MRAC and Ocean Acidification in Washington

Presentation to WCMAC
Aberdeen, WA
June 13, 2018

MARINE RESOURCES ADVISORY COUNCIL

What we'll cover

- **Overview of MRAC**

  Martha Kongsgaard,
  Marine Resources Advisory Council

- **Status of OA science**

  Dr. Jan Newton, Washington Ocean Acidification Center

- **Agency-related OA work**

  Dr. Kirsten Feifel (DNR)

  Rich Childers (WDFW)

Overview of MRAC

Martha Kongsgaard
Chair, Marine Resources Advisory Council

How it all started


Photo credit: Benjamin Drummond / benjandsara.com

Between 2005 and 2009, billions of oyster larvae mysteriously died at major commercial Pacific Northwest oyster hatcheries.

How it all started

In response, Governor Gregoire and the Washington State Legislature established:

- 2012: Washington State Blue Ribbon Panel on Ocean Acidification
- 2013: Washington Ocean Acidification Center (WOAC)
- 2013: Marine Resources Advisory Council (MRAC)

….to ensure Washington state addresses **ocean acidification** in a strategic and comprehensive way

MRAC basics

- Acts as a state body to maintain a sustainable coordination focus on ocean acidification
- Membership includes:
  - Legislative, executive, and elected officials
  - NGOs
  - Private sector
- Participation also from academic institutions and federal agencies
- Meets quarterly


Photo credit: Bill Dewey

Who we are

MRAC Chair: Martha Kongsgaard

Current Members:

Brian Allison, Puget Sound Commercial Crab Assoc.
Maia Bellon, Ecology
Mike Cassinelli, City of Ilwaco
Mark Clark, WA State Conservation Commission
Rich Childers, WDFW
Mindy Roberts, Washington Environmental Council
Garrett Dalan, WCMAC
Tom Davis, Washington State Farm Bureau
Bill Dewey, Taylor Shellfish Farms
Norm Dicks, Van Ness Feldman LLP
Tony Floor, Northwest Marine Trade Association
Hilary Franz, DNR
Gus Gates, Surfrider Foundation
Lisa Graumlich, UW College of the Environment
The Honorable Dave Hayes, WA State House of Representatives
Libby Jewett, NOAA
Jay Manning, Puget Sound Partnership
Nan McKay, Northwest Straits Commission
Erika McPhee-Shaw, Western Washington Univ.
The Honorable Kevin Ranker, WA State Senate
Marilyn Sheldon, Coastal Shellfish Grower
Douglas Steding, Assoc. of WA Business
Terry Williams, Tulalip Tribes of Washington

What we do

- Ensure OA work is efficient, leveraged, and integrated into key programs across the state
- Coordinate with WOAC to ensure science is at the heart of everything we do
- Deliver recommendations to the Governor and Legislature on OA
- Seek public and private funding to support recommendations
- Assist in conducting OA outreach activities

Similarities/differences with WCMAC

Similarities

- Created by state Legislature in 2013
- Made up of diverse group of stakeholders, with overlapping membership
- Address climate change impacts to marine resources

How MRAC differs

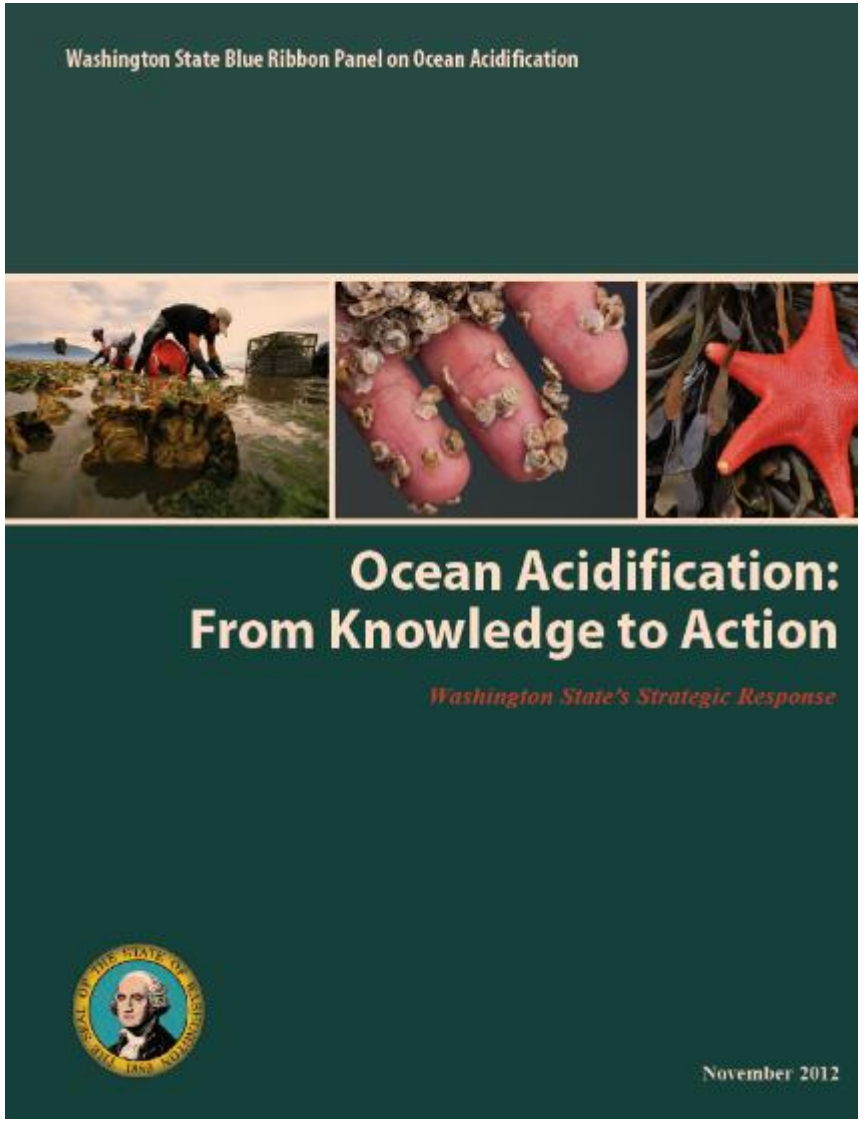
- Uniquely focused on ocean acidification
- Not involved in marine spatial planning
- Engaging efforts across Puget Sound as well as the Washington coast

Photo credit: Northwest Straits Commission

MRAC's guiding strategy

Blue Ribbon Panel Report *Ocean Acidification: From Knowledge to Action* from 2012

- Comprehensive strategy for addressing OA in WA
- First of its kind
- Recommends 42 actions across six focus areas



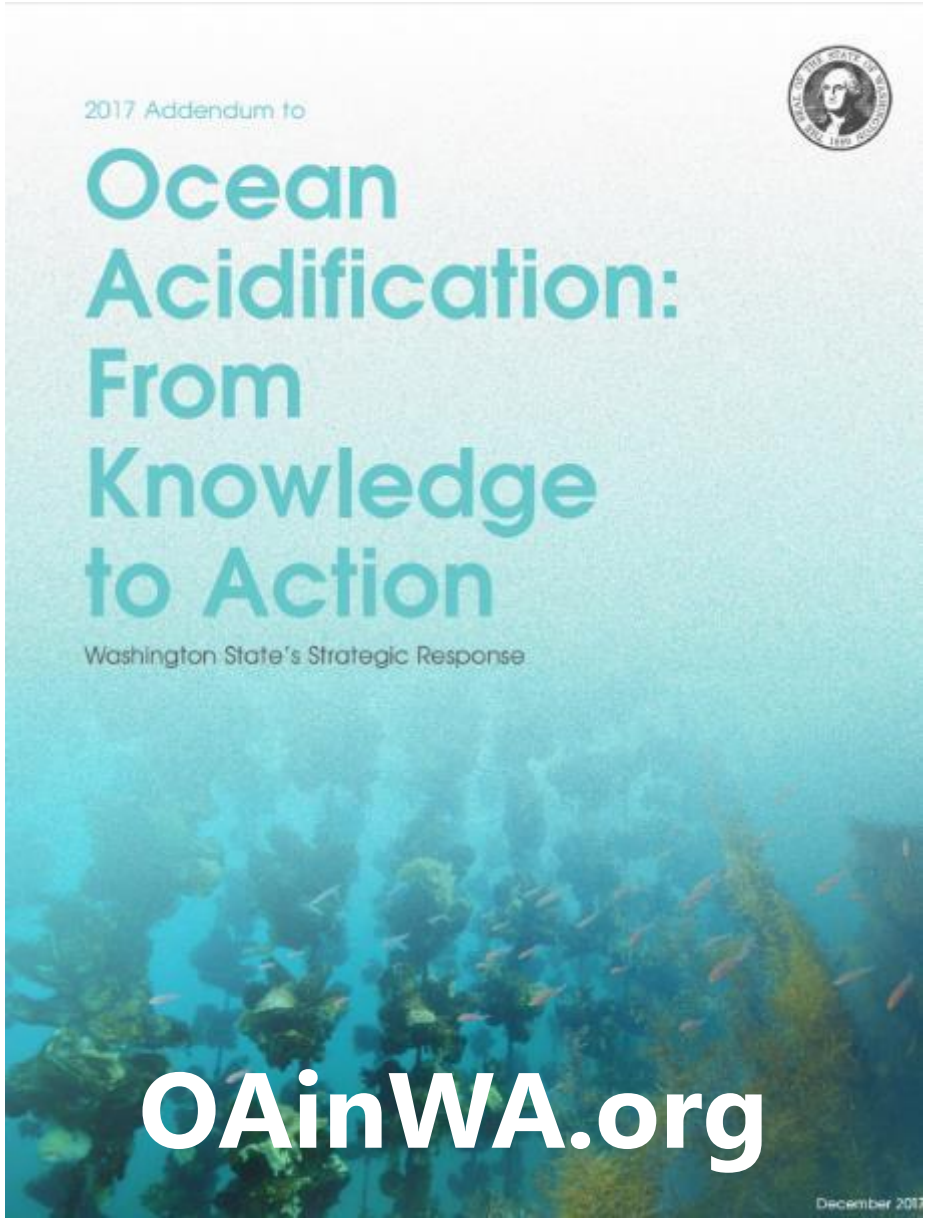
The comprehensive strategy

- Reduce carbon emissions
- Reduce local land-based contributions
- Increase our ability to adapt and to remediate impacts
- Invest in monitoring and scientific investigations
- Inform, educate, and engage stakeholders, the public, and decision makers
- Maintain a sustainable and coordinated focus

Recent update to the strategy

2017 Addendum to the Blue Ribbon Panel Report

- Learns from emerging science
- Incorporates new management needs
- Highlights opportunities for action



Partners leading efforts across the globe

Photo credits: International Alliance to Combat Ocean Acidification

What's next

Overarching priorities include:

- Biological investigations
- Bolster efforts to reduce local nutrient sources
- Build on monitoring efforts
- Build additional adaptation tools (e.g., kelp cultivation and eelgrass restoration)
- Support statewide carbon reduction efforts
- Other needs identified in natural resource managers' survey

Currently engaging members in developing budget priorities for the 2019-2021 biennium

How can WCMAC help?

- Elevate OA as a issue of concern among coastal stakeholders
- Let us know about how you might like to collaborate

Status of OA science

Dr. Jan Newton
Washington Ocean Acidification Center

Some of our partners:

Washington waters are particularly vulnerable to ocean acidification

Ocean acidification is appearing in Washington decades ***sooner*** than anticipated.

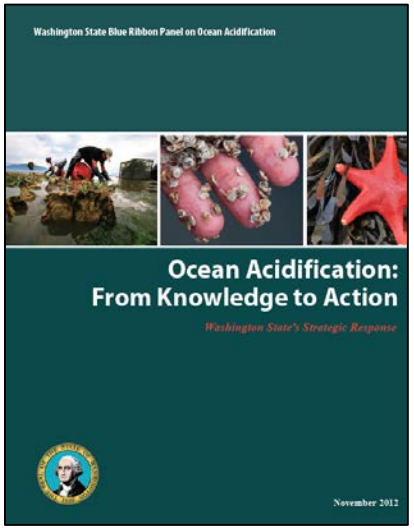
Regional factors can exacerbate acidification caused by global CO_2 emissions:

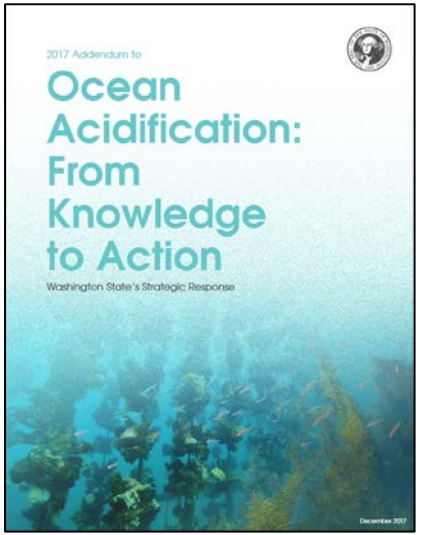
- **Naturally high production with decay of organic matter** in subsurface waters
- **Coastal upwelling** of CO_2-rich waters

Photo: R. McMillan

Washington is at the forefront of taking action

- Convened a **Blue Ribbon Panel**; its Report made actionable recommendations (2012)
- Created a **Marine Resources Advisory Council**, to keep progress going forward (2013)
- Created the **Washington Ocean Acidification Center** at UW for science actions (2013)
- Made an **Addendum** to the Report, to update info (2017)





Six things we know about ocean acidification in Pacific Northwest coastal waters

WOAC
WASHINGTON OCEAN ACIDIFICATION CENTER

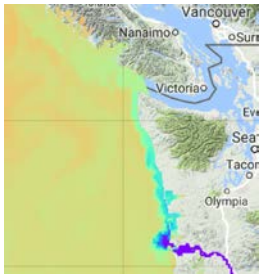
1. **Rising atmospheric CO_2 changes ocean chemistry and negatively impacts shelled organisms.**
2. **Pacific Northwest shellfish are sensitive to reduced calcium carbonate-saturation state within the current range of conditions.**
3. **Natural and anthropogenic contributions are additive.**
4. **Anthropogenic contributions to ocean acidification are detectable and have increased the frequency, intensity, and duration of harmful conditions.**
5. **Small changes in the environment can cause large responses among living organisms.**
6. **Local species are affected**

www.coenv.uw.edu/oacenter

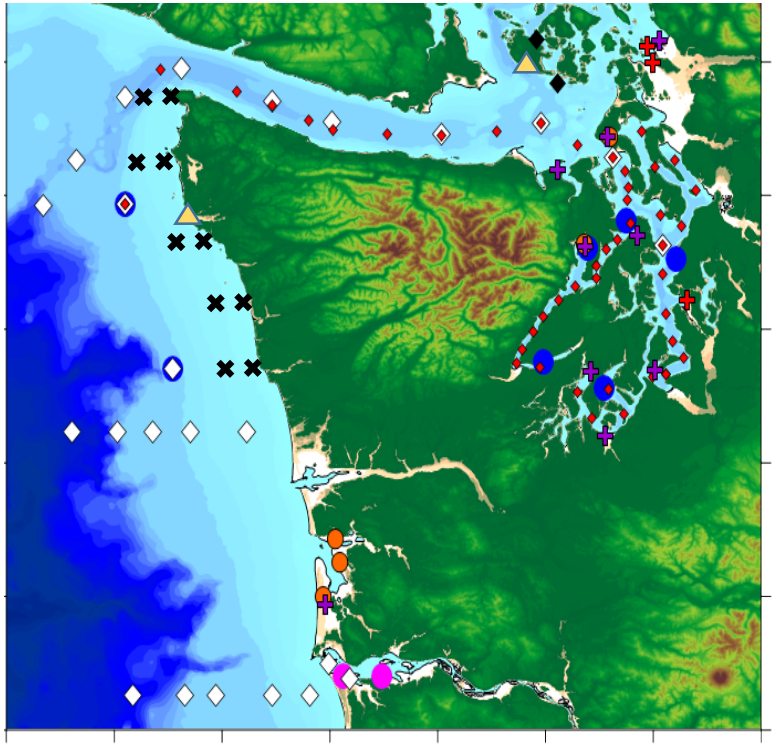
Washington Ocean Acidification Center implementing key BRP recommendations

Coordinates and synthesizes science to:

1. ***Assess water conditions and what's driving ocean acidification***
   - Monitoring (both in natural environment and at shellfish hatcheries)
2. ***Provide forecasts to facilitate adaptation***
   - Forecast modeling
3. ***Assess how local species respond***
   - Biological experiments



