The Effect of Salinity and Predator Cues on Feeding Rates of Juvenile *Crassostrea virginica*

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Introduction

- Eastern oysters (*Crassostrea virginica*) are critical to estuarine ecosystems (Beck et al. 2011), and especially important in Florida's Big Bend region and Apalachicola Bay, where significant degradation has endangered oyster populations (Seavey, 2011).
- Oysters feed by filtering algae out of the water column through their gills (Castro et. al, 2023).
- To reduce the risk of predation, oysters can close their valves, which may reduce their filtration rates (Dodd, 2017).
- Past research regarding *C. virginica* and other bivalves has explored the effects of temperature, respiration rates, and salinity levels on filtration and growth rates.
- There is a gap in research regarding how abiotic factors (e.g., temperature, salinity) and biotic factors (predation risk) interact to alter feeding rates of oysters.
- Conducting this research can aid in the conservation efforts of oyster reefs, especially understanding the biotic and abiotic factors that impact their juvenile stages into adulthood.
- The decrease in oysters and their habitats may be a consequence of a reduction in feeding, growth, and survival rates due to the presence of predators or suboptimal abiotic conditions.
- We hypothesize that there will be a reduction in feeding rates in low and high salinity regimes, and that the presence of predators will reduce feeding rates in all salinity regimes.

Methods

- 36, 5L tanks with three different salinity regimes: low (15-20 ppt), medium (22-27 ppt), and high (29-35 ppt). Each salinity regime contained 6 tanks (n = 6 tanks/treatment combination).
- Each tank contained an air pump, a submersible heater, and a filter.
- Eighteen tanks contained one predator, *Melongena corona*, the Florida Crown Conch, that had previously been fed adult oysters.
- The juvenile oysters were suspended in small mesh cages to prevent predation by the conchs.
- Temperature and salinity ranges of each tank were kept constant, and adjustments were made as needed using a YSI. The pH, alkalinity, and nitrate levels were checked in random tanks weekly.
- *C. virginica* were fed ~100,000 cells of microalgae, *Tisochrysis lutea*, in each tank on filtration testing days. A 5 mL water sample was immediately withdrawn from each tank with a pipette and placed into an amber vial.
- Water from each tank was withdrawn and tested at three separate one-hour intervals, over the course of three hours.
- Using a pipette, 10 µL from each vial was injected onto a small slide and individually run through the Countess III Automated Cell Counter to test the concentration of algal cells at each time point.
- This test was conducted three times over the 8-week experiment.
- Filtration rate was calculated by the change in algae density from one time point to the next.
- A two-way ANOVA was performed along with an additional variance analysis through a generalized linear model and a post-hoc comparison with a 95% confidence interval.
- This was to analyze the effects of salinity and predator cues on the feeding rates of juvenile oysters.

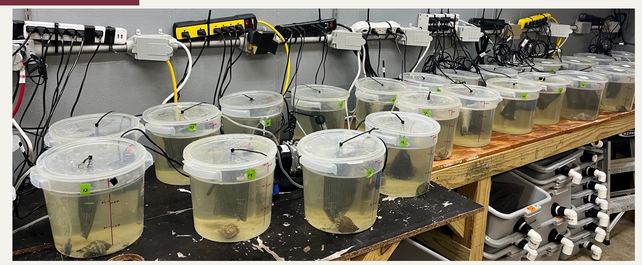

Figure 1. Tanks 11-36 visualizing the set up of salinity regime and predator cue.

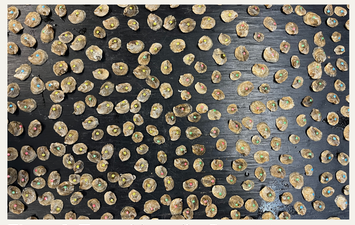

Figure 2. Tagged juvenile *C. virginica.*

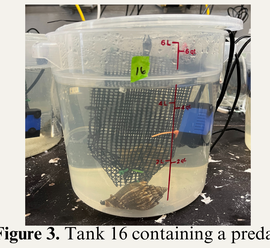

Figure 3. Tank 16 containing a predator.

Results

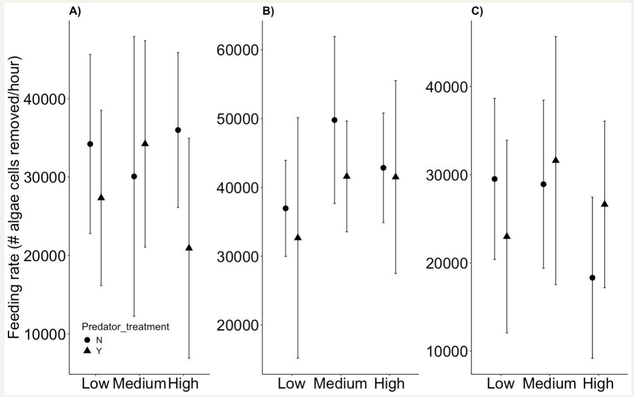

Figure 4. Average feeding rates of juvenile *C. virginica* as a function of salinity regime and predator treatments for the three trials. Bars represent 95% confidence intervals and shapes represent predator treatment.

- This experiment tests both factors of predator cue and salinity regime and their effect on the feeding rates of juvenile oysters.
- Out of the three filtration trials performed, the presence of predators tends to reduce *C. virginica* feeding rate with variation (p = < 0.01), however, this pattern was only significant in one of three trials performed, trial A.
- In trial A, the presence of predators significantly reduced feeding rates in the high salinity regime (p = < 0.05).
- With the completion of the experiment, the analyzed results suggest that salinity and predation risk interact to reduce juvenile oyster feeding rates.

Treatments				
Salinity	Predator	N	Mean Salinity (ppt) (+/- SD)	Mean Temperature (ºC) (+/- SD)
Low	Y	5	18.6	23.09
Low	N	6	18.19	22.86
Medium	Y	6	22.95	22.75
Medium	N	6	24.17	22.84
High	Y	6	32.31	23.03
High	N	6	31.23	23.04

Table 1. Average salinity and temperature of each treatment combination throughout the 8-week experiment.

Discussion

- Results suggest that juvenile oyster feeding rates decrease in the presence of predators within a high salinity regime, however, the effects are highly variable.
- This is particularly interesting due to other research reporting results against this idea stating that predation risk does not affect filtration rates of *Crassostrea virginica* (Dodd, 2017). However, the design of both experiments differs, with Dodd et al. 2017 measuring filtration by chlorophyll a concentration in outdoor mesocosms.
- We encountered some limitations within our experimental process, including variability surrounding the Countess III cell density readings, periodic loss of power, and a few crown conch deaths in some tanks.
- Further research can be done to explore various abiotic factors and their impacts on oysters, other bivalves, and marine organisms concerning the growing issue of climate change, especially in the Gulf of Mexico.

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