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Herbivore impacts on the invasive marine alga *Grateloupia turuturu*

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Introduction

Non-native species are species which have been transported from another environment . These species often have the ability to outcompete natives, and can create a monoculture if not kept in check by herbivores or some other mechanism. The marine macroalga *Grateloupia turuturu* (Fig. 1) is a blade-forming non-native species first discovered in Rhode Island in 1994 (Villalard-Bohnsack and Harlin 1997).

Fig. 1 *Grateloupia turuturu*

Limited information exists on the ecology of *Grateloupia*, and the effect that two invasive herbivore species common in Rhode Island, the snail *Littorina littorea* (Fig. 2) and Asian shore crab *Hemigrapsus sanguineus* (Fig. 2), have on its presence. Herbivore pressure exerts top-down control on the abundance of marine macroalgae in some ecosystems (Menge 2000). A top-down controlled system may have the ability to mitigate the population of a non-native algal species, as well as native algal species.

Objective

The goal of this study was to assess the ability of common herbivores to control *Grateloupia* populations.

Methods

Two trials were conducted, with both consisting of four replicates of each of the four treatments, as follows:

1. **Control**
2. **Snail present**
3. **Crab present**
4. **Both snail and crab present**


Fig. 2 *Grateloupia turuturu* (cut to 1.5x1.5cm), *Littorina littorea*, and *Hemigrapsus sanguineus*

Split mesocosms had a 1.5x1.5cm piece of *Grateloupia* on each side of a mesh partition (Fig. 3,4). Grazers were placed on only one side of the partition, with the other side accounting for facilitation. Change in biomass was calculated between day 0 and 6 and used to determine three metrics.

"Grazing" = Grazer treatment + Facilitation treatment
"Facilitation" = Facilitation treatment – Control
"Net Effect" = Grazing + Facilitation

Each metric was compared between treatments using a 1-way ANOVA (JMP 7).


Fig. 3 Full set up with 16 split mesocosms in a water bath at 13°C


Fig. 4 Bucket containing a snail and crab with *Grateloupia*

Results

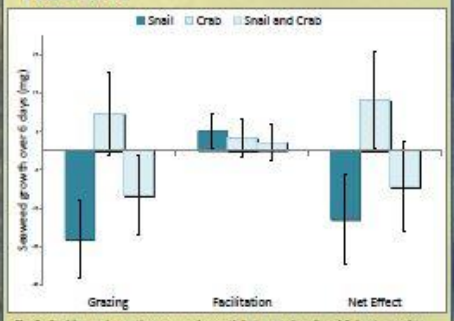

Fig. 5. Positive and negative seaweed growth between days 0 and 6 due to grazing, facilitation, and a combination of the two across all treatments.

There was no significant difference in the grazing, facilitation, or net effect between the four treatments (Fig. 5). Grazing p=0.1128, Facilitation p=0.8986, Net Effect p= 0.2110. Direct grazing of snails on *Grateloupia* was observed, especially when snails were present without crabs.

Conclusions

- Trends show that *Littorina* graze directly on *Grateloupia*, but *Hemigrapsus* does not
- Indirect presence of herbivores does not greatly facilitate *Grateloupia* growth
- Future work will involve more replication as well as offering multiple choices of algae in addition to *Grateloupia* to these herbivores to test preferences in a community setting

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Literature Cited Menge, B. 2000. Top-down and bottom-up community regulation in marine rocky intertidal habitats. J. Exp. Mar. Biol. Ecol. 250: 257–289. Perini, V., 2013. The role of seasonality, seaweed traits, and seaweed-herbivore interactions in nutrient cycling in the southern Gulf of Maine. Biology Master's Theses. Paper 24.Villalard-Bohnsack, M., Harlin, M. 1997. The appearance of *Grateloupia doryphora* (Halymeniaceae, Rhodophyta) on the northeast coast of North America. Phycol. 36: 324–328.

My project looked at an invasive species of seaweed in Narragansett Bay. All of the existing literature describes the invasion (when it happened, where it's spread) but nobody had really looked at what it is doing now that it is here. I conducted a series of feeding trials with snails and crabs to see whether they are eating the seaweed and thereby controlling its population. I set up buckets with just snails, just crabs, and both snails and crabs together in contact with weighed pieces of seaweed. Each bucket was divided into two sides, with seaweed on both and the herbivore on just one side, so I could see whether the waste (feces) the herbivore was producing was helping the seaweed grow on the side without direct contact, where it couldn't be eaten. I found that the snails were eating the seaweed, the crabs weren't, and when the crabs and snails were together the snails still ate it, but didn't eat as much. This is probably because the snails were stressed out by the crabs, and often the crabs would flip over the snails and they couldn't right themselves to then move over to the seaweed and eat it. In conclusion, snails may be able to control the population of the invasive seaweed, but their ability to do so is lessened when predators are present. Future work could include involving multiple species of seaweed in the same set-up to investigate if the results are the same with other food choices present.