WOAC strategies for assessing Washington's waters

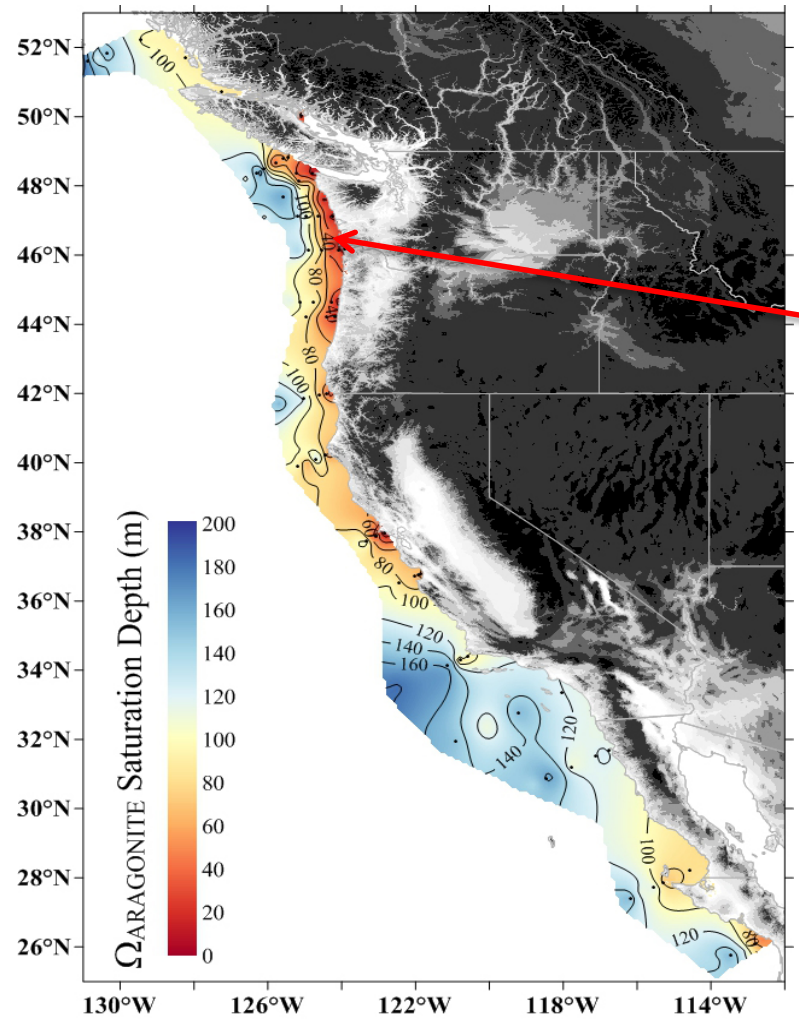


Utilize:

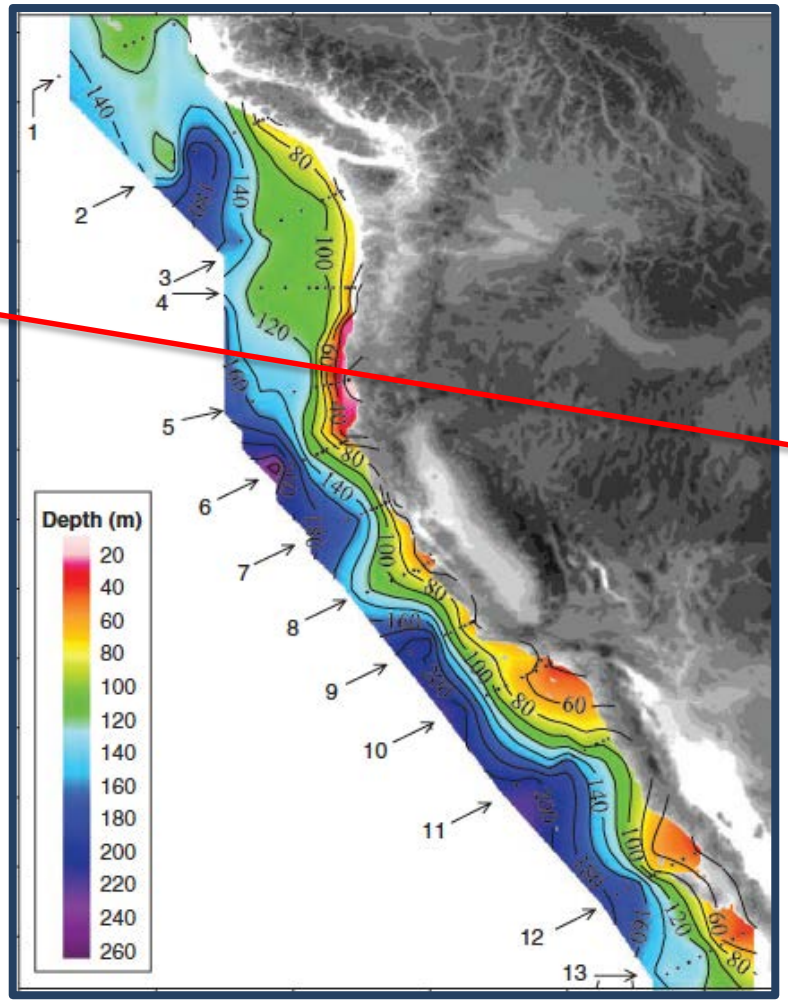
- Both **chemistry** (DIC, TA) and **biology** measurements
- Both **temporal** trends (buoys) & **spatial** coverage (surveys)
- **Leverage** from existing networks

Map: Greeley; Photos: Vander Giessen & USA Today

Aragonite Saturation Depth (m) (2016)



Aragonite Saturation Depth (m) (2007)

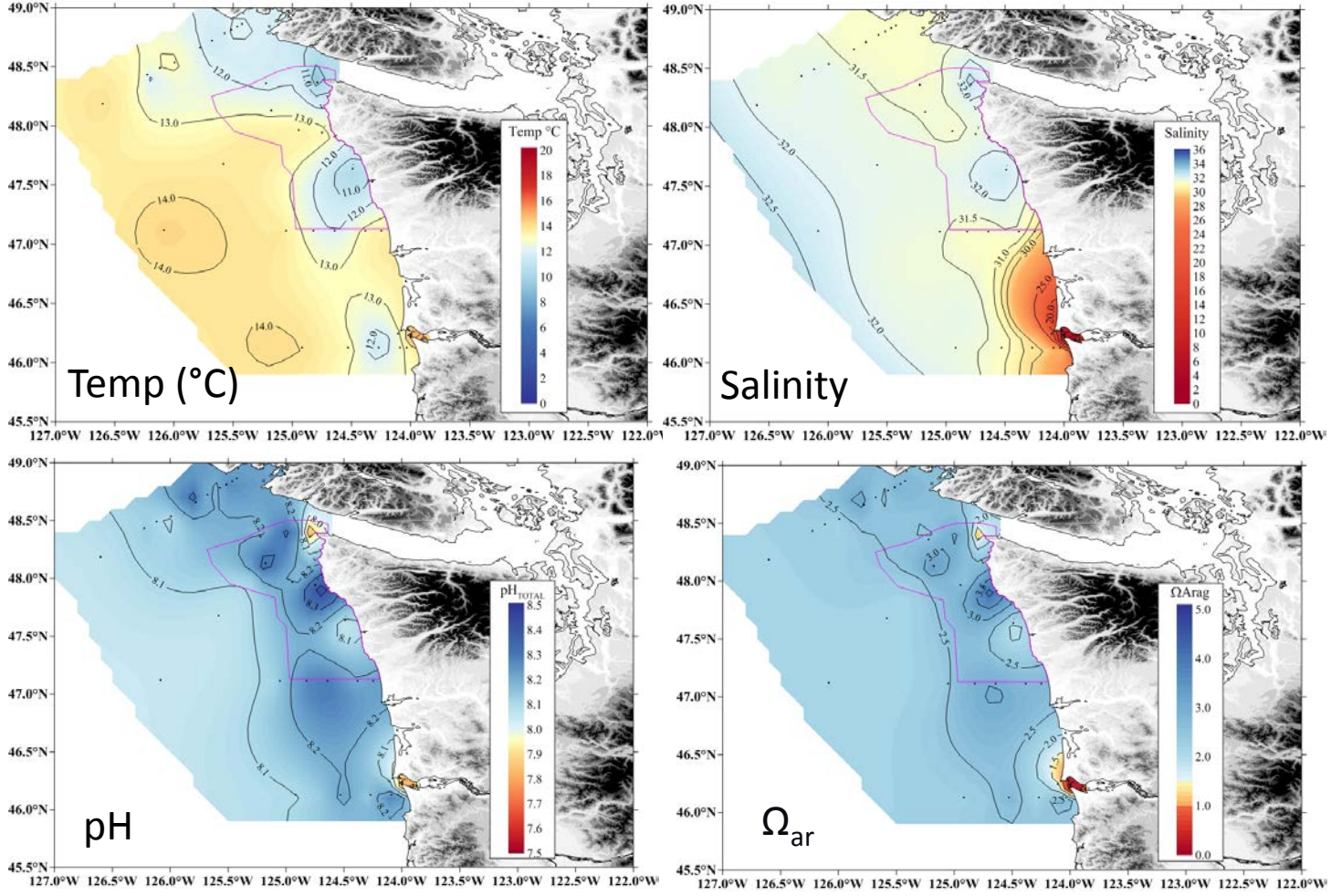


NOAA West Coast Cruise 8 May – 6 June 2016 compared with May-June 2007

Aragonite saturation depth indicates strong upwelling near the coast from northern California to Vancouver Island.

Feely et al (in prep)

Sea surface conditions

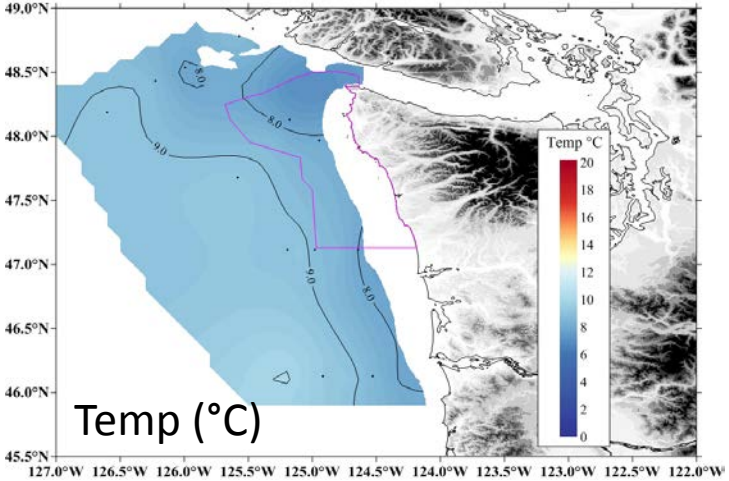


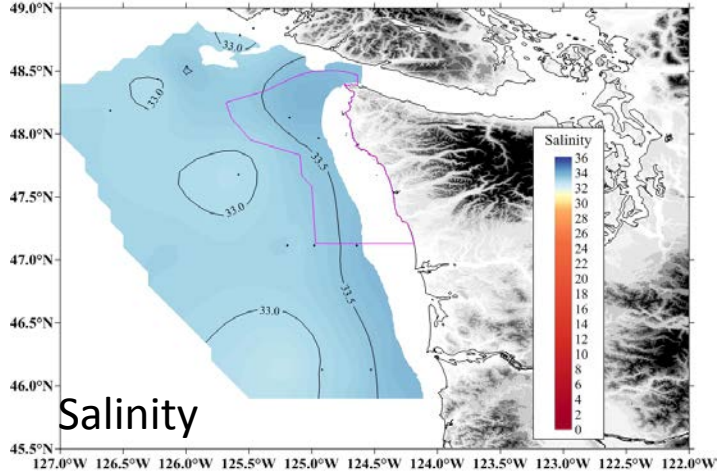
NOAA West Coast Cruise 8 May – 7 June 2016

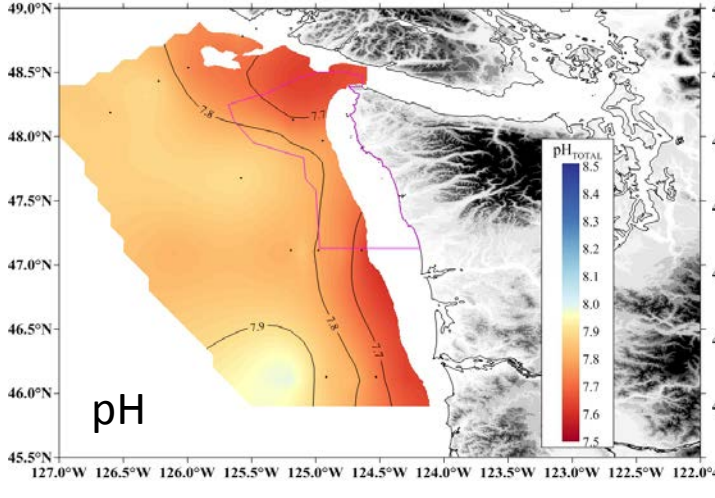
- Temperature data shows warm anomalies and upwelling in PNW
- Salinity data shows Juan de Fuca and Columbia River plumes.
- Chemical data shows upwelling features along the coast.

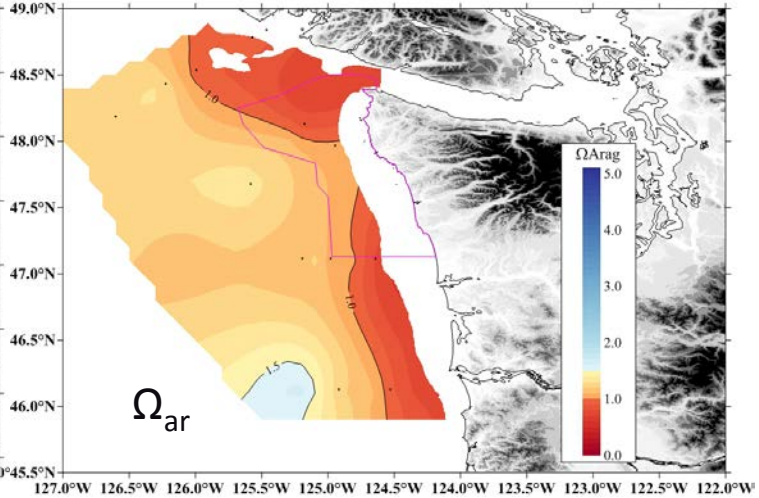
Feely et al (in prep)

80 m conditions







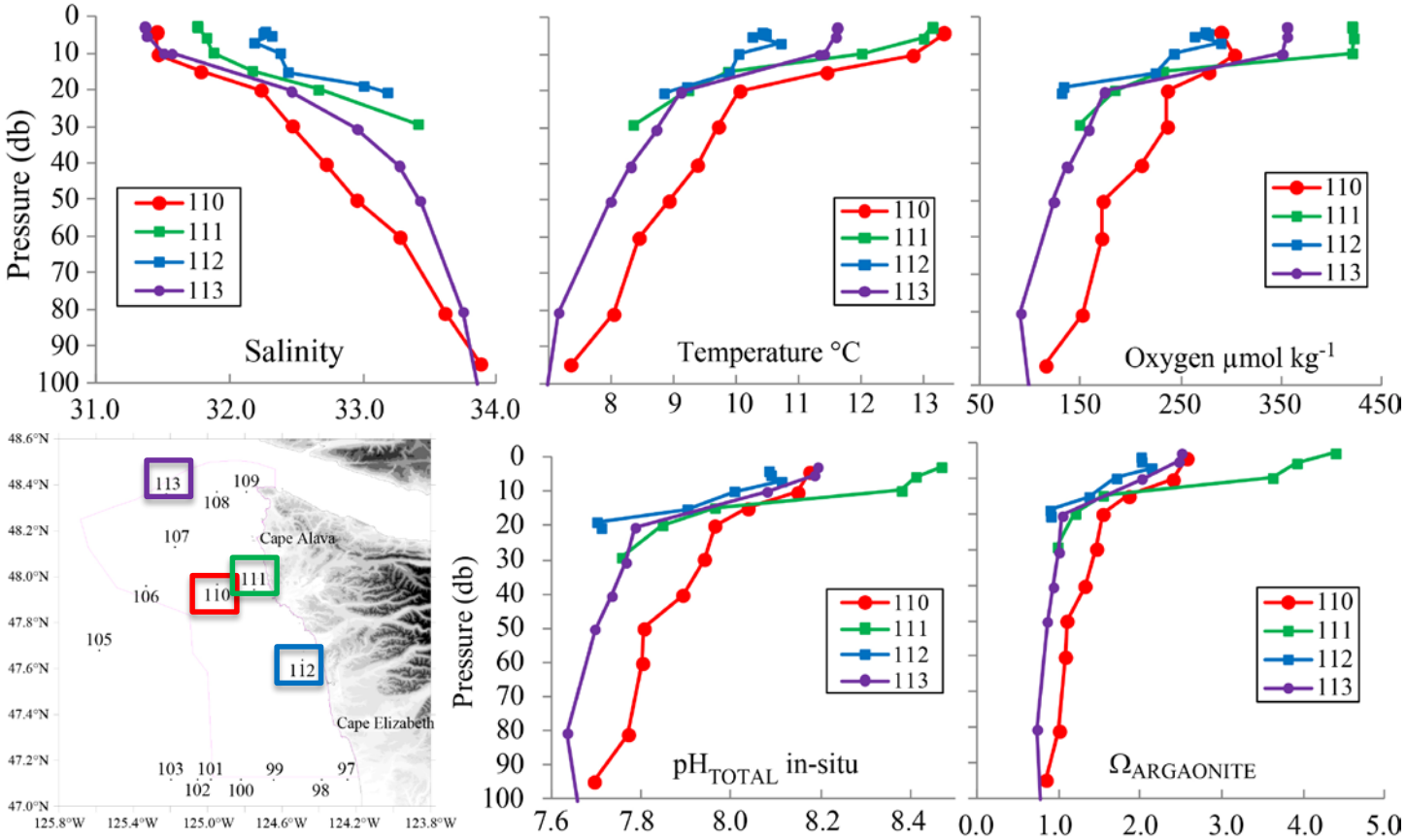


NOAA West Coast Cruise 8 May – 7 June 2016

- Temperature data shows cold upwelling water.
- Salinity data shows salty upwelling water.
- Chemical data shows corrosive waters in upwelling water.

