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SRA Creek-by-Creek Report
Oyster Restoration Reefs

2020 Bottom Dissolved Oxygen and Salinity Analysis

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Abstract

Conditions at oyster restoration reefs were good in 2020. Dissolved oxygen was always above the dead zone level of 2.0 mg/L, except for one day in June, and above 5.0 mg/L all of fall. Salinity was low in springtime, but this is expected with high rainfall. From late June to November salinity was in the tolerable range for oysters (8-15 ppt). These conditions ensure that our oyster restoration reefs can grow and thrive in the Severn River.

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INTRODUCTION

This analysis focuses on bottom dissolved oxygen (d.o) and bottom salinity, two important metrics of water quality for oysters. Oysters are confined to the bottom of the river so they cannot escape dead zone conditions (d.o. < 2.0 mg/L) or low salinity conditions that more mobile creatures such as crabs or fish can. Oysters prefer dissolved oxygen above 5.0 mg/L and a salinity range of 8-15 ppt. Prolonged exposure to d.o. or salinity outside of these tolerance ranges can cause negative effects such as stress, depressed growth, and decreased survival.

In 2019, SRA began its water quality monitoring program, thanks to support from the Delaplaine Foundation. SRA tracks conditions at 44 monitoring stations from late May to early November to better understand the conditions experienced by river life, including oysters. This report was compiled to summarize abiotic conditions experienced by oysters in 2020 at current restoration reefs.

The areas studied in this report include current oyster restoration reefs known locally as Traces Hollow (TH), Manresa (MA), Peach Orchard (PO), and Weems Upper (WU), located between the Route 50 and U.S. Naval Academy bridges (figure 1). Traces Hollow is a reef restored through Marylanders Grow Oysters (MGO), a program that since 2009 has annually populated the reef with volunteer raised spat. The other 3 reefs were restored through the Oyster Recovery Partnership and Operation Build a Reef in 2017 and 2018.

SRA's water quality monitoring program tracks conditions at each of these reefs to monitor how the oysters are doing, and learn how water quality conditions may be affecting restoration.

Figure 1. SRA's water quality monitoring stations located at current oyster restoration reefs.

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EXECUTIVE SUMMARY

Bottom dissolved oxygen levels were either sufficient (2.0 mg/L < d.o. < 5.0 mg/L) or good (d.o > 5.0 mg/L) for oysters for the majority of monitoring in 2020. Dead zone only affected restoration reefs Manresa and Traces Hollow on one day in 2020: June 4th. This is very promising for our restoration efforts, and is abnormal compared to other stations on the Severn River of similar depths that experience dead zone conditions for consecutive weeks during the summer (Round Bay stations and creek stations for example).

Bottom salinity in 2020 at all reefs followed similar trends from May to November. In springtime salinity was fresher, in the range of 5-8 ppt. Salinity then abruptly jumped to over 15 ppt in late June. Bottom salinity then remained in the range of oyster tolerance (8-15 ppt) for the remainder of monitoring, steadily growing saltier over fall (reaching 14 ppt by November).

Despite one incident of dead zone, and fresher salinity in the spring, conditions at all oyster reefs were very good in 2020. More investigation is needed to determine if the dead zone or fresh salinity had any measurable effect on the oysters at Traces Hollow, Manresa, Peach Orchard, and Weems Upper. But overall, 2020 abiotic conditions should be supporting SRA's oyster restoration efforts.

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ANALYSIS

Bottom Dissolved Oxygen

In 2020, bottom d.o. measurements were taken weekly from May 28th to November 5th with a YSI probe. The probe was lowered until the bottom was felt by slack in the cord. Then the probe was raised to the nearest 0.5 m depth as to not be in the mud or directly on the hard substrate. Bottom dissolved oxygen data for all restoration reefs is displayed in figure 2. Data points that fall below the red line indicate poor, dead zone levels, whereas data above the red line or green line indicates moderate or good levels for oysters, respectively.

