

Soda Bottle Upweller System: Optimizing Production of Eastern Oyster Seed

Introduction

Aquacultural Research Corporation was founded in 1960 and is a shellfish hatchery, nursery, farm and wholesale operation. Demand for oyster and quahog seed increases each year, and hatcheries like ARC strive to meet orders. Space limitations and labor requirements currently limit production. Commonly used downweller tanks (figure 1) have up to a 70% larger footprint and require daily maintenance. Fluidized soda bottle upwellers (figure 2 and 6) can save space and labor with a smaller footprint and less rigorous cleaning schedule. ARC was awarded a farm grant by NE SARE to build a soda bottle upweller, using heated seawater and a cultured algae holding tank (figure 3). The goal was to optimize growing conditions and increase production of oyster seed. With increased production, more seed orders can be fulfilled to better meet the needs of local farmers.

Objectives:

1. Find optimal stocking density for each soda bottle to maximize growth
2. Find optimal bottle flow rate for maximized growth

Methods

General Procedures:

- Measure and stock initial volumes of <1mm oyster seed in each bottle
- Increase algae feed amounts each day and measure bottle outflows
- Monitor seawater flow, temperature, pH and algae density
- Measure final volumes and calculate percent growth

Experiments:

2020 Season:

Compare initial bottle stocking volumes (150ml to 600ml) to final volumes after 7-9 days and calculate percent growth

