Final Report

OYSTER RESTORATION PRE-CONSTRUCTION SITE ASSESSMENT OF BENTHIC HABITATS IN ST. MARY'S RIVER SANCTUARY, MARYLAND

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Table of Contents

Figures *4*

Tables 4

1.0 Introduction *5*

2.0 Methods *6*

2.1 Sampling Design 6

2.2 Sampling Methods 7

2.3 Data Management *10*

2.4 Habitat Assessment Data Analysis *11*

3.0 Results *13*

5.0 References *22*

APPENDIX 1 –St. Mary's Sample Datasheet *23*

Figures

Figure 1. Location of the St. Mary's River Sanctuary (shaded blue). 5

Figure 2. Picture of patent-tongs used to collect oysters and substrate. 8

Figure 3. Picture of representative patent tong sample. Numbers and arrows correspond to substrate characteristics documented before the sample was brought on board for processing. Bubble 1 – represents the portion of the sample that is observed to document the patent tong fullness index. Bubble 2 – represents the portion of the sample that is observed to document exposed shell. Bubble 3 – represents the portion of the sample that is observed to document surface sediment depth. Colors of each bubble correspond to descriptions of each measurement in Table 2. 9

Figure 4. Graphical interpretation of exposed shell, surface sediment, and surface shell volume variables for each patent tong sample. Base oyster graphics from Tracy Saxby, Integrations and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/imagelibrary/). 11

Figure 5. A-priori classification of habitat types in St. May's River Sanctuary that were sampled by patent tongs in 2018. 6

Figure 6. Ranks from the patent tong survey to determine habitat suitability. (Figure adapted from upper St. Mary's Blueprint Report). 18

Figure 7. Resulting restoration treatment on reefs determined from the patent tong analysis. (Figure adapted from upper St. Mary's Blueprint Report). 21

Tables

Table 1. Strata sampled based on pre-classification using GIS data and earlier survey work in the St. Mary's River Sanctuary. 7

Table 2. List of substrate characteristics and substrate composition descriptors documented for each sample collected. 10

Table 3. Five benthic habitat components used to develop the index of habitat quality and the criteria used to rank each component (for determination of seed-only suitability). 13

Table 4. Sampling dates and details for patent tong survey conducted in St. Mary's River. 14

Table 5. Resulting area of each habitat classification after 2018 patent tong survey. 14

Table 6. Final reef sites and restoration types for tributary blueprint. 15

Table 7. Reef-level characteristics for each site surveyed in late 2018 in the St. Mary's River. 16

1.0 Introduction

The upper St. Mary's River is one of five Maryland tributaries targeted for large-scale restoration under the 2014 Chesapeake Watershed Agreement. The river is located in southern Maryland and an upstream portion was designated as an oyster sanctuary in 2010. The sanctuary encompasses 1,304 surface acres in a mesohaline region (Figure 1). Selection as a large-scale restoration tributary was based in part on a history of strong oyster recruitment, ongoing restoration and replenishment activities, and support from the local community.

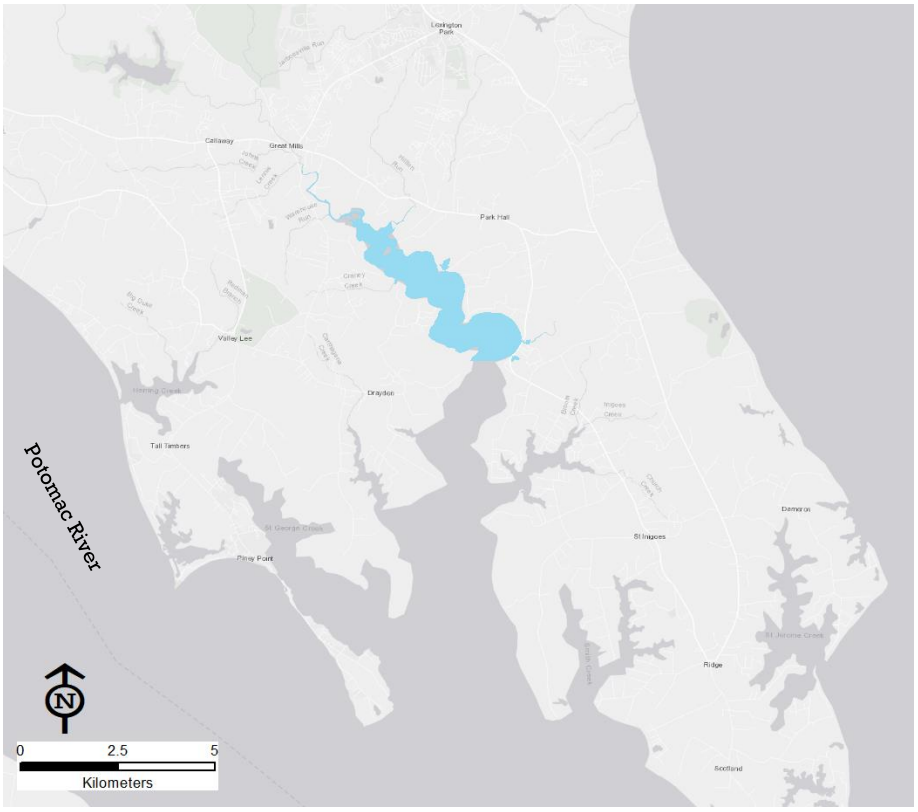


Figure 1. Location of the St. Mary's River Sanctuary (shaded blue).

To identify benthic habitat suitable for oyster growth in the St. Mary's River Sanctuary, the Maryland Interagency Work-group (hereafter, Workgroup) determined that a pre-construction site assessment survey was needed. The survey was conducted in late 2018. Benthic habitat in the St. Mary's River Sanctuary was stratified based on upon *a-priori* assumptions of benthic condition classified using the Coastal and Marine Ecological Classification Standards (CMECS). Results from the 2010 Maryland Geological Survey sonar survey were updated with information from 2012 and 2015 patent tong surveys. The workgroup considered the following bottom types as restorable: anthropogenic oyster rubble, sand with shell, biogenic oyster rubble, and muddy sand with shell. Additionally, GIS analysis was used to eliminate areas overlapping submerged aquatic vegetation beds, areas within 150 feet of aquaculture leases, and areas within 250 feet of US Coast Guard navigational aids.

2.0 Methods

2.1 Sampling Design

Sampling sites were generated from systematic sampling grids developed in ArcMap (ESRI, Version 10.5) and draped over GIS layers (Figure 2). Individual habitat layers were created for each major restoration category (substrate and seed, seed only, control, and premet) contained in the tributary blueprint (MIORW 2019). The nature of the application of grids to irregularly shaped GIS layers creates partial grid cells within some of the habitat stratum. Some partial grids were removed from the sampling frame because they were either too small or too narrow to be sampled effectively.

