MACROALGAE EFFLUENT IMPACTS ON WATER CHEMISTRY AND LARVAL CULTURE

Muzquiz, M.L., Beezhold, C.B., Hall, L.J.,Ng, I.Q.,Panneno, J.F.[1], and Johnson, K.M.[1,2]
1- California Polytechnic State University, San Luis Obispo 2- California Sea Grant, University of California San Diego
*Co-presenting First-authors

This project is made possible by a grant from the Santa Rosa Creek Foundation

Introduction

Why Grow Seaweed and oysters together? As climate change progresses, the increasing amount of CO_2 is driving ocean acidification which has been shown to negatively impact larval development of shellfish. Macroalgae cultivation increases the pH, offering a solution for offsetting low pH conditions in shellfish hatchery facilities. In addition, macroalgae is a nutritious food source that is eaten all over the world. With the increasing human population, seaweed aquaculture can alleviate the issue of food scarcity. Cultivation of macroalgae alongside shellfish hatcheries may provide industry members with an opportunity to diversify their portfolios while increasing success within the hatchery.

Ulva spp. - Known as sea lettuce, is a genus of green algae characterized by being only 2 cell layers thick. Its value as a food source for marine organisms and its potential human uses in culinary and bioremediation applications make *Ulva* a valuable species for cultivation.

Gracilaria spp. - Known as olgo, is a type of red algae characterized by its branching structure, often found in marine habitats. It's valued for its ecological importance and commercial applications, particularly in the production of agar, a versatile substance used in various industries.

Ostrea lurida - Olympia oysters historically have been native to estuaries from British Columbia, Canada to Baja, California. Native oysters are challenged with habitat loss, disease, overharvesting, and degraded water quality. Olympia oysters play a pivotal role in ecosystems as keystone species and ecosystem engineers. Conservation efforts have been made through aquaculture for the planned management and protection of native oysters.

Culturing Seaweed(*Ulva/Gracilaria*)

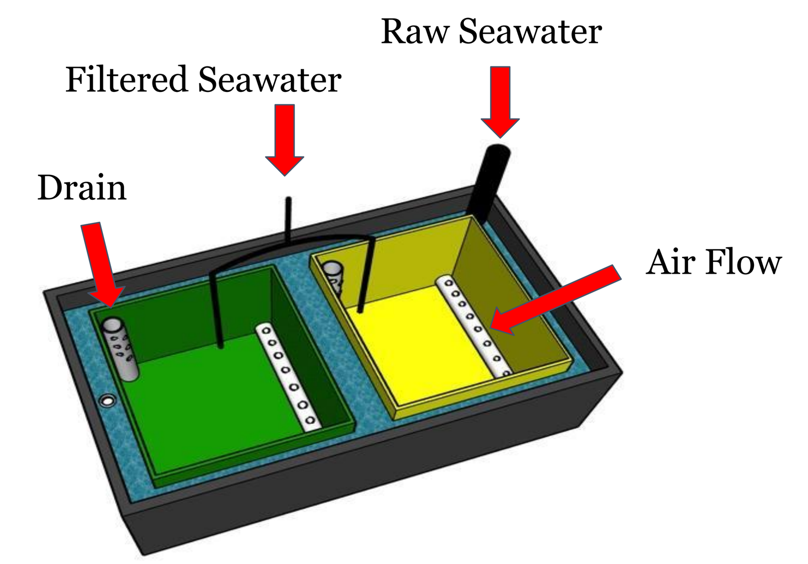


Fig. 2a Diagram of flat bottom tanks. **2b** Image of flat bottom tanks with *Ulva spp.*

Water Chemistry of Macroalgae Treatment

Larvae were cultured in either **seaweed treated water** or **filtered saltwater** at either **21 degrees** or **24 degrees celsius**. The water from the cultivation *Gracilaria spp.* **(pH = 8.1)** and *Ulva spp.* **(pH= 8.0)** was utilized for the seaweed treatment in order to see its influence on olympia oyster growth. The impacts of each method of cultivation were viewed at multiple stages of the oysters' lives from veliger to settler to juvenile survivors.

