Investigating the Relationship Between Physical Water Quality Parameters and Chlorophyll-A in Rehoboth Bay, Delaware

Emily Andrade, Robert Allison, Aaron Bland, Mohana Gadde, Memory Nakazwe, Dr. Theresa Venello, and Dr. Gulnihal Ozbay
Department of Agriculture and Natural Resources, Delaware State University, Dover, DE

Abstract

Introduction

- Oysters are vital coastal organisms, improving local economies, water quality, and providing habitat for fish and invertebrates.
- Water quality (WQ) monitoring is essential for sustainable growth in shellfish farming, ongoing bay restoration, and helping resource managers make policy decisions regarding shellfish farming.
- **Objective**:
  - Monitor and identify relationships between temperature, dissolved oxygen, pH, total suspended solids, and chlorophyll-a in Rehoboth Bay, DE.

Methods

- Water samples collected bi-monthly at seven sites within Rehoboth Bay in the 2020 and 2021 field seasons.
- Physical, chemical, and biological water quality parameters were measured using multiparameter water quality instruments (YSI 556 Multiprobe, YSI 6 series sonde, YSI Exo2 sonde, and Aquafluor fluorometer).
- Relationships between parameters examined by GAMs using R.
- Parameter differences between year and site examined by ANOVA.

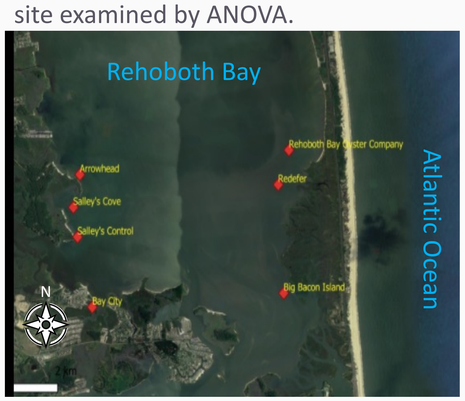

Fig. 1 Study sites in Rehoboth Bay, Delaware.

Results & Discussion

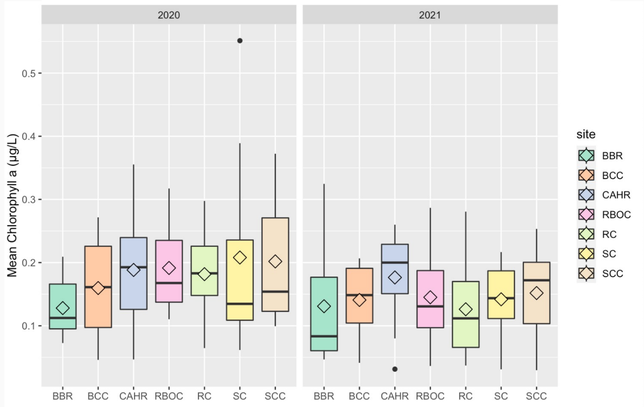

Fig. 2 Boxplot of Chlorophyll –*a* across sampling sites for 2020 and 2021. Diamond shape represents mean value.

Chlorophyll –*a*

- Mean Chlorophyll –*a* values higher in 2020 than 2021, but little across bay variation.

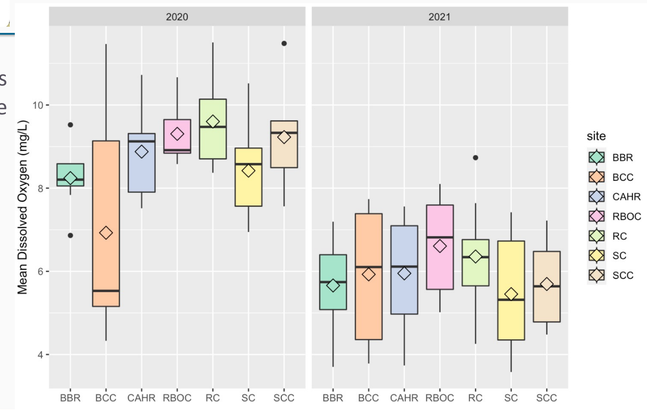

Fig. 3 Boxplot of dissolved oxygen (mg/L) across sampling sites for 2020 and 2021. Diamond shape represents mean value.

