

SOAR Project Proposal
Summer 2019

Interactions Between Asian Shore Crabs and Juvenile Blue Crabs

Faculty Advisor: Joshua Lord, Assistant Professor of Biological Sciences

Student: Matthew Anderson

Project Title: Interactions Between Asian Shore Crabs and Juvenile Blue Crabs

Project Description: This project will examine the interactions between Asian shore crabs, a species native to the western Pacific ocean, and juvenile blue crabs, which are native to the western Atlantic ocean. Asian shore crabs (*Hemigrapsus sanguineus*) are an invasive species on the east coast, meaning that they are not native and negatively impact invaded ecosystems; since arriving they have spread quickly and depleted populations of competitors and prey. While the adult blue crab (*Callinectes sapidus*) is much larger than an adult shore crab, the juvenile blue crabs are roughly the same size and would compete with Asian shore crabs for both food and shelter. The competition between the two crabs could have dramatic impacts, as the blue crab is important as a keystone species in ecosystems along the east coast (Hines, 2007). A keystone species is one which drastically affects the ecosystem, and without it, the ecosystem would suffer greatly. In the Chesapeake Bay, all the different life stages of the blue crab act as food for different animals, from different fish to birds. As a predator, it helps to limit periwinkle snail populations, which when left unchecked would eat all of the cordgrass, a common type of grass found in different marsh landscapes. This grass acts as a binding agent for the sediment in the water and provides shelter for lots of animals. The loss of the blue crab, as a keystone species, would lead to a chain reaction causing damage to ecosystems all along the east coast. The blue crab also has a big impact on the fishing industry, as it has been commercially fished for years. In the Chesapeake Bay alone, blue crab fishing brings in millions of dollars, making it the highest grossing industry on the bay. The experiment will help us understand how blue and Asian shore crabs interact, so that we can determine how the invasive crabs may impact populations of the ecologically and economically important blue crab.

We are looking to answer the following questions

1. Which species will be a better competitor for both food and shelter?
2. What types of aggressive interactions do the two species have with each other?
3. Does the size of the blue crab impact its competitive performance?

For the experiment, we will collect both Asian shore crabs and juvenile blue crabs from the New Jersey coast to use for our experiment, as both will be present during the summer. We will also do multiple types of sampling with quadrats and seine nets to estimate the density and shelter use of both of these species in their natural environments along the New Jersey shore. We will then

replicate this in lab, with both species of crabs in a container that has a limited amount of areas to use as shelter. The interactions between the crabs will be recorded with GoPro cameras and used to determine which species of crabs tend to get shelter and how aggressive the interactions are to acquire and defend that shelter. We also will have a second experiment that focuses on the feeding efficiency of the two different crabs. This will be done by placing the two crabs in a tank, giving them time to adjust to the new environment. Then, a dead clam (or any other food that is in the same area as the crabs) will be secured into the center of the tank. Feeding efficiency can be qualified by comparing the number of successful times a crab can get some food from the shell, as well as how successful one crab is of stopping the other from eating from the shell, assuming there are aggressive interactions for the food. These interactions will also be noted to see how aggressive the two species are towards one another and also allow us to determine which species tends to outcompete the other. Both tests will first be performed using crabs of roughly the same size, but then we will change the size of the crabs so that one is larger than the other, and see if the size will help one species perform better than the other. The interactions between these species have not been well studied, so this project will allow us to determine whether or not invasive Asian shore crabs will negatively impact blue crab populations and later mid-Atlantic coastal ecosystems.

Roles and Responsibilities of Faculty and Student:

Faculty Role: I (Josh Lord) have published 10+ scientific papers on the ecological impacts of invasive species, in a wide range of journals from *Biological Invasions* (4x) to *Marine Ecology Progress Series*. Much of this research has focused on competitive or predator-prey interactions, including substantial genetic and ecological work on the spread and impact of Asian shore crabs along the coast of Maine. My lab is currently well-situated for this type of research, as we have 3 GoPro cameras that can be used to take time-lapse photos or video that will be used to analyze crab interactions. While I haven't had any students work on this particular project, my previous SOAR student (Katie Boyle) kept juvenile blue crabs in our recirculating seawater system at Moravian for 6+ months, and I have Asian shore crabs that have been in the lab for over a year. So, we have all the facilities and resources necessary to design and conduct this experiment. Matt and I have already discussed this project of course, but we will be in constant contact over the summer as I help him to collect crab data in the field, set up the lab experiments, analyze video footage of crab interactions, and statistically analyze the results. I will work closely with him to train him on the type of experimental techniques we will utilize in the project, with the goal that he will be able to work independently by the middle of the summer.