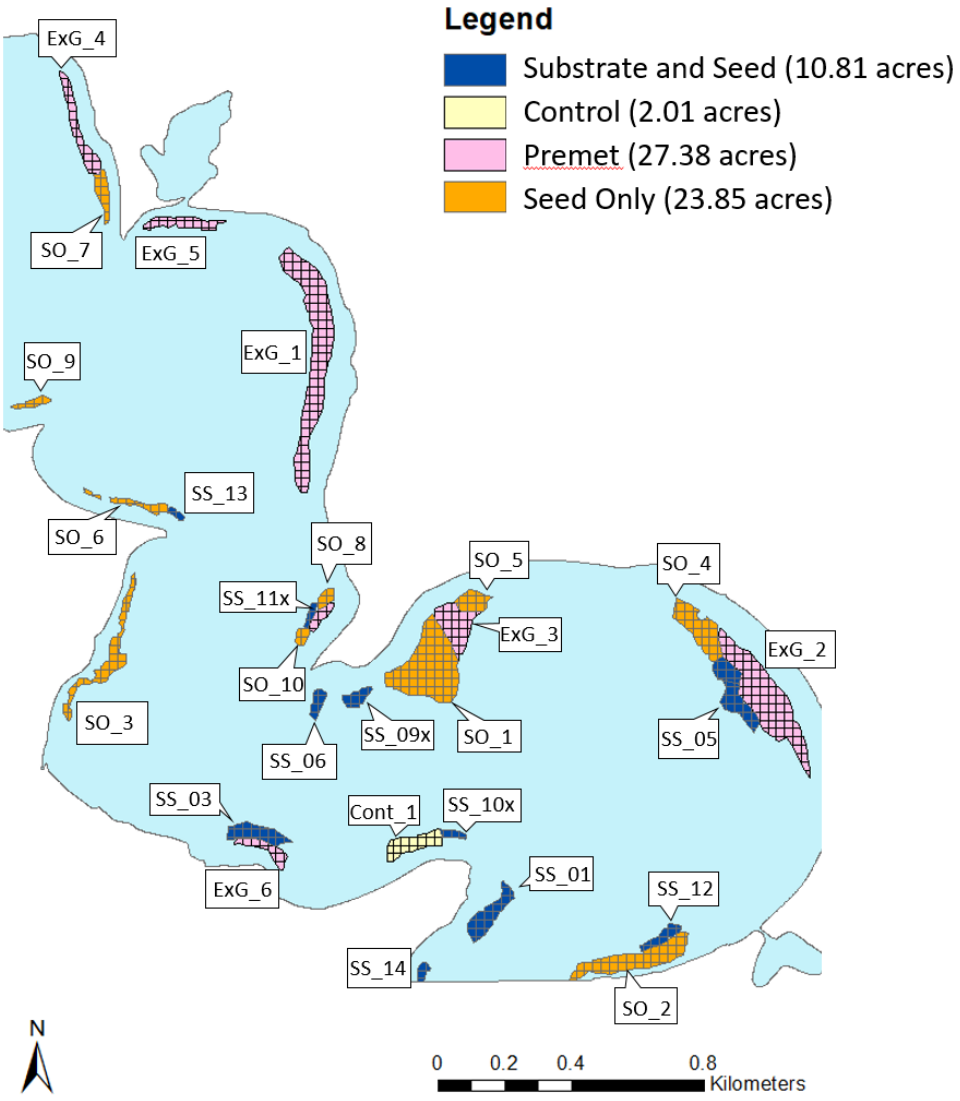


Figure 2. *A-priori* classification of habitat types in St. Mary's River Sanctuary that were sampled by patent tongs in 2018.

2.2 Sampling Methods

Oyster Recovery Partnership (ORP) pre-construction assessment protocols require fine-scale resolution information to determine whether benthic habitats are suitable for oyster growth. Therefore, all strata were sampled using a 25 x 25m systematic grid cell with sampling locations in the center of each grid. The area of each habitat stratum and the number of samples is presented in Table 1.

Table 1. Strata sampled based on pre-classification using GIS data and earlier survey work in the St. Mary's River Sanctuary.

Pre-classified restoration type	**Area (acres)**	**Sampling points**
Substrate and seed	10.81	110
Seed only	23.85	216
Premet	27.38	236
Control	2.01	17
SMRWA Restoration Site	6.59	0

Sample planning was coordinated by ORP and sample collection was managed by Versar, Inc. A chief scientist from Versar, Inc. guided the vessel crew and scheduled each daily sampling event. Sampling was conducted during daylight hours and generally required 6 to 8 hours to complete. Navigation to sampling sites was done using a differential global positioning system (DGPS) attached to a laptop with ArcMap (ESRI, Version 10.1) running as a navigational program.

The benthic condition of oyster reef habitat was assessed using patent tongs deployed from the *F/V* Hooker. Patent-tongs are a specialized commercial fishing gear used to harvest oysters in Chesapeake Bay (Figure 3). Patent tongs function much like a benthic grab and are well suited to quantify the condition of benthic habitat through the retrieval of the sediment surface layer which could include oysters, shell, or other sediment features. The patent tong is lowered to the bottom in an open position and oysters and other surface sediment features are collected when the grab is closed. The patent tong has 55mm long teeth that help to penetrate the substrate when lowered to the bottom. The teeth allow the patent-tong to scrape the surface layer of an oyster reef to ensure that the surface layer is effectively sampled. The teeth are less effective and not necessarily needed in softer substrates such as mud dominated substrates. The patent tongs used were 1.16m by 1.27m, which sampled a 1.47m^2 area of the bottom. The coordinates of each patent-tong sample were collected when the patent tongs reached the sediment surface. A DGPS antenna was positioned adjacent to the location where the patent-tongs were deployed so no position offset was required.

Samples were processed to provide a combination of qualitative and quantitative measurements required to meet the overall project objectives. All measurements were listed on a field datasheet (Appendix 1) which combined two sample processing protocols (Rapid Assessment and Three Year Check-In) previously used to evaluate habitats in the Little Choptank River (ORP 2019). Once the grab was brought to the surface, several qualitative measurements to document the depth of sediment covering shell (Surface Sediment), the percent

of shell not covered by sediment (Exposed Shell), and the amount of material in the sample (Patent Tong Fullness) and the substrate composition were made from observations of the sample before the sample was brought onboard for processing (Figure 3 and 4; Table 2).

