°C, salinity 36.34, current low.

13:18- Start Transect 1, 75.1 m, head N; 100% pavement/rubble/ cobble; 50% Anadyomene, CCA/Peyssonnelia, few sponges- Xestospongia muta; Davidaster crinoid; no octocorals, sparse Antipatharia; Agaricia 5-10 cm abundant (in most every photo).

13:29- End XS 1, 74.7 m. Head N 100 m for off transect. Grouper pit- reef fish, no grouper seen. 15 cm Agaricia partially bleached, *Scolymia lacera*.

13:34- Start XS 2, 74.0 m, head N; same habitat and biota, *Madracis brueggemanni*; *Agaricia* 5-10 cm abundant; all *Agaricia*, do not see *Helioserus*; few *Geodia neptuni*, *G. gibberosa*, Spirastrellidae, *Madracis decactis*. 10 m pit- few lionfish, reef fish.

13:47- End XS 2, 75.1 m. Head NW 100 m off transect.

13:54- Start XS 3, 75.2 m, head NW; 95% hard bottom, pavement/rubble/cobble; CCA/Peyssonnelia, 50% *Anadyomene*, *M. brueggemanni*, *Antipathes* common, few sponges; 5-10 cm *Agaricia abundant* (in nearly all images).

14:05- End XS 3, 75.5 m. Head W off transect 100 m. Pit with 3 lionfish, reef fish, no grouper seen.

14:18- Start XS 4, 75.9 m, head NW; same habitat, 5-10 cm *Agaricia* abundant. 95% pavement/rubble/cobble; 30% *Anadyomene*, no octocorals, few demosponges, *X. muta*. Pit with red grouper, 5 lionfish, reef fish.

14:30- End XS 4, 76.4 m. Head N 100 m.

14:37- Start XS 5, 76.5 m, head W; 100% hard bottom, pavement/rubble/cobble; 30% *Anadyomene*, CCA/Peyssonnelia, 5-10 cm *Agaricia* abundant; *Davidaster*, Demosponges uncommon; *Antipathes* common,

Comatulida crinoids.
14:47- End XS 5, 76.6 m. Head to Block 93; 500 m to SE corner of Block 93.

Dominant Benthic Macrobiota:
CCA/Peyssonnelia, *Anadyomene* 30-50% cover, *Davidaster* crinoids, *Antipathes* common; sparse demosponges- *Geodia*, *Xestospongia muta*; no octocorals; 5-10 cm *Agaricia* abundant (several in most photos), no large *Agaricia*. Few fish except at grouper pits.

Species List from Dive Notes:
Cnidaria
Antipatharia: Antipathes atlantica, Antipathes sp., Stichopathes lutkeni - black sea whip
Scleractinia: Agaricia sp., Madracis brueggemanni, Madracis decactis, Madracis sp., Montastraea cavernosa, Scolymia sp.
Porifera: Xestospongia muta - , Geodia gibberosa - , Geodia neptuni complex - , Holocentrus sp. - Squirrelfish unid., Apogon pseudomaculatus - twospot cardinalfish, Apogon sp. - cardinalfish unid., Bodianus pulchellus - spotfin hogfish, Centropyge argi - cherubfish, Chaetodon ocellatus - spotfin butterflyfish, Chaetodon sedentarius - reef butterflyfish, Chromis cyanea - Blue chromis, Chromis enchrysurus - yellowtail reeffish, Chromis insolata - sunshine chromis/sunshinefish, Chromis scotti - purple reeffish, Chromis sp. - Chromis unid., Epinephelus morio - red grouper, Haemulon striatum - striped grunt, Haemulon vittata - Boga, Holacanthus tricolor - rock beauty, Liopropoma eukrines - wrasse bass, Prognathodes aculeatus - Longsnout butterflyfish, Prognathodes aya - bank butterflyfish, Schultzea beta - school bass, Seriola sp. - amberjack, Serranus annularis - orangeback bass, Serranus tortugarum - chalk bass, Sparisoma atomarium - Greenblotch parrotfish, Pterois volitans - lionfish, Canthigaster sp. - sharpnose puffer

<u>Block 93-</u>
15:07- Start XS 1, 76.5 m, head W; 100% hard bottom, pavement/rubble/cobble; 30% *Anadyomene*, CCA/Peyssonnelia, 5-10 cm *Agaricia* abundant (most images), *Davidaster*, no Octocorals, demosponges uncommon.
15:19- End XS 1, 76.2 m. Head NW 100 m off transect. 5 m diameter pit- 9 lionfish, reef fish, no grouper observed.
15:27- Start XS 2, 76.6 m, head NW; 95% hard bottom, pavement/rubble/cobble; same biota, 30% Anadyomene, Antipathes atlantica, 5-10 cm Agaricia abundant.
15:41- End XS 2, 76.6 m. Head N 100 m.
15:47- Start XS 3, 76.6 m, head W; same habitat and biota, 30% Anadyomene, no octocorals, few demosponges; 5-10 cm Agaricia abundant.
15:56- End XS 3, 76.7 m. Head N 100 m. Abandoned grouper pit.
16:01- Start XS 4, 76.6 m, head W; 95% hard bottom, pavement/rubble/cobble; 30% Anadyomene, same biota; Agaricia 5-10 cm abundant (in most photos).
16:10- End XS 4, 76.2 m. Head N 100 m.
16:38- Start XS 5, 75.7 m, head W; 95% hard bottom, pavement/rubble/cobble; same biota, 30% Anadyomene; abundant 5-10 cm Agaricia. 75.3 m- top of ridge on MB.
16:48- Stop XS 5, 75.1 m. Off transect, head N for samples.
17:11- Off transect; head to NW corner of block, 419 m away. Anadyomene 50%. 5 m diameter grouper pit- red grouper, 2 lionfish, reef fish.
17:31- Start extra Transect XS 6, 76.5 m, head N along NW border of block. 95% hard bottom, pavement/rubble/cobble; 5-10 cm Agaricia abundant (most photos); CCA/Peyssonnelia, 30% Anadyomene, demosponges sparse, few Antipathes, no octocorals, few Madracis brueggemanni.
17:39- End XS 6, 76.3 m; end dive.

Dominant Benthic Macrobiota:
CCA/Peyssonnelia on all rock, 30-50% cover *Anadyomene*, *Davidaster* crinoids, *Antipatharia*, demosponges sparse, no octocorals. Fish uncommon except in grouper pits, some red grouper.

Species List from Dive Notes:
Antipatharia: *Antipathes atlantica* - , *Stichopathes lutkeni* - black sea whip, *Antipathes* sp. -

Dive Site: Pulley Ridge, Inside HAPC; Blocks 96 & 93, Central Basin- South; ROV 15-09, UNCW 268

Scleractinia: *Agaricia* sp. - , *Madracis brueggemanni* - , *Madracis* sp. - , *Montastraea cavernosa* - , *Madracis decactis* - , *Scolymia* sp. -
Porifera: *Astrophorida* (Tetractinellida) - , *Xestospongia muta* - , *Geodia gibberosa* - , *Geodia neptuni* complex -
Fish: *Holocentrus* sp. - Squirrelfish unid., *Bodianus pulchellus* - spotfin hogfish, *Centropyge argi* - cherubfish, *Chaetodon sedentarius* - reef butterflyfish, *Chromis cyanea* - Blue chromis, *Chromis enchrysurus* - yellowtail reeffish, *Chromis insolata* - sunshine chromis/sunshinefish, *Chromis scotti* - purple reeffish, *Chromis* sp. - *Chromis* unid., *Haemulon striatum* - striped grunt, *Holacanthus tricolor* - rock beauty, *Liopropoma eukrines* - wrasse bass, *Prognathodes aculeatus* - Longsnout butterflyfish, *Seriola* sp. - amberjack, *Serranus annularis* - orangeback bass, *Serranus tortugarum* - chalk bass, *Sparisoma atomarium* - Greenblotch parrotfish, *Apogon* sp. - cardinalfish unid., *Epinephelus morio* - red grouper, *Apogon pseudomaculatus* - twospot cardinalfish, *Chaetodon ocellatus* - spotfin butterflyfish, *Prognathodes aya* - bank butterflyfish, *Haemulon vittata* - Boga, *Schultzea beta* - school bass, *Pterois volitans* - lionfish, *Canthigaster* sp. - sharpnose puffer

Samples Collected:
Sample 1- *Agaricia* sp., 8 cm, brown, whorled like *A*. *undata*; Sample 2- *Agaricia* sp., 8 cm, brown, concentric ridges, iridescent green calyces like stars (*A*. *fragilis*?); Sample 3- *Dictyoceratida*, 10 cm Ircinia? (not collected; manipulator broke).

Dive Site: Pulley Ridge, Inside HAPC; Blocks 96 & 93, Central Basin- South; ROV 15-09, UNCW 268

CPCe Percent Cover Analysis:

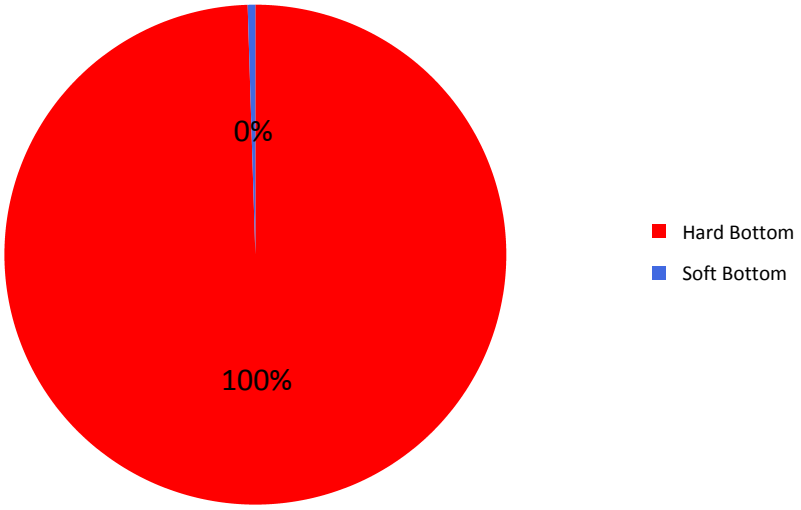
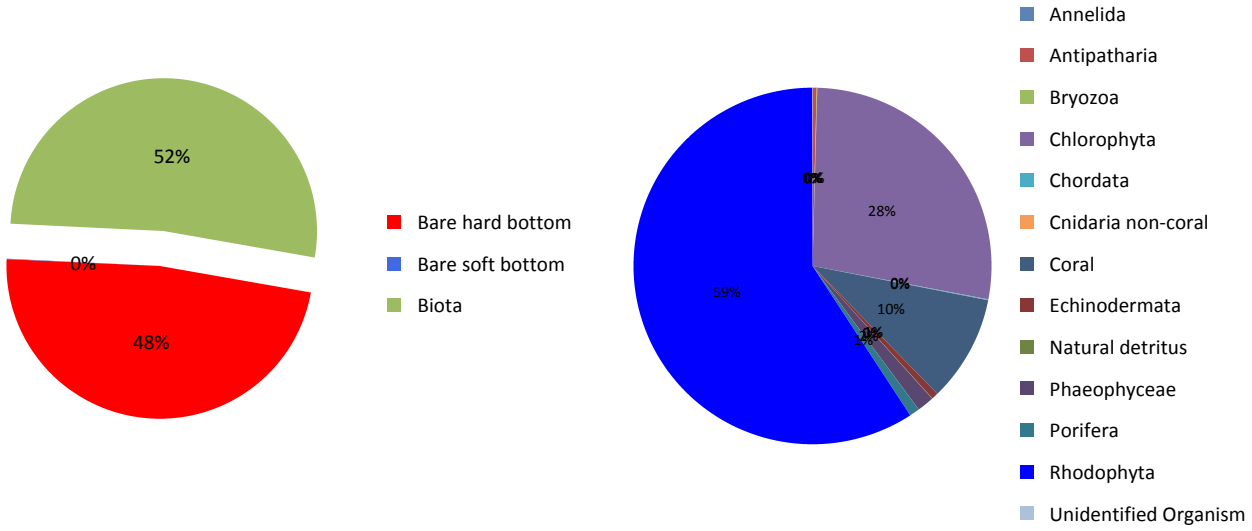


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-09. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-09.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Inside HAPC; Blocks 96 & 93, Central Basin- South; ROV 15-09, UNCW 268

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-09.

Group/Phylum/Taxa	ROV 15-09
Biota	52.02%
Chlorophyta	14.33%
Anadyomene menziesii	12.04%
Chlorophyta	0.10%
Halimeda copiosa	0.01%
Halimeda sp.	0.05%
Valonia ventricosa	0.03%
Verdigellas peltata	2.11%
Ochrophyta	0.79%
Dictyota sp.	0.79%
Rhodophyta	30.78%
Corallinales (crustose coralline)	30.65%
Peyssonnelia sp.	0.11%
Rhodophyta	0.03%
Porifera	0.48%
Agelas clathrodes	0.01%
Agelas- PR3	0.01%
Agelas sp.	0.01%
Auletta sp.	0.01%
Demospongiae	0.19%
Geodia neptuni complex	0.08%
Geodia sp.	0.02%
Ircinia campana	0.01%
Ircinia felix	0.01%
Ircinia strobilina	0.02%
Poecilosclerida	0.02%
Tetractinellida	0.08%
Xestospongia muta	0.03%
Cnidaria	5.20%
Agaricia fragilis	0.28%
Agaricia grahamae	0.52%
Agaricia sp.	3.79%
Antipatharia	0.06%
Antipathes atlantica	0.12%
Antipathes furcata	0.01%
Condylactis gigantea	0.01%

Dive Site: Pulley Ridge, Inside HAPC; Blocks 96 & 93, Central Basin- South; ROV 15-09, UNCW 268

Helioseris cucullata	0.04%
Madracis brueggemanni	0.07%
Madracis decactis	0.28%
Madracis formosa	0.03%
Annelida	0.01%
Annelida	0.01%
Bryozoa	0.03%
Bryozoa	0.01%
Bryozoa- white fan	0.03%
Echinodermata	0.32%
Analcidometra armata	0.13%
Davidaster discoideus	0.18%
Eucidaris tribuloides	0.01%
Chordata	0.04%
Actinopterygii	0.04%
detritus	0.02%
Natural detritus	0.02%
UNKNOWN	0.02%
Unidentified organism	0.02%
Bare hard bottom	47.94%
Habitat	47.94%
Bare dead coral plate	0.13%
Bare rock	7.12%
Bare rubble/cobble	40.69%
Bare soft bottom	0.04%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Inside HAPC; Blocks 96 & 93, Central Basin- South; ROV 15-09, UNCW 268

Density of Fish:

Table 2. Density (# individuals/m^2 of fish from video transects at dive site ROV 15-09.

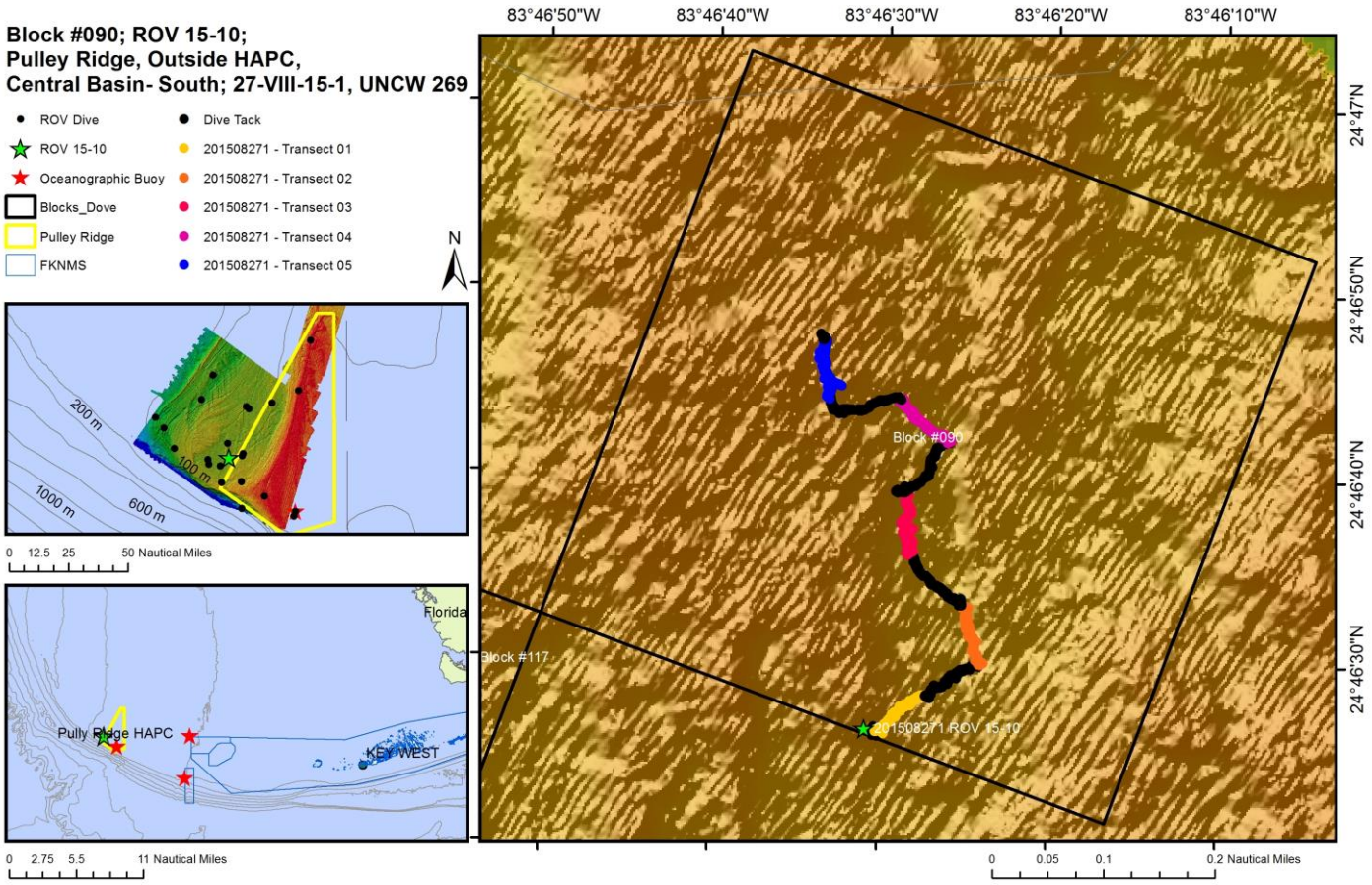
Class/Order/Family/Common name -Taxa	No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
fish unid.- Actinopteri	152	0.1382
Beryciformes		
Holocentridae		
Squirrelfish unid.- *Holocentrus* sp.	2	0.0018
Perciformes		
Apogonidae		
cardinalfish unid.- *Apogon* sp.	75	0.0682
Carangidae		
amberjack- *Seriola* sp.	2	0.0018
Chaetodontidae		
Longsnout butterflyfish- *Prognathodes aculeatus*	4	0.0036
reef butterflyfish- *Chaetodon sedentarius*	22	0.0200
spotfin butterflyfish- *Chaetodon ocellatus*	1	0.0009
Haemulidae		
striped grunt- *Haemulon striatum*	623	0.5664
Labridae		
spotfin hogfish- *Bodianus pulchellus*	4	0.0036
Pomacanthidae		
cherubfish- *Centropyge argi*	9	0.0082
rock beauty- *Holacanthus tricolor*	14	0.0127
Pomacentridae		
Blue chromis- *Chromis cyanea*	1	0.0009
Chromis unid.- *Chromis* sp.	3	0.0027
purple reeffish- *Chromis scotti*	27	0.0245
sunshine chromis/sunshinefish- *Chromis insolata*	10	0.0091
yellowtail reeffish- *Chromis enchrysurus*	30	0.0273
Scaridae		
Greenblotch parrotfish- *Sparisoma atomarium*	1	0.0009
Serranidae		
chalk bass- *Serranus tortugarum*	4	0.0036
orangeback bass- *Serranus annularis*	3	0.0027
red grouper- *Epinephelus morio*	2	0.0018
school bass- *Schultzea beta*	300	0.2727
wrasse bass- *Liopropoma eukrines*	5	0.0045

Dive Site: Pulley Ridge, Inside HAPC; Blocks 96 & 93, Central Basin- South; ROV 15-09, UNCW 268

Scorpaeniformes		
Scorpaenidae		
lionfish- *Pterois volitans*	15	0.0136
Grand Total	**1309**	**0.5664**

Dive Site: Pulley Ridge, Outside HAPC; Block 90, Central Basin- South; ROV 15-10, UNCW 269

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html
Scientific Observers:	Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	Naar_pulley_10m1_TIF
Purpose:	Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction
ROV:	Mohawk ROV
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II

ROV Sensors: Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density

Date of Dive:	8/27/2015	**Specimens:**	
Ship Position System:	DGPS	**Digital Photos:**	180
Report Analyst:	John Reed, Stephanie Farrington	**DVD:**	2
Date Compiled:	1/27/2017	**Hard Drive:**	1

Dive Site: Pulley Ridge, Outside HAPC; Block 90, Central Basin- South; ROV 15-10, UNCW 269

Dive Data:

Minimum Bottom Depth (m):	78.3	**Total Transect Length (km):**	1.033
Maximum Bottom Depth (m):	81.8	**Surface Current (kn):**	0.5
On Bottom (Time- GMT):	8:04	**On Bottom (Lat/Long):**	24.77°N; -86.77°W
Off Bottom (Time- GMT):	10:17	**Off Bottom (Lat/Long):**	24.78°N; -83.78°W
Physical (bottom); Temp (°C):	19.82	**Salinity:** 36.42 **Visibility (ft):**	15 **Current (kn):**

Physical Environment:

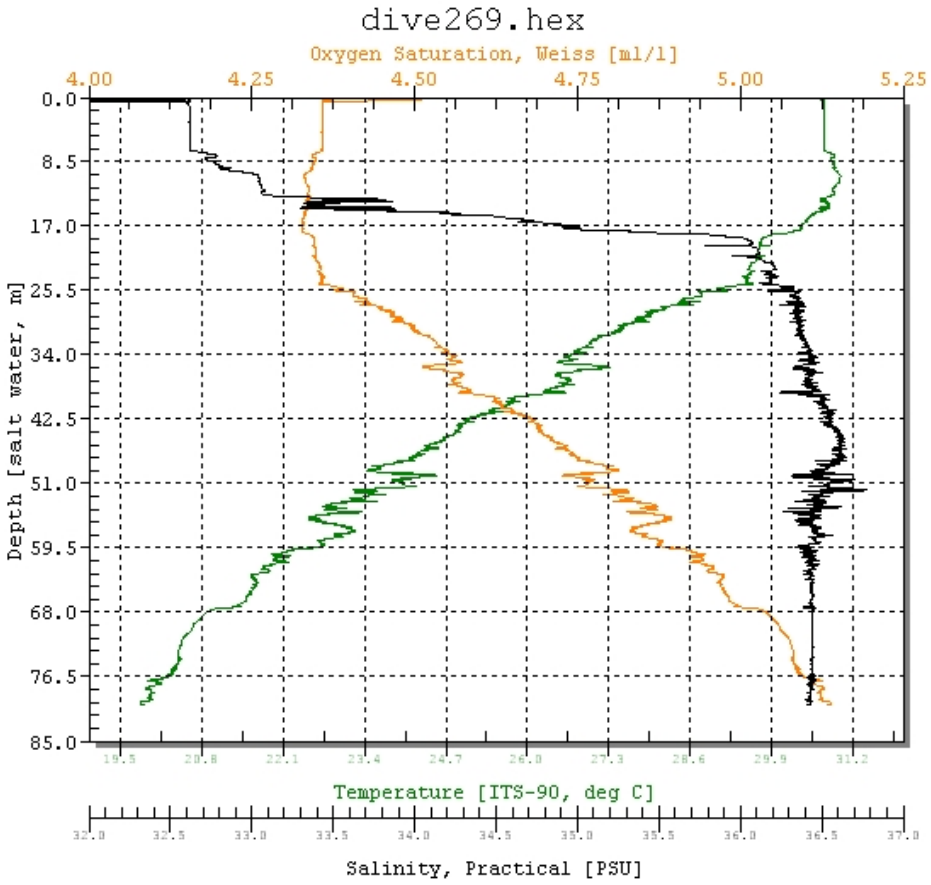


Figure 1: Shows the CTD data during the descent of ROV 15-10. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-10 are as follows: max depth: 81.19 m, temperature: 19.83 °C, conductivity: 49500 µS/cm, pressure: 118.44 PSI, salinity: 36.42 PSU, sound velocity: 1523.96 m/s, oxygen concentration: 5.15 ml/l, density: 1026.25 Kg/m^3, nitrogen saturation: 9.45 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Outside HAPC; Block 90, Central Basin- South; ROV 15-10, UNCW 269

Dive Imagery:

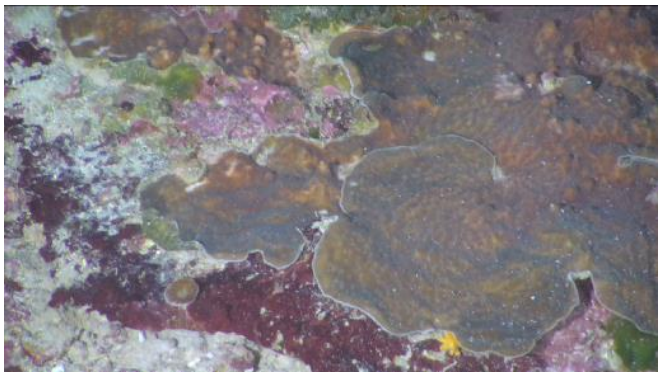


Figure 2: -81.6 m
Agaricia sp. plate coral.

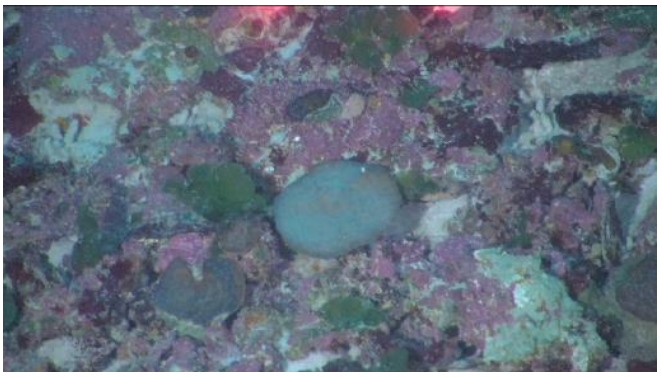


Figure 3: -81.7 m
Agaricia sp. corals on coralline algae encrusted rock.

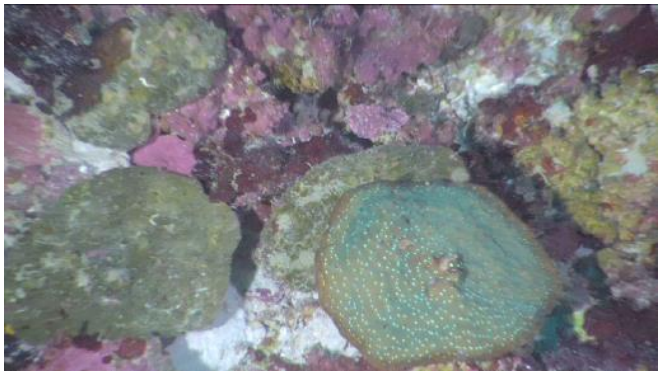


Figure 4: -81.6 m
Agaricia sp. plate coral and rocks with coralline algae.

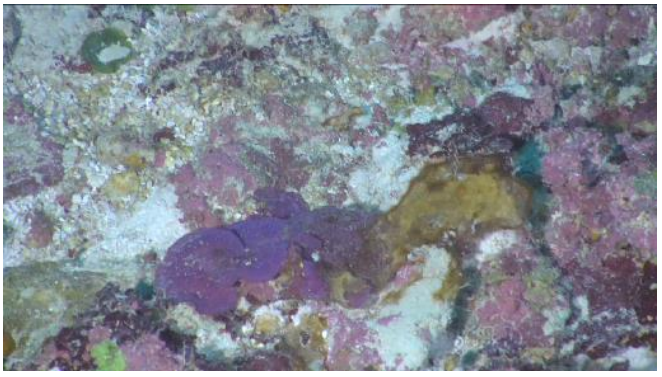


Figure 5: -81.6 m
Purple peyssonnelioid algae.

Dive Site: Pulley Ridge, Outside HAPC; Block 90, Central Basin- South; ROV 15-10, UNCW 269

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 27-VIII-15-1; ROV Dive 15-10; Mohawk UNCW Dive 269. Target Site: Florida, outside Pulley Ridge HAPC, south Central Basin, random blocks #90; 80 m.

Objectives- Ground truth MB map (low resolution USGS); conduct five random 100-m photo/video transects within block. Conduct video transects for fish population characterization and photo transects for habitat and benthic macrobiota characterization. Collect benthic macro-organisms for taxonomy voucher specimens.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/125, auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom; photos were taken every 30 seconds. Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. Five random 100 m quantitative transects were conducted in each Block. Each 100 m transect was conducted at ~0.25 kn, for 15-20 minutes until the ROV passed through 100 m circle overlaid on navigation screen; quantitative still images were taken every 30 sec for a minimum of 30 images per transect. Off transects between the quantitative transects were 15-20 minutes for close-up video frame grabs of fish and biota, and for collections. Direction of transects were random, but generally headed NE or NW, depending on the ship's maneuverability with the wind and current.

Site Description/Habitat

Depth range: 79.7 to 80.7 m.

MB- Low resolution (USGS) sonar shows flat, relatively featureless bottom.

7:59- Launch. P/cloudy, seas 1' from SW, 10 kn from SW, seawater- 30.768°C, salinity 32.657 (CTD- halocline at 17 m), current 0.5 kn from NW.

8:05- On bottom, 81.4 m. Visibility- 5 m (green surface layer from Mississippi River on satellite), temperature 19.82, salinity 36.42, current <1/8 kn from N.

8:10- Start Transect 1, 81.4 m, head NE; 90% hard bottom, pavement/rubble/cobble; dominant cover CCA; *Anadyomene* sparse, *Antipathes atlantica*, *Madracis* decactis 10 cm common, *Halimeda* sparse, *Verdigellas*, demosponges diverse- *Polymastia*, *Geodia neptuni*, *X. muta*; Stylaster common. *Agaricia* 5-10 cm abundant (in most photos), *M. brueggemanni*. No grouper pits or grouper.

8:27- End XS 1, 81.3 m. Head NE 100 m off transect.

8:39- Start XS 2, 81.5 m, head N; 90% hard bottom, pavement/rubble/cobble; same biota. Agaricia 5-10 cm abundant; sponges sparse, octocorals sparse; few 1 m grouper pits, but no grouper.

8:58- End XS 2, 81.7 m. Head N 100 m.

9:10- Start XS 3, 81.3 m, head N; 90% hard bottom, pavement/rubble/cobble; dominated by CCA and *Verdigellas*. 5-10 cm *Agaricia* abundant. No pits or grouper.

9:30- End XS 3, 81.0 m. Head NE 100 m.

9:58- Start XS 4, 81.4 m, head NW; 95% hard bottom, pavement/rubble/cobble; same biota; *Agaricia* 5-10 cm common but not as abundant as previous transects (1-2 in most photos). 5 m diameter pit- no grouper, 1 lionfish.

9:53- End XS 4, 80.5 m. Head W 100 m. 1 m pit, red grouper, 1 lionfish. 5 m pit- reef fish, no grouper seen, 2 lionfish. Sparse *Anadyomene*. Recent dead *Helioserus*.

10:00- Start XS 5, 80.0 m, head N. 95% hard bottom, pavement/rubble/cobble; dense CCA, *Verdigellas*, 5% *Anadyomene*, Antipatharia common, few octocorals, *Davidaster*. 2 m pit- 2 lionfish. *Agaricia* 5-10 cm abundant (1-2/photo).

10:15- End XS 5, 79.7 m. End dive.

Dominant Benthic Macrobiota:
CCA covered pavement, Peyssonnelia, *Anadyomene* <5%, sparse *Halimeda*, *Verdigellas*, *Antipathes atlantica*, demosponges diverse- *Polymastia*, *Geodia neptuni*; Comatulida, *Stylocidaris*. *Agaricia* 5-10 cm abundant, *Madracis decactis* common, *M*. *brueggemanni* common. Few small scoured pits- reef fish, few lionfish, no grouper.

Species List from Dive Notes:
Cnidaria:
Anthoathecata : *Stylaster filogranus*, *Stylaster* sp. - hydrocoral - unidentified
Antipatharia: *Antipathes atlantica* - , *Stichopathes lutkeni* - black sea whip
Scleractinia: *Agaricia* sp., *Helioseris cucullata*, *Madracis brueggemanni*, *Madracis decactis*, *Madracis* sp.
Porifera: *Amphimedon*- PR2, *Xestospongia muta*, *Polymastia* sp., *Geodia* sp.
Chordata: Synodontidae - Lizardfishes unid, *Holocentrus* sp. - Squirrelfish unid., *Apogon* sp. - cardinalfish unid., *Bodianus pulchellus* - spotfin hogfish, *Centropyge argi* - cherubfish, *Chaetodon sedentarius* - reef butterflyfish, *Chromis cyanea* - Blue chromis, *Chromis enchrysurus* - yellowtail reeffish, *Chromis insolata* - sunshine chromis/sunshinefish, *Chromis scotti* - purple reeffish, *Epinephelus morio* - red grouper, *Haemulon striatum* - striped grunt, *Holacanthus tricolor* - rock beauty, *Liopropoma eukrines* - wrasse bass, *Priacanthus arenatus* - bigeye, *Prognathodes aculeatus* - Longsnout butterflyfish, *Prognathodes aya* - bank butterflyfish, *Schultzea beta* - school bass, *Seriola* sp. - amberjack, *Serranus annularis* - orangeback bass, *Serranus tortugarum* - chalk bass, *Sparisoma atomarium* - Greenblotch parrotfish, *Pterois volitans* - lionfish, *Canthigaster* sp. - sharpnose puffer

No samples.

Dive Site: Pulley Ridge, Outside HAPC; Block 90, Central Basin- South; ROV 15-10, UNCW 269

CPCe Percent Cover Analysis:

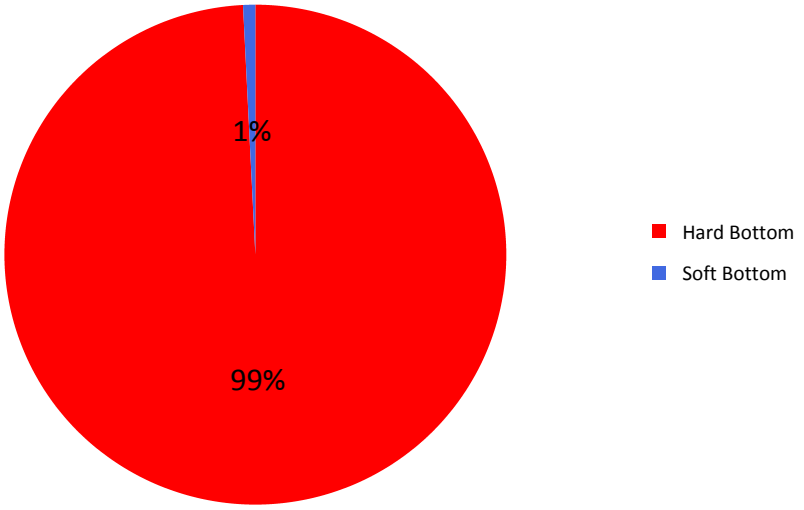
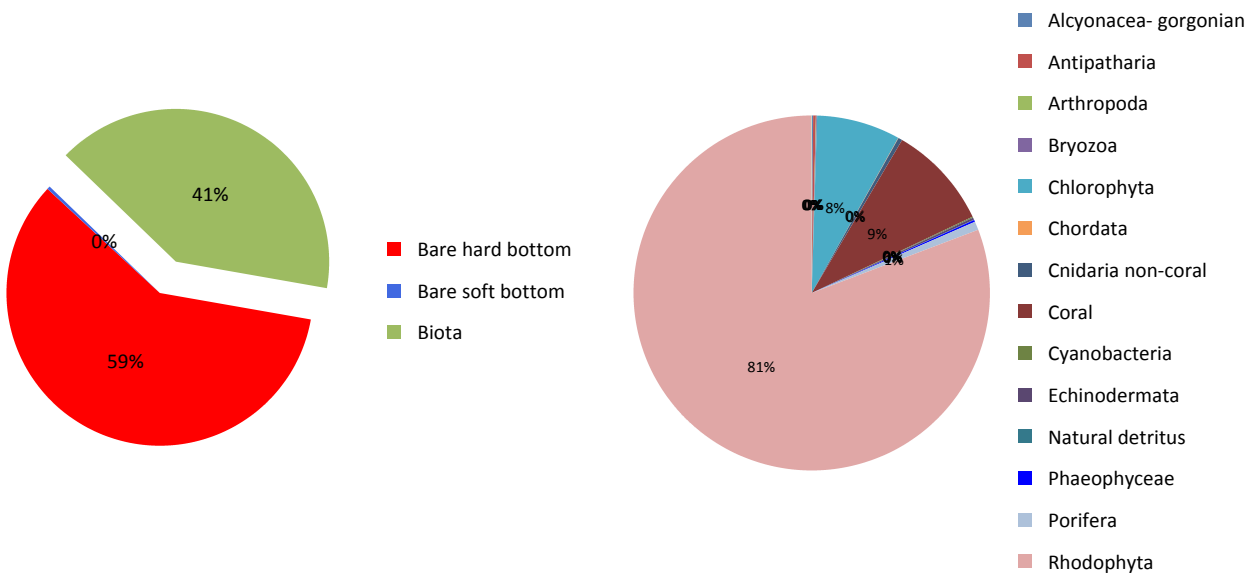


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-10. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-10.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Outside HAPC; Block 90, Central Basin- South; ROV 15-10, UNCW 269

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-10.

