Learning from the Washington State Ocean Acidification Blue Ribbon Panel

Bill Dewey
Taylor Shellfish Farms
Overview

- OA impacts on shellfish growers
- National/Washington Shellfish Initiatives
- OA Blue Ribbon Panel process/recommendations
- Recent activities Governor Inslee and Legislature
Shellfish seed production

Taylor Shellfish Farms Hatchery
Dabob Bay, Washington (USA)
Shellfish seed production
Oceans' rising acidity a threat to shellfish — and humans

As carbon dioxide continues to build up in the atmosphere as a result of burning fossil fuels, the seas absorb much of it. The full effects have yet to be felt.

Workers harvest oysters in Sanish Bay, Wash., at low tide. Scientists have found that the rising acidity of the oceans is preventing the protective shells of some Pacific oysters from developing. (Liz O. Baylen, Los Angeles Times / June 21, 2008)
US West Coast shellfish hatcheries and major nurseries:

- Lummi Nation Hatchery
- Coast Hatchery
- Whiskey Creek Hatchery
- Taylor Hatcheries and nurseries
- Goose Point Hatchery
- Goose Point Hatchery
- Hawaii
Taylor Shellfish oyster larvae

- First two days of life
  Pacific oyster larvae precipitate ~ 90 percent of their body weight as calcium carbonate shell
- Do this with energy derived from the egg
- With low aragonite they expend too much energy building shell
- Not enough left to build their feeding mechanism
- Stressed and/or die

Shallow water intake
- pH = 8.0
- High Ω Aragonite

Deep water intake
- pH = 7.49
- Low Ω Aragonite

SEM photo: OSU Brunner/Waldbusser

Shallow water intake with energy from the egg, resulting in High Ω Aragonite. Deep water intake results in Low Ω Aragonite, leading to stress and/or death.
Oyster larvae

Feeding and motatating appendage (velum)
Oyster larvae
Panic/Adaptation

- Ramped up monitoring and research
- Expanded larvae production capacity at Kona, Hawaii, USA
- Treating hatchery rearing water
- Breeding OA resistant oysters
Expanded industry collaboration

- Pacific Coast Shellfish Growers Association working to:
  - Resolve seed shortage for industry
  - Secure funding for monitoring, research & modeling
  - Sharing lessons learned between facilities

www.pcsnga.org
Treating hatchery intake water

- Water treatment systems installed in Whiskey Creek’s Netarts Bay hatchery and Taylor Shellfish Dabob Bay hatchery
- Injecting sodium carbonate in response to real-time monitoring to increase availability of carbonate ions for larvae to build shell.
- Targeting $\Omega$ of 3.0
Expanded outreach & education

- Local, national and international media attention
- Documentaries
- Speaking at various forums on ocean acidification
- Participating in public policy discussions
Secretary of State Kerry’s
Our Ocean conference
Washington Shellfish Initiative

- Launched 12/9/11
- Included formation of OA Blue Ribbon Panel
- Julie Horowitz – Governor Inslee shellfish policy advisor
  - She is overseeing implementation of WSI and BRP actions
- Re-launch in the works
Ocean Acidification: From Knowledge to Action
Washington State’s Strategic Response

November 2012

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; and
6. Maintain a sustainable and coordinated focus on ocean acidification at all levels of government.
Panel Co-Chairs:

William D. Ruckelshaus — Madrona Venture Group
Jay Manning — Cascadia Law Group

Members:

Lisa Ayers — Pacific County Commissioner
Brian Blake — State Representative
Steven Bloomfield — Mason County Commissioner
Shallin Busch — NOAA, Ocean Acidification Laboratory
Chris Davis — The Nature Conservancy
Bill Dewey — Taylor Shellfish Company
Norm Dicks — Congressman
Richard A. Feely — NOAA, Pacific Marine Environmental Laboratory
Carolyn Friedman — UW, School of Aquatic & Fishery Sciences
Peter Goldmark — Commissioner of Public Lands
Sara Kendall — Weyerhaeuser Company
Terrle Klinger — UW, School of Marine & Environmental Affairs
Micah McCarty — Makah Tribe
Dennis J. McLerran — EPA Region 10
Edward Miles — UW, Center for Science and Earth System
Jan Newton — UW, Applied Physics Laboratory
Betsy Peabody — Pacific Shellfish Institute and Puget Sound Restoration Fund
Kevin Ranker — State Senator
Jennifer Ruesink — UW, Department of Biology
Ron Sims — Leadership Council, Puget Sound Partnership
Norma Smith — State Representative
Dan Swecker — State Senator
Ted Sturdevant — Department of Ecology
George Waldbusser — OSU, College of Ocean & Atmospheric Sciences
Brad Warren — Sustainable Fisheries Partnership
Terry Williams — Tulalip Tribes
<table>
<thead>
<tr>
<th><strong>Reduce Carbon Dioxide Emissions</strong></th>
<th>Work with international, national, and regional partners to advocate for a comprehensive strategy to reduce carbon dioxide emissions. <em>(Action 4.1.1)</em></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Enlist key leaders and policymakers to act as ambassadors advocating for carbon dioxide emissions reductions and protection of Washington’s marine resources from acidification. <em>(Action 4.1.4)</em></td>
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## Key Early Actions

