2021 Spatfall-Recruitment Study

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ABSTRACT

This observational study on oyster recruitment (spatfall) in the St. Mary's River has been implemented over multiple years, beginning with a pilot study in 2018. The 2021 Recruitment Study results differ from prior years in that, in general, spatfall was higher especially in the upper river. The goal of this study is to use both cost effective and accurate methods to determine where the best spatfall occurs, in order to inform decision-makers (government, industry, public, etc.) in determining where substrate plantings should be located. In this way, industry can maximize investment and future harvest. An additional goal is to inform an expanding body of science regarding restoration efforts that seek to answer questions such as: Are sanctuaries playing a significant role in restoration of non-sanctuary waters? How important is it to have areas of high density of oysters (>50/m2) within the overall goal of restoration? Are sanctuaries playing a role in the genetic development of disease resistance? How does the placement and size of sanctuaries play into the overall goals of the sanctuaries as stated in the 2010 executive order expanding Maryland's sanctuaries?

Spatfall (oyster recruitment) in the St. Mary's River was studied at twelve sites in the river both inside and outside the sanctuary and spread throughout the lower seven miles of the tidal river. Data collected at each of the twelve sites included number of spat recruited during the study timeline, June through October 2021, and monthly water quality readings (turbidity, salinity, temperature, and dissolved oxygen). Multiple year studies provide data on spatfall throughout the tidal St. Mary's River as it varies from year to year.

Photo 1. Study participants collect monthly water quality data.

Four study sites had a spat count of over 1,000. However, all twelve sites had a substantial increase in spatfall over previous years. In 2019 it was found that spatfall was higher in areas of high oyster density. It can be reasoned that the oyster density at the sites increased over the years and may have resulted in higher spatfall than what was recorded in the previous years. Nine of the twelve study sites are located in harvest areas, and so oyster density may not have changed significantly from year to year. A comparison with harvest data might suggest an increase in oyster density if harvest has also increased.

In summary, 2021 spatfall was significantly higher and the average size of spatfall was greater than any of the prior three years at all twelve study sites.

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INTRODUCTION

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. 2000]. The depletion of the Eastern Oyster has had far reaching impacts and has led many to work to re-establish the organism's prominence.

The St. Mary's River qualifies as a Tier 1 tributary and has most of the characteristics supporting oyster restoration. [Maryland Department of Natural Resources, 2016] There are fifty-one designated oyster sanctuaries in Maryland's portion of the Chesapeake Bay. The sanctuaries are of varying size and condition but represent the State's commitment to restore the Eastern Oyster population. The St. Mary's River shellfish sanctuary was first established on October 1, 2010. [Code of Maryland Regulations 08.02.04. 2016] The prohibition on harvest within the sanctuary has led to: 1) the re-establishment of thriving oyster bars with multi-age-classes, which today exhibit better survival rates than the 20-year average, and 2) 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 compared to twelve years earlier. Ongoing scientific monitoring by St. Mary's College of Maryland confirms this success.

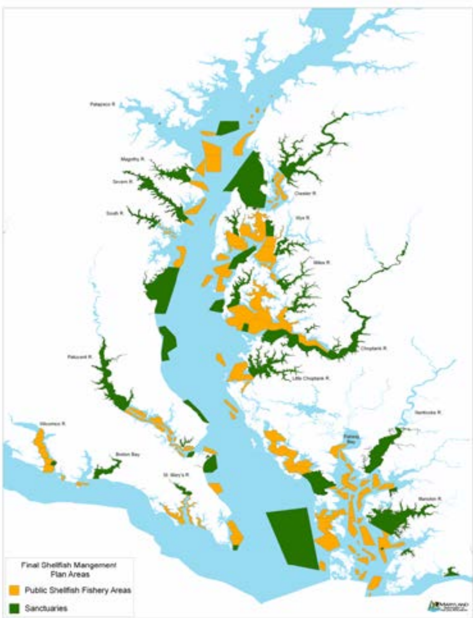

Figure 1. Maryland's fifty-one shellfish sanctuaries and designated public shellfish fishery areas. Image courtesy Maryland DNR.

The Eastern Oyster biomass in the St. Mary's River has been overharvested for several years according to the University of Maryland's recent report "Stock Assessment of the Eastern Oyster, Crassotrea virginica, in the Maryland waters of Chesapeake Bay." [Wilberg 2018] The fertilized larvae of breeding oysters swim and drift in the water column for about two weeks prior to seeking permanent residence. Several factors play a role in where larvae may settle. Localized currents (or lack of), tidal flows, and wind effects are believed to be significant factors. Scientific studies in areas with recurring moderate to high velocity current suggest larval drift distance is significant and recruitment can happen miles away, and typically downriver for the Chesapeake Bay's tidal tributaries. The St. Mary's River has a weak current throughout most of the tidal estuary; some areas have recurring tidal flows other areas have little current as a result of tidal rise and fall. In these areas, wind likely plays a greater role. A second known factor is that reproduction is highly successful in areas with high density of adult oysters (more than 150 animals per square meter). Conversely, areas with few oysters have very poor reproduction success. The lower St. Mary's is recruiting few oysters likely due to the depleted stock and resulting low density (less than 5 per square meter). The upper tidal stretch, containing the shellfish sanctuary, does recruit successfully and has increased its biomass over the past ten years.

Record breaking rainfall in summer 2020 (especially the 14 to 18 inches that fell during the August 4 due to the remnants of Hurricane Isaias) caused a large and persistent algal bloom with resulting eutrophication over the following 12-18 days. This event caused well over 80% mortality in deeper waters in some areas within the sanctuary. Highest mortality was observed in the south side of Horseshoe Bend and around Pagan Point in waters over six feet MLW depth. The western shore west of Horseshoe Point upriver to Long Point were also greatly affected in waters over eight feet MLW depth. Mortality upriver of Horseshoe Point on the eastern shoreline was less consistent with some areas unaffected.

Photo 2. Great Mills inundated with flood waters on August 4, 2020.

This study establishes baseline data on oyster larvae recruitment throughout the St. Mary's tidal estuary. Data collected over years can inform the development and placement of shell-planted reserve areas or sanctuary areas that will have the best outcomes for the fishery. Some basic questions we seek answers to are:

1. To what extent does larval drift out of the sanctuary and recruit into the public fishery areas?

2. What areas of the public fishery receives the highest recruitment?

3. To what extent is successful recruitment a factor of larval drift and local adult oyster densities?

What other factors are important to know that might impact successful recruitment (i.e. weather factors, climate change, nutrient loading, algae blooms, chemical pollutants)? St. Mary's College of Maryland and the St. Mary's River Watershed Association implement outreach programs such as the Marylanders Grow Oyster (MGO) program and the Living Reef Action Campaign, as well as other direct restoration related efforts within the St. Mary's River Shellfish Sanctuary. Additionally, they engage in or support research by a variety of different entities including local high school and college students, graduate students from regional institutions, and marine scientists. The five-acre Oyster Reef Project located adjacent to St. Mary's College of Maryland in many ways serves as a living classroom.

MATERIALS AND METHODS

The 2021 Recruitment Study used the same sites as the 2020 Recruitment Study: Bryan, Horseshoe, Seminary, Portobello, Green Pond (also known as Gravelly Run), Cooper Creek, Priest Point, Thompson, Coppage, Goad, Sage Point (referred to as "Sedge Point" in the previous study), and Mouth of Creek (Fig. 2). Of note is that Coppage was shifted slightly, 53 meters to the NNE, at the request of watermen, in order to place the traps on bottom that was shelled in 2019 so as to minimize variability due to softer bottom types.

Figure 2. Map of study sites in St. Mary's River.

SITE	Coordinates	Depth (meters)
01. Bryan	38.20361° -76.45626°	2.5
02. Horseshoe	38.19792°, -76.44672°	1.5
03. Seminary	38.18859° -76.43687°	2.0
04. Portobello	38.17131, -76.45811	2.5
05. Green Pond/Gravelly Run	38.17402° -76.44096-7°	2.2
06. Cooper Creek	38.16773° -76.45881°	2.2
07. Coppage	38.16256° -76.45119°	2.1
08. Thompson	38.15158°, -76.46190°	2.0
09. Priest Point	38.15151°, -76.44261°	2.8
10. Goad/Graveyard	38.11855°, -76.43439°	2.4
11. Sage Point/Gum Edge	38.10708°, -76.42731°	2.5
12. Mouth of Creek	38.11483°, -76.46398°	2.2

Figure 3. Coordinates and depths of study sites.