Group/Phylum/Taxa	ROV 15-10
Biota	40.52%
Chlorophyta	3.07%
Anadyomene menziesii	1.22%
Chlorophyta	0.12%
Halimeda sp.	0.02%
Ulva sp.	0.02%
Valonia ventricosa	0.02%
Verdigellas peltata	1.68%
Ochrophyta	0.07%
Dictyota sp.	0.07%
Rhodophyta	32.72%
Corallinales (crustose coralline)	32.62%
Peyssonnelia sp.	0.10%
Cyanobacteria	0.03%
Cyanobacteria	0.03%
Porifera	0.32%
Aplysina sp.	0.02%
Demospongiae	0.17%
Erylus sp.	0.02%
Geodia neptuni complex	0.08%
Tetractinellida	0.02%
Xestospongia muta	0.02%
Cnidaria	4.13%
Agaricia fragilis	0.33%
Agaricia sp.	2.43%
Alcyonacea- gorgonian	0.05%
Antipatharia	0.05%
Antipathes atlantica	0.03%
Antipathes furcata	0.02%
Hydroidolina	0.05%
Madracis brueggemanni	0.27%
Madracis decactis	0.63%
Madracis formosa	0.17%
Stylasteridae	0.10%
Bryozoa	0.03%
Schizoporella sp.	0.02%

Dive Site: Pulley Ridge, Outside HAPC; Block 90, Central Basin- South; ROV 15-10, UNCW 269

Bryozoa- white fan	0.02%
Arthropoda	0.02%
Anomura	0.02%
Echinodermata	0.08%
Analcidometra armata	0.05%
Asteroidea	0.02%
Davidaster discoideus	0.02%
Chordata	0.02%
Actinopterygii	0.02%
detritus	0.02%
UNKNOWN	0.02%
Unidentified organism	0.02%
Bare hard bottom	59.16%
Habitat	59.16%
Bare dead coral plate	0.18%
Bare rock	3.35%
Bare rubble/cobble	55.63%
Bare soft bottom	0.32%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Outside HAPC; Block 90, Central Basin- South; ROV 15-10, UNCW 269

Density of Fish:

Table 2. Density (# individuals/m) of fish from video transects at dive site ROV 15-10.

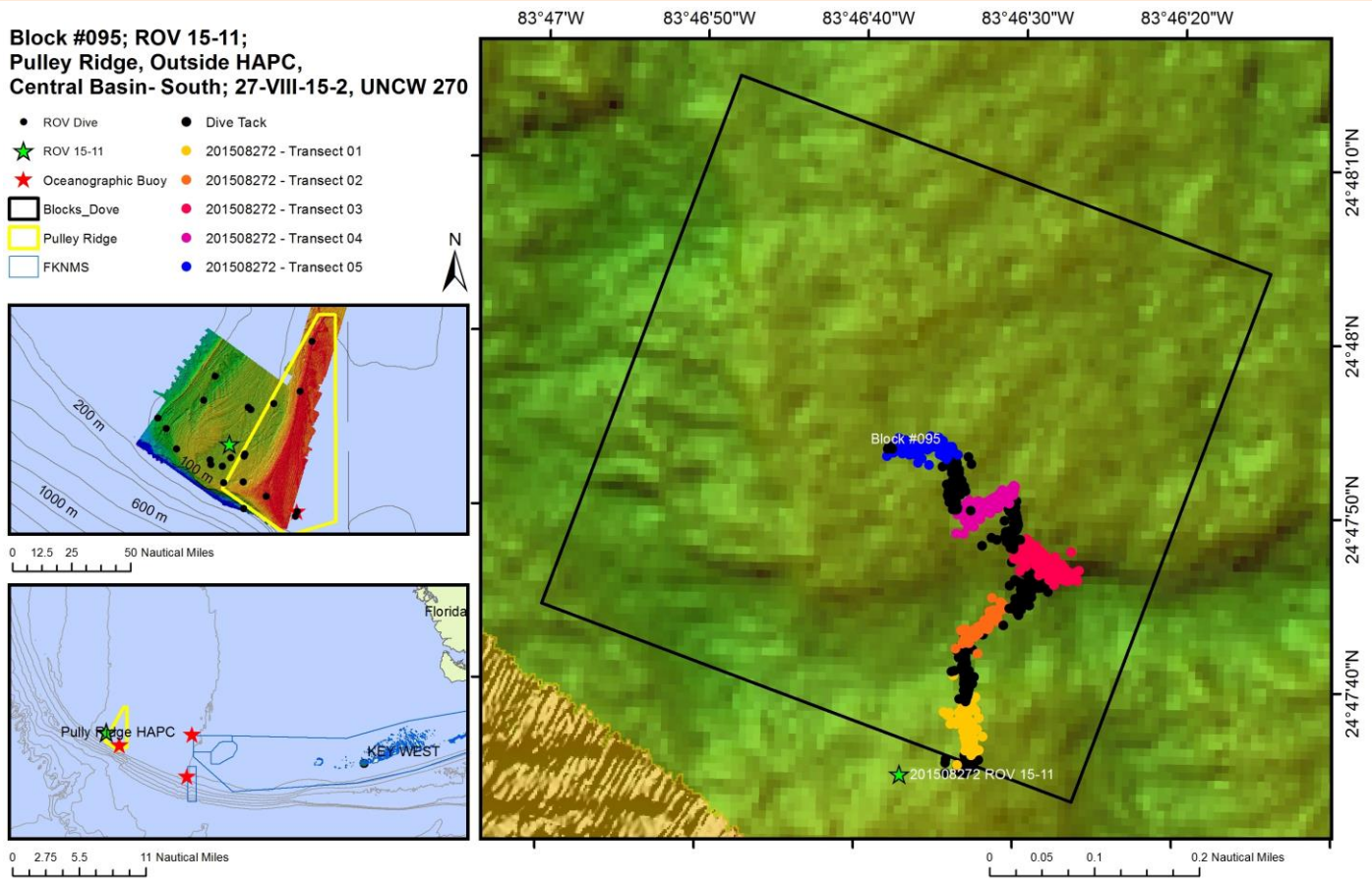
Class/Order/Family/Common name -Taxa	ROV 15-10 No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
fish unid.- Actinopteri	1	0.0020
Beryciformes		
Holocentridae		
Squirrelfish unid.- *Holocentrus* sp.	13	0.0260
Perciformes		
Chaetodontidae		
bank butterflyfish- *Prognathodes aya*	2	0.004
Longsnout butterflyfish- *Prognathodes aculeatus*	2	0.0040
reef butterflyfish- *Chaetodon sedentarius*	4	0.0080
Haemulidae		
striped grunt- *Haemulon striatum*	90	0.1800
Labridae		
red hogfish- *Decodon puellaris*	1	0.002
spotfin hogfish- *Bodianus pulchellus*	2	0.0040
Pomacanthidae		
cherubfish- *Centropyge argi*	3	0.0060
Pomacentridae		
Chromis unid.- *Chromis* sp.	2	0.0040
purple reeffish- *Chromis scotti*	3	0.0060
sunshine chromis/sunshinefish- *Chromis insolata*	6	0.0120
yellowtail reeffish- *Chromis enchrysurus*	40	0.0800
Priacanthidae		
bigeye- *Priacanthus arenatus*	2	0.004
Scaridae		
Greenblotch parrotfish- *Sparisoma atomarium*	5	0.0100
Serranidae		
chalk bass- *Serranus tortugarum*	2	0.0040
orangeback bass- *Serranus annularis*	4	0.0080
wrasse bass- *Liopropoma eukrines*	6	0.0120
Scorpaeniformes		
Scorpaenidae		
lionfish- *Pterois volitans*	4	0.0080
Tetraodontiformes		

Dive Site: Pulley Ridge, Outside HAPC; Block 90, Central Basin- South; ROV 15-10, UNCW 269

Tetraodontidae		
Sharpnose Puffer- *Canthigaster rostrata*	2	0.004
Grand Total	**194**	**0.1800**

Dive Site: Pulley Ridge, Outside HAPC; Block 95, Central Basin- South; ROV 15-11, UNCW 270

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html
Scientific Observers:	Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	Naar_pulley_10m1_TIF
Purpose:	Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction
ROV:	Mohawk ROV
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II

ROV Sensors: Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density

Date of Dive:	8/27/2015	**Specimens:**	
Ship Position System:	DGPS	**Digital Photos:**	171
Report Analyst:	John Reed, Stephanie Farrington	**DVD:**	2
Date Compiled:	1/27/2017	**Hard Drive:**	1

Dive Site: Pulley Ridge, Outside HAPC; Block 95, Central Basin- South; ROV 15-11, UNCW 270

Dive Data:

Minimum Bottom Depth (m):	78.6	**Total Transect Length (km):**	1.017
Maximum Bottom Depth (m):	82.7	**Surface Current (kn):**	0.7
On Bottom (Time- GMT):	11:03	**On Bottom (Lat/Long):**	24.79°N; -83.78°W
Off Bottom (Time- GMT):	12:54	**Off Bottom (Lat/Long):**	24.8°N; -83.78°W
Physical (bottom); Temp (°C):	19.83	**Salinity:** 36.42 **Visibility (ft):** 33	**Current (kn):**

Physical Environment:

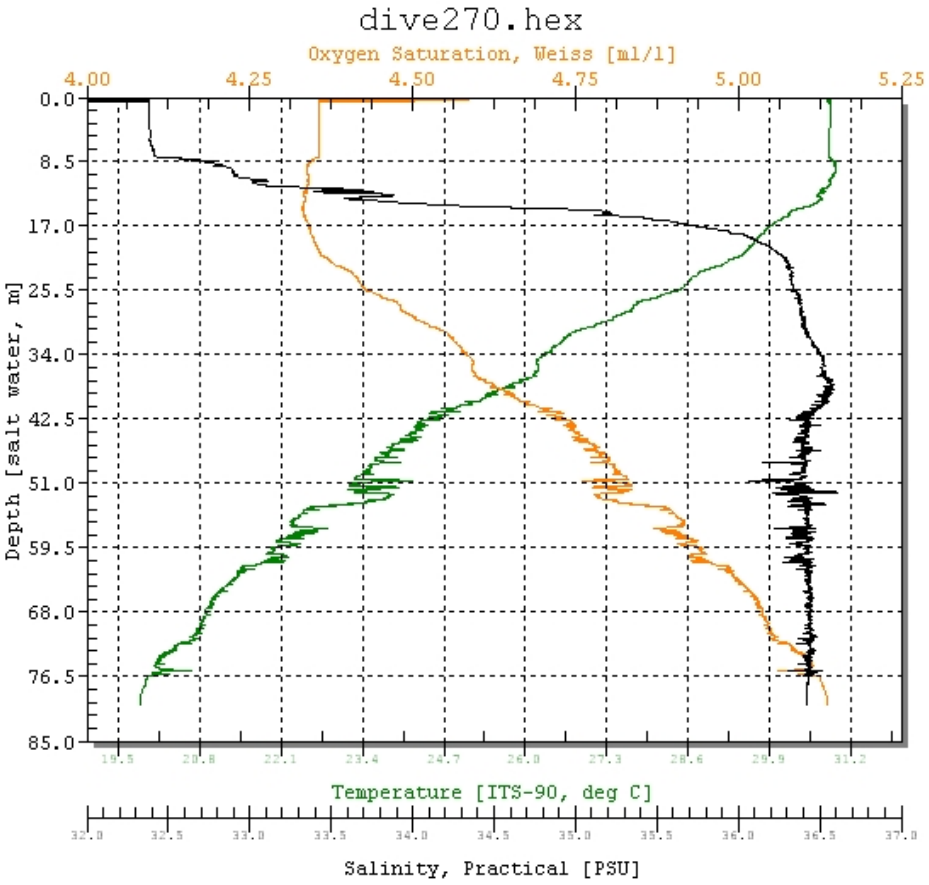


Figure 1: Shows the CTD data during the descent of ROV 15-11. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-11 are as follows: max depth: 81.92 m, temperature: 19.85 °C, conductivity: 49500 µS/cm, pressure: 119.5 PSI, salinity: 36.42 PSU, sound velocity: 1524.02 m/s, oxygen concentration: 5.15 ml/l, density: 1026.24 Kg/m^3, nitrogen saturation: 9.45 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Outside HAPC; Block 95, Central Basin- South; ROV 15-11, UNCW 270

Dive Imagery:

Figure 2: -80.5 m
Lionfish (10 cm lasers).

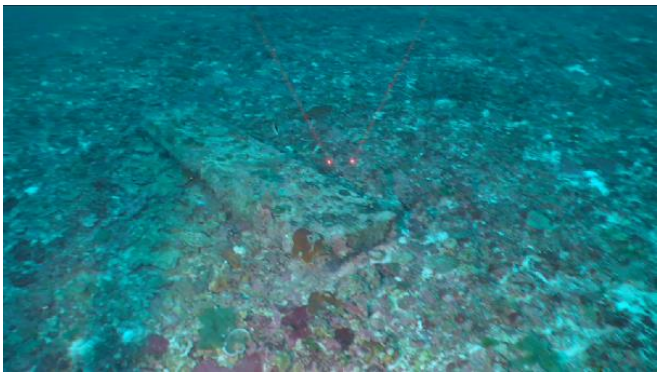


Figure 3: -80.7 m
Human debris (10 cm lasers).

Figure 4: -82.3 m
Basketstarfish closed up on black coral stem.

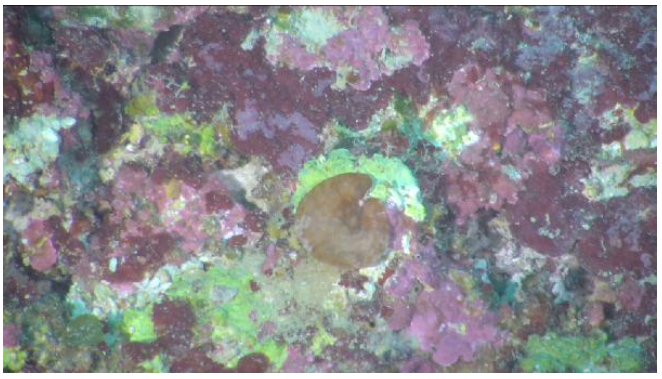


Figure 5: -81.5 m
Small *Agaricia* sp. Coral recruit with various species of pink and purple coralline algae.

Dive Site: Pulley Ridge, Outside HAPC; Block 95, Central Basin- South; ROV 15-11, UNCW 270

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 27-VIII-15-2; ROV Dive 15-11; Mohawk UNCW Dive 270. Target Site: Florida, outside Pulley Ridge HAPC, south Central Basin, random blocks #95; 81 m.

Objectives- Ground truth MB map (low resolution USGS); conduct five random 100-m photo/video transects within block. Conduct video transects for fish population characterization and photo transects for habitat and benthic macrobiota characterization. Collect benthic macro-organisms for taxonomy voucher specimens.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/125, auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom; photos were taken every 30 seconds. Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. Five random 100 m quantitative transects were conducted in each Block. Each 100 m transect was conducted at ~0.25 kn, for 15-20 minutes until the ROV passed through 100 m circle overlaid on navigation screen; quantitative still images were taken every 30 sec for a minimum of 30 images per transect. Off transects between the quantitative transects were 15-20 minutes for close-up video frame grabs of fish and biota, and for collections. Direction of transects were random, but generally headed NE or NW, depending on the ship's maneuverability with the wind and current.

Site Description/Habitat

Depth range: 80.5 to 82.6 m.
MB- Low resolution (USGS) sonar shows shallow valley cut E-W south of plateau.
10:56- Launch. Cloudy, seas 1' from SW, 7 kn from SW, surface water- 30.810°C, salinity 32.553 (halocline on CTD at 20 m), current 0.7 kn from NW.
11:04- On bottom, 81.8 m, head N. MB- in valley. Visibility 10 m, bottom temp 19.84°C, salinity 36.42, current low.
11:07- Start Transect 1, 81.4 m, head N; 95% hard bottom, pavement/rubble/cobble; CCA, sparse Anadyomene, demosponges uncommon; Agaricia 5-10 cm common (1-2/most photos), M. decactis.
11:24- End XS 1, 81.4 m. Head NE 100 m.
11:33- Start XS 2, 82.6 m, head NE; in valley, 1 m relief; 95% hard bottom, pavement/rubble/cobble; CCA dominant, *Verdigellas*, *Halimeda* sparse; demosponges uncommon, *Agelas* cup, *Geodia neptuni*; *Agaricia* 5-10 cm common.
11:48- End XS 2, 82.3 m. Head NE 100 m.
11:55- Start XS 3, 82.4 m, head NW; MB- north slope of valley. 90% hard bottom, rubble/cobble/pavement; same biota; demosponges uncommon, no octocorals; 5-10 cm *Agaricia* common but not abundant.
12:10- End XS 3, 81.1 m. Head N 100 m. Pit with 3 lionfish.
12:15- Start XS 4, 80.7 m, Head N?; MB- on plateau, 2 m relief to valley. Same habitat, biota, sparse *Anadyomene*.
12:28- End XS 4, 80.5 m. Head N 100 m. 2 m pit- 2 lionfish, reef fish.
12:38- Start XS 5, 80.7 m, head NW; MB- top of plateau; 95% rubble/cobble/pavement; CCA, *Antipathes*, demosponges uncommon- *Geodia neptuni*; Stylaster, no octocorals, *Davidaster*, *M. decactis*, *M. brueggemanni*, *Agaricia* 5-10 cm common (1-2/most photos).
12:52- End XS 5, 80.6 m. End dive.

Dominant Benthic Macrobiota:

CCA dominant on rubble, *Verdigellas*, sparse *Halimeda*; demosponges uncommon, *Antipatharia* uncommon; octocoral uncommon- *Telesto*; Coral- *M. decactis*, *M. brueggemanni*, *Agaricia* 5-10 cm common (1-2 in most

photos).

Species List from Dive Notes:
Cnidaria: Alcyonacea- gorgonian, *Telesto* sp. -
Anthoathecata: *Stylaster* sp. - hydrocoral - unidentified,
Antipatharia Antipatharia - black corals, *Antipathes atlantica*, *Antipathes furcata*, *Antipathes* sp., *Stichopathes lutkeni* - black sea whip
Scleractinia: *Agaricia* sp., *Madracis brueggemanni*, *Madracis decactis*, *Scolymia* sp.,
Porifera: *Agelas*- PR3, Axinellidae, *Xestospongia muta*, *Polymastia* sp., *Geodia neptuni* complex
Human debris: Human debris- cans/bottles - , Human debris- unid. -
Chordata: *Holocentrus* sp. - Squirrelfish unid., *Apogon* sp. - cardinalfish unid., *Bodianus pulchellus* - spotfin hogfish, *Centropyge argi* - cherubfish, *Chaetodon sedentarius* - reef butterflyfish, *Chromis enchrysurus* - yellowtail reeffish, *Chromis insolata* - sunshine chromis/sunshinefish, *Chromis scotti* - purple reeffish, *Chromis* sp. - Chromis unid., *Epinephelus* sp. - graysby, *Haemulon vittata* - Boga, *Holacanthus tricolor* - rock beauty, Labridae - wrasse unid., *Liopropoma eukrines* - wrasse bass, *Priacanthus arenatus* - bigeye, *Prognathodes aculeatus* - Longsnout butterflyfish, *Prognathodes aya* - bank butterflyfish, *Serranus annularis* - orangeback bass, *Serranus phoebe* - tattler, *Serranus tortugarum* - chalk bass, *Sparisoma atomarium* - Greenblotch parrotfish, *Pterois volitans* - lionfish, *Canthigaster* sp. - sharpnose puffer

No samples.

Dive Site: Pulley Ridge, Outside HAPC; Block 95, Central Basin- South; ROV 15-11, UNCW 270

CPCe Percent Cover Analysis:

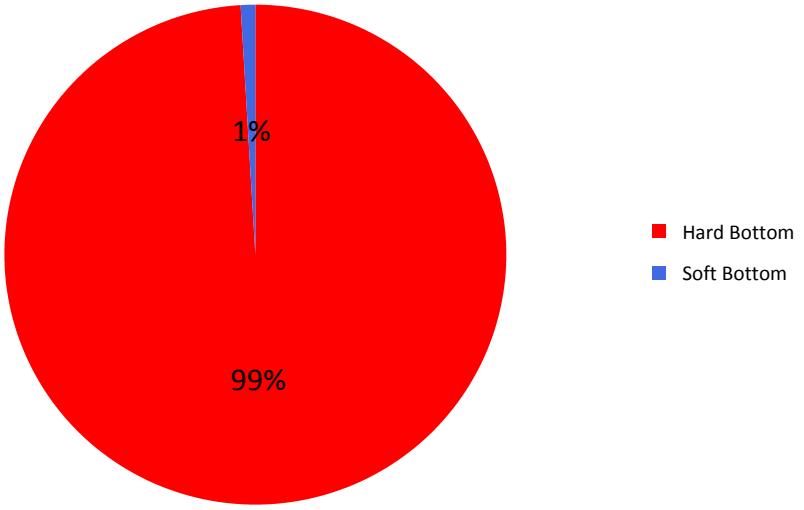
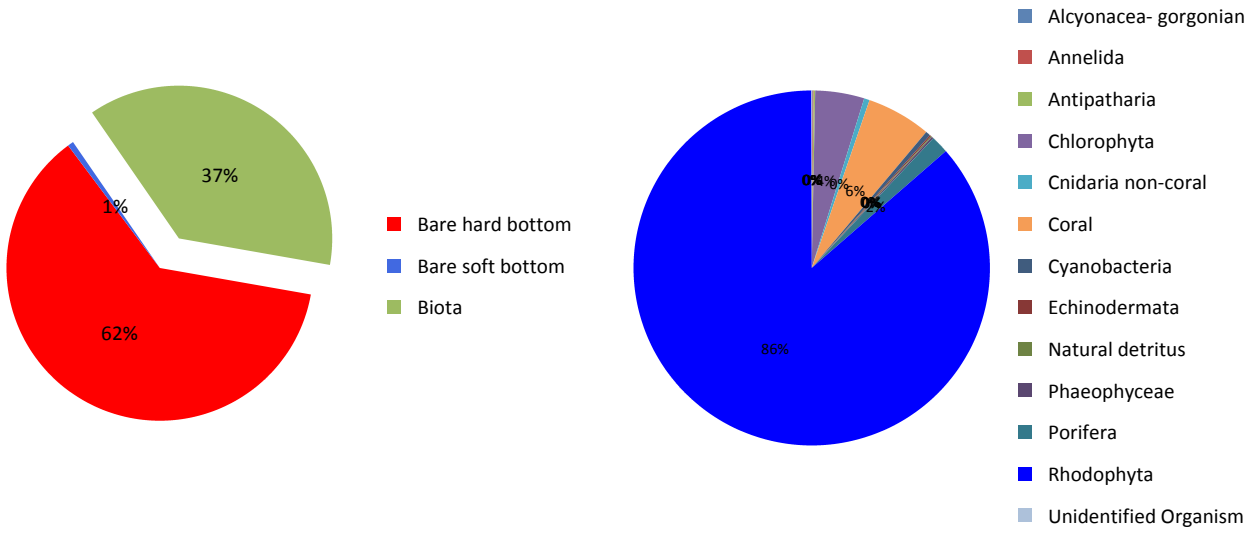


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-11. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-11.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Outside HAPC; Block 95, Central Basin- South; ROV 15-11, UNCW 270

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-11.

Group/Phylum/Taxa	ROV 15-11
Biota	37.37%
Chlorophyta	1.67%
Anadyomene menziesii	0.03%
Chlorophyta	0.07%
Halimeda copiosa	0.03%
Valonia ventricosa	0.07%
Verdigellas peltata	1.47%
Ochrophyta	0.07%
Dictyota sp.	0.07%
Rhodophyta	32.28%
Corallinales (crustose coralline)	32.07%
Peyssonnelia sp.	0.22%
Cyanobacteria	0.17%
Cyanobacteria	0.17%
Porifera	0.60%
Demospongiae	0.17%
Demospongiae- PR14	0.02%
Poecilosclerida	0.02%
Polymastia sp.	0.35%
Xestospongia muta	0.05%
Cnidaria	2.45%
Agaricia fragilis	0.12%
Agaricia sp.	0.83%
Alcyonacea- gorgonian	0.03%
Antipatharia	0.03%
Corallimorpharia	0.02%
Hydroidolina	0.02%
Madracis brueggemanni	0.20%
Madracis decactis	0.98%
Madracis formosa	0.05%
Stichopathes lutkeni	0.02%
Stylasteridae	0.15%
Annelida	0.03%
Hermodice carunculata	0.03%
Echinodermata	0.05%
Asteroidea	0.02%

Dive Site: Pulley Ridge, Outside HAPC; Block 95, Central Basin- South; ROV 15-11, UNCW 270

Davidaster discoideus	0.03%
detritus	0.03%
UNKNOWN	0.02%
Unidentified organism	0.02%
Bare hard bottom	62.02%
Habitat	62.02%
Bare dead coral plate	0.12%
Bare rock	1.20%
Bare rubble/cobble	60.70%
Bare soft bottom	0.62%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Outside HAPC; Block 95, Central Basin- South; ROV 15-11, UNCW 270

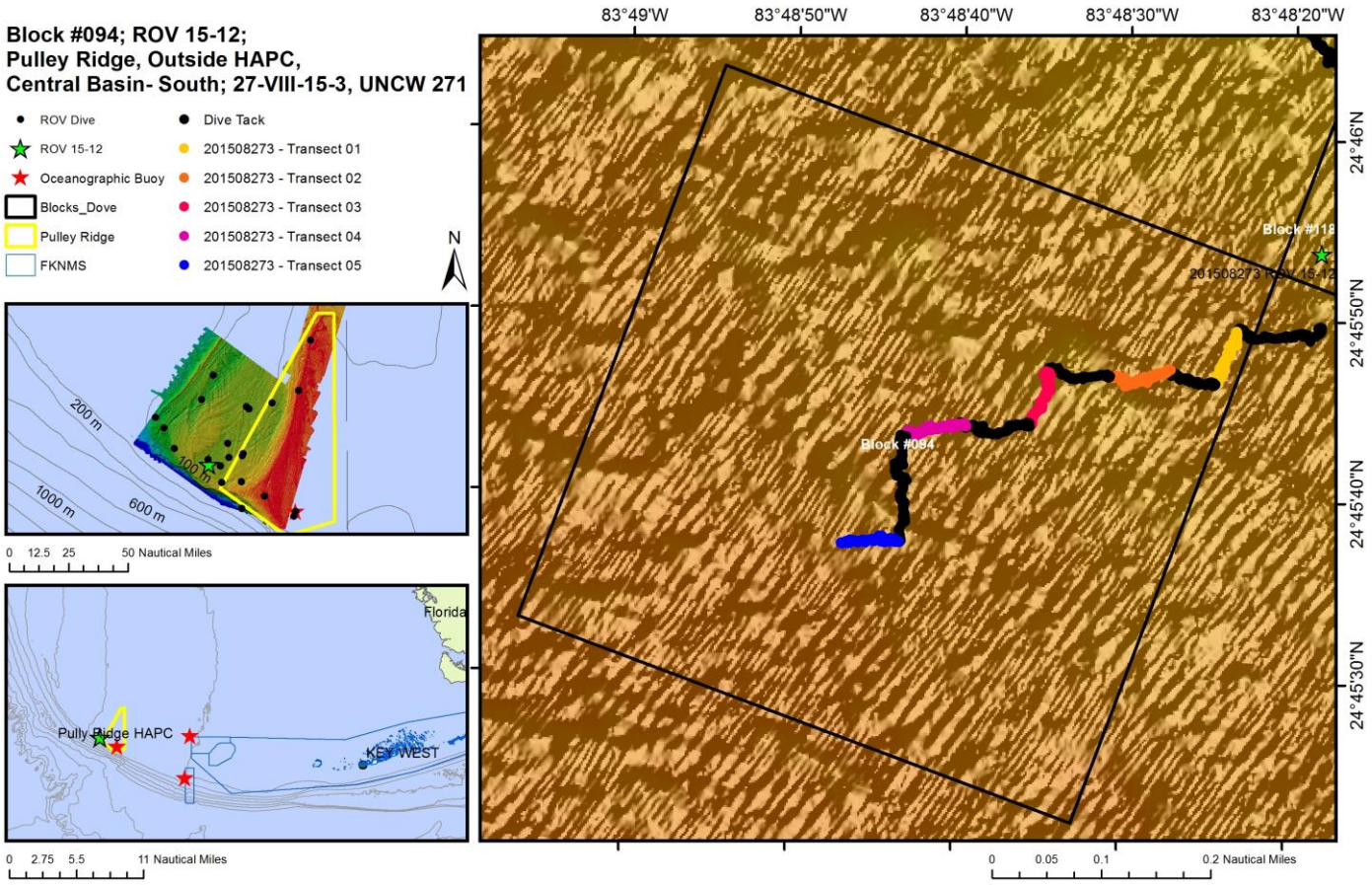
Density of Fish:

Table 2. Density (# individuals/m) of fish from video transects at dive site ROV 15-11.

Class/Order/Family/Common name -Taxa	No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
fish unid.- Actinopteri	4	0.0080
Beryciformes		
Holocentridae		
Squirrelfish unid.- *Holocentrus* sp.	3	0.0060
Perciformes		
Chaetodontidae		
bank butterflyfish- *Prognathodes aya*	1	0.002
Longsnout butterflyfish- *Prognathodes aculeatus*	1	0.0020
reef butterflyfish- *Chaetodon sedentarius*	5	0.0100
Labridae		
spotfin hogfish- *Bodianus pulchellus*	3	0.0060
Pomacanthidae		
cherubfish- *Centropyge argi*	4	0.0080
rock beauty- *Holacanthus tricolor*	3	0.0060
Pomacentridae		
Chromis unid.- *Chromis* sp.	7	0.0140
purple reeffish- *Chromis scotti*	1	0.0020
sunshine chromis/sunshinefish- *Chromis insolata*	5	0.0100
yellowtail reeffish- *Chromis enchrysurus*	44	0.0880
Priacanthidae		
bigeye- *Priacanthus arenatus*	2	0.004
Scaridae		
Greenblotch parrotfish- *Sparisoma atomarium*	1	0.0020
Serranidae		
orangeback bass- *Serranus annularis*	2	0.0040
red grouper- *Epinephelus morio*	1	0.0020
tattler- *Serranus phoebe*	1	0.002
wrasse bass- *Liopropoma eukrines*	7	0.0140
Grand Total	**95**	**0.0880**

Dive Site: Pulley Ridge, Outside HAPC; Block 94, Central Basin- South; ROV 15-12, UNCW 271

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html
Scientific Observers:	Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	Naar_pulley_10m1_TIF
Purpose:	Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction
ROV:	Mohawk ROV
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II

ROV Sensors: Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density

Date of Dive:	8/27/2015	**Specimens:**	
Ship Position System:	DGPS	**Digital Photos:**	180
Report Analyst:	John Reed, Stephanie Farrington	**DVD:**	2
Date Compiled:	1/27/2017	**Hard Drive:**	1

Dive Site: Pulley Ridge, Outside HAPC; Block 94, Central Basin- South; ROV 15-12, UNCW 271

Dive Data:

Minimum Bottom Depth (m):	76.5	**Total Transect Length (km):**	1.131
Maximum Bottom Depth (m):	81.5	**Surface Current (kn):**	0.5
On Bottom (Time- GMT):	14:07	**On Bottom (Lat/Long):**	24.76°N; -83.8°W
Off Bottom (Time- GMT):	16:08	**Off Bottom (Lat/Long):**	24.76°N; -83.81°W
Physical (bottom); Temp (°C):	20.22	**Salinity:** 36.43 **Visibility (ft):** 12	**Current (kn):** 0.24

Physical Environment:

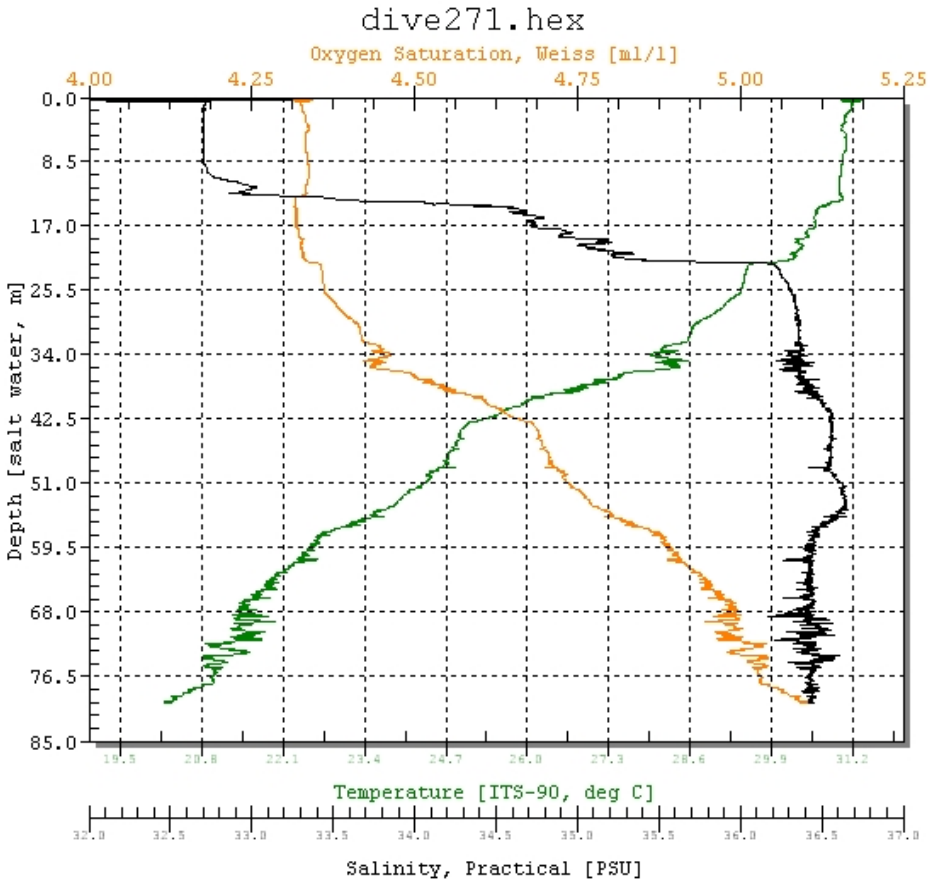


Figure 1: Shows the CTD data during the descent of ROV 15-12. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-12 are as follows: max depth: 80.49 m, temperature: 20.3 °C, conductivity: 50000 µS/cm, pressure: 117.4 PSI, salinity: 36.43 PSU, sound velocity: 1525.24 m/s, oxygen concentration: 5.1 ml/l, density: 1026.13 Kg/m^3, nitrogen saturation: 9.38 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Outside HAPC; Block 94, Central Basin- South; ROV 15-12, UNCW 271

Dive Imagery:

Figure 2: -80.2 m
Human debris, battery.

Figure 3: -79.7 m
Aplysina lacunosa tube sponge.

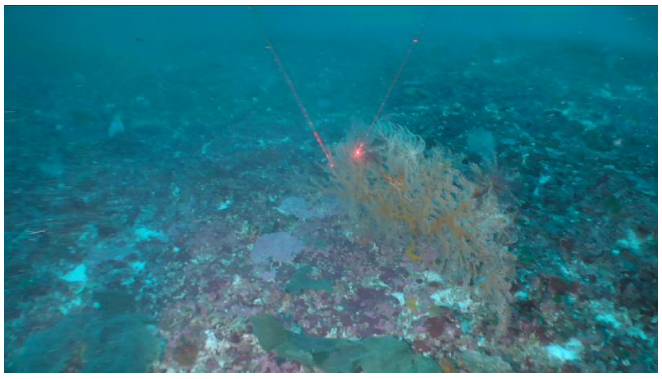


Figure 4: -79.7 m
Swiftia exserta gorgonian.

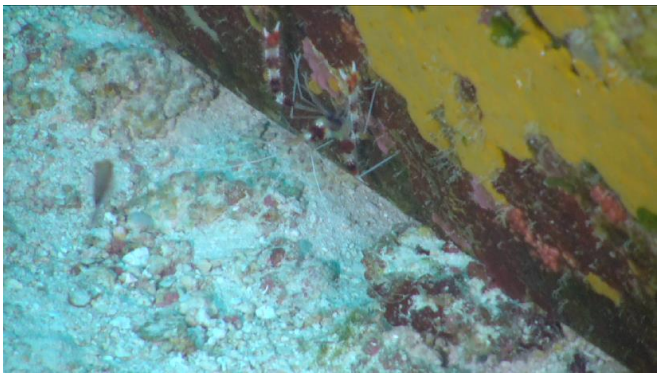


Figure 5: -80.3 m
Stenopus hispidus banded shrimp making habitat out of human debris (battery).

