Introduction

Many environmental parameters influence nutrient availability across the intertidal gradient. Emersion time and wave exposure are two major limiting factors that affect nutrient input and subsequently affect algal distributions and abundance. Nutrients, specifically nitrogen, enter the intertidal zone through surface waters, making emersion time and wave exposure crucial to the productivity of marine algae.

Pelvetiopsis limitata

- Brown intertidal alga in the order Fucales
- Upper intertidal zones
- Frequent at more wave-exposed sites
- Pacific Coast of North America

Sites

Bodega Marine Reserve:
A. Mussel Point (Wave-Exposed)
B. Lessoniopsis Point also known as Crazy Point (Wave-Exposed)
C. Two sites inside Horseshoe Cove (Wave-Protected)

Hypotheses

1. When wave exposure increases, nitrogen availability will increase causing a decrease in the carbon to nitrogen ratio and an increase in the percent of nitrogen found in samples of P. limitata.
2. An increase in wave exposure will drive the upper limit of the P. limitata higher. The higher P. limitata will be exposed to air more often, thus obtaining most of their nitrogen through splashes. Our second hypothesis is that this will increase the carbon to nitrogen ratio and decrease the percent of nitrogen found in upper limit samples of P. limitata.

Conclusion

1. Wave-exposure influences nitrogen availability to Pelvetiopsis limitata.
   a. P. limitata found at the lower limits had increased nitrogen in their tissue because of decreased exposure.
   b. P. limitata found at the upper limits had decreased nitrogen in their tissues because of increased exposure.
2. The amount of nitrogen available to P. limitata effects growth and reproductive success.
3. The amount of nitrogen available to parent P. limitata does not affect egg size.
4. However, wave exposure is not the only environmental parameter affecting nitrogen supply.
   a. The Mussel Point site represents the extremes of tissue nitrogen content in P. limitata. But Mussel Point does not represent the extremes of tide range.
   b. Why then is tissue nitrogen content in P. limitata at Mussel Point so high?
   1. The alternative hypothesis is that the P. limitata at Mussel Point live on mussels and therefore obtains more nitrogen from mussel excretion.

Does P. limitata’s Tidal Range Differ with Exposure?

Methods

We measured the tidal range of P. limitata’s distribution at four sites to determine whether the upper and lower limits differed with wave exposure.

Results

P. limitata’s tidal range differs with wave-exposure. The upper limit of P. limitata is highest at Mussel Point and Crazy Point, the two wave-exposed sites. The lower limit is also higher at the more exposed sites than the protected ones. The difference between the upper and lower limits at the exposed sites is greater than that at the protected sites.

Does Tissue Nitrogen Content Differ with Exposure?

Methods

Thirty vegetative samples of P. limitata were taken from each of the four sites to determine if tissue nitrogen content differs between the upper and lower limit of the Pelvetiopsis zone. Tissue nitrogen content was determined by using a Nitrogen Carbon Soil Analyzer.

Results

Tissue nitrogen content differs between wave-exposed and wave-protected sites. Also, nitrogen content differs between upper and lower limits within sites. At the lower limit of the Mussel Point site, the percent nitrogen is highest and the carbon to nitrogen ratio is lowest.

Further Questions

- Does the amount of nitrogen available have an effect on embryo growth?
  - Does it have an effect on embryo survivorship?
- Do herbivores prefer P. limitata with high nitrogen content?
  - Do they prefer P. limitata with low nitrogen content?

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