An Examination of the Species-Area-Energy Relationship Driving Decomposer Diversity Within "Sponge" Habitats in an Estuarine Bay.

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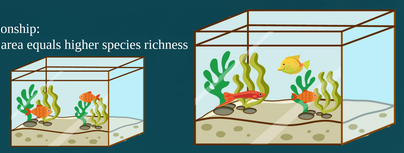
Introduction

- The species-area relationship:
  - Increased habitat area equals higher species richness (Harte et. al, 2009)



- The species-energy hypothesis:
  - Total energy availability drives species richness (Hurlbert, 2006)

- Then is species-area relationship or species-energy relationship more useful to estimating species richness?
- These relationships are typically hard to pull apart and test independently
  - Food vs furniture (Borst et. al, 2019)
- In marine systems, many organisms are not mobile in their adult stage
  - Space can be a limiting resource
- In decomposer systems, organisms are reliant on food input
  - Food can be depleted and is a limiting resource
- A marine decomposer system then is like a candy house
  - Is how big their home is or what it is made of more important?
- Sponges are foundation species
  - They provide structure and nutrition to organisms

Hypothesis and Predictions

- Hypothesis:
  - Habitats with large areas allow for more species richness
  - Habitats that provide both structure and nutrition allow for increased species richness
- Predictions:
  - Organic habitats should increase biodiversity through habitat structure and nutrition
  - Synthetic habitats should not increase biodiversity as much as organic habitats sponges due to their inability to provide nutrition
  - Organic habitats with large surface areas should promote more biodiversity than synthetic habitats with the same surface areas

Acknowledgments

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Literature Cited

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Results

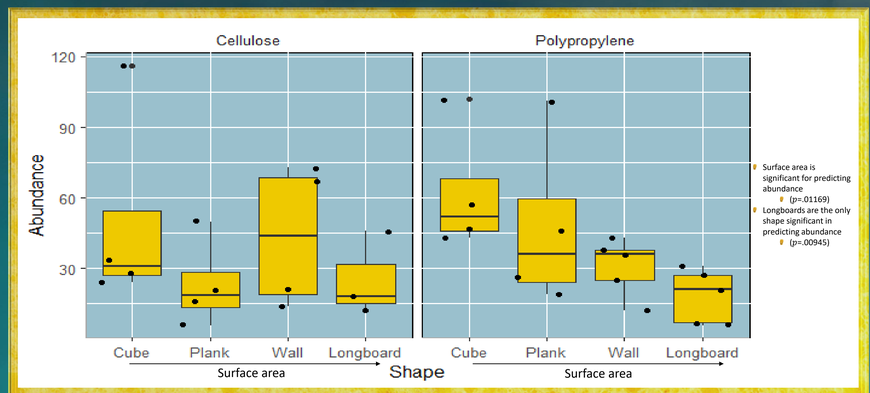


Figure 1. Abundance of organisms compared to sponge type, CS being cellulose sponges and PS being polypropylene sponges.

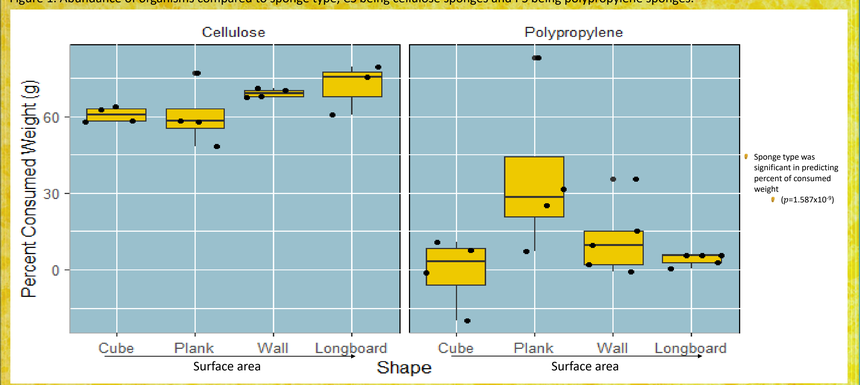


Figure 2. Percent of sponge consumed compared to sponge type, CS being cellulose sponges and PS being polypropylene sponges.