Dive Site: Pulley Ridge, Outside HAPC; Block 94, Central Basin- South; ROV 15-12, UNCW 271

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 27-VIII-15-3; ROV Dive 15-12; Mohawk UNCW Dive 271. Target Site: Florida, outside Pulley Ridge HAPC, south Central Basin, random block #94; 81 m.

Objectives- Ground truth MB map (low resolution USGS); conduct five random 100-m photo/video transects within block. Conduct video transects for fish population characterization and photo transects for habitat and benthic macrobiota characterization. Collect benthic macro-organisms for taxonomy voucher specimens.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/125, auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom; photos were taken every 30 seconds. Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. Five random 100 m quantitative transects were conducted in each Block. Each 100 m transect was conducted at ~0.25 kn, for 15-20 minutes until the ROV passed through 100 m circle overlaid on navigation screen; quantitative still images were taken every 30 sec for a minimum of 30 images per transect. Off transects between the quantitative transects were 15-20 minutes for close-up video frame grabs of fish and biota, and for collections. Direction of transects were random, but generally headed NE or NW, depending on the ship's maneuverability with the wind and current.

Site Description/Habitat

Depth range: 79.1 to 81.5 m.
MB- Low resolution (USGS) sonar shows flat, featureless bottom.
14:02- Launch. P/cloudy, seas 1' from SW, 3 kn from W, surface water- 31.165°C, salinity 32.708 (halocline on CTD 20 m from Mississippi outflow), current 0.8 from NW.
14:07- On bottom, 81.5 m; sand tilefish mound. Visibility 15 m, temp 20.22°C, salinity 36.43, current ¼ kn from NE.
14:17- Start XS 1, 80.5 m, head SW; 95% hard bottom, pavement/rubble/cobble; CCA/Peyssonnelia, 10% *Anadyomene*, *Davidaster*; corals- 5-10 cm *Agaricia* abundant (in most photos), *M. decactis*, *M. brueggemanni*, Stylaster.
14:29- End XS 1, 80.1 m. Head W 100 m. 2 m pit- red grouper, 3 lionfish, reef fish.
14:37- Start XS 2, 80.1 m, head W; 95% hard bottom, pavement/rubble/cobble; same biota; *Anadyomene* sparse; *Agaricia* 5 cm common.
14:58- End XS 2, 80.5 m. Head W 100 m.
15:07- Start XS 3, 80.9 m, head SW; 95% hard bottom, pavement/rubble/cobble; same biota, 1-5% *Anadyomene*; *Agaricia* 5 cm abundant.
15:20- End XS 3, 79.9 m. Head W 100 m.
15:29- Start XS 4, 79.8 m, head W; 95% hard bottom, same habitat, 5% *Anadyomene*; 5 cm *Agaricia* common; 3 m pit- scamp, 4 lionfish.
15:40(?)- End XS 4, 79.6 m. Head S 100 m. 30 cm *Swiftia exserta*. Manipulator broke- no collections.
15:54- Start XS 5, 79.8 m, head W; 95% hard bottom; same habitat, biota, 5% *Anadyomene*; 5 cm *Agaricia* common, not abundant. No pits.
16:09- End XS 5, 79.1 m. End dive.

Dominant Benthic Macrobiota:

Algae- CCA covers all bare rock, *Peyssonnelia*, *Verdigellas*, *Anadyomene* sparse 1-5%

Dive Site: Pulley Ridge, Outside HAPC; Block 94, Central Basin- South; ROV 15-12, UNCW 271

Corals- *M*. *decactis*, *M*. *brueggemanni*; *Agaricia* 5 cm common, not abundant; Stylaster.
Antipatharia- *Antipathes atlantica*, spp.
Octocorals- 1 *Swiftia exserta*
Demosponges- *Geodia neptuni*, *X*. *muta*, *Agelas conifer*, *Aplysina rigida*
Crinoids- *Davidaster*
Fish- few pits, few lionfish, 1 red grouper, scamp, reef fish

No samples- manipulator jaw broke.

Dive Site: Pulley Ridge, Outside HAPC; Block 94, Central Basin- South; ROV 15-12, UNCW 271

CPCe Percent Cover Analysis:

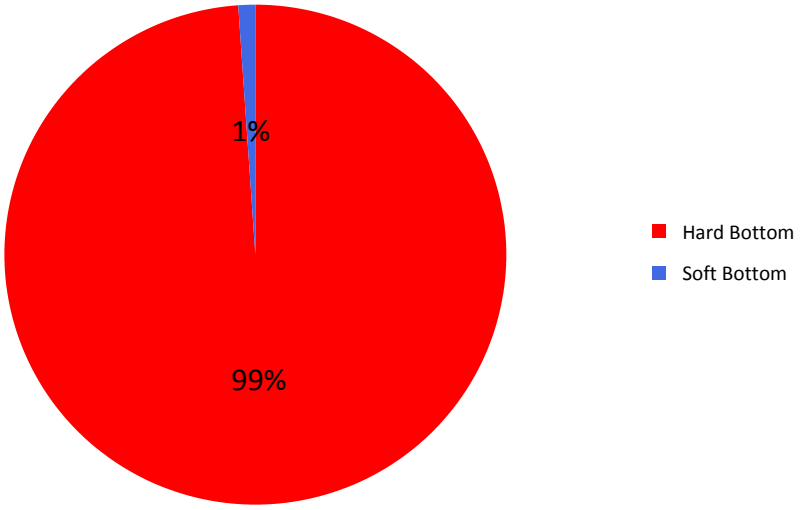
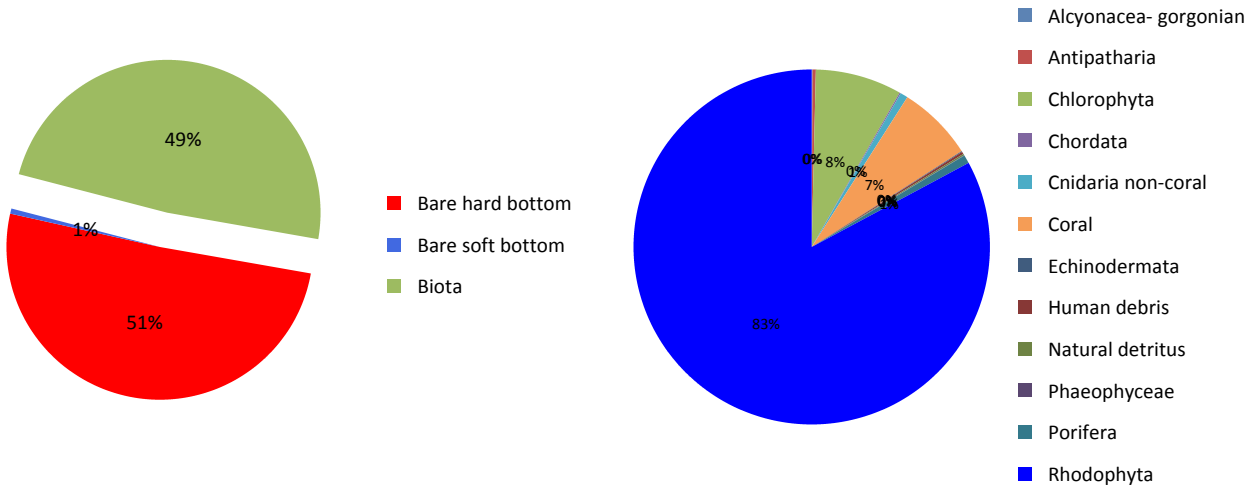


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-12. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-12.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Outside HAPC; Block 94, Central Basin- South; ROV 15-12, UNCW 271

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-12.

Group/Phylum/Taxa	ROV 15-12
Biota	48.63%
Chlorophyta	3.82%
Anadyomene menziesii	1.87%
Chlorophyta	0.05%
Verdigellas peltata	1.90%
Ochrophyta	0.02%
Dictyota sp.	0.02%
Rhodophyta	40.38%
Corallinales (crustose coralline)	40.18%
Peyssonnelia sp.	0.18%
Rhodophyta- fleshy blade	0.02%
Porifera	0.37%
Agelas conifera	0.03%
Demospongiae	0.27%
Erylus sp.	0.02%
Polymastia sp.	0.02%
Xestospongia muta	0.03%
Cnidaria	3.89%
Agaricia fragilis	0.72%
Agaricia grahamae	0.05%
Agaricia sp.	1.25%
Alcyonacea- gorgonian	0.03%
Antipatharia	0.07%
Antipathes atlantica	0.07%
Antipathes furcata	0.02%
Helioseris cucullata	0.02%
Hydroidolina	0.08%
Madracis brueggemanni	0.45%
Madracis decactis	0.77%
Madracis formosa	0.08%
Oculina diffusa	0.03%
Stylasteridae	0.25%
Echinodermata	0.03%
Davidaster discoideus	0.03%
Chordata	0.05%
Actinopterygii	0.02%

Dive Site: Pulley Ridge, Outside HAPC; Block 94, Central Basin- South; ROV 15-12, UNCW 271

Ascidiacea	0.03%
detritus	0.07%
Human Debris	0.10%
Human debris	0.10%
Fishing line/long line	0.08%
Trawl gear	0.02%
Bare hard bottom	50.72%
Habitat	50.72%
Bare dead coral plate	0.17%
Bare rock	2.34%
Bare rubble/cobble	48.21%
Bare soft bottom	0.55%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Outside HAPC; Block 94, Central Basin- South; ROV 15-12, UNCW 271

Density of Fish:

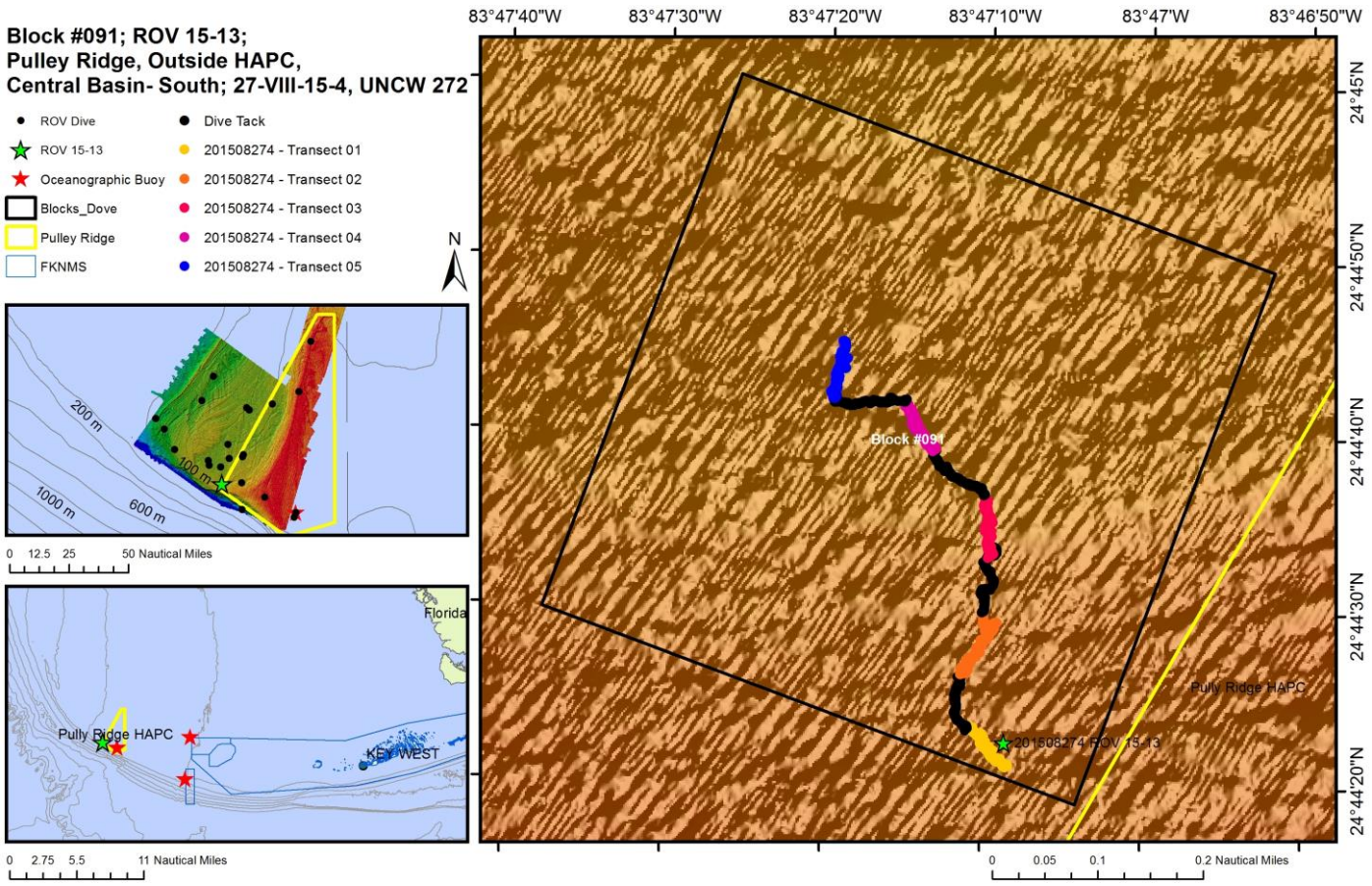
Table 2. Density (# individuals/m) of fish from video transects at dive site ROV 15-12.

Class/Order/Family/Common name -Taxa	ROV 15-12 No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
fish unid.- Actinopteri	76	0.1520
Beryciformes		
Holocentridae		
Squirrelfish unid.- *Holocentrus* sp.	7	0.0140
Perciformes		
Apogonidae		
cardinalfish unid.- *Apogon* sp.	1	0.0020
Carangidae		
amberjack- *Seriola* sp.	1	0.0020
Chaetodontidae		
Longsnout butterflyfish- *Prognathodes aculeatus*	1	0.0020
reef butterflyfish- *Chaetodon sedentarius*	13	0.0260
Labridae		
hogfish- *Lachnolaimus maximus*	1	0.002
spotfin hogfish- *Bodianus pulchellus*	8	0.0160
Wrasse unid.- *Halichoeres* sp.	2	0.004
Lutjanidae		
Snapper unid.- *Lutjanus* sp.	2	0.004
Pomacanthidae		
blue angelfish- *Holacanthus bermudensis*	1	0.002
cherubfish- *Centropyge argi*	17	0.0340
rock beauty- *Holacanthus tricolor*	7	0.0140
Pomacentridae		
Blue chromis- *Chromis cyanea*	1	0.0020
Chromis unid.- *Chromis* sp.	4	0.0080
purple reeffish- *Chromis scotti*	11	0.0220
sunshine chromis/sunshinefish- *Chromis insolata*	34	0.0680
yellowtail reeffish- *Chromis enchrysurus*	58	0.1160
Scaridae		
Greenblotch parrotfish- *Sparisoma atomarium*	5	0.0100
Serranidae		
chalk bass- *Serranus tortugarum*	4	0.0080
orangeback bass- *Serranus annularis*	11	0.0220

Dive Site: Pulley Ridge, Outside HAPC; Block 94, Central Basin- South; ROV 15-12, UNCW 271		
school bass- *Schultzea beta*	100	0.2000
wrasse bass- *Liopropoma eukrines*	7	0.0140
Scorpaeniformes		
Scorpaenidae		
lionfish- *Pterois volitans*	3	0.0060
Tetraodontiformes		
Tetraodontidae		
Sharpnose Puffer- *Canthigaster rostrata*	1	0.002
Grand Total	**376**	**0.2000**

Dive Site: Pulley Ridge, Outside HAPC; Block 91, Central Basin- South; ROV 15-13, UNCW 272

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html
Scientific Observers:	Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	Naar_pulley_10m1_TIF
Purpose:	Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction
ROV:	Mohawk ROV
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II

ROV Sensors: Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density

Date of Dive:	8/27/2015	**Specimens:**	
Ship Position System:	DGPS	**Digital Photos:**	159
Report Analyst:	John Reed, Stephanie Farrington	**DVD:**	2
Date Compiled:	1/27/2017	**Hard Drive:**	1

Dive Site: Pulley Ridge, Outside HAPC; Block 91, Central Basin- South; ROV 15-13, UNCW 272

Dive Data:

Minimum Bottom Depth (m):	76.3	**Total Transect Length (km):**	1.011
Maximum Bottom Depth (m):	79.6	**Surface Current (kn):**	0.5
On Bottom (Time- GMT):	16:47	**On Bottom (Lat/Long):**	24.74°N; -83.79°W
Off Bottom (Time- GMT):	18:27	**Off Bottom (Lat/Long):**	24.75°N; -83.79°W
Physical (bottom); Temp (°C):	20.01	**Salinity:** 36.42 **Visibility (ft):** 45	**Current (kn):** 0.25

Physical Environment:

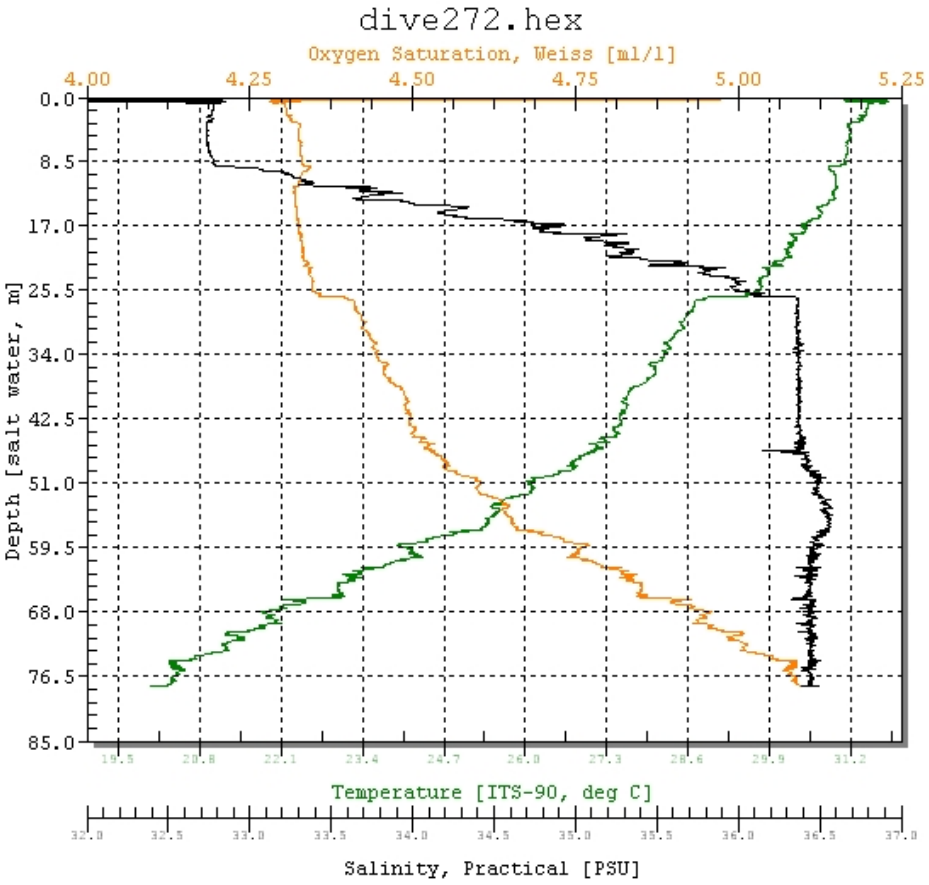


Figure 1: Shows the CTD data during the descent of ROV 15-13. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-13 are as follows: max depth: 78.96 m, temperature: 20.01 °C, conductivity: 49700 µS/cm, pressure: 115.18 PSI, salinity: 36.43 PSU, sound velocity: 1524.41 m/s, oxygen concentration: 5.13 ml/l, density: 1026.2 Kg/m^3, nitrogen saturation: 9.42 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Outside HAPC; Block 91, Central Basin- South; ROV 15-13, UNCW 272

Dive Imagery:

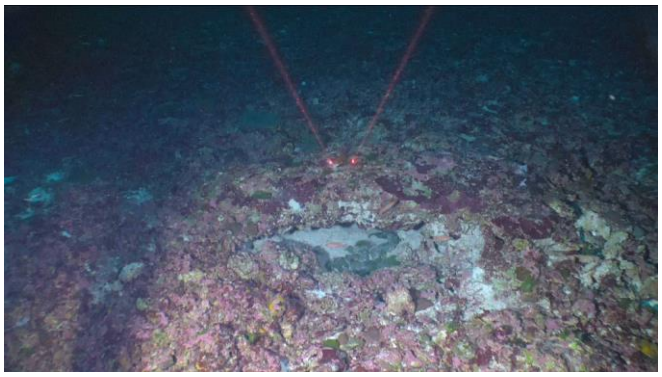


Figure 2: -79.4 m
Rock pavement, rubble habitat (10 cm lasers).

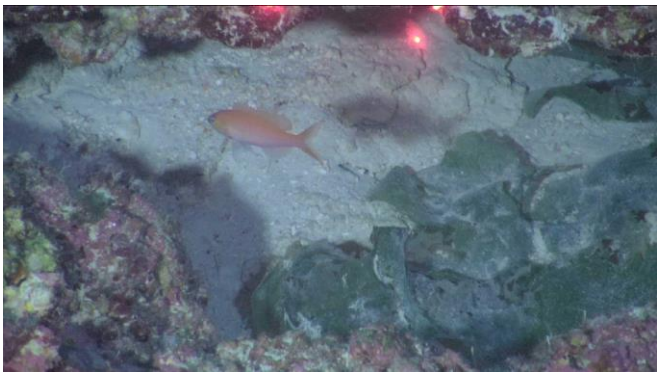


Figure 3: -79.4 m
Anthiid fish in red grouper pit.

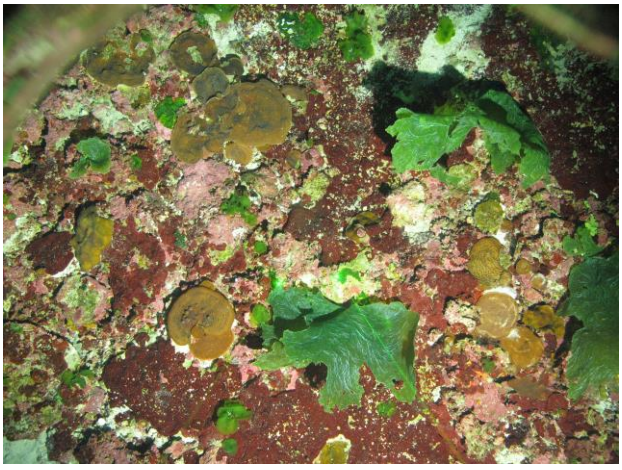


Figure 4: -78.5 m
Dense cover of plate corals *Agaricia* spp., lettuce algae *Anadyomene menziesii*, and crustose coralline algae.

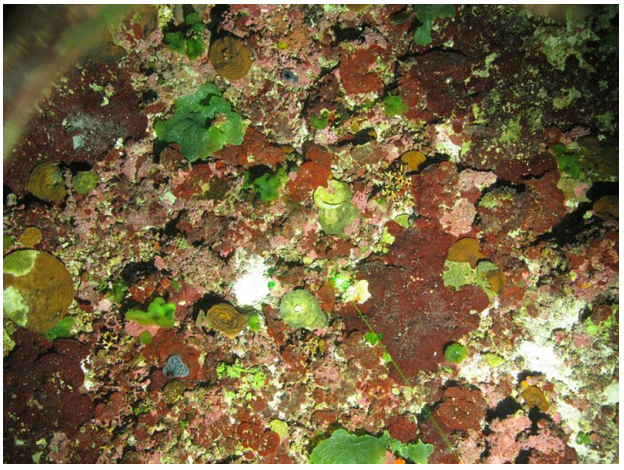


Figure 5: -77.7 m
Rock pavement and cobble habitat with dense cover of corals, sponges, and algae. *Agaricia fragilis* plate coral at left shows signs of disease and recent die-off (white and green patches).

Dive Site: Pulley Ridge, Outside HAPC; Block 91, Central Basin- South; ROV 15-13, UNCW 272

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 27-VIII-15-4; ROV Dive 15-13; Mohawk UNCW Dive 272. Target Site: Florida, outside Pulley Ridge HAPC, south Central Basin, random block #91; 81 m.

Objectives- Ground truth MB map (low resolution USGS); conduct five random 100-m photo/video transects within block. Conduct video transects for fish population characterization and photo transects for habitat and benthic macrobiota characterization. Collect benthic macro-organisms for taxonomy voucher specimens.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/125, auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom; photos were taken every 30 seconds. Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. Five random 100 m quantitative transects were conducted in each Block. Each 100 m transect was conducted at ~0.25 kn, for 15-20 minutes until the ROV passed through 100 m circle overlaid on navigation screen; quantitative still images were taken every 30 sec for a minimum of 30 images per transect. Off transects between the quantitative transects were 15-20 minutes for close-up video frame grabs of fish and biota, and for collections. Direction of transects were random, but generally headed NE or NW, depending on the ship's maneuverability with the wind and current.

Site Description/Habitat

Depth range: 78.2 to 79.6 m.
MB- Low resolution (USGS) sonar shows flat, featureless bottom.
16:42- Launch. P/cloudy, seas calm, 5 kn from NW, surface seawater- 31.626°C, salinity 32.788 (halocline 25 m from Mississippi outflow seen in satellite), current 0.5 kn from NW.
16:17- On bottom, 78.9 m; 15 m visibility, 20.01°C, salinity 36.42, current 1/8 kn from NE.
16:49- Start XS 1, 78.9 m, head NW; 95% hard bottom, dense pavement with rubble/cobble; dense cover CCA, 30-50% *Anadyomene*, *Antipatharia atlantica*, *Davidaster* crinoid; coral- 5-10 cm *Agaricia* abundant (several in most photos), M. brueggemanni, M. decactis; sponges uncommon.
17:04- End XS 1. Head N 100 m. 30 cm Agaricia.
17:09- Start XS 2, 78.3 m, head NE; 95% hard bottom, same habitat, biota; 30% *Anadyomene*, 5-10 cm *Agaricia* abundant; pit with few lionfish.
17:24- End XS 2. Head N 100 m. Pit- several lionfish.
17:33- Start XS 3, 78.7 m, head N; 90% hard bottom; mostly pavement, same biota; 10% *Anadyomene*; *Agaricia* abundant, few 30-40 cm *Agaricia*.
17:46- End XS 3, 79.5 m. Head NW 100 m. Pit- 1 anthiid, first seen on cruise.
17:54- Start XS 4, 79.5 m, head NW; 95% hard bottom, same habitat, biota; 5% *Anadyomene*; *Agaricia* abundant, 1 30-cm *Agaricia*.
18:08- End XS 4. Head W 100 m. 8 red snapper.
18:16- Start XS 5, 79.2 m, head N; 95% hard bottom, same habitat, biota; 5% *Anadyomene*, 5-10 cm *Agaricia* abundant (several/most photos), few 20-30 cm.
18:27- End XS 5, 79.6 m; end dive.

Dominant Benthic Macrobiota:

Algae- CCA covers all bare rock, Peyssonnelia, *Halimeda* sparse, *Anadyomene* sparse 1-5%30-50%.

Dive Site: Pulley Ridge, Outside HAPC; Block 91, Central Basin- South; ROV 15-13, UNCW 272

Corals- *M*. *decactis*, *M*. *brueggemanni*; Agaricia 5-10 cm abundant (several in most photos), several 20-40 cm; Stylaster.
Antipatharia sparse- Antipathes atlantica, spp., Stichopathes lutkeni
Octocorals- Telesto, orange gorgonian
Demosponges sparse- *Niphates*
Crinoids- *Davidaster*
Fish- few pits, few lionfish, 1 anthiid (first seen on cruise), 8 red snapper

No samples- manipulator jaw broke.

Dive Site: Pulley Ridge, Outside HAPC; Block 91, Central Basin- South; ROV 15-13, UNCW 272

CPCe Percent Cover Analysis:

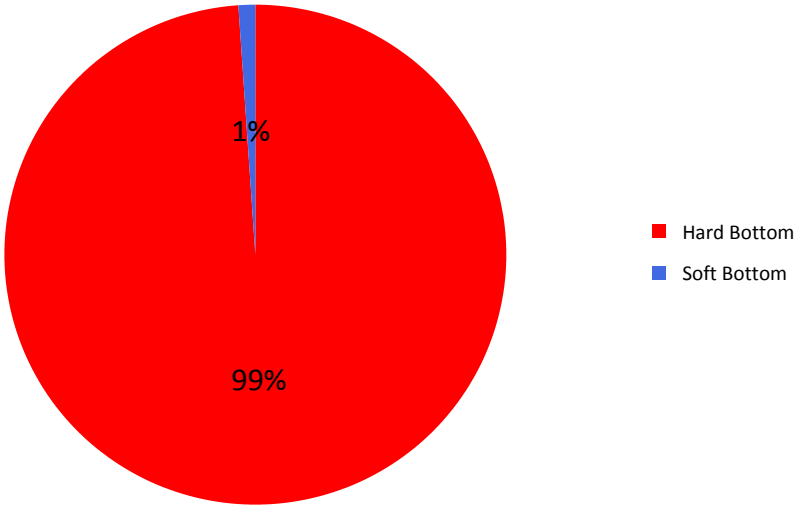
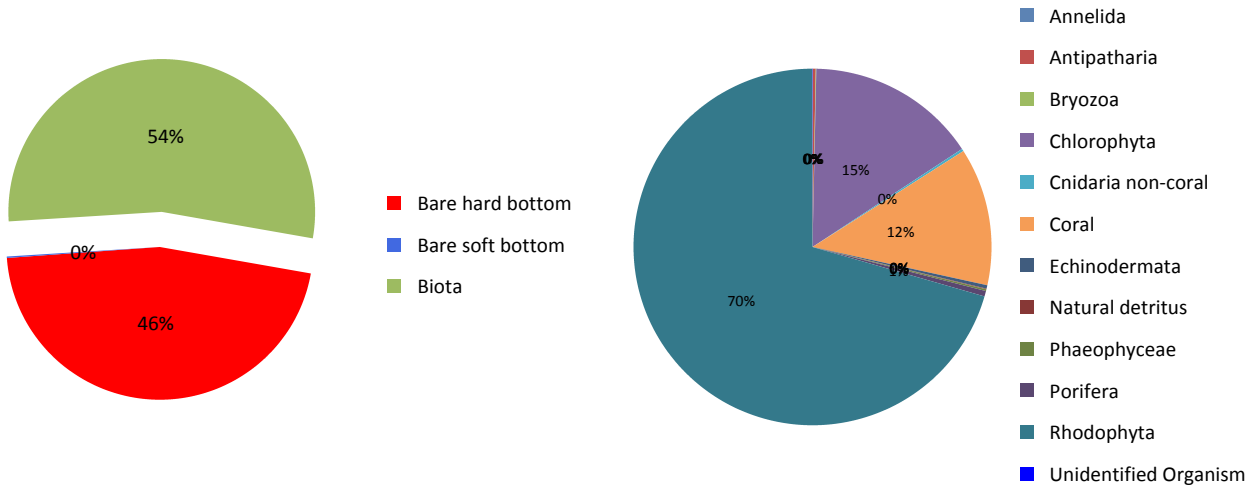


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-13. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-13.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Outside HAPC; Block 91, Central Basin- South; ROV 15-13, UNCW 272

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-13.

Group/Phylum/Taxa	ROV 15-13
Biota	53.77%
Chlorophyta	8.28%
Anadyomene menziesii	6.65%
Chlorophyta	0.03%
Verdigellas peltata	1.60%
Ochrophyta	0.08%
Dictyota sp.	0.08%
Rhodophyta	37.90%
Corallinales (crustose coralline)	37.85%
Peyssonnelia sp.	0.05%
Porifera	0.27%
Agelas clathrodes	0.02%
Agelas- PR3	0.02%
Demospongiae	0.20%
Erylus sp.	0.02%
Geodia neptuni complex	0.02%
Cnidaria	6.97%
Agaricia fragilis	0.47%
Agaricia grahamae	0.25%
Agaricia sp.	5.06%
Antipatharia	0.03%
Antipathes atlantica	0.10%
Helioseris cucullata	0.02%
Hydroidolina	0.05%
Madracis brueggemanni	0.34%
Madracis decactis	0.52%
Madracis formosa	0.05%
Stylasteridae	0.07%
Annelida	0.02%
Filograna sp.	0.02%
Bryozoa	0.03%
Bryozoa- white fan	0.03%
Echinodermata	0.17%
Analcidometra armata	0.03%
Davidaster discoideus	0.13%
detritus	0.03%

Dive Site: Pulley Ridge, Outside HAPC; Block 91, Central Basin- South; ROV 15-13, UNCW 272

UNKNOWN	0.02%
Unidentified organism	0.02%
Bare hard bottom	46.08%
Habitat	46.08%
Bare dead coral plate	0.10%
Bare rock	4.27%
Bare rubble/cobble	41.71%
Bare soft bottom	0.15%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Outside HAPC; Block 91, Central Basin- South; ROV 15-13, UNCW 272

Density of Fish:

Table 2. Density (# individuals/m) of fish from video transects at dive site ROV 15-13.