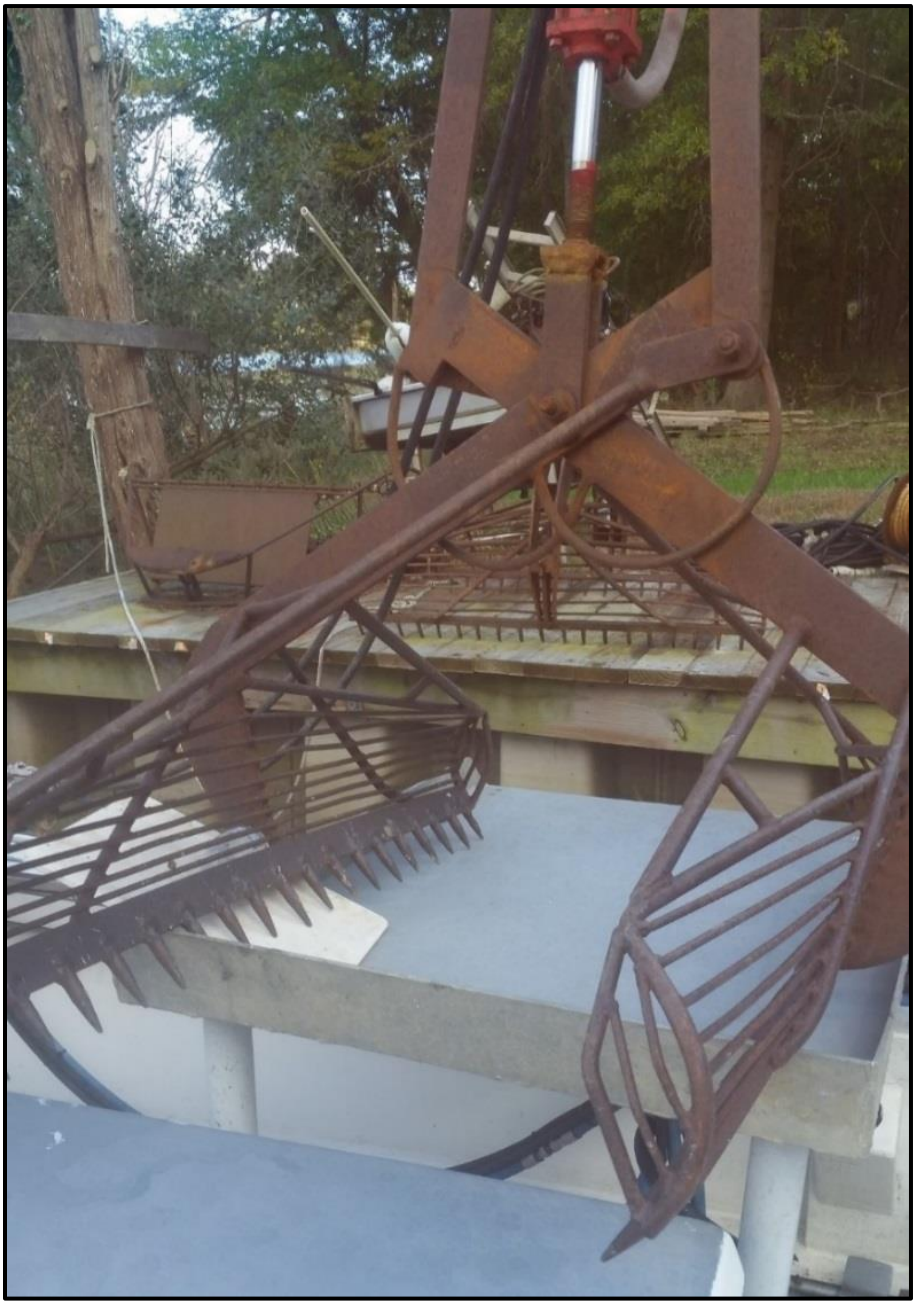


Figure 3. Picture of patent-tongs used to collect oysters and substrate.

The sample was placed onto the processing table and thoroughly rinsed to remove excess substrate. In each sample, all oysters were counted, identified as live or dead, and a minimum of 30 live oysters were measured for each sample. Oyster clumps and the number of oysters associated with a clump were recorded to serve as a measure of structural complexity on the reef. In addition to the minimum of 30 live oyster heights measured, the shell height and total count of

dead (box) and recently dead (gapers) oysters was also documented from each sample. The percent of the sample covered by fouling organisms and specifically percent fouling by tunicates and mussels was documented for each sample as well. The volume of oyster and the volume of shell were measured for each sample. Percentage of gray shell and shell hash was assessed.

Figure 4. Picture of representative patent tong sample. Numbers and arrows correspond to substrate characteristics documented before the sample was brought on board for processing. Bubble 1 – represents the portion of the sample that is observed to document the patent tong fullness index. Bubble 2 – represents the portion of the sample that is observed to document exposed shell. Bubble 3 – represents the portion of the sample that is observed to document surface sediment depth. Colors of each bubble correspond to descriptions of each measurement in Table 2.

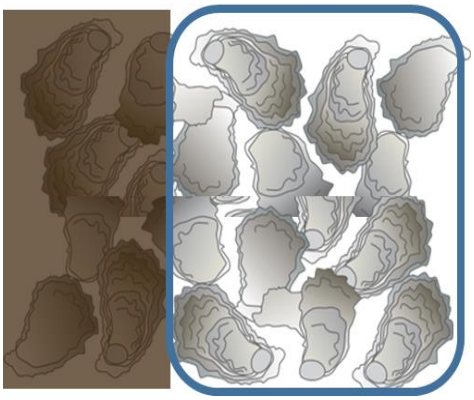
Surface and bottom water temperature, dissolved oxygen, pH, and salinity were measured during each sampling event at representative locations over each oyster reef using a 6600 multiparameter water quality sonde (YSI Corporation, Yellow Springs, Ohio). Other environmental and station specific variables collected at each site included sample number, date and time, depth of water, vessel name, and staff present.

Table 2. List of substrate characteristics and substrate composition descriptors documented for each sample collected.

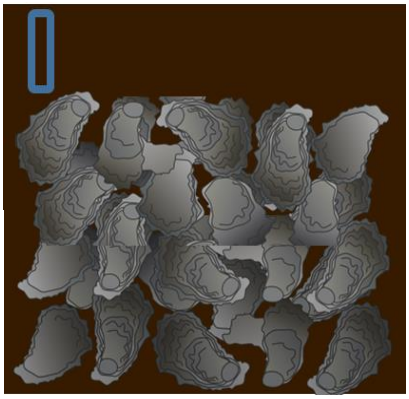
Substrate Characteristics	
Patent Tong Fullness Index	Estimate of the amount of substrate in a patent tong grab before tongs were rinsed. 0= No substrate, grab empty; 5= Patent tong full of substrate.
Exposed Shell	Estimate in quarter % increments of the percent of the substrate surface that is covered with shell. 100% exposed shell will have shell visible over the entire sample surface.
Surface Sediment	Estimate of the centimeter depth of surface sediment observed in the patent tong grab. 0 surface sediment would indicate no surface sediment present.
Substrate Composition	
Primary Substrate	Dominant substrate observed in the entire sample. Substrate types include mud, sand, sandy mud, oysters, clumped shell, loose shell, shell hash, and gravel.
Secondary Substrate	Secondary substrate observed in the entire sample. Substrate types include mud, sand, sandy mud, oysters, clumped shell, loose shell, shell hash, and gravel.
Tertiary Substrate	Tertiary substrate observed in the entire sample. Substrate types include mud, sand, sandy mud, oysters, clumped shell, loose shell, shell hash, and gravel.
Percent Gray Shell	Percent of the total shell that is estimated to be buried based on black colorization.
% Shell Hash	Description of the shell quality. Percentage of the sample that is composed of shell hash.
Total Volume	Total volume of loose shell and oyster in the tong sample.
Oyster Volume	Volume of live, gaper, and box oysters in the tong sample.
Number of Live Oysters	Number of live oysters in the sample.

2.3 Data Management

All data were compiled and entered into the ORP Oyster Restoration Monitoring and Assessment relational database. Quality control and assurance was performed on all survey data and included comparisons of randomly selected digital data to the field data sheets, summarizing data to review for outliers or out of range values, and plotting sample coordinates to ensure samples were collected within site boundaries.



Top down view of patent-tong grab. This example shows the amount of exposed shell on the right as 75% of the sample exposed.



Buried shell with sediment on top. The surface sediment depth score is based on the depth of the sediment on top of the oysters depicted in the blue area.

