Surveying intertidal organism populations to study the impact of invasive species and predator/prey interactions on *Mytilus edulis*

Liam Healy, Class of 2022

The blue mussel *Mytilus edulis* is a critically important organism in the Gulf of Maine, serving both as a foundation species for the region as well as being commercially vital to Maine fisheries. In recent decades, it has been noted that *M. edulis* populations are in a precipitous decline along the east coast of the United States (Sorte *et al.*, 2017). While several factors have been cited as potential causes of this crisis, including ocean acidification and other water chemistry changes, we sought to delve further into a potentially important factor, namely the impact of predator populations on blue mussel populations. It has been found that blue mussels respond with physical changes to environments with high predation, so it stands to reason that predation would also significantly impact their population dynamics (Reimer and Tedengren, 1997; Freeman, Meszaros and Byers, 2009). This summer, we focused on one particular predator of the blue mussel: the invasive green crab *Carcinus maenas*, which has been found to be responsible for marine invertebrate population decline in the US in the past (Thomson, 2017). However, while focusing on one factor is important for a scientific study, we also believe that studying all possible causes of the current population drop could help in formulating solutions to the issue, and so we also incorporated water chemistry data collection and lab work into our summer work.

To examine the possible influence of green crabs on blue mussel population densities, we conducted population surveys at five field sites along the coast of Maine: Giant's Stairs, Pott's Point, Ocean Point, Pemaquid Point and Marshall Point. Each site was chosen due to the presence of both green crabs and blue mussels, as sites with only one or the other would not provide relevant data for our study. Surveys consisted of laying out a transect line using a long measuring tape and dropping quadrats (large squares constructed out of PVC pipe) along the line. All living organisms within the quadrats were counted to the best of our ability. Additionally, crab traps were placed at each site for 24 hours to get an estimate of subtidal crab population numbers, as crabs living below the low tide line could come up the beach at high tide and consume mussels. We also used a YSI probe to obtain water chemistry data at each site, as well as collecting water samples to send to a chemistry lab for additional analysis. Finally, we collected several mussels from each site to bring back to the Schiller Coastal Studies Center for dissection to study their possible changes to shell thickness as a response to large populations of green crabs (Freeman, Meszaros and Byers, 2009). All of this data was collected so that we could investigate several possible contributing factors to the blue mussels' disappearance, as well as so my coworker Samuel Neirink and myself could have as varied a scientific research experience as possible. Our data was compiled into spreadsheets in Excel and then analyzed using the R coding language.

Unfortunately, we were not able to find a clear relationship between green crab population size and blue mussel population density across our sites. This could be due to our relatively low sample size across a time frame of only a few months, or it could be the case that green crabs are not in fact significant contributors to the decline of blue mussels in the Maine intertidal. Samuel Neirink and myself will be carrying the ideas and data from this study into the fall semester, where I will be working on related research for the Bowdoin Marine Science Semester and he will be conducting an independent research project. We hope to reexamine our hypotheses and to develop new questions and collect new data on the subject in order to productively expand on the work we did this past summer.

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