Leading the Fight Against Ocean Acidification

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Ocean acidification poses a serious threat to Washington's marine economy, communities, and environment. The Pacific Northwest shellfish industry has been among the first to feel significant, recognizable effects of ocean acidification. Disastrous production failures between 2005 and 2009 at major commercial Pacific Northwest oyster hatcheries saw billions of oyster larvae mysteriously die. Similar concerns were raised when wild Pacific oyster reproduction diminished. Increasing evidence suggests ocean acidification also has the potential to impair marine ecosystems including species that are direct drivers of economic activity (such as salmon or rockfish) as well as those that support the food web (such as pteropods and algae). The ocean acidification threat has real implications for our economy and livelihoods. Washington is the country's leading producer of farmed bivalves, with recent annual revenue of nearly \$150 million¹. In 2013, Pacific oysters alone contributed nearly \$35 million to the state's farmed shellfish harvest production value, while geoduck and other clam sales contributed an additional \$42 million². In addition to farmed bivalves, the wild Dungeness crab fishery is also a significant economic driver, providing more than \$82 million in annual revenue in 2016³.



Workers at Herrold's Fish and Oyster Co. transplant oysters in Willapa Bay. Photo credit: Benjamin Drummond / benjandsara.com

¹ U.S. Department of Agriculture, 2013.

² Washington Sea Grant, 2015.

³ Crab landing summary information from shellfish receiving tickets provided by Washington Department of Fish and Wildlife Information Services.

The shellfish and seafood industries are important employers in Washington state, especially in some rural, coastal communities. In recent years, the shellfish aquaculture industry alone employed nearly 3,000 Washingtonians in direct and indirect jobs⁴. Washington's total seafood industry generates even more impressive employment and revenue at neighborhood seafood restaurants, distributors, processors, importers, and retailers, contributing over 50,000 jobs in Washington and over \$2.5 billion to the state's economic output⁵.

Not included in these statistics are the economic and cultural value of marine resource to Washington's tribal communities. Some tribal people refer to native seafood as feeding their spirit as well as their physical needs. While we still need to learn more about how ocean acidification affects the full range of species driving our economic and cultural systems, it is clear that the effects of ocean acidification could significantly impact the state's economy and people.

1.1 The Strategy to Act on Ocean Acidification

In 2012, recognizing the threat to Washington's shellfish industry, its tribal communities, and its broader marine environment, Governor Christine Gregoire created the Washington State Blue Ribbon Panel on Ocean Acidification (referred to as "the Panel"). The Panel consisted of scientists; public opinion leaders; industry representatives; state, local, federal, and tribal policymakers; and conservation community representatives. The Panel:

- Reviewed and summarized the current state of scientific knowledge about ocean acidification
- Identified the research and monitoring needed to increase scientific understanding and improve resource management
- Developed recommendations to respond to ocean acidification and reduce its harmful causes and effects
- Identified opportunities to improve coordination and partnerships to enhance public awareness on how to address ocean acidification

The Panel released their findings and recommendations in the 2012 Ocean Acidification: From Knowledge to Action report, available at: www.ecy.wa.gov/ water/marine/oa/2012panel.html

The report established a comprehensive strategy of 42 actions to address ocean acidification in Washington, organized across six areas:

- 1. Reduce emissions of carbon dioxide
- 2. Reduce local land-based contributions to ocean acidification
- 3. Increase our ability to adapt to and remediate the impacts of ocean acidification
- 4. Invest in Washington's ability to monitor and investigate the causes and effects of ocean acidification
- 5. Inform, educate, and engage stakeholders, the public, and decision makers in responding to ocean acidification
- Maintain a sustainable and coordinated focus on ocean acidification at all levels of government



Deckhands sort through a Dungeness crab catch. Photo credit: Benjamin Drummond / benjandsara.com

⁴ Northern Economics, 2013.

⁵ National Marine Fisheries Service, 2017 (for calendar year 2015).

Setting an example, across the nation and across the globe

Following the 2012 Panel, Washington state emerged as a global leader in the fight against ocean acidification. The Panel's recommendations created a framework for transferring knowledge to action - a model that other states and entities across international borders have emulated. Examples of others following Washington's lead include the state of Maine's Ocean Acidification Commission, a task force to study the effects of ocean acidification and impacts on commercially valuable species. Additionally, following Washington's Panel, the California Ocean Science Trust convened the West Coast Ocean Acidification and Hypoxia Science Panel (OAH) from 2013 to 2016, which functioned as a catalyst for management actions in collaboration with California, Oregon, Washington, and British Columbia.