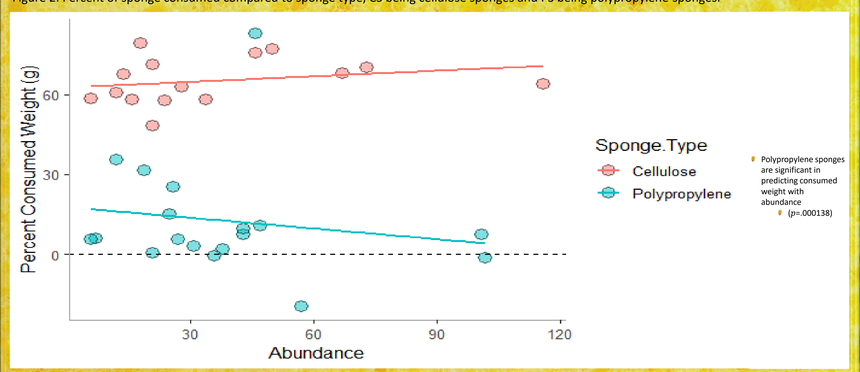
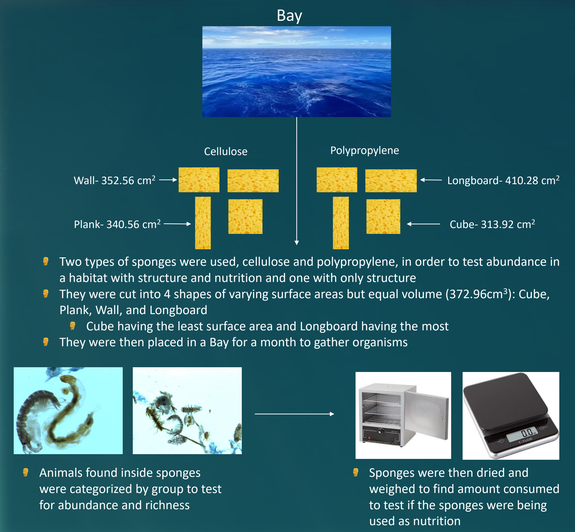


Figure 3. Percent of sponge consumed compared to the log of abundance. The red line and dots represent cellulose sponges and their line of fit, the blue line and dots represent polypropylene sponges and their line of fit.

Methods



- Two types of sponges were used, cellulose and polypropylene, in order to test abundance in a habitat with structure and nutrition and one with only structure
- They were cut into 4 shapes of varying surface areas but equal volume (372.96cm^3): Cube, Plank, Wall, and Longboard
  - Cube having the least surface area and Longboard having the most
- They were then placed in a Bay for a month to gather organisms

- Animals found inside sponges were categorized by group to test for abundance and richness
- Sponges were then dried and weighed to find amount consumed to test if the sponges were being used as nutrition

Conclusions

- At this time abundance can only be predicted by longboard sponges and surface area
  - Surface area is significant for predicting abundance, but conversely to what was expected with higher abundance in sponges with less surface area (p=.01169)
    - This may be caused by increased vulnerability to predation in sponges that maximized surface area
  - Longboards are the only sponge shape that is currently significant to abundance prediction (p=.00945)
  - While not all sponge shapes or sponge types are able to predict abundance, with limited samples it is clear that cellulose sponges allow for a slightly higher range of abundance
- Sponge type was significant in predicting percent of consumed weight (p=1.587x10^{-9})
  - Consumed weight contains outliers for polypropylene sponges as one sample had been all but completely decomposed for unknown reasons, and for some other samples it proved difficult to reduce weight even after several washings and dryings. This may also be due to bacterial mat formation within the sponges.
- These patterns are preliminary, and more data may lend more credence to them
  - Identifying these organisms to species and examining their life histories may allow us to understand these patterns
- These results seem to suggest that space is the limiting factor in animal abundancy.
  - Due to relatively equal amounts of animals found between organic and synthetic sponges, we can conclude that food is not the limiting factor
- We now have a better understanding of the complexities that habitat diversity can have on organisms that inhabit them