Entire shell volume sampled by patent tongs with surface shell depicted on top and the darker shells underneath is buried shell.

Figure 5. Graphical interpretation of exposed shell, surface sediment, and surface shell volume variables for each patent tong sample. Base oyster graphics from Tracy Saxby, Integrations and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/imagelibrary/).

2.4 Habitat Assessment Data Analysis

Two analytical approaches were used to determine if reefs needed restoration and the type of restoration activity that was required. The first approach used oyster density and biomass as metrics to evaluate whether reefs required restoration. The second approach used an index of habitat quality to characterize reefs habitats and determine the type of restoration treatment suitable for each reef that required restoration activity.

In the first approach, oyster density estimates were standardized to number per m^2 from the area sampled by patent tong. Total counts of live oysters or other variables (e.g., oyster size class, shell volume) were averaged over all samples collected at the individual site. Oyster biomass estimates were calculated for individual oysters using the equation $W = 0.000423 * L^{1.7475}$ where W = dry tissue weight in g and L = shell height in mm (Mann and Evans 1998). Biomass was then summed for the entire sample and standardized using the same method as density estimates. Average biomass was calculated across all samples collected at the site.

Reefs with oyster density and biomass greater than 50 oysters and grams per m^2 over 30% of the reef area were determined to be premet and initial restoration is not needed.

In the second approach, an index of habitat quality was developed to determine whether sites were suitable for Seed Only restoration or whether they required substrate addition. Five benthic habitat components observed from samples were used to develop the index:

1. Exposed Shell
2. Primary Substrate
3. Surface Sediment
4. Number of Live Oysters
5. Surface Shell
    a. Total sampled shell and surface shell volume was estimated for each individual sample. Field measurements of shell resources included total shell volume and the percent of black (buried) shell estimated in a sample for patent tong samples. Total shell volume was standardized by the area sampled by patent tongs. Surface shell estimates were calculated as the percent of the total sampled shell volume that was not considered black shell.

The numerical value of each of the five benthic components was binary and was expressed as a 1 or 0, with a result of 1 assumed to be suitable for Seed Only restoration and 0 being unsuitable. The index was developed using best professional judgement by members of the Maryland Interagency Workgroup. Each of the benthic components were continuous variables with a range of observations or values that could be observed in the field. The condition of each variable was considered to have an influence on the distribution of oysters, but only a portion of all observations for each benthic component was considered suitable for oyster population growth. For example, the number of live oysters ranged from zero to over 100 at some sites, but only oyster densities greater than 5 individuals/m^2 was considered suitable oyster habitat. A set of criteria for each variable was developed to construct the final index of habitat quality (Table 3).

A final habitat suitability score for each grid cell was derived as the sum of each benthic component score at the individual grid cell using the equation:

$$\begin{aligned} &Habitat\ Suitability\ Score \\ &= Exposed\ Shell\ Score + Bottom\ Type\ Score + Surface\ Sediment\ Score + Number\ of\ Live\ Oyster\ Score \\ &\quad + Surface\ Shell\ Volume\ Score \end{aligned}$$

The result of habitat suitability score determined whether a sampling grid cell was suitable for Seed Only deployment based on a ranking between zero and five. Ranks between 0 to 2 were unsuitable for Seed Only restoration and were only considered for substrate addition. Reef with a rank of 3 were considered marginal and requiring further review of all variables at the site level to determine suitability, and ranks of 4 and 5 were suitable for Seed Only restoration.

Table 3. Five benthic habitat components used to develop the index of habitat quality and the criteria used to rank each component.

Benthic Component	**Suitable for Oysters**
Exposed Shell	50% exposed or greater
Bottom Type	Oyster, loose shell, or shell hash. Sand or sandy mud and the secondary bottom type is either oyster, loose shell, or shell hash. Sand or sandy mud and the surface sediment = 0.
Surface Sediment	Less than 5 cm
Number of Live Oysters	Greater than 5 oysters per square meter
Surface Shell Volume	Greater than 10 liters per square meter.

The final habitat suitability index was programed in ArcMap (ESRI, Version 10.5) and the sampling grids and the habitat ranks for each grid cell were projected to create a spatially explicit map of habitat suitability at the site level. The quantity and distribution of site rankings was visually inspected to determine whether a site was a candidate for Seed Only deployment. The goal of the review was to determine whether a site was suitable for Seed Only or substrate addition based on the combination of habitat ranks represented at the site. Sites dominated by 4 and 5 habitat ranks were considered suitable for Seed Only. Sites dominated by 0 to 2 habitat ranks were considered unsuitable and were only considered for substrate addition restoration activity. Due to the patchy nature of oyster reefs many of the reef sites had a combination of ranked cells throughout the site and in some instances sites considered to be dominated by ranks of 4 and 5 also exhibited lower scoring ranks. In those cases a site was still considered dominated by ranks of 4 and 5 when there were no large areas of contiguous lower ranked cells and over 90% of the grid cells exhibited ranks of 4 or 5. In addition, the cell level resolution allowed for modifications to the dimensions of the site if areas of the site were considered unsuitable and could be removed. Areas that were considered unsuitable were removed through GIS processing techniques and the remaining habitat was considered suitable for Seed Only restoration (Figure 6).

3.0 Results

Between late October and early December 2018, ORP and Versar collected and processed over 500 patent tong grabs in the St. Mary's River Sanctuary (Table 4). The size and distribution of *a-priori* classified habitats was similar to the benthic conditions quantified by the

habitat suitability index with some marginal differences observed (Table 5). Five sites *a-priori* classified as Seed Only habitat were reclassified by the suitability index as premet, and Site SO_4 was split into two sites, one reclassified as premet and one reclassified as Substrate and Seed. In addition, reclassification of other habitat types to Seed Only produced a total of 15.88 acres finalized as Seed Only restoration. The majority of Substrate and Seed habitat was accurately delineated based on the *a-priori* classification, with just under 2 acres reclassified to Seed Only and 0.34 acre reclassified to premet based on the habitat suitability index. A total of 7.47 acres were added to the premet acres.

All habitats were adjusted based on the habitat suitability results. The distribution of all classified habitats are depicted in Figures 6 to 11. The final number of individual sites by habitat type included one control, eight Substrate and seed, twelve premet, and ten Seed Only sites (Table 6). Reef-level characteristics for each site are presented in Table 7.

In conclusion, the results of this survey suggest the process of *a-priori* habitat classification in combination with subsequent baseline surveys provides information needed to delineate benthic conditions with the accuracy needed to plan future restoration activities.

Table 4. Sampling dates and details for patent tong survey conducted in St. Mary's River.

Date	Sites Sampled	Samples Collected
10/29/2018	ExG_3, SO_1	43
11/6/2018	Cont_1, SO_1	37
11/7/2018	ExG_2, ExG_5, SS_05	72
11/8/2018	ExG_2, SO_4	47
11/14/2018	SO_3, SO_4, SS_06, SS_09x	56
11/19/2018	ExG_1	49
11/20/2018	ExG_1, ExG_3, SS_10x	40
11/27/2018	ExG_5, ExG_6, SS_03	51
11/28/2018	SS_01, SS_14	25
11/29/2018	ExG_1, ExG_3, SS_13, SO_5, SO_6	51
12/3/2018	ExG_4, SS_11x, SO_7, SO_9	45
12/4/2018	SS_12, ExG_7, SO_2, SO_8, SO_10	49
12/5/2018	SO_2	18

Table 5. Resulting area of each habitat classification after 2018 patent tong survey.

