Oysters and Ocean Acidification in the Pacific Northwest

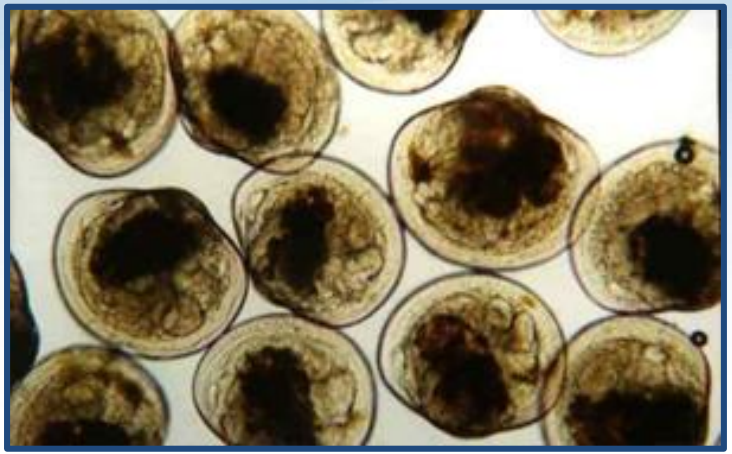
CHE Webinar September 18, 2014

Presented by Dr. Simone Alin

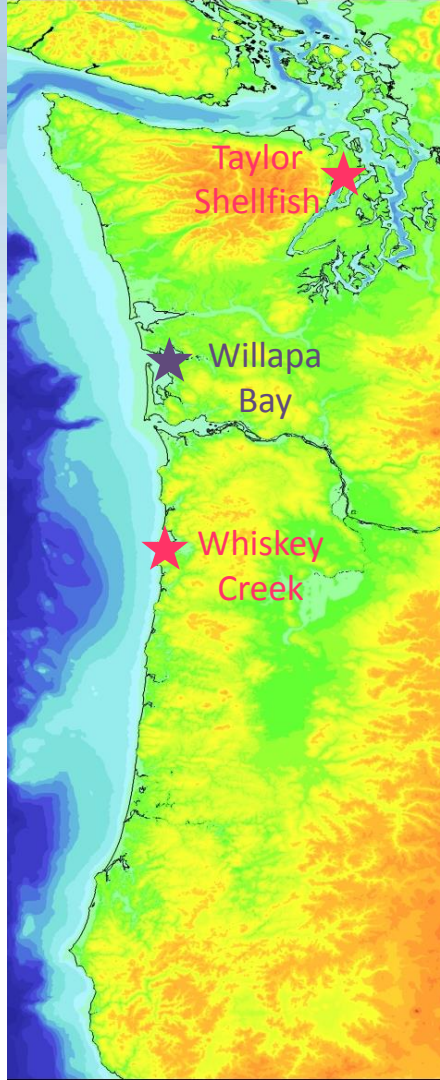
NOAA OCEAN ACIDIFICATION PROGRAM

Pacific Northwest hatchery failures

Relevance



Photos: Taylor Shellfish



"Between 2005 and 2009, disastrous production failures at Pacific Northwest oyster hatcheries signaled a shift in ocean chemistry that has profound implications for Washington's marine environment."

Washington Blue Ribbon Panel on Ocean Acidification 2012

Ocean Acidification (OA) Chemistry 101

CO_2

$CO_2 + H_2O \rightarrow H_2CO_3$

carbon dioxide

water

carbonic acid

$H_2CO_3 \rightarrow H^+ + HCO_3^-$

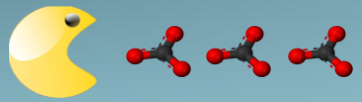
hydrogen ion (pH)

