Atlantic Coastal Fish Habitat Partnership (ACFHP)
Progress Report: January 2017

Project: Hab in the Mab: Characterizing black sea bass habitat in the Mid-Atlantic Bight.

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Goals and Objectives:

The objective of this study is to improve our understanding of the relationship between black sea bass (BSB) abundance and habitat characteristics in the Mid-Atlantic region.

1) Determine the preference of BSB for particular habitats by assessing their abundance, size structure, and feeding ecology within natural and artificial reefs;
2) Improve the understanding, and other habitat characteristics of natural and artificial reefs;
3) Determine if reduced fragmentation and increased connectivity of habitats increases fish recruitment, by experimentally manipulating corridors between isolated patches.

Study Sites

To date we have surveyed four sites consisting of artificial reefs (ship wrecks) of varying age (Fig 1). These sites have been surveyed for abundance, biogenic epifauna, and stomach contents (Table 1). All sites are within coastal portions of the states of Delaware, Maryland, and Virginia, between the latitudes of 37° N and 38.5° N, at depths of 16 to 30 m.

Table 1. Summary of sites surveyed in 2016

Site Name	Type	Date Sunk	Depth (m)
Pharoby A	Wreck-North	1980	16
Pharoby B	Wreck-South		16
Pharoby C	Open Bottom		16
Riggins A	Wreck	1991	16
Riggins B	Wreck-Debris		16
Riggins C	Open Bottom		16
Vandelay	Wreck	Est 100 yrs	23.5
Palmer	Wreck	1915	23.5

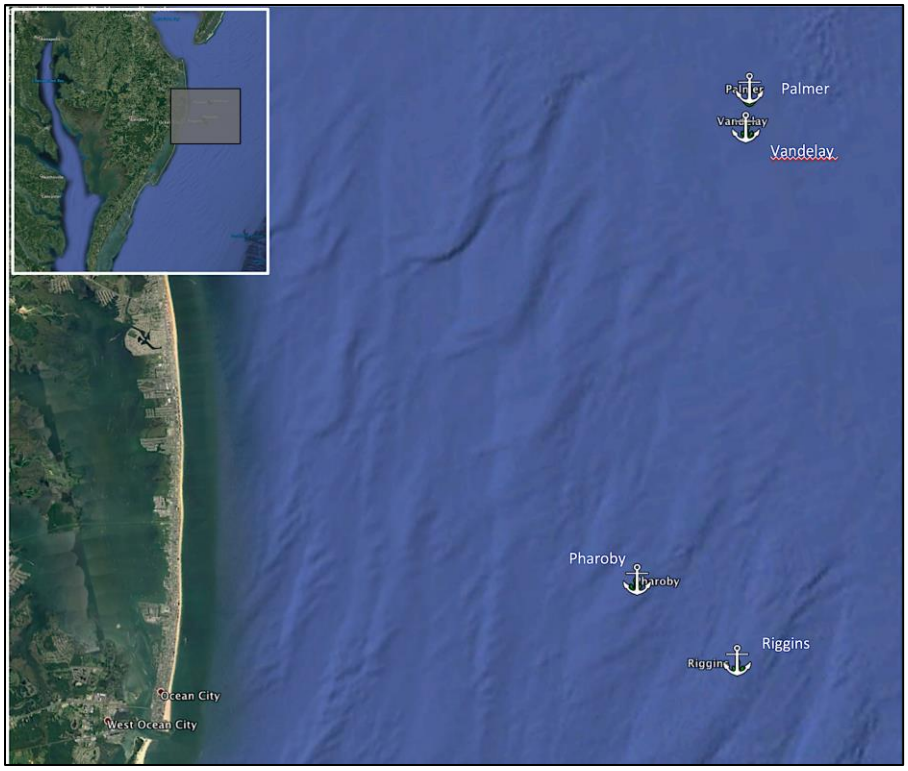

Figure 1. Map showing the study sites of the four shipwrecks.

Accomplishments to Date:

Abundance: To determine if BSB abundance varies with habitat types we designed two tripods (approximately 1 m in height) that each support two GoPro® *Hero3+* cameras, facing at 90° angles to each other (Fig. 2). Tripods are set by divers so that the cameras are facing the targeted habitat. Open bottom surveys were conducted on the Riggins and Pharoby wrecks only. This was because those wrecks are separated into two sections with 30-122 m respectively of open bottom in between. The 2016 open bottom video surveys served as control for the habitat corridor experiment. Tripods were set approximately 12-18 m in the direction of the second section of the wreck, facing away from the main wreck. Once tripods are set up, the cameras are set to record for 1 hr before retrieval to ensure at least 30 min of undisturbed footage. Anywhere from two to four videos are taken each day. Surveys were conducted in three sampling series, which is summarized in table 2. Videos were deemed unusable if tripods were knocked over shortly after recording or if visibility was too poor.