Forty-eight "traps" (wire cages measuring 12" x 18" x 8") were each filled with 120 wild grown, aged oyster shells selected for equivalent size and surface area. Shells were purchased "green" from a shucking house and aged for four years. Shells were then power washed while the traps were rolled over several times. Four of these survey traps were placed on the river bottom in a square pattern and spaced three meters apart at each of the twelve study sites. Chain of custody forms tracked the traps throughout the project.

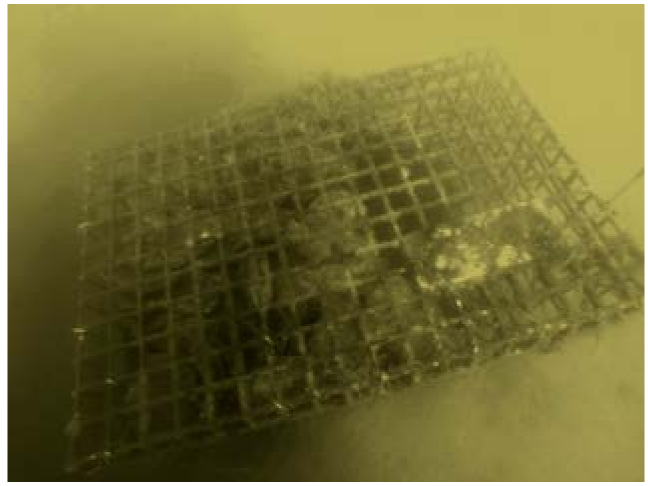

Photo 3. Underwater photo of trap deployed on river bottom.

Attached to one of the traps at each site was a buoy suspended in the water column to approximately one meter 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 nearshore traps at each of the twelve sites. Should a passerby disturb the floating buoy, it would not disturb the experiment. Each of the twelve floating buoys were labeled:

DO NOT DISTURB

DNR Study

SCP202149

301-904-2387

The labeling indicated desire that the area not be disturbed, the contractor for the study (the Department), our scientific collections permit number, and a cell phone number where we could be reached to address any concerns or questions.

Traps were deployed on June 1st, and GPS coordinates were recorded for the central location of each deployment at the twelve sites. Traps were checked monthly and water quality readings taken on June 1st, July 3rd, August 2nd, September 4th and 30th, and October 31st. A Secchi disk and a YSI PRO2030 were used to collect water quality readings. The YSI was fitted with new DO sensor and calibrated for dissolved oxygen immediately prior to each monthly sampling of the twelve sites. Standardized field log sheets were used to record the data, and, in every case, a second set of eyes verified the datum entered for each parameter.

During the study all ten traps deployed at Green Pond had to be temporarily moved (August 27) so that two-year old spat could be harvested from this site for planting downriver at another location. Care was given to avoid mortality. Traps were returned to the study site on September 13.

Traps were retrieved on October 20th, 23rd, and 25th and taken to a holding area at the St. Mary's College of Maryland waterfront where they were temporarily placed in shallow water on hardwood pallets.

Photo 4. Study assistant Jack O'Brien retrieves traps at Seminary.

Each shell within the traps was inspected for spatfall and a standardized field log sheet was used to record the presence of live and dead spat (referred to as "boxes") in three size groupings: equal to and under 10mm, 11mm to 25mm, and over 25mm. Counters included Bob Lewis, Colleen Smith, Jack O'Brien, Bob Paul, Kevin Fahey, Jodi Baxter, Laurinda Serafin, Chandler Wyatt, and Daniel Ulrich. Our analysis and graphs depict the size groupings, not the actual measurements. Counting of spat occurred on October 21st, 23rd, 24th, 28th and November 4th. Note that total spatfall counts include both live and boxes (dead).

In the analysis, each study site's total spatfall is reported by size grouping and by live/dead count. The dataset will be shared with decision makers—DNR Shellfish Division, St. Mary's County oyster committee, scientists at St. Mary's College of Maryland—and made publicly available through our website http://www.SMRWA.org.

Our permit required us to remove the cages prior to November 1st, which is opening day for public harvest with dredges. The study areas are not usually harvested in October with hand tongs. Note that in some years the breeding season does linger well into October, and we suspect this may have been the case in 2019 (James from Piney Point Hatchery reported heavy spawn in September). Observed spatfall in 2020 suggests that an October spawn was minimal, although a few spat under 10mm were noted. Spatfall in 2021 showed a large recruitment in early summer but spat under 10mm (which coincides with a September-October spawn) was minimal.

RESULTS – Spatfall and water quality in general with a deeper look at five typical sites

The 2021 Study shows the highest spatfall of any year studied. The 2021 total spatfall of 9,001 was more than double the 2020 total spatfall of 3,849. [Note the 2020 spat count does not include Coppage because the cages couldn't be found that year (2020).]

The increase in spatfall might be due to the consistent healthy levels of dissolved oxygen and salinity recorded throughout the study season. Water quality is heavily dependent on weather and so a monthly water quality reading may be inefficient in providing enough data to come to a firm conclusion in this regard. Instead of doing monthly readings, a reading every two weeks at the sites should offer better insight on the environment in which the oysters are living.

Each site shows an increase in spatfall compared to the last study season in 2020 and an improvement of water quality from both 2019 and 2020. (Fig. 4) Overall, dissolved oxygen was higher and salinity remained fairly consistent throughout the 2021 study timeline. In 2021, dissolved oxygen at every site was greater than 4 mg/L and salinity remained above 10 ppt except at the two furthest upriver sites which dipped into the nines in July. Salinity never rose above 13.5 ppt. Water temperature at the bottom peeked on August 2, 2021 at 28.7° C at the furthest upriver site (Bryan). Comparing water quality readings over the past four years, 2021 has the most consistency (least variability) in salinity; the highest dissolved oxygen; and the lowest peak summer temperatures at all twelve sites. This summer's cooler peak water temperature may be an important factor in both the increase in spatfall and in the high percentage of large size spat (over 25mm). [Dekshenieks 1993]

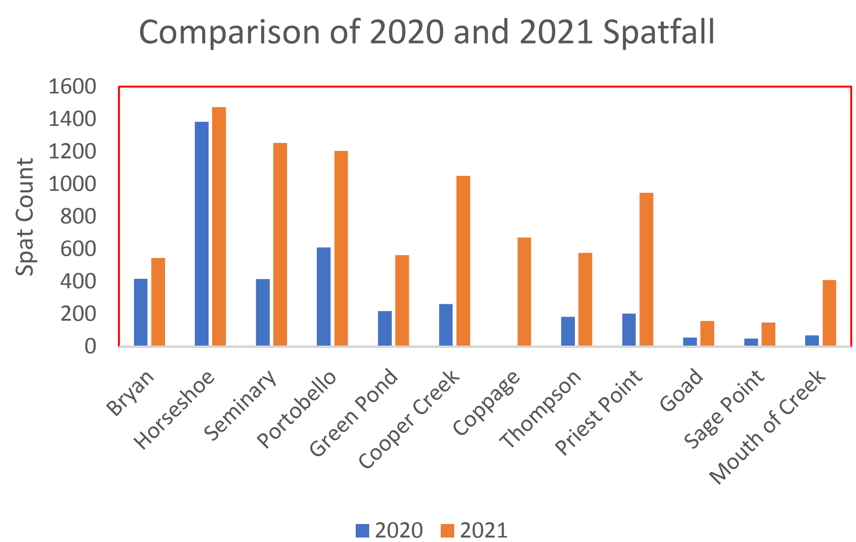

Figure 4. Comparison of 2020 and 2021 spatfall. Note: Coppage does not have data for 2020.

Cooper Creek

Cooper Creek has seen an increase in spat in the four years of the recruitment studies (Fig. 5). Water quality at this site has remained at healthy levels since the start of data collecting in 2019 with the only low reading being of salinity in 2019 at 9.25 on June 24th.

Photo 5. Spatfall at Cooper Creek

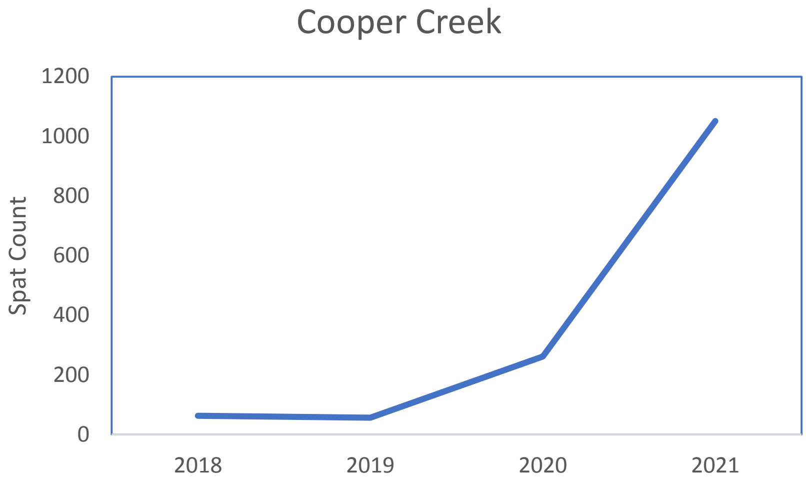

Figure 5. Total spatfall over four years at Cooper Creek.