bicarbonate ion

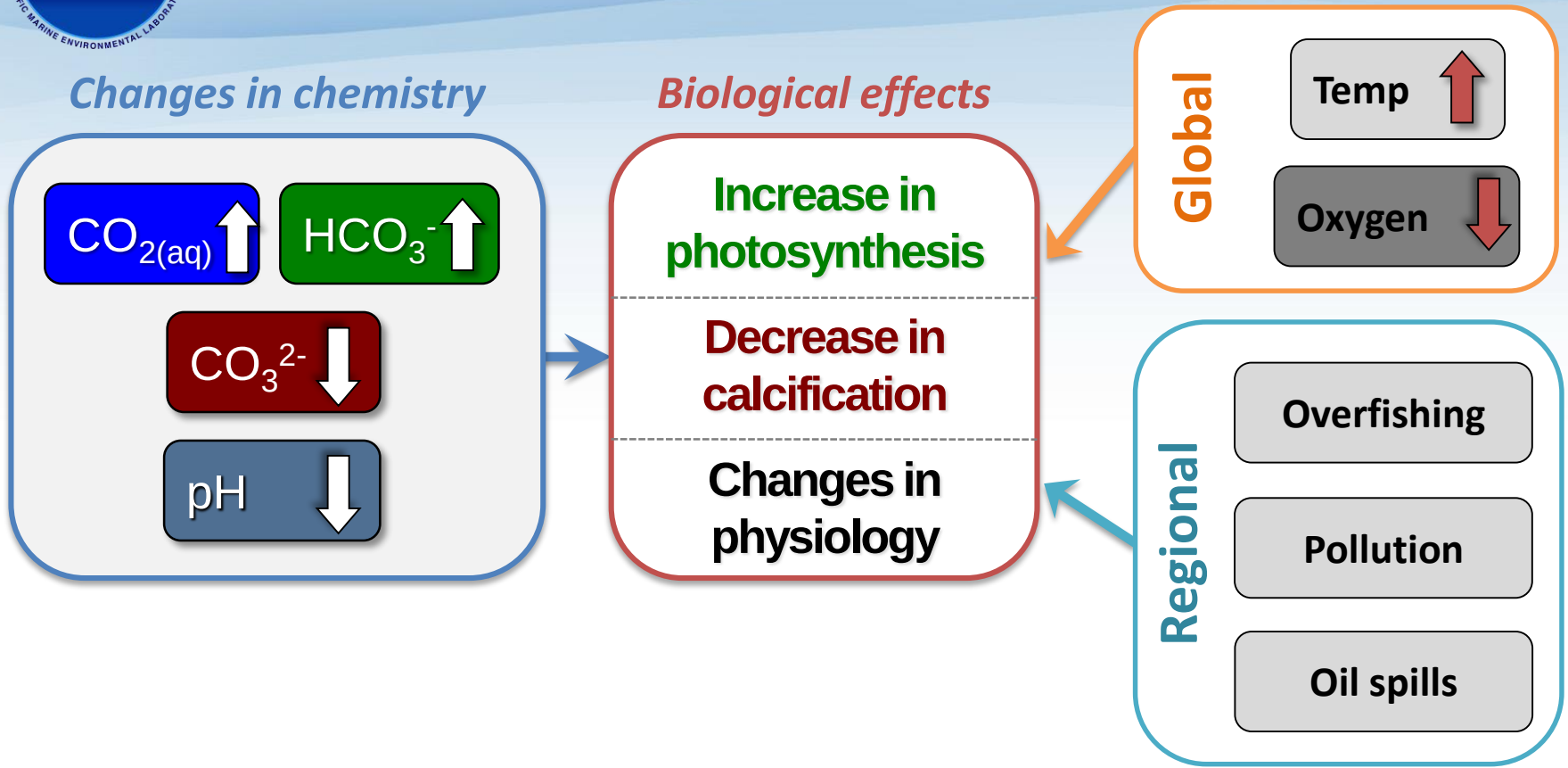
$H^+ + CO_3^{2-}$

carbonate ion

calcium carbonate saturation state (Ω)



How CO_2 in seawater affects marine life



Socioeconomic implications of ocean acidification

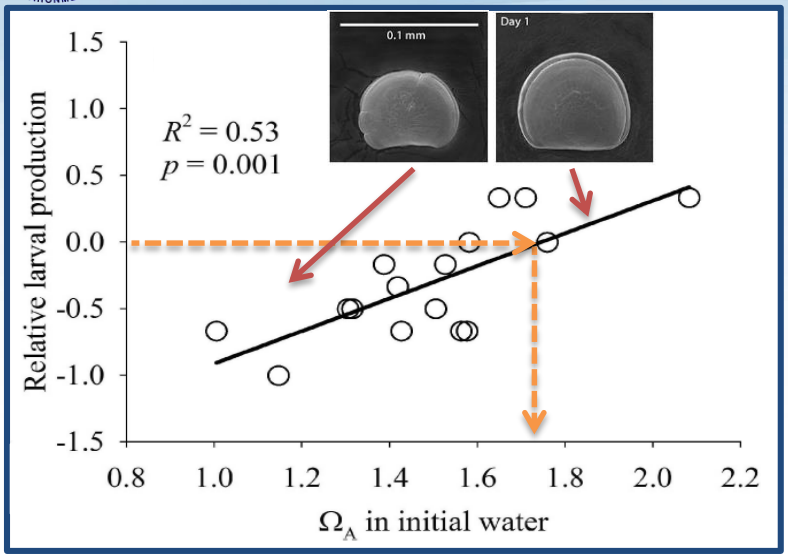
In Washington State alone:

- The shellfish aquaculture industry is worth $270 million per year and employs more than 3,200 people.
- Recreational shellfish harvesting contributes another $30 million per year to the state.
- The seafood industry generates 42,000 jobs and contributes $1.7 billion to gross state product.
- Shellfish are an important natural resource and of cultural importance to Washington's tribal communities.

