May 7, 2015

West Coast Ocean Acidification and Hypoxia Science Panel:
Emerging Findings and Opportunities

Photo: N. Bednarsek

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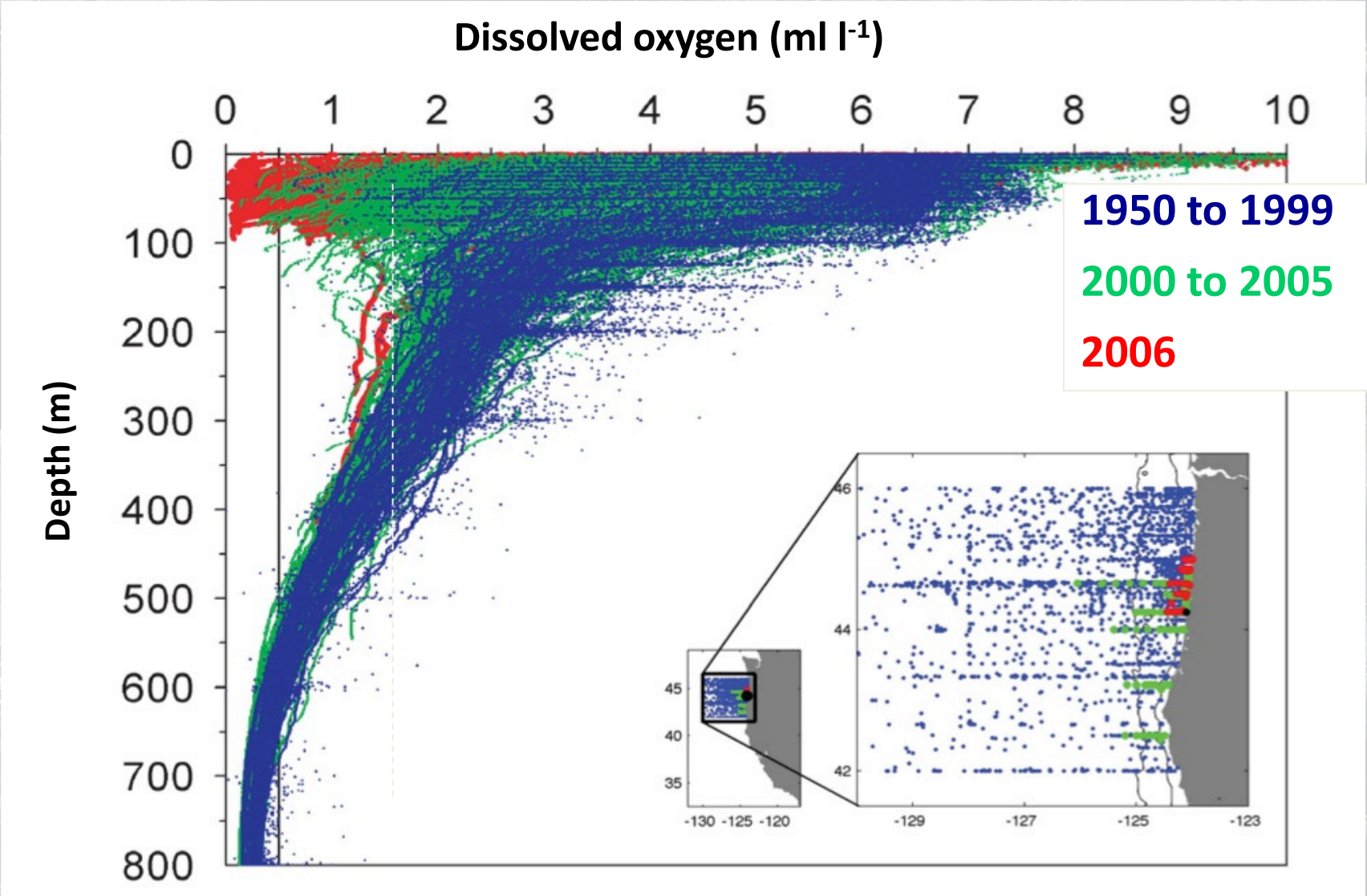
The West Coast Ocean Acidification & Hypoxia Science Panel

In Oregon, early questions from fishermen

Near-shore hypoxia was the culprit!



Chan et al. Science 2008

How has our understanding of hypoxia evolved?

Initially…

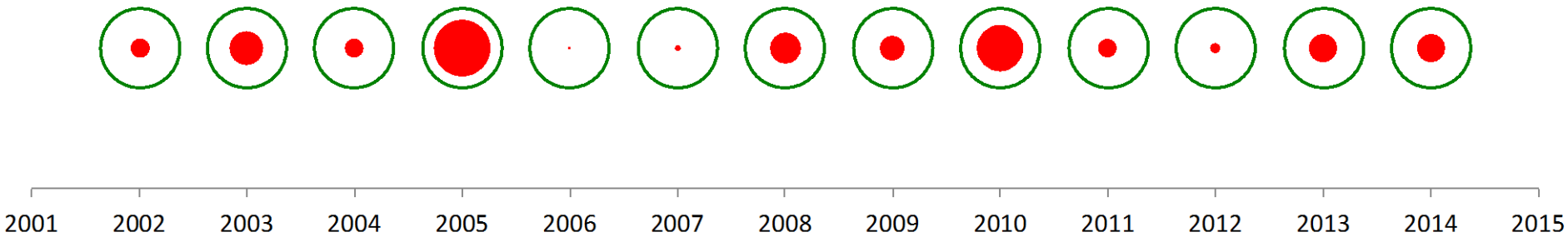
1. **Severely low oxygen a one-time exception rather than the rule?**

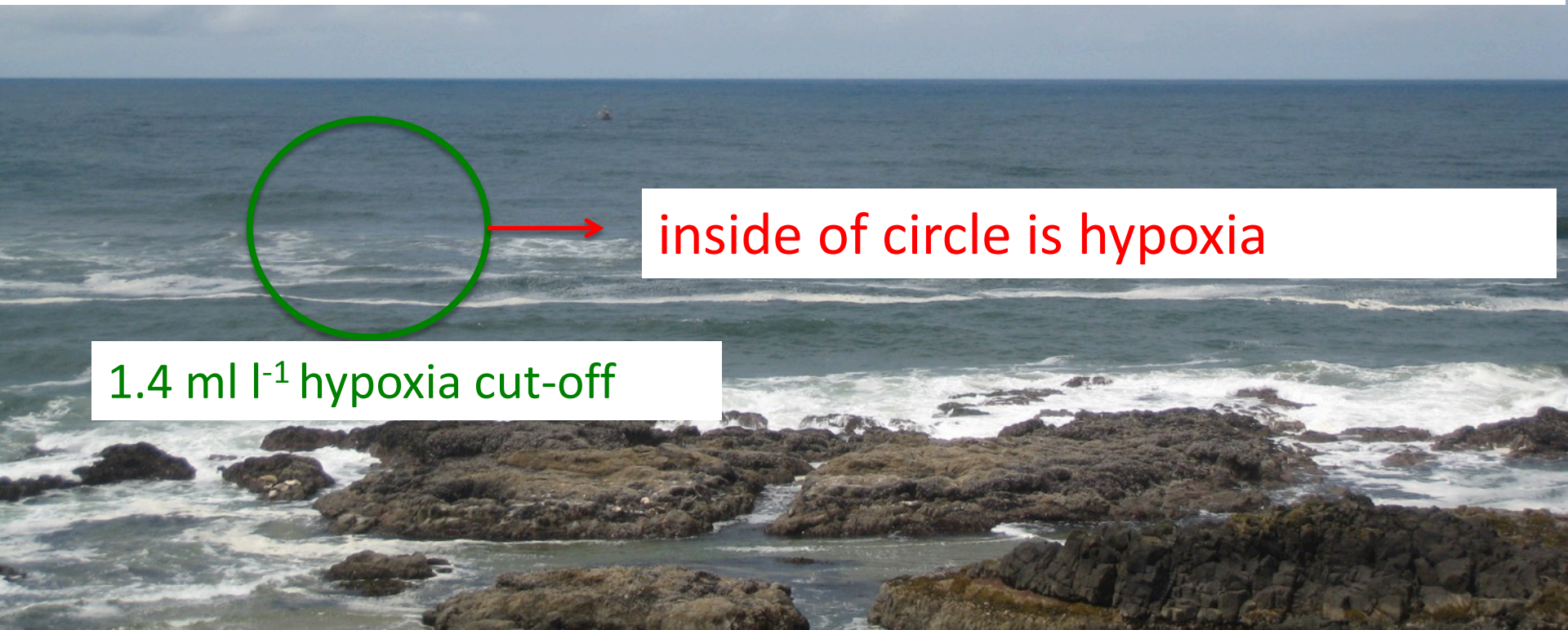
2. **Highly localized, an Oregon problem?**

