

OCEAN ACIDIFICATION IN WASHINGTON

Washington’s culture, traditions and economies are strongly connected to its ocean and estuaries. We gravitate to the more than 3,000 miles of marine shoreline to walk the beach, dig for razor clams, eat freshly harvested fish, crab and oysters, watch for orcas and birds, and marvel at the yearly return of salmon. **But our waters are in trouble.**

More than 10 years ago, oyster hatcheries in the Pacific Northwest experienced mass mortalities of their baby bivalves. Scientists worked with shellfish growers to determine the cause: ocean acidification. Corrosive waters meant these oysters couldn’t build and maintain their shells.

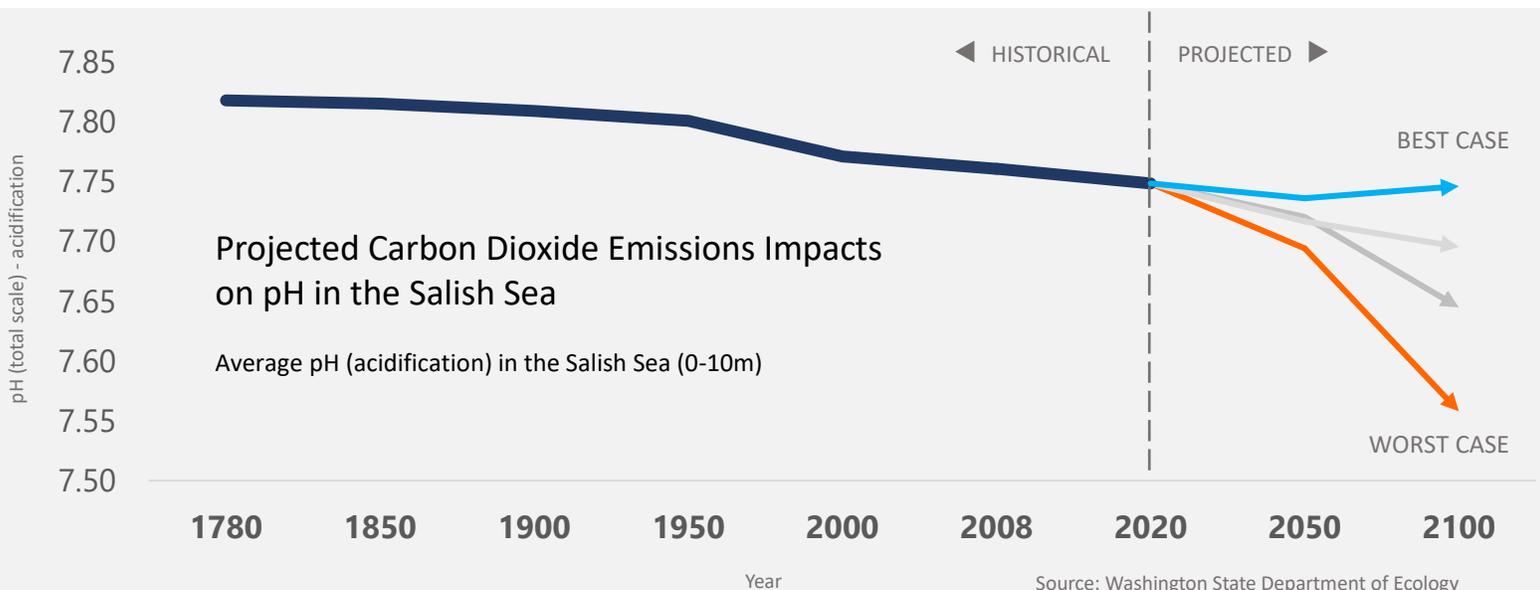
Washington’s shellfish growers, scientists, and government and community leaders chose to confront the challenge. Together we’re working to understand how ocean acidification is harming our state and how we can help those who are harmed while we work on making our ocean healthy again.

While our marine waters are changing due to ocean acidification, warming and loss of oxygen, new science indicates the damage to our ocean and coasts may be happening faster and more broadly than previously understood, largely due to climate change. This means we must act faster.

Ocean acidification’s effects on marine species are made worse by other climate impacts and stressors such as low oxygen and warming ocean temperatures. Local and human sources of nutrient pollution, such as from septic systems, wastewater treatment plants and agriculture runoff, are contributors to ocean acidification in areas of Puget Sound.

These changes undermine the health of our marine environment, threaten jobs and may fundamentally alter socially and culturally important resources and traditions of tribes and other coastal communities.

Washingtonians are seeing firsthand how climate change is harming our ocean and coasts: increasing acidification, rising water temperatures, lower oxygen levels and more intense toxic algal blooms.



IMPACTS IN WASHINGTON

Health of the Marine Environment

Data and research supports that changing ocean conditions are already affecting species such as oysters, Dungeness crab and salmon, and some of the smaller species that fish and whales rely on for food, like krill and pteropods. These effects will jump dramatically in the coming years if we fail to act soon.

Lab studies show that in acidified waters, salmon have a harder time detecting predators and that harmful algal blooms produce more toxins. And fewer salmon mean that Southern Resident orcas go unfed and nets for commercial and personal consumption come up empty.