Feely et al (in prep)

Vertical Profiles in Washington Coastal Waters



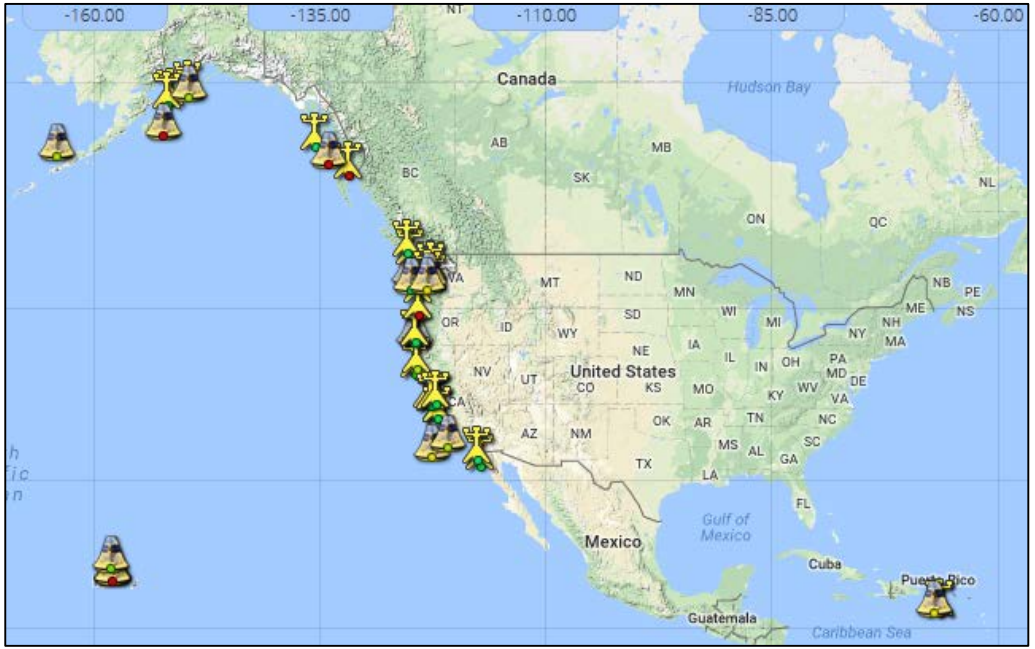
NOAA West Coast Cruise 8 May – 7 June 2016

- Temperature data shows warm anomalies in PNW
- Salinity data shows Juan de Fuca
- Chemical data indicate upwelling events

Feely et al (in prep)

Understanding OA dynamics: chemical and biological observations

www.ipacoa.org

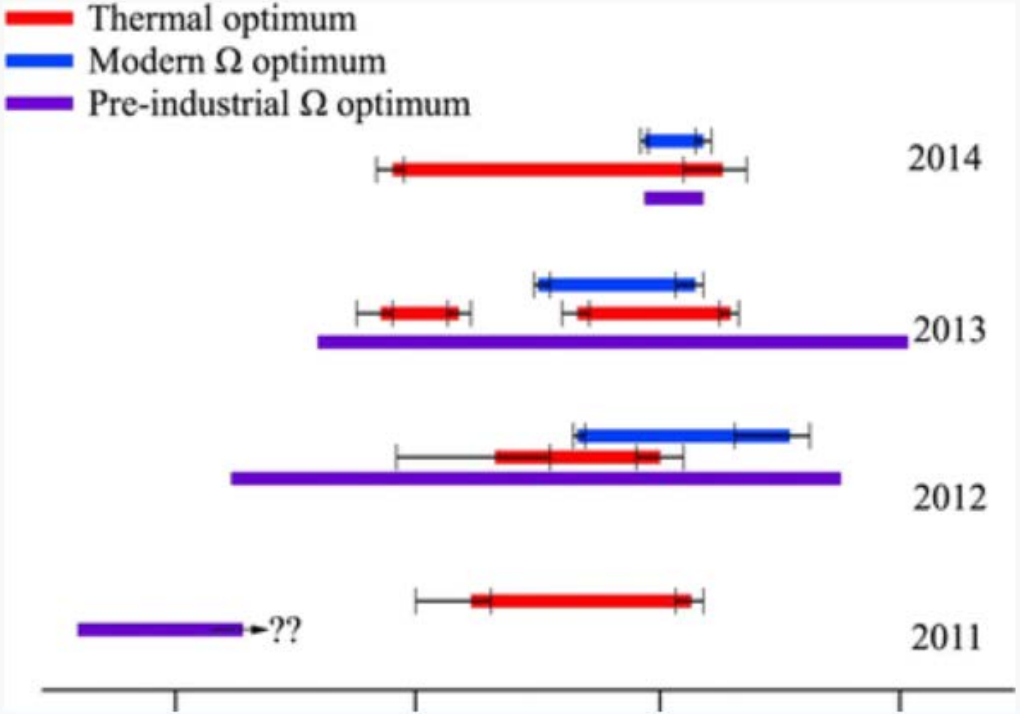


Estuaries and Coasts
January 2017, Volume 40, Issue 1, pp 173–186 | Cite as

The Carbonate Chemistry of the "Fattening Line," Willapa Bay, 2011–2014

Authors | Authors and affiliations

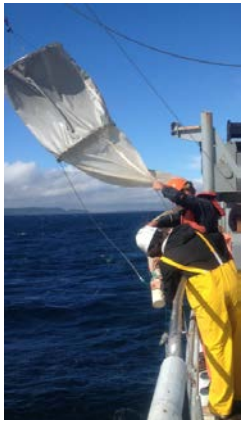
Burke Hales, Andy Suhrbier, George G. Waldbusser, Richard A. Feely, Jan A. Newton

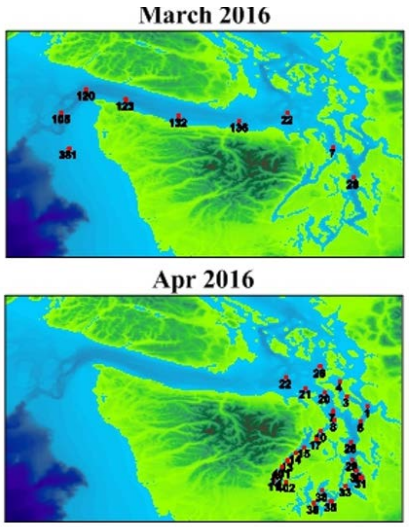


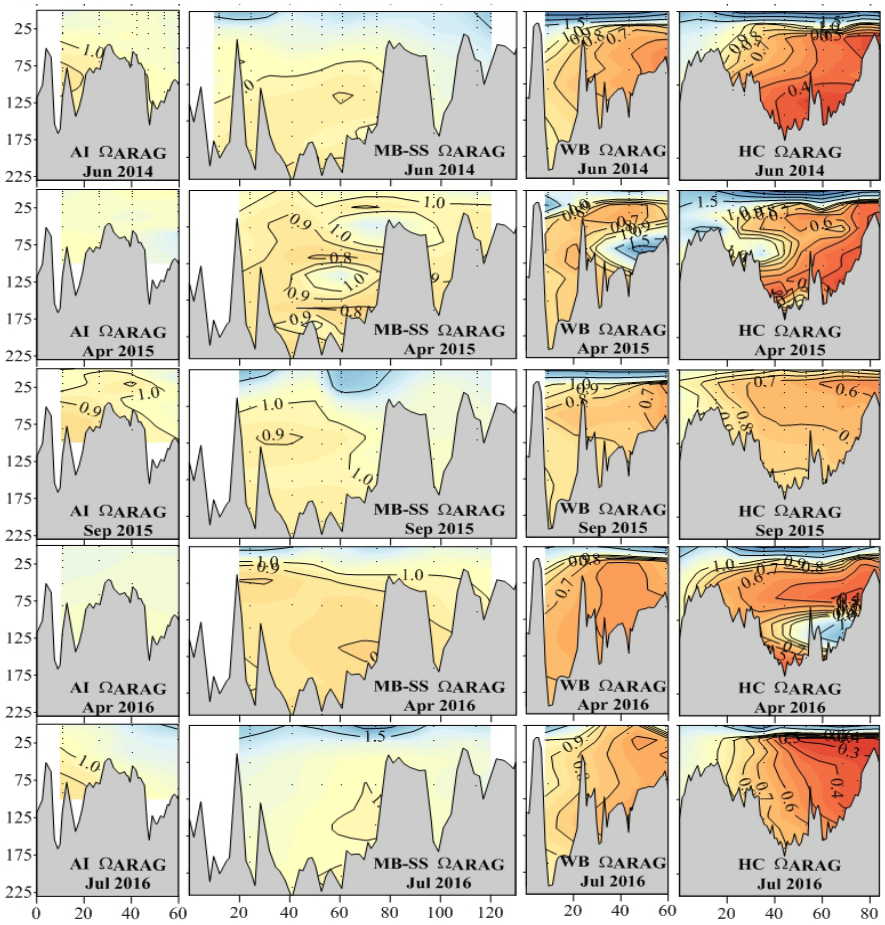
Ship spatial surveys

- Carbon variables
- Water quality
- Plankton:
  phytoplankton,
  microzooplankton,
  macrozooplankton

- First samples 2008
- WOAC since 2014:
  - Seasonal sampling (3x/year)

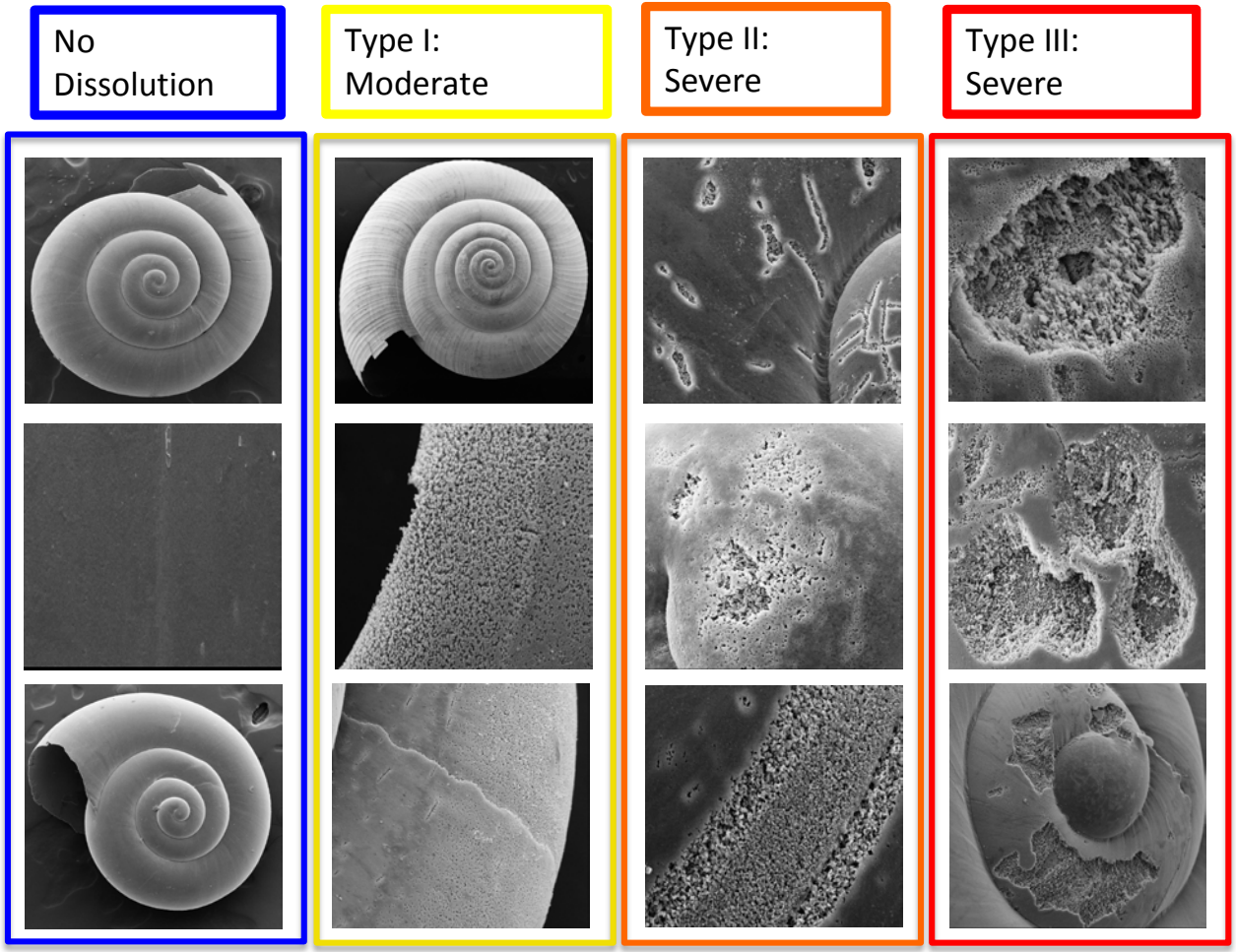






Alin, Newton, and Feely, in prep

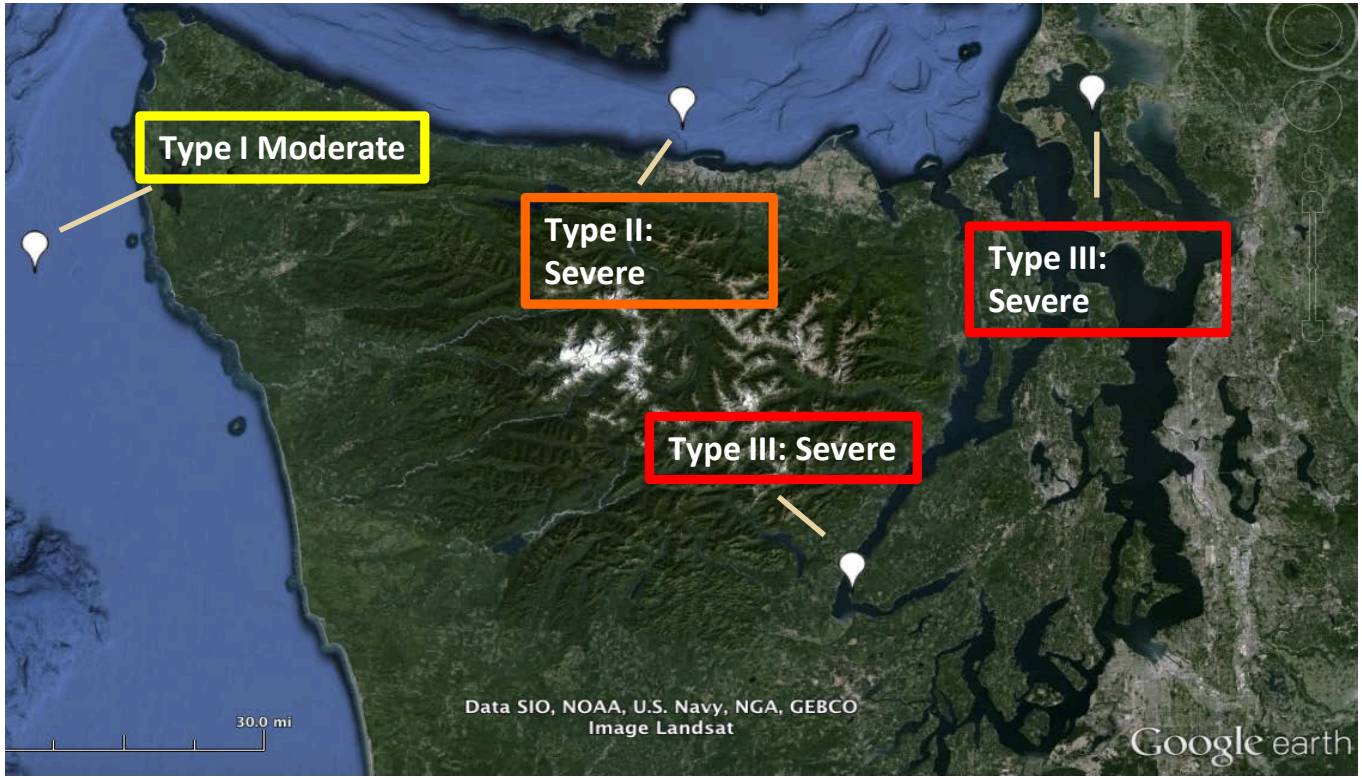
WOAC is using pteropods as bio-indicators:



Images: Bednarsek and Johnson, UW

Pteropod Dissolution Severity
Washington State

Most frequent status, based on Washington OA Center data



Moorings: Addressing temporal variation & drivers

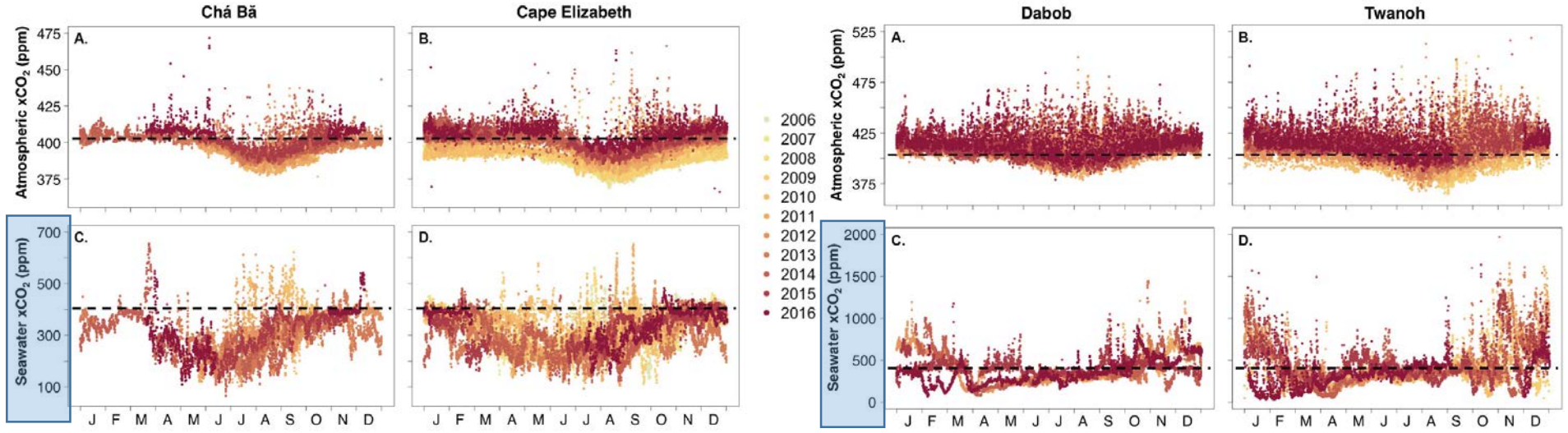
- Water quality
- Carbon variables

- High-frequency sampling (>1x/day)

- First data 2006 (CE); 2009 (Tw)

Mooring analyses: Coast versus Hood Canal

- **Magnitude of variation is different**
  - Range: **151-482** versus **34-1233** *(C Eliz vs. Twanoh, 2016)*
  - St Dev: **64** versus **200** *(C Eliz vs. Twanoh, years 2009-2015)*



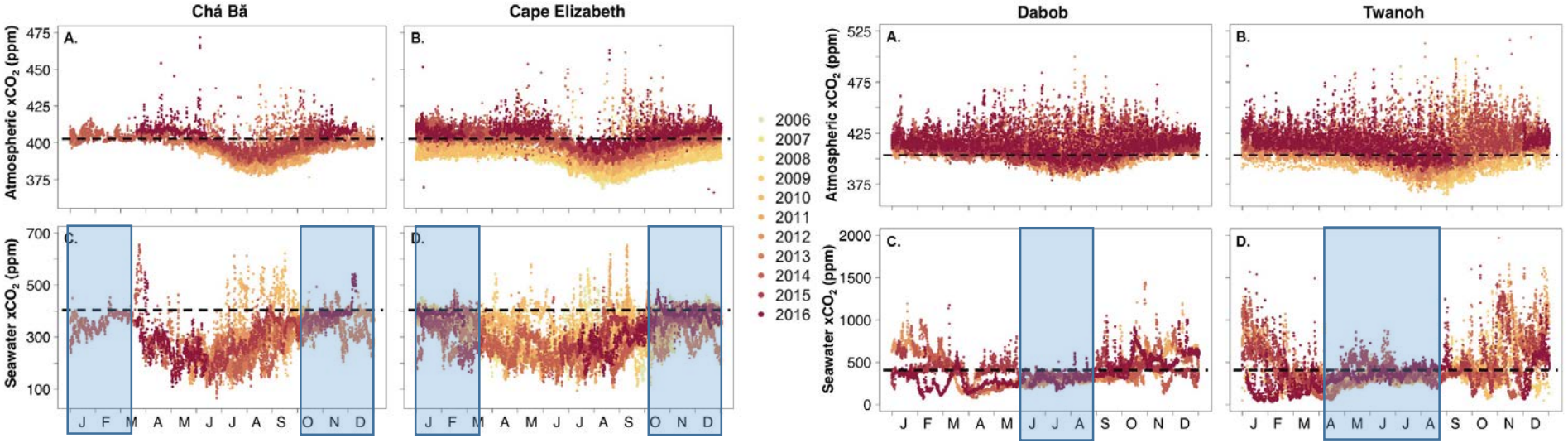
Alin et al., 2017, 2016 PSEMP

Mooring analyses: Coast versus Hood Canal

- **Seasonal pattern of variation is different:**
  - Coast highest variation **during summer**: associated with upwelling
  - Hood Canal highest variation **during winter**: associated with mixing/storms

Range of variation in xCO_2 is less off coast than in Hood Canal; moreover, the seasonal timing of highest variability differs:

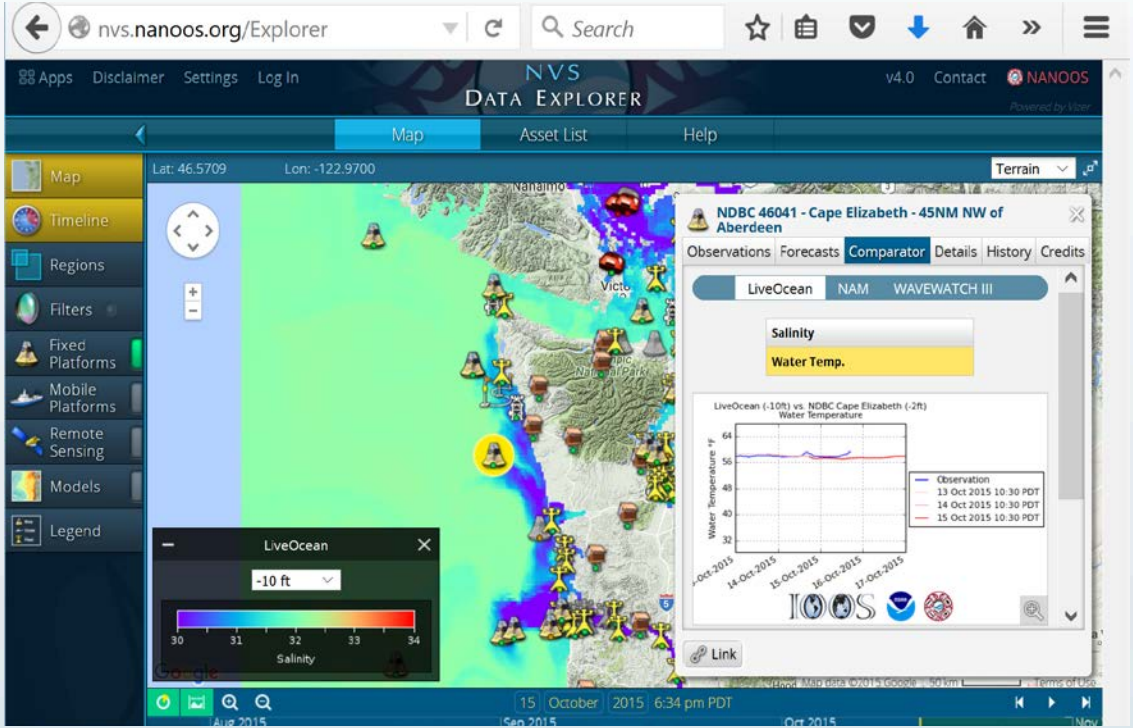
- Coast highest variation **during summer**: associated with upwelling
- Hood Canal highest variation **during winter**: associated with mixing/storms



Though comparing summers alone, Twanoh range is ~200 ppm larger than at C Eliz

Alin et al., 2017 PSEMP

Three-day forecasts to inform shellfish industry and management

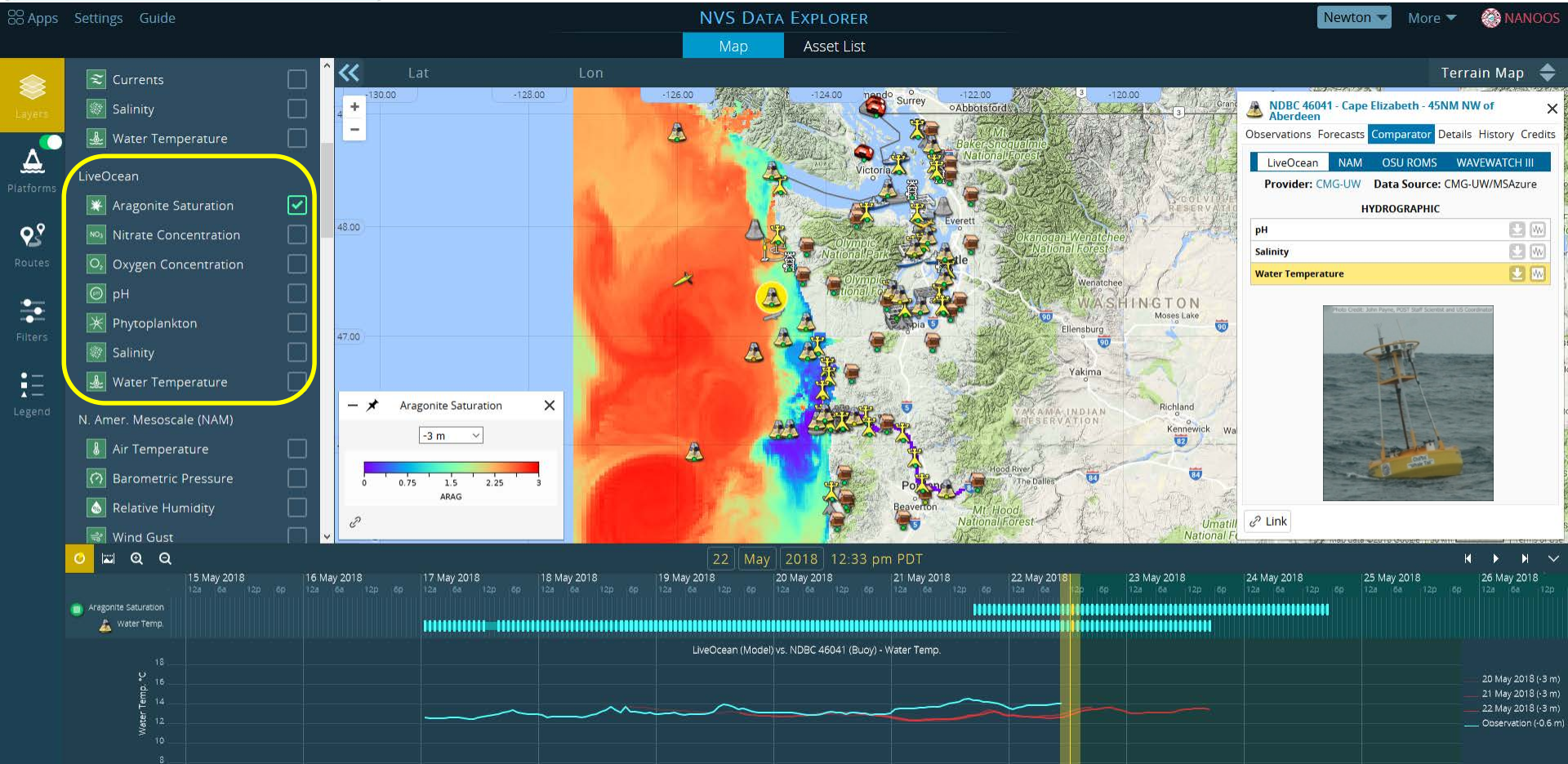


- The ocean acidification community is developing tools to inform managers, industry, policymakers, and the public.
- The LiveOcean "event-scale" model forecasts ocean conditions including temperature, salinity, and chemistry a few days ahead of time (*map colors show modeled surface temperature*).
- NANOOS allows stakeholders (e.g., shellfish growers) to compare current (measured) and forecasted temperature, salinity, and biogeochemistry (oxygen, nitrate, *p*H, Ω_{arag}).

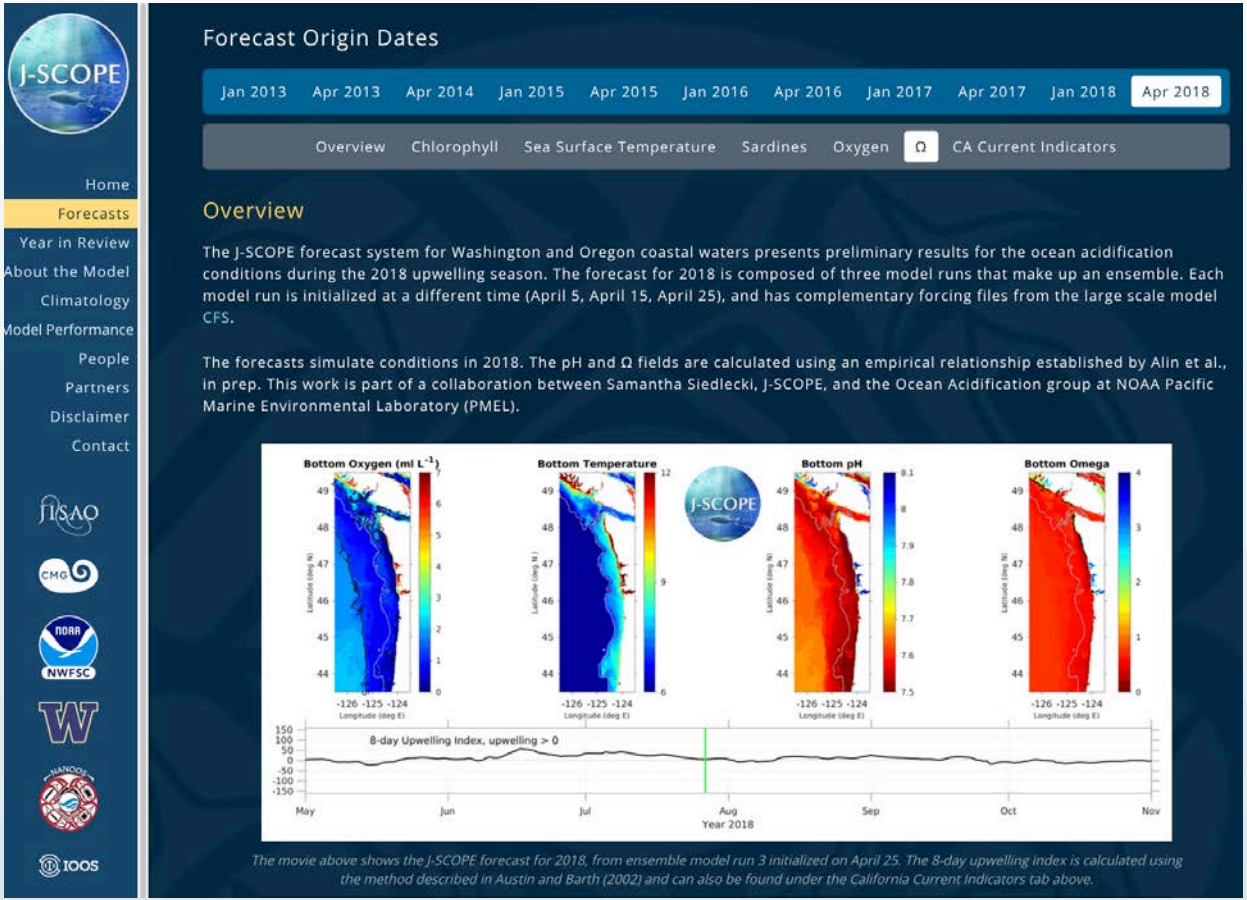
Lead PI: Parker MacCready, U Wash

http://nvs.nanoos.org/ShellfishGrowers

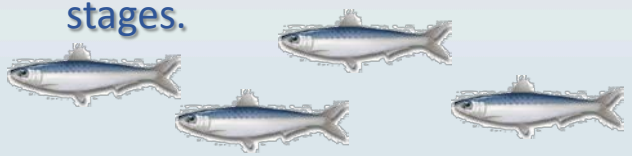
Understanding OA dynamics: observations and forecasts



