

## THE STATE OF WASHINGTON TACKLES OCEAN ACIDIFICATION

By Sarah E. Mack  
mack@tmw-law.com

Published in *Western Water Law & Policy Reporter*  
Volume 17, No. 3  
January 2013  
[www.argentco.com](http://www.argentco.com)

On November 27, 2012, the Governor's Blue Ribbon Panel on Ocean Acidification released its final report entitled *Ocean Acidification: From Knowledge to Action, Washington State's Strategic Response*, along with 42 action recommendations. In general, the report acknowledges that ocean acidification is a global issue, and that more science and data collection are needed in order to determine the impacts and contribution from specific activities occurring in Washington. Nevertheless, Governor Christine Gregoire has called for Washington to act now to combat ocean acidification and to "lead the world" in solving this problem.

The report, and an accompanying Governor's Executive Order, calls for reducing emissions of carbon dioxide at a global, national, and regional level; reducing local "land-based contributions" to ocean acidification; increasing the state's ability to adapt to and remediate the impacts of ocean acidification; and better monitoring and investigation of its causes and effects.

### What is ocean acidification?

The report defines ocean acidification as a reduction in the pH of seawater for an extended period of time. Neutral pH is 7.0. Solutions with pH values less than 7.0 are considered "acidic" and those with pH values greater than 7.0 are "basic." Because pH is expressed on a logarithmic scale (a pH of 7.0 is ten times more acidic than a pH of 8.0), a small change in pH can correspond to a large change in acidity.

Reductions in the pH of seawater are due primarily to the ocean's uptake of carbon dioxide from the atmosphere. Since the beginning of the industrial era, carbon dioxide emissions from human activities have risen dramatically, and approximately one-quarter of those human-generated emissions have been absorbed by the earth's oceans. Because carbon dioxide gas has an acidifying effect when dissolved in seawater, the average acidity of the surface ocean has increased by about 30 percent since 1750. At the current rate of global

carbon dioxide emissions, the average acidity of the surface ocean is expected to increase by 100 to 150 percent over pre-industrial levels by the end of this century.

### **Washington's vulnerability**

This shift in ocean chemistry has serious implications for Washington's marine environment and its economy. Lowered pH in seawater has corrosive effects on shell-forming organisms, including oysters, clams, scallops, mussels, abalone, crabs, geoducks, barnacles, sea urchins, sand dollars, sea stars, and sea cucumbers. When carbon dioxide concentrations in seawater increase, the availability of carbonate ions decreases, making it more difficult for calcifiers (organisms dependent upon the mineral calcium carbonate) to form, build, and maintain shells, skeletons, or other vital body parts. Shellfish larvae and juveniles are especially vulnerable.

Pacific Northwest oyster hatcheries, which raise young oysters in seawater, experienced disastrous production failures between 2005 and 2009. Billions of oyster larvae were dying, caused by the arrival of low-pH seawater along the west coast.

Washington is the country's top provider of farmed oysters, clams, and mussels. The estimated total annual economic impact of shellfish aquaculture is \$270 million, with more than 3,200 people employed directly or indirectly by shellfish growers. Shellfish are also an integral part of Washington's commercial wild fisheries, generating over two-thirds of the harvest value of those fisheries. Washington's tribal communities depend on wild shellfish; almost all of the commercial wild clam fisheries in Puget Sound are tribal, and the tribes also harvest wild shellfish for ceremonial and subsistence purposes. Recreational shellfish harvesting generates \$3 million annually in state licensing revenue, and recreational clam and oyster harvesting contributes more than \$27 million annually to coastal economies.

According to the report, more than 30 percent of Puget Sound's marine species are vulnerable to ocean acidification by virtue of their dependence on calcium carbonate. Ocean acidification has implications for the broader marine environment as well. Many calcifiers provide habitat, shelter, and/or food for various plants and animals. Impacts on species like sea snails – which serve as food for seabirds, whales and fish – can affect entire marine food webs.

Washington is particularly vulnerable to ocean acidification because of coastal upwelling, which exacerbates the acidifying effects of global carbon dioxide emissions. Coastal upwelling brings offshore water rich in carbon dioxide and low in pH up from the deep ocean and onto the continental shelf. The carbon dioxide content in today's upwelled water reflects naturally occurring carbon dioxide generated by biological processes in the ocean as well as carbon dioxide absorbed from the atmosphere 30 to 50 years ago. According to the report, today's upwelled water bears "the imprint of the atmosphere in

about 1970,” and as carbon dioxide concentrations continue to increase so too will the “carbon loading” of the seawaters making their way to the Washington coast. The report predicts more acidifying conditions coming from upwelled waters for several decades to come.

