

St. Mary's River 2018 Recruitment Study

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Abstract

The aim of this oyster larval recruitment study in the St. Mary's River is to use both cost effective and accurate methods to determine where the best recruitment occurs, in order to inform decision-makers in determining where appropriate seed areas are located. The results will be used to determine potential site(s) for a future seed area, or to inform a much larger seed study. The motivation behind the implementation of this study is a local controversy; there are opposing viewpoints between residents and watermen in determining the location of commercial harvest areas, including seed areas. Watermen want to use a seed area located within the St. Mary's River Oyster Sanctuary so as not to take away river bottom from the public fishery. Waterfront property owners and environmentalists are strongly opposed to any commercial operations within the sanctuary since it is counter to the science that informed the designation of the sanctuary. Current law prohibits any harvest of wild oysters within a shellfish sanctuary. This study will use scientific methodology to survey recruitment in areas of the river outside the sanctuary *and* in areas that have few or no oysters so as not to encroach on the public fishery.

Background

The loss of the Eastern Oyster (*Crassostrea virginica*) can be directly linked to over harvesting. In addition, diseases such as Dermo and MSX have furthered the decline and have pushed the Eastern Oyster, a once prevalent organism in the Chesapeake Bay, to the brink of extinction (O'Beirn et al). The depletion of the Eastern Oyster has had far reaching impacts and has led many environmental groups to work to re-establish the organism's prominence.

According to the Department of Natural Resources, there are 51 documented oyster sanctuaries in the Maryland's portion of the Chesapeake Bay. The sanctuaries are of varying size and condition but represent the desire to restore the Eastern Oyster population to its former glory. The sanctuary on the St. Mary's River shellfish sanctuary was first established on October 1, 2010. The prohibition on harvest within the sanctuary has led to the establishment of thriving oyster bars with multi-age-classes, which exhibit better survival rates than the 20-year average, and substantial oyster population growth--both in overall area and animal density. Within the sanctuary, a 5-acre three dimensional reef area currently undergoing restoration is immensely successful with water clarity and quality noticeably enhanced from just six years earlier. Ongoing scientific monitoring by St. Mary's College of Maryland confirms this success.

The St. Mary's River Watershed Association also implements outreach programs such as the Marylanders Grow Oyster (MGO) program and other direct restoration programs. The sanctuary does not only provide a home for oysters. Reef structures and oyster bars make a perfect habitat for numerous species. In fact the reef site is one of the most popular local fishing spots. Recently there has been interest from local watermen to allow sections of the sanctuary to be used as a seed site with the hope that recruitment at those locations would be plentiful. They propose to harvest this seed at just 1 to 4 months of age and transplant it to other areas in the Bay. The Code of Maryland clearly states that harvest of oysters in a sanctuary is prohibited. (COMAR 08.02.04.15B) Therefore, it remains unclear whether a seed area within the sanctuary is legal.

Potential impacts that a seed area could have on the sanctuary could be tremendous. According to Louisiana State University researcher Steven Beck, areas that have been harvested for oysters have more loose shell, more mud, and higher levels of Chlorophyll-a. From this it can be inferred that harvest from a seed site would have detrimental impacts on the surrounding established oyster colonies. Additionally, the spawning and settlement of spat is based upon temperature, salinity, and availability of food (Deksheniaks et al). The biotic and abiotic conditions that foster strong oyster recruitment remain fairly constant throughout the St. Mary's River. The exception to this is that oyster larvae prefer to settle on hard surfaces (Kennedy et al). However, sandy bottoms with shell installations make spat settlement possible throughout the entirety of the St. Mary's River.

The one caution to this ability to recruit spat nearly everywhere with firm sandy bottom and shell enhancement, is larvae settlement is greatly reduced in salinity levels below 14 ppt and becomes nominal below 8 ppt and does not occur often below 6 ppt. (Deksheniaks et al) The 2018 season has higher than average rainfall causing lower than normal salinity. This change is consistent with long-term forecasting in the region due to climate change. (Thomas et al) Therefore, it should be anticipated that lower salinity levels will become the norm. The sanctuary typically has lower salinity than our study area since it is upriver where fresh waters enter the system from rainfall.