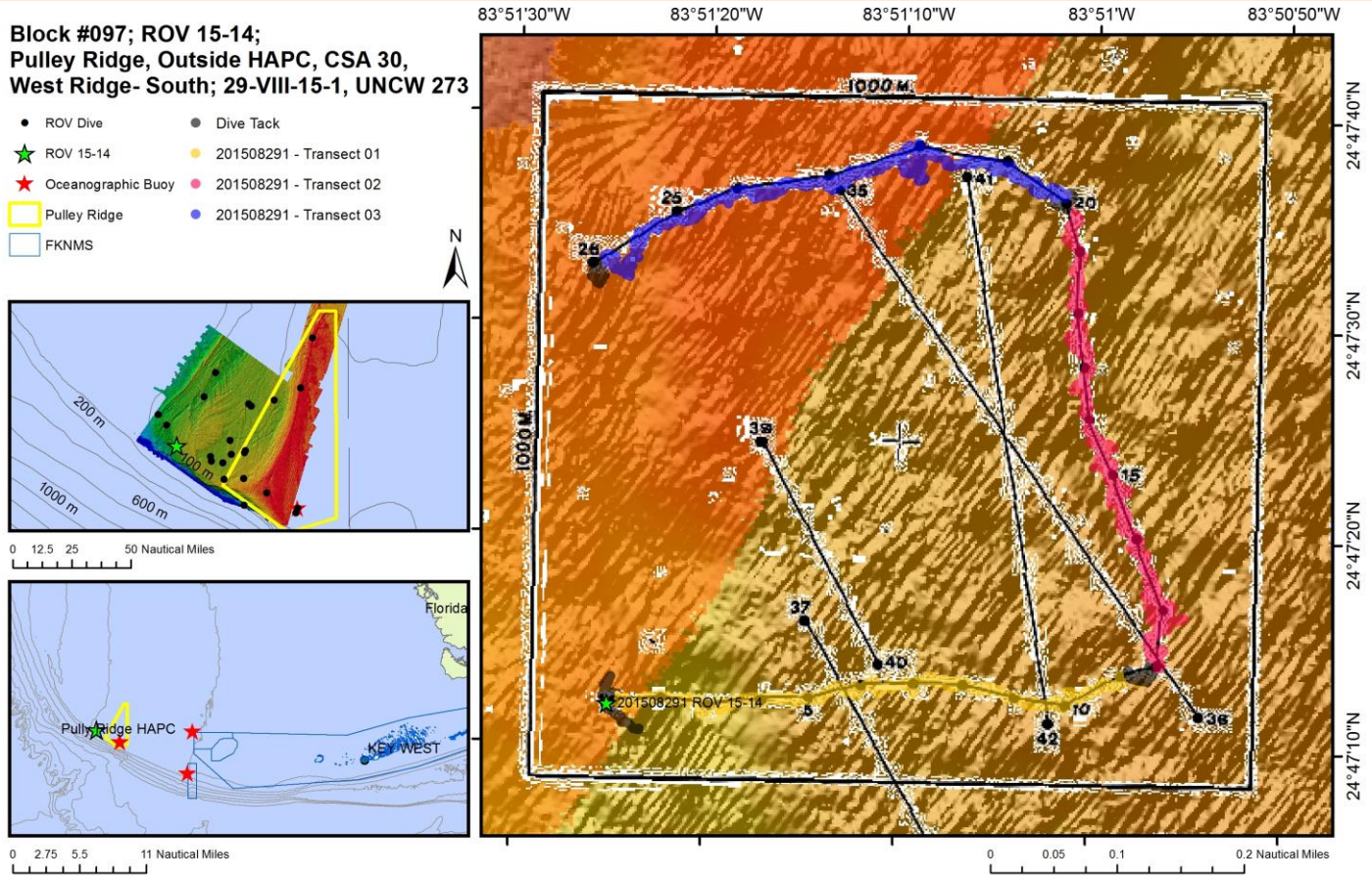
Class/Order/Family/Common name -Taxa	ROV 15-13 No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
fish unid.- Actinopteri	233	0.4660
Beryciformes		
Holocentridae		
blackbar soldierfish- *Myripristis jacobus*	2	0.004
Squirrelfish unid.- *Holocentrus* sp.	8	0.0160
Perciformes		
Carangidae		
amberjack- *Seriola* sp.	1	0.0020
Chaetodontidae		
Longsnout butterflyfish- *Prognathodes aculeatus*	1	0.0020
reef butterflyfish- *Chaetodon sedentarius*	8	0.0160
Haemulidae		
striped grunt- *Haemulon striatum*	1	0.0020
Labridae		
spotfin hogfish- *Bodianus pulchellus*	4	0.0080
Wrasse unid.- *Halichoeres* sp.	1	0.002
Pomacanthidae		
cherubfish- *Centropyge argi*	27	0.0540
rock beauty- *Holacanthus tricolor*	8	0.0160
Pomacentridae		
Chromis unid.- *Chromis* sp.	2	0.0040
purple reeffish- *Chromis scotti*	2	0.0040
sunshine chromis/sunshinefish- *Chromis insolata*	14	0.0280
yellowtail reeffish- *Chromis enchrysurus*	27	0.0540
Scaridae		
Greenblotch parrotfish- *Sparisoma atomarium*	6	0.0120
Serranidae		
chalk bass- *Serranus tortugarum*	2	0.0040
graysby- *Cephalopholis cruentata*	1	0.002
orangeback bass- *Serranus annularis*	1	0.0020
school bass- *Schultzea beta*	16	0.0320
tattler- *Serranus phoebe*	1	0.002
wrasse bass- *Liopropoma eukrines*	9	0.0180

Dive Site: Pulley Ridge, Outside HAPC; Block 91, Central Basin- South; ROV 15-13, UNCW 272

Scorpaeniformes		
Scorpaenidae		
lionfish- *Pterois volitans*	2	0.0040
Tetraodontiformes		
Monacanthidae		
Slender Filefish- *Monacanthus tuckeri*	4	0.008
Grand Total	**381**	**0.4660**

Dive Site: Pulley Ridge, Outside HAPC; CSA 30, Block 97; West Ridge- South; ROV 15-14, UNCW 273

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html
Scientific Observers:	Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	Naar_pulley_10m1_TIF
Purpose:	Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction
ROV:	Mohawk ROV
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II

ROV Sensors: Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density

Date of Dive:	8/29/2015	**Specimens:**	1
Ship Position System:	DGPS	**Digital Photos:**	211
Report Analyst:	John Reed, Stephanie Farrington	**DVD:**	3
Date Compiled:	1/27/2017	**Hard Drive:**	1

Dive Site: Pulley Ridge, Outside HAPC; CSA 30, Block 97; West Ridge- South; ROV 15-14, UNCW 273

Dive Data:

Minimum Bottom Depth (m):	67	**Total Transect Length (km):**	2.683
Maximum Bottom Depth (m):	83.7	**Surface Current (kn):**	0.9
On Bottom (Time- GMT):	8:20	**On Bottom (Lat/Long):**	24.79°N; -83.86°W
Off Bottom (Time- GMT):	12:07	**Off Bottom (Lat/Long):**	24.79°N; -83.86°W

Physical (bottom); Temp (°C): 21.38 **Salinity:** 36.44 **Visibility (ft):** 45 **Current (kn):** 0.25

Physical Environment:

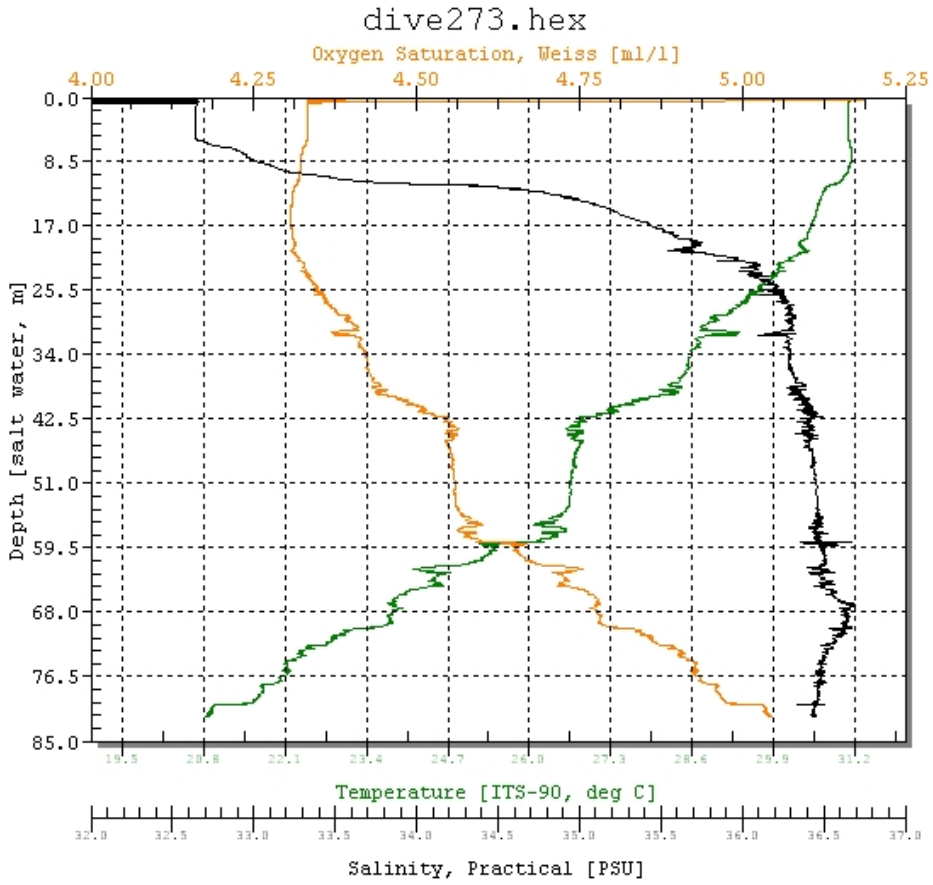


Figure 1: Shows the CTD data during the descent of ROV 15-14. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-14 are as follows: max depth: 82.28 m, temperature: 20.81 °C, conductivity: 50600 µS/cm, pressure: 120.01 PSI, salinity: 36.43 PSU, sound velocity: 1526.68 m/s, oxygen concentration: 5.06 ml/l, density: 1026 Kg/m^3, nitrogen saturation: 9.3 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Outside HAPC; CSA 30, Block 97; West Ridge- South; ROV 15-14, UNCW 273

Dive Imagery:

Figure 2: -80.6 m
Xestospongia muta barrel sponge (with bite taken out) and short bigeye.

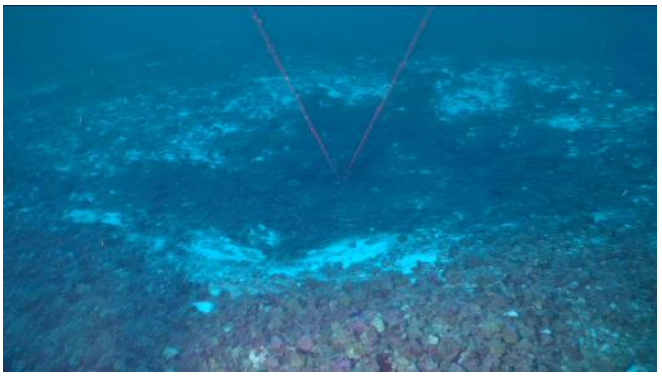


Figure 3: -80.1 m
Red grouper pit approximately 10 m diameter and 2 m deep.

Figure 4: -79.8 m
Oceanapia sp. demosponge (10 cm lasers).

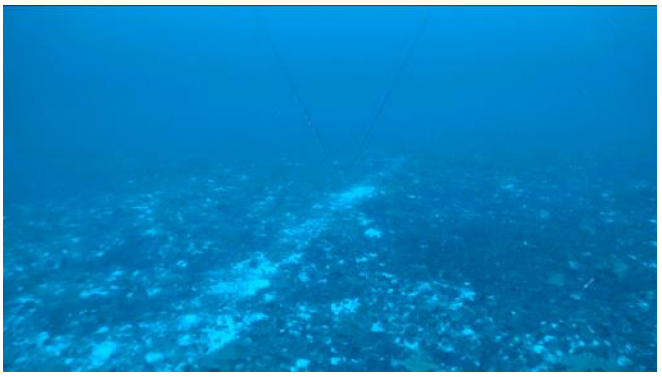


Figure 5: -79.1 m
Trawl scar across Pulley Ridge.

Dive Site: Pulley Ridge, Outside HAPC; CSA 30, Block 97; West Ridge- South; ROV 15-14, UNCW 273

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 29-VIII-15-1; ROV Dive 15-14; Mohawk UNCW Dive 273. Target Site: Florida, outside Pulley Ridge HAPC, southwest delta of MB sonar map, random blocks #97-98, CSA Site #30; 81 m.

Objectives- Ground truth MB map (low resolution USGS); instead of conducting five random 100-m photo/video transects within block, we followed the exact transect track line conducted by Continental Shelf Associates towed video/photo sled in 1980-81 for the Southwest Florida Shelf Surveys for BLM. Conduct video transects for fish population characterization and photo transects for habitat and benthic macrobiota characterization. No collections made- ROV manipulator jaw broken.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/250 (faster speed than normal to prevent blurring at faster ROV speed of 0.5 kn), auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom. The ROV was kept at 1.3 m for entire dive; photos were taken every 1 minute for a total of 150 images, 50 images per transect leg (same total number as the normal five 100-m transects). Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. The entire dive track was ~2400 m long covering a 1-km square area that overlapped both random blocks 97 and 98. The dive track was 'C'-shaped, consisting of three ~800-m long transect lines: southern W-E line, S-N line, and northern E-W line.

Site Description/Habitat

Depth range: 79.8 to 83.4 m.

MB- Low resolution (USGS) sonar shows a delta-like feature in the southwest corner of the MB map.

8:16- Launch. Partly cloudy, seas 2' from east, 7 kn from NE, surface water- 31.041°C, salinity 32.891 (still low salinity Mississippi water seen in satellite images), current 1.2 kn from NW. On bottom- 21.42°C, salinity 36.44 (halocline at 25 m), visibility 15+ m, current ¼ kn from NE.

8:27- Start transect 1 (800 m long, southern west to east leg), depth 83.4 m; 90-95% hard bottom, rubble/cobble/pavement, some areas with 70% rubble and little pavement; pavement dominated by purple Peyssonnelia, rubble by CCA, *Verdigellas*, sparse Anadyomene, sparse sponges, some octocorals- Ellisellidae, Primnoidae, sand tilefish mounds common, no *Agaricia* seen, few *Madracis brueggemanni*. One 10-m diameter grouper pit, 15 lionfish, reef fish, no grouper observed.

9:30- End XS 1, 79.8 m. Total photos 54.

9:38- Start XS 2, 800 m leg south to north, 79.9 m; 95% hard bottom, rubble/cobble/pavement, areas of 70% rubble; same biota, sand tile burrows common, 10-20% *Anadyomene*, no Primnoidae, *Halimeda* common. One 10 cm *Agaricia* purportedly seen in down shot (10:10 am, 80.3 m).

10:46- End XS 2, 80.4 m. Total 50 images.

10:58- Start XS 3 (800 m long, northern east to west leg), 80.2 m; 90% hard bottom, rubble/cobble/pavement, areas of 50-70% rubble and sparse biota; dominant biota- CCA, pavement patches with dense Peyssonnelia, sparse *Anadyomene*; sand tilefish mounds with numerous small reef fish; dense primnoid octocorals in areas.

12:00- End final XS 3, 81.5 m. Total photos for XS 3, 53.

12:07- End dive. Cancel ops- head to Rebecca Shoal in FKNMS, 70 miles east to hide from Hurricane Ericka.

Dominant Benthic Macrobiota:

Corals- one 10 cm *Agaricia*, *Madracis brueggemanni* common, Stylaster.

Dive Site: Pulley Ridge, Outside HAPC; CSA 30, Block 97; West Ridge- South; ROV 15-14, UNCW 273

Algae- CCA, Peyssonnelia, *Verdigellas*, *Anadyomene*, *Halimeda copiosa* common, one **Sargassum**.
Antipatharia- uncommon, *Antipathes furcata*.
Octocorals- patchy but common; Primnoidae, Ellisellidae, small 5-10 cm gorgonians common, some sparsely branched 10 cm orange gorgonians.
Sponges- diverse and common in areas; *Xestospongia muta*, *Geodia neptuni*, *Agelas* spp., *Agelas* PR 3, Erylus PR 4, *Oceanapia*.
Crinoids- *Davidaster* sp.
Fish- small reef fish mostly on sand tilefish mounds, few lionfish, no large grouper, one large grouper pit.

Dive Site: Pulley Ridge, Outside HAPC; CSA 30, Block 97; West Ridge- South; ROV 15-14, UNCW 273

CPCe Percent Cover Analysis:

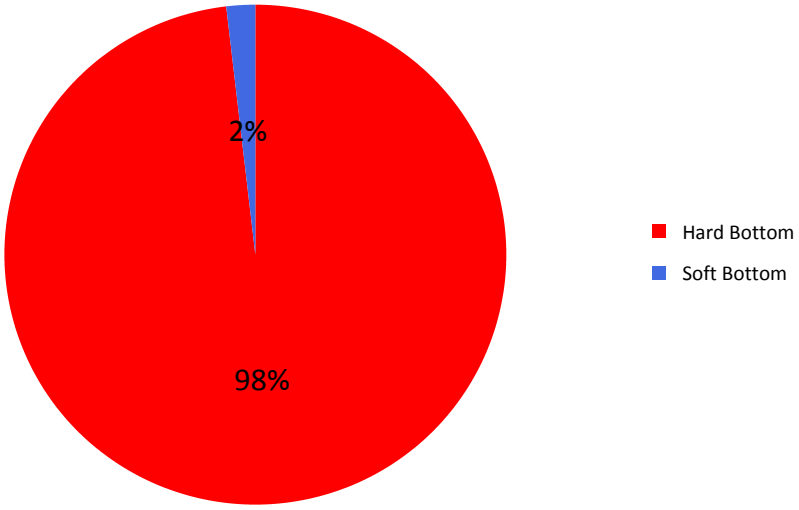
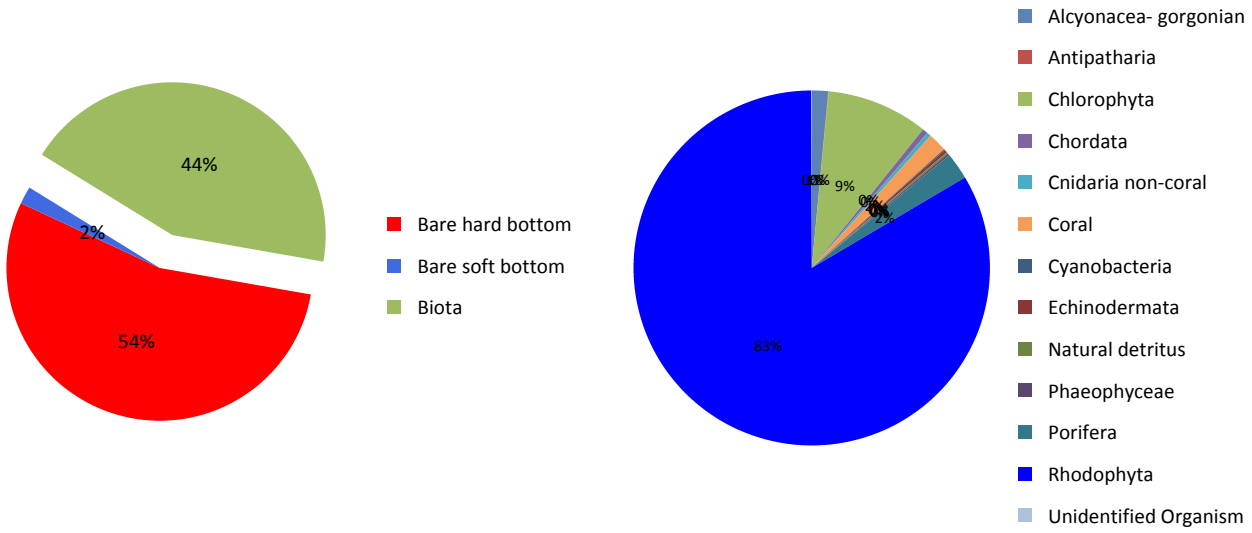


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-14. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-14.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Outside HAPC; CSA 30, Block 97; West Ridge- South; ROV 15-14, UNCW 273

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-14.

Group/Phylum/Taxa	ROV 15-14
Biota	43.94%
Chlorophyta	4.05%
Anadyomene menziesii	2.19%
Chlorophyta	0.07%
Halimeda copiosa	0.15%
Halimeda sp.	0.02%
Valonia ventricosa	0.02%
Verdigellas peltata	1.62%
Ochrophyta	0.08%
Dictyota sp.	0.08%
Rhodophyta	36.69%
Corallinales (crustose coralline)	21.94%
Peyssonnelia sp.	14.58%
Rhodophyta	0.08%
Rhodophyta- fleshy blade	0.08%
Cyanobacteria	0.05%
Cyanobacteria	0.05%
Porifera	1.07%
Agelas- PR1	0.02%
Agelas sp.	0.10%
Cinachyrella sp.	0.02%
Demospongiae	0.45%
Demospongiae- PR01	0.02%
Demospongiae- PR12	0.03%
Dictyoceratida	0.02%
Discodermia sp.	0.02%
Erylus- PR1	0.15%
Erylus sp.	0.03%
Geodia sp.	0.03%
Neofibularia nolitangere	0.03%
Poecilosclerida	0.07%
Poecilosclerida- PR3	0.03%
Spongosorites sp.	0.03%
Theonella sp.	0.02%
Cnidaria	1.58%
Actiniaria	0.02%

Dive Site: Pulley Ridge, Outside HAPC; CSA 30, Block 97; West Ridge- South; ROV 15-14, UNCW 273

Agaricia sp.	0.03%
Alcyonacea- gorgonian	0.17%
Antipatharia	0.02%
Bebryce sp.	0.03%
Carijoa riisei	0.03%
Ellisella sp.	0.05%
Hydroidolina	0.07%
Leptogorgia sp.	0.08%
Madracis brueggemanni	0.65%
Madracis decactis	0.02%
Madracis formosa	0.03%
Oculina diffusa	0.02%
Plexauridae	0.02%
Primnoidae	0.25%
Stylasteridae	0.07%
Thesea sp.	0.02%
Zoanthidae	0.02%
Echinodermata	0.12%
Davidaster discoideus	0.12%
Chordata	0.22%
Actinopterygii	0.20%
Ascidiacea	0.02%
detritus	0.07%
UNKNOWN	0.02%
Unidentified organism	0.02%
Bare hard bottom	54.19%
Habitat	54.19%
Bare rock	0.73%
Bare rubble/cobble	53.45%
Bare soft bottom	1.87%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Outside HAPC; CSA 30, Block 97; West Ridge- South; ROV 15-14, UNCW 273

Density of Fish:

Table 2. Density (# individuals/m) of fish from video transects at dive site ROV 15-14.

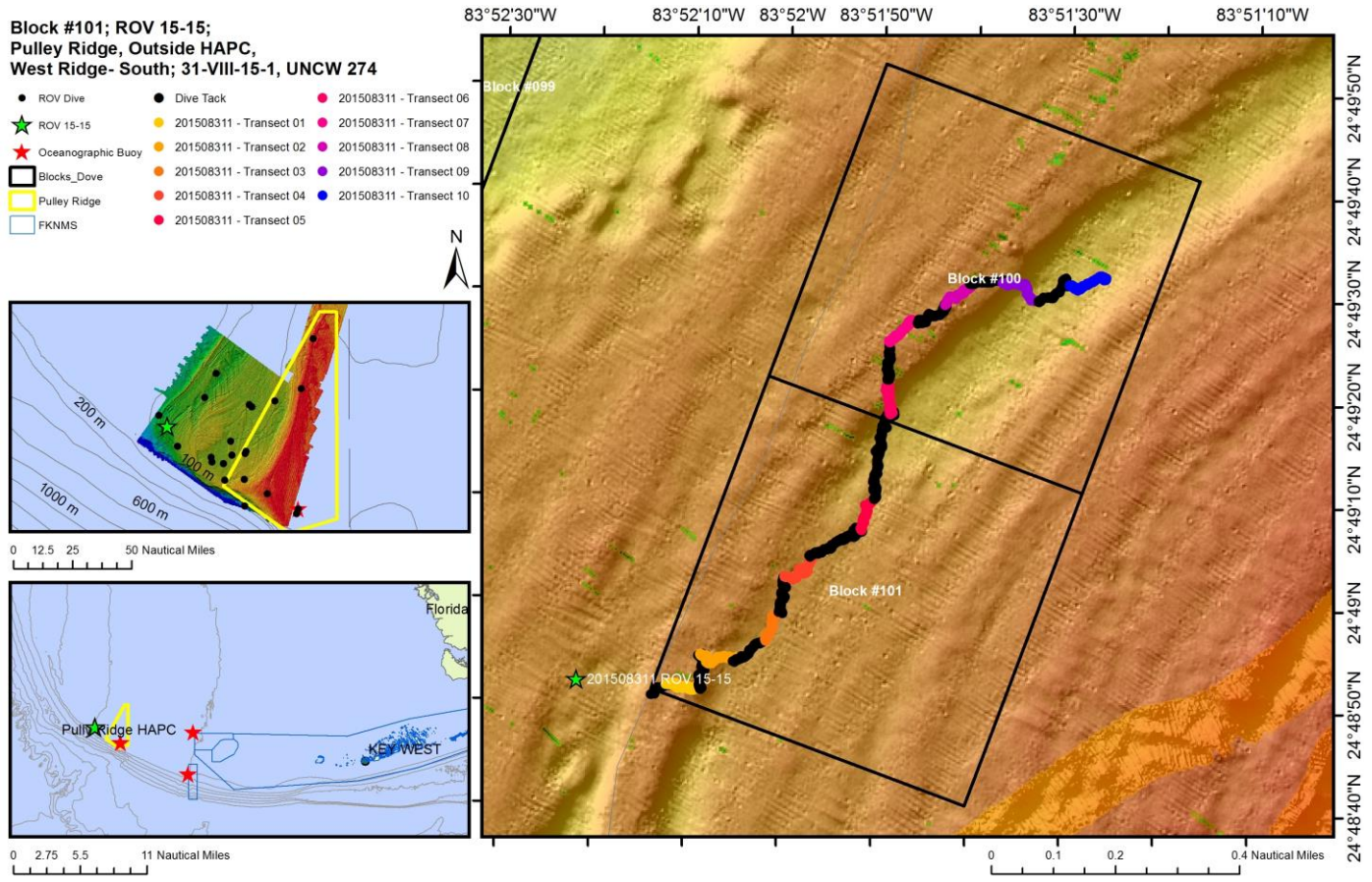
Class/Order/Family/Common name -Taxa	ROV 15-14 No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
fish unid.- Actinopteri	151	0.5033
Beryciformes		
Holocentridae		
Squirrelfish unid.- *Holocentrus* sp.	29	0.0967
Perciformes		
Acanthuridae		
Doctorfish- *Acanthurus chirurgus*	1	0.003
Chaetodontidae		
reef butterflyfish- *Chaetodon sedentarius*	44	0.147
spotfin butterflyfish- *Chaetodon ocellatus*	2	0.007
Haemulidae		
striped grunt- *Haemulon striatum*	4	0.013
Labridae		
slippery dick- *Halichoeres bivittatus*	1	0.003
spotfin hogfish- *Bodianus pulchellus*	4	0.013
Wrasse unid.- *Halichoeres* sp.	1	0.003
Lutjanidae		
Snapper unid.- *Lutjanus* sp.	1	0.003
Malacanthidae		
Sandtile- *Malacanthus plumieri*	2	0.007
Pomacanthidae		
cherubfish- *Centropyge argi*	74	0.247
rock beauty- *Holacanthus tricolor*	4	0.013
Pomacentridae		
Chromis unid.- *Chromis* sp.	5	0.017
purple reeffish- *Chromis scotti*	6	0.020
sunshine chromis/sunshinefish- *Chromis insolata*	3	0.010
yellowtail reeffish- *Chromis enchrysurus*	16	0.053
Priacanthidae		
bigeye- *Priacanthus arenatus*	1	0.003
short bigeye- *Pristigenys alta*	1	0.003
Scaridae		
Greenblotch parrotfish- *Sparisoma atomarium*	5	0.017

Dive Site: Pulley Ridge, Outside HAPC; CSA 30, Block 97; West Ridge- South; ROV 15-14, UNCW 273

Serranidae		
chalk bass- *Serranus tortugarum*	35	0.117
orangeback bass- *Serranus annularis*	4	0.013
school bass- *Schultzea beta*	250	0.833
snow bass- *Serranus chionaraia*	1	0.003
wrasse bass- *Liopropoma eukrines*	4	0.013
Scorpaeniformes		
Scorpaenidae		
lionfish- *Pterois volitans*	17	0.0567
Tetraodontiformes		
Balistidae		
grey triggerfish- *Balistes capriscus*	3	0.0100
Diodontidae		
Porcupinefish- *Diodon hystrix*	1	0.0033
Grand Total	**670**	**0.8333**

Dive Site: Pulley Ridge, Outside HAPC; Block 101 & 100; SW West Ridge- South; ROV 15-15, UNCW 274

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html
Scientific Observers:	Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	Naar_pulley_10m1_TIF
Purpose:	Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction
ROV:	Mohawk ROV
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II

ROV Sensors: Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density

Date of Dive:	8/31/2015	**Specimens:**	6
Ship Position System:	DGPS	**Digital Photos:**	366
Report Analyst:	John Reed, Stephanie Farrington	**DVD:**	5
Date Compiled:	1/27/2017	**Hard Drive:**	1

Dive Site: Pulley Ridge, Outside HAPC; Block 101 & 100; SW West Ridge- South; ROV 15-15, UNCW 274

Dive Data:

Minimum Bottom Depth (m):	79.6	**Total Transect Length (km):**	2.409
Maximum Bottom Depth (m):	90.1	**Surface Current (kn):**	1
On Bottom (Time- GMT):	8:39	**On Bottom (Lat/Long):**	24.41°N; -83.87°W
Off Bottom (Time- GMT):	13:04	**Off Bottom (Lat/Long):**	24.83°N; -83.86°W

Physical (bottom); Temp (°C): 20.65 **Salinity:** 36.48 **Visibility (ft):** **Current (kn):** 0.25

Physical Environment:

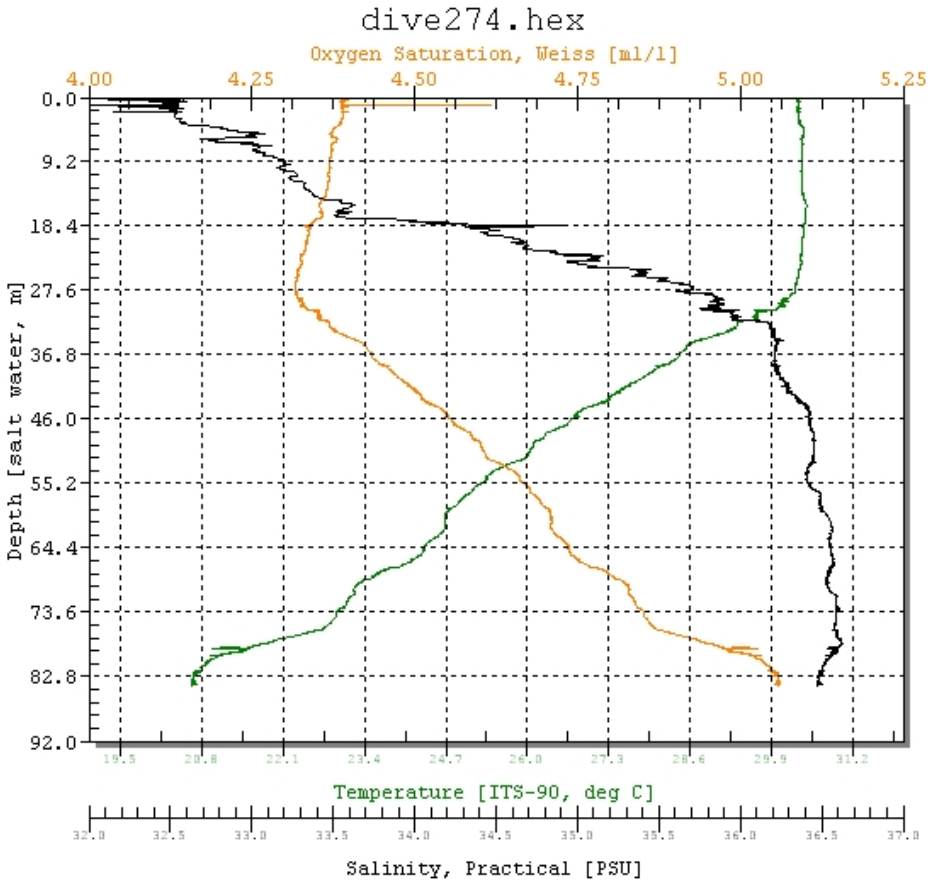


Figure 1: Shows the CTD data during the descent of ROV 15-15. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-15 are as follows: max depth: 89.42 m, temperature: 20.5 °C, conductivity: 50300 µS/cm, pressure: 130.44 PSI, salinity: 36.46 PSU, sound velocity: 1525.98 m/s, oxygen concentration: 5.08 ml/l, density: 1026.13 Kg/m^3, nitrogen saturation: 9.34 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Outside HAPC; Block 101 & 100; SW West Ridge- South; ROV 15-15, UNCW 274

Dive Imagery:

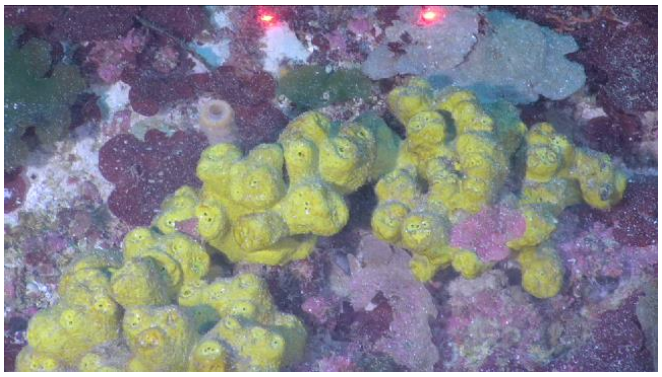


Figure 2: -88.5 m
Sample 1, yellow sponge *Spongosorites* PR-1.

Figure 3: -87 m
Red pipefish hides amungst *Peyssonnelia* algae.

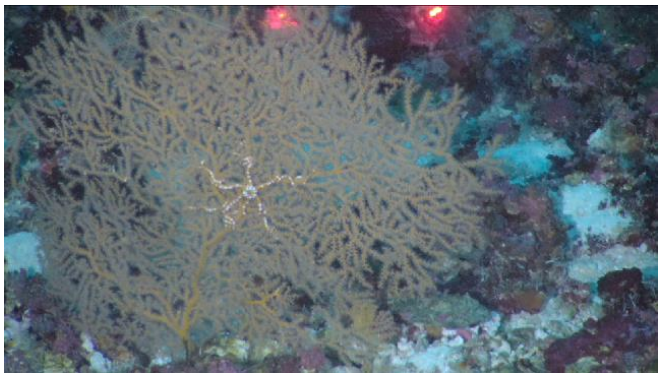


Figure 4: -87.2 m
Yellow gorgonian with brittlestar.

Figure 5: -88.3 m
Large Red grouper at edge of grouper pit.

Dive Site: Pulley Ridge, Outside HAPC; Block 101 & 100; SW West Ridge- South; ROV 15-15, UNCW 274

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 31-VIII-15-1; ROV Dive 15-15; Mohawk UNCW Dive 274. Target Site: Florida, outside Pulley Ridge HAPC, SW delta of MB, random blocks 101 and 100; 84 m.

Objectives- Ground truth MB map (low resolution USGS); conduct five random 100-m photo/video transects within block. Conduct video transects for fish population characterization and photo transects for habitat and benthic macrobiota characterization. Collect benthic macro-organisms for taxonomy voucher specimens.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/125, auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom; photos were taken every 30 seconds. Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. Five random 100 m quantitative transects were conducted in each Block. Each 100 m transect was conducted at ~0.25 kn, for 15-20 minutes until the ROV passed through 100 m circle overlaid on navigation screen; quantitative still images were taken every 30 sec for a minimum of 30 images per transect. Off transects between the quantitative transects were 15-20 minutes for close-up video frame grabs of fish and biota, and for collections. Direction of transects were random, but generally headed NE or NW, depending on the ship's maneuverability with the wind and current.

Site Description/Habitat

Block #101:

Depth range: 86.0 to 89.4 m.

MB- Low resolution (USGS) sonar shows series of N-S curved ridges like river delta.

08:30- Launch. Cloudy, seas 2' from SW, 12 kn from SW, surface water- 30.344°C, salinity 32.450, current 1.0 kn from WNW.

08:37- On bottom, SW corner of block, 86.0 m. Visibility 5 m increasing to 10 m, 20.65°C, salinity 36.48 (halocline at 36 m), current 0.2 kn from NE.

8:44- Start XS 1, 85.8m, head NE 100 m; 90-95% hard bottom, rubble/cobble; CCA, Peyssonnelia, *Verdigellas*, *Halymenia*; demosponges diverse and common- orange Agelasidae common, *Agelas* PR 3, Auletta, 20 cm *Agelas* fan, *Amphimedon* PR 2 orange CB, Clathriidae; octocorals common- Ellisellidae, orange fans; *Antipathes atlantica*; *Davidaster* crinoids. No grouper pits.

85.2 m- top of ridge

8:59 m- End XS 1, 85.0 m. Head N 100 m off transect; along main ridge of MB. Sandy, small rubble; finger sponge- *Discodermia* or *Erylus*; Anthiids; sand mound with pit- looks like blueline tilefish burrow.

9:17- Start XS 2, 85.5 m, head E 100 m; variable 70-95% hard bottom, rubble/cobble; dense Peyssonnelia, CCA, *Verdigellas*, 5-10 cm octocorals common, demosponges common and diverse, *Halimeda*.

9:32- Agaricia 3 cm, 86.0 m.

9:33- End XS 2, 86.8 m. Head NE 100 m.

9:44- Start XS 3, 87.2 m, head N 100 m, MB in valley east of ridge, ridge 2 m relief. 90% hard bottom, rubble/cobble; same biota; *M*. *brueggemanni*, *M*. *decactis* 10 cm. *Agaricia* 10 cm at 87 m.

9:59- End XS 3, 86.8 m. Head N 100 m.

10:06- Start XS 4, 86.4 m, head NE 100 m; 90-95% hard bottom, rubble/cobble; same biota; 10 m pit, 2 m deep with rock hole at bottom, lionfish; another pit.

10:20- End XS 4, 86.8 m. Head NE 100 m for non-transect. *Agaricia* 10 cm, dark brown, 86.9 m.

10:38- Start XS 5, 86.8 m, head NW 100 m; 95% hard bottom, rubble/cobble; same biota, some *Halymenia*, possibly *Agaricia* 10 cm.
10:48- End XS 5, 87.4 m. Head N to Block 100. 10 m pit- red snapper, red grouper, dense reef fish, 6 lionfish; *Agaricia* 3 cm, 89.4 m.
88.8 m- base of ridge.

Dominant Benthic Macrobiota:
Algae- Peyssonnelia, CCA, *Verdigellas*, *Halimeda*, *Halymenia*.
Coral- *Agaricia*- several 10 cm; *Madracis brueggemanni*, *M*. *decactis*, *Stylaster filogranus*.
Antipatharia- *Antipathes atlantica*, *Stichopathes lutkeni*, *Tanacetipathes* sp.
Octocorallia- Ellisellidae, 5-10 cm fans common spp., *Nicella* sp.
Demosponges- dense and diverse, *Agelas* spp., *Agelas* PR 3, *Auletta*, *Amphimedon* PR 2, Clathriidae, *Discodermia* or *Erylus* sp., *Erylus* PR 1, X. muta, *Spongosorites siliquaria*, *Spongosorites* sp.
Crinoids- *Davidaster*.
Fish- sand tilefish mounds common, lionfish- few, anthiids; grouper pit- red grouper, red snapper, reef fish, 6 lionfish.

Samples Collected:
Sample 1- *Spongosorites*? sp., yellow fingers; Sample 2- *Discodermia*? sp. or Erylus? sp., 10 cm fingers; Sample 3- Octocorallia, 10 cm yellow fan; Samples 4-6- Peyssonnelia.

<u>Block #100:</u>
11:08- Sample 1, 88.4 m, *Spongosorites*? sp.; 30 cm yellow lobate fingers with apical oscula.
11:16- Sample 2, 88.4 m, *Discodermia*? sp. or Erylus sp.; 10 cluster of fingers, with small apical oscula, brown.
11:22- Sample 3, 88.2, Octocorallia; 10 cm sparsely branched, light-orange.
11:30- Start XS 1, 88.5 m, head N 100 m; 90% hard bottom, rubble/cobble; Peyssonnelia, CCA, demosponges common and diverse, 5-10 cm octocorals common, *Verdigellas*, *M*. *brueggemanni*, sand tilefish mounds, *Antipathes atlantica*, *Halymenia*, *Geodia neptuni*.
11:42- End XS 1, 85.4 m, top of ridge, 4 m relief. Head 100 m N off transect.
11:54- Start XS 2, 84.7 m, head NE 100 m; variable 70-95% hard bottom, rubble/cobble; same biota.
12:07- End XS 2, 85.2 m. Head NE 100 m along top of ridge.
12:16- Start XS 3, 85.3 m, head NE 100 m on top of ridge; 70-90% hard bottom, rubble/cobble; same biota; *Spongosorites siliquaria*; 1 *Anadyomene*.
12:28- End XS 3, 85.2 m. Head 100 m E.
12:34- Start XS 4, 85.9 m, head?; 95% hard bottom, rubble/cobble; same biota, *Antipathes* common.
12:45- End XS 4, 90.0 m; base of ridge, 5 m relief. Head NE 100 m.
12:54- Start XS 5, 90.0 m, head NE 100 m; 90% hard bottom, rubble/cobble; same biota; *M*. *brueggemanni*, *M*. *decactis*.
13:04- End XS 5, 89.1 m. MB in valley. Two 2 cm *Agaricia*, 89.1 m.
13:09- End dive.