3. **Not likely to matter for management?**

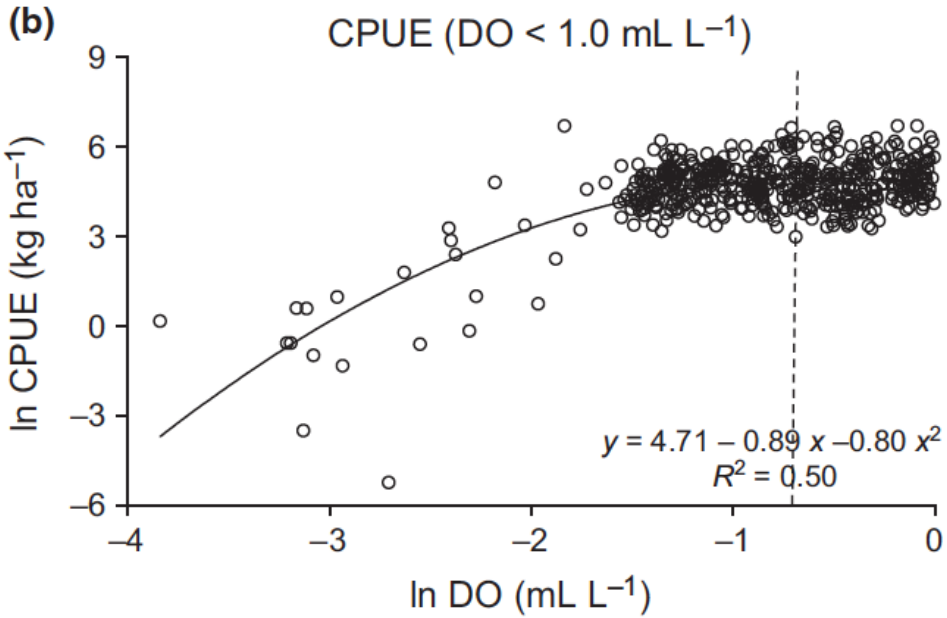
Not a one-time event…

Minimum dissolved oxygen concentration

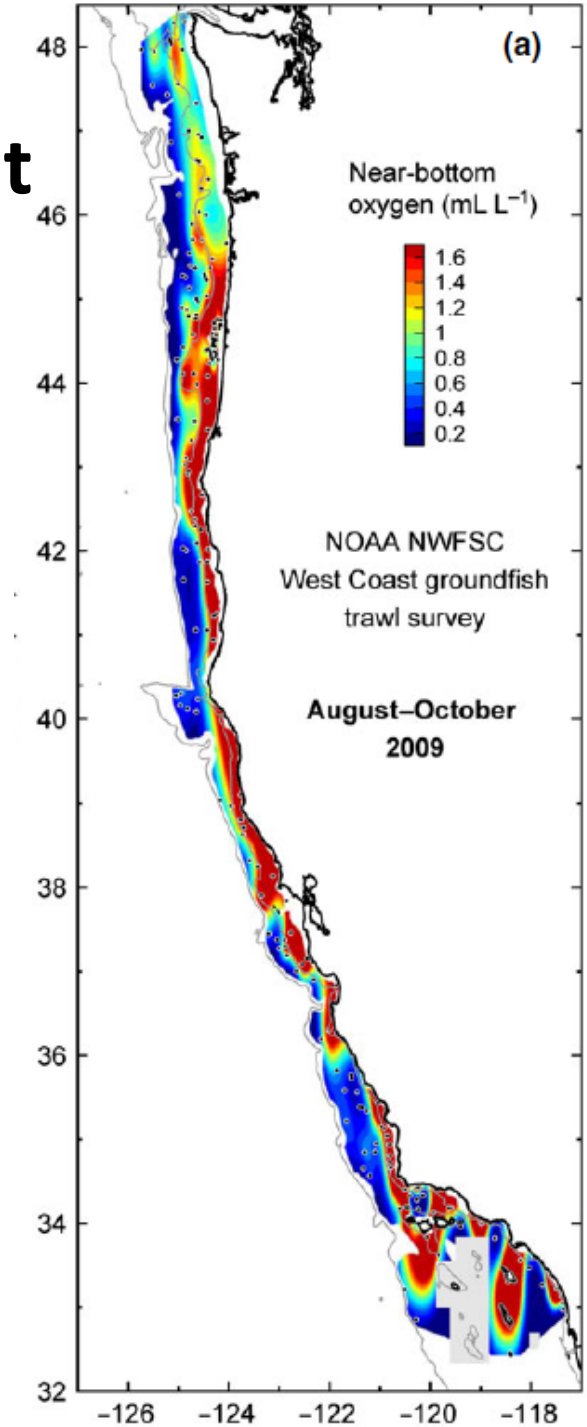




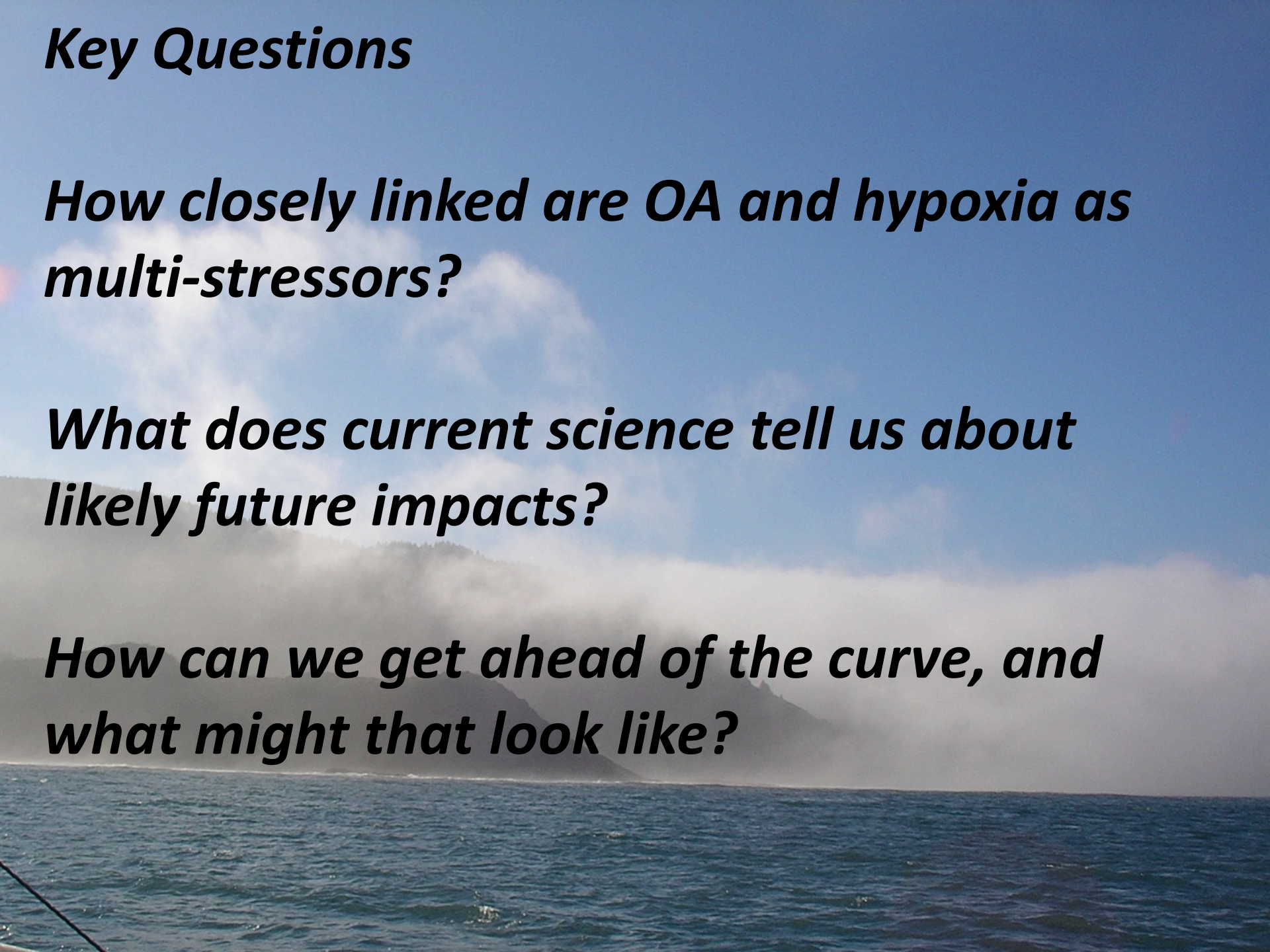
Not just an Oregon issue and not without implications for management