Methodology

Twenty-four cages were each filled with 120 wild-grown, aged and cleaned oyster shells selected for equivalent size and surface area. Four of these survey setups were placed on the bottom in a square pattern and spaced three meters apart - at each of six sites. Each of the sites selected were based on historical record of oyster bars and for 1) general local knowledge of recruitment in the area, 2) firm sandy bottom, 3) water depth of 6 to 8 feet at mean low water (MLW), 4) lack of oysters or few oyster present, and 5) void of subaquatic vegetation.

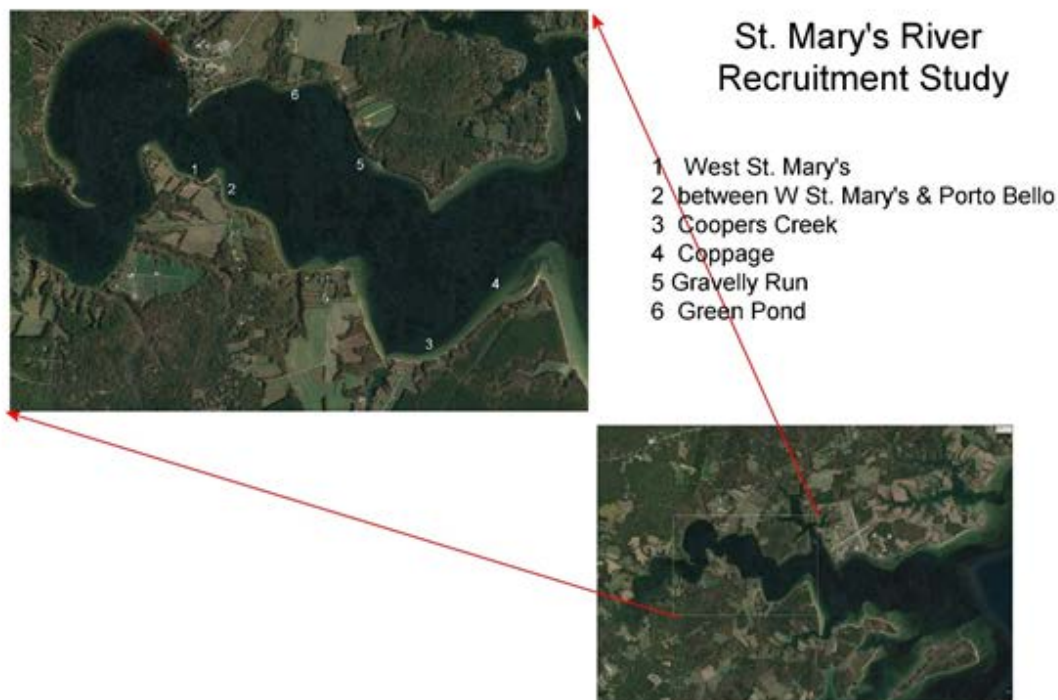


Figure 1. Map of Study Sites

The cages were placed equidistant from each other three meters apart and fastened together with a sinking rope of exactly three meters in length. Attached to one of the cages at each site was a buoy suspended in the water column to approximately three feet below MLW. In addition to the underwater buoy a second surface-floating buoy was attached to an anchor and was placed next to one of the cages at each of the six sites. Should a passerby disturb the floating buoy, it would not disturb the experiment. Each of the six floating buoys were labeled:

DO NOT DISTURB
SMRWA
SCP 201826A
301-904-2387

The labeling indicated our desire that the area not be disturbed, the acronym for our organization St. Mary's River Watershed Association, our scientific collections permit number, and a cell phone number where we could be reached to address any concerns or questions.

Cages were deployed on June 14th and 15th, and GPS coordinates were recorded for the central location of each deployment at the six sites. Also recorded were depth (MLW), bottom firmness and type, wild oyster density, and presence of SAV. Salinity was recorded at the upriver and downriver sites, West St. Mary's and Coppage respectively, on June 2, August 16, and September 14. Variability was nominal with both sites equivalent on June 2, the downriver site being 0.2 ppt higher on

August 16, and the upriver site being 0.1 ppt higher on September 14 Throughout the study, salinity level remained between 7.3 and 9.3 ppt.