Seasonal forecasts to inform shellfish industry and management



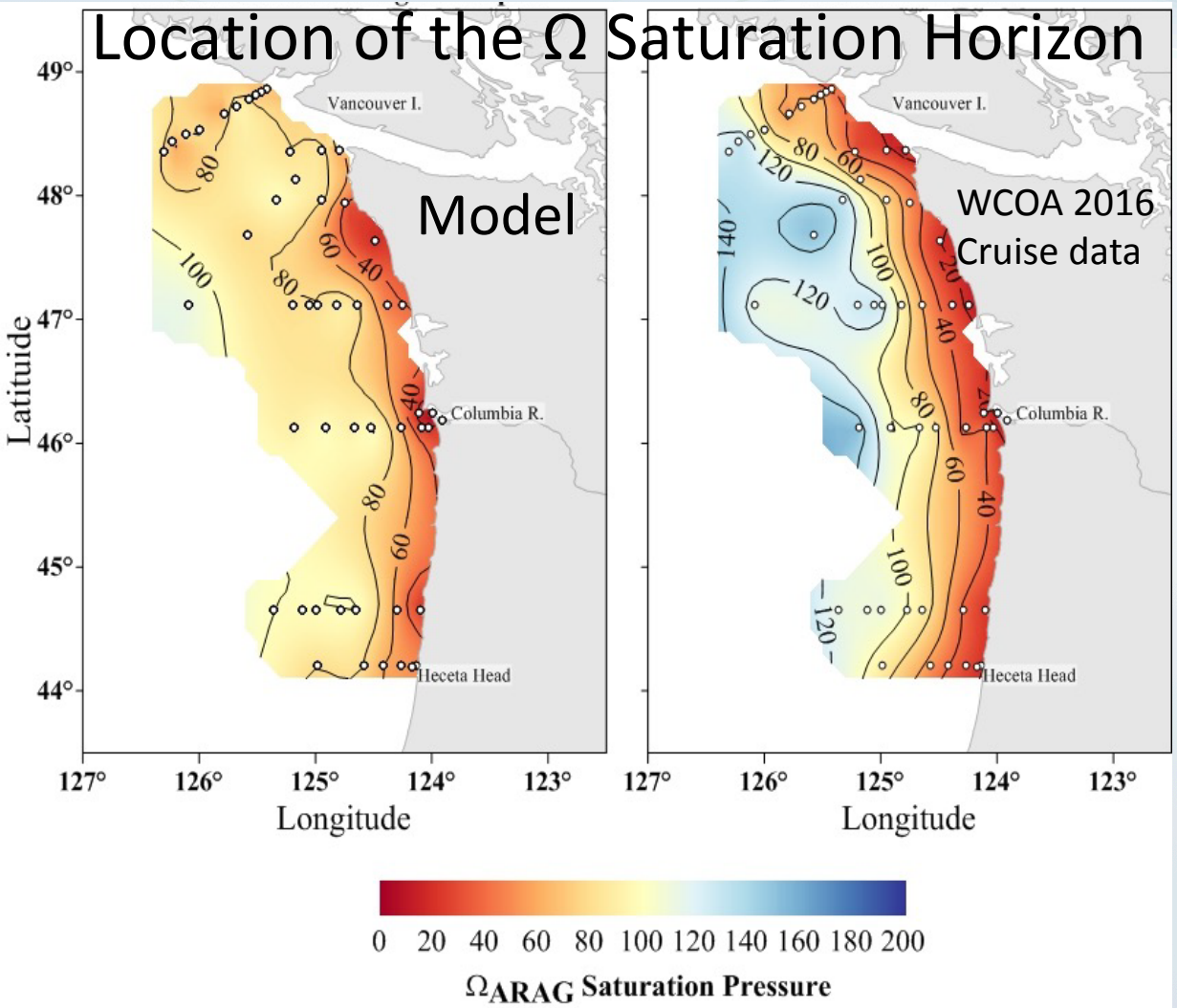
- J-SCOPE seasonal forecast model predicts ocean temperature, salinity, and chemistry six to nine months in advance.
- We are working with tribal and state fishery managers to develop tools relevant to specific fisheries, such as forecasting “optimal windows” for oyster recruitment in Willapa Bay and tools to understand OA impacts on Dungeness crab at various life stages.



Lead PI: Samantha Siedlecki, U Conn

http://www.nanoos.org/products/j-scope/home.php

Location of the Ω Saturation Horizon

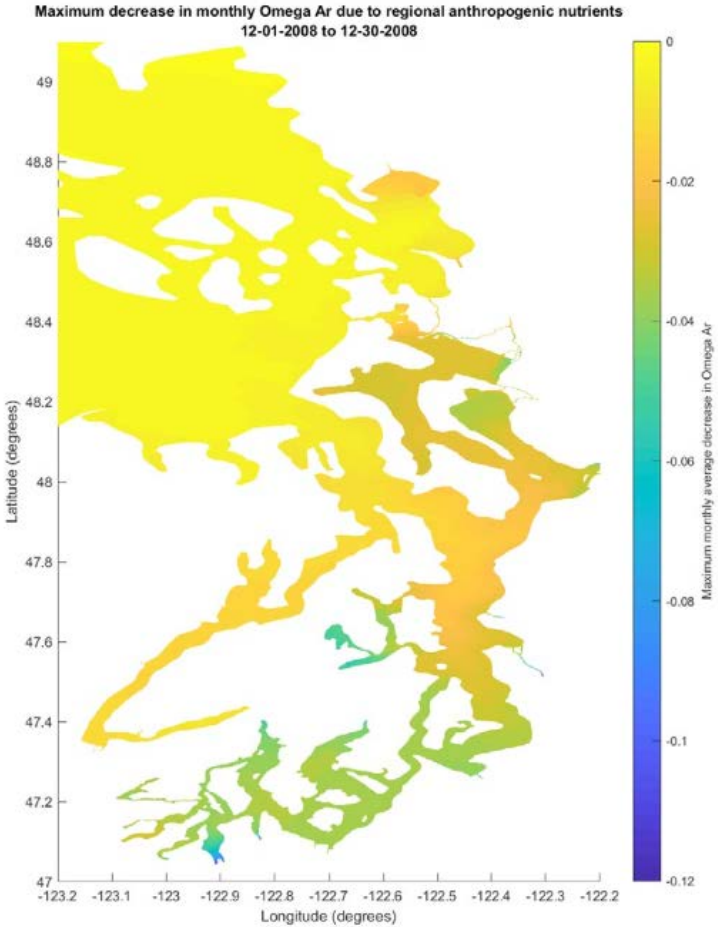


JSCOPE forecast for the May 2016 saturation pressure ($\Omega < 1.0$) for the model (left) and the observations from the WCOA 2016 cruise (right). The forecast was initiated in January 2016.

Siedlecki et al., 2016.

Source attribution modeling

- "The changes in ΩA due to regional anthropogenic nutrient sources in 2008 range from near zero in the Strait of Juan de Fuca, to around -0.01 in Hood Canal and the northern Main Basin, to about -0.02 to -0.05 in the Whidbey Basin, southern Main Basin, and most of South Puget Sound, and as much as -0.12 in inner Budd Inlet.
- For comparison, another study reported basin-average changes in ΩA in the bottom layer due to global anthropogenic sources of as much as -0.16.
- Consequently, the local nutrient-derived sources of acidification may be a significant fraction of the total in some locations"



Predicted maximum monthly average decrease in Ω_A in the bottom layer in 2008 due to regional anthropogenic nutrient sources, originating within Washington. Credit: Pelletier et al., 2017.

Lead PI: Greg Pelletier, Dept of Ecology

Biological experiments:

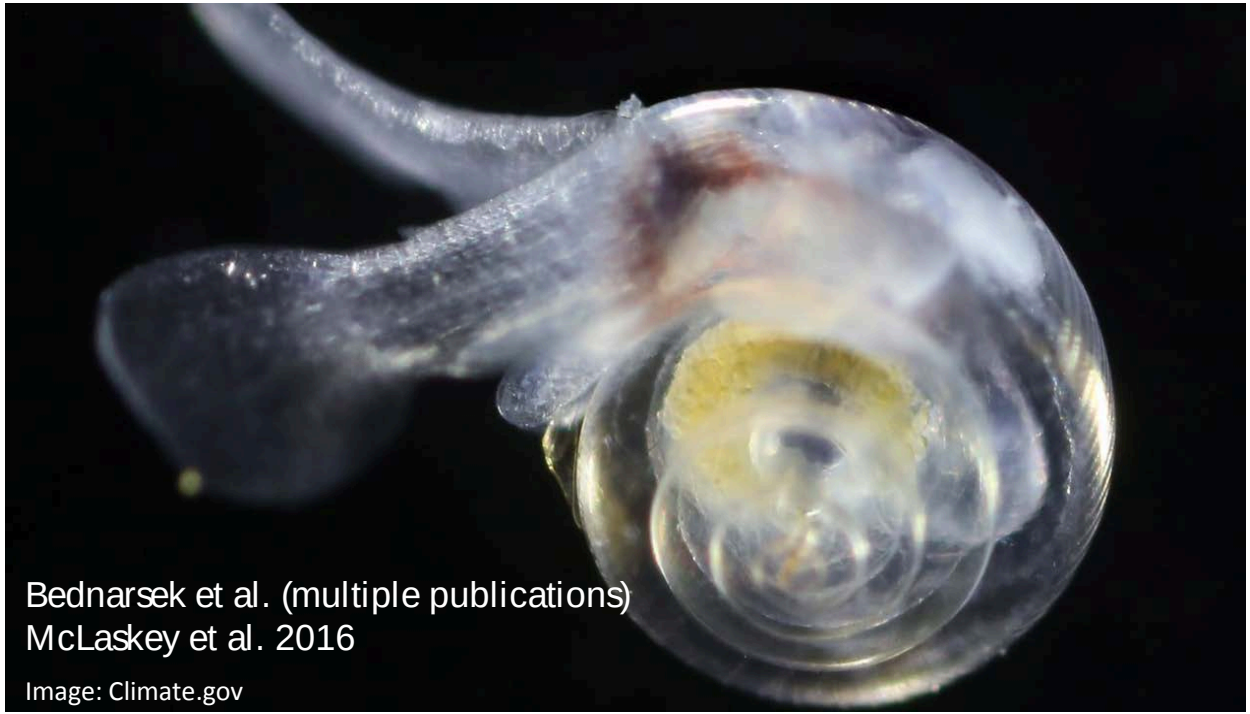
Focus on WA species:

- **Economic importance**
- **Ecological importance**

Support: WOAC, NOAA, WSG, and NSF

Photos: McElhany, NOAA; Keister, UW; Olson, WWU

Planktonic shells are thinner under OA conditions
Calcification rates decline
Changes in behavior occur
Chitinous forms are negatively affected



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T. Klinger

Bivalves shells and byssus are smaller, weaker under OA conditions

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T. Klinger

Mortality of Dungeness crab larvae and juveniles increases under OA conditions

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Copper rockfish show changes in behavior under OA conditions

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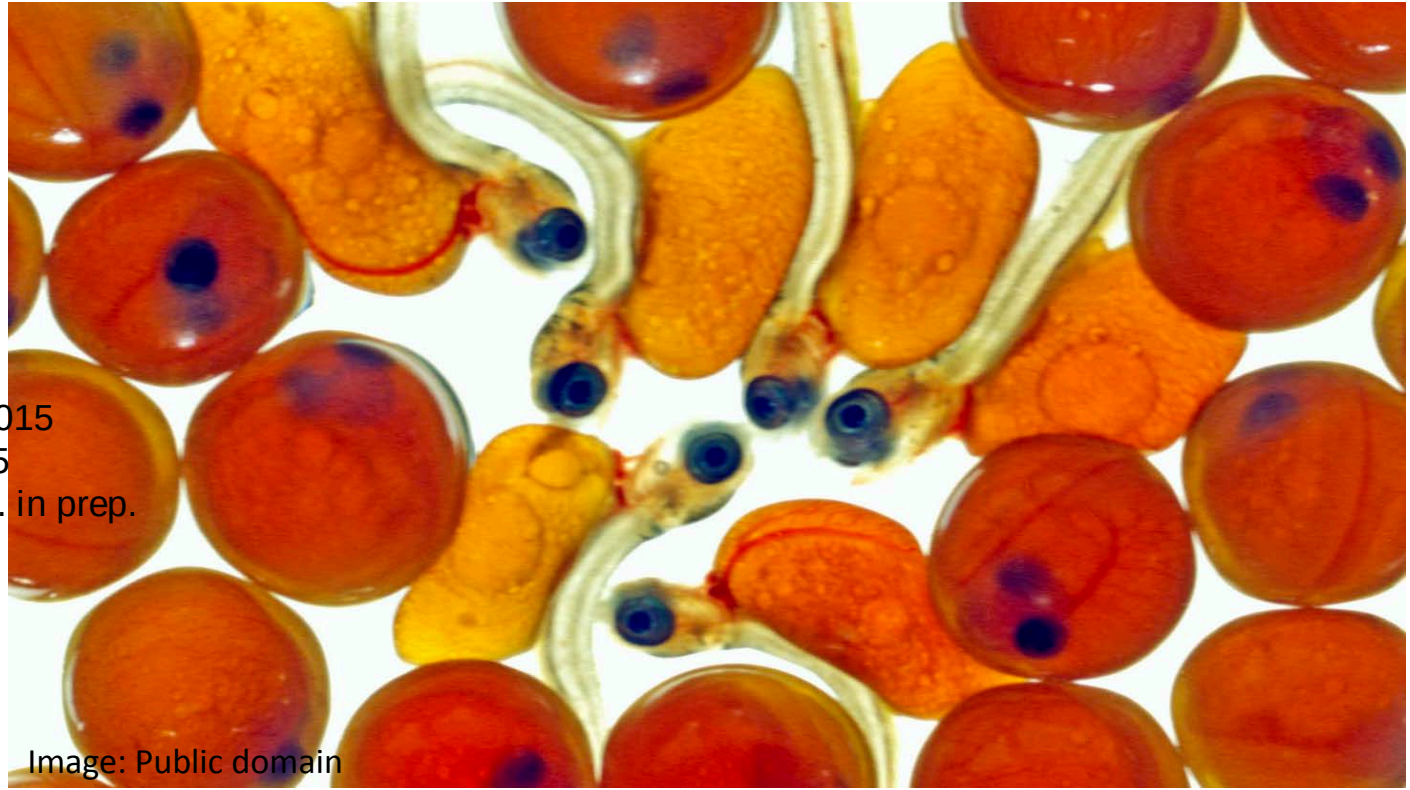
Pink salmon show dose-dependent reductions in critical life-history and behavioral traits; predator response is affected



Haigh et al. 2015
Ou et al. 2015
Williams et al. in prep.

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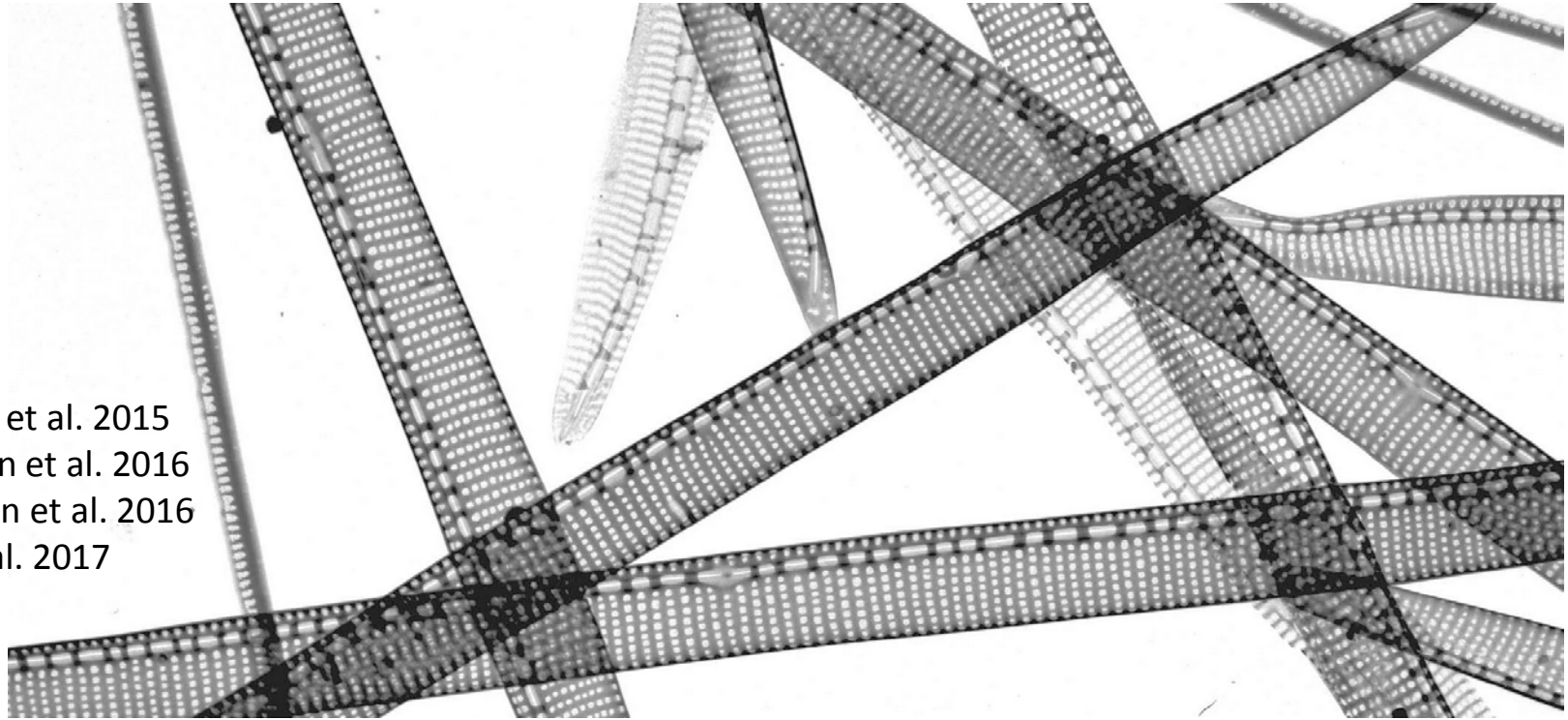
T. Klinger