Restoration Type	*a-priori* Habitat Classification (Acres)	Post-Survey Habitat Classification (Acres)	Change (Acres)
Seed Only	23.85	15.88	-7.97
Substrate and seed	10.81	9.74	-1.07
Control	2.01	2.01	0
Premet	27.38	34.85	+7.47
SMRWA and College Restoration Site	6.59	6.59	0
Total	70.64	69.07	-1.57

Table 6. Final reef sites and restoration types for tributary blueprint.

Site_ID	Restoration Type	Area (acres)	Yates Bar
Cont_01	Control Site	2.01	Pagan
SMRWA_01	SMRWA Restoration Site	6.59	None
SO_02	Seed only	0.26	Short Point
SO_03	Seed only	0.40	None
SO_04	Seed only	0.70	Biscoe
SO_09	Seed only	0.56	Bryan
SO_07	Seed only	2.88	Horseshoe Bend
SO_01	Seed only	8.07	Horseshoe Bend
SO_05	Seed only	1.27	Horseshoe Bend
SO_08	Seed only	0.39	Pagan
SO_06	Seed only	0.49	Short Point
SO_10	Seed only	0.87	None
SS_08	Substrate and seed	0.92	Seminary
SS_01	Substrate and seed	1.21	None
SS_03	Substrate and seed	1.69	Biscoe
SS_07	Substrate and seed	0.75	Horseshoe Bend
SS_06	Substrate and seed	0.53	Horseshoe Bend
SS_05	Substrate and seed	2.36	None
SS_04	Substrate and seed	1.26	None
SS_02	Substrate and seed	1.02	None
ExG_03	Exceeds Goal	3.07	Short Point
ExG_04	Exceeds Goal	2.25	None
ExG_06	Exceeds Goal	1.11	None
ExG_05	Exceeds Goal	1.77	None
ExG_01	Premet	10.24	None
ExG_08	Premet	0.35	Horseshoe
ExG_09	Premet	0.58	Horseshoe
ExG_10	Premet	0.48	None
ExG_07	Premet	0.67	None
ExG_02	Premet	7.73	None
ExG_11	Premet	2.17	Horseshoe Bend
ExG_12	Premet	4.44	Seminary

Table 7. Reef-level characteristics for each site surveyed in late 2018 in the St. Mary's River Sanctuary. N is number of samples collected on each site and SD is standard deviation. The last column describes modifications made to each site after the 2018 patent tong survey that are reflected in the current tributary blueprint.

Restoration Type	Site ID	Yates Bar	N	Area (acres)	Dominant Substrate	Avg live density (#/m^2)	SD	Avg % Black Shell	Avg Total Shell Volume (L/m^2)	Max Oyster Volume (L/m^2)	Avg Oyster Volume (L/m^2)	SD	Max Oyster Biomass (g/m^2)	Avg Oyster Biomass (g/m^2)	SD	Modification
Substrate & Seed	SS_01	N/A	21	2.23	Sandy mud	1.46	2.75	73.48	2.07	4.00	0.29	0.84	10.83	1.28	2.44	0.86 acres changed to Seed Only
Substrate & Seed	SS_03	Biscoe	20	1.86	Sandy mud	0.92	2.47	65.75	1.44	1.00	0.13	0.30	9.05	0.89	2.33	
Substrate & Seed	SS_05	N/A	27	2.87	Sandy mud	0.28	1.05	99.44	10.24	2.00	0.10	0.38	4.10	0.22	0.80	Site divided into two
Substrate & Seed	SS_06	Horseshoe Bend	7	0.66	Sandy mud	0.10	0.24	99.29	0.97	0.10	0.01	0.03	0.38	0.05	0.13	
Substrate & Seed	SS_09x	Horseshoe Bend	8	0.84	Sandy mud	0.09	0.23	98.75	0.86	0.10	0.01	0.03	0.42	0.05	0.14	
Substrate & Seed	SS_10x	Pagan	5	0.39	Sand	4.09	5.12	51.00	2.60	3.00	0.84	1.14	13.98	4.07	5.35	Changed to Seed Only
Substrate & Seed	SS_11x	Horseshoe	4	0.34	Oysters	57.91	61.78	46.25	20.53	27.00	9.78	11.08	113.21	46.06	48.09	Changed to Premet
Substrate & Seed	SS_12	Seminary	11	0.91	Loose shell	0.06	0.20	87.27	18.48	0.13	0.03	0.06	1.15	0.10	0.33	
Substrate & Seed	SS_13	Short Point	3	0.26	Shell hash	0.23	0.32	93.33	2.70	0.10	0.03	0.05	0.33	0.11	0.15	Changed to Seed Only
Substrate & Seed	SS_14	N/A	4	0.40	Sandy mud	4.09	4.20	68.75	1.90	1.00	0.53	0.48	5.25	2.52	2.53	Changed to Seed Only
Premet	ExG_1	N/A	85	10.24	Oysters	47.02	43.47	64.66	18.02	27.00	8.54	7.61	128.52	35.86	31.51	
Premet	ExG_2	N/A	69	8.42	Oysters	41.87	39.55	66.44	20.23	33.00	11.12	8.91	180.51	40.93	40.68	
Premet	ExG_3	Horseshoe Bend	24	2.88	Loose shell	18.34	30.13	76.46	14.02	20.00	4.02	6.32	79.60	14.49	23.72	Changed to Seed Only
Premet	ExG_4	N/A	23	2.25	Oysters	42.30	34.39	54.52	15.61	26.00	12.13	9.22	112.03	46.67	37.39	
Premet	ExG_5	N/A	19	1.77	Oysters	44.64	37.57	52.89	16.12	18.00	8.46	7.05	85.80	38.65	32.47	
Premet	ExG_6	Biscoe	12	1.14	Sandy mud	14.08	12.85	27.08	4.00	8.00	3.00	2.85	32.44	12.15	10.24	Resized and changed to Seed Only
Premet	ExG_7	N/A	8	0.67	Oysters	110.88	39.60	26.88	26.13	33.00	16.88	7.87	177.84	91.60	39.65	
Control	Cont_1	Pagan	17	2.01	Oysters	65.21	50.50	42.65	25.95	32.00	13.39	10.12	221.64	63.07	56.43	
Seed Only	SO_1	Horseshoe Bend	62	8.07	Oysters and mud	25.89	47.13	56.06	14.99	32.00	4.71	6.82	410.52	28.41	59.45	
Seed Only	SO_2	Seminary	40	4.45	Oysters	44.27	41.78	50.26	18.45	27.00	9.03	7.93	106.14	38.02	34.79	Changed to Premet