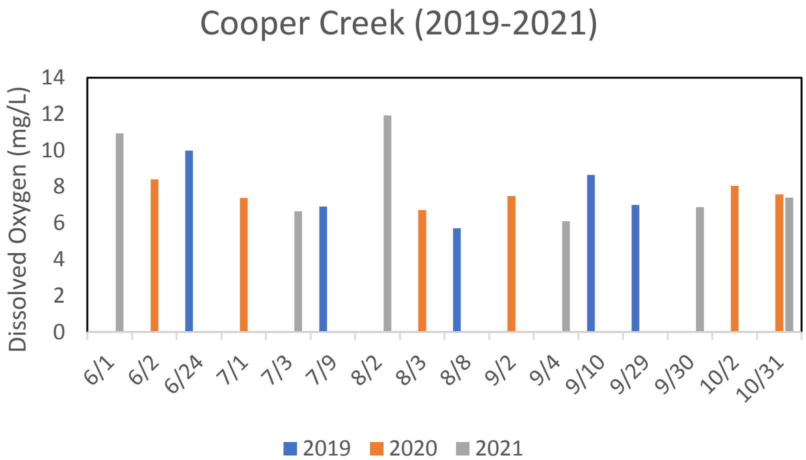

Figure 6. Dissolved oxygen over three years at Cooper Creek.

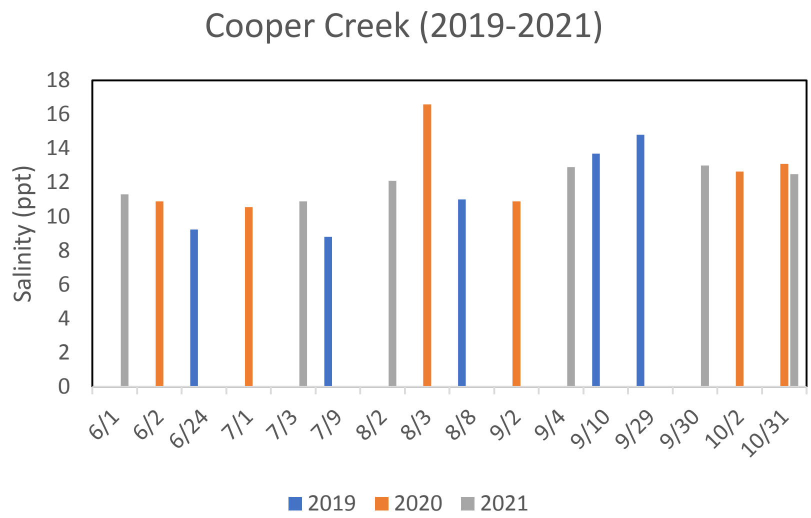

Figure 7. Salinity over three years at Cooper Creek.

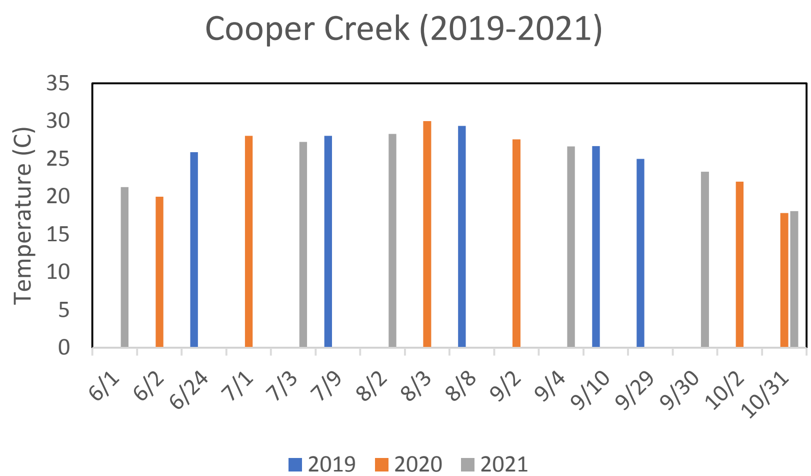

Figure 8. Water temperatures over three years at Copper Creek.

Sage Point

Sage Point has seen an increase in spat in the four years of the recruitment studies (Fig. 9). Water quality at this site has remained at healthy levels since the start of data collecting in 2019 with the only low readings being salinity on June 24th 2019 (9.6ppt), on July 9th 2019 (9.3ppt), and on June 2nd 2020 (9.6ppt) and dissolved oxygen on July 9th 2019 (3.42 mg/L). The site known as Fort in the 2019 study was used to compare to Sage point in the graphs below since the sites are fairly close to each other.

Photo 6. Spatfall at Sage Point.

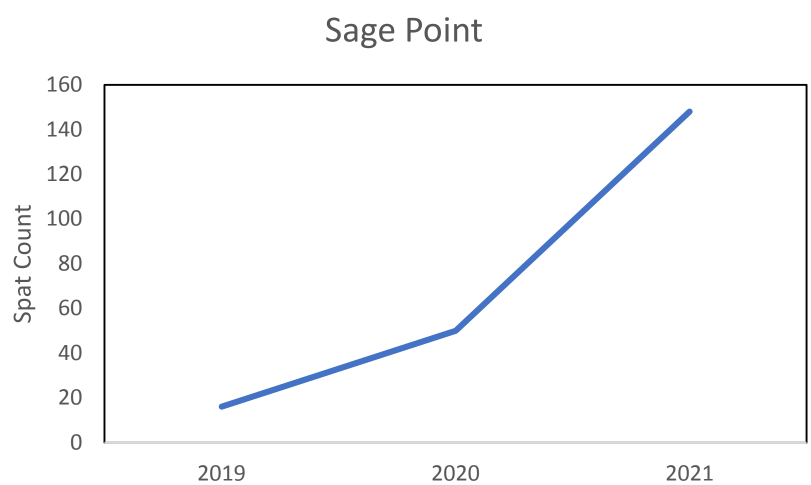

Figure 9. Total spatfall over three years at Sage Point.

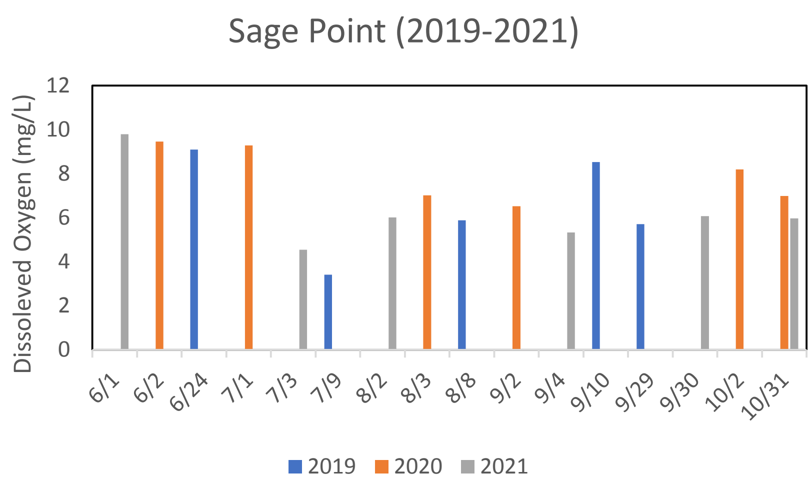

Figure 10. Dissolved oxygen levels over three years at Sage Point.