West Coast Groundfish Survey



Keller et al. Fisheries Oceanography 2015

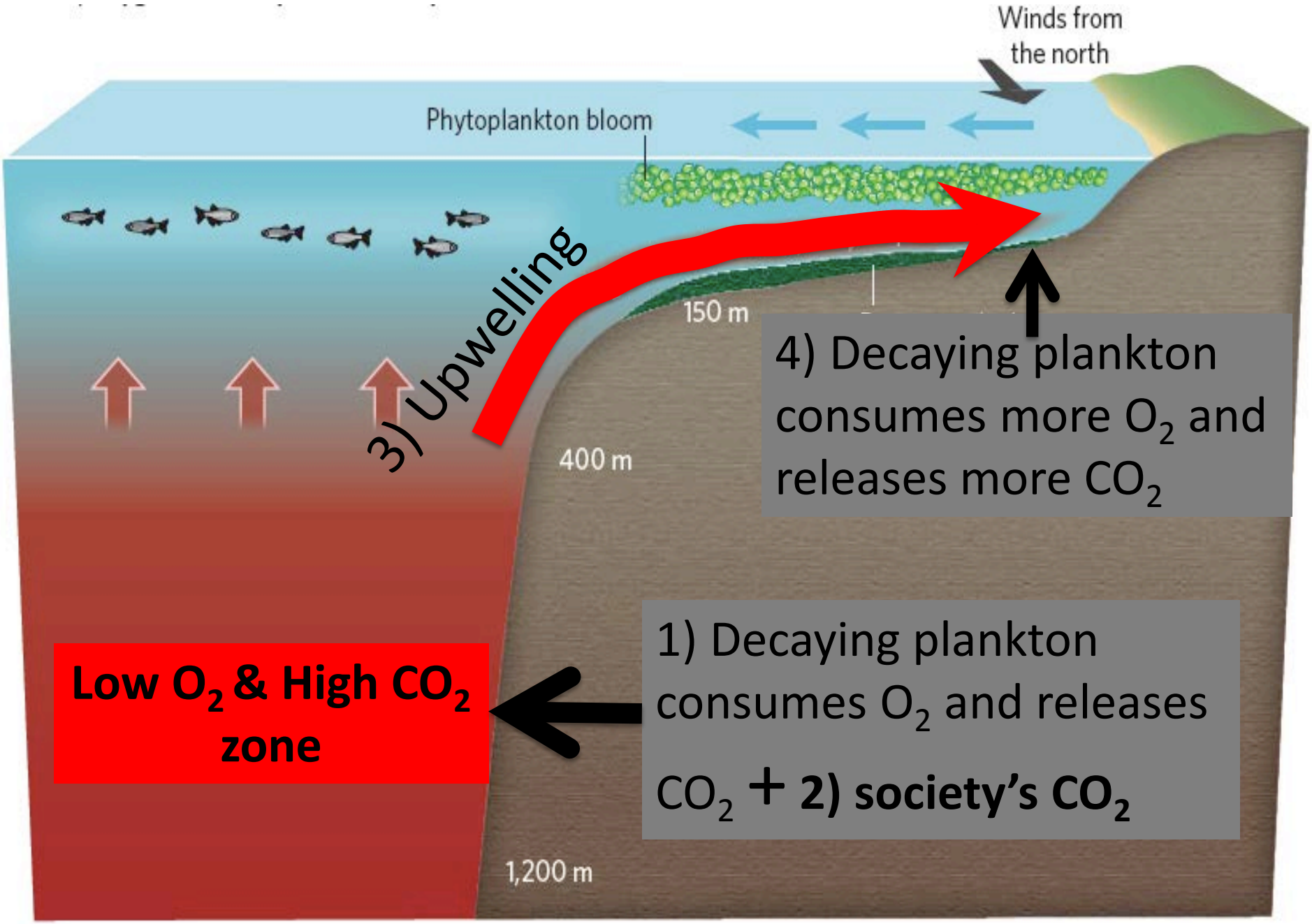


Key Questions

How closely linked are OA and hypoxia as multi-stressors?

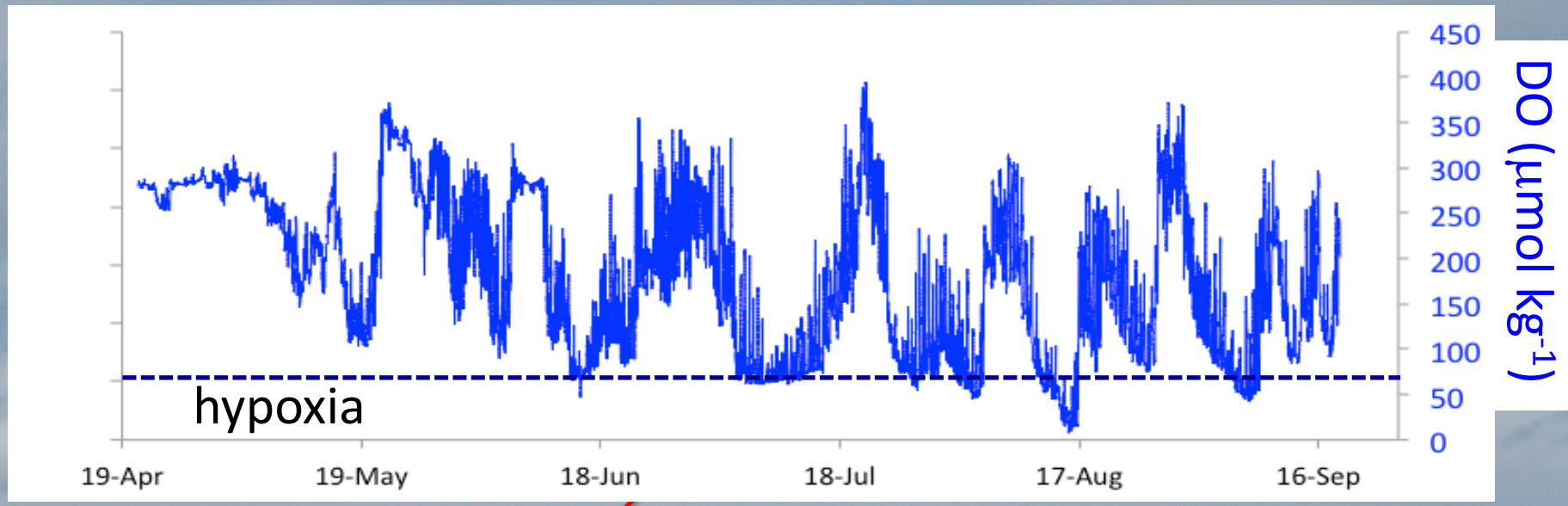
What does current science tell us about likely future impacts?

How can we get ahead of the curve, and what might that look like?