Student Role: Matt will be the lead scientist on this project--it is a project that we have come up with together, and he will put in the time necessary to design, conduct, and analyze these experiments in summer 2019. He will not only present his results to SOAR students and faculty over the summer and at Scholars Day in spring 2020, but also will present his work at the LVEES (Lehigh Valley Ecology and Evolution Symposium) in April 2020. By putting together both a poster and oral presentation, Matt will improve his communication skills, which will be a

valuable tool for a career in science. Designing and conducting experiments as a full-time job in a laboratory setting will additionally provide him with valuable experience that he can apply in future research opportunities at Moravian and elsewhere.

Timetable: The experiment will be conducted over ten weeks during the summer of 2019.

Benefits to the Student, Faculty Member, and Moravian College:

As mentioned above, Matt will gain valuable skills related to experimental design and analysis that will serve him well both at Moravian and for a career in the life sciences. Experimental work burnishes critical thinking abilities and enhances disciplinary understanding, so he will benefit from this experience in other classes and future research experiences at Moravian. Presenting at Moravian-specific and local conferences will give him valuable experience with communicating his research to an interdisciplinary, an important skill for any researcher to have. The faculty member (Dr. Josh Lord) will have an opportunity to explore an interesting line of research in a field that he is familiar with. It will also continue to diversify the types of marine biology experiments that have been conducted in his lab--as the only marine biologist at Moravian (and one of just a couple in the Lehigh Valley), it is important that students don't only work on one specific avenue of research. Along those lines, it benefits Moravian greatly to have active student and faculty involvement in research--this is one of the ways that students learn best (and is part of the strategic plan of the college). This project in particular is focused on invasive species, which is a hot topic in the field and one that is locally relevant, as this project targets common New Jersey species. By allowing students to perform research, Moravian creates more well rounded students that are better suited to go into the field with some experience and makes for more competitive applications for both jobs and graduate schools alike.

Work Cited

Hines, A. H. (2007). Ecology of juvenile and adult blue crabs. In *The Blue Crab Callinectes Sapidus* (ed. V. S. Kennedy and L. E. Cronin), pp. 565-654. College Park: Maryland Sea Grant.

SOAR Student Statement of Purpose
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Student: Matthew Anderson, Neuroscience, 2021

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Rationale:

When I first came to Moravian College, I was under the impression that medical school was the path for me; nothing else really crossed my mind when people discussed possible careers. Yet during my first year at Moravian, I was exposed to a lot of different topics and professions outside of just the medical field. One of the biggest things I was exposed to was research. From the various guest speakers to the professors themselves, I started to go to the different talks that were held about research done in different fields. I found that their work seemed very interesting and that research didn't come off as intimidating as I first thought. My spring semester sophomore year, I took both Marine Biology and Psych 211, and this is where I first started getting a more clear picture of what research was like. In Psych 211, we learned more about ways research can be conducted (more geared towards psychology, but there was still lots of information that is universal throughout research). Then in Marine Biology we actually ran miniature experiments in class, collecting data over a few weeks, analyzing the data, and writing a paper about our findings. I also did a project similar to this in both Psych 212 and on Dr Lord's marine ecology trip to Oregon last May term.

Throughout my time at Moravian, I've had small opportunities to test out research in a smaller scale. SOAR would give me the opportunity to take it towards a level much closer to the experiments done in the field of marine biology. While I am a neuroscience major, I have taken various different classes that have touched on the topics of marine biology and ecology. I also have been working closely with Dr. Lord to come up with an idea, design the experiment, and do background research to help support the proposal.

Expected Outcomes:

By taking part in SOAR, there are many different things that will benefit me and my future, both at Moravian and onward. Some of the take aways I hope to obtain from this experience include improving on my writing and presentation of scientific findings, critical thinking and problem solving, as well as helping my better understand what career path I want to take. While I came to Moravian thinking I was set on Pre-med, learning about other fields (primarily research) has made me realize I should branch out and try different things to see if there's a different career that would actually be better suited for me.

As previously mentioned, I've taken classes that have required me to look at data and write about the findings, but these classes aren't able to perfectly simulate the exact hardships faced when designing your own experiment and working with your own data that can actually be considered significant. Taking part in SOAR would allow me to continue designing an experiment that can produce results with the possibility of being significant, allowing me to then tackle and try to figure out and work with real data and how to best interpret that data, a skill useful in any field. This would also help me better improve my critical thinking and allow me to have research that I've carried out and can call my own. With this new research done, I would be able to present the results at various conferences, both at Moravian and at different conferences. This would allow me to work on my presentation skills, as well as helping to showcase what Moravian students are doing and what great opportunities they are given to excel.