

Ocean Acidification Workshop

Ignite Slides

December 3rd, 2014

Ocean Acidification in Alaska

Learn about it. Discuss it. Build support for State action.



Photo by Shallin Busch





**NOAA
FISHERIES**

Alaska
Fisheries
Science Center

Ocean Acidification: Kodiak Laboratory Crab Research

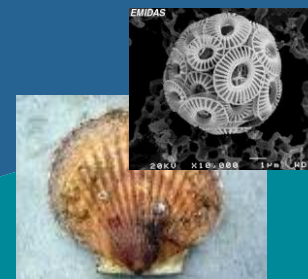
Robert Foy, Chris Long, Kathy Swiney

2014 AOOS Ocean Acidification Workshop

Linking Knowledge to Need: Responding to Ocean
Acidification (OA) in Alaska



December 3, 2014



NOAA Crab Research Overview & Outcomes



NOAA Alaska Fisheries Science Center focused on commercially important fish and shellfish, their prey, and shelter (coral). NOAA crab research focused on physiological response of commercial crab species.

1. Red king crab and Tanner crab survival and growth decreased throughout multiple life history stages.
2. Physiological functions and energetic tradeoffs apparent.
3. Negative population level response predicted at future CO₂ levels based on short term laboratory experiments.

NOAA Crab Research Next Steps



- Realistic exposure scenarios: vary pH diurnally and seasonally
- Response Variables: Hemocyte pH, behavior
- Response Variables: Genetics: protein expression
- Response Variables: Metabolic responses: respiration, energetics
- Expand Species: Snow crab, coral
- Monitoring: Scale specific to life history stages
- Increase forecasting precision.

What we still don't know:

- Long term (i.e. lifelong) effects of exposure
- Capacity for acclimation and adaptation
- Natural pH variability
- Environmental changes (warming, pollution)
- Ecosystem services (e.g. food webs, fisheries, predators, competitors)

Responses of Alaskan groundfishes to ocean acidification

Thomas P. Hurst¹

Collaborators:

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Alaska groundfish comparison

Based on laboratory experiments exposing eggs and larvae to elevated CO₂ in laboratory experiments.

Northern rock sole



More sensitive

To 1600 μ atm CO₂ ; to 60 days post hatch
No effect on hatch success or size at hatch
Reduced growth and condition in post-flexion fish
Trend toward higher mortality at high CO₂ levels
Hurst et al. in review.

Walleye pollock

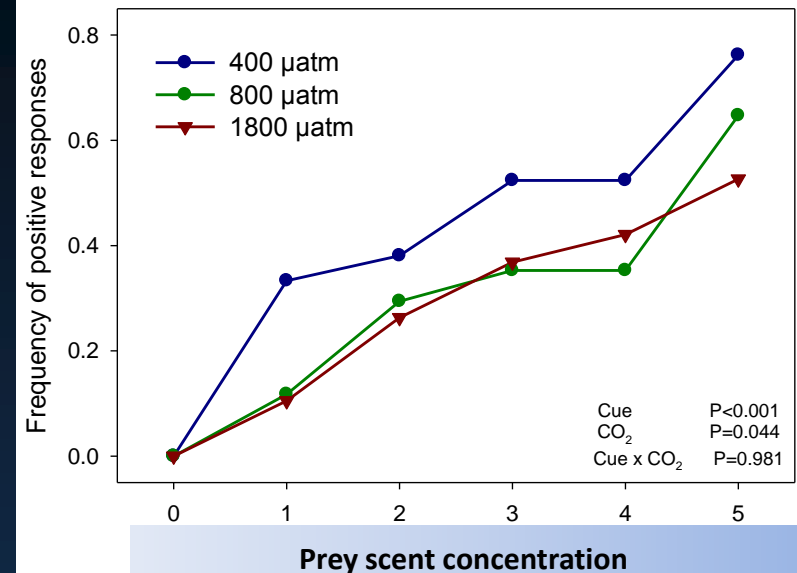
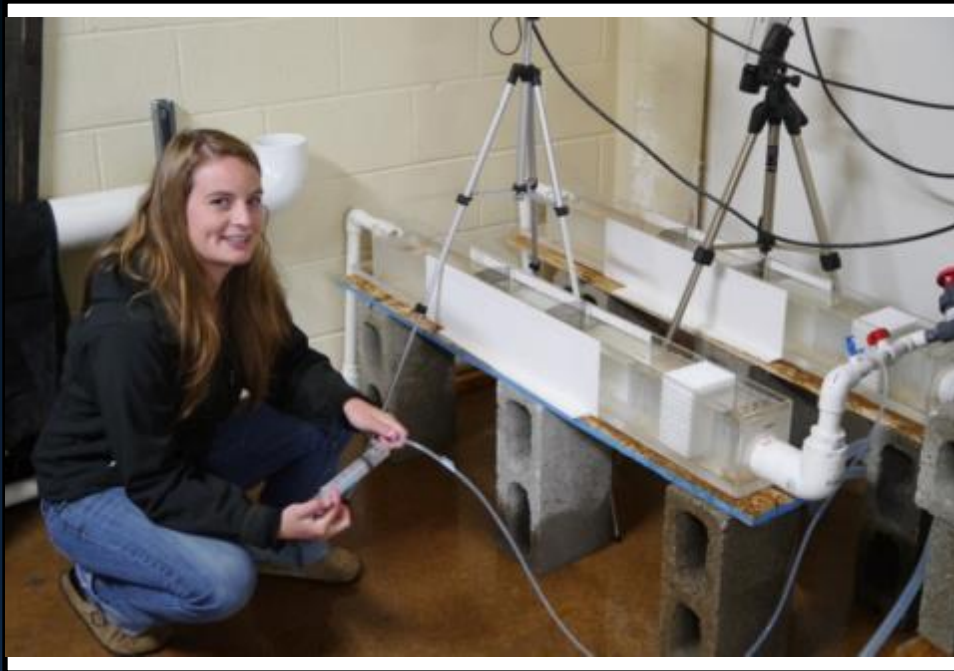