Dominant Benthic Macrobiota:
Algae- Peyssonnelia, CCA, *Verdigellas*, *Halimeda*, *Halymenia*, *Anadyomene* uncommon.
Coral- *M*. *brueggemanni* common, *Stylaster filogranus*, two 2 cm *Agaricia*.
Antipatharia- *Antipathes atlantica* common.
Octocorallia- 5-10 cm fans common spp., Nicella sp.
Demosponges- common and diverse, *Agelas* spp., *Spongosorites siliquaria*.
Crinoids- *Davidaster*.
Fish- sand tilefish mounds common.

Dive Site: Pulley Ridge, Outside HAPC; Block 101 & 100; SW West Ridge- South; ROV 15-15, UNCW 274

CPCe Percent Cover Analysis:

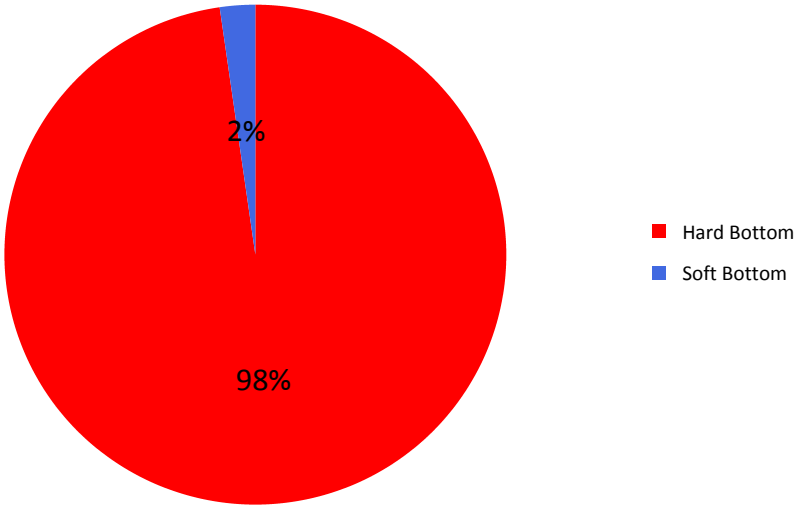
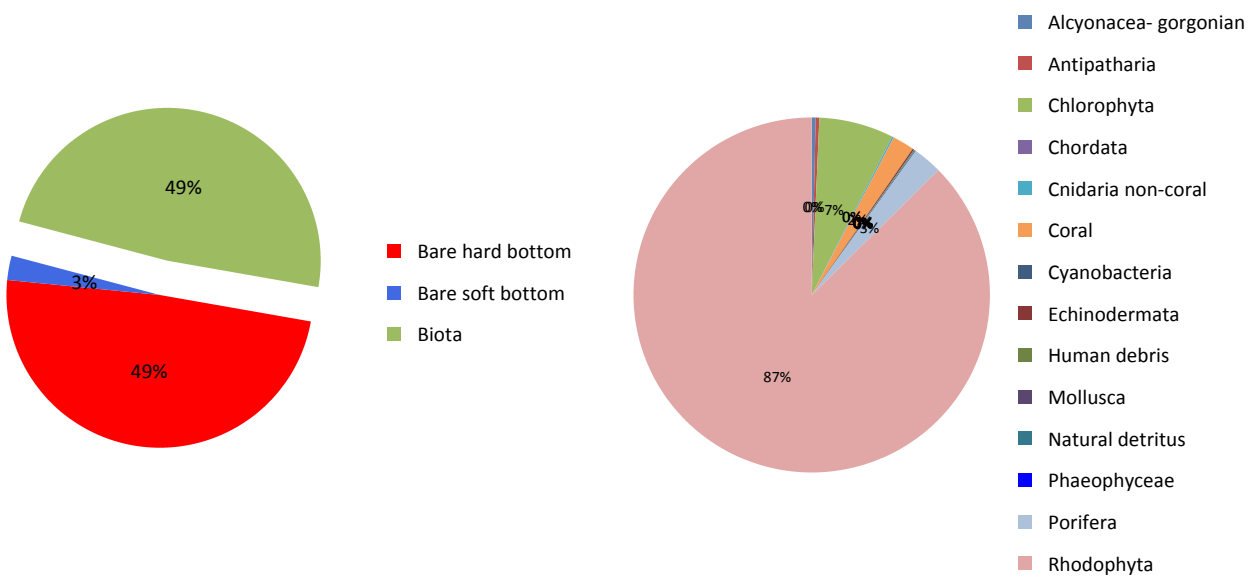


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-15. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-15.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Outside HAPC; Block 101 & 100; SW West Ridge- South; ROV 15-15, UNCW 274

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-15.

Group/Phylum/Taxa	ROV 15-15
Biota	48.60%
Chlorophyta	3.29%
Anadyomene menziesii	0.03%
Chlorophyta	0.02%
Halimeda copiosa	0.03%
Halimeda sp.	0.02%
Verdigellas peltata	3.21%
Ochrophyta	0.01%
Dictyota sp.	0.01%
Rhodophyta	42.53%
Corallinales (crustose coralline)	20.38%
Halymenia sp.	0.05%
Peyssonnelia sp.	22.02%
Rhodophyta	0.04%
Rhodophyta- fleshy blade	0.03%
Cyanobacteria	0.01%
Cyanobacteria	0.01%
Porifera	1.28%
Acanthella sp.	0.02%
Agelas clathrodes	0.01%
Agelas conifera	0.03%
Agelas- PR3	0.02%
Agelas sp.	0.08%
Amphimedon- PR1	0.01%
Amphimedon- PR2	0.03%
Amphimedon sp.	0.01%
Aplysina sp.	0.01%
Auletta sp.	0.01%
Callyspongia sp.	0.01%
Cinachyrella sp.	0.01%
Demospongiae	0.61%
Demospongiae- PR12	0.01%
Demospongiae- PR24	0.01%
Discodermia sp.	0.12%
Erylus- PR1	0.01%
Erylus sp.	0.04%

Dive Site: Pulley Ridge, Outside HAPC; Block 101 & 100; SW West Ridge- South; ROV 15-15, UNCW 274

Geodia neptuni complex	0.02%
Geodia sp.	0.02%
Poecilosclerida	0.03%
Spirastrellidae	0.02%
Spongosorites- PR1	0.10%
Spongosorites siliquaria	0.03%
Tetractinellida	0.01%
Tetractinellida- PR2	0.02%
Theonella sp.	0.01%
Xestospongia muta	0.03%
Cnidaria	1.36%
Agaricia fragilis	0.03%
Agaricia sp.	0.08%
Alcyonacea- gorgonian	0.06%
Antipatharia	0.08%
Antipathes atlantica	0.04%
Antipathes furcata	0.03%
Diodogorgia sp.	0.01%
Ellisella sp.	0.01%
Hydroidolina	0.04%
Leptogorgia sp.	0.01%
Madracis brueggemanni	0.52%
Madracis decactis	0.31%
Madracis formosa	0.03%
Nicella sp.	0.01%
Plexauridae	0.08%
Primnoidae	0.01%
Stichopathes lutkeni	0.02%
Stylasteridae	0.03%
Mollusca	0.01%
Gastropoda	0.01%
Echinodermata	0.07%
Davidaster discoideus	0.07%
Chordata	0.01%
Ascidiacea	0.01%
detritus	0.03%
Human Debris	0.05%
Human debris	0.05%
Human debris- Other	0.05%
Bare hard bottom	48.79%
Habitat	48.79%
Bare rock	0.28%

Dive Site: Pulley Ridge, Outside HAPC; Block 101 & 100; SW West Ridge- South; ROV 15-15, UNCW 274

Bare rubble/cobble	48.50%
Bare soft bottom	2.57%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Outside HAPC; Block 101 & 100; SW West Ridge- South; ROV 15-15, UNCW 274

Density of Fish:

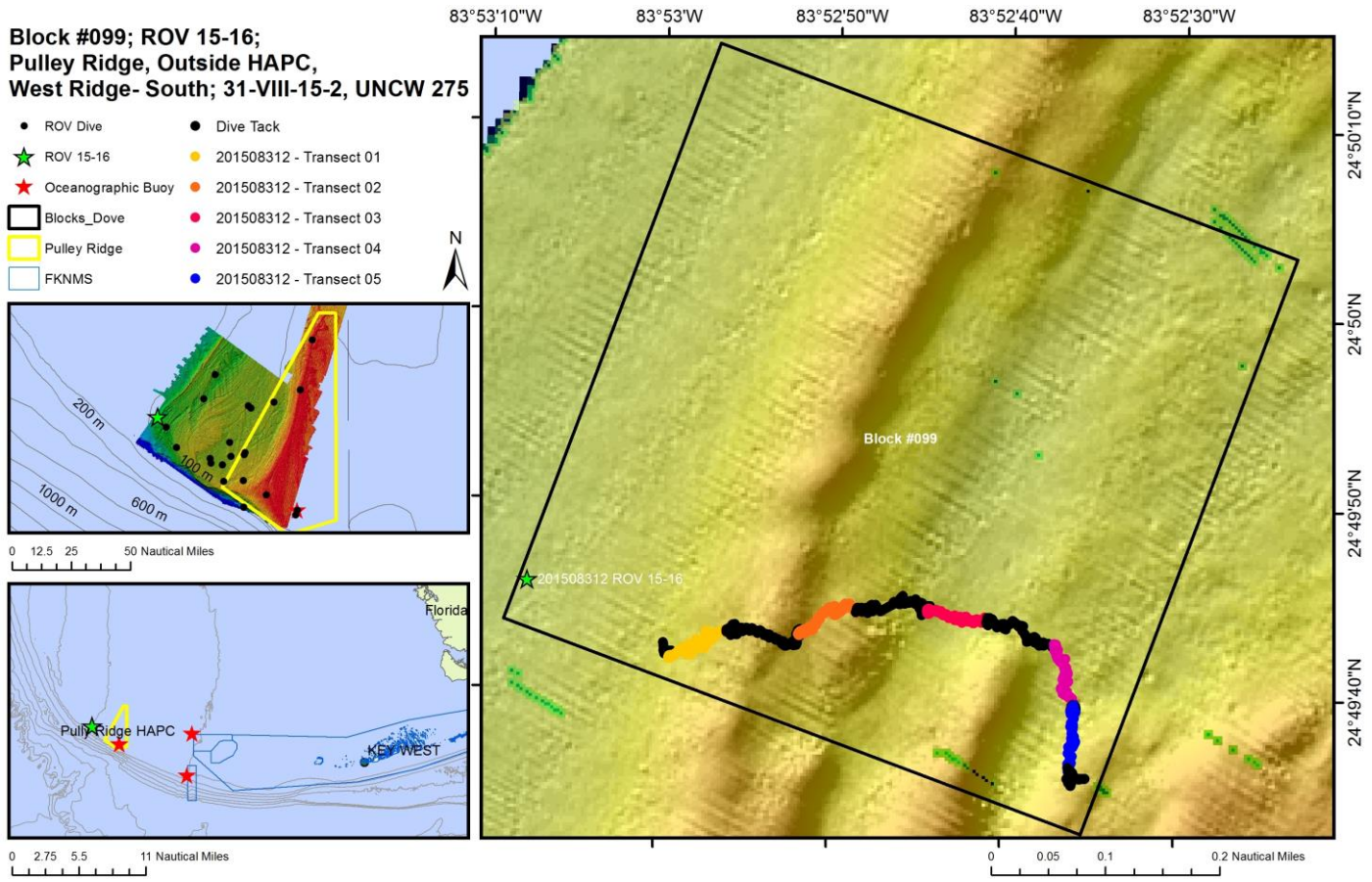
Table 2. Density (# individuals/m) of fish from video transects at dive site ROV 15-15.

Class/Order/Family/Common name -Taxa	ROV 15-15 No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
fish unid.- Actinopteri	82	0.0820
Beryciformes		
Holocentridae		
Squirrelfish unid.- *Holocentrus* sp.	1	0.0010
Perciformes		
Carangidae		
amberjack- *Seriola* sp.	2	0.0020
Jack- *Caranx* sp.	5	0.0050
Chaetodontidae		
reef butterflyfish- *Chaetodon sedentarius*	12	0.0120
Labridae		
red hogfish- *Decodon puellaris*	1	0.0010
spotfin hogfish- *Bodianus pulchellus*	2	0.0020
Wrasse unid.- *Halichoeres* sp.	4	0.0040
Pomacanthidae		
cherubfish- *Centropyge argi*	5	0.0050
Pomacentridae		
bicolor damselfish- *Stegastes partitus*	1	0.0010
Chromis unid.- *Chromis* sp.	12	0.0120
purple reeffish- *Chromis scotti*	2	0.0020
yellowtail reeffish- *Chromis enchrysurus*	2	0.0020
Scaridae		
Greenblotch parrotfish- *Sparisoma atomarium*	12	0.0120
Serranidae		
chalk bass- *Serranus tortugarum*	4	0.0040
orangeback bass- *Serranus annularis*	13	0.0130
snow bass- *Serranus chionaraia*	1	0.0010
tattler- *Serranus phoebe*	1	0.0010
wrasse bass- *Liopropoma eukrines*	2	0.0020
Scorpaeniformes		
Scorpaenidae		
lionfish- *Pterois volitans*	11	0.0110
Tetraodontiformes		

Dive Site: Pulley Ridge, Outside HAPC; Block 101 & 100; SW West Ridge- South; ROV 15-15, UNCW 274		
Monacanthidae		
Slender Filefish- *Monacanthus tuckeri*	2	0.0020
Tetraodontidae		
Sharpnose Puffer- *Canthigaster rostrata*	2	0.0020
Grand Total	**179**	**0.0820**

Dive Site: Pulley Ridge, Outside HAPC; Block 99; West Ridge- South; ROV 15-16, UNCW 275

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html
Scientific Observers:	Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	Naar_pulley_10m1_TIF
Purpose:	Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction
ROV:	Mohawk ROV
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II

ROV Sensors: Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density

Date of Dive:	8/31/2015	**Specimens:**	3
Ship Position System:	DGPS	**Digital Photos:**	190
Report Analyst:	John Reed, Stephanie Farrington	**DVD:**	2
Date Compiled:	1/27/2017	**Hard Drive:**	1

Dive Site: Pulley Ridge, Outside HAPC; Block 99; West Ridge- South; ROV 15-16, UNCW 275

Dive Data:

Minimum Bottom Depth (m):	88	**Total Transect Length (km):**	0.926
Maximum Bottom Depth (m):	94.8	**Surface Current (kn):**	1.1
On Bottom (Time- GMT):	14:22	**On Bottom (Lat/Long):**	24.83°N; -83.88°W
Off Bottom (Time- GMT):	16:08	**Off Bottom (Lat/Long):**	24.83°N; -83.88°W

Physical (bottom); Temp (°C): 20.24 **Salinity:** 36.47 **Visibility (ft):** 45 **Current (kn):** 0.5

Physical Environment:

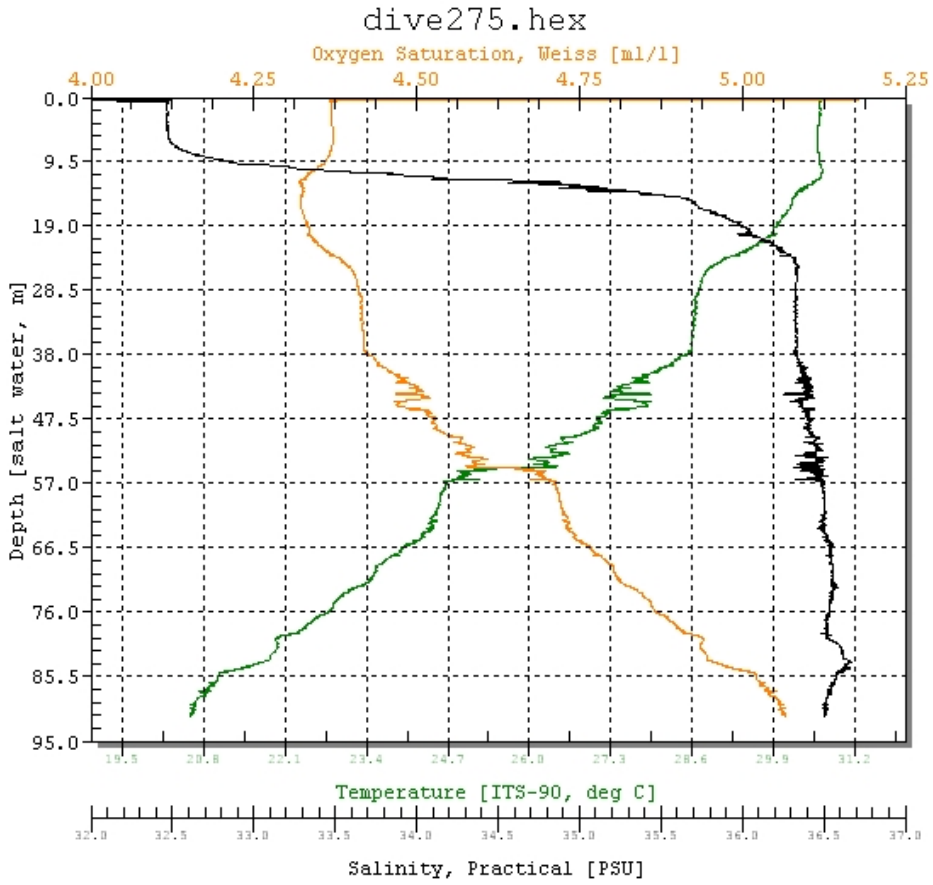


Figure 1: Shows the CTD data during the descent of ROV 15-16. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-16 are as follows: max depth: 93.8 m, temperature: 19.91 °C, conductivity: 49300 µS/cm, pressure: 136.83 PSI, salinity: 36.21 PSU, sound velocity: 1524.15 m/s, oxygen concentration: 5.15 ml/l, density: 1026.12 Kg/m^3, nitrogen saturation: 9.45 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Outside HAPC; Block 99; West Ridge- South; ROV 15-16, UNCW 275

Dive Imagery:

Figure 2: -91.7 m
Unidentified gorgonian.

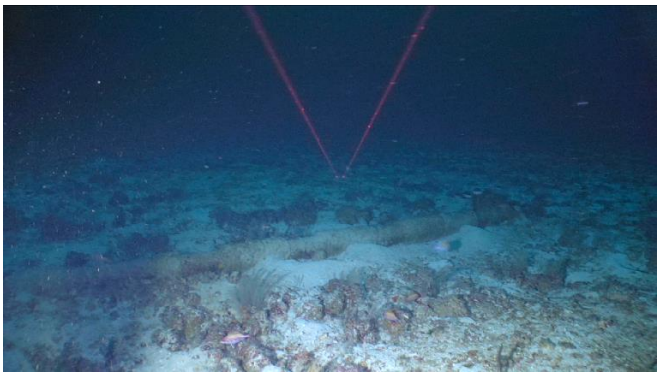


Figure 3: -91.4 m
Human debris- large pipe or mast.

Figure 4: -93.8 m
Scorpion fish (10 cm lasers).

Figure 5: -91.3 m
Unidentified gorgonian.

Dive Site: Pulley Ridge, Outside HAPC; Block 99; West Ridge- South; ROV 15-16, UNCW 275

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 31-VIII-15-2; ROV Dive 15-16; Mohawk UNCW Dive 275. Target Site: Florida, outside Pulley Ridge HAPC, MB- southern West Ridge, random block 99; 95 m.

Objectives- Ground truth MB map (low resolution USGS); conduct five random 100-m photo/video transects within block. Conduct video transects for fish population characterization and photo transects for habitat and benthic macrobiota characterization. Collect benthic macro-organisms for taxonomy voucher specimens.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/125, auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom; photos were taken every 30 seconds. Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. Five random 100 m quantitative transects were conducted in each Block. Each 100 m transect was conducted at ~0.25 kn, for 15-20 minutes until the ROV passed through 100 m circle overlaid on navigation screen; quantitative still images were taken every 30 sec for a minimum of 30 images per transect. Off transects between the quantitative transects were 15-20 minutes for close-up video frame grabs of fish and biota, and for collections. Direction of transects were random, but generally headed NE or NW, depending on the ship's maneuverability with the wind and current.

Site Description/Habitat

Depth range: 89.7 to 94.8 m.
MB- Low resolution (USGS) sonar shows southern end of West Ridge.
14:16- Launch. Cloudy, seas 2' from SW, 11 kn from SW, surface water- 30.651°C, salinity 32.476, current 1.1 Kn from NW.
14:21- On bottom, 94.8 m, SW corner of block, MB- west base of ridge. 20.34°C, salinity 36.47, halocline at 25 m, current ½ kn from NE, visibility 15 m.
14:25- Start XS 1, 94.8 m, base of ridge, head NE 100 m; 100% soft bottom, scattered 5-10 cm rubble, few sponges, CCA, sparse *Verdigellas*, sparse octocorals, *Tanacetipathes*, roughtongue bass.
14:42- End XS 1, 91.8 m. Head E to ridge top.
14:43- Sample 1, 91.8 m, Octocorallia.
14:57- top of ridge, 90.5 m, 4 m relief; soft bottom 20% scattered rubble/cobble, sand tilefish mounds, few small boulders.
15:02- Start XS 2, 89.7 m, top of ridge, head NE 100 m; soft bottom with 20% rubble/cobble; Antipatharia, octocorals 15 cm fans.
15:14- End XS 2, 90.8 m. Head E 100 m. Some Anadyomene.
15:28- Start XS 3, 93.9 m, head NE 100 m; 100% soft bottom, sparse rubble.
15:44- Stop XS 3, 94.4 m. Head South.
15:4?- Start XS 4, 93.7 m, head S 100 m; soft bottom with 5-10 cm rubble/cobble; <5% *Anadyomene*, sparse demosponges, CCA on rubble, *Ellisellidae* whip.
15:51- End XS 4, 93.7 m. 50% rubble/50% sand. 5 cm *Agaricia*. Squalls, 20-25 kn winds, seas building, difficulty station keeping. No interval non-transect.
15:54- Start XS 5, 93.7 m, head S 100 m, MB east of ridge; 50/50 rubble/sediment increasing to 70% rubble; coarse white sand; demosponges common, diverse; CCA, Peyssonnelia, some octocorals, no *Antipathes*, 5 cm *Agaricia*.
16:02- End XS 5, 91.5 m.

Dive Site: Pulley Ridge, Outside HAPC; Block 99; West Ridge- South; ROV 15-16, UNCW 275

16:04- Collect samples. 80% rubble, diverse, dense biota.
16:07- End dive; seas building 4-5 ft., wind 25 kn.

Dominant Benthic Macrobiota:
Algae- CCA, Peyssonnelia, *Verdigellas*, Peyssonnelia <5%, *Halimeda*.
Coral- *Agaricia*- few 2-10 cm.
Octocorals- common, orange fans, *Nicella* sp., white fans, Ellisellidae.
Antipatharia- *Tanacetipathes* sp., *Antipatharia atlantica*, *Stichopathes lutkeni*.
Porifera- sparse, areas common and diverse, *Agelas* spp.
Crinoidea
Fish- roughtongue bass, sand tilefish mounds.

Samples Collected:
Sample 1- Octocorallia, 10 cm tan fan; Sample 2- Nicella sp., 10 cm orange fine mesh; Sample 3- Ellisellidae, sparse branching, orange.

Dive Site: Pulley Ridge, Outside HAPC; Block 99; West Ridge- South; ROV 15-16, UNCW 275

CPCe Percent Cover Analysis:

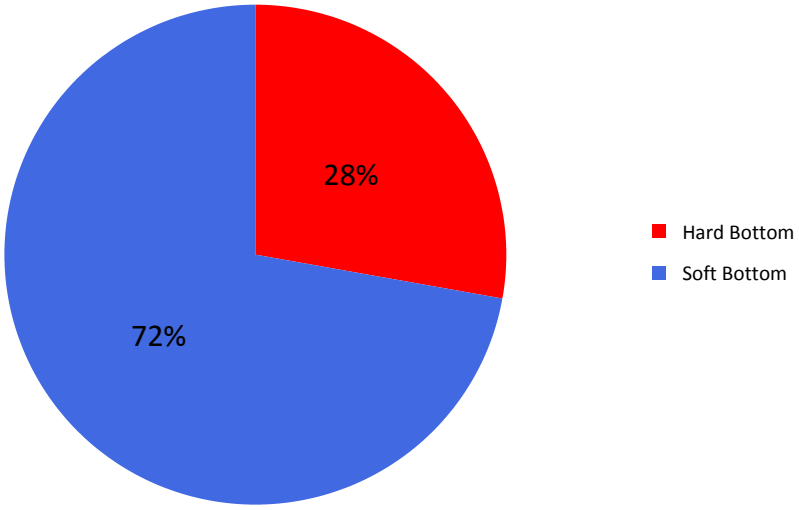
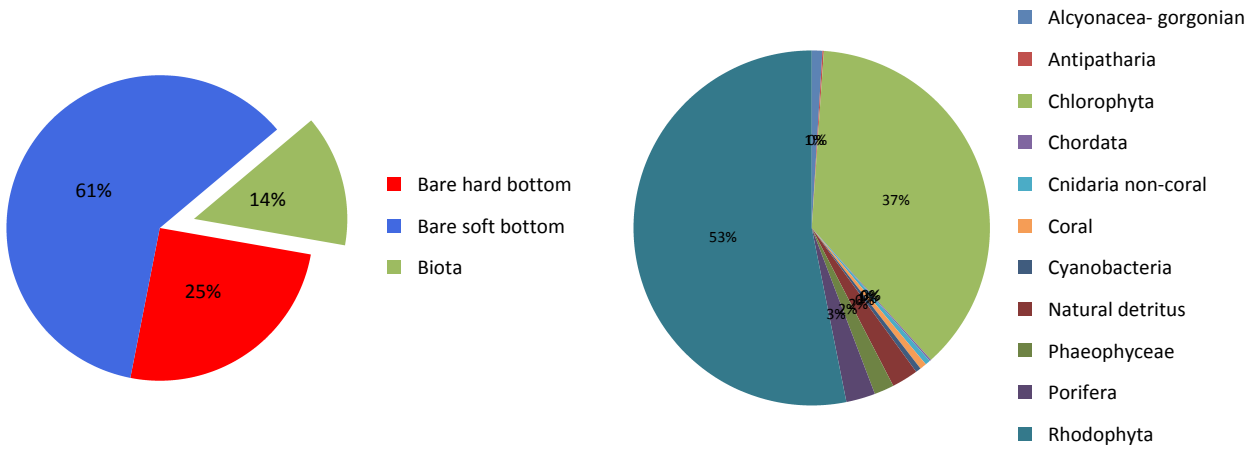


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-16. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-16.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Outside HAPC; Block 99; West Ridge- South; ROV 15-16, UNCW 275

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-16.

Group/Phylum/Taxa	ROV 15-16
Biota	13.93%
Chlorophyta	5.19%
Anadyomene menziesii	3.18%
Chlorophyta	0.07%
Halimeda copiosa	0.08%
Halimeda sp.	0.40%
Verdigellas peltata	1.46%
Ochrophyta	0.25%
Phaeophyceae	0.25%
Rhodophyta	7.40%
Corallinales (crustose coralline)	1.19%
Halymenia sp.	0.07%
Peyssonnelia sp.	1.47%
Rhodophyta	4.35%
Rhodophyta- fleshy blade	0.32%
Cyanobacteria	0.07%
Cyanobacteria	0.07%
Porifera	0.37%
Agelas clathrodes	0.02%
Amphimedon sp.	0.02%
Demospongiae	0.27%
Discodermia sp.	0.02%
Geodia neptuni complex	0.02%
Ircinia felix	0.02%
Poecilosclerida- PR3	0.02%
Cnidaria	0.30%
Alcyonacea- gorgonian	0.02%
Antipathes furcata	0.02%
Ellisella sp.	0.02%
Ellisellidae	0.02%
Hydroidolina	0.07%
Madracis brueggemanni	0.05%
Madracis decactis	0.03%
Plexauridae	0.08%
Chordata	0.02%
Ascidiacea	0.02%

Dive Site: Pulley Ridge, Outside HAPC; Block 99; West Ridge- South; ROV 15-16, UNCW 275

detritus	0.33%
Bare hard bottom	25.30%
Habitat	25.30%
Bare rock	0.07%
Bare rubble/cobble	25.23%
Bare soft bottom	60.77%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Outside HAPC; Block 99; West Ridge- South; ROV 15-16, UNCW 275

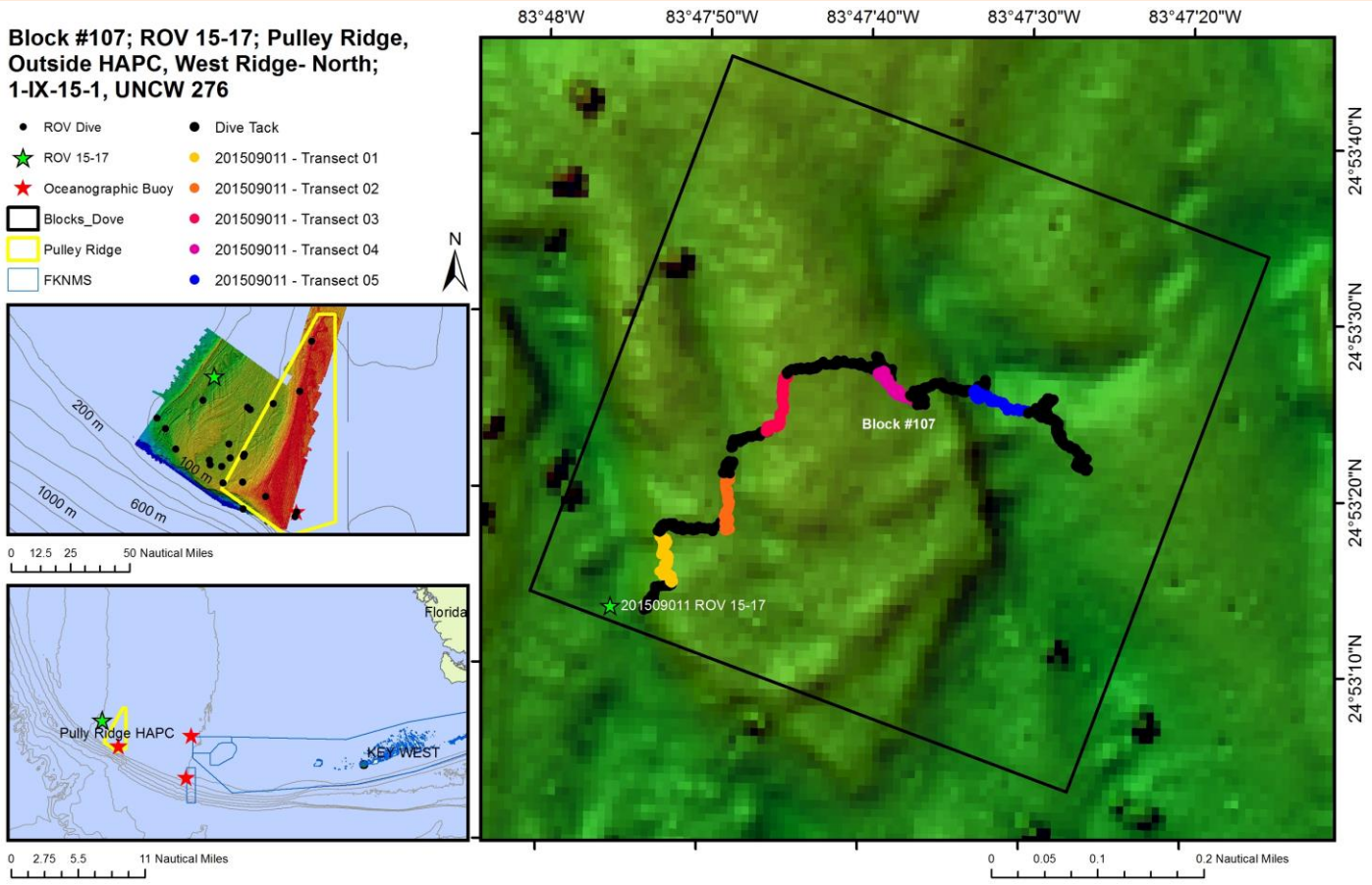
Density of Fish:

Table 2. Density (# individuals/m) of fish from video transects at dive site ROV 15-16.

Class/Order/Family/Common name -Taxa	ROV 15-16 No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
fish unid.- Actinopteri	4	0.0080
Aulopiformes		
Synodontidae		
Lizardfish unid.- *Synodus* sp.	1	0.002
Perciformes		
Acanthuridae		
Ocean Surgeonfish- *Acanthurus tractus*	2	0.004
Carangidae		
amberjack- *Seriola* sp.	2	0.0040
Chaetodontidae		
bank butterflyfish- *Prognathodes aya*	1	0.002
Pomacentridae		
yellowtail reeffish- *Chromis enchrysurus*	79	0.1580
Serranidae		
chalk bass- *Serranus tortugarum*	15	0.0300
tattler- *Serranus phoebe*	3	0.0060
Pleuronectiformes		
Bothidae		
flounder unid.- Bothidae	1	0.002
Tetraodontiformes		
Balistidae		
filefish unid.- Balistidae	1	0.002
Monacanthidae		
Slender Filefish- *Monacanthus tuckeri*	2	0.0040
Grand Total	**111**	**0.1580**

Dive Site: Pulley Ridge, Outside HAPC; Block 107; West Ridge- North; ROV 15-17, UNCW 276

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html
Scientific Observers:	Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	Naar_pulley_10m1_TIF
Purpose:	Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction
ROV:	Mohawk ROV
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II

ROV Sensors: Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density

Date of Dive:	9/1/2015	**Specimens:**	13
Ship Position System:	DGPS	**Digital Photos:**	254
Report Analyst:	John Reed, Stephanie Farrington	**DVD:**	3
Date Compiled:	1/27/2017	**Hard Drive:**	1

Dive Site: Pulley Ridge, Outside HAPC; Block 107; West Ridge- North; ROV 15-17, UNCW 276

Dive Data:

Minimum Bottom Depth (m):	73.9	**Total Transect Length (km):**	1.620
Maximum Bottom Depth (m):	87.6	**Surface Current (kn):**	0.6
On Bottom (Time- GMT):	8:02	**On Bottom (Lat/Long):**	24.89°N; -83.8°W
Off Bottom (Time- GMT):	11:00	**Off Bottom (Lat/Long):**	24.89°N; -83.79°W

Physical (bottom); Temp (°C): 20.24 **Salinity:** 36.38 **Visibility (ft):** 15 **Current (kn):** 0.25

Physical Environment:

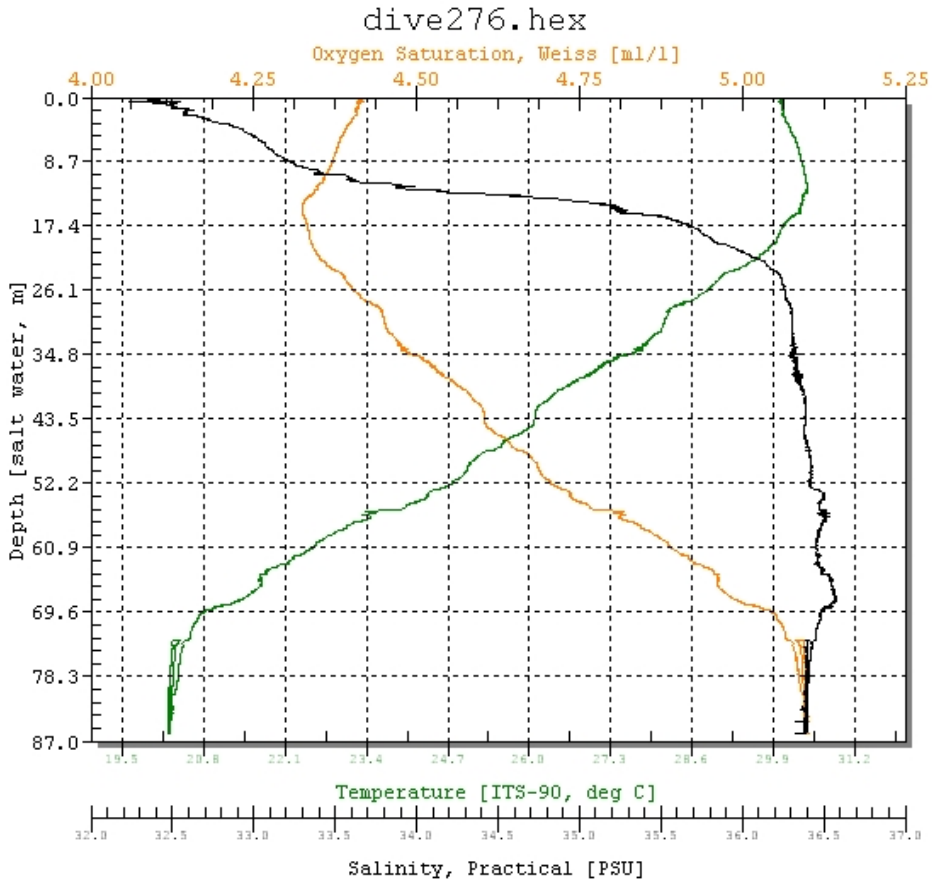


Figure 1: Shows the CTD data during the descent of ROV 15-17. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-17 are as follows: max depth: 86.14 m, temperature: 20.24 °C, conductivity: 49900 µS/cm, pressure: 125.65 PSI, salinity: 36.38 PSU, sound velocity: 1525.13 m/s, oxygen concentration: 5.11 ml/l, density: 1026.13 Kg/m^3, nitrogen saturation: 9.39 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Outside HAPC; Block 107; West Ridge- North; ROV 15-17, UNCW 276

Dive Imagery:

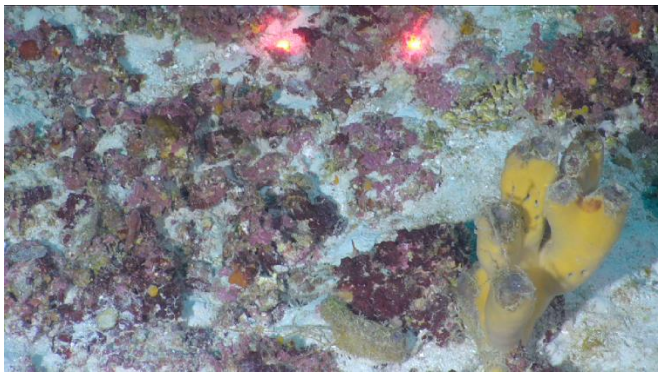


Figure 2: -83.2 m
Yellow finger sponge *Erylus* PR-1.