Dissolved Oxygen

- Dissolved Oxygen varied between years with mean values higher in 2020 than 2021, but little across bay variation.

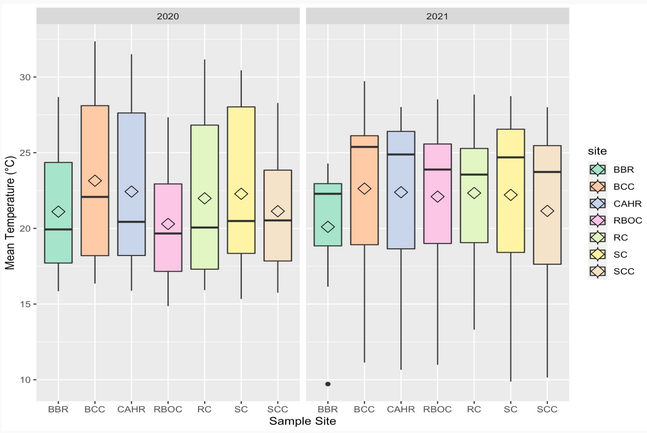

Fig. 4 Boxplot of Temperature (°C) across sampling sites for 2020 and 2021. Diamond shape represents mean value.

Temperature

- Median temperature values were higher in 2021 than 2020, but average temperature values were similar across the bay sites.

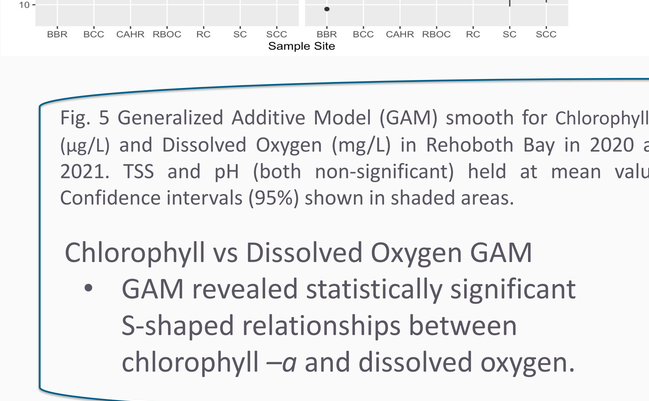

Fig. 5 Generalized Additive Model (GAM) smooth for Chlorophyll –*a* (µg/L) and Dissolved Oxygen (mg/L) in Rehoboth Bay in 2020 and 2021. TSS and pH (both non-significant) held at mean values. Confidence intervals (95%) shown in shaded areas.

Chlorophyll vs Dissolved Oxygen GAM

- GAM revealed statistically significant S-shaped relationships between chlorophyll –*a* and dissolved oxygen.

Results cont.

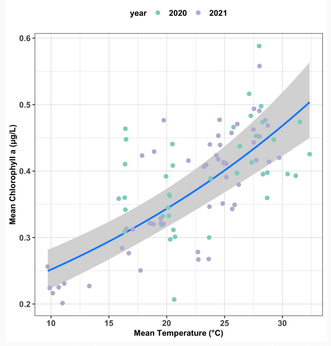

Fig. 6 GAM smooth for Chlorophyll –*a* (µg/L) and Temperature (°C) in Rehoboth Bay in 2020 and 2021. TSS and pH (both non-significant) held at mean values. Confidence intervals (95%) shown in shaded areas.

Chlorophyll vs Temperature

- GAM revealed statistically significant relationships between chlorophyll –*a* and temperature.
- As temperature values increase, chlorophyll –*a* values do as well.

Conclusions

- Overall, not much variability present throughout Rehoboth Bay.
- Some differences present between 2020 and 2021.
- Chlorophyll –*a* has significant relationships with dissolved oxygen and temperature.
- Other non-significant parameters present in the model (TSS and pH)
- Continued water quality needed in the future to monitor the area.

Acknowledgements

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