<table>
<thead>
<tr>
<th>Reduce Local Land-Based Contributions</th>
<th>Implement effective nutrient and organic carbon reduction programs in locations where these pollutants are causing or contributing to multiple water quality problems. <em>(Action 5.1.1)</em></th>
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<tr>
<td></td>
<td>Support and reinforce current planning efforts and programs that address the impacts of nutrients and organic carbon. <em>(Action 5.1.2)</em></td>
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## Key Early Actions

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<tr>
<th>Increase Our Ability to Adapt to and RemEDIATE the Impacts of Ocean Acidification</th>
<th>Action 6.1.1</th>
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<tr>
<td>Develop vegetation-based systems of remediation for use in upland habitats and in shellfish areas.</td>
<td>(Action 6.1.1)</td>
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<tr>
<td>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.</td>
<td>(Action 6.2.1)</td>
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<tr>
<td>Investigate and develop commercial-scale water treatment methods or hatchery designs to protect larvae from corrosive seawater.</td>
<td>(Action 6.2.3)</td>
</tr>
<tr>
<td>Identify, protect, and manage refuges for organisms vulnerable to ocean acidification and other stressors.</td>
<td>(Action 6.3.2)</td>
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<tr>
<td>Invest in Washington’s Ability to Monitor and Investigate the Effects of Ocean Acidification</td>
<td>Establish an expanded and sustained ocean acidification monitoring network to measure trends in local acidification conditions and related biological responses. <em>(Action 7.1.1)</em></td>
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<td>Quantify key natural and human-influenced processes that contribute to acidification based on estimates of sources, sinks, and transfer rates for carbon and nitrogen. <em>(Action 7.2.1)</em></td>
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<td>Determine the association between water and sediment chemistry and shellfish production in hatcheries and in the natural environment. <em>(Action 7.3.1)</em></td>
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<td>Conduct laboratory studies to assess the direct effects of ocean acidification, alone and in combination with other stressors, on local species and ecosystems. <em>(Action 7.3.2)</em></td>
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<td>Establish the ability to make short-term forecasts of corrosive conditions for application to shellfish hatcheries, growing areas, and other areas of concern. <em>(Action 7.4.1)</em></td>
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## Key Early Actions

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<th>Inform, Educate, and Engage Stakeholders, the Public, and Decision Makers in Addressing Ocean Acidification</th>
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<td>Identify key findings for use by the Governor, Panel members, and others who will act as ambassadors on ocean acidification. <em>(Action 8.1.1)</em></td>
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<td>Increase understanding of ocean acidification among key stakeholders, target audiences, and local communities to help implement the Panel’s recommendations. <em>(Action 8.1.2)</em></td>
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<td>Provide a forum for agricultural, business, and other stakeholders to engage with coastal resource users and managers in developing and implementing solutions. <em>(Action 8.1.4)</em></td>
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<td>Maintain a Sustainable and Coordinated Focus on Ocean Acidification</td>
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Scientific Summary of Ocean Acidification in Washington State Marine Waters

Editors

Richard A. Feely  NOAA Pacific Marine Environmental Laboratory
Terrie Klinger  University of Washington School of Marine & Environmental Affairs
Jan A. Newton  University of Washington Applied Physics Laboratory
Meg Chadsey  Washington Sea Grant

November 2012
Sweetening the Waters

The Feasibility and Efficacy of Measures to Protect Washington’s Marine Resources from Ocean Acidification