Seed Only	SO_3	N/A	34	3.07	Sandy mud	31.50	35.48	60.38	11.95	22.00	6.33	6.65	99.77	25.77	28.78	Changed to Premet
Seed Only	SO_4	Horseshoe Bend	28	3.20	Sandy mud	27.35	30.59	82.00	13.80	21.00	6.84	6.91	105.40	27.02	29.92	Portion changed to Premet, portion changed to Substrate & Seed
Seed Only	SO_5	Horseshoe Bend	13	1.27	Loose shell	38.94	41.59	60.77	16.35	30.00	8.96	9.01	83.99	30.34	30.55	
Seed Only	SO_6	Short Point	12	1.09	Sandy mud	7.84	13.39	59.58	4.92	11.00	2.19	3.68	37.57	6.46	11.13	Area reduced to 0.49 acres
Seed Only	SO_7	N/A	11	1.11	Oysters	45.90	38.20	48.09	15.98	28.00	12.21	10.04	124.22	49.68	42.94	Changed to Premet
Seed Only	SO_8	Horseshoe	5	0.58	Loose shell	63.50	52.24	48.00	15.80	20.00	11.60	8.69	130.85	58.78	46.58	Changed to Premet
Seed Only	SO_9	Bryan	7	0.56	Oysters and mud	28.91	16.98	48.43	13.24	20.00	9.17	5.47	66.57	29.60	18.07	
Seed Only	SO_10	N/A	4	0.48	Oysters	66.09	44.03	42.50	16.00	16.00	9.50	5.89	92.15	51.98	33.14	Changed to Premet

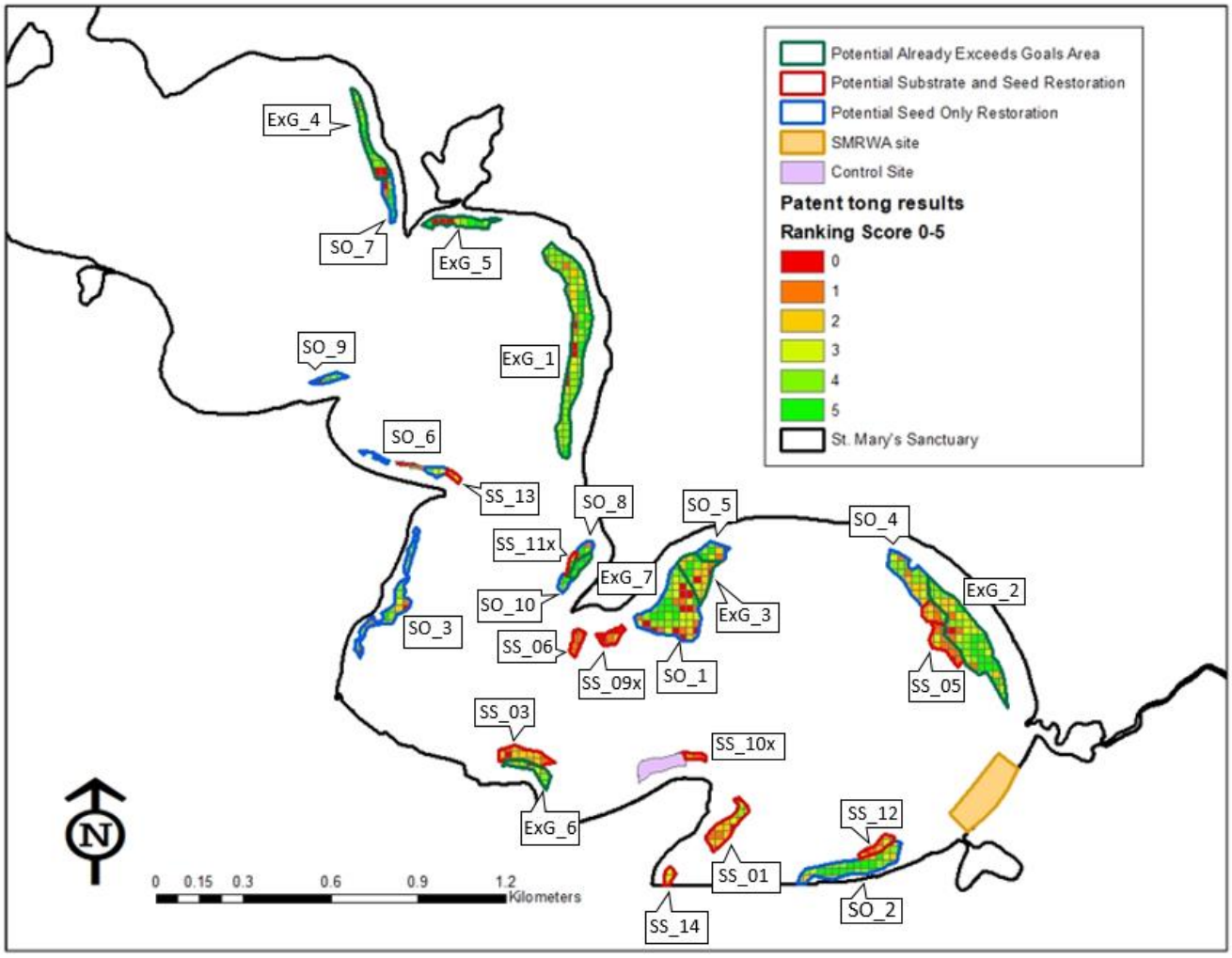


Figure 6. Ranks from the patent tong survey to determine habitat suitability. (Figure adapted from upper St. Mary's Blueprint Report).