2021 Season:

Compare different bottle flow rates to percent growth



Figure 1



Figure 2



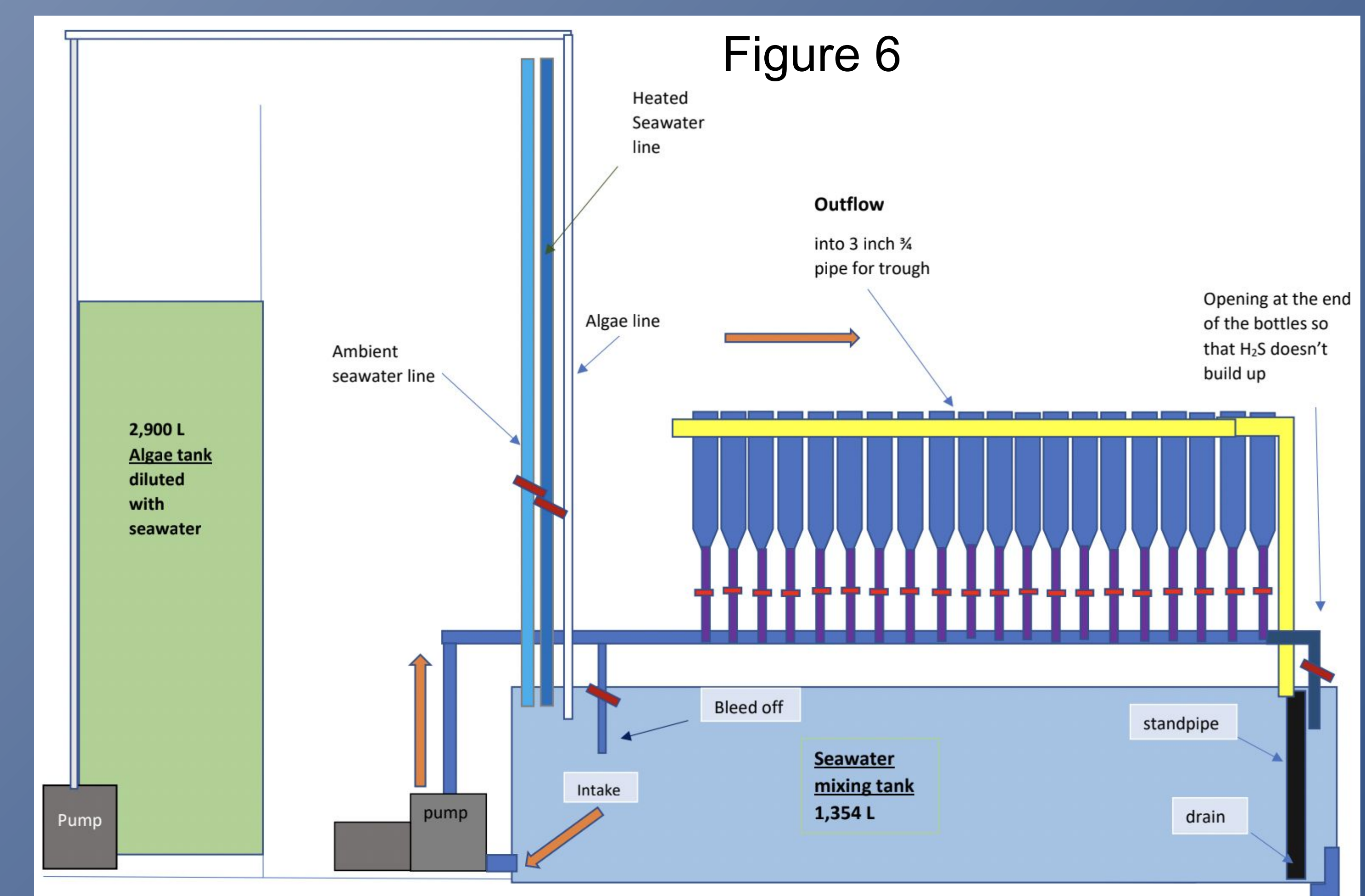
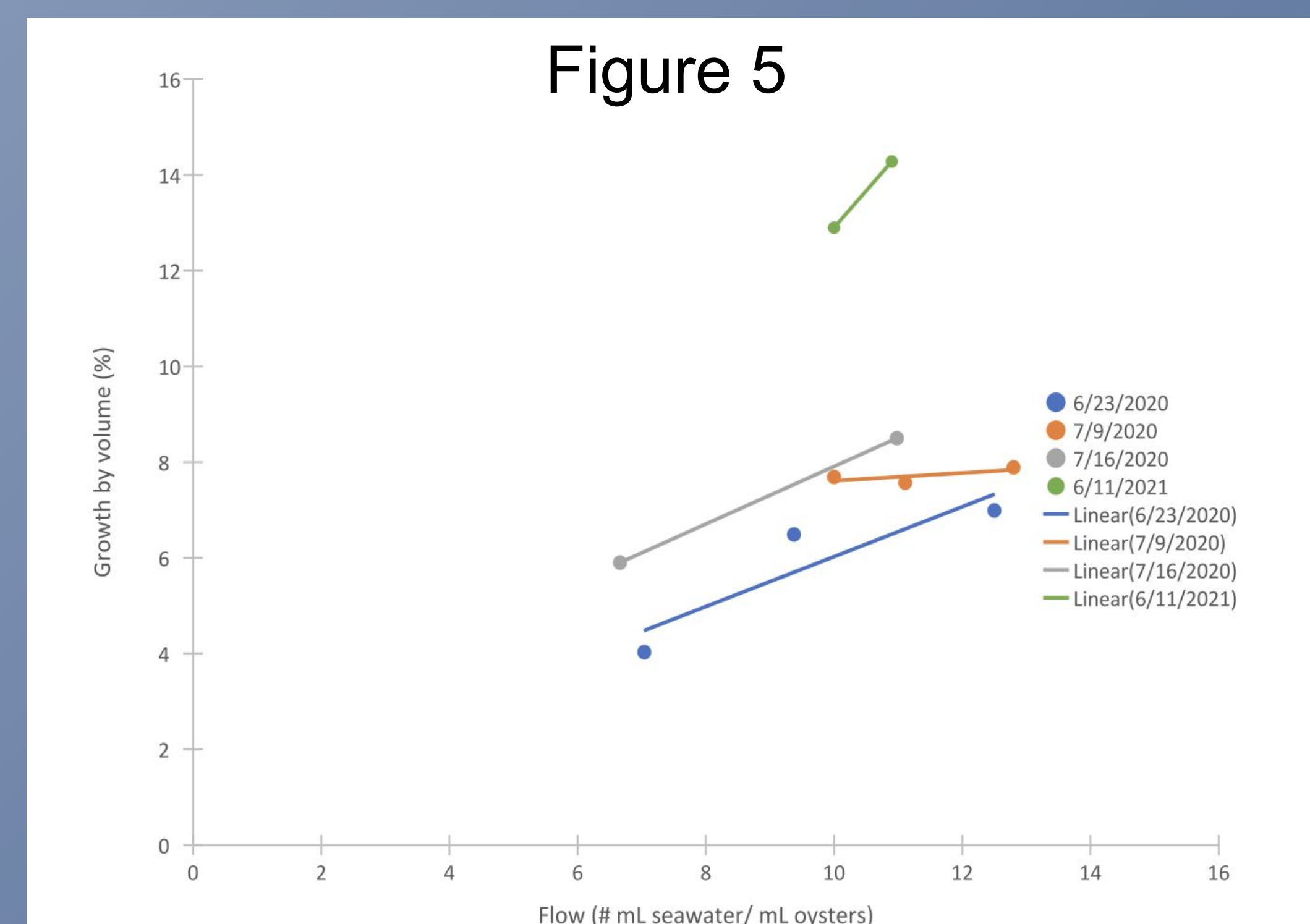
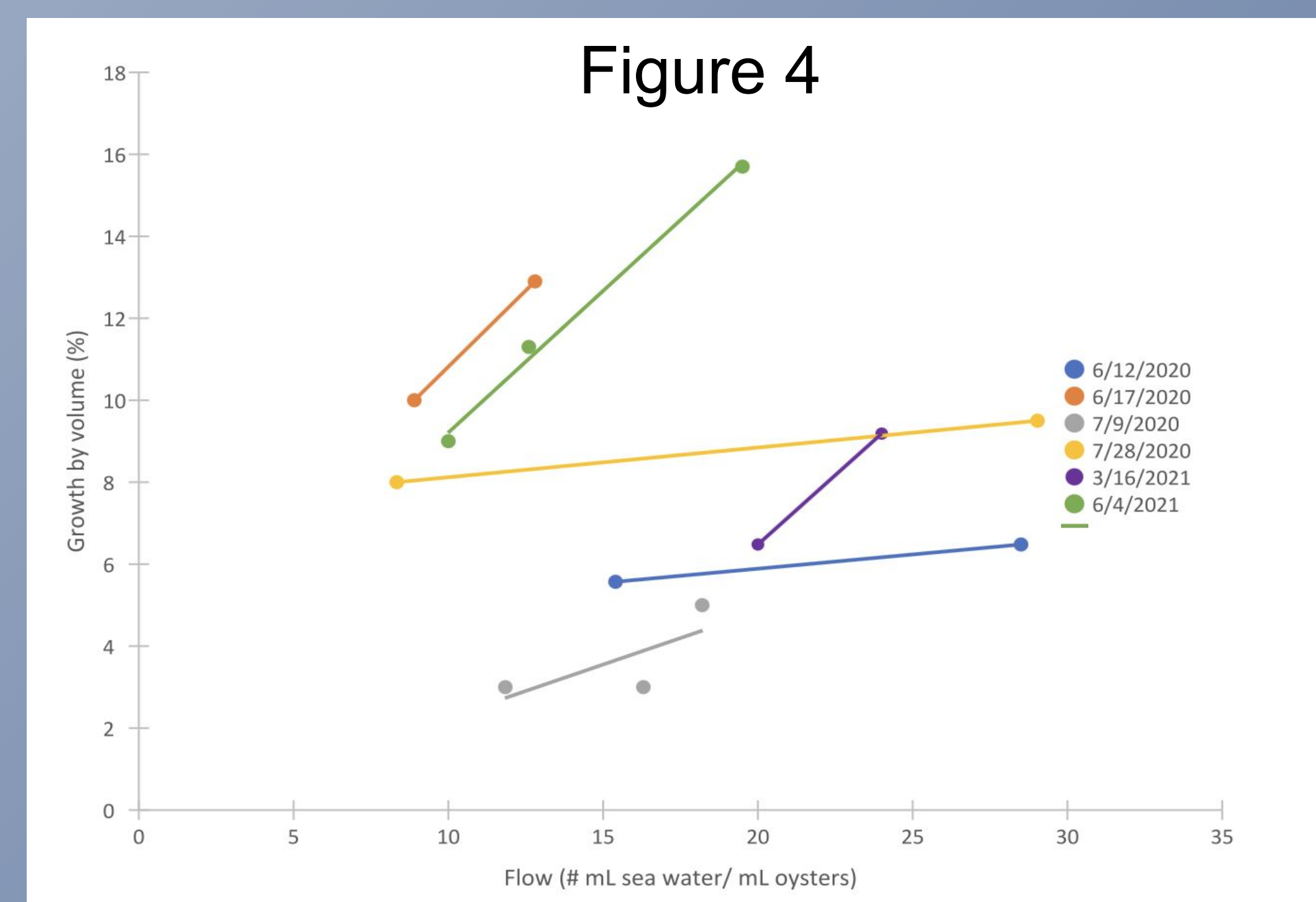
Figure 3

Results / Conclusions

- No correlation was discovered between initial bottle volumes and percent growth in 2020 season. Overall flow of algae/seawater through each bottle was suspected to have an impact, and became the main interest of the 2021 season experiments.
- A positive correlation between percent growth and a higher bottle flow was discovered (figure 4 and 5) during our 2021 season. We hypothesize that with increased flow there is a higher food availability which impact growth rates. During experimentation, oysters at different stages of growth curves were used. While growth rates varied at the same flow rates, there is an overall average increase of growth when flows increased.

Future Directions:

- Use all size classes of oyster seed less than <1mm as different sizes may require different flow rates.
- Create standard flow rates and stocking volumes to maximize growth in soda bottle upweller systems.



Acknowledgments: ARC would like to thank NE SARE for their support and Dale Leavitt for advising the project.