By Eric Scigliano
November 2012

An analysis commissioned by the Global Ocean Health Program, a joint project of the National Fisheries Conservation Center and the Sustainable Fisheries Partnership, to assist the Washington State Blue Ribbon Panel on Ocean Acidification and citizens seeking options to tackle the problem.
WHEREAS, the acidification of the world’s oceans, measured by the lowering of pH numbers and caused primarily by increasing levels of carbon dioxide in the atmosphere, has arrived on the West Coast sooner than predicted and is already reaching levels that are corrosive for shellfish and other marine organisms; and

WHEREAS, Washington’s marine waters are particularly vulnerable to ocean acidification because they experience the effects of global carbon dioxide absorbed by the oceans in addition to regional and local factors. One of the most important regional factors is coastal upwelling, which occurs when strong northerly winds blow across the Pacific Ocean, bringing deeper water up to the surface, along the Washington coast, into coastal estuaries like Willapa Bay and Grays Harbor, and the Puget Sound basin. Today’s upwelled water is rich in carbon dioxide and low in pH and oxygen, and was in contact with the atmospheric concentration of carbon dioxide from 30 to 50 years ago, meaning we will continue to see acidification for several decades after global carbon dioxide emissions begin to fall; and

WHEREAS, acidification near the coasts, and particularly in highly populated and developed areas, is often exacerbated by local sources of pollutants, such as nutrients and organic material, that generate additional carbon dioxide in marine waters; and

WHEREAS, between 2005 and 2009, the Pacific Northwest oyster hatcheries experienced disastrous production failures when billions of their youngest oysters, the larvae, died due to acidified seawater that dissolved shells or prevented their formation; and

WHEREAS, Washington is the country’s top provider of farmed oysters, clams, and mussels. Our shellfish growers employ directly and indirectly more than 3,200 people around the state and provide an annual total economic contribution of $270 million statewide. The increasing levels of acidification in Washington’s marine waters pose serious and immediate threats to our shellfish resources, and the revenue and jobs supported by the shellfish industry; and

WHEREAS, ocean acidification has important implications to Washington’s tribal communities and fishermen who increasingly depend on shellfish species to support their families; and

WHEREAS, increasing levels of acidity also have implications for the broader marine ecosystem because many organisms that are important food sources for species such as salmon, whales, and seabirds are dependent on their ability to form and maintain shells, skeletons, or other hard parts; and
Passed legislature June 2013

Creates the Washington Marine Resources Advisory Council in Governor’s office

- Sustainable coordinated focus to address the impacts of ocean acidification
- Advise and work with the UW Ocean Acidification Center on effects and sources of ocean acidification
- To deliver recommendations to the Governor and Legislature
- To seek public and private funding to assist in effort
- To do outreach and education on ocean acidification
University of Washington
Ocean Acidification Center

- Created by Legislature in June 2013
- Five priority actions:
  - Water quality monitoring at the six existing shellfish hatcheries and rearing areas
  - Expanded and sustained ocean acidification monitoring network
  - Establish the ability to make short-term forecasts of corrosive conditions
  - Laboratory studies to assess the direct causes and effects of ocean acidification
  - Investigate and develop commercial-scale water treatment methods or hatchery designs
Governor Inslee’s Executive Order 14–04

**Carbon Emissions Reduction Taskforce**
Convene a taskforce to make recommendations for a carbon emissions reduction program for consideration during 2015 legislative session.

**Coal-Fired Electricity Transition**
Work with private utilities and federal agencies to facilitate the transition from coal to cleaner electricity sources.

**Energy Efficiency**
Focus on saving costs and reducing emissions from buildings by improving their efficiency and taking advantage of clean power.

**Governor Inslee’s Climate Executive Order**

“This is the right time to act. This is the right place. And we are the right people to make this happen.”
– Gov. Inslee, April 29, 2014

**Clean Technology**
Develop a new state program to support renewable energy and energy efficiency technology innovation in the public and private sectors.

**Clean Transportation**
Decide how to accelerate our use of clean cars and clean fuels, and reduce transportation emissions.

#ActOnClimate
bit.ly/ClimateWA
“It used to be the canary in the coal mine” Mr. Inslee said in a recent interview. “Now it’s the oyster in the half shell. You can’t overstate what this means to Washington.”
Conducted a climate forum for shellfish growers at the 9/22/14 Annual General Meeting

Engaging with broader business community

Signed onto Washington Business Climate Declaration

Yesterday met with Governor’s Chief Of Staff and climate policy team
Washington State’s OA webpage:

UW Ocean Acidification Center webpage:
http://coenv.washington.edu/research/major-initiatives/ocean-acidification/

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Questions?