Resilient

To 2100 μ atm CO₂ ; to 28 days
No effect on survival to hatch
Slight growth improvement at intermediate CO₂
No CO₂ effect on survival
Hurst et al. 2012 & 2013

Northern rock sole appear more sensitive to elevated CO₂ than walleye pollock tested in the same experimental setup.

Walleye pollock– prey scent detection



Preliminary experimental observations:

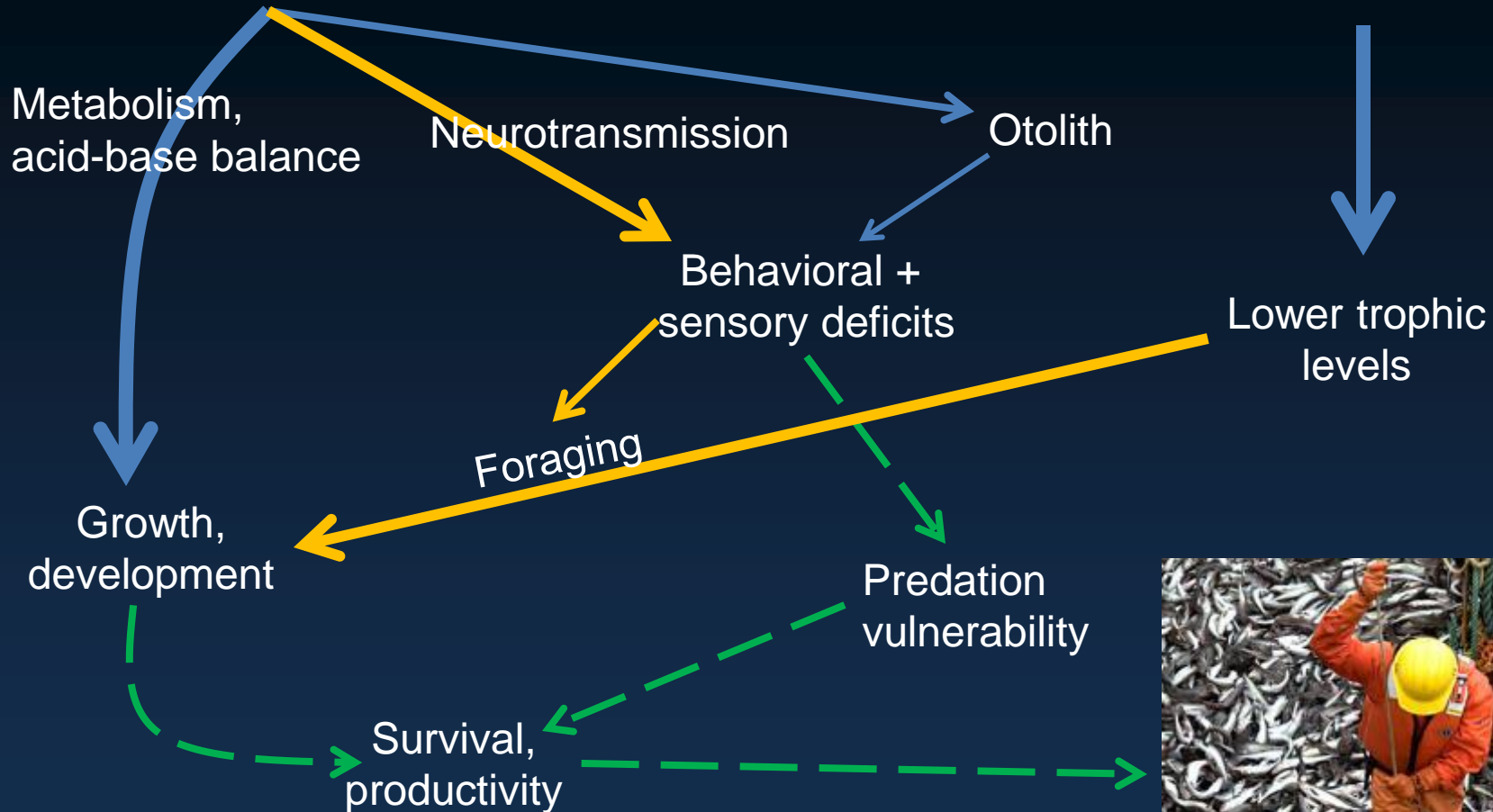
Behavioral / sensory impairment does not appear limited to tropical reef fishes.