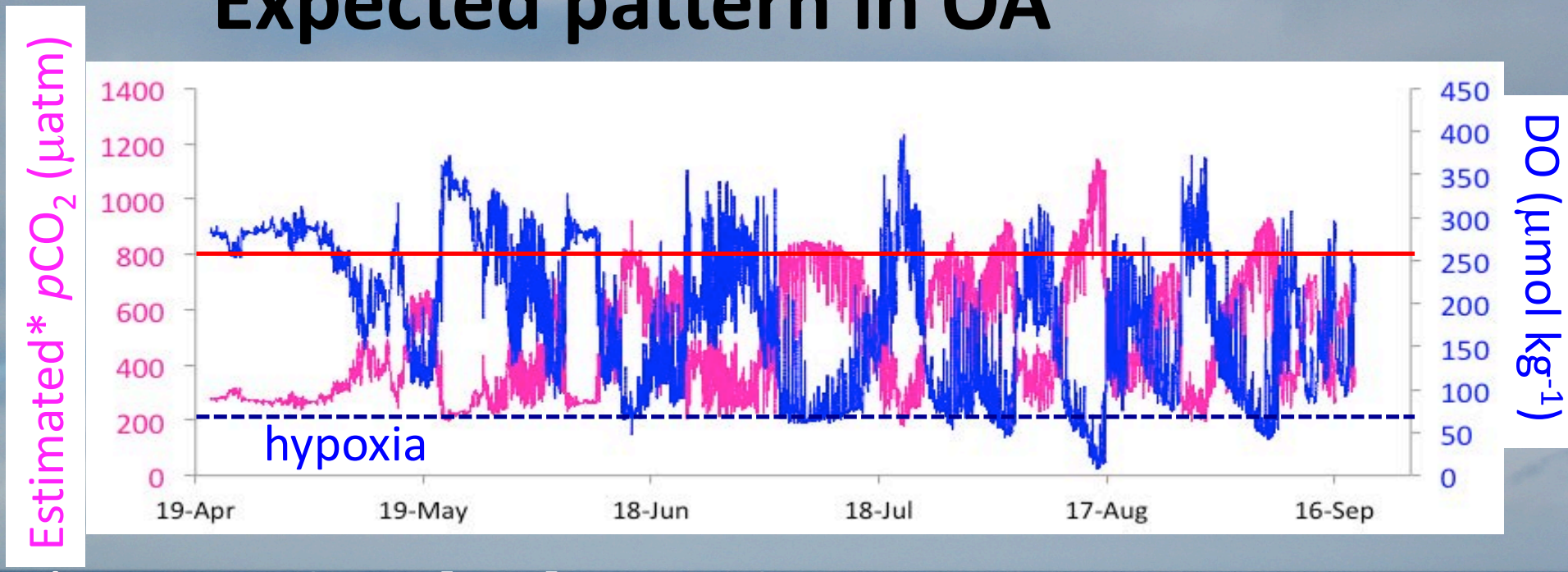


Modified from Gewin (2011)

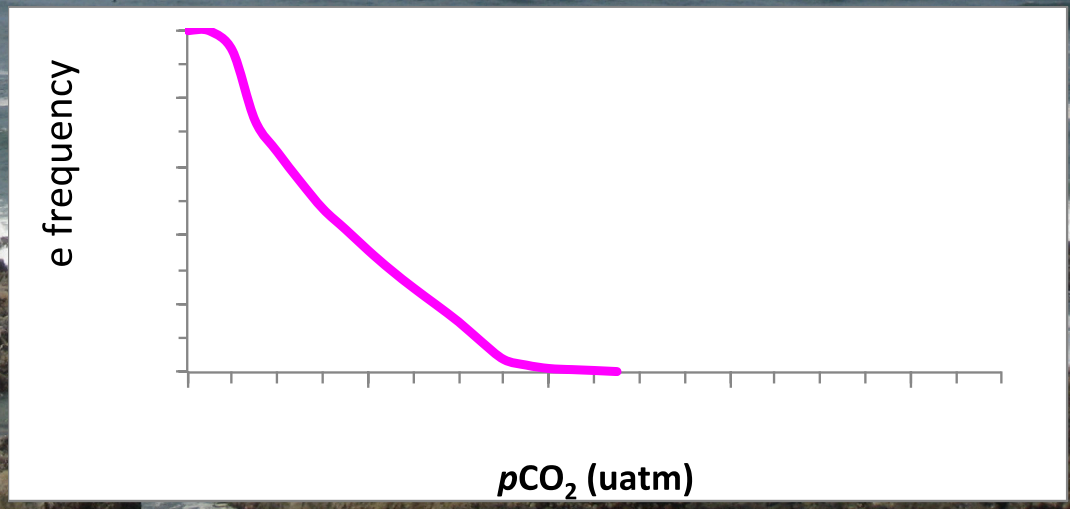
How tightly linked are OA and hypoxia?



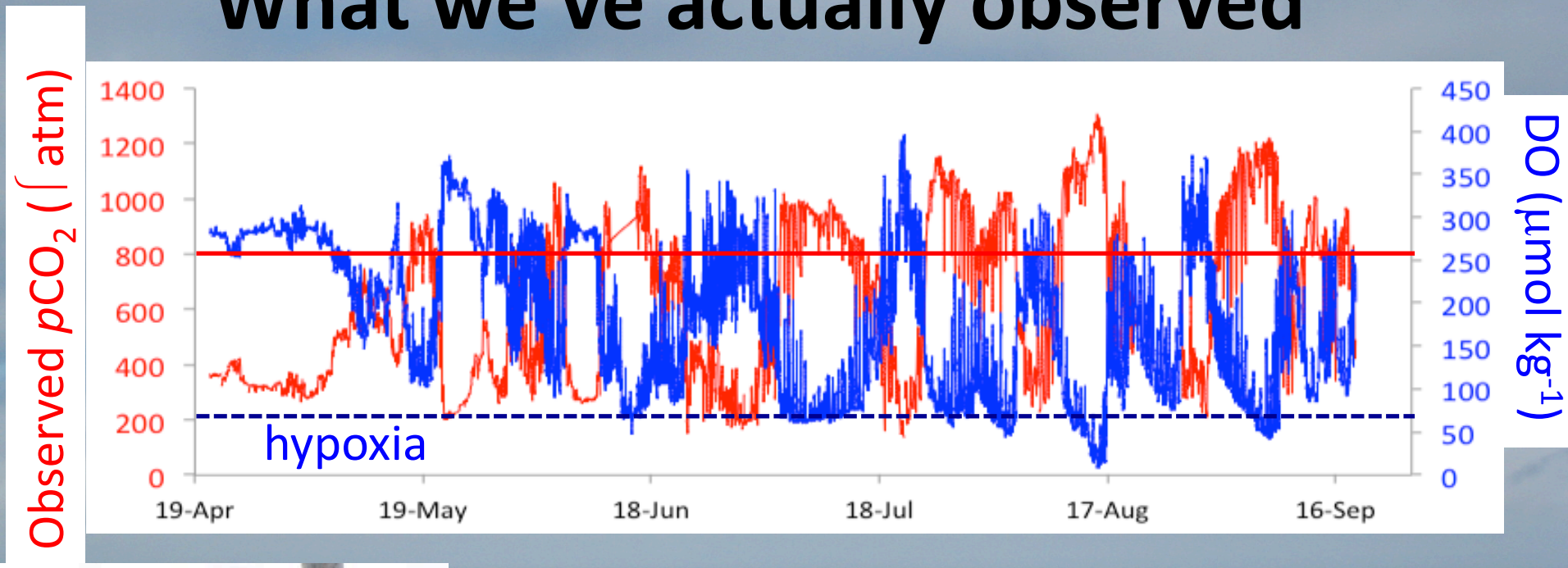
Expected pattern in OA



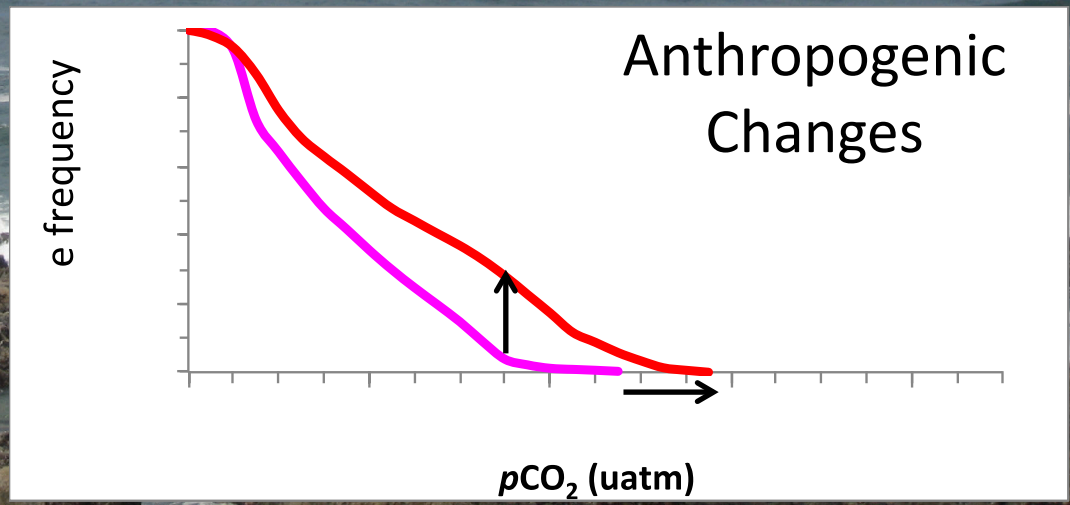
*** Starting from [DIC] that reflects last equilibration with a pre-industrial (280 ppm) atmosphere**