All twenty-four cages were retrieved from the river on September 29, 2018. All twenty-four cages were in good condition and performed as planned. To maximize accuracy, total recruitment at each location was counted and recorded. Counters were trained and all animals (and mortality) found were double-checked for accuracy and consistency. Size was noted to some extent with spat larger than one inch noted as a percentage of the numeric total.

The dataset will be shared with decision makers--DNR Shellfish Division, Maryland legislators, county oyster committee, scientists at St. Mary's College of Maryland--and made publically available through the website <http://www.SMRWA.org>

Our permit required us to remove the cages prior to October 1, which is opening day for public harvest with hand tongs. These areas are not usually harvested in October with hand tongs, but are harvested by dredge beginning November 1. Note that in some years the breeding season does linger well into October.

Results & Recommendations

Results demonstrate recruitment in all sections of the public St. Mary's River. Results were strongest in the Cooper's Creek and Gravelly Run sites. Both of these sites showed high spat settlement late in the season, as the vast majority of spat at these sites were less than one inch in length. Sites that displayed substantial spat

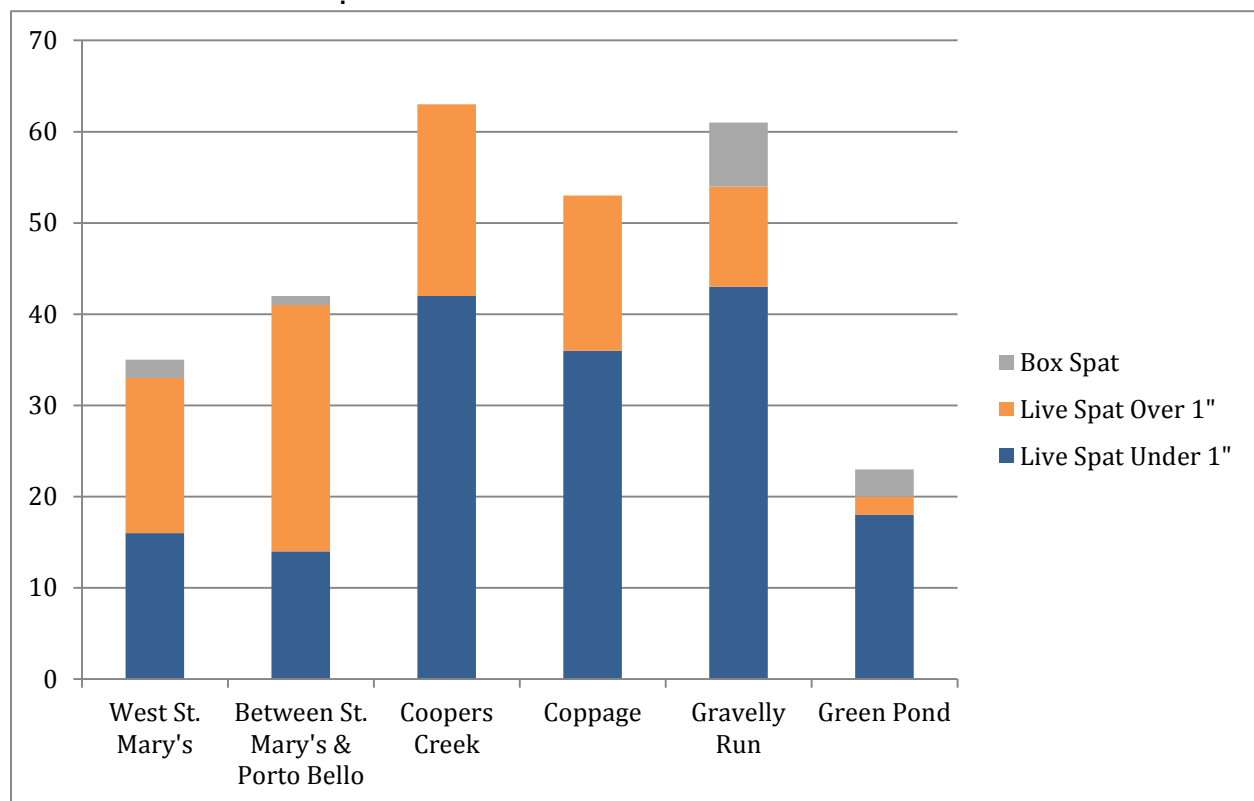


Figure 2. Spat Recruitment at the Six Study Sites

settlement early in the season were West St. Mary's and between St. Mary's and Porto Bello. At the West St. Mary's site, one half of the spat counted were over one inch in length, while at the site between St. Mary's and Porto Bello, the percentage of large spat was even higher, with two thirds of the spat measuring over one inch. West St. Mary's , between West St. Mary's and Porto Bello, and Green Pond are within the closest proximity of the sanctuary, however, had the lowest spat strike. Mortality of spat was minimal and is represented in Figure 2 as "Box Spat."

The two sites with the greatest spat strike were quite a distance away from the sanctuary. This suggests support for the claim that oyster spat settlement is based on optimal conditions, not on proximity to the location of release. The data demonstrates that the area including Coopers Creek and Coppage, with all the area in between, seems to be a potential candidate for a future seed area. Past harvest reports demonstrate that these sites have had good oyster harvests. In addition to this, a preliminary survey of the site was conducted prior to study cages being placed, and the survey showed that these sites have a hard sandy bottom with some shell and existing oysters, natural conditions that make the location a good spot for prolific spat settlement. To better determine if this location is economically viable for a future seed site, additional data needs to be gathered to demonstrate successful spat recruitment over multiple years.