Need more experimentation on a range of ecologically relevant behaviors to evaluate the impact of this impairment.

OA effect pathways

Direct effects

Indirect effects



Summary & Conclusions

The direct effects of OA on growth energetics of walleye pollock and northern rock sole appear to be minor, but not equal.

Preliminary work indicates that OA may induce behavioral and/or sensory deficits, as demonstrated in some tropical species.

Future:

- Fuller evaluation of sensory / behavioral responses to OA
- OA-induced changes in prey availability and prey quality
- OA in context of multiple stressors

For commercially important species, these studies will require the development of collaborations between agency and academic researchers.

Primary funding support:



Ignite Session: OA Amplifiers

Ocean Acidification in Alaska

Wiley Evans

*Ocean Acidification Research Center, UAF
Pacific Marine Environmental Laboratory, NOAA*

Ship-based data are critical; but need to augment with stationary and mobile platforms capable of high-resolution measurements

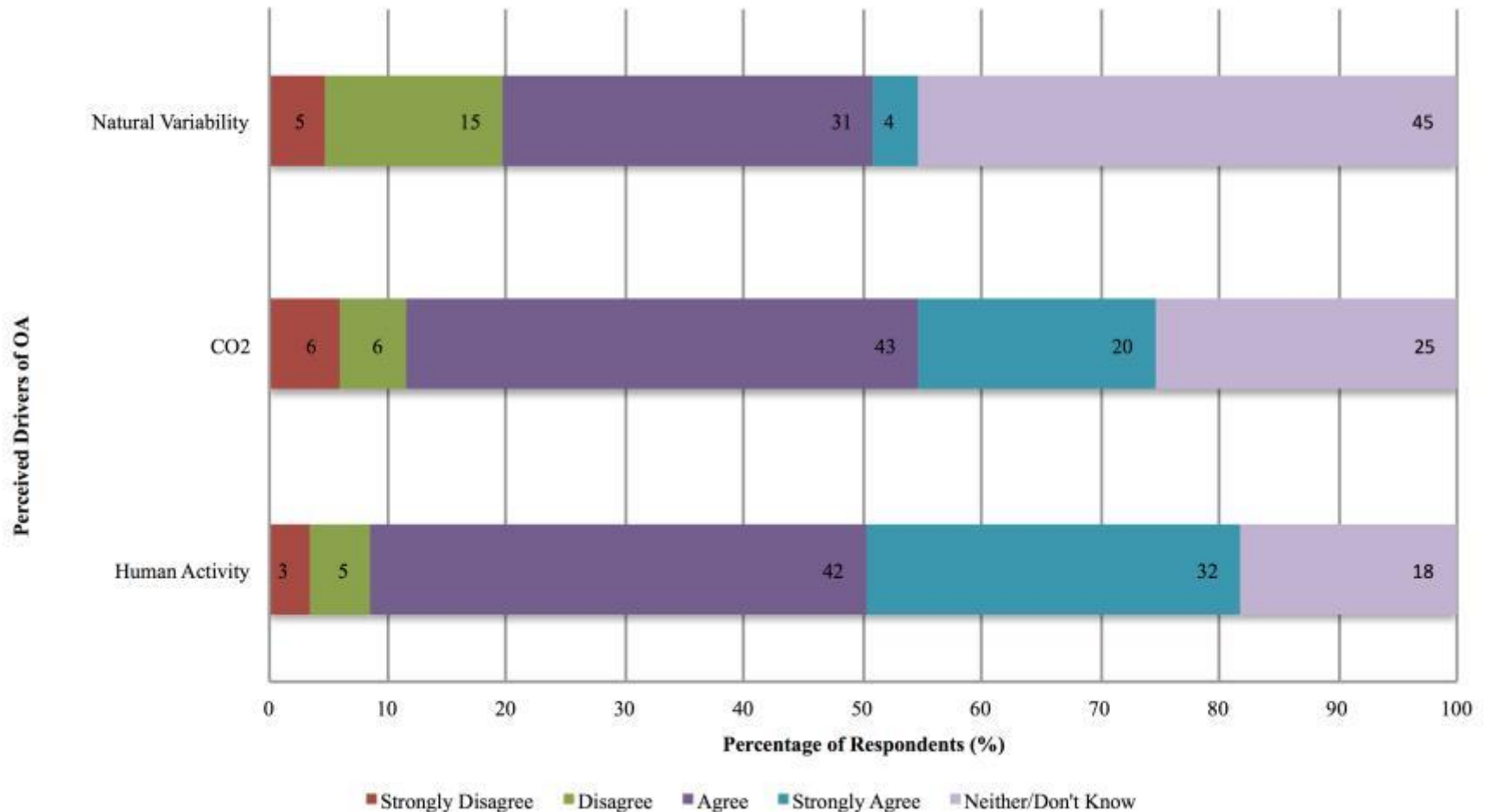
Outcomes to date: shelf-wide seasonal snap-shots, highly resolved at select sites, evolving understanding of melt-driven corrosivity