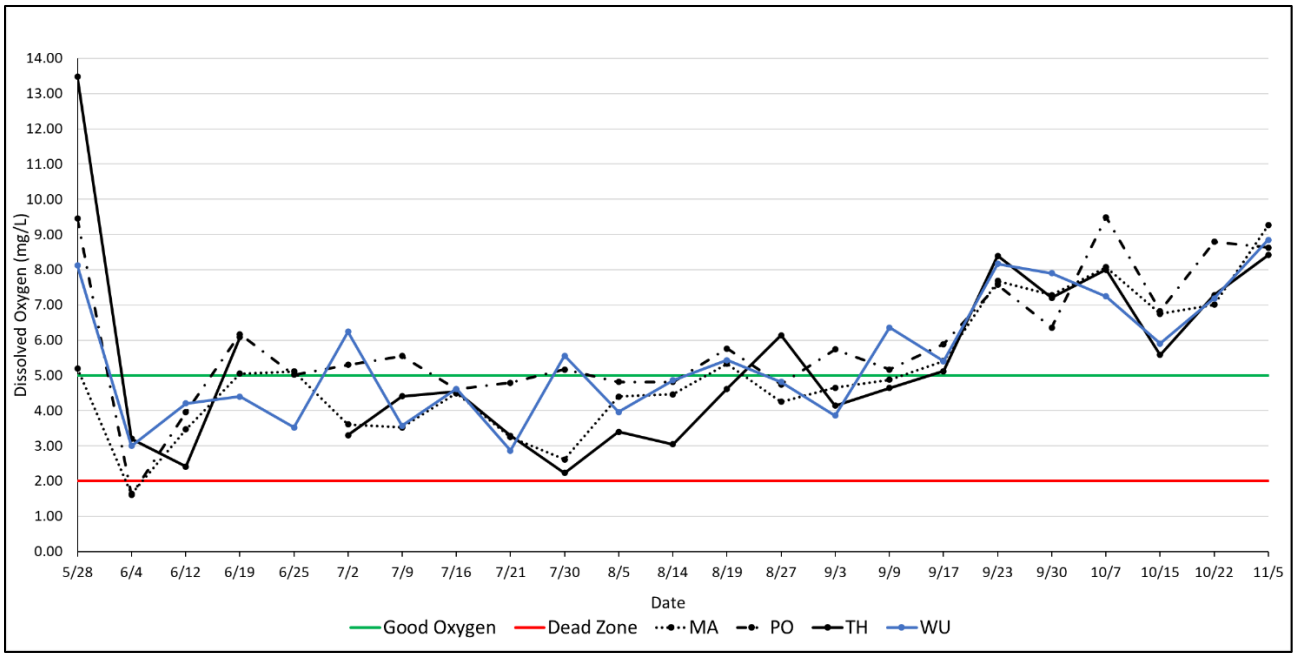

Figure 2. Bottom dissolved oxygen at restoration reefs in 2020.

- In May, there is good oxygen levels at all reefs, with oxygen at TH, PO, and WU, exceptional at 13.48 mg/L, 9.45 mg/L, and 8.12 mg/L, respectively.
- In May, MA oxygen was lower at 5.20 mg/L but still sufficient for oysters.
- Oxygen plummeted at all reefs in June, entering moderate levels at WU and TH, and dead zone at MA and PO Orchard. This is the only incident of dead zone for the monitoring season.
- In the summer months bottom d.o. at reefs tended to either hover around 5.0 mg/L or fall just below, at 3 or 4 mg/L. These levels are not insufficient for oysters but are not necessarily in the good range that promote maximum growth.
- Oxygen at PO was very consistent week to week, remaining around 5.0 mg/L.
- Oxygen was more sporadic at WU, jumping from above 5.0 mg/L and then falling to 3.0 mg/L week by week.
- MA and TH followed similar trends through the summer dropping to just above 2.0 mg/L then increasing to above 5.0 mg/L in August.
- In September and into the fall bottom d.o. at all reefs entered the good range for oysters (above 5.0 mg/L). All reefs experienced a range of 5.58-9.48 mg/L.

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Bottom Salinity

The Severn River is a brackish water body. This means that it is neither fully freshwater (0 ppt) or fully ocean/saltwater (35 ppt)[1]. Instead the typical salinity range, or amount of dissolved salt in the water, of the Severn River is mesohaline (5-18 ppt)[2]. Oysters however prefer a slightly higher range of salt in their environment (8-15 ppt). Prolonged exposure to salinity outside of this range can cause negative effects such as stress, decreased reproduction and growth, and lessened survival. Salinity follows the pattern of rainfall, so it is expected to be lower in spring, when rainfall is frequent, and increase as rainfall subsides in the summer and fall.