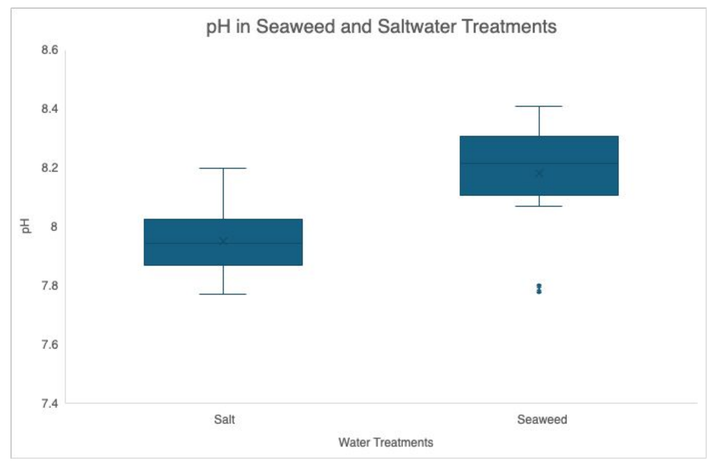


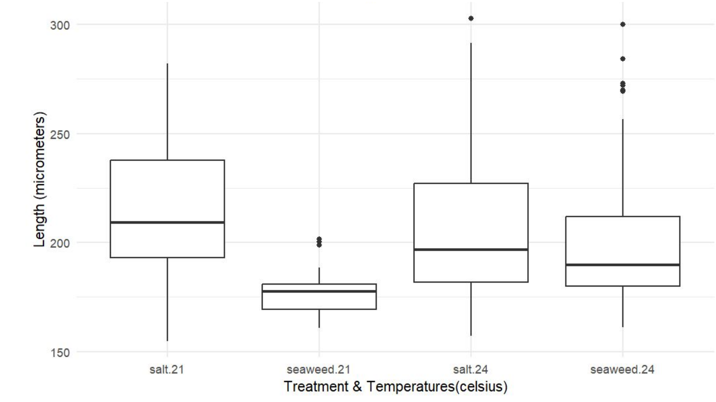
Fig. 3a. pH of treatment waters (seaweed and saltwater) used to culture olympia larval oysters during summer 2024 **3b.** pH indicator tool

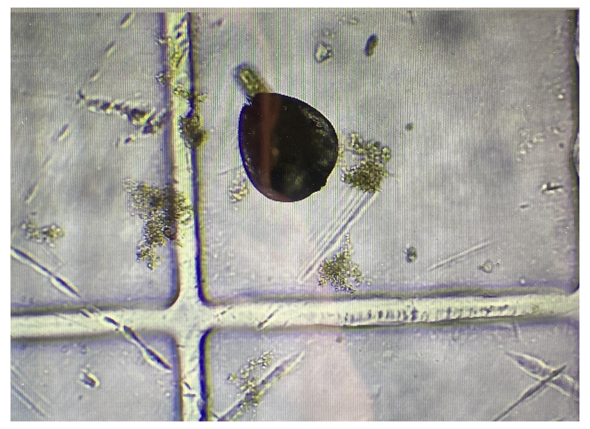
Olympia Broodstock Conditioning and Larva Culturing

Fig. 4. (left) Static chambers for larvae once reaching veliger phase of growth.