Next steps for glacial melt impact: freshwater end-member variability and continuous measurements at select sites

Public Perceptions of OA in Alaska

Lauren Frisch

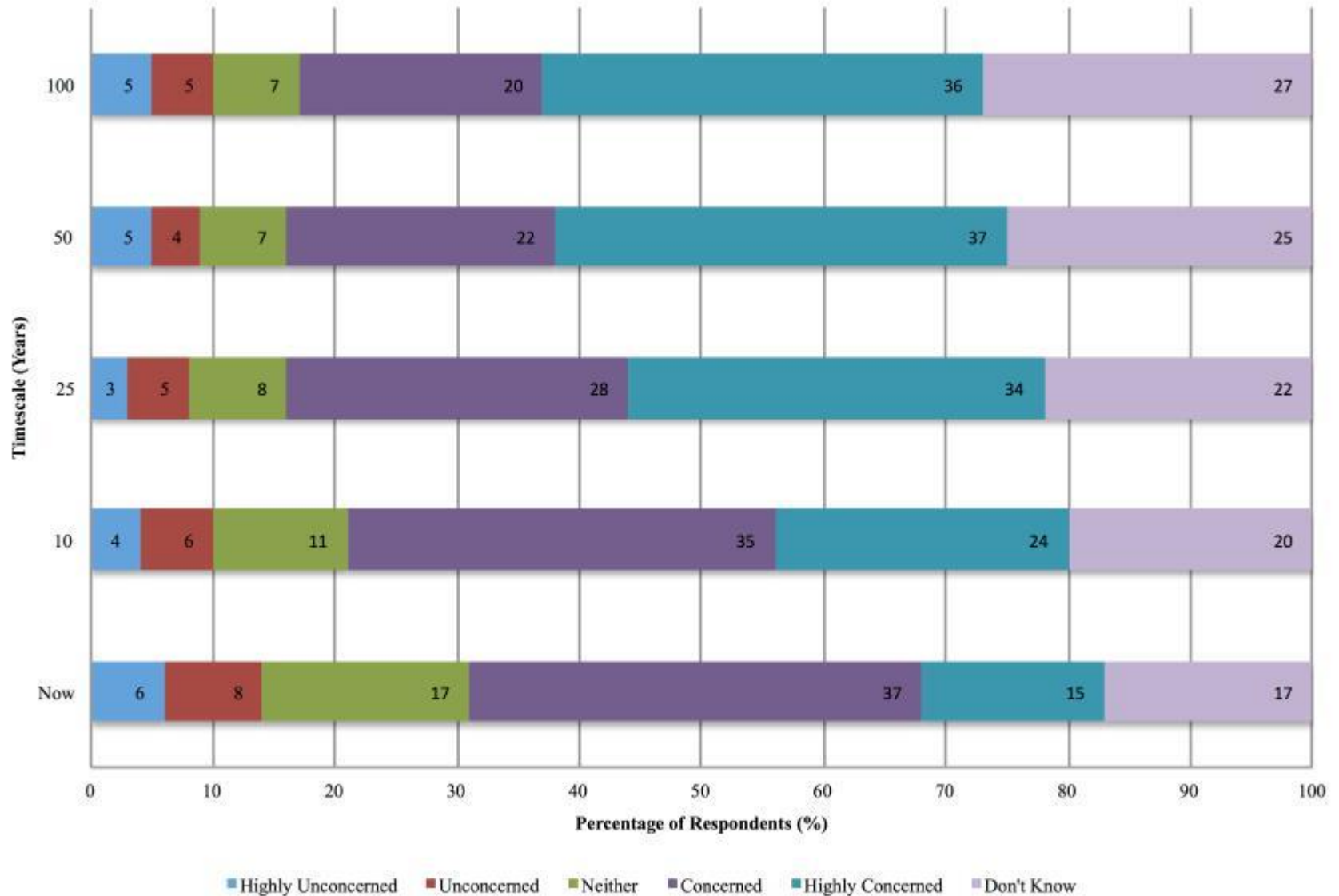
Widespread basic understanding



“record carbon dioxide levels in the atmosphere above 400ppm for the first time in recorded history are being absorbed in the surface of the ocean and are sequestered in the deep cold waters of the ocean, threatening the calcareous shell tests of many life forms”

“I am a little vague on the subject but believe it refers to the harm done by dumping fish waste into the ocean mainly by fish processors”

Low perceptions of specific risk



Ocean Acidification & Alaska Fisheries

Views and Voices of Alaska's Fishermen and Coastal Residents

Rachel Donkersloot, PhD
Alaska Marine Conservation Council



Project Overview

- In 2011-2012 AMCC organized community roundtables in the fishing communities of Dillingham, Kodiak and Homer.
- Designed to engage coastal Alaskans and members of the Alaska seafood industry whose lives and local economies will be affected by changes linked to OA.



Key Finding 1

- Because of uncertainty about what the exact impacts of ocean acidification on fisheries will be, concerns about the future tend to be eclipsed by more immediate and tangible issues facing fishermen and fishing communities.
- One exception was the shellfish growers who are already experiencing the loss of oyster spat due to corrosive waters in the Pacific Northwest.

Key Finding 2

- In addition to quantifiable economic impact, coastal Alaskans are concerned about damaging traditional uses of marine resources and harm that will come to the ecosystem that supports those resources.

Key Finding 3

- Fishermen want to participate in scientific monitoring of ocean pH. Fishermen aboard vessels can collect water samples and shellfish growers are skilled observers of local conditions.

