

Investigating Ocean Acidification at a Maine Oyster Reef Restoration Site
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Midcoast Maine is highly vulnerable to the negative impacts of climate change, including coastal ocean acidification (Fernandez et al. 2020). This has major consequences for the survival of all aquatic life, but is particularly notable for shellfish with carbonate-based shells, as there is lower availability of calcium carbonate, particularly in the form of aragonite. Within the Gulf of Maine, one of the fastest warming sections of ocean in the world, acidification is an increasing issue for local oyster fisheries (Neumann 2022). Under these acidic conditions, oysters have been shown to display stunted growth, increased mortality, and developmental issues (Lemasson et al. 2017). To support both the ecological benefits of oysters and the local aquaculture economy, a collaborative project between organizations like The Basin Oyster Project, Colby College, The University of Maine, and Bowdoin College was created to determine whether The Basin, located in Phippsburg Maine, could sustain a viable oyster population, as it did several decades ago.

Building on work previously completed in Professor LaVigne's lab, we continued data collection by way of biweekly research cruises for water samples in The Basin, located in Phippsburg. In addition to water samples from the boat, we also took weekly samples from the dock at the Schiller Coastal Studies Center. Subsequently, we ran our water samples through Dissolved Inorganic Carbon and Total Alkalinity analyses. With the data, we analyzed trends over time in pH, temperature, dissolved oxygen content, turbidity, salinity, and aragonite saturation in order to develop a better understanding of whether or not this area would currently be an ideal habitat for oysters. After several years of data collection, if The Basin is deemed an appropriate location, man-made oyster reefs will be built and placed in the water.

Our preliminary results suggest that most water parameters fall within ideal ranges for Eastern oysters for at least part of the year and therefore The Basin is showing initially positive signs of being an ideal site for oyster reef restoration. Aragonite saturation fell below the critical minimum threshold for growth (<1.5) at a few points since Spring 2024 and the entire winter is growth limiting for oysters, but the duration of summer is long enough to allow for spawning. We suspect that biological forces and ecosystem productivity may be the primary driver in variation in water chemistry conditions, and therefore the habitability for oysters. This is due to the coastal nature of the area, where our sample sites are influenced by tides and terrestrial inputs. It is difficult to accurately interpret seasonal trends in a data set that contains only a few years of data, which highlights the importance of long term data collection. As I continue working in Professor LaVigne's lab in the fall, I will continue to build on the many field and lab skills I gained through this summer research opportunity.

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References:

- Fernandez, Ivan J. 2020. "Maine's Climate Future: 2020 Update." *Climate Change Institute Faculty Scholarship*, (February).
https://digitalcommons.library.umaine.edu/climate_facpub/6?utm_source=digitalcommons.library.umaine.edu%2Fclimate_facpub%2F6&utm_medium=PDF&utm_campaign=PDFCoverPages.
- Lemasson, Anaëlle J. 2017. "Linking the biological impacts of ocean acidification on oysters to changes in ecosystem services: A review." *Journal of Experimental Marine Biology and Ecology* 492 (June): 49-62. <https://doi.org/10.1016/j.jembe.2017.01.019>.
- Neumann, Julia L. 2022. "Vulnerability Assessment of the Gulf of Maine Eastern Oyster Aquaculture Industry to the Projected Impacts of Ocean and Coastal Acidific." *Environmental Indicators and Impact Assessment Commons*, (May).
https://repository.usfca.edu/capstone/1340?utm_source=repository.usfca.edu%2Fcapstone%2F1340&utm_medium=PDF&utm_campaign=PDFCoverPages.