Figure 3: -82.9 m
Black grouper in red grouper pit with numerous lionfish and Anthiids.

Figure 4: -83.5 m
Red grouper, black grouper (right),and lionfish share a grouper pit.

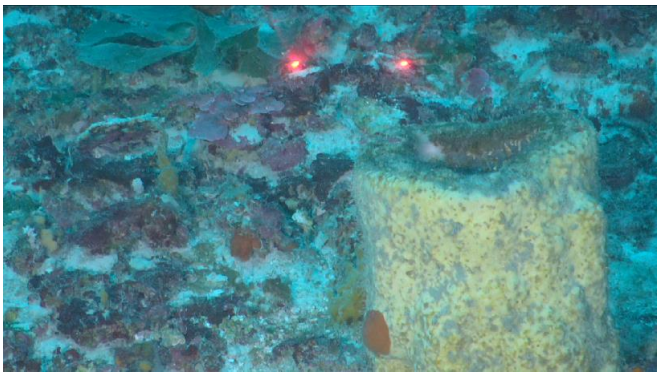


Figure 5: -86.6 m
Astrophorida vase sponge (10 cm lasers).

Dive Site: Pulley Ridge, Outside HAPC; Block 107; West Ridge- North; ROV 15-17, UNCW 276

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 1-IX-15-1; ROV Dive 15-17; Mohawk UNCW Dive 276. Target Site: Florida, outside Pulley Ridge HAPC, MB-flat low relief plateau east of West Ridge, random block 107; 85 m.

Objectives- Ground truth MB map (low resolution USGS); conduct five random 100-m photo/video transects within block. Conduct video transects for fish population characterization and photo transects for habitat and benthic macrobiota characterization. Collect benthic macro-organisms for taxonomy voucher specimens.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/125, auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom; photos were taken every 30 seconds. Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. Five random 100 m quantitative transects were conducted in each Block. Each 100 m transect was conducted at ~0.25 kn, for 15-20 minutes until the ROV passed through 100 m circle overlaid on navigation screen; quantitative still images were taken every 30 sec for a minimum of 30 images per transect. Off transects between the quantitative transects were 15-20 minutes for close-up video frame grabs of fish and biota, and for collections. Direction of transects were random, but generally headed NE or NW, depending on the ship's maneuverability with the wind and current.

Site Description/Habitat

Depth range: 87.4 to 82.1 m.
MB- Low resolution (USGS) sonar shows flat plateau east of northern West Ridge.
7:55- Launch. Sunny, seas 2' from SW, 11 kn from SE, 29.968°C, salinity 32.428, current 0.6 kn from NW.
8:02- On bottom, 87.4 m.
8:07- Start XS 1, 85.1 m, head N 100 m, on top of plateau; 90% hard bottom, rubble; CCA, Peyssonnelia, *Verdigellas*, *Halymenia*; demosponges common and diverse- Agelasidae, *Amphimedon*, *Astrophorida*, *X. muta*; *Madracis brueggemanni*, Stylaster, *Antipatharia atlantica*, sparse *Anadyomene*. One 5 cm Agaricia. One abandoned grouper pit.
8:18- End XS 1, 83.5 m. Head E 100 m off transect. Abandoned 10 m grouper pit, no lionfish, few reef fish.
8:27- Start XS 2, 83.2 m; 90% hard bottom, rubble/cobble/possible some pavement; CCA, 5% *Anadyomene*, demosponges common, *Antipatharia* common, few 5-10 cm octocorals, *Davidaster*.
8:37- End XS 2, 83.2 m. Head NE 100 m. Collect 2 samples.
9:00- Start XS 3, 82.7 m, head NE 100 m; 95% hard bottom, rubble/cobble; same biota, 20% *Anadyomene*, some octocorals.
9:10- End XS 3, 82.1 m. Head E 100 m. MB shows grouper pit; not seen in video. Sample 3.
9:33- Start XS 4, 82.7 m, near east edge of plateau in MB, head SE 100 m; 95% hard bottom, rubble/cobble; same biota. 5 m pit, not in MB, 2 m deep with rock hole at base- red grouper, 2 lionfish. Second 10 m pit- reef fish; 3rd pit.
9:44- End XS 4, 83.0 m. In pit- 2 black grouper, 1 red grouper, reef fish, 27 lionfish, graysby, Brotulidae; 5 m abandoned pit, few lionfish. Head E to escarpment on east side of plateau.
84.9 m- MB shows base of escarpment, 1 m relief (whoopee doo). Sample 4,5.
10:11- Start XS 5, 84.5 m, head SE on basin east base of plateau; 80-90% hard bottom, grades into 70% hard bottom, mostly all rubble/small cobble. Dominant biota- CCA, some Peyssonnelia, demosponges common and diverse, *Antipathes atlantica* common, few octocorals, no *Anadyomene*; sponges decreasing during the transect.

10:21- End XS 5, 86.4 m. Collect samples.
11:00- End dive, 86.6 m.

Dominant Benthic Macrobiota:
Algae- CCA, Peyssonnelia, *Verdigellas*, *Anadyomene*, *Halymenia*, *Halimeda copiosa*.
Coral- *Madracis brueggemanni*, Stylaster; *Agaricia*- 5 cm rare.
Antipatharia- *Antipathes atlantica*.
Octocorals- Few 5-10 cm, Primnoidae, Ellisellidae, *Telesto* sp., *Ellisella* sp., *Nidalia occidentalis*.
Corallimorpharia-
Porifera- Common and diverse; *Agelas* spp., *Amphimedon* spp., *Astrophorida* spp., *X. muta*, *Spongosorites* sp., *Erylus* sp., *Erylus* PR 1, *Cinachyra* sp., *Spongosorites siliquaria*.
Ophiuroidea- Gorgonocephalidae, Ophiuroidea.
Crinoids- *Davidaster* sp., Comatulida unid.
Fish- 10 m grouper pit- 5, red grouper- 2, lionfish- 25, black grouper- 2, graysby, Brotula, reef fish in pits.

Samples Collected:
Sample 1- *Aplysina lacunosa*; Sample 2- Erylus PR 2; Sample 3- Octocorallia orange 8 cm; Sample 4- *Telesto* sp.; Sample 5- Comatulid crinoid; Sample 6- Crustose coralline, pink frilly; Sample 7- *Antipatharia atlantica*; Sample 8- rock, conglomerate; Sample 9- *Halimeda copiosa*; Sample 10- *Verdigellas* sp.; Sample 11- Ophiuroidea; Sample 12- *Nidalia* sp.; Sample 13- Stomatopoda.

Dive Site: Pulley Ridge, Outside HAPC; Block 107; West Ridge- North; ROV 15-17, UNCW 276

CPCe Percent Cover Analysis:

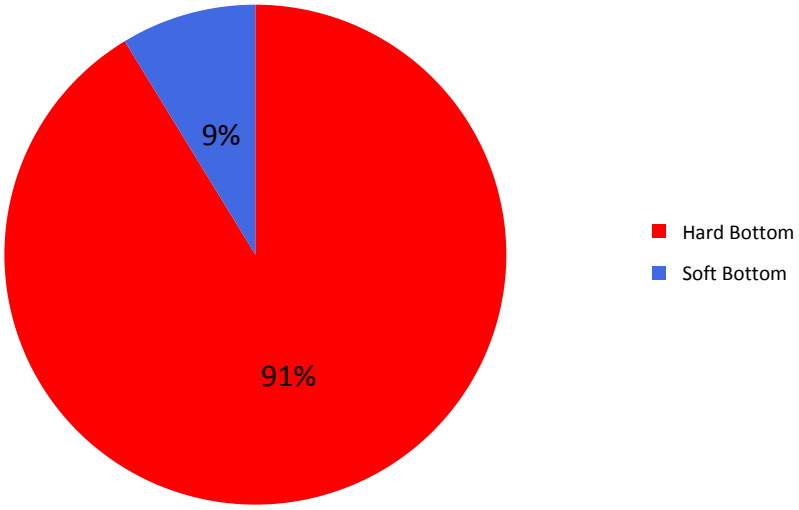
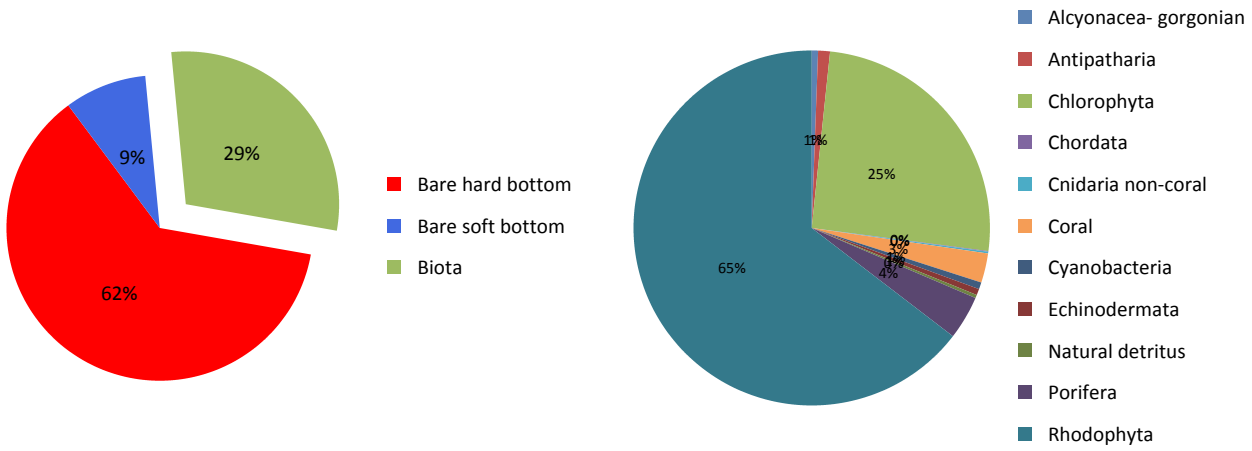


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-17. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-17.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Outside HAPC; Block 107; West Ridge- North; ROV 15-17, UNCW 276

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-17.

Group/Phylum/Taxa	ROV 15-17
Biota	29.30%
Chlorophyta	7.45%
Anadyomene menziesii	5.12%
Halimeda copiosa	0.05%
Valonia ventricosa	0.02%
Verdigellas peltata	2.27%
Rhodophyta	18.92%
Corallinales (crustose coralline)	14.50%
Peyssonnelia sp.	4.20%
Rhodophyta	0.17%
Rhodophyta- fleshy blade	0.05%
Cyanobacteria	0.18%
Cyanobacteria	0.18%
Porifera	1.17%
Agelas- PR1	0.02%
Agelas- PR3	0.05%
Agelas sp.	0.05%
Amphimedon- PR2	0.17%
Auletta sp.	0.05%
Axinella corrugata	0.02%
Axinellidae	0.02%
Callyspongia sp.	0.02%
Demospongiae	0.32%
Demospongiae- PR01	0.02%
Demospongiae- PR12	0.03%
Discodermia sp.	0.02%
Erylus sp.	0.02%
Geodia neptuni complex	0.07%
Poecilosclerida	0.05%
Poecilosclerida- PR3	0.02%
Spongosorites- PR1	0.13%
Spongosorites sp.	0.03%
Tetractinellida	0.07%
Xestospongia muta	0.02%
Cnidaria	1.32%
Agaricia fragilis	0.02%

Dive Site: Pulley Ridge, Outside HAPC; Block 107; West Ridge- North; ROV 15-17, UNCW 276

Alcyonacea- gorgonian	0.02%
Antipatharia	0.08%
Antipathes atlantica	0.17%
Antipathes furcata	0.03%
Corallimorpharia	0.03%
Ellisella sp.	0.05%
Ellisellidae	0.03%
Hypnogorgia pendula	0.03%
Madracis brueggemanni	0.68%
Madracis decactis	0.07%
Madracis formosa	0.02%
Plexauridae	0.02%
Stichopathes lutkeni	0.02%
Stylasteridae	0.02%
Tanacetipathes tanacetum	0.02%
Thesea sp.	0.02%
Echinodermata	0.17%
Analcidometra armata	0.02%
Davidaster discoideus	0.15%
Chordata	0.02%
Actinopterygii	0.02%
detritus	0.08%
Bare hard bottom	62.05%
Habitat	62.05%
Bare dead coral plate	0.02%
Bare rock	0.15%
Bare rubble/cobble	61.88%
Bare soft bottom	8.65%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Outside HAPC; Block 107; West Ridge- North; ROV 15-17, UNCW 276

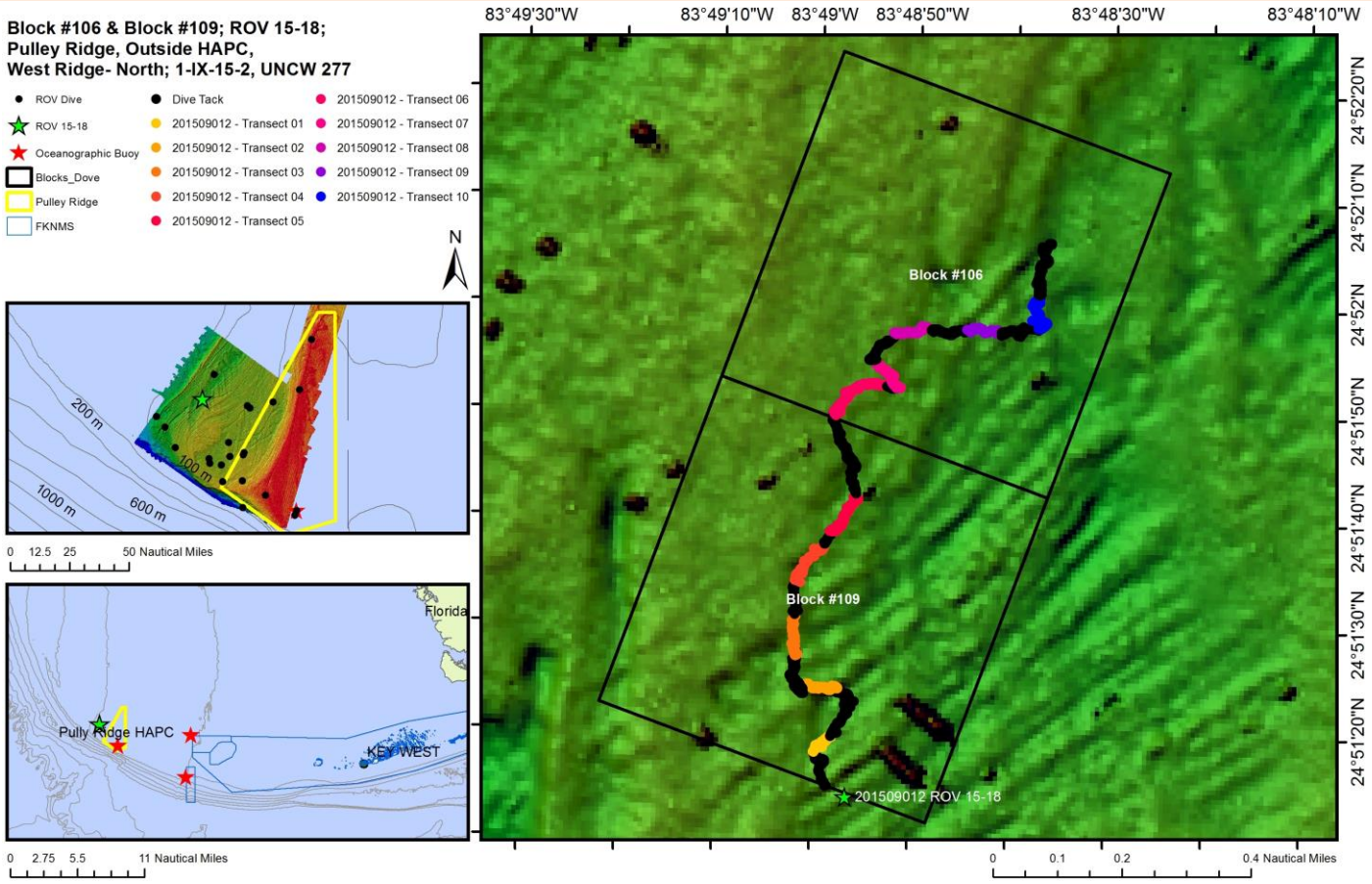
Density of Fish:

Table 2. Density (# individuals/m) of fish from video transects at dive site ROV 15-17.

Class/Order/Family/Common name -Taxa	ROV 15-17 No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
Perciformes		
Chaetodontidae		
Longsnout butterflyfish- *Prognathodes aculeatus*	1	0.0020
Pomacentridae		
Chromis unid.- *Chromis* sp.	1	0.0020
sunshine chromis/sunshinefish- *Chromis insolata*	1	0.002
yellowtail reeffish- *Chromis enchrysurus*	1	0.0020
Scaridae		
Greenblotch parrotfish- *Sparisoma atomarium*	1	0.0020
Serranidae		
red grouper- *Epinephelus morio*	1	0.0020
school bass- *Schultzea beta*	478	0.956
wrasse bass- *Liopropoma eukrines*	2	0.0040
Scorpaeniformes		
Scorpaenidae		
lionfish- *Pterois volitans*	8	0.0160
Grand Total	**494**	**0.9560**

Dive Site: Pulley Ridge, Outside HAPC; Block 109 & 106; West Ridge- North; ROV 15-18, UNCW 277

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html
Scientific Observers:	Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	Naar_pulley_10m1_TIF
Purpose:	Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction
ROV:	Mohawk ROV
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II

ROV Sensors: Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density

Date of Dive:	9/1/2015	**Specimens:**	5
Ship Position System:	DGPS	**Digital Photos:**	373
Report Analyst:	John Reed, Stephanie Farrington	**DVD:**	4
Date Compiled:	1/27/2017	**Hard Drive:**	1

Dive Site: Pulley Ridge, Outside HAPC; Block 109 & 106; West Ridge- North; ROV 15-18, UNCW 277

Dive Data:

Minimum Bottom Depth (m):	77.4	**Total Transect Length (km):**	2.565
Maximum Bottom Depth (m):	87.8	**Surface Current (kn):**	0.9
On Bottom (Time- GMT):	13:25	**On Bottom (Lat/Long):**	24.85°N; -83.82°W
Off Bottom (Time- GMT):	17:33	**Off Bottom (Lat/Long):**	24.87°N; -83.81°W

Physical (bottom); Temp (°C): 20.98 **Salinity:** 36.47 **Visibility (ft):** 45 **Current (kn):** 0.5

Physical Environment:

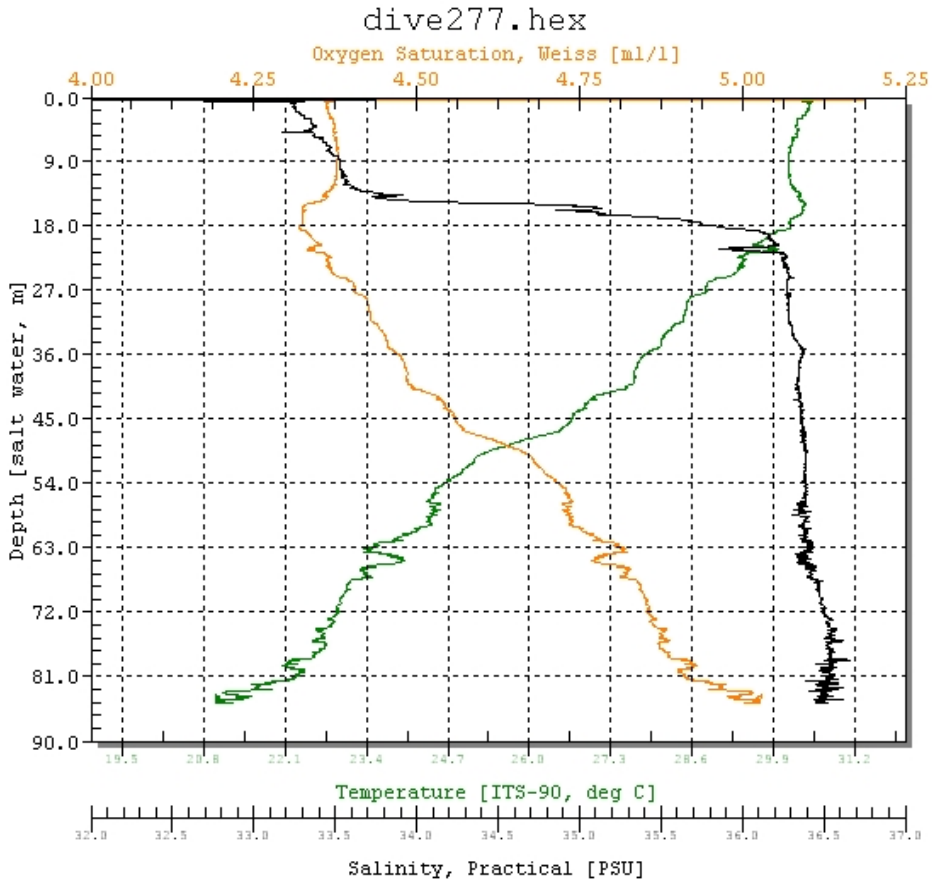


Figure 1: Shows the CTD data during the descent of ROV 15-18. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-18 are as follows: max depth: 87.25 m, temperature: 20.88 °C, conductivity: 50700 µS/cm, pressure: 127.27 PSI, salinity: 36.49 PSU, sound velocity: 1527 m/s, oxygen concentration: 5.05 ml/l, density: 1026.05 Kg/m^3, nitrogen saturation: 9.29 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Outside HAPC; Block 109 & 106; West Ridge- North; ROV 15-18, UNCW 277

Dive Imagery:

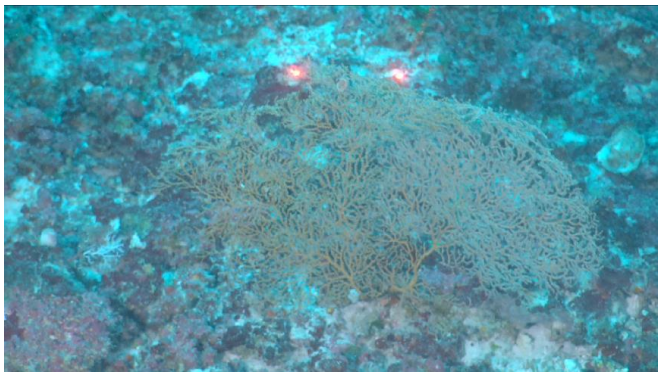


Figure 2: -84.1 m
Nicella sp. Gorgonian.

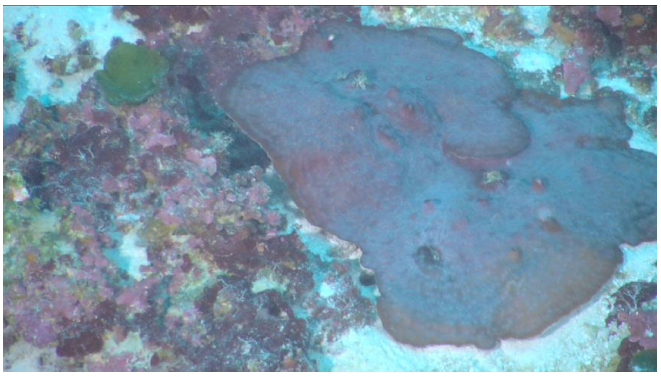


Figure 3: -84.7 m
Large 1-m diameter *Agaricia* sp. plate coral.

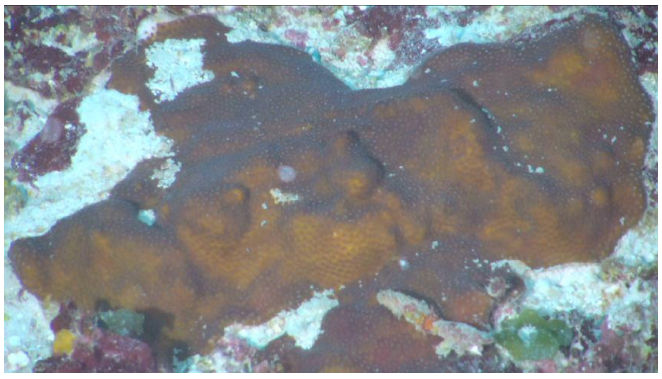


Figure 4: -85.6 m
Madracis decactis encrusting coral.

Figure 5: -86.8 m
Red grouper in a grouper pit (10 cm lasers).

Dive Site: Pulley Ridge, Outside HAPC; Block 109 & 106; West Ridge- North; ROV 15-18, UNCW 277

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 1-IX-15-2; ROV Dive 15-18; Mohawk UNCW Dive 277. Target Site: Florida, outside Pulley Ridge HAPC, MB-flat shelf east of central West Ridge, random blocks 109 and 106; 86 m.

Objectives- Ground truth MB map (low resolution USGS); conduct five random 100-m photo/video transects within block. Conduct video transects for fish population characterization and photo transects for habitat and benthic macrobiota characterization. Collect benthic macro-organisms for taxonomy voucher specimens.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/125, auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom; photos were taken every 30 seconds. Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. Five random 100 m quantitative transects were conducted in each Block. Each 100 m transect was conducted at ~0.25 kn, for 15-20 minutes until the ROV passed through 100 m circle overlaid on navigation screen; quantitative still images were taken every 30 sec for a minimum of 30 images per transect. Off transects between the quantitative transects were 15-20 minutes for close-up video frame grabs of fish and biota, and for collections. Direction of transects were random, but generally headed NE or NW, depending on the ship's maneuverability with the wind and current.

Site Description/Habitat

Block 109:

Depth range: 83.6 to 86.0 m.

13:19- Launch. Sunny, seas 1' from SE, 7 kn from SE, surface water- 30.333°C, salinity 33.325, current 0.9 kn from WNW.

13:25- On bottom, 86.0 m. Vertical visibility 25 m, horizontal 15 m, 20.98°C, salinity 36.47 (halocline 20 m), current

13:32- Start XS 1, 85.0 m, head NE 100 m; 95% hard bottom, rubble/cobble; CCA, Peyssonnelia, sparse *Anadyomene* <1%, *Verdigellas* common, sparse demosponges- *Discodermia*? or *Erylus*?, *Antipathes atlantica* common.

13:43- End XS 1, 85.1 m. Head N 100 m off transect. 5 m pit- scamp, reef fish, 2 lionfish, 1 red grouper.

13:57- Start XS 2, 85.4 m, head NW 100 m; 90% hard bottom, rubble/cobble 10-20 cm; scamp, CCA, *Antipathes* common, octocorals sparse, *Stichopathes*.

14:10- End XS 2, 84.1 m. Head N 100 m. Collect sample.

14:30- Start XS 3, 84.8 m, head N 100 m; 90% hard bottom, rubble/cobble; CCA, demosponges sparse, octocorals sparse, *Anadyomene* sparse, *Verdigellas* common, *Antipathes* common; 10 m pit- red grouper.

14:39- End XS 3, 83.6 m. Head N 100 m.

14:45- Start XS 4, 83.9 m, head NE 100 m; 95% hard bottom, rubble/cobble/pavement; same biota, 5% *Anadyomene*. Abandoned pit.

14:55- End XS 4, 84.6 m. Head NE 100 m. 10 m pit- 5 scamp, lobster, 4 lionfish.

15:01- Start XS 5, 84.2 m, head NE 100 m; 95% hard bottom, rubble/cobble/pavement; same biota.

15:08- End XS 5, 84.5 m. Head north to Block 106.

Dominant Benthic Macrobiota:

Algae- CCA, Peyssonnelia, *Verdigellas peltata*, *Anadyomene* sparse 1-5%.

Corals- M. decactis, Stylaster filogranus.

Antipatharia- Antipathes atlantica common, Stichopathes lutkeni.
Octocorallia- *Nicella goreaui*?
Porifera- Discodermia? or *Erylus*? sp., *Agelas clathrodes*.
Crinoidea- Comatulida.
Decapoda- Lobster.
Fish- Several grouper pits- scamp- 6, red grouper- 2, lionfish- 6.

Samples Collected:
Sample 1- *Nicella goreaui*?

Block 106:
Depth Range: 83.7 to 87.6 m.
15:22- Start XS 1, 83.7 m, head NE 100 m; 90% hard bottom, rubble/cobble/some pavement; CCA, Peyssonnelia, <5% *Anadyomene*, sparse octocorals- Nicella; sparse demosponges, *Antipathes* common.
15:31- End XS 1, 83.7 m. Head NE 100 m; same biota and cover. Double pit with ledge in bottom- red grouper, no lionfish.
15:36- Start XS 2, 84.6 m, head NW 100 m; 95% hard bottom, same. 5 cm *Agaricia*.
15:45- End XS 2, 84.0 m. Head NE 100 m. 5% *Anadyomene*.
15:50- Start XS 3, 83.7 m, head?; 95% hard bottom, same, 5% *Anadyomene*; *Agaricia*- several, 5-10 cm, somewhat common but small, *Madracis decactis* common. Demosponges and octocorals sparse.
15:58- End XS 3, 84.4 m. Head E 100 m. More small *Agaricia*, fairly common; *M*. *brueggemanni*, *Telesto*, *Erylus*.
16:10- Start XS 4, 84.8 m, head E 100 m; 90% hard bottom; same. MB- on linear NE-SW ridges. More 2-10 cm *Agaricia* common. Sparse *Antipathes*, demosponges and octocorals.
16:19- End XS 4, 85.1 m. Head E 100 m. More small *Agaricia*, one partially bleached; *Madracis decactis* common 10 cm; *M*. *brueggemanni*. Collect samples.
16:46- Start XS 5, 86.4 m, head N 100 m; 90% hard bottom, rubble/cobble/pavement; same biota, several small *Agaricia*, *Anadyomene* 1%.
16:56- End XS 5, 86.2 m. Head N looking for coral, fish and samples. More 5-10 cm *Agaricia*, *M*. *decactis*. Collect samples. Pit with ledges- red grouper, reef fish, 1 lionfish.
17:33- End dive, 87.6 m.

Dominant Benthic Macrobiota:
Algae- CCA, Peyssonnelia, *Verdigellas*, *Anadyomene* 1-5 %, cyanobacteria- 2 m mat.
Coral- *Agaricia* 2-10 cm fairly common but not abundant; *M*. *brueggemanni* common, *M*. *decactis* common, *M*. *formosa*- 1.
Antipatharia- *Antipathes atlantica*, common.
Octocorallia- sparse, *Nicella* sp., *Telesto* sp.
Porifera- sparse, *Agelas* PR 2, Clathriidae.
Crinoidea- Comatulida
Fish- Several grouper pits- red grouper 2, lionfish- several but not abundant.

Samples Collected:
Sample 2- 20 cm tan fan Octocorallia; Sample 3- *Madracis brueggemanni*; Sample 4- 8 cm *Agaricia fragilis*?, brown, white rim; Sample 5- *Madracis Formosa*?, 10 cm, brown, thicker branches than *M*. *brueggemanni*.

Dive Site: Pulley Ridge, Outside HAPC; Block 109 & 106; West Ridge- North; ROV 15-18, UNCW 277

CPCe Percent Cover Analysis:

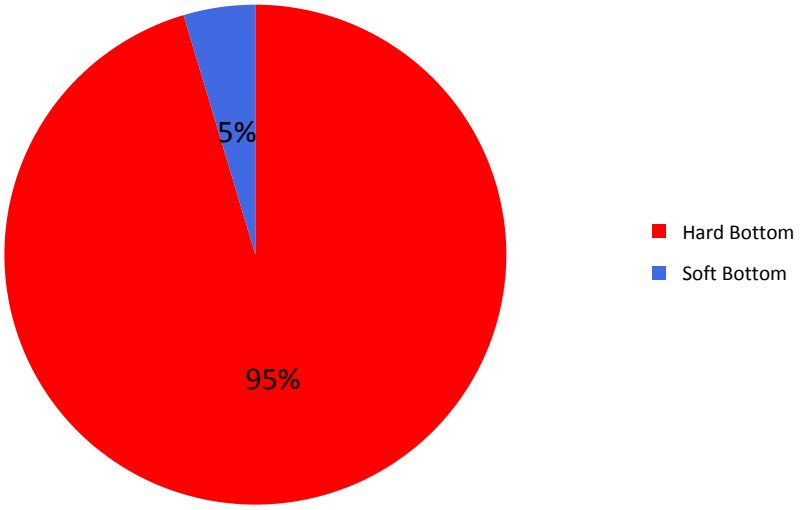
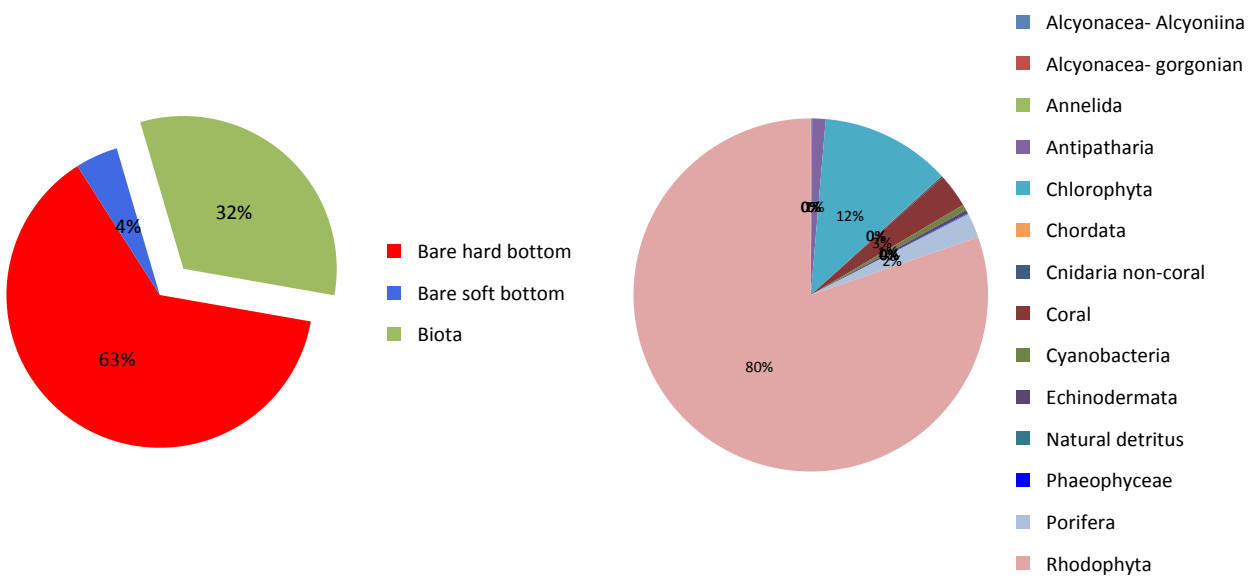


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-18. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-18.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Outside HAPC; Block 109 & 106; West Ridge- North; ROV 15-18, UNCW 277

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-18.