For analysis, 30 min of undisturbed video were sampled by selecting individual frames at intervals of 30 seconds, and counting all fish within selected frames (Fig. 3). Counts were used to determine minimum, maximum, and average number of fish for that day (MeanCount). Surveys will be compared between sampling series and between years. We are currently analyzing 50 videos collected during the three sampling series in 2016 (Table 2).

Analysis of abundance was attempted via two complementary methods (video and timed controlled angling; TCA) however TCA was concluded to be ineffective. TCA was conducted using three anglers with identical rigs (rod, reel, 3 hooks and sinker), who fished for 3 min,

during a drift past habitats of interest; this was repeated 8 times at each site fished. However, due to some habitats having high vertical relief, snagging of fishing lines became an issue rendering a TCA ineffective. Therefore, TCA was dropped from the abundance analysis.

Figure 2. Graduate Student Cara Schweitzer with underwater video tripod.

Biogenic epifauna: Quadrat surveys were conducted to determine composition of epifauna and fouling organisms, and to test for differences between different habitat types (natural and artificial) and age. For this purpose, we constructed a 65 x 65 cm quadrat sampling frame with a camera suspended at a height of 61 cm (Fig. 4). A 30.5 m tape measure was attached to the anchor line and elongated along the long axis of the wreck. Quadrat images were captured every 2 m along the tape measure with up to five consecutive images of open bottom at each end. This was repeated in both directions. Biogenic epifauna will be identified to the Family or Genus level and if possible, species. Percent cover will be calculated as the proportion of total pixels for each species. We are currently analyzing 125 quadrat images from the four wreck sites (Table 2).

Feeding ecology: To better understand BSB feeding ecology and to determine if BSB feeding habits are dependent on habitat, stomach contents and stable isotopes (SI; of δ 13C and δ 15N) will be analyzed. BSB were caught using hook and line baited with squid at the four sites previously mentioned. Fishing was conducted either in the morning or afternoon, however afternoon trips resulting in low catches and were discontinued. Once captured, fish were placed on ice then brought back to the lab where they were measured, sexed, stomach removed and preserved for analysis, and muscle and liver samples were collected for stable isotope analysis. All stomachs were initially preserved in 10% formalin for a minimum of 2 weeks and transferred to 70% ethanol for tissue fixation. To analyze stomach contents, prey items were removed, weighed, and identified to the lowest possible taxonomic level. Approximately 90 stomachs have been processed, with crustaceans constituting the majority of the diet. A total 107 BSB were caught for analysis in 2016 (Table 3). Muscle and liver samples were sent to UC Davis for SI analysis in early February 2017.

Table 2. Series, dates, and number of video and quadrat samples collected in 2016.

Date	Series	Site	Videos	Quadrats
6/15/16	1	Riggins	2	
6/15/16	1	Riggins-open	1	
6/16/16	1	Pharoby-open	3	
7/8/16	1	Pharoby	4	
7/15/16	1	Palmer	4	
7/15/16	1	Vandelay	4	
7/23/16		Pharoby		61
8/19/19		Riggins		19
8/24/16		Vandelay		25
8/24/16		Palmer		61
9/9/16	2	Riggins	3	
9/9/16	2	Riggins-open	2	
9/13/16	2	Palmer	1	
9/13/16	2	Vandelay	3	
9/18/16	2	Pharoby	4	
9/18/16	2	Pharoby-open	2	
10/19/16	3	Pharoby	2	
10/19/16	3	Pharoby-open	1	
10/30/16	3	Riggins-open	2	
10/30/16	3	Riggins	4	
11/12/16	3	Palmer	4	
11/12/16	3	Vandelay	4	

