Alaska Ocean Acidification Network

Ocean Acidification and Pacific Oysters in Southeast Alaska

As ocean acidification (OA) research expands, researchers and Alaska shellfish growers can work together to tackle questions, fill monitoring gaps, and collaborate on adaptation strategies. FAQs about OA in Southeast Alaska are highlighted below, and strategies to manage potential concerns are on the back page. We hope this opens the door to conversation between shellfish growers and researchers. Stay tuned for events through ASGA and the Alaska Mariculture Alliance this year.

Is OA a problem for Pacific oysters?

Pacific oysters are highly vulnerable to corrosive seawater conditions during the first 48 hours of life, and are also sensitive during the settling phase. Oysters exposed to corrosive conditions during these life stages, even if they survive, may experience carry-over effects on growth, development, and survival. Adult oysters in contrast are less sensitive to ocean acidification, but exposure to acidic conditions may leave them vulnerable to other environmental stressors, like heat waves, pathogens (e.g. Vibrio spp) and pollutants, potentially leading to impaired growth and reproductive output, or increased mortality. We need more data to know how OA correlates to real effects on adult shellfish.

Are Pacific oysters in Alaska being affected by OA right now?

Although waters in Southeast Alaska are naturally prone to corrosive conditions, oyster farms do not appear to be affected in Alaska at this point in time. However, hatcheries to the south of us in British Columbia have to buffer their water, just as hatcheries do in Washington and Oregon. Growers in BC are also starting to see summer mortality events that are associated with Vibrio infection, likely triggered by warming waters and potentially exacerbated by OA.

When might Alaska oyster growers need to worry about OA?

The conditions we see today are already different from several decades ago. The overall pace of ocean acidification in Southeast has been accelerating, and in the next 15 years we expect to see the same magnitude of change as we've seen over the past 250 years. It is possible that the industry will need to plan for a different growing environment and look towards mitigation and adaptation options.

Ocean acidification is caused by the uptake of human-caused carbon dioxide in the atmosphere by the oceans. Researchers refer to two important metrics when discussing OA: acidity (pH) and aragonite saturation state (written Ωarag). pH provides us with a measure of how acidic seawater is, while Ωarag represents how corrosive the water is to shell-building organisms like oysters.

Adaptation and Mitigation

Are there practices that could help mitigate OA for Alaska shellfish growers?

1. Researchers and oyster growers should continue gathering data on pH and aragonite saturation state around Southeast Alaska to provide site-specific and seasonal information on growing conditions.

2. Locate hatcheries and farms in areas with less exposure to corrosive conditions and other stressors, now and into the future. These include regions close to the outer coast, with direct connections to waters of the continental shelf, and areas that do not receive a lot of glacial meltwater in the summer. Avoid areas with confined waters, or areas with lots of tidal mixing.

3. Allow oyster seed to grow to larger size before outplanting. This may provide some protection against corrosive conditions, as well as multiple stressors like warm temperatures and disease. In some cases it may also be beneficial to buffer or partially buffer the water, depending on site conditions.

4. Handle animals and plant seed during favorable seasons for a particular site. For example, in waters that are affected by glacial melt in late summer, the best time to plant seed may be spring or early summer. In contrast, at a site that is more affected by spring snowmelt, planting in mid-summer might be preferable. Whenever seasonal conditions are unfavorable, avoid handling animals to reduce stress.

Ocean chemistry varies greatly across Southeast Alaska, and across seasons. This is because while ocean acidification is a global phenomenon, local factors can exacerbate or mitigate its intensity. Unlike in Oregon, Washington, and parts of British Columbia, where ocean acidification magnifies the effect of coastal upwelling which brings naturally corrosive deep ocean water to the nearshore surface, Southeast Alaska is a predominantly downwelling ecosystem. Here, in winter, surface waters are corrosive in all confined waterways that lack a direct connection to the open continental shelf. In summer, corrosive conditions are seen in areas that receive significant freshwater from glacial melt. And corrosive conditions are seen all year in zones where the tides regularly mix deep and surface waters, such as Wrangell Narrows. The ferry M/V *Columbia*, instrumented with a carbon measurement system, helped document these conditions through a collaborative multi-year project.