Group/Phylum/Taxa	ROV 15-18
Biota	32.32%
Chlorophyta	3.82%
Anadyomene menziesii	1.16%
Chlorophyta	0.01%
Verdigellas peltata	2.66%
Ochrophyta	0.02%
Dictyota sp.	0.02%
Rhodophyta	25.95%
Corallinales (crustose coralline)	25.78%
Peyssonnelia sp.	0.05%
Rhodophyta	0.07%
Rhodophyta- fleshy blade	0.06%
Cyanobacteria	0.17%
Cyanobacteria	0.17%
Porifera	0.73%
Agelas- PR1	0.01%
Agelas sp.	0.03%
Amphimedon- PR2	0.02%
Auletta sp.	0.01%
Callyspongia sp.	0.01%
Demospongiae	0.33%
Demospongiae- PR17	0.02%
Discodermia sp.	0.01%
Erylus- PR1	0.07%
Erylus- PR2	0.01%
Erylus sp.	0.07%
Geodia neptuni complex	0.04%
Geodia sp.	0.01%
Ircinia sp.	0.01%
Petrosiidae	0.01%
Poecilosclerida	0.04%
Scopalina ruetzleri	0.01%
Spirastrellidae	0.01%
Spongosorites siliquaria	0.02%
Tetractinellida	0.01%
Xestospongia muta	0.02%

Dive Site: Pulley Ridge, Outside HAPC; Block 109 & 106; West Ridge- North; ROV 15-18, UNCW 277

Cnidaria	1.48%
Agaricia fragilis	0.04%
Agaricia sp.	0.13%
Alcyoniina	0.01%
Antipatharia	0.21%
Antipathes atlantica	0.13%
Antipathes furcata	0.06%
Carijoa riisei	0.02%
Hydroidolina	0.04%
Hypnogorgia pendula	0.01%
Madracis brueggemanni	0.22%
Madracis decactis	0.61%
Madracis sp.	0.01%
Annelida	0.01%
Filograna sp.	0.01%
Echinodermata	0.11%
Analcidometra armata	0.06%
Davidaster discoideus	0.05%
Chordata	0.02%
Actinopterygii	0.02%
detritus	0.01%
Bare hard bottom	63.20%
Habitat	63.20%
Bare rock	1.10%
Bare rubble/cobble	62.11%
Bare soft bottom	4.47%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Outside HAPC; Block 109 & 106; West Ridge- North; ROV 15-18, UNCW 277

Density of Fish:

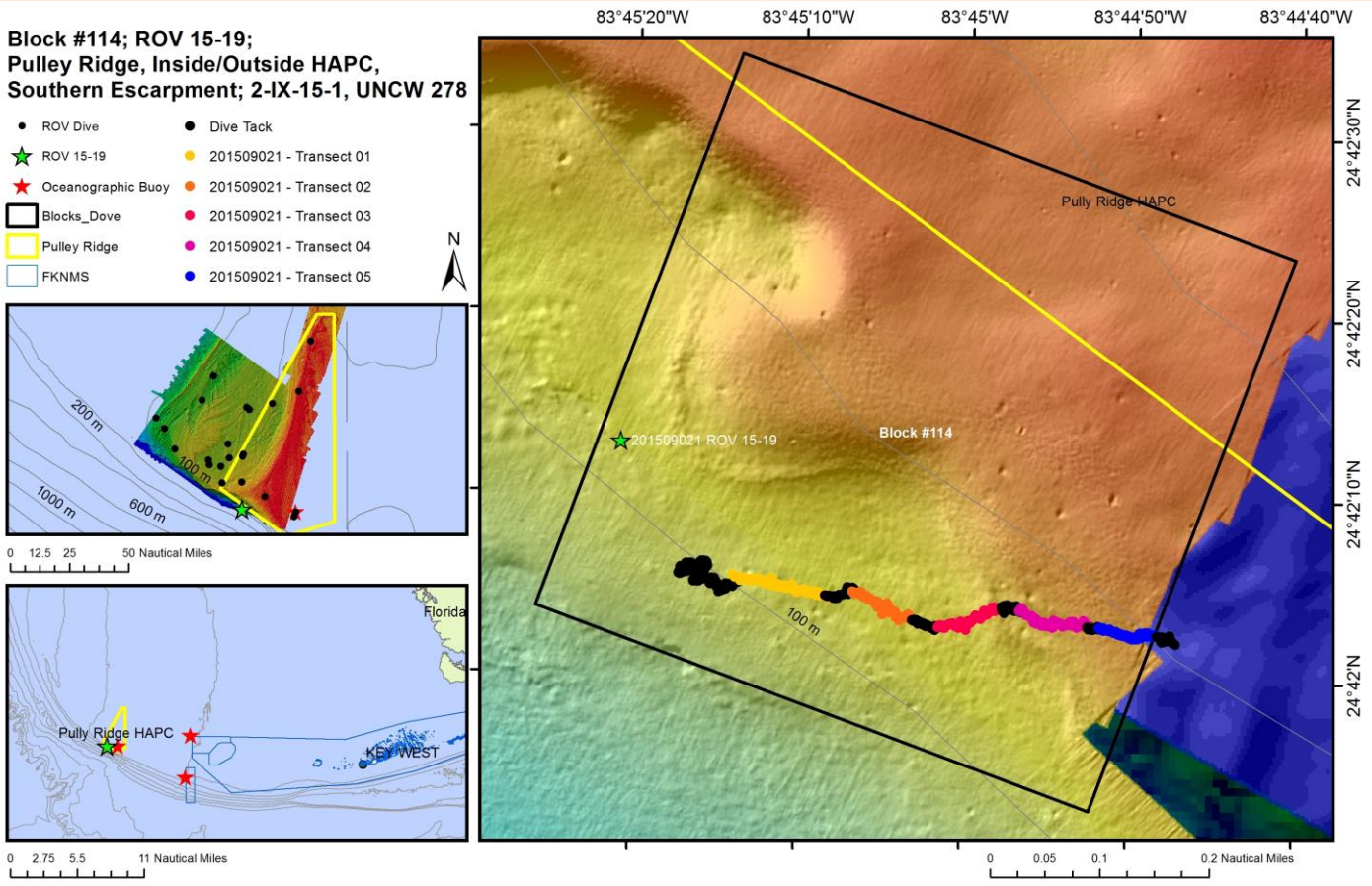
Table 2. Density (# individuals/m) of fish from video transects at dive site ROV 15-18.

Class/Order/Family/Common name -Taxa	ROV 15-18 No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
fish unid.- Actinopteri	38	0.0380
Beryciformes		
Holocentridae		
Squirrelfish unid.- *Holocentrus* sp.	1	0.0010
Perciformes		
Apogonidae		
cardinalfish unid.- *Apogon* sp.	95	0.0950
twospot cardinalfish- *Apogon pseudomaculatus*	1	0.0010
Carangidae		
Jack- *Caranx* sp.	1	0.0010
Chaetodontidae		
bank butterflyfish- *Prognathodes aya*	3	0.0030
reef butterflyfish- *Chaetodon sedentarius*	8	0.0080
spotfin butterflyfish- *Chaetodon ocellatus*	5	0.0050
Labridae		
spotfin hogfish- *Bodianus pulchellus*	5	0.0050
Pomacanthidae		
blue angelfish- *Holacanthus bermudensis*	1	0.0010
cherubfish- *Centropyge argi*	1	0.0010
rock beauty- *Holacanthus tricolor*	3	0.0030
Pomacentridae		
Chromis unid.- *Chromis* sp.	3	0.0030
purple reeffish- *Chromis scotti*	9	0.0090
sunshine chromis/sunshinefish- *Chromis insolata*	25	0.0250
yellowtail reeffish- *Chromis enchrysurus*	140	0.1400
Serranidae		
chalk bass- *Serranus tortugarum*	6	0.0060
red grouper- *Epinephelus morio*	2	0.0020
roughtongue bass- *Pronotogrammus martinicensis*	10	0.0100
scamp grouper- *Mycteroperca phenax*	5	0.0050
school bass- *Schultzea beta*	383	0.3830
tattler- *Serranus phoebe*	2	0.0020
wrasse bass- *Liopropoma eukrines*	5	0.0050
Sparidae		

Dive Site: Pulley Ridge, Outside HAPC; Block 109 & 106; West Ridge- North; ROV 15-18, UNCW 277		
red porgy- *Pagrus pagrus*	1	0.0010
Scorpaeniformes		
Scorpaenidae		
lionfish- *Pterois volitans*	5	0.0050
Tetraodontiformes		
Tetraodontidae		
Sharpnose Puffer- *Canthigaster rostrata*	1	0.0010
Grand Total	**759**	**0.3830**

Dive Site: Pulley Ridge, Inside/Outside HAPC; Block 114; Southern Escarpment; ROV 15-19, UNCW 278

General Location and Dive Track:



Site Overview:

Project: Pulley Ridge Mesophotic Reef Connectivity Project

Principal Investator: Dr. Robert Cowen, PhD

PI Contact Info: Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365

Website: www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html

Scientific Observers: Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington

Dive Overview:

Vessel: R/V Walton Smith

Sonar Data: Nancy_Pulley_SouthernDropoff_2m_UTM17N

Purpose: Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction

ROV: Mohawk ROV

Data Management: Access Database

ROV Navigation Data: Trackpoint II

ROV Sensors: Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density

Date of Dive: 9/2/2015

Ship Position System: DGPS

Report Analyst: John Reed, Stephanie Farrington

Date Compiled: 1/27/2017

Specimens:

Digital Photos: 173

DVD: 2

Hard Drive: 1

Dive Site: Pulley Ridge, Inside/Outside HAPC; Block 114; Southern Escarpment; ROV 15-19, UNCW 278

Dive Data:

Minimum Bottom Depth (m):	85.4	**Total Transect Length (km):**	0.929
Maximum Bottom Depth (m):	110.1	**Surface Current (kn):**	1.5
On Bottom (Time- GMT):	8:39	**On Bottom (Lat/Long):**	24.7°N; -83.75°W
Off Bottom (Time- GMT):	9:48	**Off Bottom (Lat/Long):**	24.7°N; -83.75°W
Physical (bottom); Temp (°C):	22.43	**Salinity:** 36.45 **Visibility (ft):**	15 **Current (kn):**

Physical Environment:

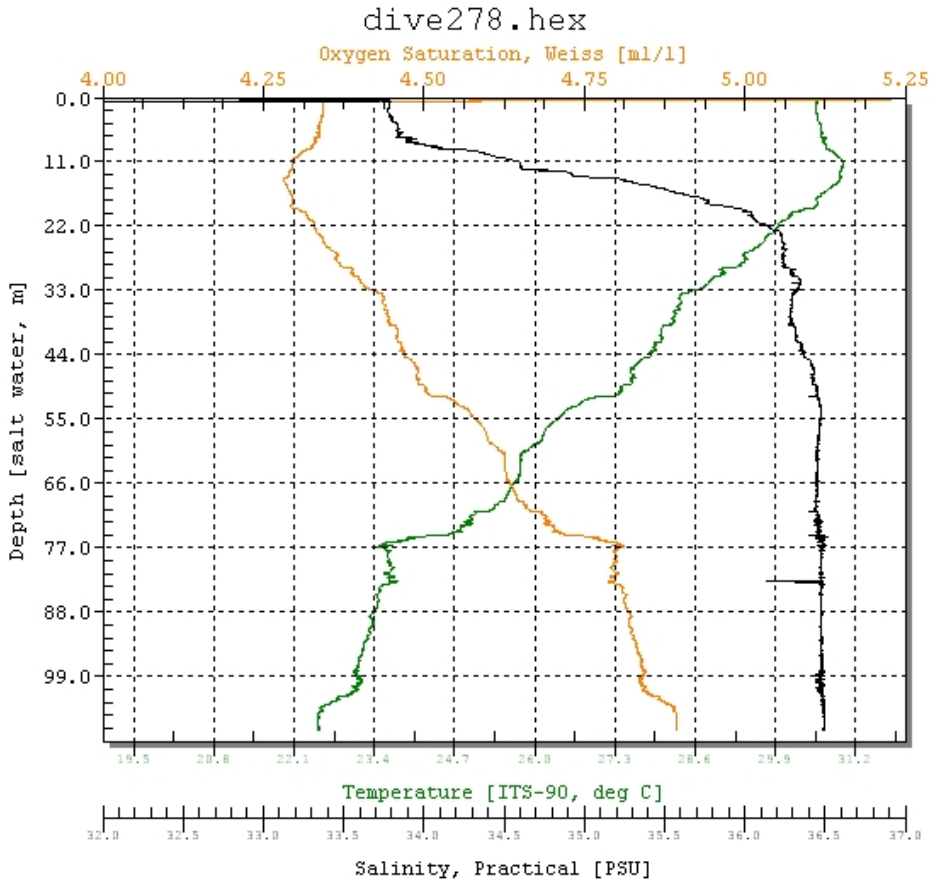


Figure 1: Shows the CTD data during the descent of ROV 15-19. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-19 are as follows: max depth: 108.77 m, temperature: 22.49 °C, conductivity: 52400 µS/cm, pressure: 158.67 PSI, salinity: 36.49 PSU, sound velocity: 1531.61 m/s, oxygen concentration: 4.91 ml/l, density: 1025.69 Kg/m^3, nitrogen saturation: 9.05 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Inside/Outside HAPC; Block 114; Southern Escarpment; ROV 15-19, UNCW 278

Dive Imagery:

Figure 2: -96 m
Yellow *Auletta* sp. sponge.

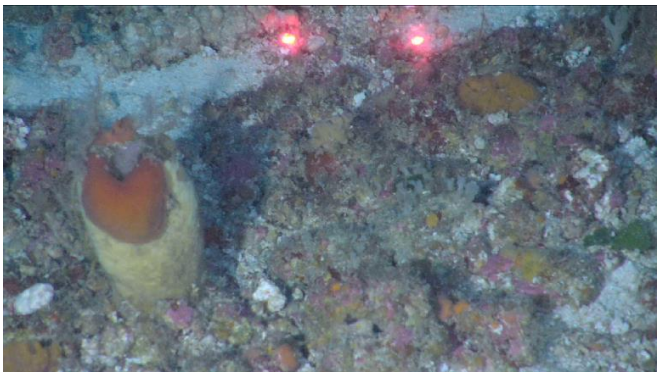


Figure 3: -96.5 m
Astrophorida tube sponge with yellow encrusting sponge.

Figure 4: -107.7 m
Pulley Ridge pavement/rubble bottom habitat.

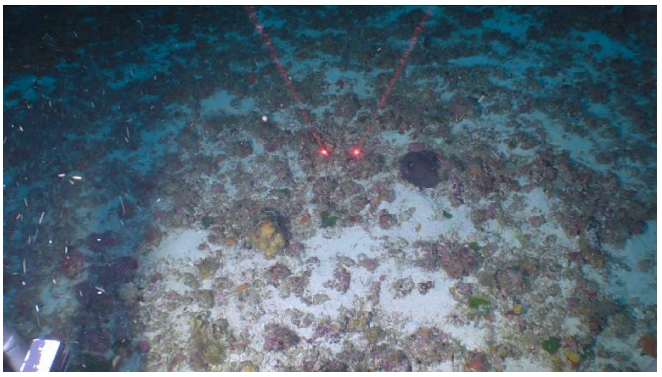


Figure 5: -97.6 m
Pulley Ridge pavement/rubble bottom with demosponges and algae (10 cm lasers),

Dive Site: Pulley Ridge, Inside/Outside HAPC; Block 114; Southern Escarpment; ROV 15-19, UNCW 278

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 2-IX-15-1; ROV Dive 15-19; Mohawk UNCW Dive 278. Target Site: Florida, inside/outside Pulley Ridge HAPC, MB- southern escarpment, random block 114; 109 m.

Objectives- Ground truth MB map (low resolution USGS) along escarpment in area of large grouper essential fish habitat. Conduct five 100-m photo/video transects in each habitat area- base of escarpment, wall, and top of wall to document grouper populations. Collect benthic macro-organisms for taxonomy voucher specimens.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/125, auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom; photos were taken every 30 seconds. Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. Five random 100 m quantitative transects were conducted in each Block. Each 100 m transect was conducted at ~0.25 kn, for 15-20 minutes until the ROV passed through 100 m circle overlaid on navigation screen; quantitative still images were taken every 30 sec for a minimum of 30 images per transect. Off transects between the quantitative transects were 15-20 minutes for close-up video frame grabs of fish and biota, and for collections. Direction of transects were random, but generally headed NE or NW, depending on the ship's maneuverability with the wind and current.

Site Description/Habitat

Depth range: 89.3 to 109.7 m.

Surface current was 1.5 kn from NW; ship unable to station keep and maneuver in direction necessary to document the escarpment. No part of the dive was made on the escarpment. Instead, we drifted east along the featureless habitat below the escarpment. The entire dive was outside of the HAPC.

8:30- Launch. Sunny 2 ft. from SE, 9 kn from SE, surface water- 30.469°C, salinity 33.774, current 1.3 – 1.5 kn from NW.

8:39- On bottom, 109.7, MB- flat shelf 200 m south of escarpment; head east (unable to go N to escarpment); 22.43°C, salinity 36.45 (halocline 25 m), current ¾ kn from NW.

8:50- Start XS 1, 109.0 m, head E 100 m; 95% large cobble 10-15 cm, sparse CCA on cobble, thin encrusting sponges (yellow and orange), sparse *Verdigellas*.

9:05- End XS 1, 105.5 m. Continue heading E 25 m off transect. Made off-XS sections short so not to run out of the block- drifting ½+ kn.

9:08- Start XS 2, 104.5 m, heading E 100 m; same habitat and biota.

9:15- End XS 2, 104 m. Head E 25 m.

9:18- Start XS 3, 103.5 m, heading E 100 m. MB- at the east end of the remains of the escarpment; no ridge, just overall low slope of 10 m (not even visible in video). Same habitat and biota, few *Geodia neptuni*, sparse Ellisellidae.

9:24- End XS 4, 98 m. Head E 25 m. MB- top of slope. More species- *Tanacetipathes*, *Erylus* PR 1, *Agelas* fans, *Antipathes furcate*.

9:33- Start XS 4, 95.5 m, head E 100 m, top of slope; 90% rubble, small cobble; CCA, *Verdigellas*, some sponges and black coral.

9:38- End XS 4, 90.4 m; head E 10 m.

9:39- Start XS 5, 90.4 m , head E 100 m; 90% rubble, small cobble; CCA on rubble, demosponges common and diverse, Stylaster, Ellisellidae.

9:46- End XS 5, 89.3 m, top of shelf. End dive.

Dominant Benthic Macrobiota:
Algae- CCA, *Verdigellas*.
Coral- *Stylaster*.
Antipatharia- *Antipathes furcata*, *Tanacetipathes* sp.
Octocoral- Ellisellidae.
Porifera- Demospongiae orange/yellow encrusting, *Geodia neptuni*, Erylus PR 1.

No samples.

Dive Site: Pulley Ridge, Inside/Outside HAPC; Block 114; Southern Escarpment; ROV 15-19, UNCW 278

CPCe Percent Cover Analysis:

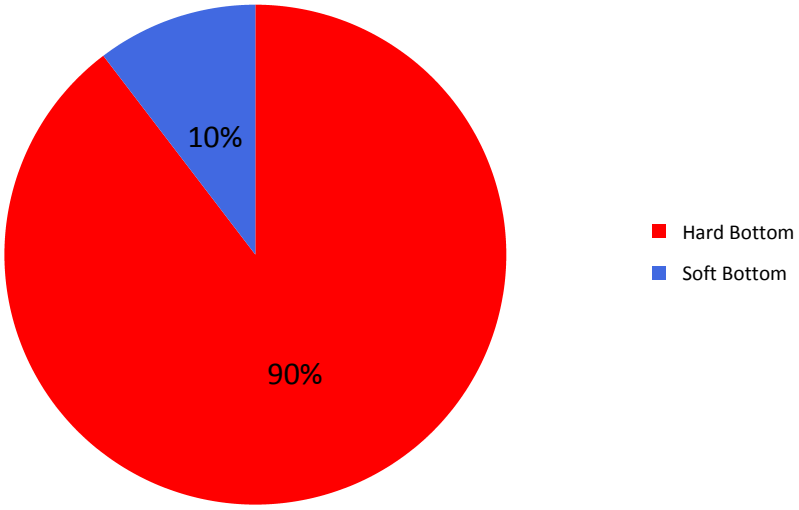
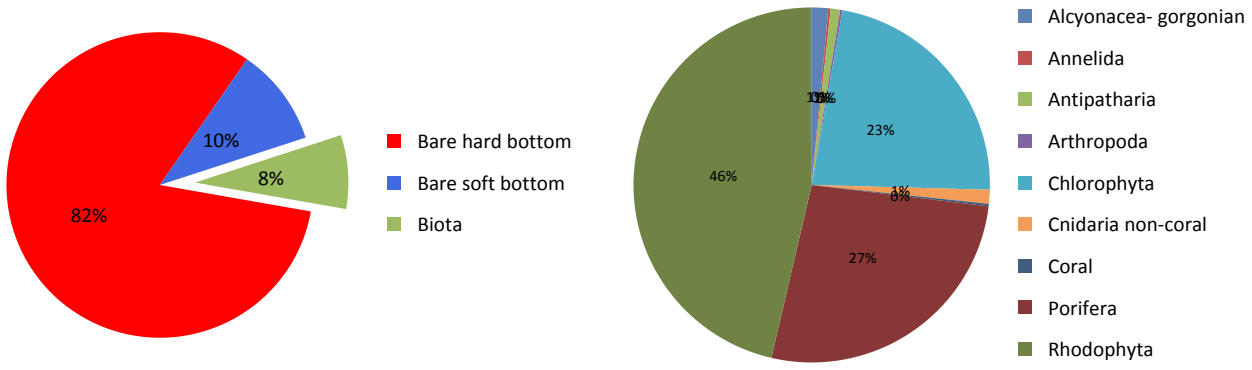


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-19. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-19.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Inside/Outside HAPC; Block 114; Southern Escarpment; ROV 15-19, UNCW 278

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-19.

Group/Phylum/Taxa	ROV 15-19
Biota	7.80%
Chlorophyta	1.77%
Verdigellas peltata	1.77%
Rhodophyta	3.62%
Corallinales (crustose coralline)	3.62%
Porifera	2.08%
Demospongiae	1.93%
Erylus- PR1	0.02%
Niphatidae	0.02%
Poecilosclerida	0.02%
Spirastrellidae	0.10%
Cnidaria	0.30%
Agaricia sp.	0.02%
Antipatharia	0.02%
Ellisella sp.	0.10%
Ellisellidae	0.02%
Hydroidolina	0.08%
Stylasteridae	0.02%
Tanacetipathes tanacetum	0.05%
Annelida	0.02%
Hermodice carunculata	0.02%
Arthropoda	0.02%
Brachyura	0.02%
Bare hard bottom	81.87%
Habitat	81.87%
Bare rock	5.22%
Bare rubble/cobble	76.65%
Bare soft bottom	10.33%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Inside/Outside HAPC; Block 114; Southern Escarpment; ROV 15-19, UNCW 278

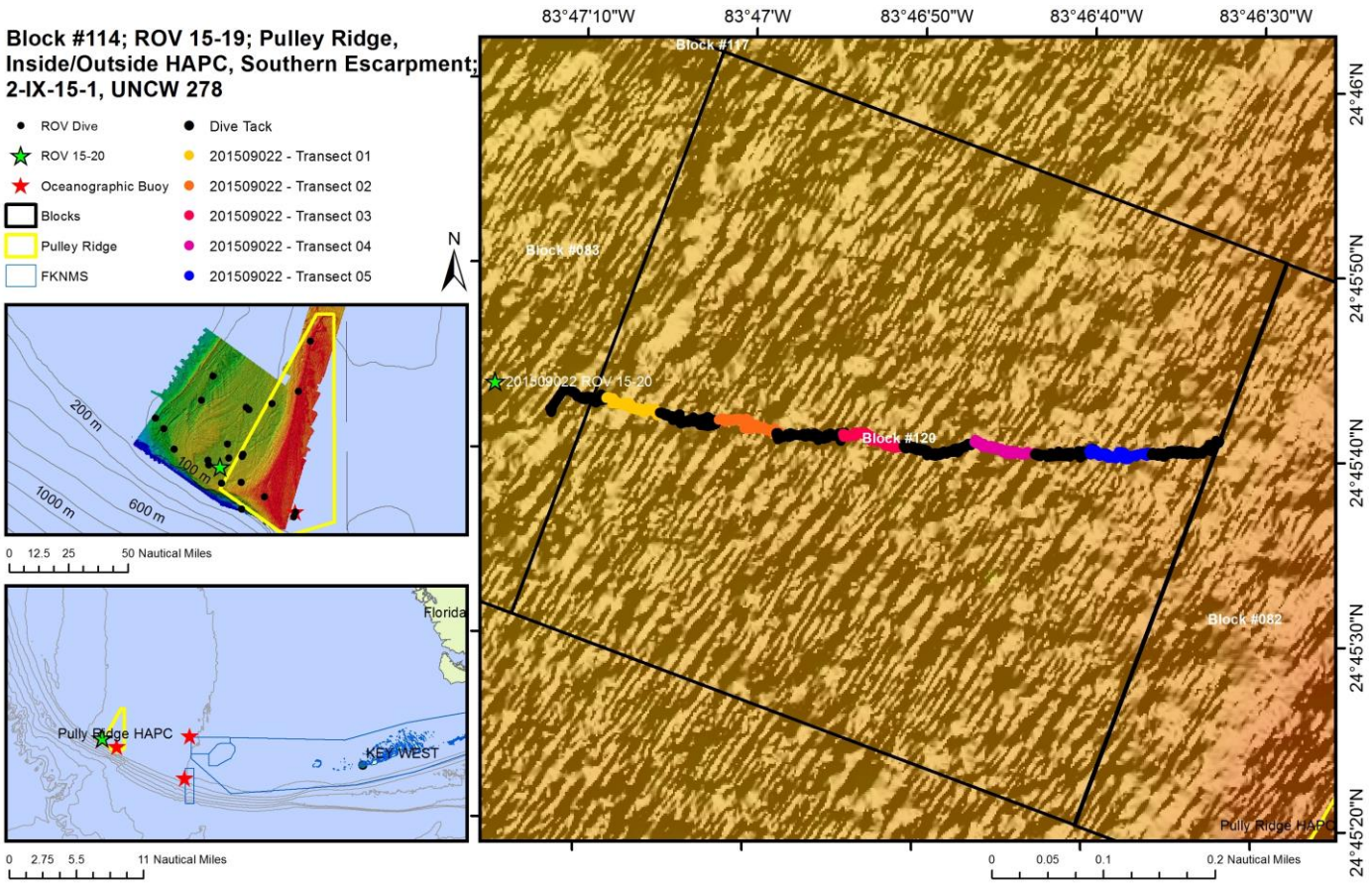
Density of Fish:

Table 2. Density (# individuals/m) of fish from video transects at dive site ROV 15-19.

Class/Order/Family/Common name -Taxa	ROV 15-19 No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
fish unid.- Actinopteri	76	0.1520
Perciformes		
Carangidae		
amberjack- *Seriola* sp.	1	0.0020
Chaetodontidae		
bank butterflyfish- *Prognathodes aya*	3	0.0060
reef butterflyfish- *Chaetodon sedentarius*	21	0.0420
Labridae		
Wrasse unid.- *Halichoeres* sp.	4	0.0080
Pomacanthidae		
cherubfish- *Centropyge argi*	3	0.0060
Pomacentridae		
yellowtail reeffish- *Chromis enchrysurus*	3	0.0060
Serranidae		
roughtongue bass- *Pronotogrammus martinicensis*	261	0.5220
tattler- *Serranus phoebe*	6	0.0120
Sphyraenidae		
Great Barracuda- *Sphyraena barracuda*	1	0.002
Scorpaeniformes		
Scorpaenidae		
lionfish- *Pterois volitans*	19	0.0380
Grand Total	**398**	**0.5220**

Dive Site: Pulley Ridge, Outside HAPC; Block 120; Central Basin- South; ROV 15-20, UNCW 279

General Location and Dive Track:



Site Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project
Principal Investator:	Dr. Robert Cowen, PhD
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365
Website:	www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html
Scientific Observers:	Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington

Dive Overview:

Vessel:	R/V Walton Smith
Sonar Data:	Naar_pulley_10m1_TIF
Purpose:	Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction
ROV:	Mohawk ROV
Data Management:	Access Database
ROV Navigation Data:	Trackpoint II

ROV Sensors: Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density

Date of Dive:	9/2/2015	**Specimens:**	1
Ship Position System:	DGPS	**Digital Photos:**	219
Report Analyst:	John Reed, Stephanie Farrington	**DVD:**	1
Date Compiled:	1/27/2017	**Hard Drive:**	1

Dive Site: Pulley Ridge, Outside HAPC; Block 120; Central Basin- South; ROV 15-20, UNCW 279

Dive Data:

Minimum Bottom Depth (m):	78.2	**Total Transect Length (km):**	1.165
Maximum Bottom Depth (m):	82.3	**Surface Current (kn):**	1.6
On Bottom (Time- GMT):	11:09	**On Bottom (Lat/Long):**	24.76°N; -83.79°W
Off Bottom (Time- GMT):	12:58	**Off Bottom (Lat/Long):**	24.76°N; -83.78°W
Physical (bottom); Temp (°C):	22.16	**Salinity:** 36.51 **Visibility (ft):** 60	**Current (kn):** 0.75

Physical Environment:

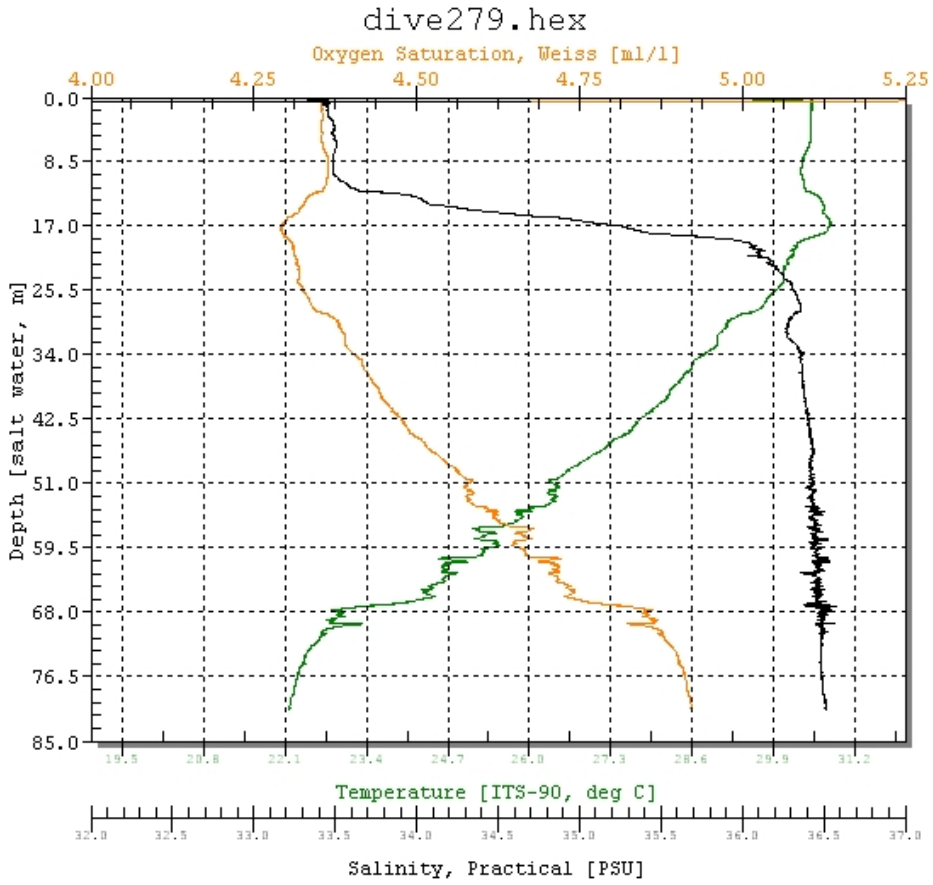


Figure 1: Shows the CTD data during the descent of ROV 15-20. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-20 are as follows: max depth: 80.82 m, temperature: 22.16 °C, conductivity: 52100 µS/cm, pressure: 117.88 PSI, salinity: 36.51 PSU, sound velocity: 1530.31 m/s, oxygen concentration: 4.93 ml/l, density: 1025.68 Kg/m^3, nitrogen saturation: 9.09 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Outside HAPC; Block 120; Central Basin- South; ROV 15-20, UNCW 279

Dive Imagery:

Figure 2: -82.1 m
Ocean triggerfish sighted on descent.

Figure 3: -80.8 m
Porgy swimming over Pulley Ridge.

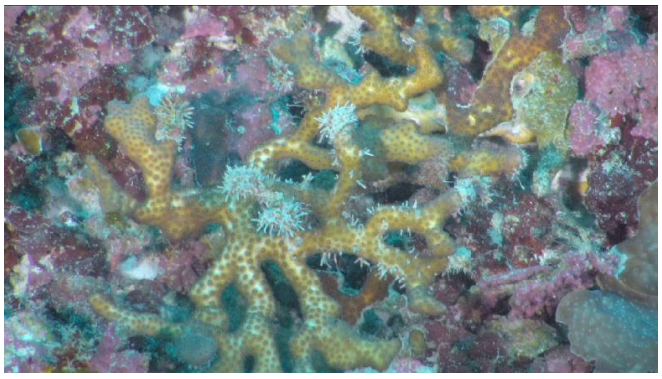


Figure 4: -80.7 m
Pencil coral *Madracis brueggemanni.*

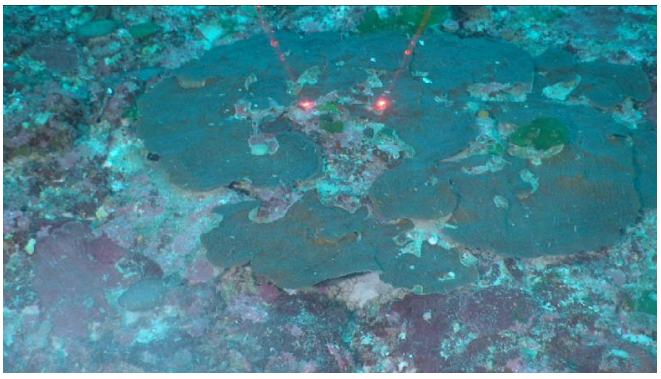


Figure 5: -80.2 m
1-m diameter *Agaricia* sp. plate coral (10 m lasers).

Dive Site: Pulley Ridge, Outside HAPC; Block 120; Central Basin- South; ROV 15-20, UNCW 279

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 2-IX-15-2; ROV Dive 15-20; Mohawk UNCW Dive 279. Target Site: Florida, Outside Pulley Ridge HAPC, central basin, random block 120; 81 m.

Objectives- Ground truth MB map (low resolution USGS); conduct five random 100-m photo/video transects within block. Conduct video transects for fish population characterization and photo transects for habitat and benthic macrobiota characterization. Collect benthic macro-organisms for taxonomy voucher specimens.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/125, auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom; photos were taken every 30 seconds. Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. Five random 100 m quantitative transects were conducted in each Block. Each 100 m transect was conducted at ~0.25 kn, for 15-20 minutes until the ROV passed through 100 m circle overlaid on navigation screen; quantitative still images were taken every 30 sec for a minimum of 30 images per transect. Off transects between the quantitative transects were 15-20 minutes for close-up video frame grabs of fish and biota, and for collections. Direction of transects were random, but generally headed NE or NW, depending on the ship's maneuverability with the wind and current.

Site Description/Habitat

Depth range: 79.7 to 82.2 m.

Strong current, 1.6 kn from NW. All transects made heading E. MB- featureless flat bottom. Block in between two blocks with highest density of *Agaricia*.

11:03- Launch. Sunny 1-2 ft. seas from SE, 8 kn from SE, 30.507°C, salinity 33.400, current 1.6 kn from NW.

11:09- On bottom, 82.0 m, 22.16°C, salinity 36.51, current ¼ kn from NW, visibility 15+ m.

11:16- Start XS 1, 81.7 m, head E 100 m; 100% hard bottom, rubble/cobble/pavement; dense CCA, sheets of frilly pink CCA on pavement, Peyssonnelia, *Verdigellas*, *Halimeda copiosa*, *Anadyomene* <1%, sparse demosponges, no Antipatharia, sparse octocorals, Stylaster, *Davidaster*, *Madracis brueggemanni*. Few small pits or scoured out rock, 20 cm relief, with small reef fish, few lionfish, no grouper. Agaricia- 5-10 cm abundant (several/image), several 50 + cm diameter Agaricia lamarcki.

11:24- End XS 1, 81.2 m. Head E 100 m. 50 cm *Agaricia*. Collect sample. Several partially dead Agaricia, 10 cm, not bleaching but recent (white to light green) dead; M. decactis.

11:44- Start XS 2, 81.0 m, head E 100 m; same habitat and biota. *Agaricia* 5-10 cm abundant, 30 cm *Agaricia*, *M. brueggemanni*; 10 m pit, no grouper, reef fish.

11:53- End XS 2, 81.0 m. Head E 100 m. Agaricia abundant; small pit- 2 lionfish; pit- 4 lionfish.

12:01- Start XS 3, 80.8 m, head E 100 m; 95% hard bottom, rubble/cobble/pavement; same biota; CCA, Peyssonnelia, sparse *Anadyomene*, sparse octocorals, sparse demosponges, *Antipatharia* common, *Verdigellas* common, Stylaster, *Davidaster*. Agaricia 5-10 cm abundant (in most every photo), few 30+ cm.

12:08- End XS 3, 80.5 m. Head E 100 m.

12:19- Start XS 4, 80.7 m, head E 100 m; same habitat and biota; <1% *Anadyomene*; *Agaricia* 5-10 cm abundant, few 50-100 cm.