Taking this work internationally, the Pacific Coast Collaborative and leaders in Washington state launched the International Alliance to Combat Ocean Acidification (OA Alliance) in 2016. The OA Alliance is building an international network of governments, organizations, and other affiliates working with the common goal of addressing changing ocean conditions. Members of the OA Alliance commit to taking meaningful actions, as crafted in their own jurisdictional Ocean Alliance Action Plan.

1.2 From Knowledge to Action

While the Panel outlined a comprehensive strategy to address ocean acidification, it purposefully did not specify how to implement the strategy. In 2013, the Washington State Legislature established the Marine Resources Advisory Council (MRAC) to act as a state body to maintain a sustainable and coordinated focus on ocean acidification by:

- Advising and working with the Washington Ocean Acidification Center (WOAC) on the effects and sources of ocean acidification
- Delivering recommendations to the governor and Legislature on ocean acidification
- Seeking public and private funding resources to support the MRAC's recommendations
- Assisting in conducting public education activities regarding ocean acidification

Since 2013, the MRAC has reviewed, evaluated, and prioritized the 42 actions from the Panel's recommendations. MRAC works across organizational boundaries to ensure ocean acidification work is efficient, leveraged, and focused so that it becomes integrated into key programs across the state. Learn more about the MRAC and its work: www.ecy.wa.gov/water/marine/oceanacidification.html



Washington's oyster aquaculture industry is vulnerable to the impacts of acidifying waters. Photo credit: Taylor Shellfish Farms

1.3 Updating Our Strategy to Continue Moving Forward

In 2017, MRAC recognized the need to convene the state's leading ocean acidification thinkers to evaluate progress, next steps, and potential revisions to the recommended actions identified by the Panel. In the five years since the Panel released their strategy:

- Significant progress has been made on the Panel's 2012 recommendations. MRAC has prioritized the actions from the Panel's recommendations, tracked implementation, and secured funding for several partners.
- Scientists have a better understanding of ocean acidification and how it affects the marine environment. Scientific monitoring and investigation has advanced our understanding of ocean acidification conditions and impacts. To keep the linkage between science, policy, and management strong, new knowledge should be incorporated into strategic priority-setting for future actions.
- The needs of managers have changed. Marine resource managers continue to identify and implement on-the-ground strategies to address ocean acidification. These efforts lead to new and emerging management and policy questions, which should shape future research efforts to maximize feedback from scientists to managers.
- The network of ocean acidification partners is now stronger than ever. The landscape of ocean acidification partners at regional, national, and international scales has grown since 2012. These efforts should be strategically coordinated to leverage resources and avoid duplicative efforts in a constrained budget environment.



Photo credit: Washington State Department of Natural Resources



Gov. Jay Inslee, left, listens to Bill Dewey, right, of Taylor Shellfish Farms talk about the shellfish industry in Samish Bay. Photo credit: The Office of Gov. Jay Inslee



Martha Kongsgaard, MRAC Chair, presenting at the Blue Ribbon Panel "Refresh" Meeting on March 17, 2017. Photo credit: EnviroIssues

"It is impressive to see how Washington's leadership on ocean acidification continues to get national and international recognition. Implementation of the Blue Ribbon Panel's recommendations has enabled the shellfish industry to recover our oyster seed production as well as prepare for the more acidic ocean conditions that are predicted for our future."

- Bill Dewey, Taylor Shellfish Farms

The process for revising the 2012 recommended actions

Beginning in fall 2016, MRAC's ad hoc committees, organized around the Panel's six focus areas, documented progress to date based on the 2012 recommendations, evaluated the existing recommendations, and proposed revisions and new recommendations. These proposals were vetted with the broader ocean acidification community at the Blue Ribbon Panel "Refresh" meeting on March 17, 2017. In addition to discussing revisions and additions to the recommendations, participants discussed key efforts to focus on over the next five years.

The purpose of this addendum

This addendum details the results of discussions to update and revise the 2012 strategy, where needed. As an addendum, this document does not replace the work of the Panel in 2012, but instead highlights new or emerging developments that need to be added into the original strategy to address ocean acidification. As such, this document focuses on clarifying changes to the 42 actions in the 2012 report and any new actions deemed important to continue addressing the threat of ocean acidification.

As a companion piece to the 2012 Ocean Acidification: From Knowledge to Action report, this addendum follows the same chapter organization. Chapter 2 provides a synthesis of our advancements in scientific understanding over the last five years. Chapter 3 includes a complete list of strategies and actions Washington needs to pursue to address ocean acidification, and calls out updated and new actions. Chapters 4 through 9 each focus on the six focus areas identified by the Panel, and include highlights in ocean acidification accomplishments over the last five years, updated and new actions, and the rationale behind them. These chapters also highlight which efforts Washington's ocean acidification community recommends for focus in the next five years.