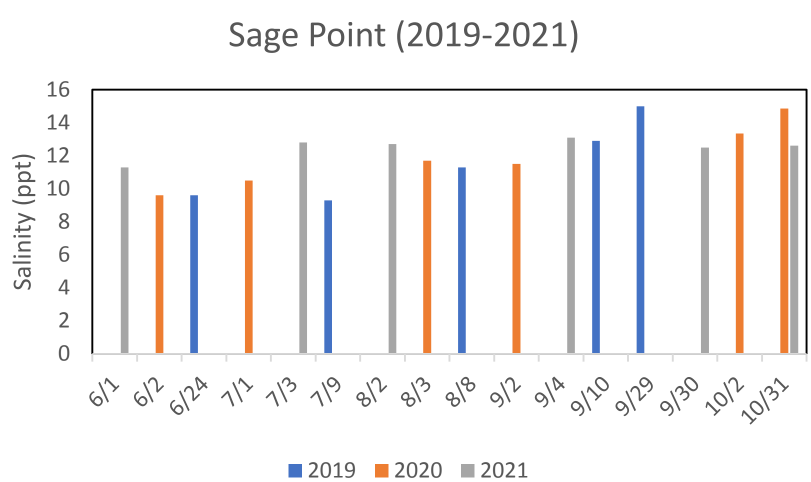

Figure 11. Salinity levels over three years at Sage Point.

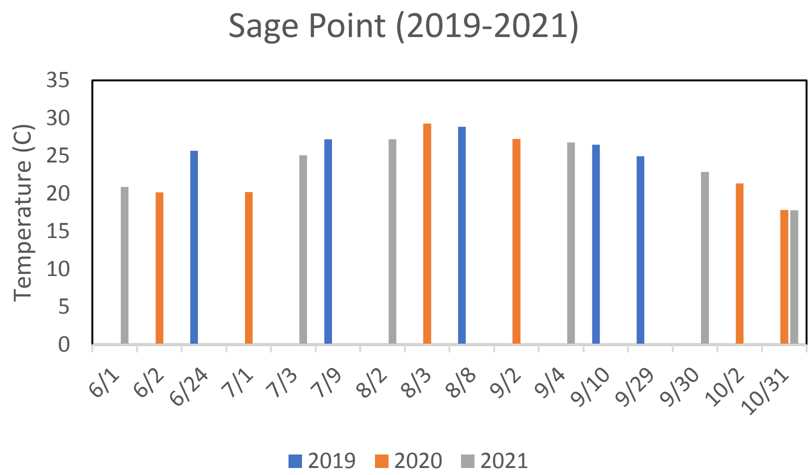

Figure 12. Water temperatures at Sage Point over three years.

Green Pond

Green Pond, also known as Gravelly Run, has seen an increase in spat in the four years of the recruitment studies (Fig. 13). Water quality at this site has remained at healthy levels since the start of data collecting in 2019 with the only low readings being salinity on June 24th 2019 (8.7 ppt) and July 9th 2019 (8.9 ppt).

Photo 7. Spatfall at Green Pond.

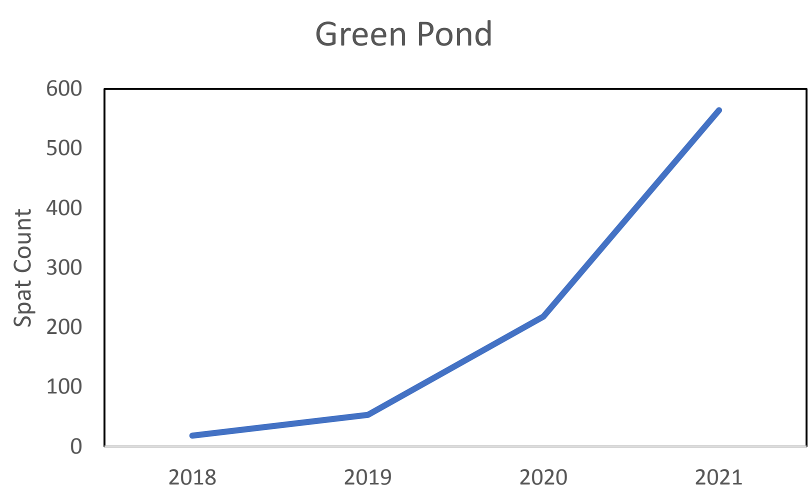

Figure 13. Total spatfall over four years at Green Pond.

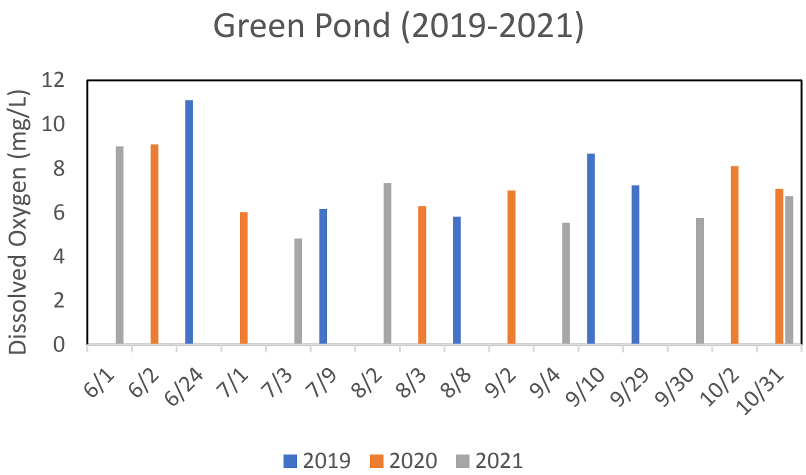

Figure 14. Dissolved oxygen over three years at Green Pond.

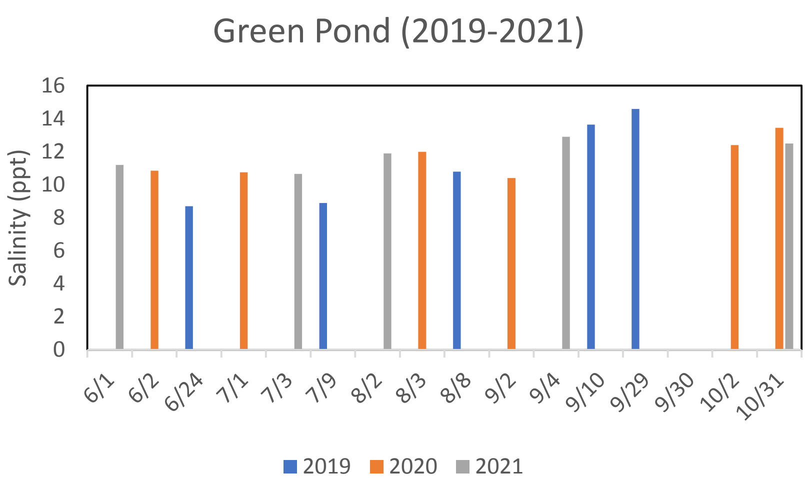

Figure 15. Salinity over three years at Green Pond.

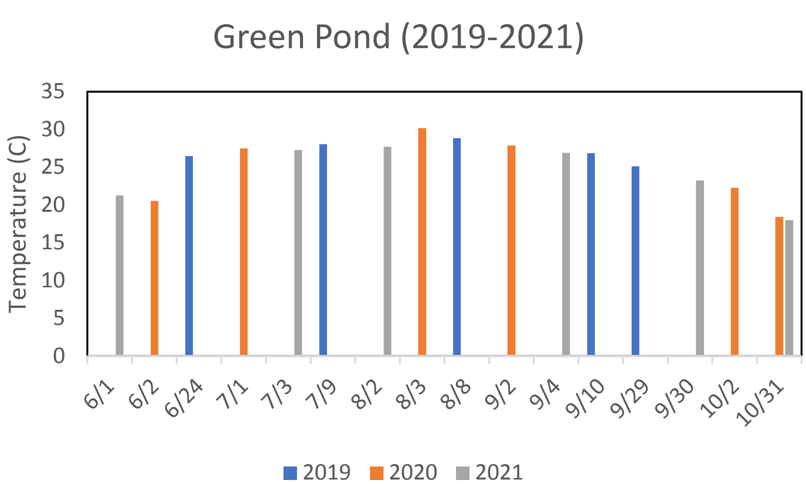

Figure 16. Water temperatures over three years at Green Pond.

Horseshoe

Horseshoe has seen an increase in spat in the four years of the recruitment studies (Fig. 17). Water quality at this site has remained at healthy levels since the start of data collecting in 2019 with the only low readings being salinity on June 24th 2019 (7.4 ppt), July 9th 2019 (7.45 ppt), August 8th 2019 (9.95 ppt), and September 2nd 2020 (9.05 ppt).

Photo 8. Spatfall at Horseshoe.

