Larval Substrate Preference and the Effects of Food Availability in the Invasive Tunicate *Styela clava*

Matthew M. Bodnar & Dr. Carmela Cuomo (Faculty Advisor)
Department of Biology and Environmental Sciences

Funded by the Summer Undergraduate Research Fellowship Program

Background

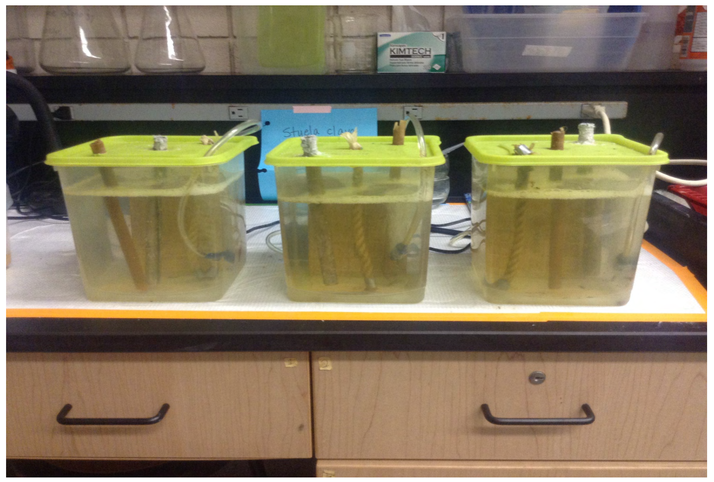
Styela clava, a tunicate native to the Northwestern Pacific Ocean, has invaded coastal marine waters worldwide (Davis, 2007). It was first documented in Connecticut waters in the 1990's and can now be found throughout Long Island Sound (Brunetti & Cuomo, 2014). *S. clava*, commonly called the "Clubbed Tunicate, can reach a maximum length of 200 mm and is commonly found in waters under 25 m deep (McClary, 2008). It fouls man-made materials, facilitating its accidental transport on boat hulls, lines and aquaculture gear (Darbyson, 2009). *Styela clava* is an highly efficient filter feeder and may outcompete native economically important shellfish wherever it invades (Peterson, 2007). Despite its reputation as a fouling organism outside of its native range, there is a demand for this species in Asia where *Styela clava* is considered a seafood delicacy and an aphrodisiac (Karney 2009). Frozen *Styela clava* retails for $8 - $12 per pound and it is estimated that freshly aquacultured *S. clava* would retail for much higher (Karney 2009). In order to develop *S. clava* as an aquaculture species, several basic biological facts need to be determined.

Figure 1. Adult *Styela clava* on line.

Objectives

The objectives of this study are:

- To determine the larval settlement substrate preference (line, aluminum, wood, or ceramic tile) of *Styela clava* in a closed system.
- To determine the level of food (phytoplankton/zooplankton) needed to bring about optimal growth in juvenile *S. clava*

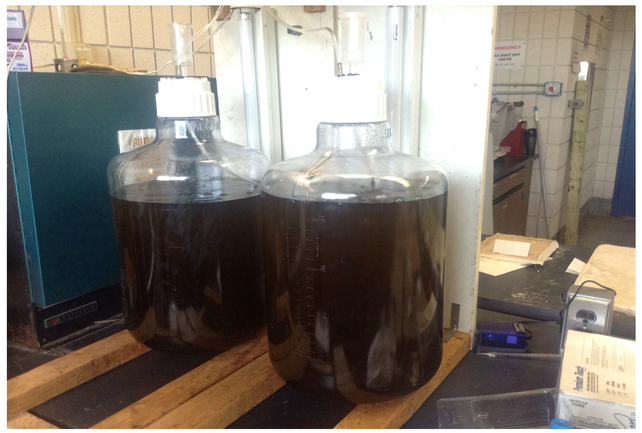


(Figure.2 The 3L experimental chambers containing the various substrates. The far left container was fed 12mL, followed by the middle container being fed 24mL, and the far right container being fed 48mL daily.)

Methods

Thirty adult *Styela clava* were collected from floating dock lines in Darien CT. Immediately after removal from the line, each tunicate was placed in a 5 gallon bucket filled with seawater from the same area. All collected tunicates were transported to the laboratory at UNH where their gametes were stripped following the protocols of Bullard & Whitlatch (2004). The stripped gametes were placed in a 4L container filled with artificial seawater and an airstone for 48 hours. Aliquots of seawater were examined under a microscope for the presence of *S. clava* larvae over the next 48 hours. At the end of the 48 hour period, an abundance of *Styela clava* larvae (~ 400 per mL) were observed and the experiment was initiated. The water from the larvae container was divided equally into the 3 containers (3 L). Artificial saltwater (27 ppt) was added to each container raising the water level to 3 L per container. Into each container was placed a length of dock line, a wooden dowel, an aluminum tube, and a ceramic tile to serve as a settlement surface. All of these materials had been allowed to soak in seawater for 1 month prior to the start in order to develop a biofilm. Water from each container was sampled every 24 hours to determine if and when larval settlement occurred. By 48 hours the water was clear of larvae indicating settlement had taken occurred.

At the conclusion of the settlement portion of the experiment, an airstone was placed into each of the 3 L containers and the feeding experiment commended. Each container was fed a different amount (12mL, 24mL, 48mL) of the phytoplankton *Tisochrysis lutea* daily, which was grown in culture in the lab. *T.iso* feedings were supplemented by the addition (12ml, 24 ml, 48 ml) of a commercial phytoplankton and zooplankton mixture in order to provide adequate nutrition to the settled organisms.



(Figure.1 The 20L cultures of *Tisochrysis lutea* being grown in the lab as food for juvenile *Styela clava*)

Results and Conclusions

This experiment is still running and will conclude in mid-November. Preliminary examination of the substrates in the tanks reveal the presence of a small number of juveniles on the various substrates in the tanks although the juveniles are currently too small to effectively and accurately count and measure. Over the next several months, it is anticipated that the juveniles will become large enough to be readily counted and that differences in substrate preference as well as in growth will be observable within the three tanks.

References

Brunetti, N. and C. Cuomo (2014) Distribution of the Invasive Tunicate *Styela clava* in Long Island Sound, New England, USA. *Bioinvasions Record* 3(1).

McClary, C. P. (2008). Reproductive behaviour of the clubbed tunicate, *Styela clava*, in northern New Zealand waters. Wellington: Ministry of Agriculture and Forestry.

Darbyson EA, Hanson JM, Locke A, Willson JM (2009) Settlement and potential transport of clubbed tunicate (*S. clava*) on boat hulls. *Aquatic Invasions* 4: 95-103

Davis MH, Davis ME (2007) The distribution of *Styela clava* (Tunicata Ascidiacea) in European waters. *Journal of Experimental Marine Biology and Ecology* 342: 182-184.

Karney RC, Rhee WY (2009) Market potential for *S. clava*, a non-indigenous pest invading New England coastal waters. *Aquatic Invasions* 4(1): 295-297

Peterson, J. K. (2007). Ascidian suspension feeding. *Journal of Experimental Marine Biology and Ecology*, 127-137.

Acknowledgements

I would like to thank Dr. Cuomo, Kass Asaye, Alyssa Garvey, Tim Stankye, Alex Rhoads, Nic Taylor, and Lesley Pires for helping me with this project. I would especially like to thank the faculty and staff who made this opportunity possible and the donors who so generously support the SURF program.