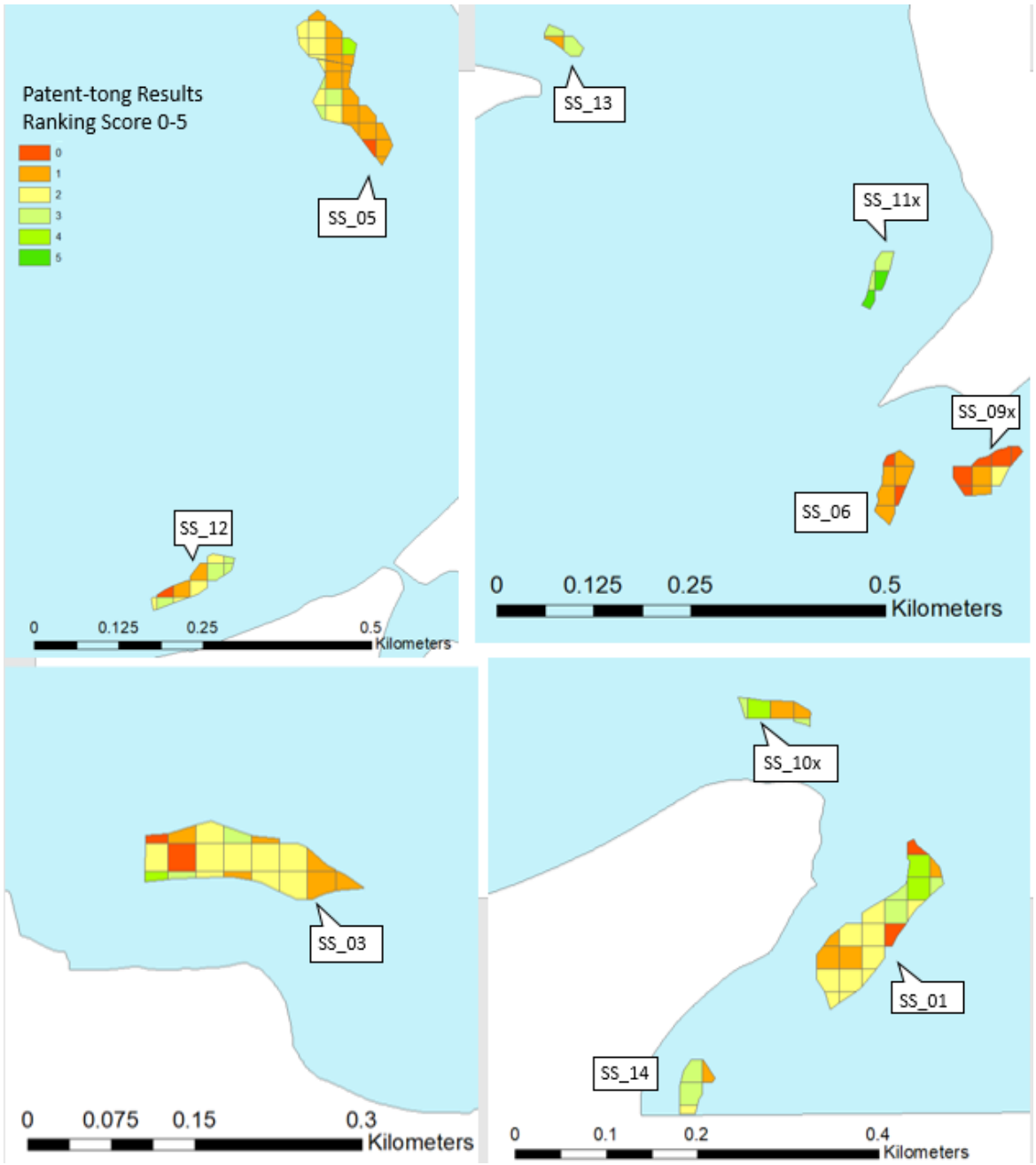


Figure 7. Ranking scores of Substrate and Seed sites sampled by patent-tong in fall 2018. Note that scale bar is different in each plate.

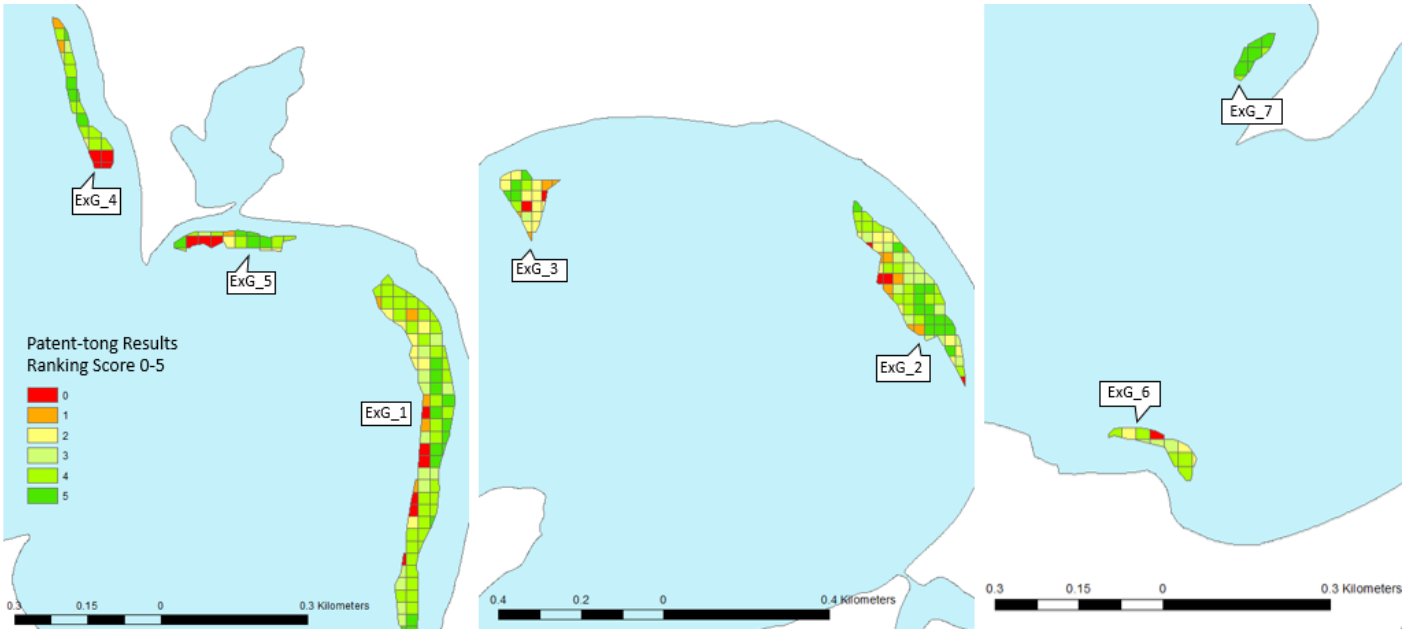


Figure 8. Ranking scores of Premet sites sampled by patent-tong in fall 2018. Note that scale bar is different in each plate.

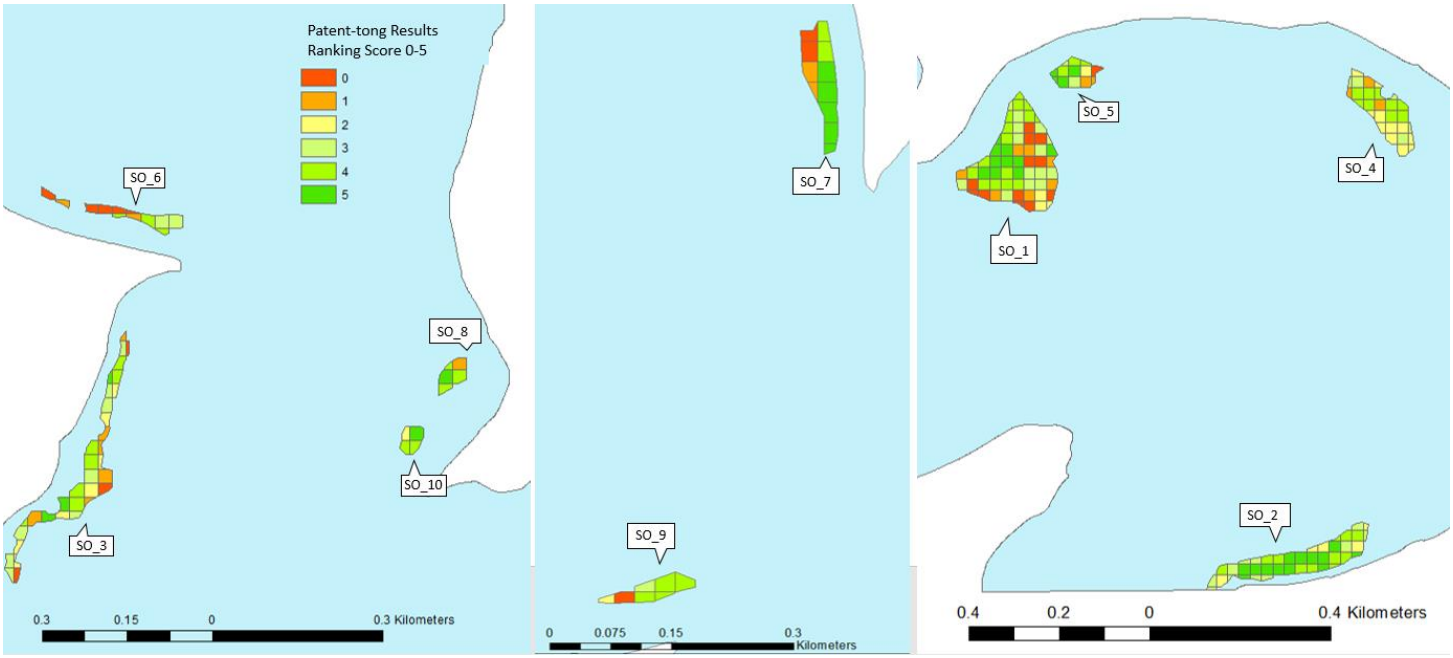


Figure 9. Ranking scores of Seed Only sites sampled by patent-tong in fall 2018. Note that scale bar is different in each plate.