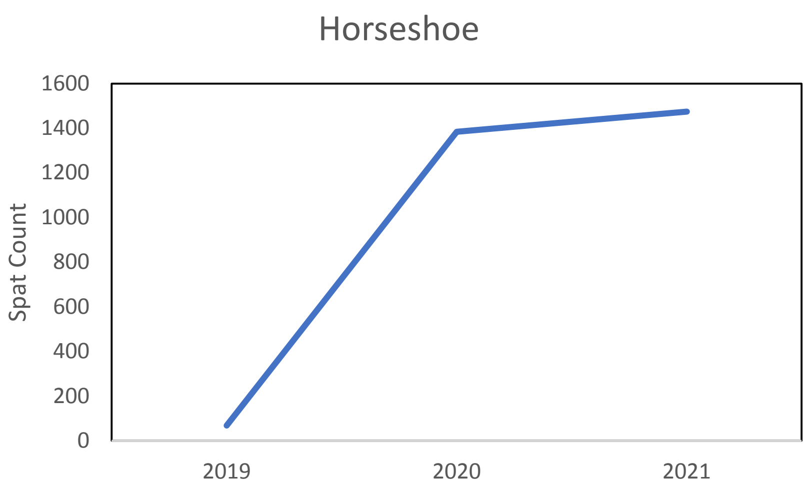

Figure 17. Total spatfall over three years at Horseshoe.

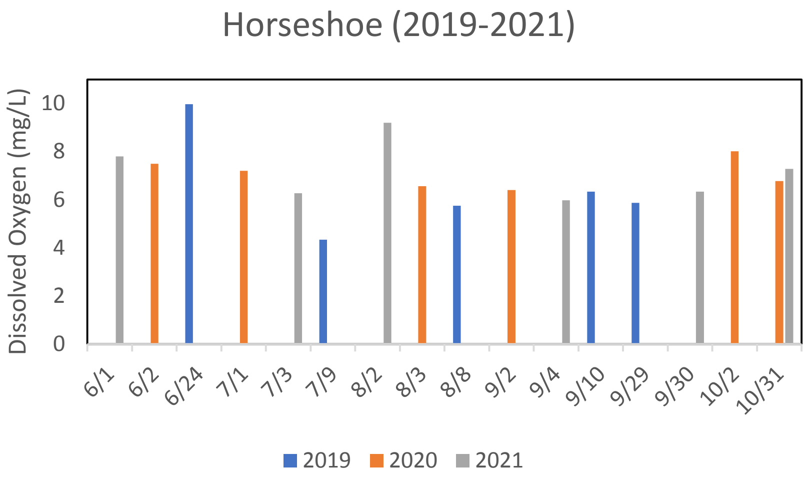

Figure 18. Dissolved oxygen over three years at Horseshoe.

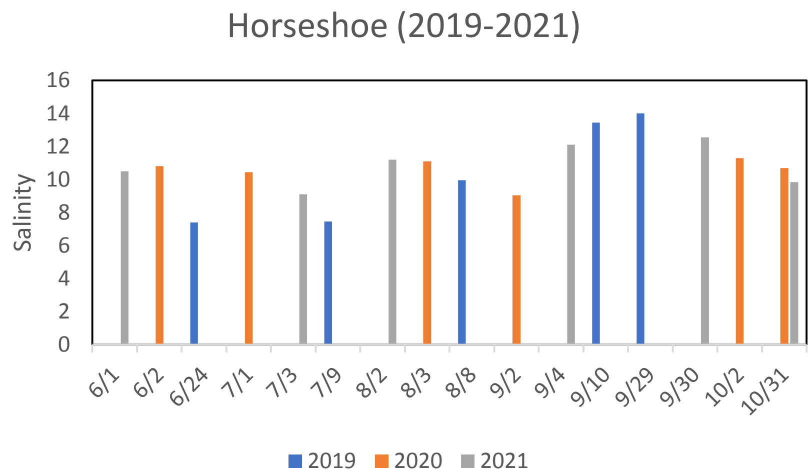

Figure 19. Salinity over three years at Horseshoe.

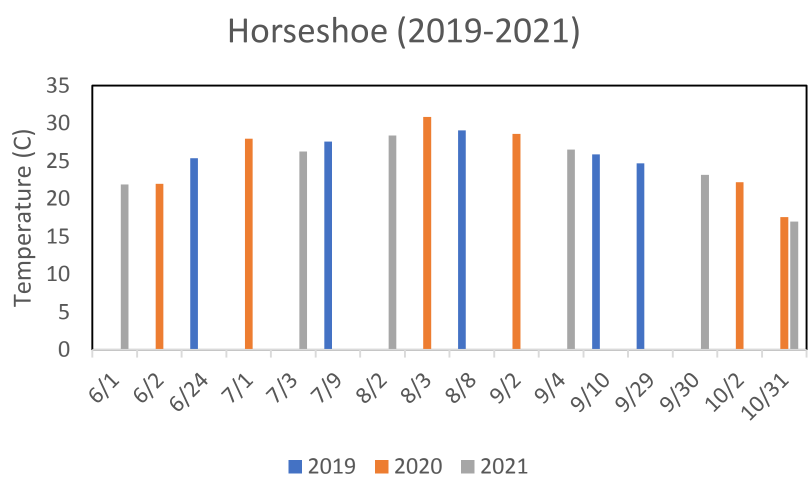

Figure 20. Water temperatures over three years at Horseshoe.

<u>Thompson</u>

Thompson has seen an increase in spat in the four years of the recruitment studies (Fig. 21). Water quality at this site has remained at healthy levels since the start of data collecting in 2019 with the only low readings being dissolved oxygen on July 3rd, 2021 (3.49 mg/L) and salinity on June 24th 2019 (9.35 ppt), July 9th 2019 (8.85 ppt), and July 1st 2020 (9.2 ppt). Note the former site Edmund (2019 study) was used to compare to Thompson in the graphs below. After discussion with the county oyster committee

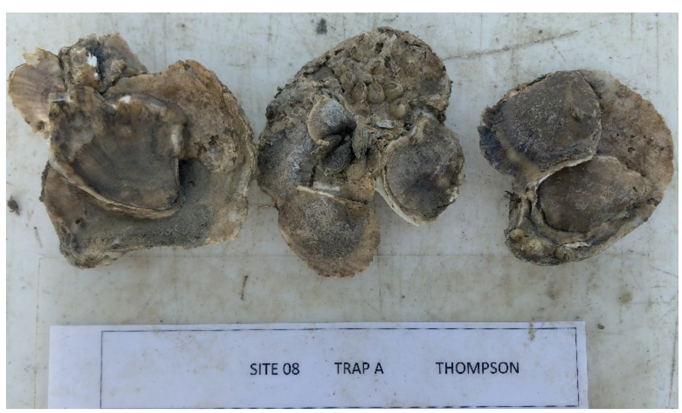

Photo 9. Spatfall at Thompson.

and DNR staff (Feb 2020) it was decided to alter this study site to the northwest 1,750 meters to the current site, Thompson.

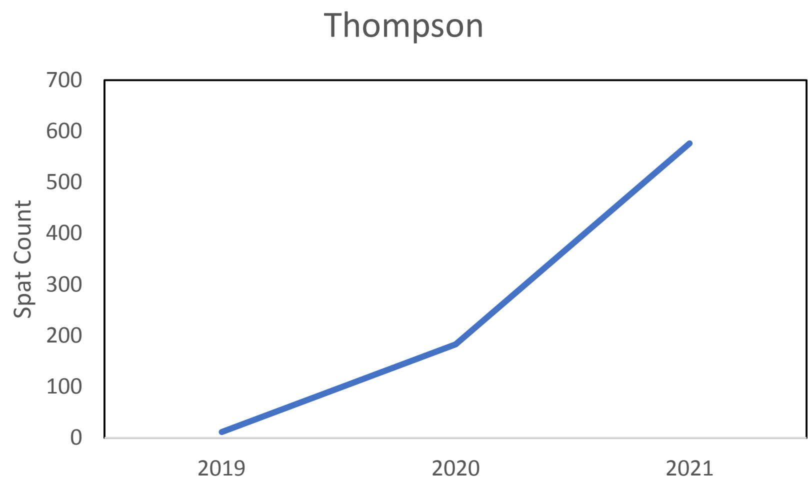

Figure 21. Total spatfall over three years at Thompson.