12:26- End XS 4, 80.6 m. Head E 100 m. Demosponges- *Agelas*, *G. neptuni*; octocorals- orange sparsely branched, *Telesto*; 3 m pit- lionfish. *Agaricia* 5-10 cm abundant; 60 cm *Agaricia*.

12:47- Start XS 5, 80.2 m; head E 100 m; same habitat and biota; *Agaricia* 5-10 cm abundant (5-10/image).

Dive Site: Pulley Ridge, Outside HAPC; Block 120; Central Basin- South; ROV 15-20, UNCW 279

12:47- End XS 5, 80.0 m. Head E 100 m to east border of block. Same habitat and biota. Small pit- lionfish; 10 m pit, 2 m deep- reef fish, no lionfish, no grouper. No large dead coral plates like on main Pulley Ridge, only small individual *Agaricia* and some conglomerate 30-50 cm A. lamarcki. Small boulder with 3 red snapper, few lionfish.
12:58- End dive, 79.7 m, at east border of block.

Dominant Benthic Macrobiota:
Algae- CCA, sheets of frilly pink CCA, Peyssonnelia, *Verdigellas*, sparse <1% *Anadyomene*, *Halimeda copiosa*.
Coral- *Madracis brueggemanni*, *M*. *decactis*, Stylaster; 5-10 cm *Agaricia* abundant on all transects, 30-50 cm present but not common.
Octocorallia- few 10 cm sparsely branched orange, *Telesto* sp.
Antipatharia- *Antipathes atlantica* common.
Porifera- sparse, *Geodia neptuni*, *Ircinia strobilina*.
Crinoidea- *Davidaster* sp.
Fish- Few small scoured pits, 3 red snapper, no large grouper; lionfish present, not abundant.

Samples Collected:
Sample 1- 10 cm *Agaricia*, partially recently dead.

Dive Site: Pulley Ridge, Outside HAPC; Block 120; Central Basin- South; ROV 15-20, UNCW 279

CPCe Percent Cover Analysis:

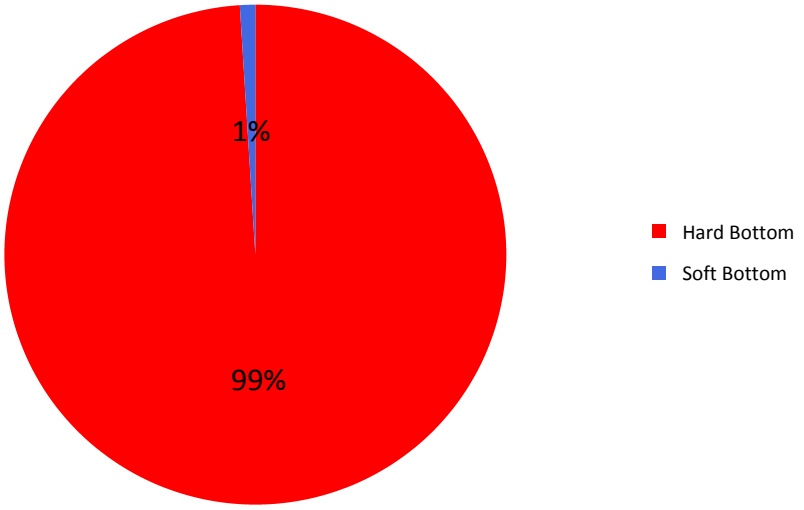
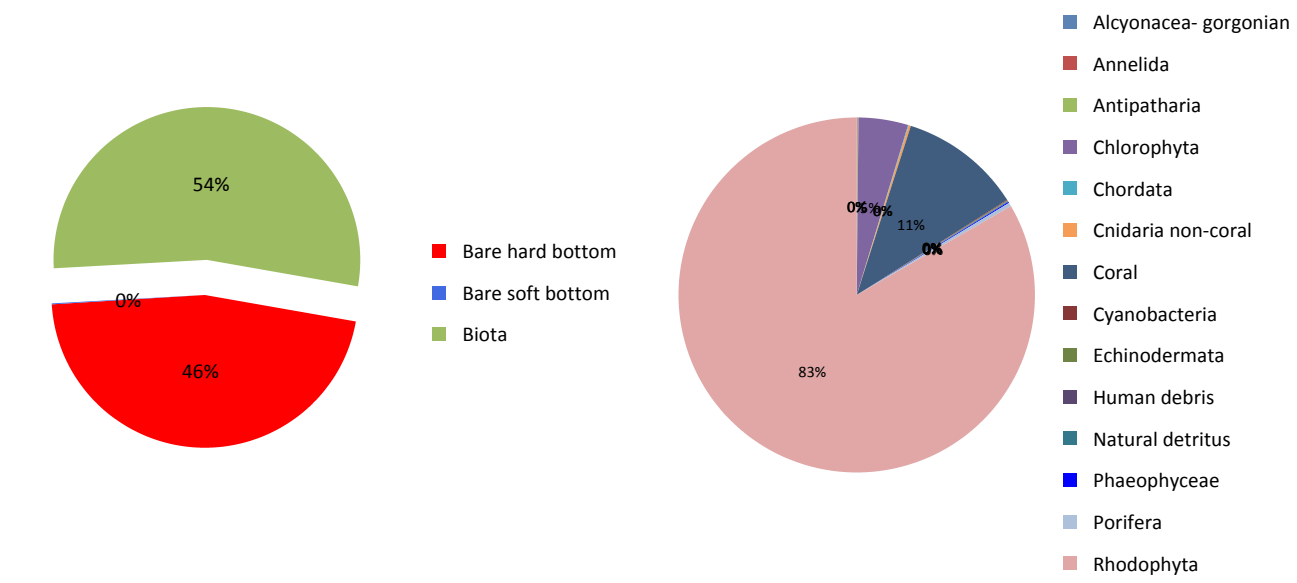


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-20. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-20.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Outside HAPC; Block 120; Central Basin- South; ROV 15-20, UNCW 279

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-20.

Group/Phylum/Taxa	ROV 15-20
Biota	53.64%
Chlorophyta	2.42%
Anadyomene menziesii	0.20%
Halimeda copiosa	0.02%
Halimeda sp.	0.05%
Verdigellas peltata	2.15%
Ochrophyta	0.05%
Dictyota sp.	0.05%
Rhodophyta	44.72%
Corallinales (crustose coralline)	43.64%
Peyssonnelia sp.	1.07%
Rhodophyta	0.02%
Cyanobacteria	0.03%
Cyanobacteria	0.03%
Porifera	0.18%
Demospongiae	0.15%
Erylus- PR1	0.02%
Neofibularia nolitangere	0.02%
Cnidaria	6.12%
Agaricia fragilis	0.70%
Agaricia grahamae	0.12%
Agaricia sp.	4.17%
Alcyonacea- gorgonian	0.02%
Antipatharia	0.03%
Ellisella sp.	0.02%
Madracis brueggemanni	0.32%
Madracis decactis	0.62%
Madracis formosa	0.03%
Stylasteridae	0.10%
Annelida	0.02%
Hermodice carunculata	0.02%
Echinodermata	0.03%
Analcidometra armata	0.02%
Comatulida	0.02%
Chordata	0.03%
Actinopterygii	0.02%

Dive Site: Pulley Ridge, Outside HAPC; Block 120; Central Basin- South; ROV 15-20, UNCW 279

Ascidiacea	0.02%
detritus	0.03%
Human Debris	0.02%
Human debris	0.02%
Human debris- Other	0.02%
Bare hard bottom	46.24%
Habitat	46.24%
Bare dead coral plate	0.28%
Bare rock	1.47%
Bare rubble/cobble	44.49%
Bare soft bottom	0.10%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Outside HAPC; Block 120; Central Basin- South; ROV 15-20, UNCW 279

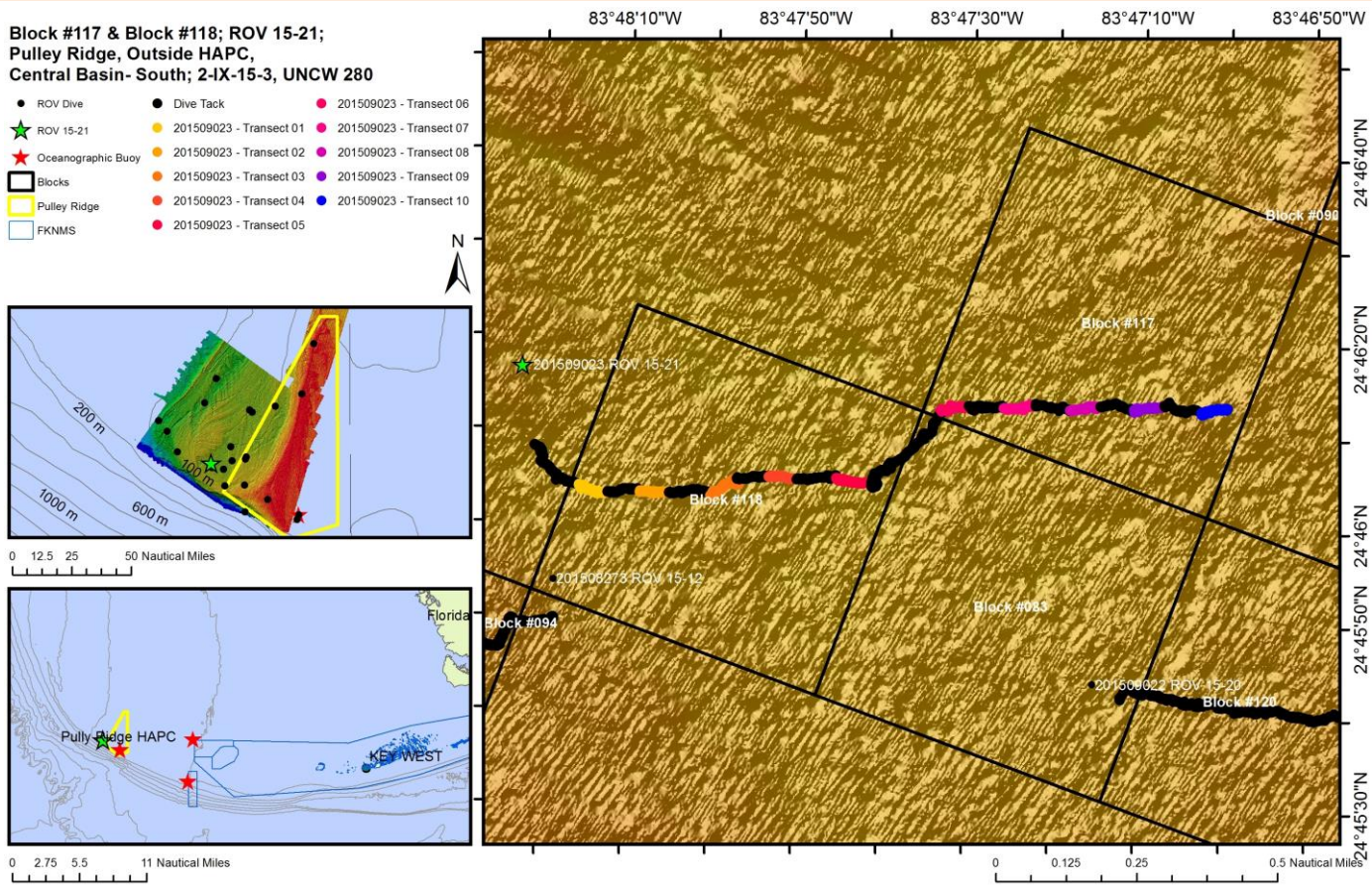
Density of Fish:

Table 2. Density (# individuals/m) of fish from video transects at dive site ROV 15-20.

Class/Order/Family/Common name -Taxa	ROV 15-20 No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
fish unid.- Actinopteri	32	0.0640
Perciformes		
Chaetodontidae		
reef butterflyfish- *Chaetodon sedentarius*	11	0.0220
spotfin butterflyfish- *Chaetodon ocellatus*	1	0.0020
Haemulidae		
striped grunt- *Haemulon striatum*	50	0.1000
Lutjanidae		
Snapper unid.- *Lutjanus* sp.	1	0.0020
Mullidae		
spotted goatfish- *Pseudupeneus maculatus*	1	0.0020
Pomacanthidae		
blue angelfish- *Holacanthus bermudensis*	1	0.0020
cherubfish- *Centropyge argi*	11	0.0220
rock beauty- *Holacanthus tricolor*	4	0.0080
Pomacentridae		
Blue chromis- *Chromis cyanea*	1	0.0020
Chromis unid.- *Chromis* sp.	3	0.0060
purple reeffish- *Chromis scotti*	9	0.0180
sunshine chromis/sunshinefish- *Chromis insolata*	4	0.0080
yellowtail reeffish- *Chromis enchrysurus*	31	0.0620
Priacanthidae		
bigeye- *Priacanthus arenatus*	2	0.0040
Serranidae		
chalk bass- *Serranus tortugarum*	3	0.0060
orangeback bass- *Serranus annularis*	1	0.0020
wrasse bass- *Liopropoma eukrines*	1	0.0020
Scorpaeniformes		
Scorpaenidae		
lionfish- *Pterois volitans*	5	0.0100
Grand Total	**172**	**0.1000**

Dive Site: Pulley Ridge, Outside HAPC; Block 118 & 117; Central Basin- South; ROV 15-21, UNCW 280

General Location and Dive Track:



Site Overview:

Dive Overview:

Project:	Pulley Ridge Mesophotic Reef Connectivity Project	**Vessel:**	R/V Walton Smith
Principal Investator:	Dr. Robert Cowen, PhD	**Sonar Data:**	Naar_pulley_10m1_TIF
PI Contact Info:	Hatfield Marine Science Center/OSU 2030 Marine Science Dr., Newport, OR 97365	**Purpose:**	Conduct ROV video/photo transects and collect specimens for species varification and coral reproduction
Website:	www.oceanexplorer.noaa.gov/explorations/15pulleyridge/welcome.html	**ROV:**	Mohawk ROV
Scientific Observers:	Dennis Hanisak, Heather Moe, Jana Ash, Jason White, John Reed, Lance Horne, Stephanie Farrington	**Data Management:**	Access Database
		ROV Navigation Data:	Trackpoint II
ROV Sensors:	Temperature (°C), Pressure, Dissolved Oxygen (ml/l), Salinity (PSU), Dissolved Oxygen (% sat), Fluoresence, Turbidity, Conductivity, Depth (m), Density		
Date of Dive:	9/2/2015	**Specimens:**	3
Ship Position System:	DGPS	**Digital Photos:**	447
Report Analyst:	John Reed, Stephanie Farrington	**DVD:**	3
Date Compiled:	1/27/2017	**Hard Drive:**	1

Dive Site: Pulley Ridge, Outside HAPC; Block 118 & 117; Central Basin- South; ROV 15-21, UNCW 280

Dive Data:

Minimum Bottom Depth (m):	73.8	**Total Transect Length (km):**	2.567
Maximum Bottom Depth (m):	82.9	**Surface Current (kn):**	1.5
On Bottom (Time- GMT):	14:02	**On Bottom (Lat/Long):**	24.77°N; -83.81°W
Off Bottom (Time- GMT):	17:42	**Off Bottom (Lat/Long):**	24.77°N; -83.78°W

Physical (bottom); Temp (°C): 22.52 **Salinity:** 36.48 **Visibility (ft):** 45 **Current (kn):** 0.5

Physical Environment:

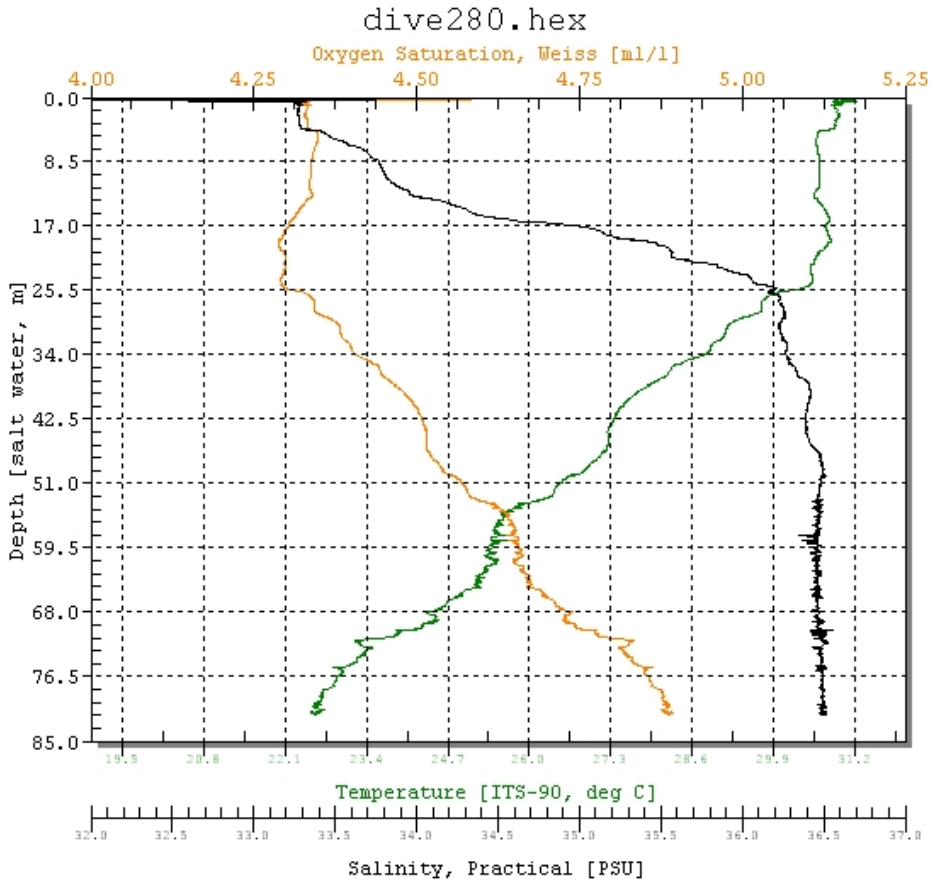


Figure 1: Shows the CTD data during the descent of ROV 15-21. All CTD data were collected with a Sea-Bird SBE 49 FastCAT CTD that was attached to the ROV (recording descent, bottom data and ascent). The data recorded at the maximum dive depth during ROV 15-21 are as follows: max depth: 81.95 m, temperature: 22.47 °C, conductivity: 52400 µS/cm, pressure: 119.54 PSI, salinity: 36.49 PSU, sound velocity: 1531.09 m/s, oxygen concentration: 4.91 ml/l, density: 1025.57 Kg/m^3, nitrogen saturation: 9.05 ml/l. These data were used to characterize hydrographic conditions at the dive sites.

Dive Site: Pulley Ridge, Outside HAPC; Block 118 & 117; Central Basin- South; ROV 15-21, UNCW 280

Dive Imagery:

Figure 2: -81.8 m
Yellow/orange erect branching sponge *Agelas* sp.

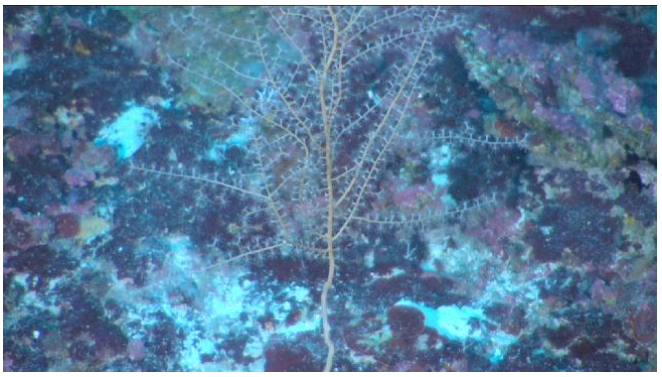


Figure 3: -81.7 m
Plumarella sp. gorgonian.

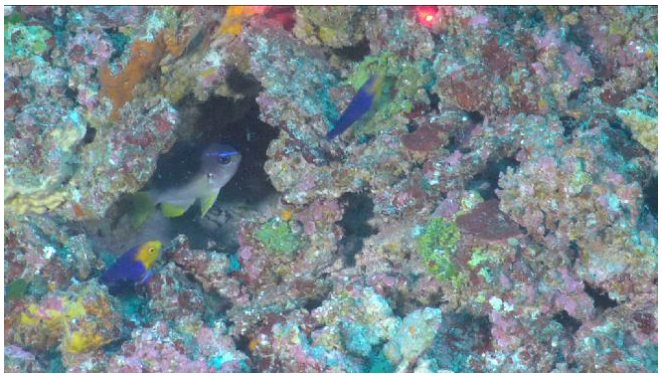


Figure 4: -82.4 m
Small reeffish in rubble habitat- yellowtail reeffish in hole, and cherubfish (blue, yellow).

Figure 5: -81.7 m
Lionfish and bigeye take shelter on a yellow *Agelas* sp. sponge.

Dive Site: Pulley Ridge, Outside HAPC; Block 118 & 117; Central Basin- South; ROV 15-21, UNCW 280

Dive Notes:

Objectives, Site Description, Habitat, Fauna:

Site/Objectives:

Site #- 2-IX-15-3; ROV Dive 15-21; Mohawk UNCW Dive 280. Target Site: Florida, outside Pulley Ridge HAPC, central basin, random blocks 118-117; 82 m.

Objectives- Ground truth MB map (low resolution USGS); conduct five random 100-m photo/video transects within block. Conduct video transects for fish population characterization and photo transects for habitat and benthic macrobiota characterization. Collect benthic macro-organisms for taxonomy voucher specimens.

ROV Setup/Dive Events:

All data (ROV navigation, video, photos, dive notes) were recorded in ESDT. Dive Notes- depth recorded as total depth (ROV altitude + ROV depth in meters); COG is ROV heading. Dive Notes were recorded by Reed and Farrington (HBOI) directly into Access database. Fish data were recorded by Heather Moe (NOAA Fisheries) in separate Access database which was compiled with the benthic database.

Digital still images were shot in Tv Mode, fixed speed at 1/125, auto f-stop, auto focus, strobe on. Quantitative photo transects used the digital still camera pointing straight down, 1.3 m off bottom; photos were taken every 30 seconds. Non-quantitative photos for habitat and species identifications were logged separately. Video for fish counts used the video camera pointed forward and down ~20° to view from the horizon to close up. Both cameras had 10-cm parallel lasers for scale. Five random 100 m quantitative transects were conducted in each Block. Each 100 m transect was conducted at ~0.25 kn, for 15-20 minutes until the ROV passed through 100 m circle overlaid on navigation screen; quantitative still images were taken every 30 sec for a minimum of 30 images per transect. Off transects between the quantitative transects were 15-20 minutes for close-up video frame grabs of fish and biota, and for collections. Direction of transects were random, but generally headed NE or NW, depending on the ship's maneuverability with the wind and current.

Site Description/Habitat

Block 118:

Depth range: 81.0 to 82.6 m.

Surface current 1.5 kn from NW, only could go E for entire dive.

13:55- Launch. Sunny 1 ft. SE, 6 kn from NE, 31.213°C, salinity 33.219, current 1.5 kn from NW.

14:02- On bottom, 82.6 m. 15 m visibility, 22.52°C, salinity 36.48 (Halocline at 25 m), current ½ kn from NW. 1 m *Agaricia lamarcki* conglomerate.

14:13- Start XS 1, 82.3 m, head E 100 m; 95% rubble/cobble/pavement; CCA, Peyssonnelia, *Verdigellas*, sparse demosponges, large frilly plate pink CCA on pavement (conglomerate cobble), less pavement than dive 279, sparse *Anadyomene* 1%, Stylaster, *Antipathes atlantica*, *Davidaster*, *Xestospongia* muta. 5-10 cm *Agaricia* abundant (0-5/photo), *M. brueggemanni*.

14:23- End XS 1, 82.0. Head E 100 m.

14:33- Start XS 2, 81.6 m, head E 100 m; same habitat and biota; 5-10 cm *Agaricia* abundant. Pit with 8 lionfish.

14:46- End XS 2, 81.3 m. Head E 100 m. Several sand tilefish mounds with reef fish. 30 cm *Agaricia*, 1 m conglomerate A. lamarcki, 10 cm M. decactis.

14:58- Start XS 3, 81.6 m, head E 100 m; same habitat and biota. 5-10 cm *Agaricia* abundant, occasional 50+ cm. Collect sample.

15:21- End XS 3, 81.9 m. Head E 100 m. 30 cm *Agaricia*.

15:31- Start XS 4, 81.8 m; head E 100 m; same habitat and biota; 5-10 cm *Agaricia* abundant, 30 cm Ag. Large area (20 m) of sand and sparse rubble.

15:40- End XS 4, 82.0 m. Head E 100 m.

15:48- Start XS 5, 81.8 m, head E 100 m; 95% hard bottom, rubble/cobble/pavement; CCA, Peyssonnelia, *Verdigellas*, Stylaster common, demosponges sparse, no octocorals, *Antipatharia* sparse, *Anadyomene* sparse <1%. 5-10 cm *Agaricia* abundant (every photo).

16:00- End XS 5, 82.0 m. Head 250 m north to SW corner of next block #117.

Dive Site: Pulley Ridge, Outside HAPC; Block 118 & 117; Central Basin- South; ROV 15-21, UNCW 280

Dominant Benthic Macrobiota:
Algae- CCA, frilly pink CCA, Peyssonnelia, *Verdigellas*, 1% *Anadyomene*.
Coral- Madracis brueggemanni,; 5-10 cm *Agaricia* abundant (several/photo), 20-50 cm present but not common; Stylaster.
Antipatharia- uncommon, *Antipathes atlantica*, *Stichopathes lutkeni*.
Octocorallia- sparse.
Actiniaria- *Condylactis gigantea*.
Porifera- Xestospongia muta, Agelas spp.
Crinoidea- Davidaster sp.
Fish- sand tilefish mounds common, reef fish with mounds and pits, lionfish in pits but not abundant; no large grouper.

Samples Collected:
Sample 1- 25 cm orange, EB *Agelas* sp.

Site Description/Habitat
Block 117:
Depth range: 81.0 to 82.0 m.
Start SW corner head E all transects due to 1.5 kn surface current.
16:23- Start XS 1, 82.0 m; head E 100 m; 95% hard bottom, rubble/cobble/pavement; CCA, Peyssonnelia, *Verdigellas*, 1% *Anadyomene*; sparse demosponges, sparse octocorals, Stylaster common, *Antipathes* sparse. 5-10 cm *Agaricia* abundant (in most photos), few 50 cm *Agaricia lamarcki*.
16:32- End XS 1, 82.0 m. Head E 100 m; same habitat and coral density.
16:39- Start XS 2, 81.8 m, head E 100 m; same habitat and biota. 5-10 cm *Agaricia* abundant; no *Anadyomene*.
16:47- End XS 2, 81.8 m. Head E 100 m; same habitat and coral density.
16:52- Start XS 3, 81.6 m; head E 100 m; same habitat, biota and coral density. Collect sample.
17:13- End XS 3, 81.5 m. Head E 100 m; same habitat and coral density.
17:22- Start XS 4, 81.6 m, head E 100 m; same habitat, biota, and coral density. 5-10 cm *Agaricia* abundant (1-5/image). 1 scamp.
17:35- Start XS 5, 81.0 m, head E 100 m; 95% hard bottom, rubble/cobble/pavement; CCA, Peyssonnelia, *Verdigellas*; sparse demosponges, sparse octocorals, sparse *Anadyomene*, sparse Antipatharia, Stylaster common. 5-10 cm *Agaricia* abundant (1- 7/image), 70 cm *Agaricia lamarcki*.
17:42- End XS 5, 81.1 m. End Dive. End Cruise. End Pulley Ridge Cruises!~

Dominant Benthic Macrobiota:
Algae- CCA, frilly pink CCA, Peyssonnelia, *Verdigellas*, 1% *Anadyomene*.
Coral- *Madracis brueggemanni*,; 5-10 cm *Agaricia* abundant (several/photo), 20-50 cm present but not common; Stylaster common
Antipatharia- uncommon, *Antipathes atlantica*, *Stichopathes lutkeni*.
Octocorallia- sparse, Primnoidae
Actiniaria- *Condylactis gigantea*.
Porifera- *Xestospongia muta*, *Agelas* spp., *Geodia* neptuni.
Crinoidea- *Davidaster* sp.
Fish- sand tilefish mounds, reef fish with mounds and pits, lionfish in pits but not abundant; 1 red grouper.

Samples Collected:
Sample 2 (of dive)- 10 cm piece of 30 cm *Agaricia lamarcki*, brown; Sample 3- 20 cm Primnoidae?.

Dive Site: Pulley Ridge, Outside HAPC; Block 118 & 117; Central Basin- South; ROV 15-21, UNCW 280

CPCe Percent Cover Analysis:

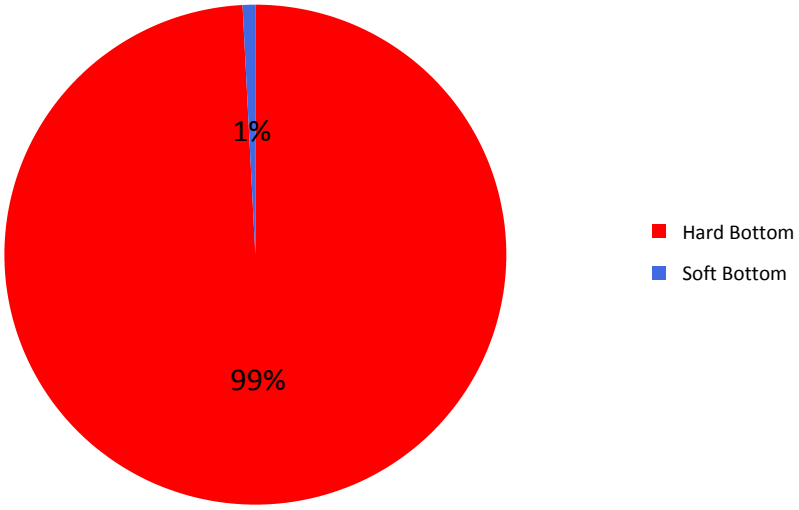
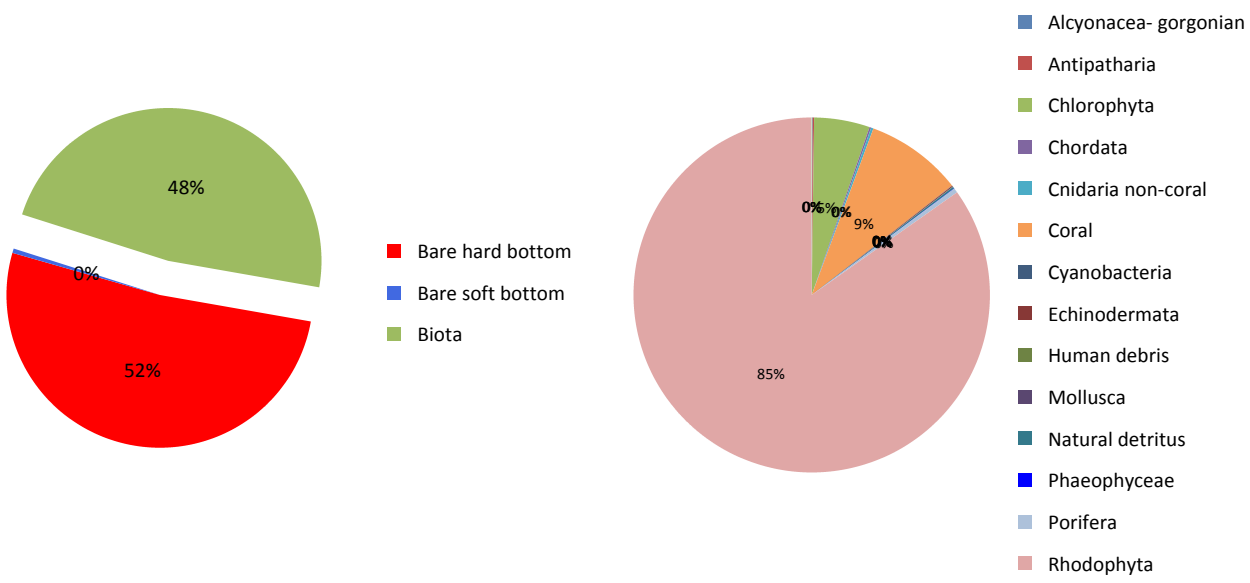


Figure 6. Percent cover of hard and soft bottom substrate at dive site ROV 15-21. CPCe© points on organisms were scored as the underlying substrate (hard or soft).



A B

Figure 7. Percent cover of bare substrate and benthic macro-biota at dive site ROV 15-21.
A. CPCe percent cover of biota and bare substrate (hard or soft bottom). B. Relative CPCe percent cover of biota and human debris.

Dive Site: Pulley Ridge, Outside HAPC; Block 118 & 117; Central Basin- South; ROV 15-21, UNCW 280

Percent Cover of Benthic Macro-Biota and Substrate:

Table 1. Percent cover of benthic macro-biota and substrate types from CPCe Point Count analysis of photographic transects at dive site ROV 15-21.

Group/Phylum/Taxa	ROV 15-21
Biota	47.85%
Chlorophyta	2.42%
Anadyomene menziesii	0.13%
Chlorophyta	0.03%
Halimeda sp.	0.03%
Valonia ventricosa	0.02%
Verdigellas peltata	2.22%
Ochrophyta	0.02%
Phaeophyceae	0.01%
Sargassum sp.	0.01%
Rhodophyta	40.56%
Corallinales (crustose coralline)	39.55%
Peyssonnelia sp.	0.94%
Rhodophyta	0.08%
Cyanobacteria	0.01%
Cyanobacteria	0.01%
Porifera	0.20%
Agelas sp.	0.01%
Demospongiae	0.15%
Geodia neptuni complex	0.01%
Xestospongia muta	0.03%
Cnidaria	4.42%
Agaricia fragilis	0.15%
Agaricia grahamae	0.18%
Agaricia sp.	2.90%
Alcyonacea- gorgonian	0.01%
Antipathes atlantica	0.03%
Antipathes furcata	0.01%
Helioseris cucullata	0.01%
Hypnogorgia pendula	0.01%
Madracis brueggemanni	0.28%
Madracis decactis	0.62%
Madracis formosa	0.07%
Madracis sp.	0.01%
Nicella sp.	0.02%
Oculina diffusa	0.01%

Dive Site: Pulley Ridge, Outside HAPC; Block 118 & 117; Central Basin- South; ROV 15-21, UNCW 280

Primnoidae	0.01%
Stylasteridae	0.10%
Tanacetipathes tanacetum	0.02%
Mollusca	0.01%
Gastropoda	0.01%
Echinodermata	0.04%
Analcidometra armata	0.02%
Davidaster discoideus	0.03%
Chordata	0.08%
Actinopterygii	0.08%
detritus	0.08%
UNKNOWN	0.03%
Human Debris	0.01%
Human debris	0.01%
Fishing line/long line	0.01%
Bare hard bottom	51.67%
Habitat	51.67%
Bare dead coral plate	0.18%
Bare rock	44.16%
Bare rubble/cobble	7.34%
Bare soft bottom	0.48%
Grand Total	**100.00%**

Dive Site: Pulley Ridge, Outside HAPC; Block 118 & 117; Central Basin- South; ROV 15-21, UNCW 280

Density of Fish:

Table 2. Density (# individuals/m) of fish from video transects at dive site ROV 15-21.

Class/Order/Family/Common name -Taxa	ROV 15-21 No. of Individuals	Density (No. of Individuals/m)
Actinopteri		
fish unid.- Actinopteri	33	0.0330
Beryciformes		
Holocentridae		
blackbar soldierfish- *Myripristis jacobus*	5	0.0050
Squirrelfish unid.- *Holocentrus* sp.	5	0.0050
Perciformes		
Chaetodontidae		
bank butterflyfish- *Prognathodes aya*	1	0.0010
reef butterflyfish- *Chaetodon sedentarius*	44	0.0440
spotfin butterflyfish- *Chaetodon ocellatus*	1	0.0010
Haemulidae		
striped grunt- *Haemulon striatum*	125	0.1250
Labridae		
spotfin hogfish- *Bodianus pulchellus*	8	0.0080
Wrasse unid.- *Halichoeres* sp.	3	0.0030
Pomacanthidae		
cherubfish- *Centropyge argi*	24	0.0240
rock beauty- *Holacanthus tricolor*	9	0.0090
Pomacentridae		
purple reeffish- *Chromis scotti*	10	0.0100
sunshine chromis/sunshinefish- *Chromis insolata*	9	0.0090
yellowtail reeffish- *Chromis enchrysurus*	60	0.0600
Priacanthidae		
bigeye- *Priacanthus arenatus*	2	0.0020
Scaridae		
Greenblotch parrotfish- *Sparisoma atomarium*	3	0.0030
Serranidae		
chalk bass- *Serranus tortugarum*	2	0.0020
orangeback bass- *Serranus annularis*	2	0.0020
red grouper- *Epinephelus morio*	1	0.0010
school bass- *Schultzea beta*	220	0.2200
tattler- *Serranus phoebe*	3	0.0030
wrasse bass- *Liopropoma eukrines*	12	0.0120

Dive Site: Pulley Ridge, Outside HAPC; Block 118 & 117; Central Basin- South; ROV 15-21, UNCW 280		
Scorpaeniformes		
Scorpaenidae		
lionfish- *Pterois volitans*	10	0.0100
Grand Total	**592**	**0.2200**