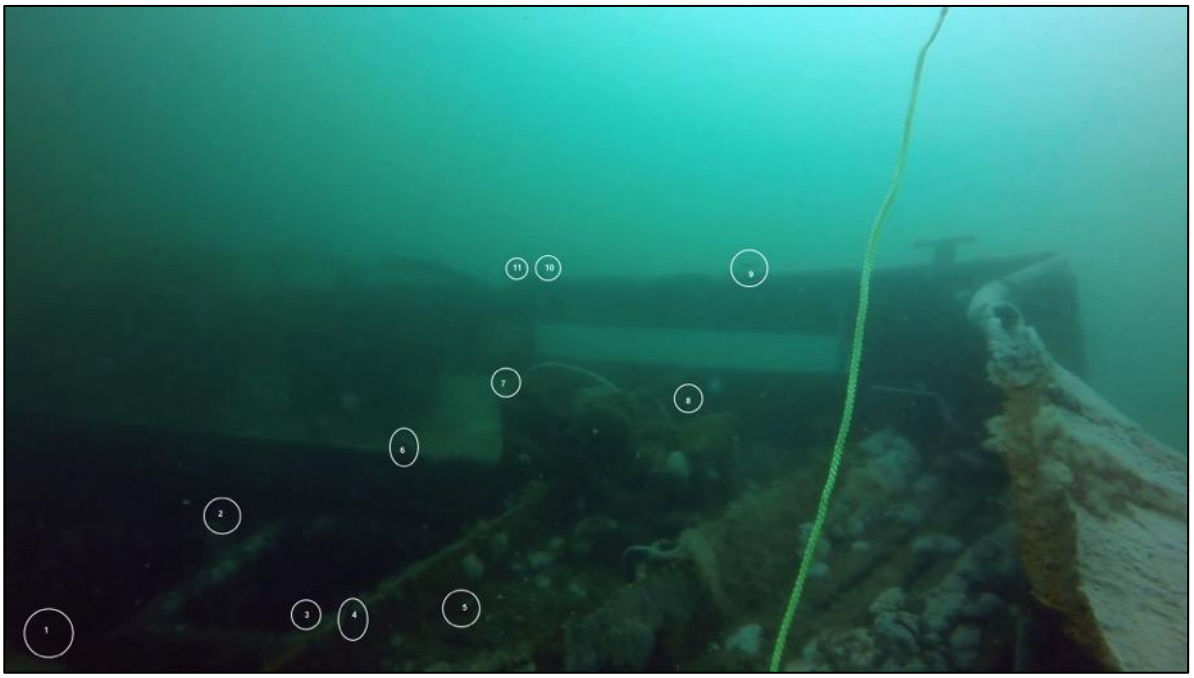

Figure 3. Frame from video abundance survey on 06/15/2016 at 90-second mark. Eleven fish are identified with white circles.

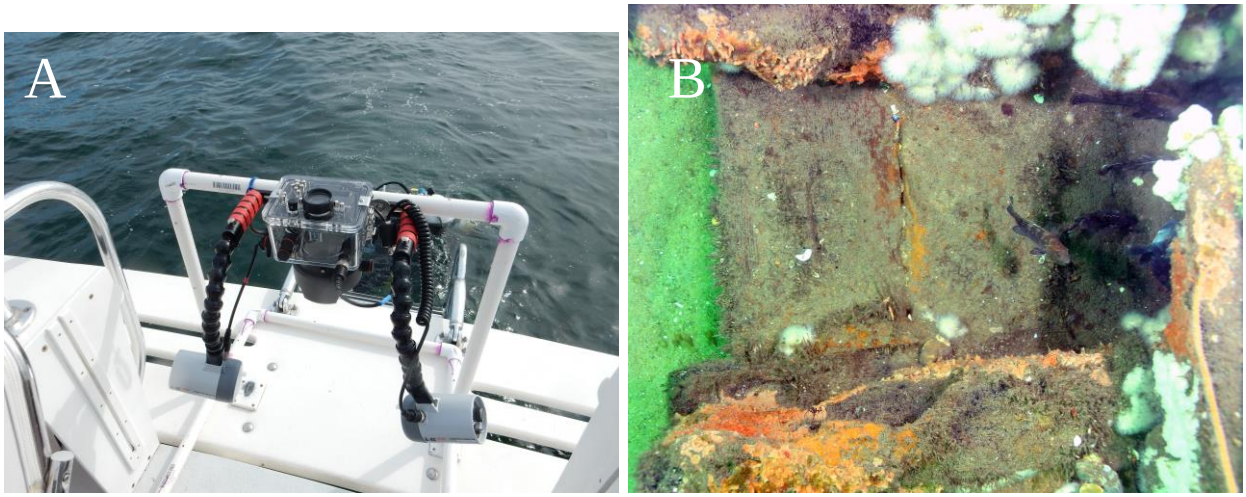

Figure 4. A) Quadrat frame with camera and strobe lights; B) quadrat photo looking down into gap in wreck, showing stony corals (white) *Cliona* sponge (orange) and black sea bass.