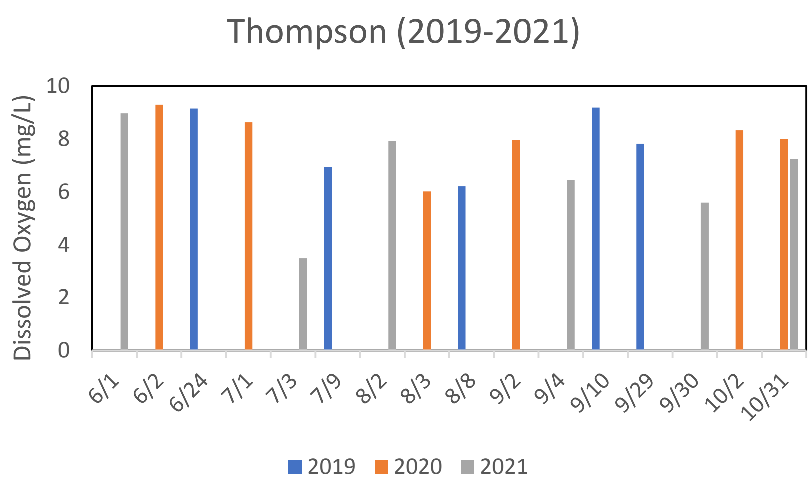

Figure 22. Dissolved oxygen over three years at Thompson.

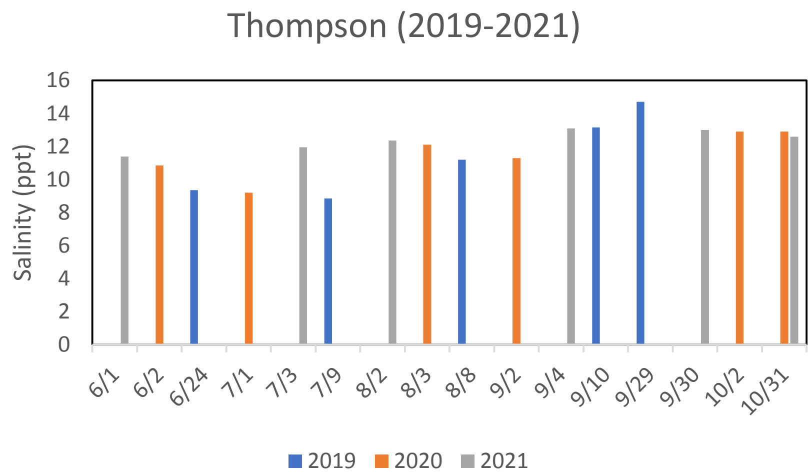

Figure 23. Salinity over three years at Thompson.

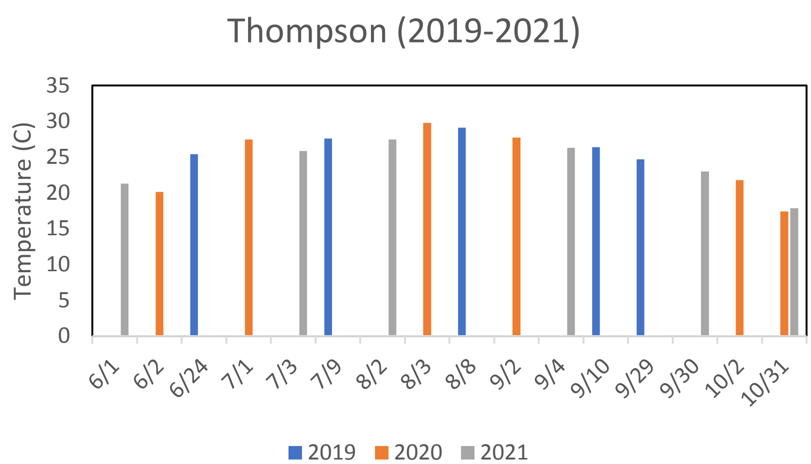

Figure 24. Water temperatures over three years at Thompson.

Spat by Size

In the 2021spatfall study analysis, 74% was over 25mm and 5% was under 10mm (Fig. 25). Additionally, the average size of spat was significantly higher than the past three years. As noted above, the total spatfall success and larger sizes is likely attributed to overall better water quality conditions. It should be noted that the largest spat recorded was 73mm, *nearly market size in just five months*. (Photo 10) The percentage of spat over 40mm was also significantly higher than observed in past years.

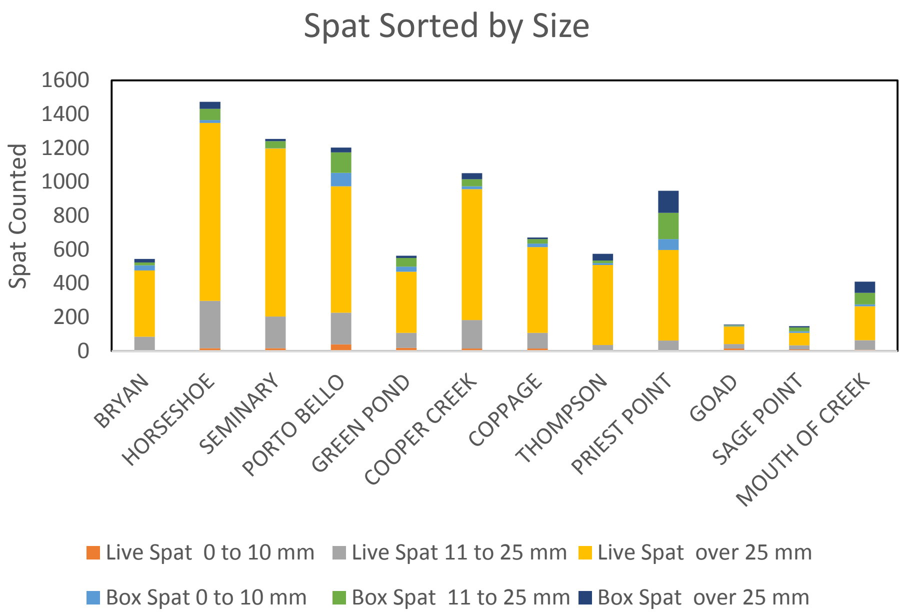

Figure 25. Spatfall sorted by size at all twelve study sites. (2021)

Photo 10. Largest spat recorded, 73mm, at Horseshoe.

GEOGRAPHIC OBSERVATIONS

Throughout the study timeline (4 years), spatfall has been highest in the sanctuary. We have suggested that this is due to higher oyster densities in nearby bars. Oyster density was surveyed in 2019 and many areas downriver had less than 5 oysters per square meter in the nearby vicinity to each study site; upper river oyster densities (in the sanctuary) were much higher exceeding 150 oysters per square meter at two sites studied; mid river oyster density was just marginally better than the lower river (below Priest and Windmill points).

This year, 2021, we observed spatfall significantly higher outside the sanctuary on the western shore study sites compared to the eastern shore sites; Priest Point is an exception to this. So why the higher densities? Maybe there are higher oyster densities on the west shore due to harvest pressures (or lack of)? A look at harvest data by location might inform this hypothesis. Maybe something else is affecting larval drift or spawn success? One possibility is the current in the river that is favoring counterclockwise flows due to the Coriolis effect is carrying more larvae from the more prosperous oyster bars and the sanctuary to the west side than the east side. In order to more scientifically ascertain reasoning, additional studies could be conducted such as a comprehensive survey of oyster density by location, and/or a study of larval drift that might include weekly trawls to ascertain where the larvae come from and where they settle.

SITE SPECIFIC CONCERNS – A LOOK AT NEXT YEAR

One study site, Priest Point, had significant mortality—the highest of the twelve 2021 study sites. It was also observed that all four cages had settled into mud and that most of the mortality were spat that had settled, became covered in mud, and then died. (Photo 11) In fact one of the cages was buried hallway in mud thereby affecting nearly all of the shells inside. We suggest a second relocation of these cages. After the 2020 season, a local waterman told us that our study location was just off of an existing oyster bar and that we should move it "SW 75 yards". We did this for 2021 with consultation from the county oyster committee, although we appear to have again missed the existing oyster bar. We will consult this waterman again and request specific coordinates for the existing bar. Then we can discuss this potential change in site location with our partners (DNR, St. Mary's College, county oyster committee) and decide how to proceed in 2022.

Photo 11. Spatfall mortality at Priest Point likely due to trap sinking in mud (2021) after spatfall.

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LITERATURE CITED

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 [Note: this ‘draft’ was approved and became the final study.]

Francis X. O’Beirn, Mark W. Luckenbach, Janet A. Nestlerode, and Gregory M. Coates. “Toward Design Criteria in Constructed Oyster Reefs: Oyster Recruitment as a Function of Substrate Type and Tidal Height” Journal of Shellfish Research, Vol.19, No.1, pp.387---395, 2000.

Michael Wilberg, PhD et al “Stock Assessment of the Eastern Oyster, Crassotrea virginica, in the Maryland waters of Chesapeake Bay” A Report to the General Assembly, December 1, 2018

APPENDIX A

Comparison of spatfall on substrates – oyster shell, quartzite stone, blue stone

ABSTRACT

The study compares natural oyster larval strike (spatfall) success on three variant culches—shells directly from shucking houses and aged three years, quartzite stone 1 to 3 inch, and blue stone 1 to 2 inch. This study provides numerical data on wild spatfall on these three different substrates.