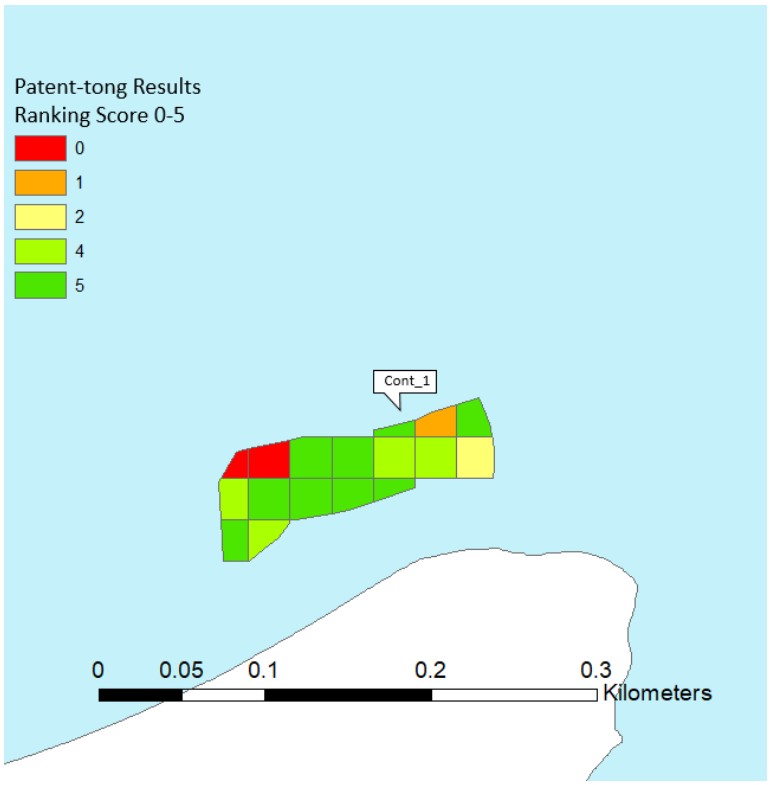


Figure 10. Ranking scores of Control site sampled by patent-tong in fall 2018.

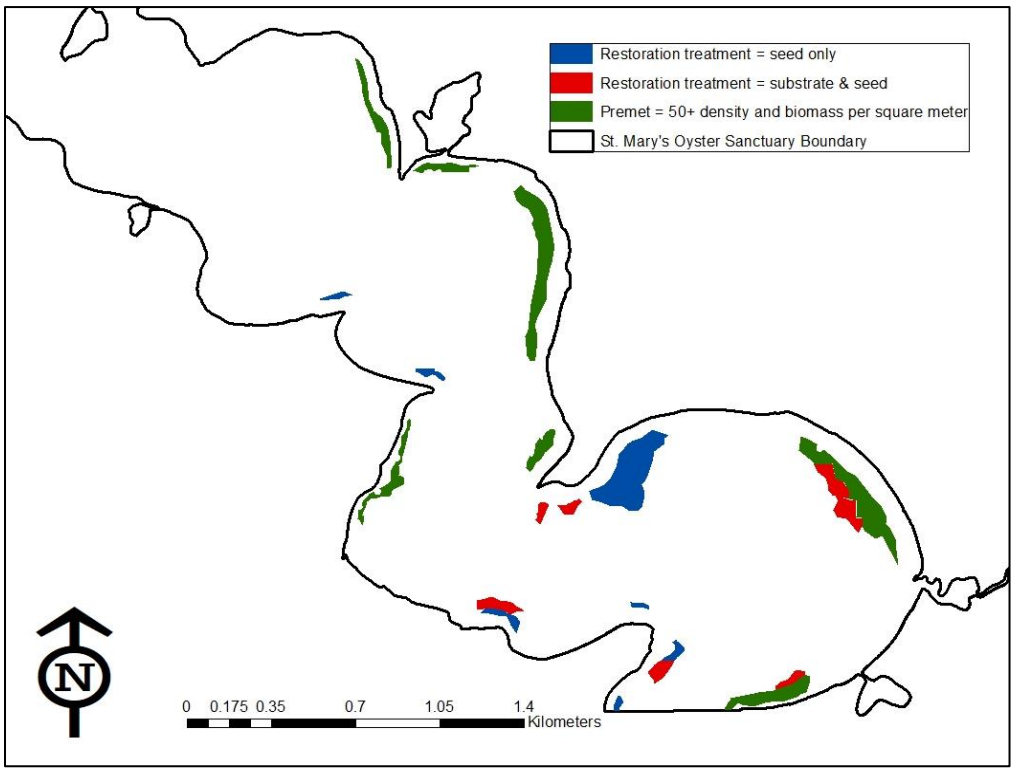


Figure 11. Resulting restoration treatment on reefs determined from the patent tong analysis. (Figure adapted from upper St. Mary's Blueprint Report).

5.0 References

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APPENDIX 1 –

St. Mary's Sample Datasheet

Fall 2018 St Marys River Oyster Monitoring

Site SS_12 SampleID STMA-2018-SS_12-1-1 Date Start Time

Crew

Waypoint

Boat

Gear Area (m2)

Latitude Longitude

Tong Fullness (0-5)

Exposed Shell (Before Rinse)

☐ 0% ☐ 25% ☐ 50% ☐ 100%

Surface sediment layer depth (cm) (cross if null)

Shell Score (1-5)

Bottom Type 1

☐ Mud ☐ Loose Shell
☐ Sandy Mud ☐ Clumped Shell
☐ Shell Hash ☐ Hard Bottom
☐ Sand ☐ Oysters

Bottom Type 2

☐ Mud ☐ Loose Shell
☐ Sandy Mud ☐ Clumped Shell
☐ Shell Hash ☐ Hard Bottom
☐ Sand ☐ Oysters

Bottom Type 3

☐ Mud ☐ Loose Shell
☐ Sandy Mud ☐ Clumped Shell
☐ Shell Hash ☐ Hard Bottom
☐ Sand ☐ Oysters

Subsampled? Total Volume (L) Oyster Volume (L) Subsample Volume (L)

% BlackShell % Fouling % Hash % Tunicates % Mussel

Comments :

Oyster Lengths

Please list clump #, length(mm), and status (L= Live, G= Gaper, B= Box)

10 oysters | 20 oysters | 30 oysters | 40 oysters | 50 oysters | 60 oysters

Oyster Lengths (continued) Please list clump #, length (mm), and status (L = Live, G = Gaper, B = Box)