Table 3. Summary of BSB sampled for stomachs and stable isotopes in 2016.

Site Visited	Date	N Fish	Time	Series
Riggins	6/11/16	3	-	1
Riggins	7/7/16	13	Morning	1
Pharoby	7/20/16	1	Morning	1
Vandalay	7/21/16	3	Afternoon	1
Palmer	7/21/16	1	Afternoon	1
Pharoby	9/13/16	47	Morning	2
Riggins	9/13/16	17	Morning	2
Pharoby	11/5/16	22	Morning	3
Riggins	11/5/16	17	Morning	3

Habitat Connectivity: In order to test whether increased habitat connectivity produces increased BSB abundance, artificial habitat was placed between existing habitats in a "mosaic stepping stone" pattern (Fig. 5). The Pharoby wreck was selected as the experimental site, and the Riggins wreck will be the control site. Oyster castles were used to construct pyramids of varying size to act as the "stepping stones" of the corridor system (Fig. 6). Twenty-nine pyramids of different size and shape were constructed using 335 blocks and placed between the two Pharoby sections on Dec. 21, 2016 (Figs. 4, 5). Four pyramids were constructed using 30 blocks in 4 layers (16,9,4,1), ten using 14 blocks in 3 layers (9,4,1), and fifteen using two layers (4,1).

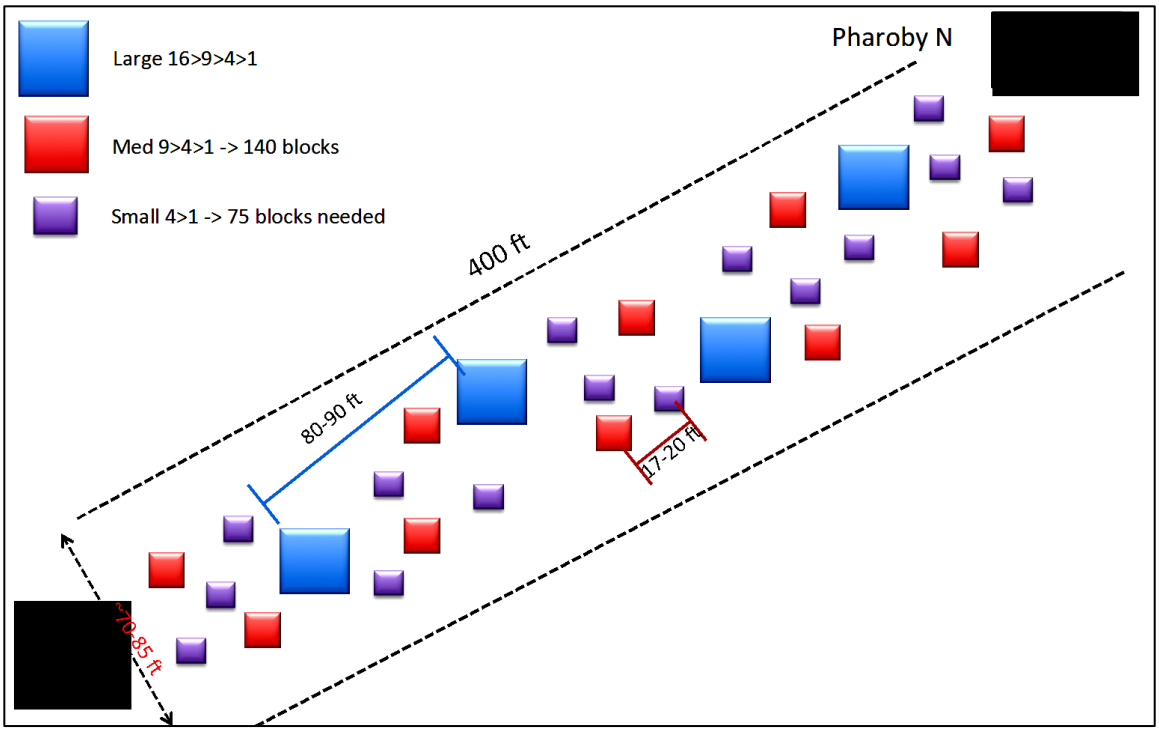

Figure 5. Conceptual diagram of the mosaic stepping stone pyramids (blue, red, and purple squares) corridor between the two Pharoby sections (black squares).