Jobs and Livelihood

Changing ocean conditions have real economic consequences. Employing more than 15,000 people in fishing, aquaculture and seafood processing — and generating billions in wages and revenue — Washington is ranked No. 1 of all coastal states for the largest living marine resources sector.

Yet harmful algal blooms can shut down shellfish harvest to protect public health. In 2015, a toxic bloom triggered by warmer ocean temperatures cost our coastal communities an estimated \$97.5 million in lost crab landings and \$40 million in tourism spending.

Tribal and Cultural Implications

Salmon, shellfish and other marine resources have been the foundation for many tribes in the Northwest for thousands of years, serving not just as food, but as the cornerstone of cultures, traditions and spirituality. These resources were so important that many area tribes signed treaties with the United States to reserve their right to continue to fish and hunt. Tribal economies have also developed around sustainable harvest of fish and shellfish. The potential loss of marine resources due to changing ocean conditions would be devastating to the well-being of many tribes.

We Need to Act Quickly

Due to Washington's location and oceanographic conditions, our state will experience ocean acidification faster and to a greater degree than many other places. These changes are occurring even more rapidly in Puget Sound waters than along our coast. This makes Washington's marine resources and communities especially vulnerable to ocean acidification repercussions.

On a smaller scale, various marine species have different thresholds for coping with ocean acidification. By 2050, models indicate that the corrosive water conditions in parts of Puget Sound will exceed the thresholds from some marine species much or most of the time.



Washington State Department of Fish and Wildlife



We Can Change the Course of Ocean Acidification with Local Actions and Leadership

The good news is that if we act now — locally and globally — we can make a difference and alter the course of ocean acidification. The longer we wait to act, though, the less effective our actions will be in halting harms to our marine resources and protecting the communities that rely on them.

Already, Washington is leading the way by implementing a comprehensive set of actions overseen by the Governor's Marine Resources Advisory Council and supported by the state Legislature. Established in 2013, the council maintains a steady, coordinated focus on ocean acidification for Washington. Its members, representing diverse interests, deliver recommendations to the governor and Legislature and seek public and private funding to support those recommendations. It works with and advises the Washington Ocean Acidification Center at the University of Washington and assists with education and outreach activities.

Due to the leadership of the council and other concerned partners, the Legislature has invested nearly \$18 million — mostly in significant actionable research — since 2012. This investment has, in turn, spurred several more million in federal and private funding.

This research, monitoring and modeling are guiding decision makers on next steps. For example, this activity has enabled the shellfish industry to adapt its operations by treating hatchery water and timing the transfer of shellfish to growing areas to boost their survival in acidified waters. Researchers are exploring how eelgrass and kelp may improve local water quality and reduce acidification. And inter-jurisdictional partners cooperate to reduce local nutrient sources such as wastewater.

As a result of all this work, our state is emerging as a global hub of knowledge, innovation and collaboration on ocean acidification. Collaborating with other states and Canadian provinces on the West Coast, Washington has formed a coalition to lead and take action to mitigate ocean acidification and other climate impacts on our ocean. Today, that consortium numbers over 80 members, increasing the impact of our efforts through collective and coordinated action.



Pteropods are a key component of the marine food web. Under ocean acidification conditions, they struggle to build and maintain their shells. Today approximately half the pteropods in our coastal waters show signs of the severe impacts of corrosive waters.

Researchers project that by 2050, as much as 70% of pteropods may be negatively affected by corrosive conditions. [Bednarsek et al., 2014]

Photo credit: Nina Bednarsek



What We Need to Do

Current scientific evidence indicates that we must do more to address ocean acidification and other climate impacts.

Further Reduce Carbon Dioxide Emissions

Washington has led the nation in adopting policies that cut climate pollution. These include transitioning to 100% clean electricity by 2045, adopting a clean fuel standard, improving efficiency of buildings, electrifying transportation and capping and reducing major climate pollution sources through the climate commitment act. These policies are essential to protecting our state from the worst impacts and science shows we will need to do even more in the years to come. If we fail to reduce emissions quickly enough, our marine waters and ocean will be irreversibly damaged.

Reduce Nutrient Pollution

Reduce nutrient pollution discharged into marine waters from sewage treatment plants and failing septic systems and runoff from farms and yards. Reducing excess nutrients from human activities can provide additional protection to marine ecosystems while we reduce emissions of greenhouse gases — locally and globally.

Improve Local Adaptation and Resiliency

Actions such as protecting and restoring kelp and eelgrass — and growing more — can improve water quality locally and provide refuge for marine species from acidified and other stressful conditions elsewhere. These habitats may improve the growth and survival of species that are sensitive to ocean acidification.

Support Science

Scientific research, monitoring and modeling are necessary to help us answer our remaining questions, inform our decisions and take action. Indeed, science is a foundation for effectively addressing ocean acidification, and the state needs to sustain these critical investments over time.



The Marine Resources Advisory Council maintains a sustainable and coordinated focus on ocean acidification in Washington state.

Visit www.oainwa.org to learn more about Washington's strategic response and the Marine Resources Advisory Council

Contact mrac@oainwa.org for more information

