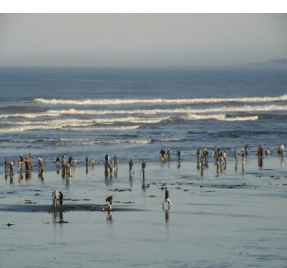
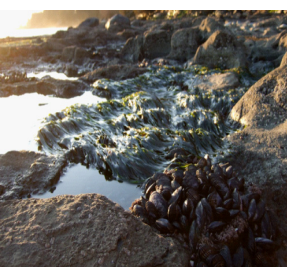


# Ocean Acidification in Washington State

## *From Knowledge to Action*



## **Governor's Proposed 2013-15 Budget**

The increasing level of carbon dioxide emissions in the atmosphere is causing the acidity of sea water to increase. Numerous animals and plants in the sea have calcium carbonate shells or skeletons. Some are sensitive to small changes in acidity and there is evidence they are already affected, as seen by the massive die-offs of oyster larvae at Pacific Northwest hatcheries between 2005 and 2009. Ocean acidification is a major threat to Washington's marine species and ecosystems and our economy.

Washington is the nation's top provider of farmed oysters, clams and mussels. The shellfish industry generates \$270 million annually, and directly and indirectly supports 3,200 jobs. Impacts to the marine food webs could affect Washington's seafood industry, which generates over 42,000 jobs and contributes at least \$1.7 billion to gross state product. Recreational oyster and clam harvesters contribute more than \$27 million annually to coastal economies. Washington tribes depend upon shellfish for food, income and connection to their cultural heritage.

A first-of-a-kind comprehensive state-level effort to address ocean acidification was unveiled on November 27, 2012. The Washington State Ocean Acidification Blue Ribbon Panel (the Panel) convened by Gov. Gregoire in February 2012, summarized the current state of scientific knowledge of ocean acidification pertinent to Washington and produced a comprehensive set of recommendations. See *Scientific Summary of Ocean Acidification in Washington State Marine Waters* and *Ocean Acidification: From Knowledge to Action, Washington State's Strategic Response*.

The Panel identified 18 key early actions, out of 42, that should be acted on now based on urgency and relative importance. The key early actions are 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 jobs that depend on these resources.

On November 27, 2012, in response to the Panel's recommendations, Gov. Gregoire issued Executive Order 12-07 directing the Department of Ecology and other cabinet agencies to implement the Panel's key early actions. The Governor also proposed a new Center for Ocean Acidification at the University of Washington; and \$3.31 million in biennial state funding to the University of Washington, and the Departments of Ecology and Natural Resources to begin to implement the Panel's key early actions. Full implementation of many of the key early actions listed below will require additional funding, with some requiring sustained funding beyond this biennium.

## University of Washington

The proposed Ocean Acidification Impacts and Adaptation Center will be housed within the University of Washington's College of the Environment, a national leader in environmental research. The Center will advance the Panel's research and monitoring recommendations and will lead and foster ongoing decision-relevant science regarding ocean acidification.

The Center will enhance and maintain coordination and collaboration among researchers across the UW and other regional academic institutions, and public, private and tribal entities, while continuing to engage the full spectrum of interests and expertise represented by the Blue Ribbon Panel. An advisory board and an ocean acidification science coordination team will be created by the Center to meet this charge.

A proposed **\$600,000** will fund a core staff at the Center. The Center will be modeled after, and integrated with, the UW's Climate Impacts Group (CIG), a highly respected leader in developing and delivering scientific information to decision makers at all levels.

A proposed **\$1.22 million** will fund the following key research and monitoring actions at the University of Washington, under the responsibility of the Center:

- *Ensure continued water quality monitoring at the six existing shellfish hatcheries and rearing areas to enable real-time management of hatcheries under changing pH conditions.* (Action 6.2.1). The monitoring data have enabled hatchery operators to avoid drawing acidic water into the hatcheries and rearing areas. \$150,000
- *Establish an expanded and sustained ocean acidification monitoring network to measure trends in local acidification conditions and related biological responses.* (Action 7.1.1). This monitoring will allow detection of local acidification conditions and increase our scientific understanding of local species responses. \$475,000
- *Conduct laboratory studies to assess the direct causes and effects of ocean acidification, alone and in combination with other stressors, on Washington's species and ecosystems.* (Action 7.3.2). The action will focus on determining the biological responses of species of ecological, economic, and cultural significance, to a full suite of stressors to which they are exposed, and will help estimate the genetic potential of these species to adapt to ocean acidification. \$170,000
- *Establish the ability to make short-term forecasts of corrosive conditions for application to shellfish hatcheries, growing areas, and other areas of concern.* (Action 7.4.1) A real-time online tool will be developed and accessible to shellfish growers and managers to track acidification on a scale of days to weeks, giving them time to change or adjust their hatcheries' operation. \$325,000
- *Investigate and develop commercial-scale water treatment methods or hatchery designs to protect larvae from corrosive seawater.* (Action 6.2.3). Scientists from the UW will help shellfish growers assess the effectiveness of the adaptation measures. \$100,000

## Washington Department of Ecology

The Department of Ecology is directed by Executive Order 12-07 to coordinate implementation of the Panel's recommendations. A proposed **\$980,000** will fund the following actions:

- *Quantify key natural and human-influenced processes that contribute to acidification based on estimates of sources, sinks, and transfer rates for carbon and nitrogen.* (Action 7.2.1). This action will provide us with an analysis of the relative importance of local contributions to ocean acidification and whether more stringent controls of nutrients and organic carbon will be required. \$480,000
- *Implement effective nutrient and organic carbon reduction programs in locations where these pollutants are causing or contributing to multiple water quality problems.* (Action 5.1.1). Existing and emerging tools and cross-organizational teams with local knowledge and implementation expertise will be used. \$380,000
- *Increase understanding of ocean acidification among key stakeholders, target audiences, and local communities to help implement the Panel's recommendations.* (Action 8.1.2). A variety of communication tools will be developed and targeted to various audiences. \$50,000
- *Provide a forum for agricultural, business, and other stakeholders to engage with coastal resource users and managers in developing and implementing solutions.* (Action 8.1.4). Early and ongoing communication between governmental agencies, academia, and agricultural, business and other stakeholders will be initiated. \$70,000

## Washington Department of Natural Resources

The Department of Natural Resources is responsible for a wide range of adaptation and remediation projects. A proposed **\$510,000** is provided to the Department to implement the following actions:

- *Determine the association between water and sediment chemistry and shellfish production in hatcheries and in the natural environment.* (Action 7.3.1). The results from this action will help guide management strategies for wild populations and culture practices in hatcheries and farms. \$150,000
- *Develop vegetation-based systems of remediation for use in upland habitats and in shellfish areas.* (Action 6.1.1). Using vegetation to reduce nutrients and remove carbon dioxide from seawater can help save vulnerable young shellfish from acidification and hypoxia. \$160,000
- *Identify, protect, and manage potential refuges for organisms vulnerable to ocean acidification and other stressors.* (Action 6.3.2). Areas that provide refuge to affected species (i.e., areas where acidification is likely to occur more slowly or to a lesser extent than in other areas, due to physical features) will be ranked high and will be recommended for conservation and protection. \$200,000

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