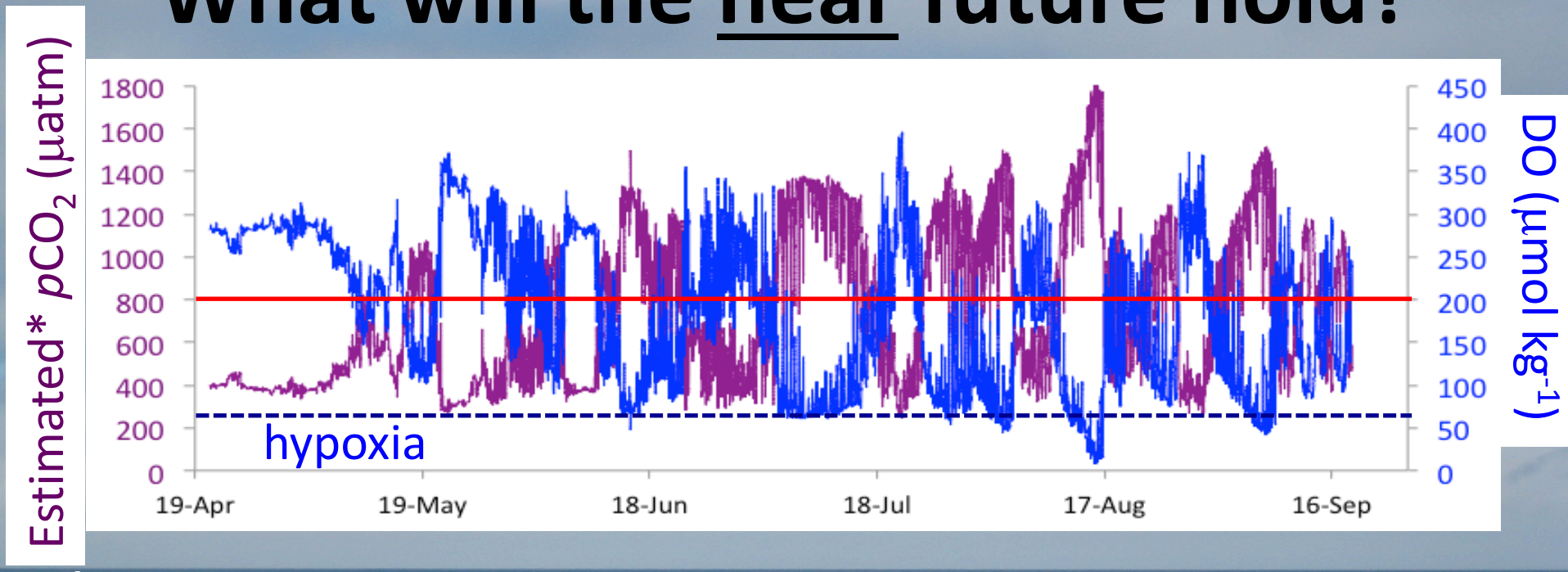
What we've actually observed



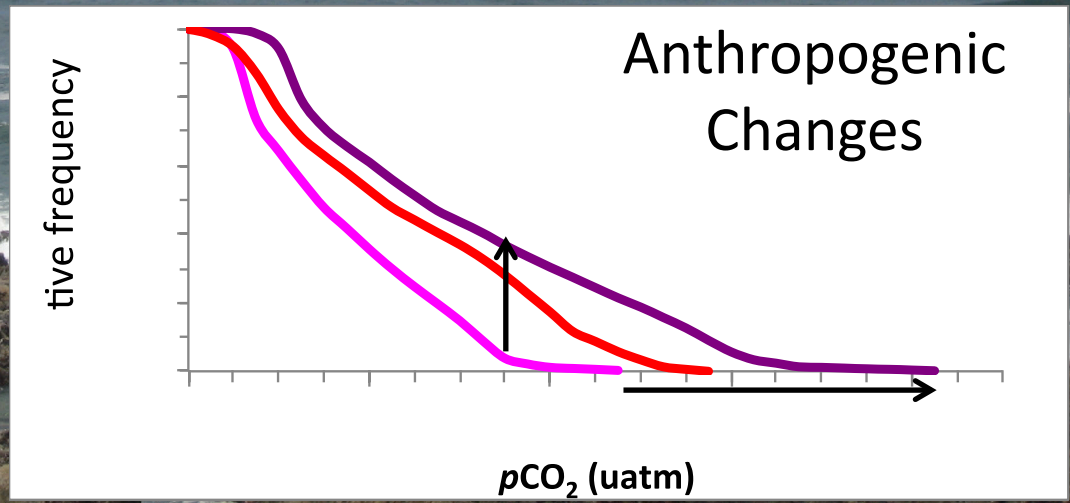
OA and hypoxia are inescapably-linked multi-stressor challenges



What will the near future hold?



*** With added DIC from last equilibration with a 400ppm atmosphere**



The West Coast Ocean Acidification and Hypoxia Science Panel

"A multi-state, bi-national effort providing scientific guidance to state and federal decision makers"

Convened Nov. 2013

ALIGNING EFFORTS ACROSS BOUNDARIES → **ENGAGING FEDERAL PARTNERS**

Pacific Coast Collaborative

WA Blue Ribbon Panel – MRAC

West Coast Governor's Alliance

CA Ocean Protection Council

Ocean Science Trust

OR Institute for Natural Resources

NOAA

US EPA

CEQ

OPPORTUNITY TO INFORM:

WATER QUALITY
NATURAL RESOURCES
LEGISLATURE
LAND USE/AIR QUALITY

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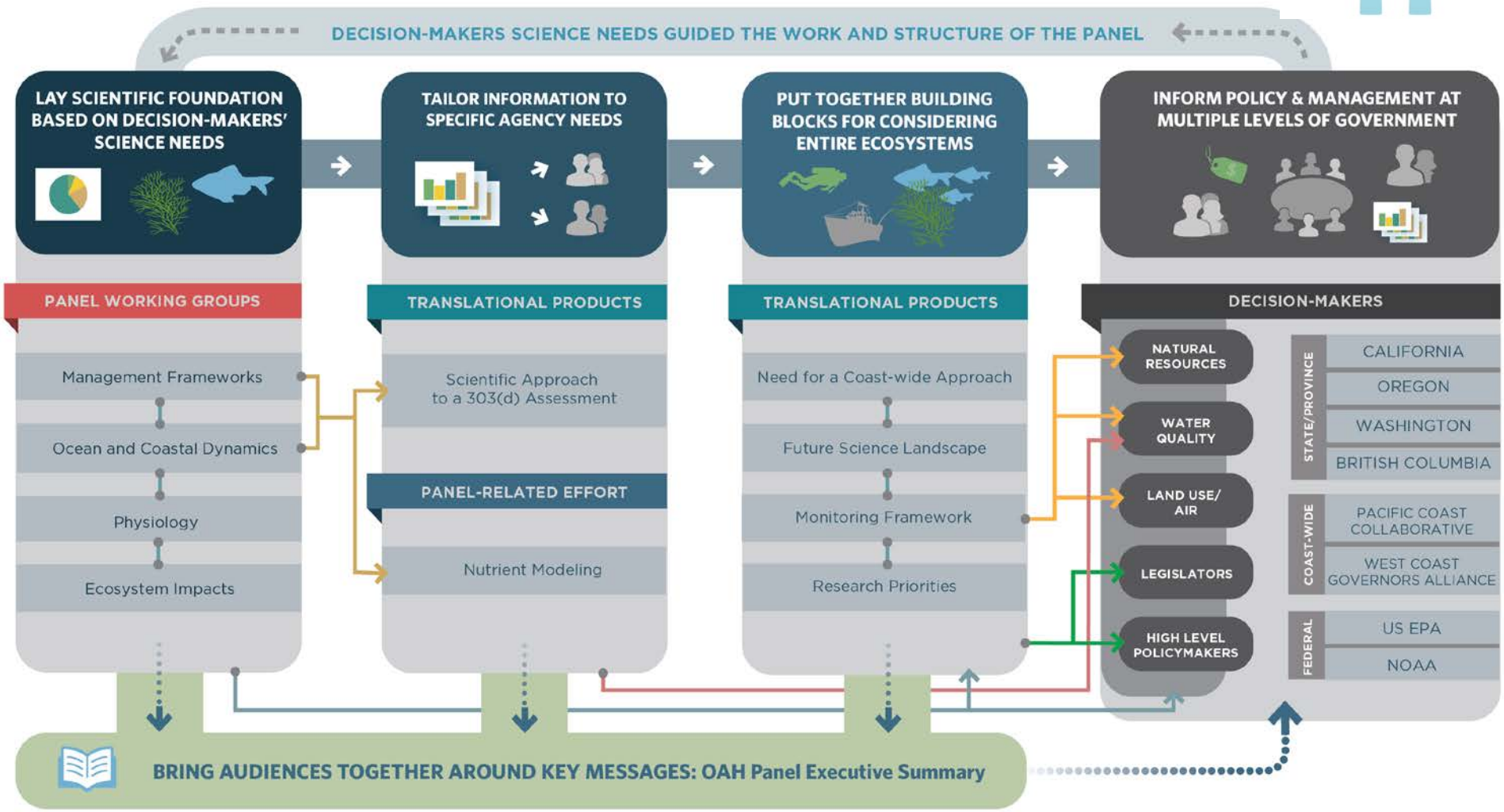
LAND USE/AIR QUALITY
HIGH LEVEL POLICY