Summary: Addressing OA in AK Waters

- Investing and expanding OA monitoring and research in Alaska waters.
- Industry-Science Partnerships
- Dual track systems: personal and political-level change



“What I’d like to see is an investment in monitoring around Kodiak Island. The research is being done in the lab, yet no monitoring.”

“You can’t manage what you don’t monitor.”

Bill Dewey– Washington OA BRP

One sentence overview:

The Washington OA Blue Ribbon Panel made up of federal, state, local and tribal leaders, scientists, ENGOs, shellfish and business representatives provided 42 recommendations directing the state's response to ocean acidification.

**Ocean Acidification:
From Knowledge to Action**

Washington State's Strategic Response



Bill Dewey– Washington OA BRP

Three bullets of outcomes:

1. Compelling shellfish industry impact “story” motivating policy response and funding
2. OA BRPanel report provides Washington with a roadmap and others with a model for OA response
3. Collaborative, coordinated research, monitoring and modeling informing on impacts and helping shellfish growers and others adapt



Bill Dewey– Washington OA BRP

Brief next steps (where you are going & what's missing)

Engrossed Senate Bill 5603 Section 4 established the Washington Marine Resources Advisory Council:

- To maintain a sustainable coordinated focus on OA
- To advise and work with the Washington OA Center on the effects and sources of OA
- To deliver recommendations to the Governor and Legislature on OA
- To seek public and private funding resources to support the Council's recommendations
- To assist in conducting public education activities regarding OA

The Marine Resources Advisory Council is essentially carrying on the work of the OA BRPanel