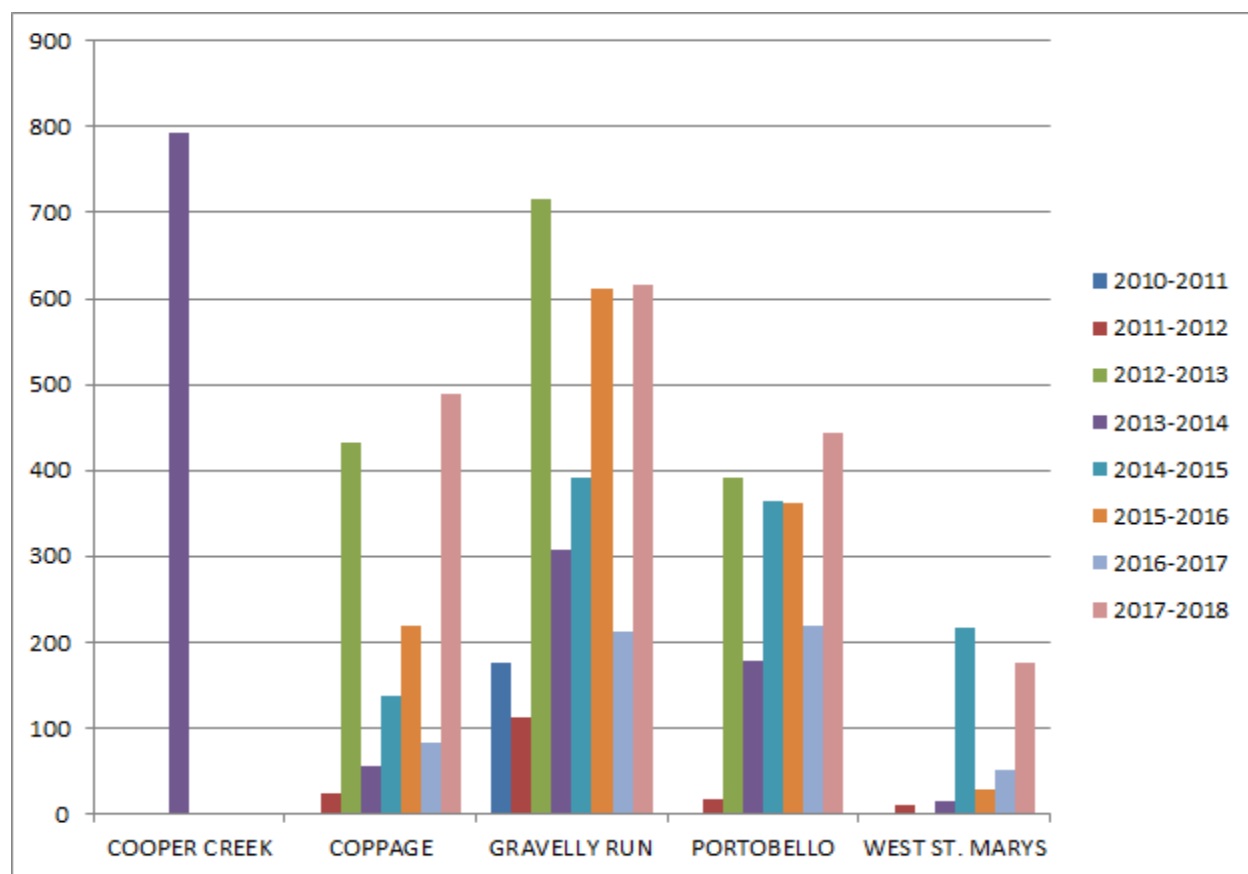


Figure 3. Oyster Harvest Reported to DNR (Compiled October 11, 2018)

Additional mapping depicting the areas where bar structure is dense and oysters are numerous will inform decision-makers who strongly desire to avoid productive public harvest areas. Side scan sonar should delineate the hard sandy bottom where our study was sited from the harder bars with higher density of oysters and shells. Close to shore areas with less than two meters depth at MLW are likely to host subaquatic vegetation. Our initial dive survey indicated that an area of interest lies between this nearshore vegetation and the offshore areas where productive harvests likely occurred.



Figure 4. Area of Interest for 15-Acre Seed Area



Figures 5 & 6. Spat Recruitment from West St. Mary's



Figures 7 & 8. Spat Recruitment from Between West St. Mary's and Porto Bello



Figures 8 & 9. Spat Recruitment from Coopers Creek



Figures 10 & 11. Spat Recruitment from Coppage



Figures 12 & 13. Spat Recruitment from Gravelly Run



Figures 14 & 15. Spat Recruitment from Green Pond

Literature Cited

Beck, Steven Lee, "The effects of oyster harvest on resident oyster reef communities and reef structure in coastal Louisiana proper" (2012).LSU Master's Theses. 2557.