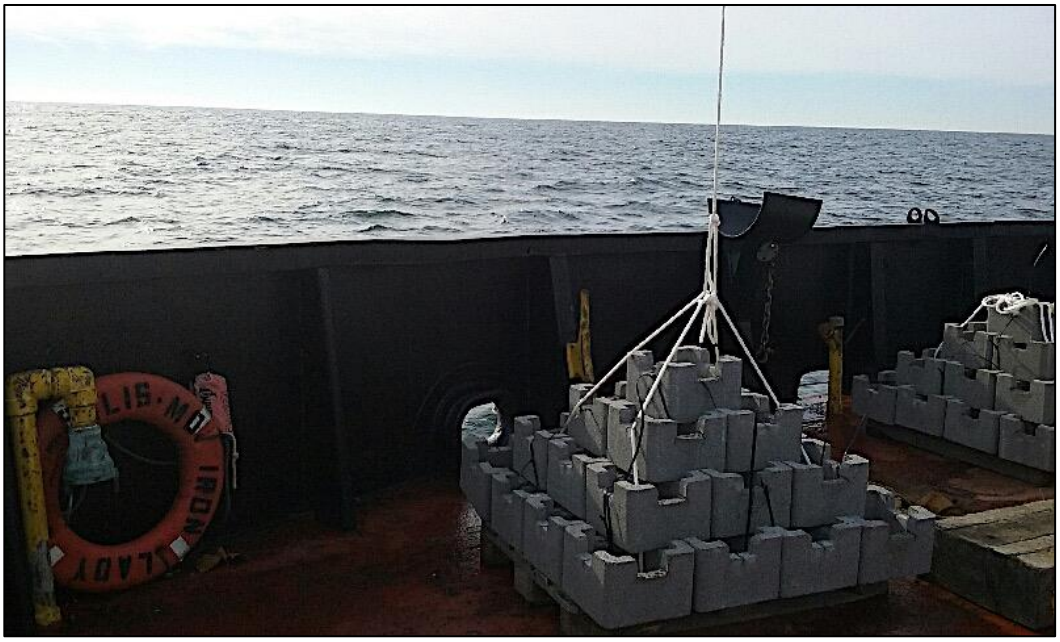
Figure 6. Oyster castle pyramids being deployed.

Future Directions

Abundance: Video surveys will be continued throughout 2017 and 2018 with three sampling series per year at the same four wrecks. Some difficulties were experienced with tripod instability, however modifications have been made to help increase stability. Continuous swim-transect video surveys will be incorporated to validate static video surveys since TCA was concluded to be ineffective. Once tripods are set, a diver will swim 30-40 m along the long axis of the habitat recording with a GoPro® *Hero 3+* at approximately 2.5-3 m above the habitat. Total fish will be counted for the duration of the video. Furthermore, habitat rugosity and vertical relief will be measured to determine if specific characteristics are important for BSB abundance.

Biogenic epifauna: Quadrats of the four sites: Riggins, Pharoby, Vandelay, and Palmer will be surveyed in 2017 and 2018 to determine any habitat succession. We intended to include natural bottom in our sampling sites, but all locations of putative "natural" bottom that we inspected were found to be old wood wrecks (e.g. Vandelay wreck) or too sparse for divers to find. There are patches of natural bottom in waters ranging from 30-35 m of depth. This will require diving with O^2 –enhanced air (EAN32, or Nitrox); we plan to obtain training in that this year so we will be able to survey those sites in 2017 and 2018. In addition to incorporating natural bottom in the quadrat surveys, additional sites will be incorporated some of which are known to have high fouling rates of blue mussel and other bivalves.

Feeding ecology: The fishing sites for 2017 will change from the original four wrecks. New sites include a relatively new artificial wreck reef that was sunk in 2014, a site showing high densities of bivalves, and natural bottom. In addition to these sites analyzed via quadrat analysis, BSB will be collected as previously stated. The stark differences in these habitats could help answer the research question: are BSB diets dependent on habitat? BSB will be analyzed for stomach contents and muscle, liver, and mucus samples will be collected for SI analysis. Each tissue has a different time stamp of feeding data where mucus shows approximately 30 days, liver is 4 months, and muscle >6 months. BSB will be collected will occur in sampling series as in 2016.

Habitat Connectivity: Abundance video surveys will be conducted through out 2017 and 2018 on the corridor system as previously mentioned. Annual photographs (2017 and 2018) will be taken to determine if any succession occurs within that period.

Presentations Made

C. Schweitzer, B.G. Stevens. "Effects of Fishing on Black Sea Bass Essential Fish Habitat." Presentation. Maryland Coastal Bays Program Science and Technical Advisory Committee. January 2017.

Timeline for Remaining Work