What is the Relationship Between Mudflat Biodiversity and Clam Abundance in Acadia National Park?

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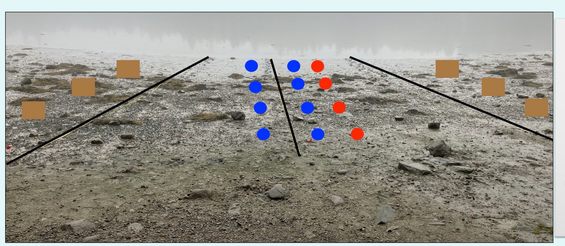
Introduction

The mudflats, or the muddy lands left uncovered at low tides, of Downeast Maine offer considerable value to the area economically and ecologically. In Hancock County, the softshell clam industry was valued at $2,559,825 in 2020[2] and the blood/sandworm industries combined were valued at $1,309,969.[2] However, this ecosystem is also one of the least studied in Acadia National Park, with the most recent study being published in 1992.[1] As our environment changes due to climate change and human actions in general, it is crucial to understand how our mudflats are being impacted by these factors over time. Our study has a goal of continuing the monitoring process started by researchers Cammen & Larsen in the 1980s,[1] while also exploring the relationship between clams and other soft-sediment invertebrates.

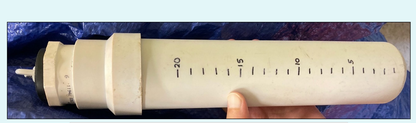
Methods

Our methods were based on the methods of Cammen & Larsen[1] with a few modifications. We collected samples at nine sites on Schoodic Peninsula and Mount Desert Island which included two sites sampled historically by Cammen & Larsen and sites that we chose in consultation with local wormers, clammers, and law enforcement. At each site, we took eight sediment samples using two-inch PVC corers. Our goal was to collect one fourth the volume of sediment Cammen & Larsen collected due to time constraints. While Cammen & Larsen took samples in two groupings at the low and high tide marks, we chose to take samples in equal intervals from the shore to the water. We sieved the samples on-site and sorted through them for invertebrates in the lab. Adding to Cammen & Larsen's methods, we also completed six clam surveys at each site, based on the survey methods recommended by the Maine Department of Marine Resources.[3] In the lab, we fixed the invertebrates in formalin for at least 48 hours before identifying them to the lowest taxonomic level possible and preserving them in 70% ethanol.

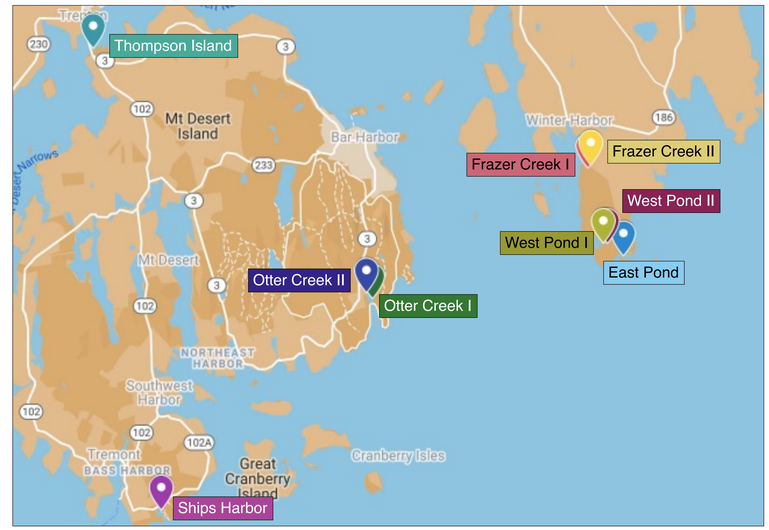


Experimental setup with squares representing clam surveys and circles representing core samples taken, with blue having invertebrates extracted and red used for sediment analysis.

Clam boxes used for clam surveys (left) and surveyed softshell clams (right).

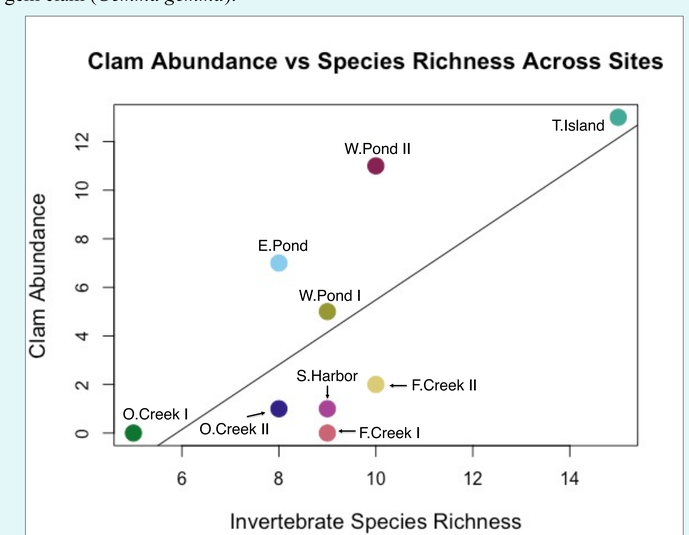


Corer used to take sediment samples.



Results

Across the nine sites, we extracted and identified 2,696 marine invertebrates and surveyed 40 clams, including mostly soft-shell clams (*Mya arenaria*) as well as one razor clam (*Ensis leei*) and one amethyst gem clam (*Gemma gemma*).



Clam abundance, or number of clams, vs invertebrate species richness, or number of different species, across all sites with linear trendline (p-value = 0.02965). The color of each point matches the colored site label on the map above. This graph shows that there is a positive correlation between species richness and clam abundance.

Conclusions

There is a positive correlation between invertebrate species richness and clam abundance. Using a linear regression, we found that this relationship is statistically significant ($p\text{-value} < 0.05$). While neither variable is necessarily dependent upon the other, it is possible that clam abundance could be used as an indicator for a site's biodiversity as more clams would mean higher biodiversity. I would also hypothesize that certain environmental factors such as sediment type and water quality could be influencing these two factors. It's possible that areas with better water quality create an environment conducive to higher species richness, as more species can survive in those conditions. We also collected sediment samples at each site and after these samples are characterized, we might find a relationship between species richness/clam abundance and sediment type.

Future Recommendations

We focused our study on the softer areas of the mudflat where it was easier to take core samples. In the future, this study should expand to cover all areas of the mudflat, including rockier areas, as clammers/wormers have noticed that clams and worms are moving into the rockier areas of mudflats, possibly to protect themselves from predation (Wormer Fred Johnson, pers. comm.). This would require using different methods of collection other than the sediment corer, such as a trowel, to collect samples, given the difficulty of taking core samples in rocky sediment.

Worm from family nereididae

Strebliospio benedicti (or mustache man)

Soft-shell clam (*Mya arenaria*)

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Literature cited

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[3]Webber, M.M., M.G. Stocco, C. Schmitt, E. Maxwell, & K. Tenga-González. N.D. Maine Shellfish Handbook. Maine Department of Marine Resources. 90 pages.