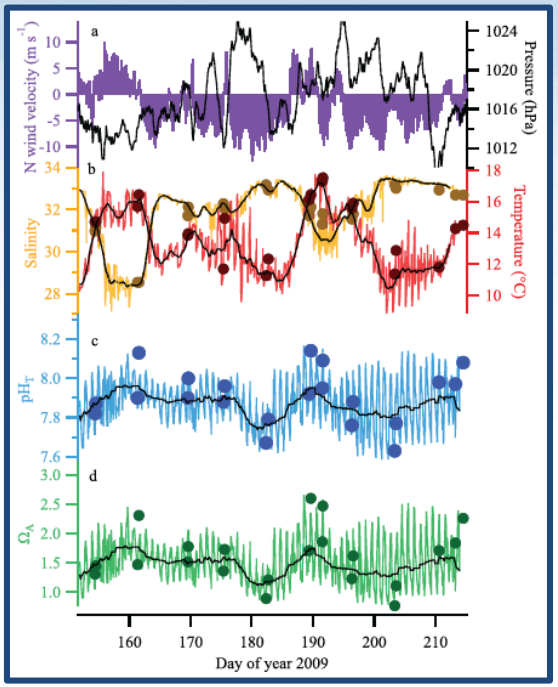
Washington Blue Ribbon Panel on Ocean Acidification 2012

Oyster production declines with elevated CO_2

Quality



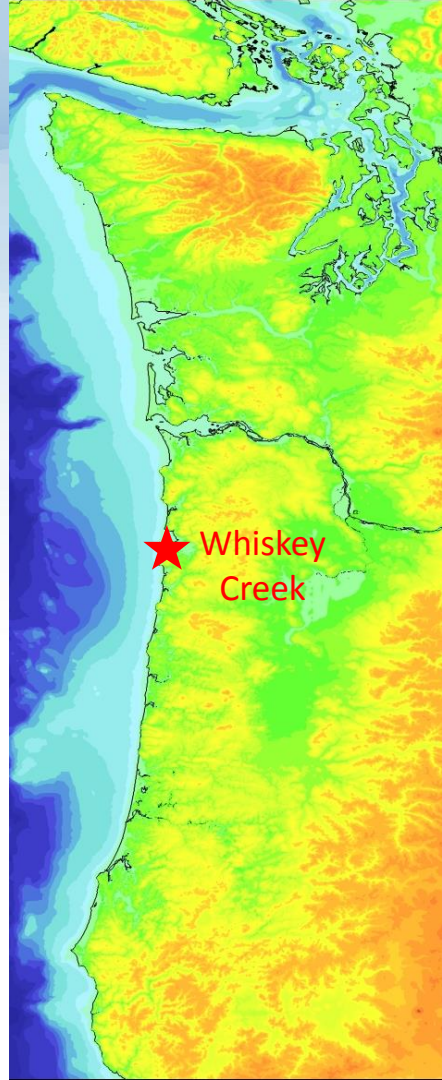
Photos: G. Waldbusser, E. Brunner



Barton et al. 2012

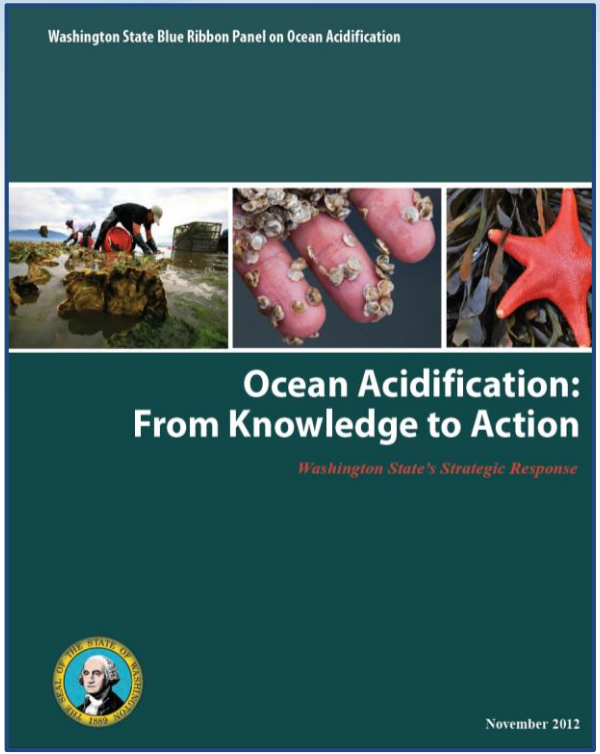
Key outcomes:

- Break-even point identified between net growth and mortality.
- Larvae have smaller shells with signs of dissolution at lower saturation states.
- Monitoring at hatcheries facilitates adaptation strategies.



Policy linkages from shellfish-science partnership

Performance



- **Washington State Blue Ribbon Panel on Ocean Acidification** – Outgrowth of partnership with shellfish growers (2011–2012)
- **West Coast OA & Hypoxia Science Panel** – California, Oregon, Washington, and British Columbia (2013–present)

The West Coast Ocean Acidification & Hypoxia Science Panel

Linkages to human health and food security

- **Food security** – Over 1 billion people derive all their dietary protein directly from the ocean.

- **Changing CO_2 and nutrient conditions**
  - Elevated CO_2 plus nutrient limitation can lead to increased toxin production in harmful algal bloom species.
  - Changes in carbon chemistry may also drive changes in phytoplankton community composition and thus food quality for higher trophic levels.