From Science to Decision-Making

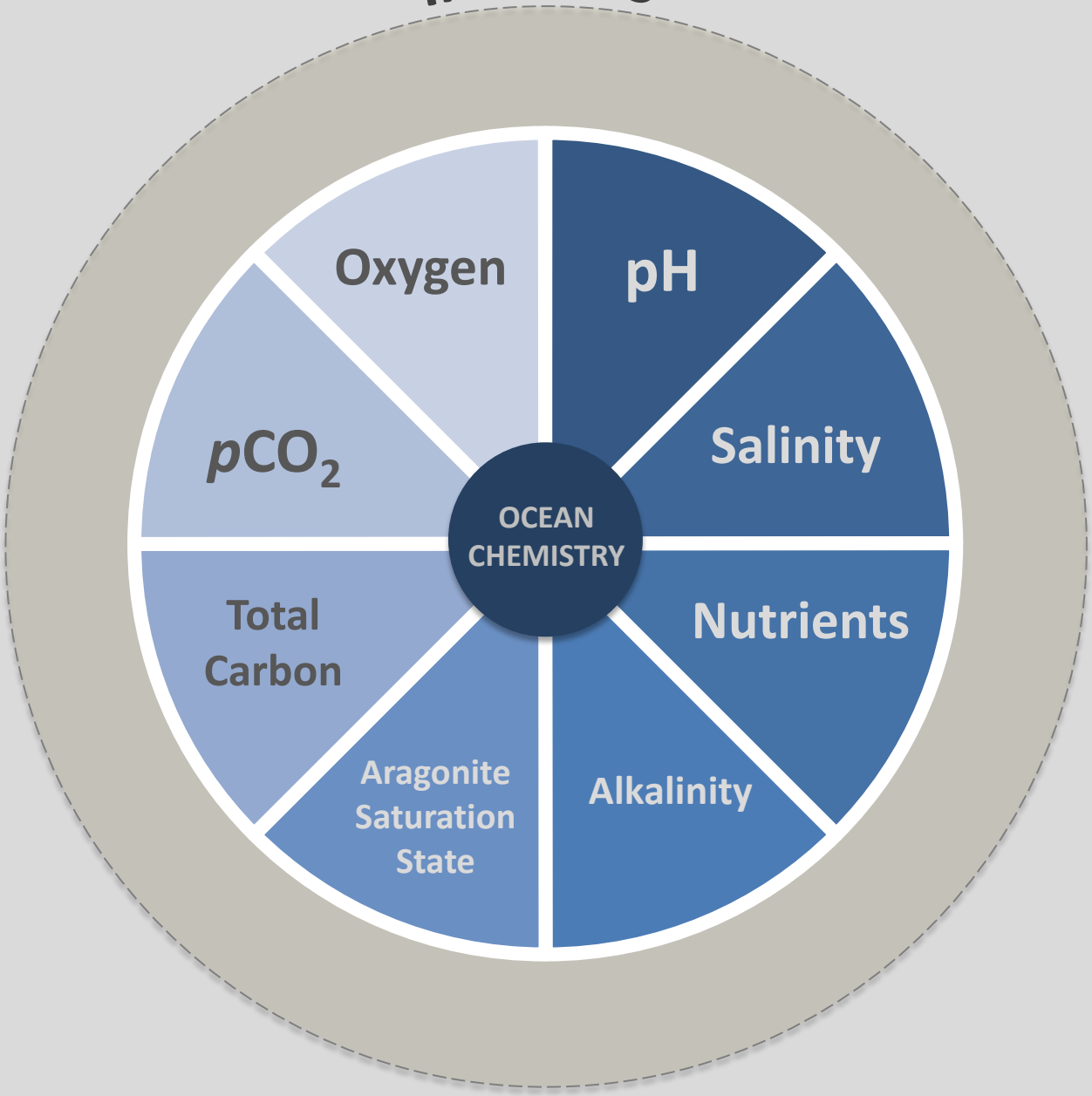


CALIFORNIA OCEAN SCIENCE TRUST

IMPACTS

THINGS WE CARE ABOUT

- Fish/Fisheries
- Biodiversity
- Ecosystem Services
- Water Quality



DRIVERS OF CHANGE

- Elevated atm. CO_2
- Elevated seawater CO_2
- Climate change
- Increased nutrient runoff
- Low O_2 water closer to surface

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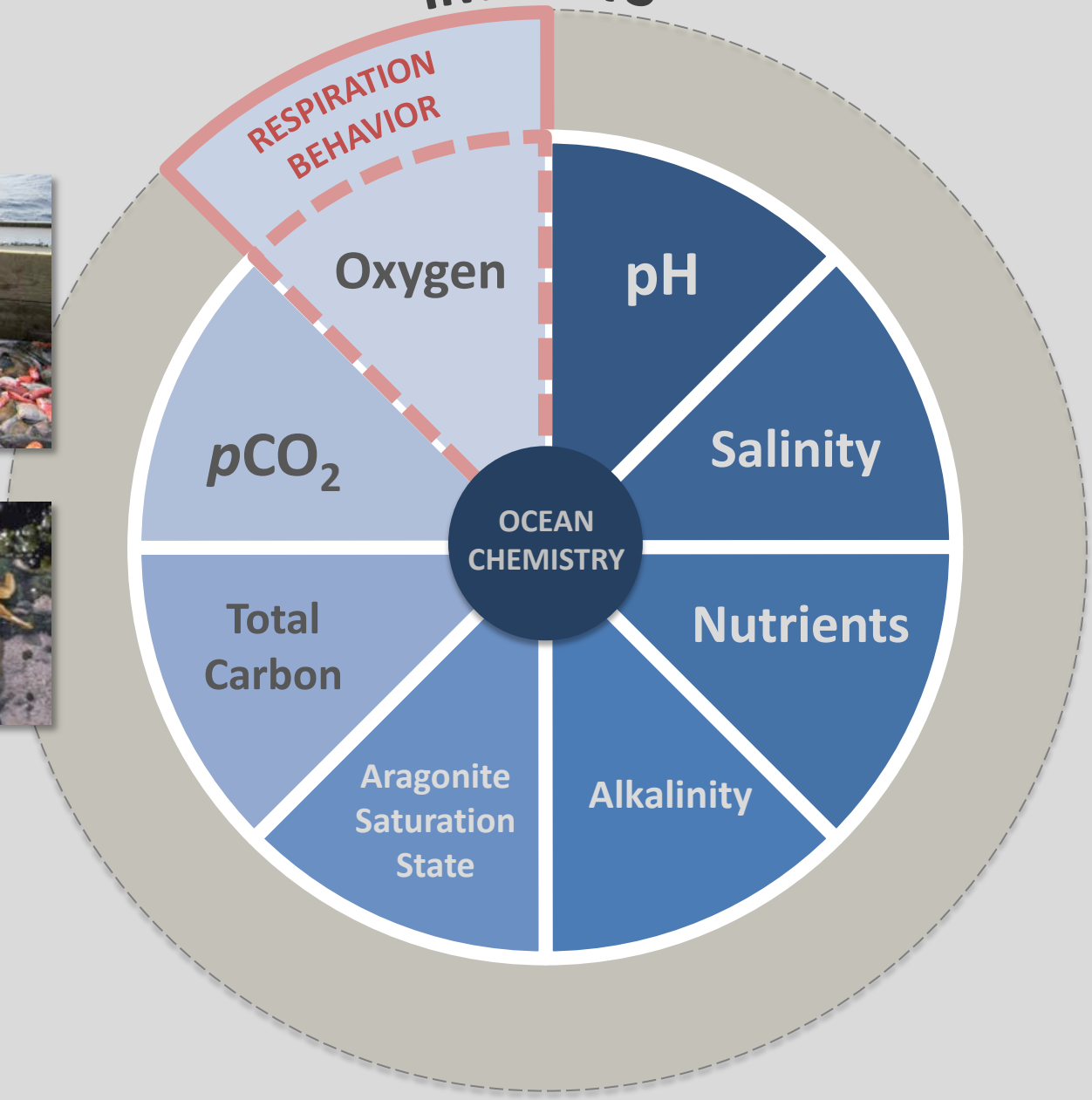
THINGS WE CARE ABOUT