Other regional factors affecting ocean acidification in Washington include runoff of nutrients and organic carbon (such as plants and freshwater algae) from land, and local emissions of carbon dioxide, nitrogen oxides, and sulfur oxides, which are absorbed by seawater. The relative importance of these regional factors varies according to location. Acidification along the outer coast of Washington and Puget Sound is strongly influenced by coastal upwelling. In shallow estuaries, acidification may be particularly influenced by inflows of fresh water (which is naturally lower in pH than seawater) carrying nutrients and organic carbon from human and natural sources. Those nutrients stimulate excessive algal growth, which in turn can make seawater more acidic when the algae and other organic matter decompose.

### **Recommended actions**

Governor Gregoire convened the Blue Ribbon Panel in February 2012 to chart a course for addressing the causes and consequences of ocean acidification. The Panel, co-chaired by former EPA Administrator William Ruckelshaus and former Ecology Director Jay Manning, announced the need for action across a broad range of areas. Out of a total of 42 recommended actions, the Panel designated 18 “Key Early Actions” that it “considers to be essential next steps for reducing the risks associated with acidification.” The report stresses that the Key Early Actions “are independent of assumptions about the availability of funding or political feasibility.”

The Panel believes the most urgent need is to slow the pace of ocean acidification by reducing the sources that cause the problem – in particular, global carbon dioxide emissions. The Panel called for continued Washington leadership in advocating for comprehensive reduction in carbon dioxide emissions. At the same time, the report warns that relying solely on emissions reductions over time would “result in significant—and in some cases irreversible—economic, cultural, and environmental impacts” to Washington’s shellfish industry and native ecosystems. The report recommends additional local actions, including local source reduction and adaptation and remediation, to “buy time” while society works to reduce global carbon dioxide emissions.

### **Local source reduction**

Local source reduction requires reducing local land-based pollutants that enhance acidification in marine waters by generating additional carbon dioxide, notably inputs of nitrogen and organic carbon from point, nonpoint, and natural sources. The Panel

recommends strengthening local source control programs and warns that “more stringent controls of nutrients and organic carbon pollutants may be required” in some cases.

In her Executive Order, Governor Gregoire directed the state Department of Ecology to work with the University of Washington “to deliver the technical analysis recommended by the panel on the relative importance to ocean acidification of local land-based sources of nutrients and organic carbon and local air emissions.” She ordered Ecology to formally request EPA to “begin the assessment of water quality criteria relevant to ocean acidification.” Simultaneously, she ordered Ecology to reduce nutrients and organic carbon where those pollutants are causing or contributing to multiple water quality problems in marine waters, directing Ecology to prioritize watersheds with the most significant water quality problems, regardless of the source – urban stormwater, septic tanks, sewage treatment facilities, or rural runoff from agricultural lands.

### **Adaptation and remediation**

The Panel’s report stresses that adaptation and remediation are also necessary to ensure the continued viability of native and commercial shellfish species and healthy marine ecosystems. The Panel recommends using “both new and trusted technologies” for remediating local seawater conditions, so that resource managers and shellfish growers can strategically adjust to changing conditions. Key early actions include developing vegetation-based systems of remediation for use in upland habitats and in shellfish areas; continued water quality monitoring at shellfish hatcheries and rearing areas to enable real-time management under changing pH conditions; developing commercial-scale water treatment methods or hatchery designs to protect larvae from corrosive seawater; and identifying, protecting, and managing “refuges” for vulnerable organisms.

Although it establishes a “coordinating mechanism” for research and data sharing and directs Ecology to work with other agencies to “engage” affected stakeholders “in developing and implementing local solutions,” the Governor’s Executive Order does not specifically address the Panel’s recommended key early actions in the arena of adaptation and remediation.

### **Concerns about the report**

The Panel’s report and the Governor’s Executive Order have already generated some concerns. For example, State Representative Norma Smith, a member of the Blue Ribbon Panel, wrote a letter to the Panel co-chairs outlining her “qualified support” of the Panel’s recommendations based on several concerns. First, the Panel had extremely limited involvement of key stakeholders representing the agricultural community, which deprived it of a “thoughtful review of the potential consequences to farmers and landowners that could impair agricultural viability in Washington state.” Second, Rep. Smith pointed out

the inconsistency in recommending increased regulations in advance of collecting “sound data” for determining the role of local source contributions to ocean acidification, noting scientific estimates that ocean upwelling is responsible for 66 percent of ocean acidification along Washington’s coast. Rep. Smith also criticized the “lack of context with regard to the enormous economic challenges we face in a fragile economic recovery and the costs to our communities, employers and landowners” of implementing the Panel’s recommendations, urging a more “holistic perspective” to most effectively serve all Washingtonians.

## **Conclusion**

As usual, the devil will be in the details, particularly in the formulation of new controls on local land-based contributors to ocean acidification. Governor Gregoire’s goal is for Washington to lead the world in addressing the problem; it remains to be seen where exactly Washington will go, and whether the world will follow.

For the Governor’s Executive Order, see [http://www.governor.wa.gov/execorders/eo\\_12-07.pdf](http://www.governor.wa.gov/execorders/eo_12-07.pdf)

For the report, see <https://fortress.wa.gov/ecy/publications/publications/1201015.pdf>