Results of the study showed quartzite stone is a poor potential substitute for shell with a low spatfall and high mortality rate per cage, while blue stone is a good substitute as its recruitment and mortality rate per cage is very similar to that of the shells. However, more data is needed to support this as the results may be site specific.

INTRODUCTION

In order to reap the best benefits of the oyster population in the St. Mary's River, the watermen have been closing off a section (approximately 10 to 15 acres) of the public harvest bottom for a few years and shelling the area with thousands of bushels of oyster shells. In this way the "reserve area" recruits significantly more natural spatfall than adjacent unshelled bottom. This process has allowed the watermen to harvest significantly greater quantities of oysters, maybe 3,000 bushels, more or less, from the reserve area in the third or fourth year after shelling. Without this shell application, the area likely would provide a few hundred bushels harvest annually at most.

However, shell is in high demand and expensive. This's study's purpose is to determine if other substrates would be a good replacement for the shells that wouldn't lessen the oyster recruitment.

METHODS

Six cages (12"x 18" x 8") each filled with 8.375 liters of rocks (measured in a bucket), three cages with the quartzite and three with blue stone. All cages were deployed at Green Pond on June 1, 2021. Another four cages were filled with 120 shells and deployed at the same site on June 1, 2021. A comparison of surface area was not attempted due to the unique morphology of each substrate. The amount of shells was 1 ½-times greater than the amount of stones when measured with the bucket. Still it is likely that surface areas of either stones was greater than the shells.

During the study all ten traps had to be temporarily moved (August 27) so that two-year old spat could be harvested from this site for planting downriver at another location. Care was given to avoid additional mortality. In preparation for harvesting the older spat, during a DNR survey the traps were mistakenly snagged and dragged. This likely caused additional mortality. Traps were returned to the study site on September 13.

All ten traps were retrieved on October 21, 2021. A chain of custody form was completed for each step-in order to track each trap throughout the study thus ensuring accuracy. The spat on the shells in each trap was counted on the day the trap was retrieved by Colleen Smith, Bob Lewis Daniel Ulrich, Cooper Brotherton, and Kevin Fahey. The counts for each trap were recorded by size grouping and status (living or dead). (A dead oyster is commonly referred to as box or scar.) Size groupings were 10mm and under, 11mm to 25mm, and over 25mm.

RESULTS

A comparison of the quartzite stone and shell indicated that quartzite stone was less favorable to recruitment and had significantly higher mortality. Whereas a comparison of blue stone to shell indicated little difference—both had good spatfall. For each substrate there was a certain amount of mortality that could have come from predators and/or the environment and/or handling upon retrieval and analysis. The shells had 17% mortality; quartzite stone had 46% mortality; and blue stone had a 13% mortality. With the quartzite stones having the lowest spatfall and highest mortality rate they appear to be a poor replacement for shells. Whereas, bluestone may provide a good replacement for oyster shell. However due to the study's limited extent, additional study is needed to show that these results are not site specific or anomalies.

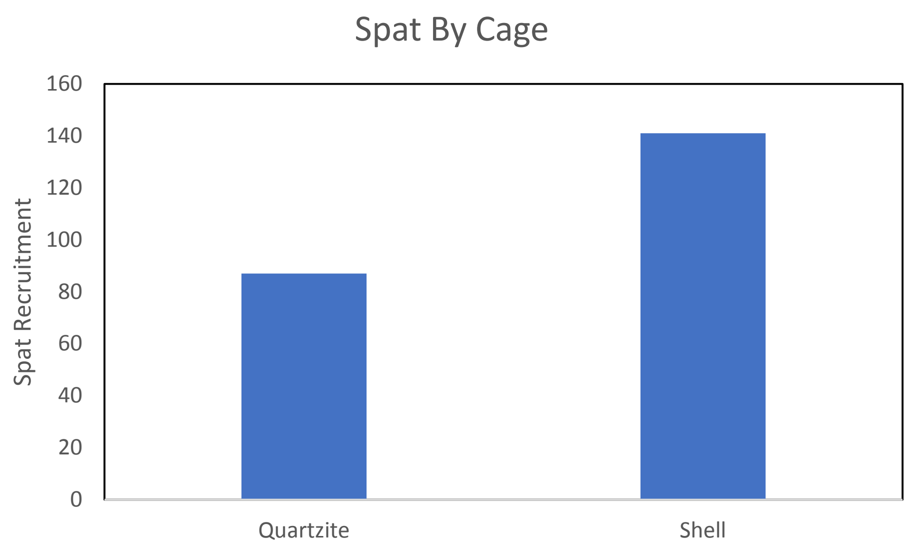

Figure A. Comparison of spatfall by cage between oyster shell and quartzite stone.

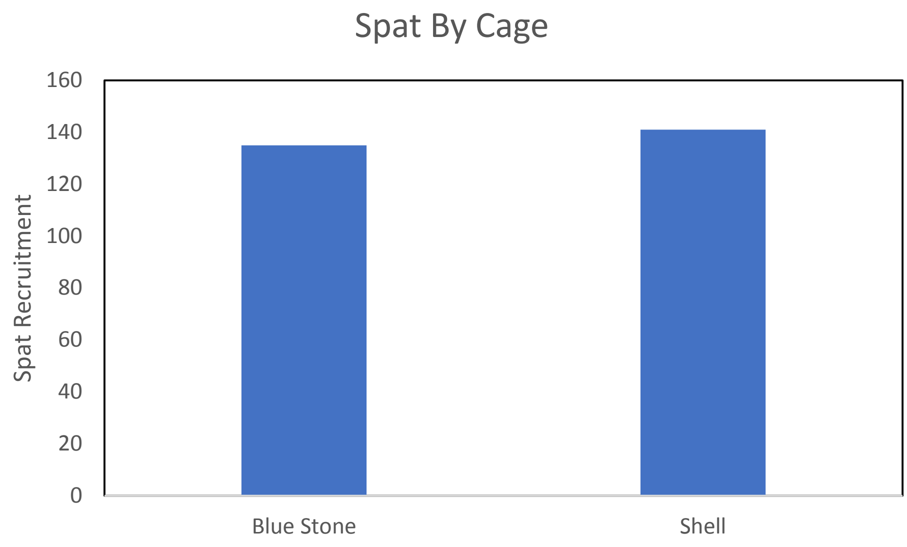

Figure B. Comparison of spatfall per cage between oyster shell and blue stone.

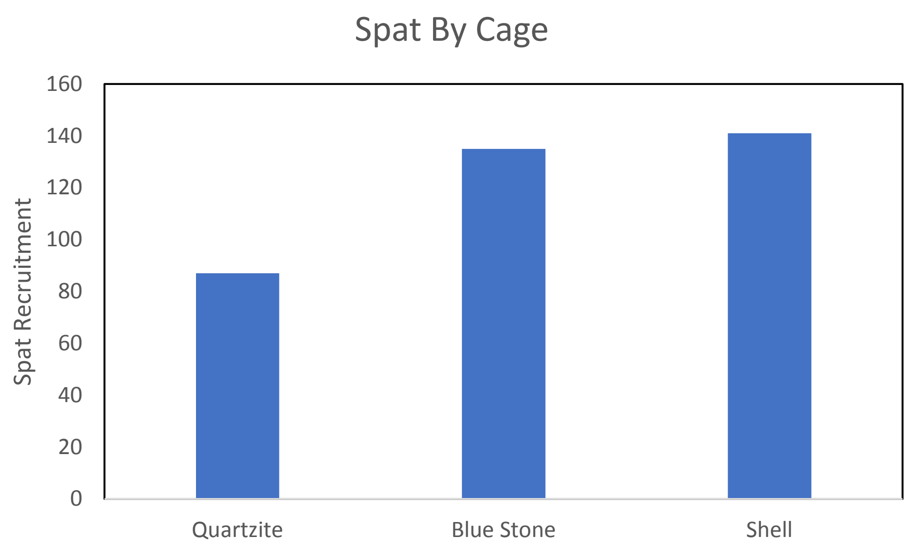

Figure C. Comparison of spatfall per cage with quartzite, blue stone, and oyster shell.

