**An Analysis of Energy Tradeoffs in *Mytilus edulis***

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*Mytilus edulis*, the blue mussel,is a keystone species native to Maine’s Rocky Intertidal, whose presence or absence disproportionally impacts the ecosystem. In the case of *M. edulis*, it creates substrate for other organisms to live on. Unfortunately, *M. edulis* populations have declined by sixty percent in the last forty years One of its predator, *Carcinus maenas*, is an invasive crab species from the Atlantic coasts of Europe*.*1Thus, it is important to understand the ways in which an invasive species is impacting the critical and endangered blue mussel. In areas of high *C. maenas* abundance *M. edulis* thicken their shells, a response known as an inducible defense.2 Crabs must use greater crushing force or increased handling time to penetrate thicker shells, making these mussels less enticing prey.3 But this defense comes at an energetic cost to the mussels, taking energy away from some form of growth or reproduction.4 During the Bowdoin Marine Science Semester, I conducted preliminary research showing that when mussels thicken their shells, they also thicken their adductor muscles, where the adductor is the muscle they use to hold their shell shut. This defends the mussels against predators like sea stars which pull their shells apart. This indicates that mussels may defend themselves against predators that crush or pull apart the shell simultaneously, rather than responding to individual predator cues, or that adductor muscles are now playing a role in keeping the shell shut even against attacks from shell crushing predators. This summer I began to expand upon this study by increasing the sample size and teasing apart flow and predation impacts, as the beginning of my honors project for the 2020-2021 school year. My initial results further suggest that the energy needed to form inducible defenses will come away from reproduction. Thus, I hypothesize that *M. edulis* from areas of high *C. maenas* predation will have less energy available for reproduction, and will therefore have smaller gonads.

This summer, I was proposing to collect blue mussels from five different sites around Harpswell with different levels of green crab predation and wave speed. At these sites, I planned to conduct surveys to assess the predation level mussels would experience from crabs there, and the wave speed, relative to the other sites. I was then planning to set up experiments in the marine lab at the Coastal Studies Center and potentially on campus as well, to test shell thickness, gonad size, adductor mussel size, and sea star handling time on the mussel I collected. However, due to the pandemic, I wasn’t able to collect mussels or do any lab work. Instead, I was able to select my field sites and conducted surveys at these sites this summer, to assess the wave speed, crab and sea star predation, and mussel populations. To select a site, I made an initial trip to roughly assess the wave exposure and crab, mussel, and sea star populations. Once I had decided to use a site, I then conducted quadrat measurements along a 100 meter transect. At low tide, 5 meters above the water line, I laid down a tape measure to 100 meters. Then every 10 meters I used a quadrat—a 1 meter by 1 meter square—to measure the mussel, crab, sea star, and algae populations within the quadrat, counting the crabs, mussels, and sea stars present, and estimating the percent cover by the algae. I also ranked the sites I am using from 1-5 based on wave exposure. I have not yet completed these surveys, but have made significant process. I also set up code in R Studio that will analyze the data I will have once I am able to run experiments in the fall; further planned, budgeted, and created a timeline for my experiments; and did extra analysis on my preliminary data. While not the summer I had planned, I still was able to move this project forward, and am in a good position to start lab work in the fall.

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**References**

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