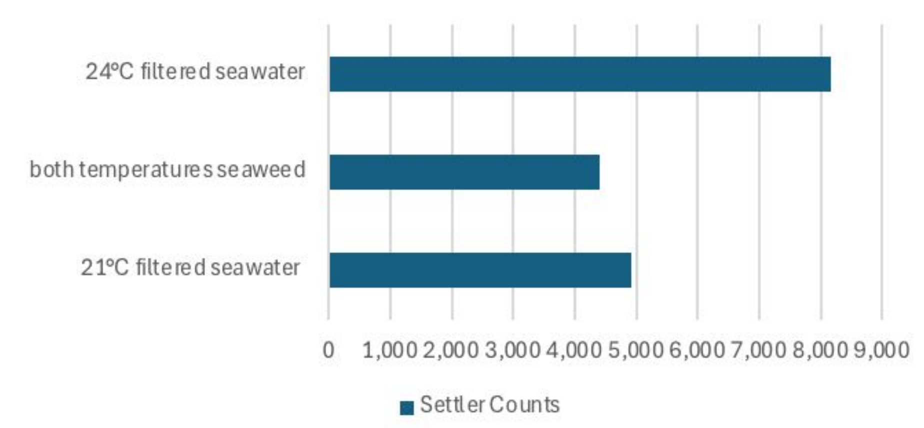
Fig. 5. (right) Downweller tanks where larvae were transferred after developing their foot as a pediveliger.

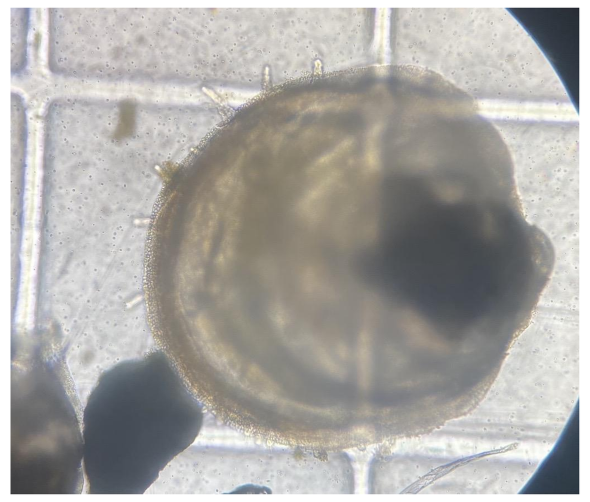
Results





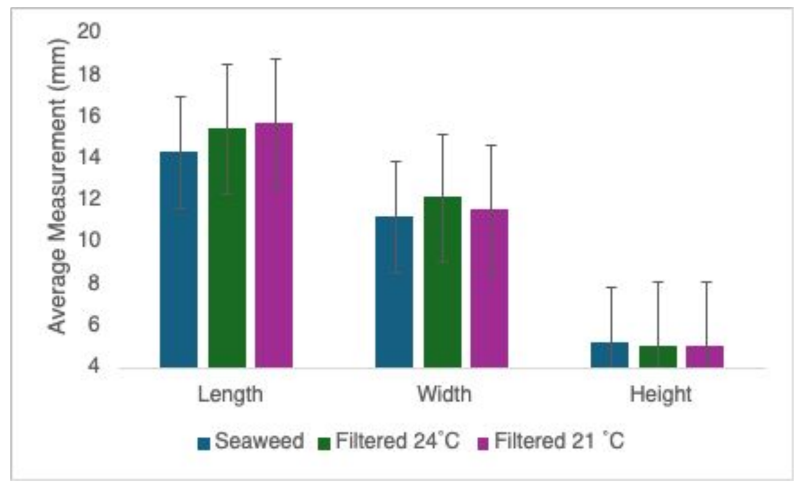
A linear model showed that mean length was significantly lower in the seaweed treatment at 21°C (**p = 0.034**). No significant effects of temperature or the treatment × temperature interaction were found. Image of a pedivelliger larvae





The 24°C filtered seawater treatment had a significantly higher settlement rate then seaweed treatment at either temperature. Image of a settled juvenile

Olympia juvenile growth



There was not significant effect of treatment on length, width, height, measurements after 10 months. Image shows juveniles at 10 months

Conclusions and Next Steps

***Seaweed Effluent* did not** improve larval performance, and even showed decreased growth and recruitment. This may be a result of poor microbial communities in seaweed effluent.

HUDL flowthrough system - Comparison with the static system for larval cultivation in summer of 2024. Test for the larval rearing efficiency and spat production

Acknowledgments:
We would like to thank Santa Rosa Creek Foundation for funding this project. We also would like thank Tom and Jason at the Cal Poly Pier for their assistance.