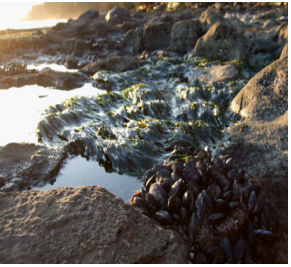


# Ocean Acidification in Washington State

*From Knowledge to Action*



## Ocean Acidification: What You Need to Know

### Q: What is ocean acidification?

**A:** Ocean acidification is a prolonged reduction in seawater pH driven primarily by increasing levels of carbon dioxide (CO<sub>2</sub>) absorbed by the ocean from the atmosphere. This CO<sub>2</sub> reacts with sea water to form carbonic acid, which increases seawater acidity and decreases the amount of calcium carbonate available to shell-forming organisms.

An *increase* in acidity means a *reduction* in pH. The pH scale has a range of 0 to 14. Solutions with pH below 7 are acidic and solutions above 7 are basic. Normal seawater has a pH of about 8.1. Acidification does not mean the oceans are acidic, for example, that seawater pH is below 7. The term means that the ocean is becoming more acidic (for example, the pH is dropping below 8.1).

### Q: What causes ocean acidification?

**A:** The principal cause at the global scale is CO<sub>2</sub> emissions from human activities. The oceans have absorbed approximately 25 percent of the CO<sub>2</sub> generated by human activities since the start of the industrial age in the mid-1700s. Ocean acidification has increased 30 percent in that time. This rate of change is nearly ten times faster than any time in the past 50 million years. Ocean acidity is projected to increase by 100-150 percent by the year 2100, given the current rate of CO<sub>2</sub> emissions.

### Q: Why is ocean acidification a problem for Washington?

- Ocean acidification is appearing in Washington decades sooner than anticipated. A combination of regional factors can exacerbate acidification caused by global CO<sub>2</sub> emissions:
- Coastal upwelling of offshore CO<sub>2</sub>-rich and low pH waters from the deep ocean onto continental shelf.
- Runoff of nutrients from land-based activities and decay of organic matter in subsurface waters.
- Emissions of other acidifying gases, such as nitrogen oxides (NO<sub>x</sub>) and sulfur oxides (SO<sub>x</sub>).

### Q: What are the implications for Washington's marine species and ecosystems?

**A:** Many life processes are sensitive to carbon dioxide and pH. Research shows calcifiers are particularly affected by ocean acidification. Calcifiers are marine organisms that depend on the mineral calcium carbonate to make shells, skeletons, and other hard body

parts. Ocean acidification makes an essential component of calcium carbonate – the carbonate ion – more scarce. As a result, calcifiers have to use more energy to pull carbonate ions out of the water to build their shells. Calcium carbonate also dissolves more easily as acidity increases. These changes can result in slower growth and/or higher mortality among calcifiers, especially in shellfish larvae and juvenile shellfish.

More than 30 percent of Puget Sound’s marine species are calcifiers: oysters, clams, scallops, mussels, abalone, crabs, geoducks, barnacles, sea urchins, sand dollars, sea stars and sea cucumbers. Even some seaweeds produce calcium carbonate structures.

Many calcifiers provide habitat, shelter, and/or food for various plants and animals. For example pteropods (pronounced “TARE-a-pods”), the delicate free-swimming snails, are eaten by seabirds, whales and Alaska pink salmon. Some species of copepods - small crustaceans eaten by juvenile herring and salmon – are also affected. Impacts on species like the pteropods and copepods are a significant concern because of their ability to affect the entire marine food web.

### **Q: Why does Washington need to act on ocean acidification?**

**A:** Washington State has the most productive commercial shellfish industry on the West Coast. Annual sales of farmed shellfish from Washington account for almost 85 percent of U.S. West Coast sales, including Alaska. The shellfish industry generates \$270 million annually, and directly and indirectly supports 3,200 jobs.

Massive die-offs of oyster larvae at Pacific Northwest hatcheries between 2005 and 2009 due to low pH seawater entering the hatcheries highlighted the potential impacts of ocean acidification on this multi-million dollar industry.

In addition, impacts to marine food webs could affect Washington’s seafood industry, which generates over 42,000 jobs in Washington and contributes at least \$1.7 billion to its gross state product.

