

Oysters and Ocean Acidification: Identifying Optimal Conditions for Reef Restoration

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Oysters are not just seafood—as filter feeders and ecosystem engineers, they can provide localized ecological benefits. This recognition has fueled a growing interest in oyster reef restoration in recent years. The Basin Oyster Project in Phippsburg, Maine is one such community-led initiative, exploring the potential for oyster reef restoration in The Basin. However, successful reef development depends on specific environmental conditions, including suitable temperature, salinity, and an aragonite saturation state (Ω_a) of at least 1.5—the threshold considered optimal for shell growth in calcifying organisms (Siedlecki et al., 2021). Aragonite saturation state is a measure of the availability of the mineral aragonite, the form of calcium carbonate that oysters use to build their shells. Ocean acidification, driven by the absorption of atmospheric CO_2 , alters marine carbonate chemistry and lowers Ω_a , making it more difficult for oysters to form and maintain their shells. As a result, assessing local carbonate chemistry is a critical step in determining the feasibility of restoration in The Basin.

This summer, we expanded upon a multi-year dataset on water quality at the Basin Oyster Project's reef restoration sites. From May through August 2025, we collected data at four sites in the Basin Preserve in Phippsburg, as well as weekly at the dock of the Schiller Coastal Studies Center. At each site, we measured surface salinity, pH, temperature, turbidity, and dissolved oxygen with a YSI EXO2 Sonde. We then filtered seawater samples to measure total alkalinity, dissolved inorganic carbon, and nutrient concentrations in the LaVigne Lab at Roux. These measurements were used to calculate Ω_a .

Our results show that Ω_a values in The Basin, measured from June–November 2024 and May–August 2025, generally remained above the optimal 1.5 threshold for shell growth. Winter data, supplemented with measurements from the Schiller Coastal Studies Center, closely matched The Basin's seasonal trends. Although dips below the threshold occurred during late fall, winter, and early spring, the overall multi-year record supports the site's suitability for surface oyster aquaculture and future reef development based on carbonate chemistry.

Ocean acidification is just one of several stressors affecting the Gulf of Maine, alongside warming waters, habitat degradation, coastal erosion, and invasive species. Although rising temperatures in the region can temporarily offset some impacts of decreasing pH on Ω_a , local influences such as coastal runoff and shifts in the Labrador Current can make coastal sites more susceptible to future Ω_a declines (Stewart, 2025). In the Gulf of Maine's highly variable coastal ecosystems, where oysters have only recently been reintroduced, reef restoration is shaped by a complex interplay of environmental factors that must be carefully considered in planning efforts. By expanding a multi-year dataset, our research provided essential insight into seasonal and spatial variability of carbonate chemistry in The Basin. Continued monitoring will be critical to guide restoration strategies that support resilient oyster populations and sustain their ecological benefits in a changing ocean.

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