Image: Public domain

Harmful algae grow faster and are more toxic under OA conditions



Tatters et al. 2015
Cochlan et al. 2016
Eberlein et al. 2016
Ou et al. 2017

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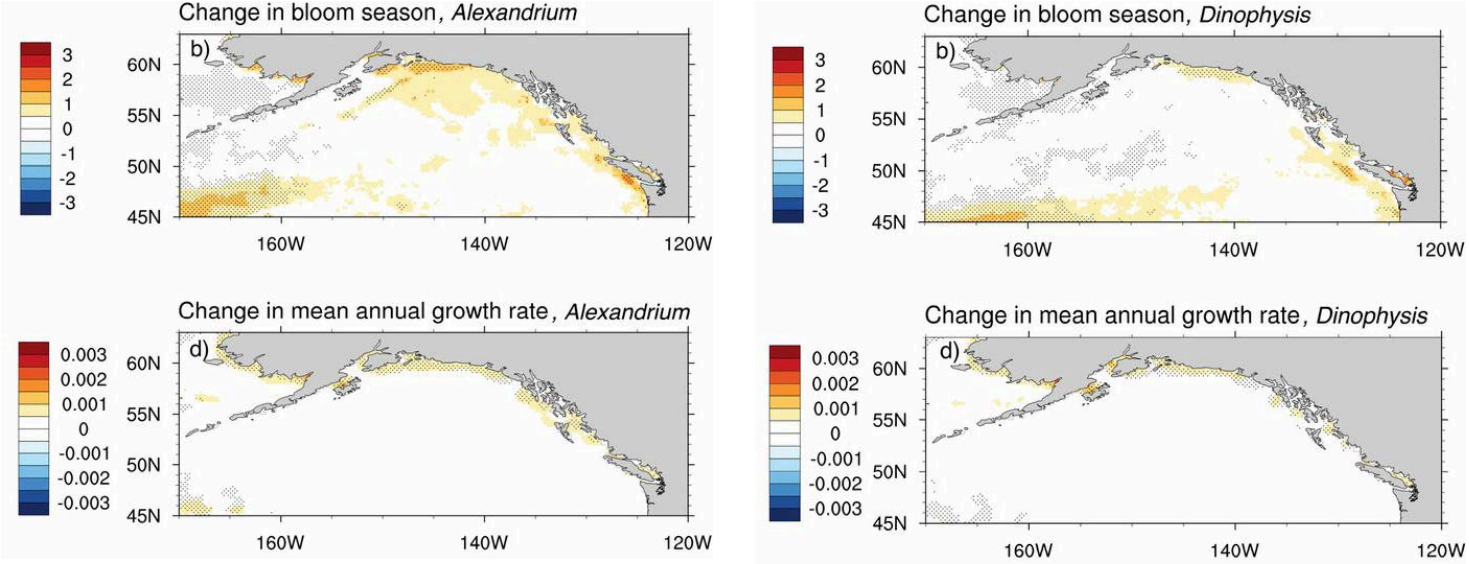
T. Klinger

HABs are expected to become more frequent and more severe under conditions of ocean change

for example, season length and growth rate are increasing



Modelled trend in bloom season (d/y) 1982 to 2016 for *Alexandrium* and *Dinophysis*

Christopher J. Gobler et al. PNAS doi:10.1073/pnas.1619575114

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T. Klinger

PNAS

6 Increase Our Ability to Adapt to and Remediate the Impacts of Ocean Acidification

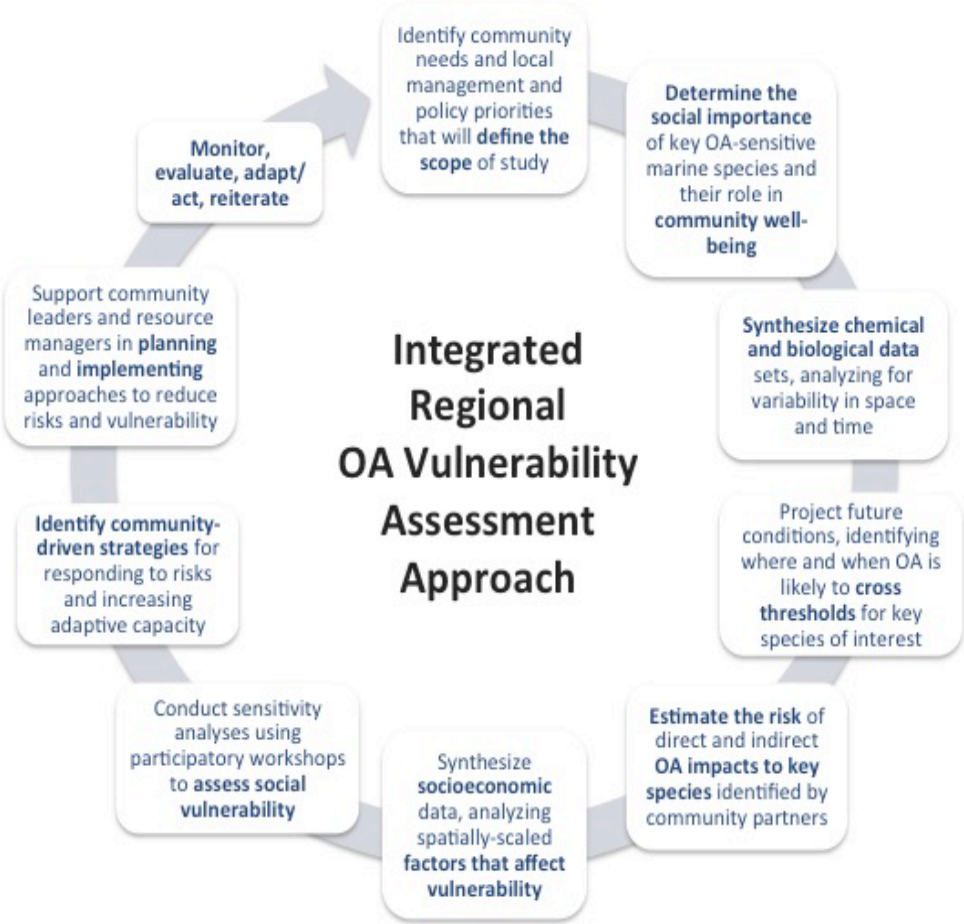
Kelp demonstration site at Hood Head. Kelp may act as a buffer to acidifying conditions, and could be an important adaptation tool. Photo credit: John Mickett

The Olympic Coast as a Sentinel: *An Integrated Social-Ecological Regional Vulnerability Assessment to Ocean Acidification*

Jan Newton, Melissa Poe, and team

Project Goal

- Our overarching goal is to provide an assessment of **coupled social-ecological vulnerability to effects from OA** that is based on *new* social science and a synthesis of existing data and model projections relevant to the Olympic Coast, its biological resources, and its inhabitants (including participating coastal tribes), **developed in an actionable interdisciplinary approach** that is:
- 1) transferrable to other locations and
- 2) strengthens capacities for vulnerable place-based communities to adapt.


Integrated Regional OA Vulnerability Assessment Approach
Identify community needs and local management and policy priorities that will define the scope of study
Determine the social importance of key OA-sensitive marine species and their role in community well-being
Synthesize chemical and biological data sets, analyzing for variability in space and time
Project future conditions, identifying where and when OA is likely to cross thresholds for key species of interest
Estimate the risk of direct and indirect OA impacts to key species identified by community partners
Synthesize socioeconomic data, analyzing spatially-scaled factors that affect vulnerability
Conduct sensitivity analyses using participatory workshops to assess social vulnerability
Identify community-driven strategies for responding to risks and increasing adaptive capacity
Support community leaders and resource managers in planning and implementing approaches to reduce risks and vulnerability
Monitor, evaluate, adapt/ act, reiterate

OA co-occurs with other stressors

Synergistic effects are known

temperature, dissolved oxygen of particular concern

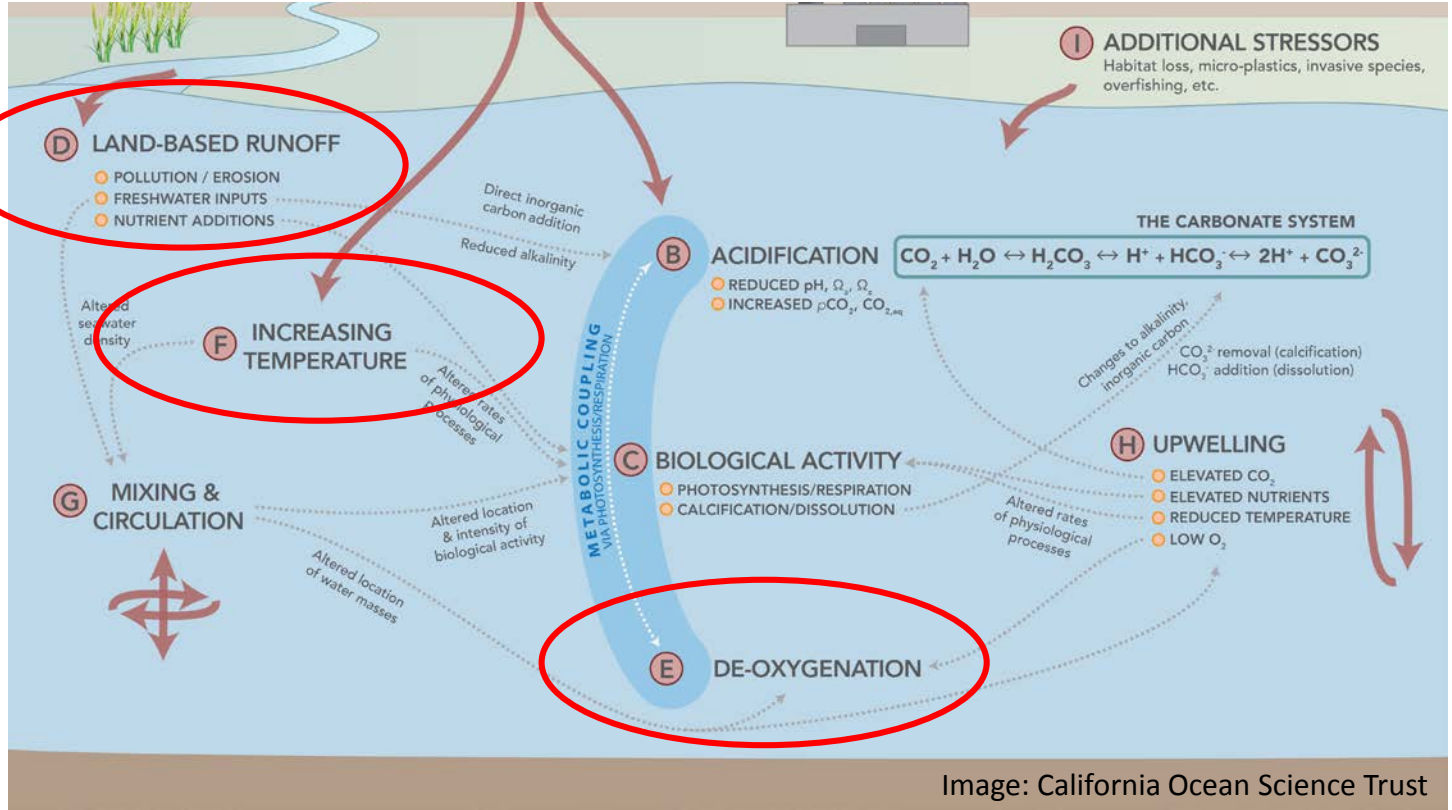


Image: California Ocean Science Trust

slide:
T. Klinger

WA Agencies-Tribes-Partners Efforts to Address OA and Natural Resource Managers Survey

Kirsten Feifel – Washington Department of Natural Resources
Rich Childers – Washington Department of Fish and Wildlife

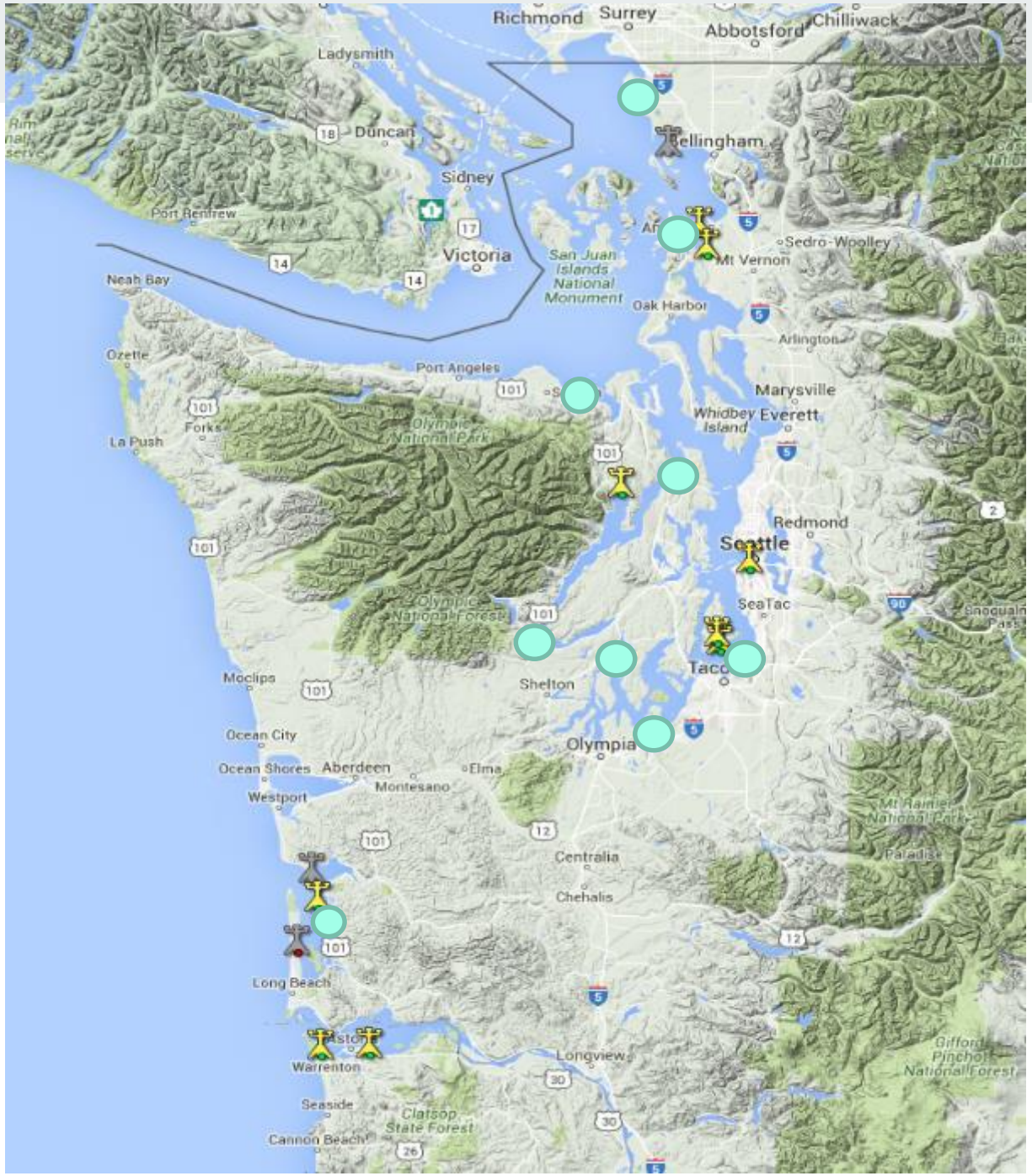
ANeMoNe

Acidification Nearshore Monitoring Network

NOAA/shellfish growers monitoring site

DNR monitoring site

Instruments measure pH, salinity, temperature, dissolved oxygen, chlorophyll every 10 minutes



Contact: Micah Horwith, DNR
micah.horwith@dnr.wa.gov

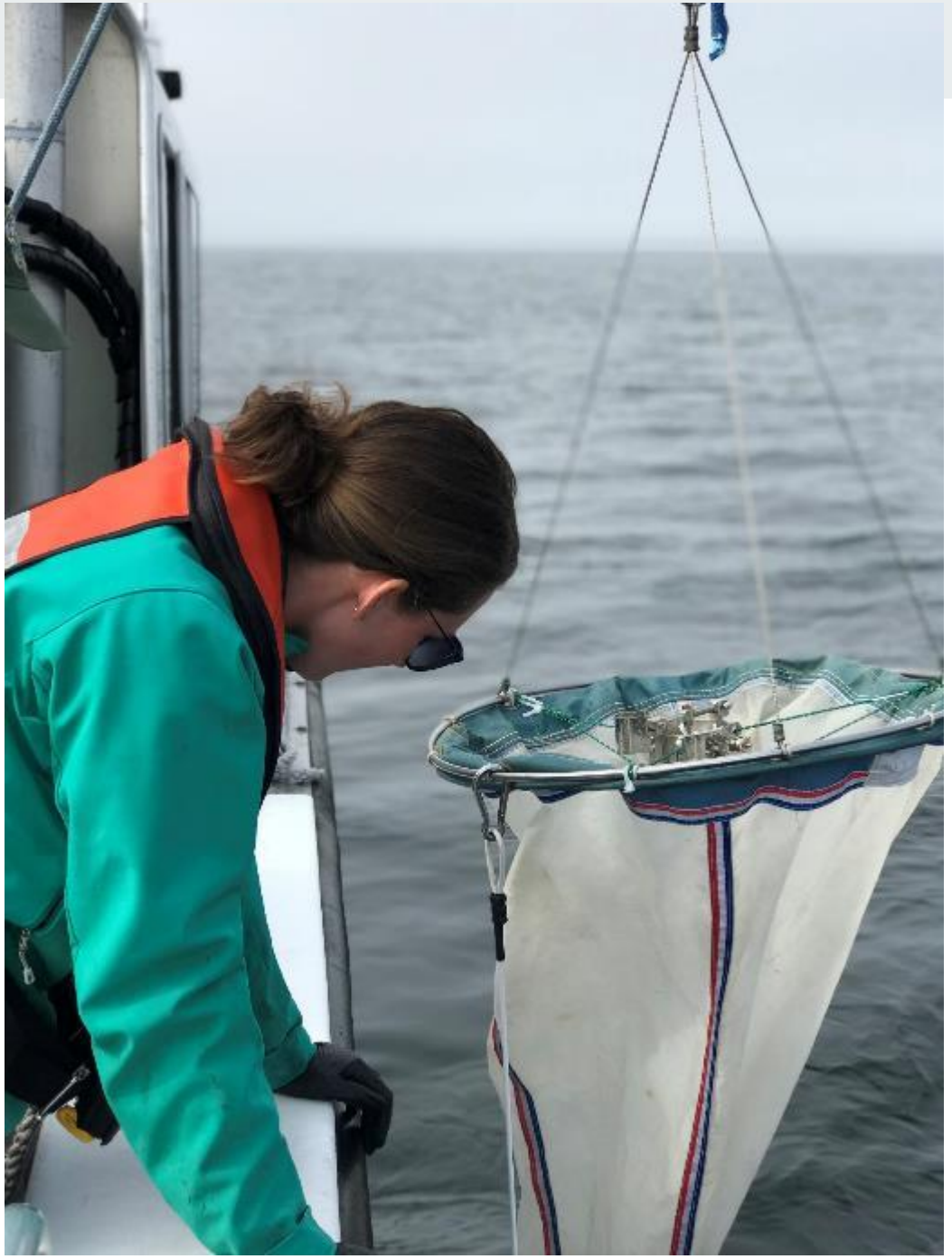
How we're understanding

Modeling to inform management of human impacts:

- Impacts/management of human sources from our region
- Vulnerability assessment of pelagic and benthic organisms
- Developing database of state-wide monitoring
- Conducting carbonate system monitoring

Puget Sound Zooplankton Monitoring Project

- A component of the Salish Sea Marine Survival Project
- Established in 2014 by Long Live the Kings and the Pacific Salmon Foundation
- 10 Partners, 16 index sites; sampled bi-monthly except in winter
- Vital project for monitoring impacts and long term trends to early life stages to wild stocks species
- Goal is to continue project long term



Ken Chew Shellfish Conservation Hatchery

- Unique opportunity to investigate OA remediation strategies;
- Vital to species restoration efforts;
- Research and production focus Olympia oysters, pinto abalone, sea cucumbers, kelp

How we're adapting

Vegetation strategies:

- Multiyear monitoring, experiments and modeling that are testing the use of vegetation-based systems for remediation;
- Kelp cultivation, eelgrass restoration and protection are potential adaptation tools

How we're adapting

Species restoration efforts:

- Shellfish production
- Eelgrass
- Kelp recovery plan
- Native oyster habitat Restoration

How we're adapting

Kelp and eelgrass habitats provide multiple benefits:

- Increase pH
- Provide vital habitat
- Store carbon
- Build up sediment


Photo credit: Washington State Department of Natural Resources

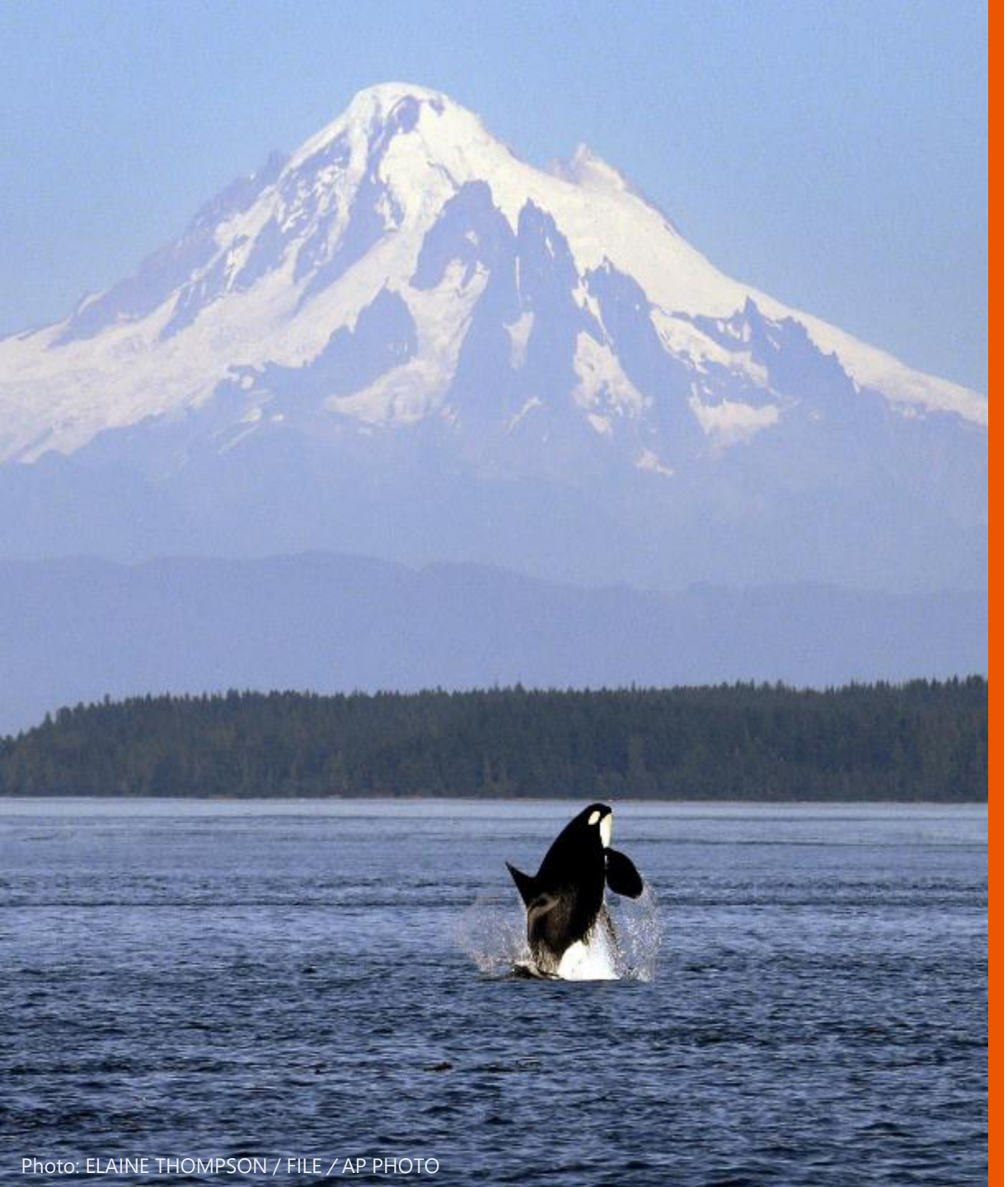


Photo: ELAINE THOMPSON / FILE / AP PHOTO

Concerns and priorities in the context of changing ocean conditions

Katie Keil, UW School of Marine and Environmental Affairs
Nyssa Baechler, UW School of Marine and Environmental Affairs
Kirsten Feifel, WA Department of Natural Resources
Rich Childers, WA Department of Fish and Wildlife

Washington Department of FISH and WILDLIFE

COLLEGE OF THE ENVIRONMENT
UNIVERSITY of WASHINGTON

WASHINGTON DEPARTMENT OF NATURAL RESOURCES

Project Goals

Washington marine waters are changing due to ocean acidification, ocean warming, and hypoxia, and there's a need to incorporate changing ocean conditions into future resource management and policy decisions

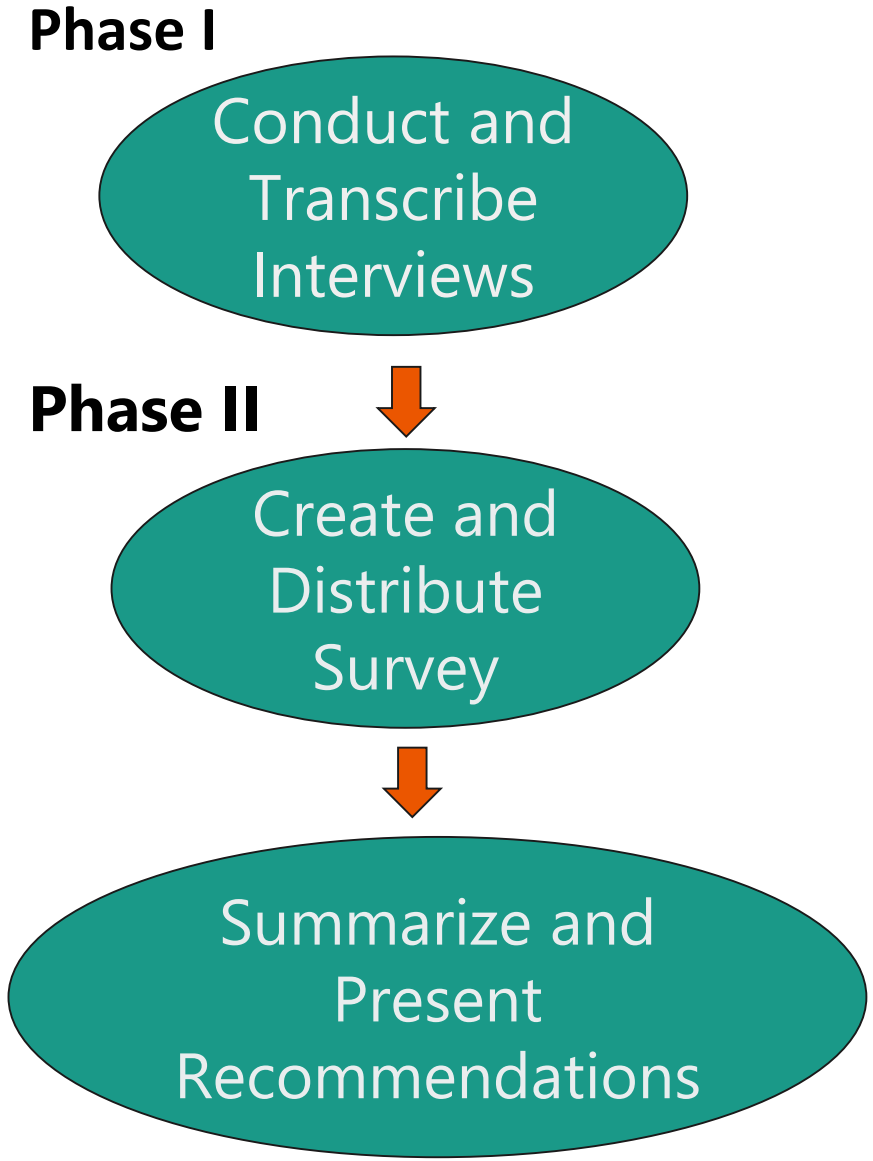
GOALS:

01 | Identify concerns and information needs re: changing ocean conditions
02 | Inform future priorities based on management and policy implications
03 | Improve linkages and coordination among partners
04 | Connect results to broader efforts

2-Phase Approach

1. Informational interviews with State and Tribal resource managers
2. Use interview information to develop an online survey for distribution to wider group

Deliverables: Summarize qualitative and quantitative results from interviews and survey into presentation and summary document



Phase I: Interviews

Interview Process

- Conducted and recorded interviews with tribal and state agency natural resource managers:
    - ➢ 27 resource managers (19 state, 8 tribal)
    - ➢ 3 state agencies, 5 individual tribes
- Transcribed interviews and coded qualitative interview data (ATLAS.ti) to identify themes to guide survey design

Interview Themes: Priority Needs

- Plankton
  - Abundance, composition, species recruitment
- Identifying species tolerances and thresholds
- Downscaling models to local areas of concern (e.g., IPCC)
- Increasing monitoring stations (river and marine)
- Reducing nutrient loading

"There's no way of exactly identifying the type of consequences when the rubber hits the road - the on the ground consequences for the fishermen in 5 years, 20 years... but **what's causing the anxiety is the unknown.** We don't know the type of impact or magnitude"

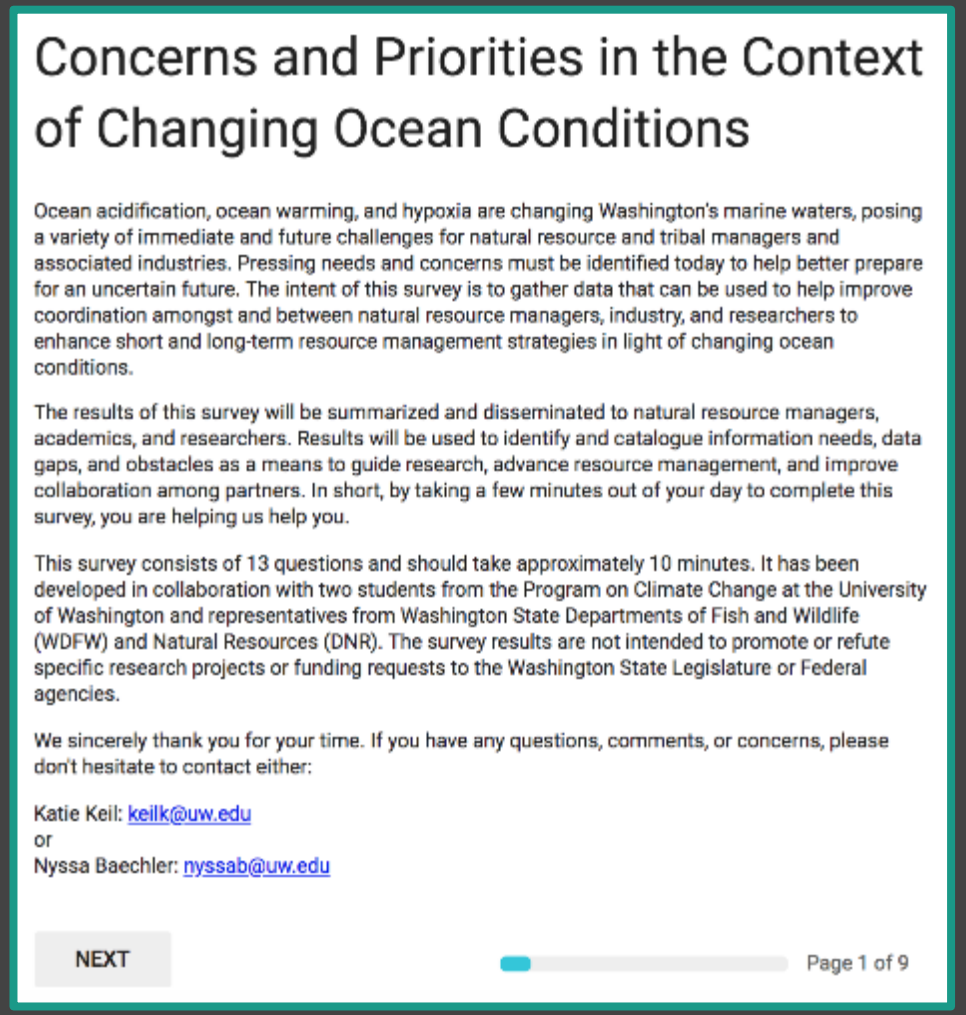
Phase II: Survey

Survey Process

Google forms survey of 13 questions

Survey Question Themes:

- Demographic Data
- Resources/Habitat Managed
- Concerns
- Data Uses and Gaps
- Barriers
- Priorities for Data, Research, & Monitoring



Concerns and Priorities in the Context of Changing Ocean Conditions

Ocean acidification, ocean warming, and hypoxia are changing Washington's marine waters, posing a variety of immediate and future challenges for natural resource and tribal managers and associated industries. Pressing needs and concerns must be identified today to help better prepare for an uncertain future. The intent of this survey is to gather data that can be used to help improve coordination amongst and between natural resource managers, industry, and researchers to enhance short and long-term resource management strategies in light of changing ocean conditions.

The results of this survey will be summarized and disseminated to natural resource managers, academics, and researchers. Results will be used to identify and catalogue information needs, data gaps, and obstacles as a means to guide research, advance resource management, and improve collaboration among partners. In short, by taking a few minutes out of your day to complete this survey, you are helping us help you.

This survey consists of 13 questions and should take approximately 10 minutes. It has been developed in collaboration with two students from the Program on Climate Change at the University of Washington and representatives from Washington State Departments of Fish and Wildlife (WDFW) and Natural Resources (DNR). The survey results are not intended to promote or refute specific research projects or funding requests to the Washington State Legislature or Federal agencies.