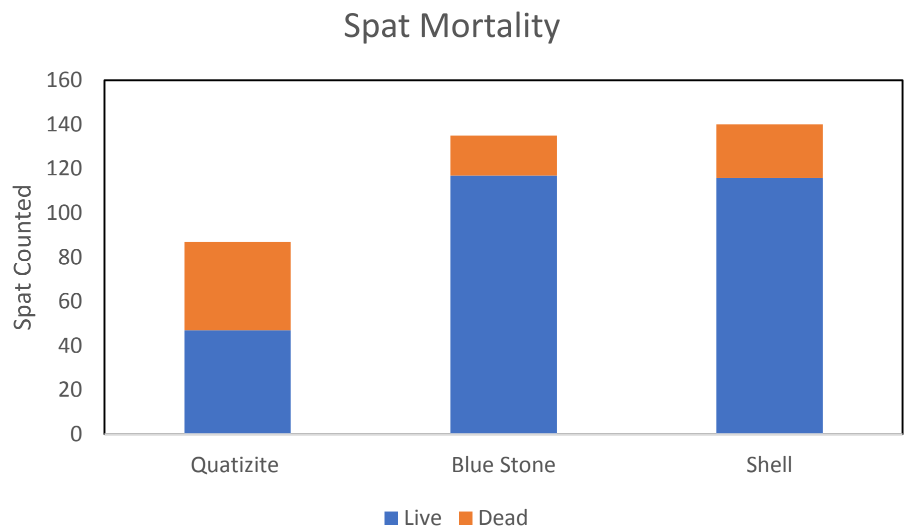

Figure D. Spatfall mortality per cage by substrate type.

APPENDIX B

Comparison of spatfall on substrates – scalded verses non-scalded oyster shells

ABSTRACT

The study compares natural oyster larval strike (spatfall) success on two variant culches—shells directly from shucking houses (green shell aged three years) and the same shells with the treatment of scalding. Shells used for this study had to be identical in each trap to make accurate comparisons of the data collected. This study provides numerical data on wild spatfall on two variations of oyster shells from the same shucking house—one being the shells that have had no treatments and the other being shells that have been scalded.

Analysis of the spatfall at two study sites (St. Mary's Hall, Queen Ann) adjacent to St. Mary's College of Maryland showed that St. Mary's Hall had a higher spatfall on the scalded shell, however Queen Ann's spatfall was similar for both substrates making the data inconclusive. The study was also limited by the number of traps, with four traps having scalded shells and four tarps with non-scalded shells at each site for a total of eight traps. The variance within each type of traps was significant, suggesting other factors might have impacted the study. Therefore, the conclusion is that spatfall likely does not vary appreciably between scalded shells and non-scalded shells. Additional study is needed.

INTRODUCTION

In order to reap the best benefits of the oyster population in the St. Mary's River, the watermen have been closing off a section (approximately 10 to 15 acres) of the public harvest bottom for a few years and shelling the area with thousands of bushels of oyster shells. In this way the "reserve area" recruits significantly more natural spatfall than adjacent unshelled bottom. This process has allowed the watermen to harvest significantly greater quantities of oysters, maybe 3,000 bushels, more or less, from the reserve area in the third or fourth year after shelling. Without this shell application, the area likely would provide a few hundred bushels harvest annually at most. [Kelley, Trossbach] However, in a February 2020 oyster recruitment study planning meeting, watermen claimed that the scalded shell does not strike as well as non-scalded shells. [Hite] Therefore, watermen claimed it was important that shells used in traps to study spatfall in the tidal St. Mary's estuary, should not be scalded.

METHODS

To test the watermen's claims, eight cages (12"x 18" x 8") each filled with 8.375 liters of shells (measured with a bucket). The shells varied in size. Therefore, a volume measurement was chosen over a count of shells. All oyster shells used in the study were wild grown, aged shells that all came from the same shucking house and were never cooked.

Scalded shells that were power washed and then boiled for ten minutes were placed in six cages, while another six cages were filled with shells that were power washed but not boiled. Chain of custody forms were completed in order to track each trap throughout the study thus ensuring accuracy. Three traps with scalded shells and three with non-scalded shells were placed at each study site; the 12 traps were deployed on June 16, 2021. The chosen study sites are adjacent to St. Mary's College of Maryland, one offshore of St. Mary's Hall and the other offshore of Queen Ann Hall; both site depths were 2 meters MLW. Black cable ties labeled the traps that held scalded shells and white cable ties labeled the traps that held non-scalded shells.

Cages were retrieved on August 16, 2021. A chain of custody form was completed for each step-in order to track each trap throughout the study thus ensuring accuracy. The spat on the shells in each trap was counted on the day the trap was retrieved by Bob Lewis, Colleen Smith, Daniel Ulrich, and Cooper Brotherton, The counts for each trap were recorded by size grouping and status (living or dead). (A dead oyster is commonly referred to as box or scar.) Size groupings were 10mm and under, 11mm to 25mm, and over 25mm.

RESULTS

At St. Mary's Hall, scalded shell had 61% of total spat on shell and un-scalded had 39% of total spat on shell. At Queen Ann, un-scalded shell had 53% of total spat on shell and scalded had 47% of the total spat on shell. In the previous culch study at Seminary in summer 2020, un-scalded shells had 52% total spat on shell and scalded had 48% of spat on shell. Again, due to the limited scope of the study and the variation of spatfall by cage, a conclusion is only speculative. Considering results from both years strongly suggests that scalding does not affect spatfall.

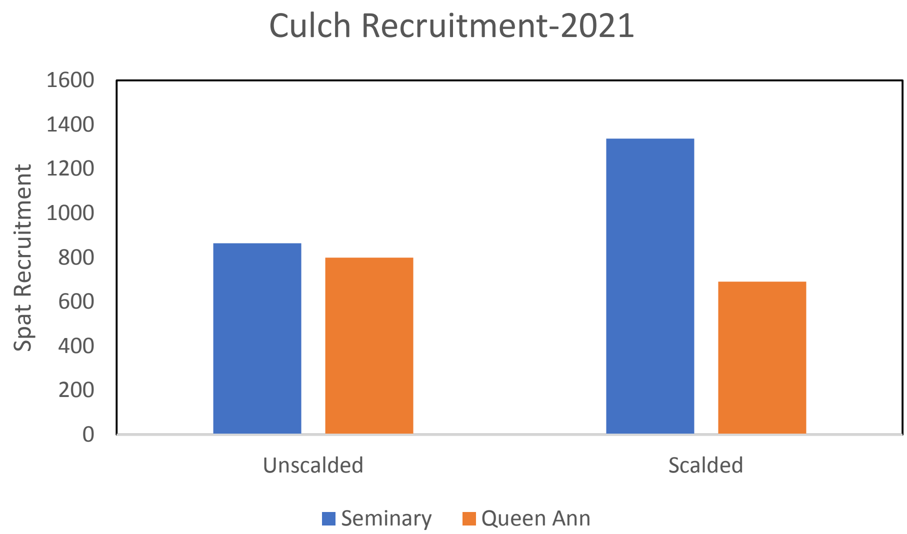

Figure E. Spatfall on two study sites by substrate – scalded vs. non-scalded oyster shells.

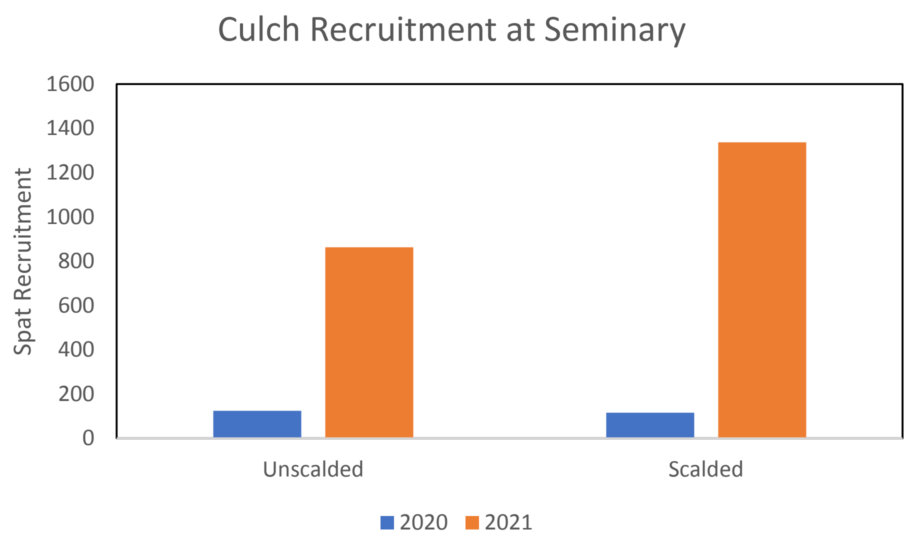

Figure F. Spatfall in two study years by substrate – scalded vs. non-scalded oyster shells.

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