IMPACTS



DRIVERS OF CHANGE

Low O_2 water closer to surface

Climate change

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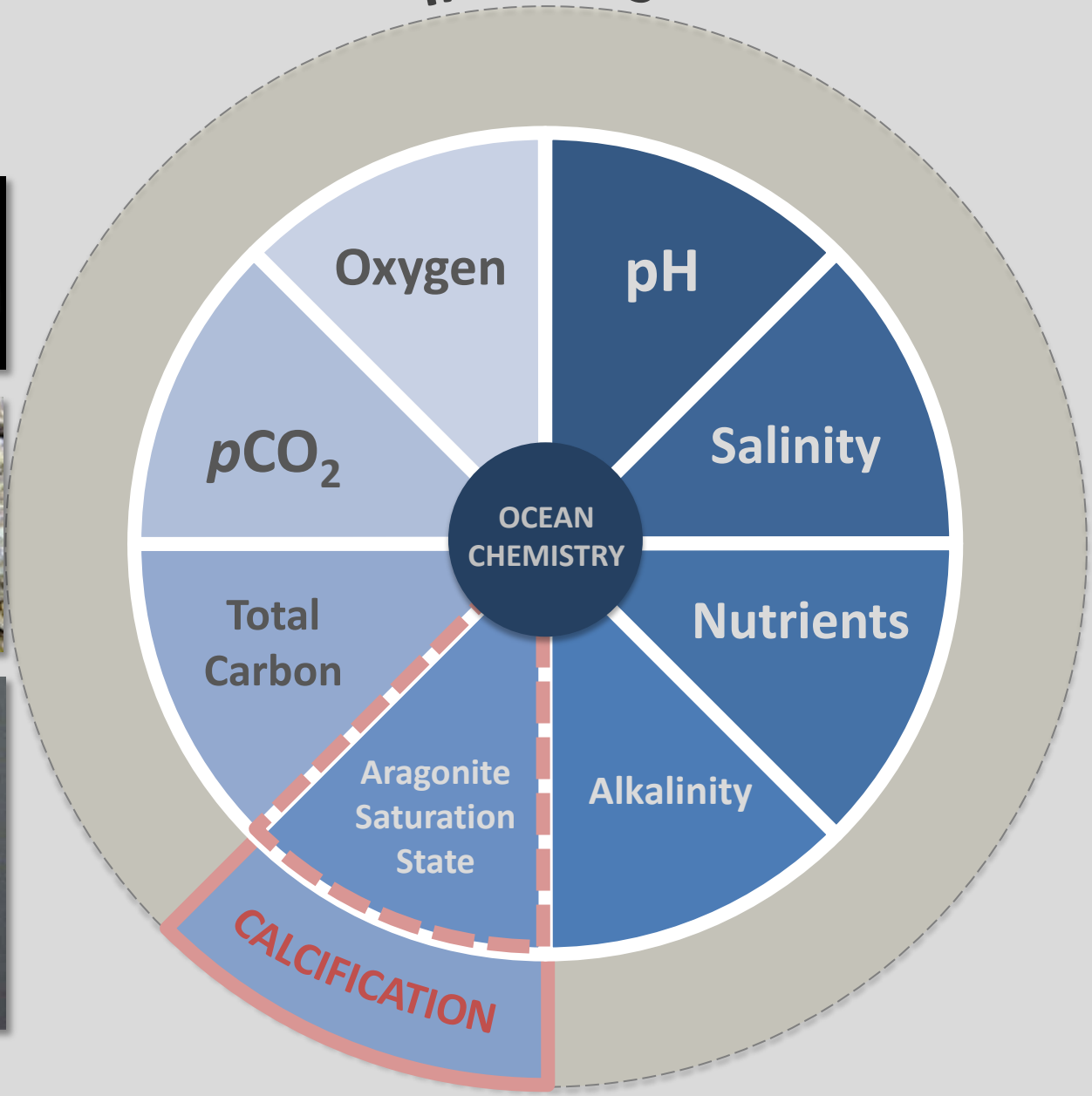
IMPACTS

THINGS WE CARE ABOUT



DRIVERS OF CHANGE

- Elevated atm. CO_2
- Elevated seawater CO_2

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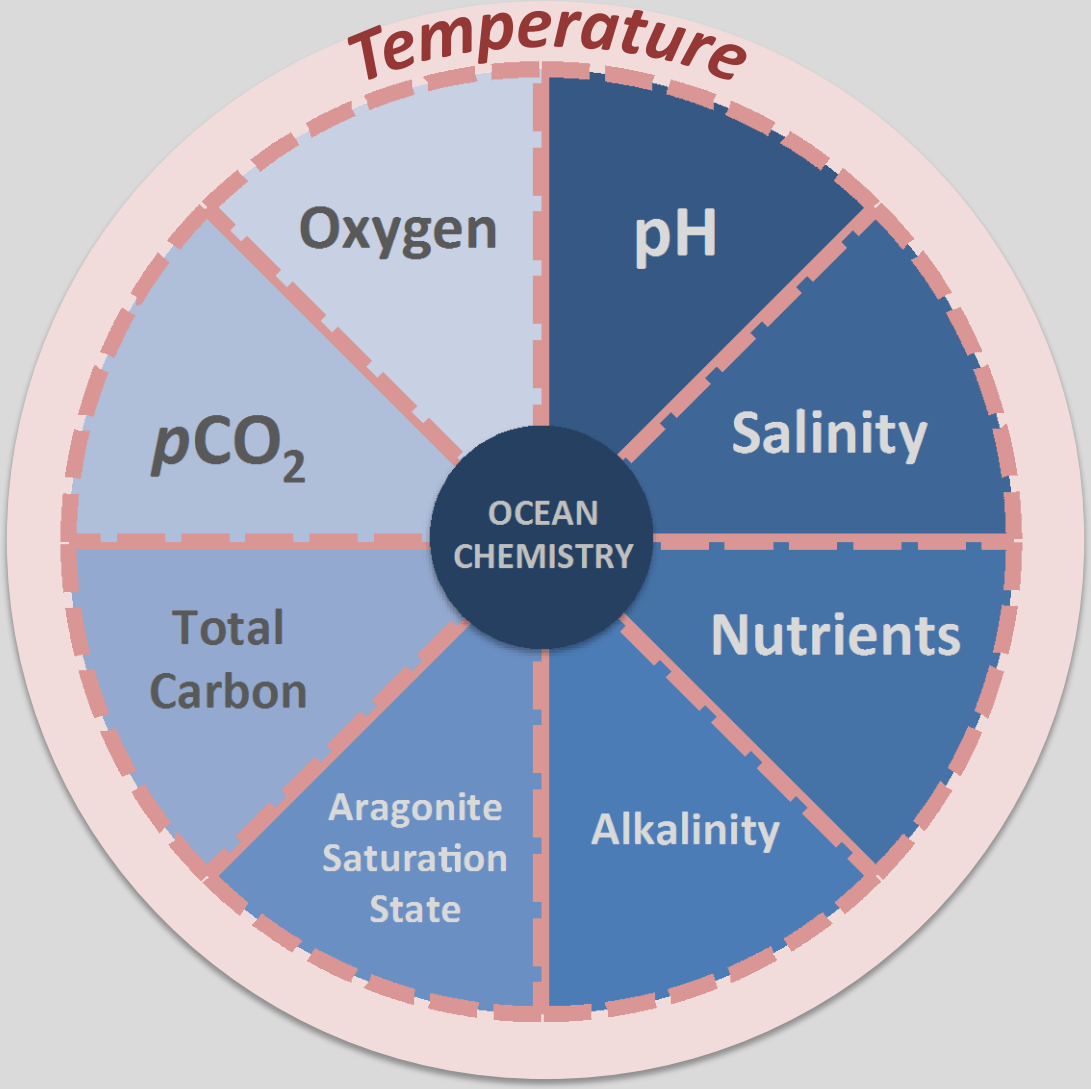
It's about changing ocean chemistry…

"Ocean acidification"
is too narrow for the
multiple stressors involved.