Recreational oyster and clam harvesters generate \$3 million annually in state revenue and contribute more than \$27 million annually to coastal economies.

Washington coastal tribes depend upon shellfish for food, income and connection to their cultural heritage.

### **Q: Why is Washington well-positioned to tackle ocean acidification?**

**A:** Ocean acidification is a problem that we can address, although it will be challenging. Washington has much to draw on to tackle this problem. Some of the world’s leading experts on ocean acidification, pollution reduction, and marine resource management work at the University of Washington, the National Oceanic and Atmospheric Administration, state agencies, and nonprofit organizations.

Additionally state agencies, businesses, and tribes are taking the lead in developing innovative approaches that reduce carbon dioxide and nutrient runoff, and state and tribal leaders are actively engaging with our federal partners to find solutions to ocean acidification. We also have a shellfish industry committed to protecting native ecosystems as well as farmed resources, and a diverse nonprofit community ready to work with the public on understanding the problem and how we might solve it. Finally, we have citizens who value the rich and diverse ecosystems in Washington's marine waters.

### **Q: What is Washington doing about it?**

**A:** Governor Gregoire convened the Blue Ribbon Panel on Ocean Acidification in February, 2012, making Washington the first state in the nation to tackle ocean acidification at this level. The 28 member Panel consisted of scientists; public opinion leaders; industry representatives; state, local, federal, and tribal policy makers; and conservation community representatives. The Panel was charged by the Governor with reviewing the best available science, and producing a set of recommendations to guide Washington's response to ocean acidification.

### **Q: What did the Panel produce?**

**A:** The Panel scientists reviewed and summarized the current state of scientific knowledge about ocean acidification in Washington State. A technical document was produced, *Scientific Summary of Ocean Acidification in Washington State Marine Waters*. The document was the foundation for the Panel report, *Ocean Acidification: From Knowledge to Action, Washington State's Strategic Response*. Both documents were submitted to the Governor on November 27, 2012.

### **Q: What are the recommendations of the Panel?**

**A:** The Panel recommended 42 actions that will:

- *Address the root cause of acidification by reducing carbon dioxide emissions.*
- *Reduce local land-based pollutants that worsen acidification.*
- *Foster adaptation and remediation to protect shellfish industry and marine ecosystems.*
- *Increase research and monitoring of acidification in state waters.*
- *Inform, educate, and engage the public, stakeholders, and decision makers in responding to ocean acidification.*
- *Maintain a sustained and coordinated focus on ocean acidification.*

### **Q: What early actions will be taken?**

**A:** The Panel recognized that it is not possible to implement all the recommendations simultaneously. Consequently it has designated 18 of the 42 actions as "key early actions" that are essential next steps for reducing the risks associated with acidification.

## **Q: What is Governor Gregoire's response to the Panel recommendations?**

**A:** On November 27, 2012 Governor Gregoire signed Executive Order 12-07 directing the Department of Ecology and other cabinet agencies to implement the recommendations of the Panel, specifically to:

- Advocate for reductions in emissions of carbon dioxide.
- Work with the University of Washington and others to coordinate and conduct scientific investigations and ensure continued science and policy collaborations.
- Execute a memorandum of understanding among key state and federal agencies.
- Reduce nutrients and organic carbon in priority areas.
- Request that the EPA assess water quality criteria relevant to ocean acidification.
- Increase public understanding of ocean acidification and its consequences.
- Consult on government-to-government basis, with affected and interested Indian Tribes and Nations in Washington State.

The Governor also proposed a new center on ocean acidification at the University of Washington to deliver scientific information and integrate and effectively link current and future science to management decisions.

Governor Gregoire's 2013-15 budget proposes \$3.31 million in state funding for priority actions. Funding these priority actions is necessary to ensure the continued viability of native and commercial shellfish species and to make real progress against the threat of ocean acidification to our marine resources, our economy, and the jobs that depend on these resources.

### **Contact:**

Hedia Adelsman

Department of Ecology

360-407-6222, [hedia.adelsman@ecy.wa.gov](mailto:hedia.adelsman@ecy.wa.gov)

For current information, visit: [www.ecy.wa.gov/water/marine/oceanacidification.html](http://www.ecy.wa.gov/water/marine/oceanacidification.html)