We sincerely thank you for your time. If you have any questions, comments, or concerns, please don't hesitate to contact either:

Katie Keil: keilk@uw.edu
or
Nyssa Baechler: nyssab@uw.edu

NEXT

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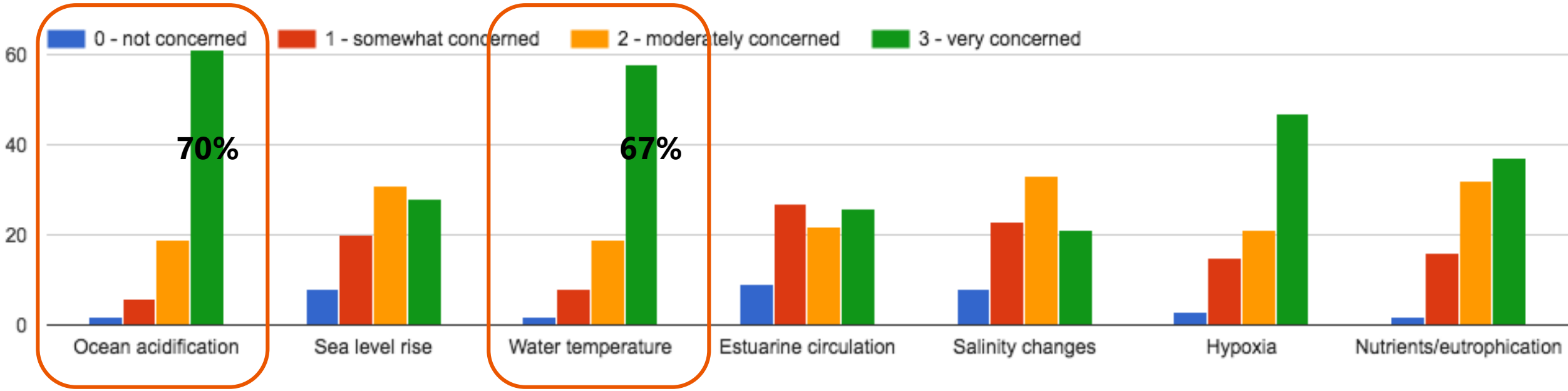
Survey Participants

92 responses from 45 entities

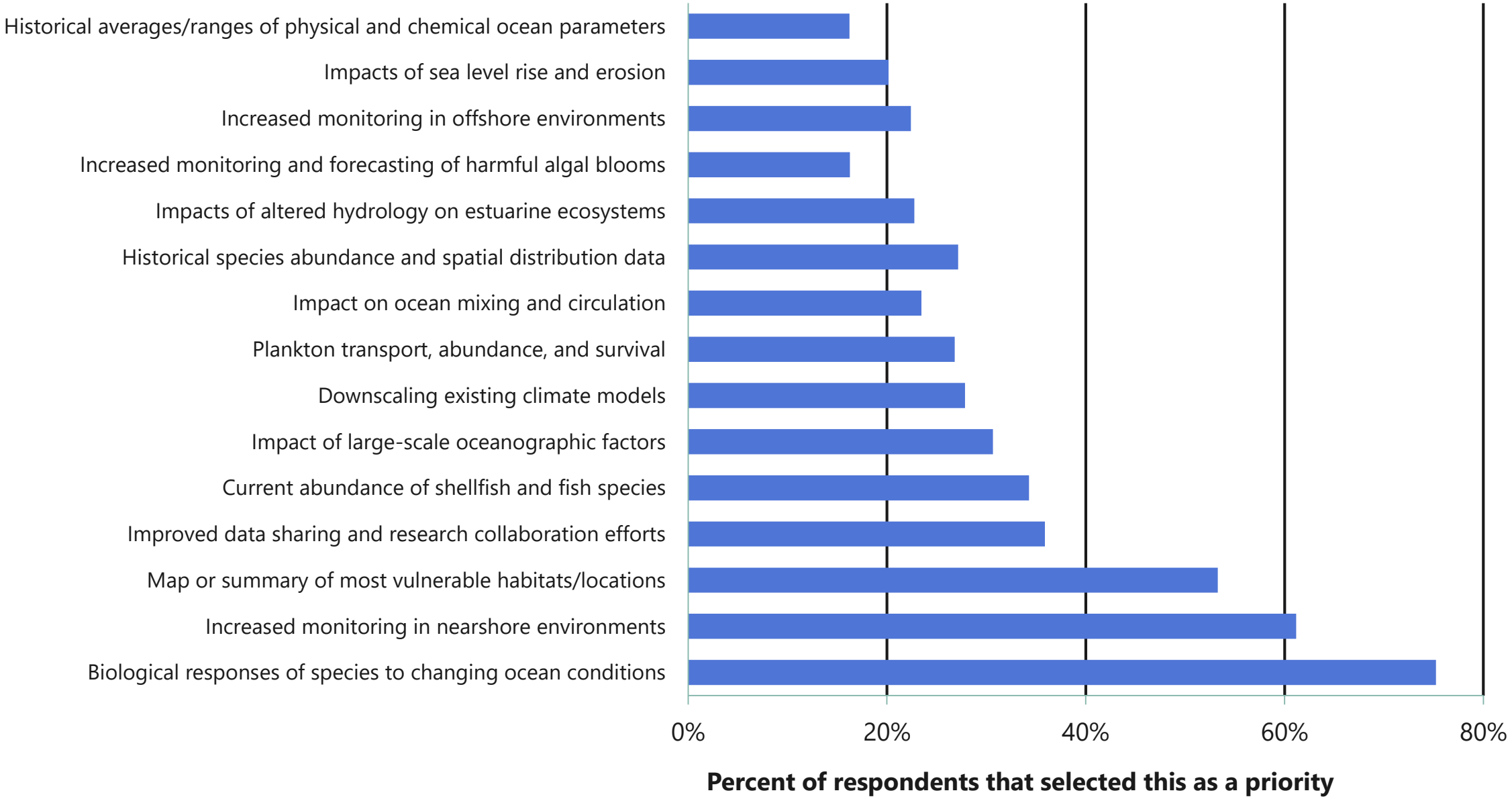
Coalition of Coastal Fisheries (1)
Columbia River Crab Fisherman's Association (1)
Department of Natural Resources (2)
Department of Health (1)
Duna Fisheries, LLC (1)
Global Ocean Health (1)
Ilwaco Charter Association (1)
Jamestown S'Klallam Tribe (3)
King County (2)
Makah Tribe (3)
Nisqually Indian Tribe (1)
NOAA Ocean Acidification Program (1)
Nooksack Tribe (1)
North Olympic Salmon Coalition (2)
Northern Oyster Company (2)
Northwest Straits Commission (1)
Ocean Associates/NMFS (1)
Office of the Governor (1)
Olympic Coast National Marine Sanctuary (2)
Pacific County (1)
Padilla Bay National Estuarine Research Reserve (1)
PMEL/NOAA/Dept of Commerce (1)
Point No Point Treaty Council (1)
Port Gamble S'Klallam Tribe (1)
Port of Ilwaco & Port of Chinook (1)
Puget Sound Crab Association (1)
Puget Sound Shrimp Association (1)
Quileute Indian Nation (1)
Quinault Indian Nation (2)
RE Sources for Sustainable Communities (1)
Skagit Watershed Council (1)
Skokomish Indian Tribe (2)
Snohomish County (2)
Suquamish Tribe (1)
Surfrider Foundation (1)
Swinomish Indian Tribal Community (2)
Taylor Shellfish Farms (4)
The Tulalip Tribes of Washington (1)
U.S. EPA (1)
University of Washington (2)
Washington Environmental Council (1)
Washington Sea Grant (2)
Washington State Department of Ecology (4)
Washington Department of Fish and Wildlife (19)
Westport Seafood Inc. (1)
... and 3 fishermen

Concerns

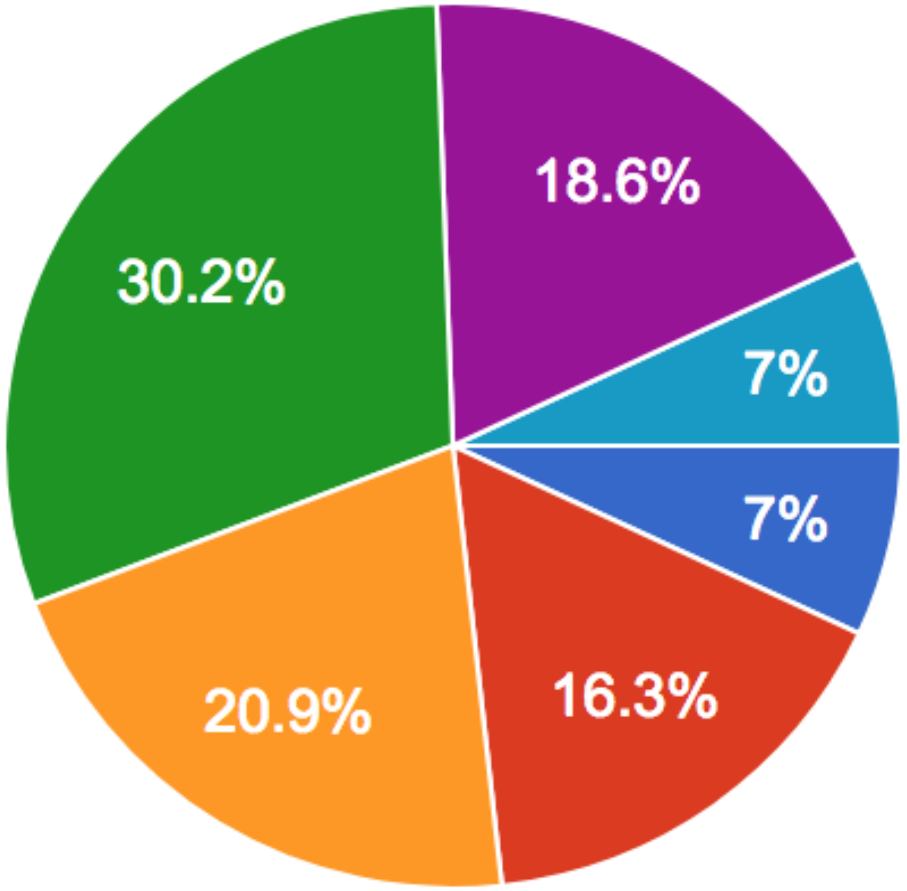
5. How concerned is your research/management group about changing ocean conditions affecting the resource(s) you work with?



Summary of Priorities



Spatial Scale Preference



Preferred scale of data:

1. Puget Sound
2. Washington coastline
3. Specific basins
4. Pacific Northwest
5. (tied) California Current

   (tied) Small-scale local embayments

Respondent Insights + Suggestions

“There needs to be a **clearinghouse** for information with authority and protocol to make final decisions so stakeholders can make progress on a solid foundation using relevant and solid data `

“More **face to face workshops between industry, resource manager and agencies** where FACTS and SOUND SCIENCE are presented and a "Final and Agreed Upon Interpretation" comes out of the workshop and all state agencies, resource managers, etc. agree to use those interpretations and data points moving forward in their decision making.”

“For the outer coast, an **Ocean Acidification Sentinel Site** could assist in all aspects…. It is a holistic approach of resource management where science is integral to education, outreach, management and public engagement campaigns to address these changing ocean conditions.”

Separate climate change from natural variation i.e. link observed changes in species abundance and distribution to climate change and ocean acidification

Conclusions

Determine Species Thresholds-Tolerance

Need to prioritize laboratory or in situ study identifying survival thresholds of vital organisms, such as plankton and commercially important fish

Continue to actively link monitoring and research results to resource management , protection, and policy discussions

Improve Collaboration and Communication

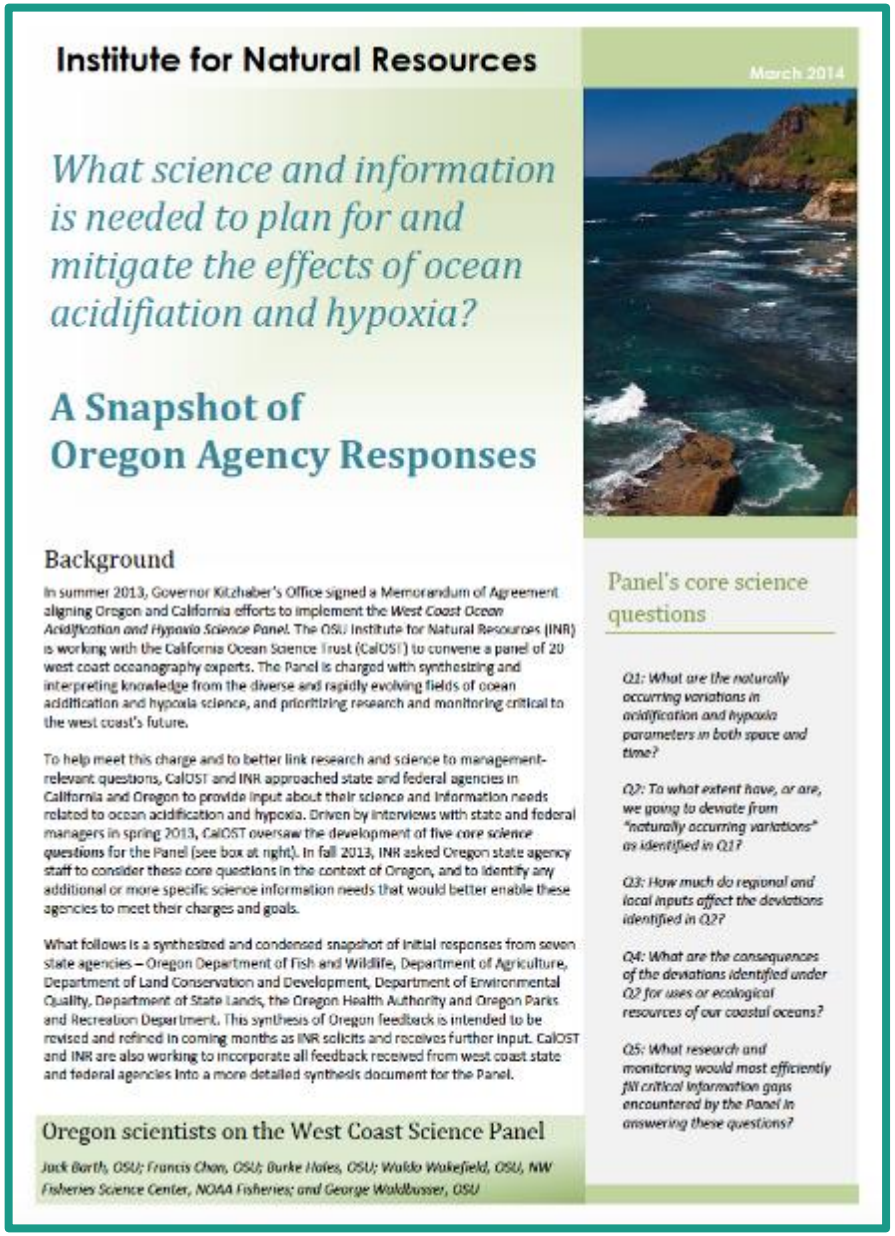
Coordinate and share monitoring efforts and research within and among entities and compile in accessible database

Final Project Deliverable

2 page summary report

- Background
- Core questions
- Noted concerns
- Recommendations
- Distribution expected summer 2018

- Available http://oainwa.org/mrac/



Institute for Natural Resources

March 2014

What science and information is needed to plan for and mitigate the effects of ocean acidifiation and hypoxia?

A Snapshot of Oregon Agency Responses

Background

In summer 2013, Governor Kitzhaber's Office signed a Memorandum of Agreement aligning Oregon and California efforts to implement the *West Coast Ocean Acidification and Hypoxia Science Panel*. The OSU Institute for Natural Resources (INR) is working with the California Ocean Science Trust (CalOST) to convene a panel of 20 west coast oceanography experts. The Panel is charged with synthesizing and interpreting knowledge from the diverse and rapidly evolving fields of ocean acidification and hypoxia science, and prioritizing research and monitoring critical to the west coast's future.

To help meet this charge and to better link research and science to management-relevant questions, CalOST and INR approached state and federal agencies in California and Oregon to provide input about their science and information needs related to ocean acidification and hypoxia. Driven by interviews with state and federal managers in spring 2013, CalOST oversaw the development of five core science questions for the Panel (see box at right). In fall 2013, INR asked Oregon state agency staff to consider these core questions in the context of Oregon, and to identify any additional or more specific science information needs that would better enable these agencies to meet their charges and goals.

What follows is a synthesized and condensed snapshot of initial responses from seven state agencies – Oregon Department of Fish and Wildlife, Department of Agriculture, Department of Land Conservation and Development, Department of Environmental Quality, Department of State Lands, the Oregon Health Authority and Oregon Parks and Recreation Department. This synthesis of Oregon feedback is intended to be revised and refined in coming months as INR solicits and receives further input. CalOST and INR are also working to incorporate all feedback received from west coast state and federal agencies into a more detailed synthesis document for the Panel.

Oregon scientists on the West Coast Science Panel

Jack Barth, OSU; Francis Chan, OSU; Burke Hales, OSU; Waldo Wakefield, OSU, NW Fisheries Science Center, NOAA Fisheries; and George Waldbusser, OSU

Panel's core science questions

Q1: What are the naturally occurring variations in acidification and hypoxia parameters in both space and time?

Q2: To what extent have, or are, we going to deviate from "naturally occurring variations" as identified in Q1?

Q3: How much do regional and local inputs affect the deviations identified in Q2?

Q4: What are the consequences of the deviations identified under Q2 for uses or ecological resources of our coastal oceans?

Q5: What research and monitoring would most efficiently fill critical information gaps encountered by the Panel in answering these questions?

“How do you absorb growing human population in a way it does not harm ecosystems that are remaining? We need to protect remaining, intact ecosystems... It’s easier to protect than rebuild.”

Acknowledgements

Survey participants and interviewees

MRAC advisory committee

- Terrie Klinger, Paul Williams, Simone Alin, and Garrett Dalan

Ryan Kelly, capstone advisor

Miriam Bertram, PCC coordinator

Sea Life Trust


Thank you!
Questions + feedback?

Q&A and Discussion

- How can we better leverage each other's efforts?
- What does WCMAC need from MRAC?
- How can we collaborate?

Photo credit: Bill Dewey

Thank you!

Photo credit: Meghan Shea