Code of Maryland Regulations Title 08. Department of Natural Resources, Subtitle 02 FISHERIES SERVICE Chapter 08.02.04 Oysters (Last update July 29, 2016)

Dekshenieks, Margaret M.; Hofmann, Eileen E.; and Powell, Eric N., "Environmental Effects on the Growth and Development of Eastern Oyster, *Crassostrea virginica* (Gmelin, 1791), Larvae: A Modeling Study" (1993).CCPO Publications. 79.

Maryland Department of Natural Resources - Oyster Advisory Commission. "Oyster Management Review: 2010-2015 - Appendix A, Characterization of Individual Sanctuaries" (July 2016). Retrieved From <http://dnr.maryland.gov/fisheries/Documents/Appendix%20A%20-%20DRAFT%2020160727.pdf> Accessed 11/13/2018. [Note: this 'draft' was approved and became the final study.]

Newell,R.I.E.1988.Ecological changes in Chesapeake Bay:Are they the result of over harvesting the American oyster *Crassostrea virginica*? pp.(536---546.)

Thomas R. Karl, Jerry M. Melillo, and Thomas C. Peterson et al. "Global Climate change Impacts in the United States" (2009) Retrieved From <https://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf> Accessed 11/14/2018.

Victor Kennedy, Roger Newell, Albert Eble. *The Eastern Oyster: Crassostrea Virginica*. Maryland: University of Maryland Sea Grant (December,1,1996)