Bottom salinity measurements were taken weekly from May 28th to November 5th with a YSI probe. The probe was lowered to the bottom at each site and salinity was recorded. On the figure 3 below, points that fall between the green and red line indicate salinity in the preferred range of oysters.

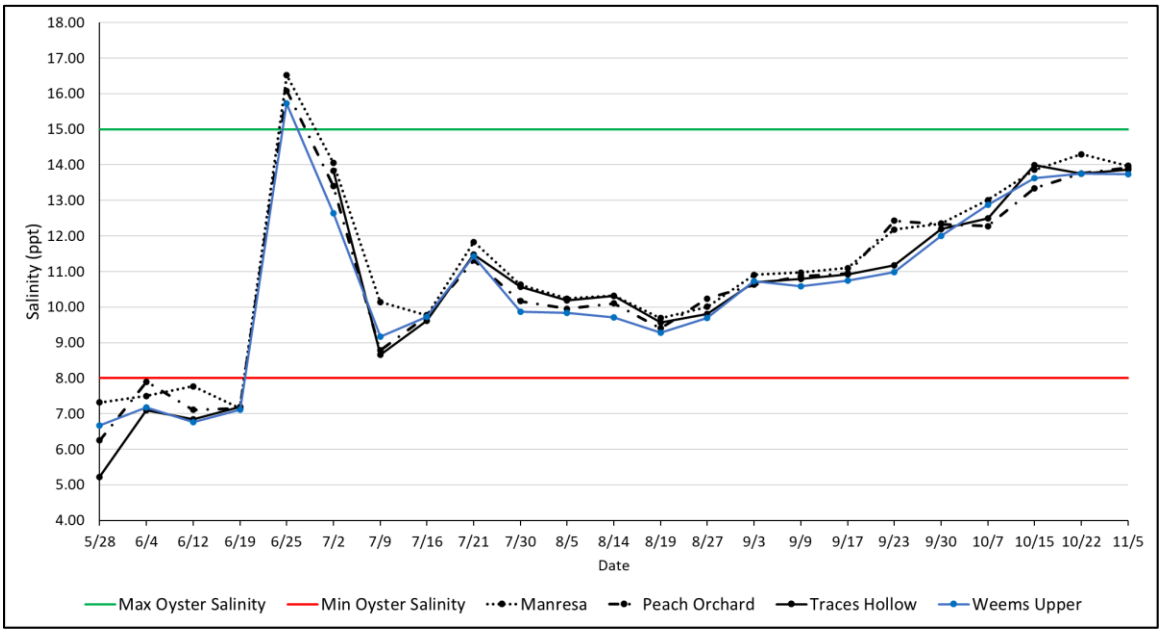

Figure 3. Bottom salinity at restoration reefs in 2020.

- In spring, due to high rainfall most likely, salinity was too fresh for oysters at all reefs and ranged from 5.22-7.90 ppt.
- Salinity then jumped to over the maximum salinity to 16.52 ppt, 16.08 ppt, and 15.72 ppt at MA, PO, and WU respectively (data missing for Traces Hollow on 6/25).
- The following week however, salinity entered the preferred range at all reefs (12-14 ppt).
- In late July, bottom salinity then started a steady increase into the fall months, reaching about 14 ppt in November.
- All reefs displayed very similar salinity trends over the course of monitoring, with no reefs exhibiting clear differences over the others.

[1] Chillrud, R. (2020, March 20). Is the Chesapeake Bay fresh or salty? Retrieved January 07, 2021, from https://www.chesapeakebay.net/news/blog/fresh_or_salty_bays_salinity_makes_a_big_difference_to_underwater_life

[2] Bergstrom, P., Murphy, R., Naylor, M., Davis, R., & Reel, J. (2006). *Underwater Grasses in Chesapeake Bay & Mid-Atlantic Coastal Waters*. College Park, MD: Maryland Sea Grant College.