Even OA *and* hypoxia
don't tell the whole story.

We need to change the
way we talk.



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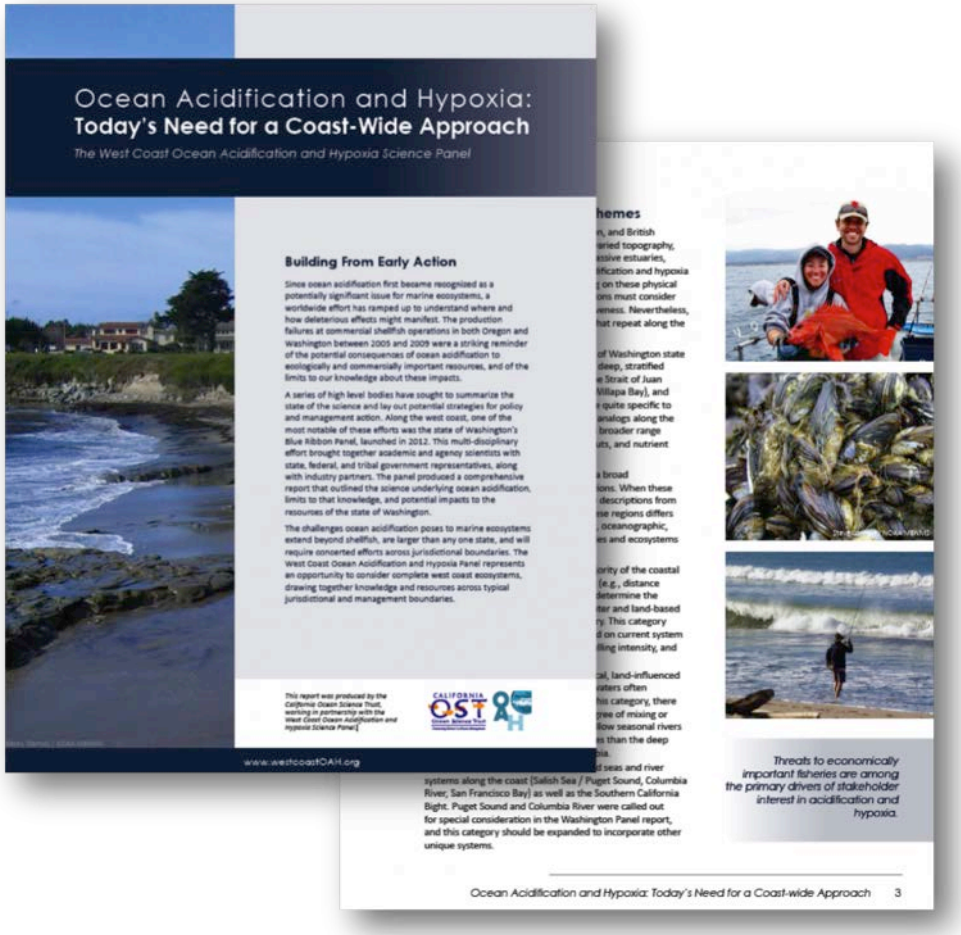
DRAFT DRAFT DRAFT
Emerging Scientific Findings

1. The global problem is elevated atmospheric CO_2
2. This is a regional intensification of a global problem that requires a coordinated regional approach
3. There are things you can do now (mitigation)
4. Support resilient ecosystems (adaptation)
5. Accelerate the development and integration of knowledge required to improve decisions
6. There is a cost to inaction

Value of a Coast-Wide Approach: Reaching Beyond Boundaries



Ocean Acidification and Hypoxia:
Today's Need for a Coast-Wide Approach

The West Coast Ocean Acidification and Hypoxia Science Panel

Building From Early Action

Since ocean acidification first became recognized as a potentially significant issue for marine ecosystems, a worldwide effort has ramped up to understand where and how deleterious effects might manifest. The production failures at commercial shellfish operations in both Oregon and Washington between 2005 and 2009 were a striking reminder of the potential consequences of ocean acidification to ecologically and commercially important resources, and of the limits to our knowledge about these impacts.

A series of high level bodies have sought to summarize the state of the science and lay out potential strategies for policy and management action. Along the west coast, one of the most notable of these efforts was the state of Washington's Blue Ribbon Panel, launched in 2012. This multi-disciplinary effort brought together academic and agency scientists with state, federal, and tribal government representatives, along with industry partners. The panel produced a comprehensive report that outlined the science underlying ocean acidification, limits to that knowledge, and potential impacts to the resources of the state of Washington.

The challenges ocean acidification poses to marine ecosystems extend beyond shellfish, are larger than any one state, and will require concerted efforts across jurisdictional boundaries. The West Coast Ocean Acidification and Hypoxia Panel represents an opportunity to consider complete west coast ecosystems, drawing together knowledge and resources across typical jurisdictional and management boundaries.

This report was produced by the California Ocean Science Trust, working in partnership with the West Coast Ocean Acidification and Hypoxia Science Panel.

www.westcoastOAH.org

Threats to economically important fisheries are among the primary drivers of stakeholder interest in acidification and hypoxia.

Ocean Acidification and Hypoxia: Today's Need for a Coast-wide Approach 3

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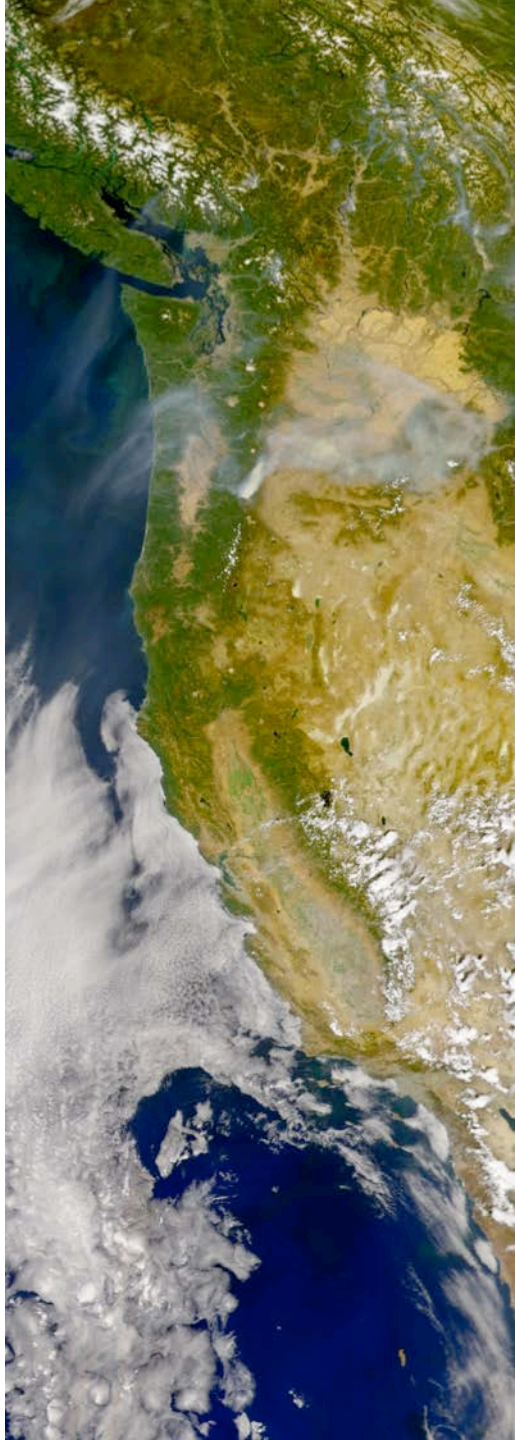
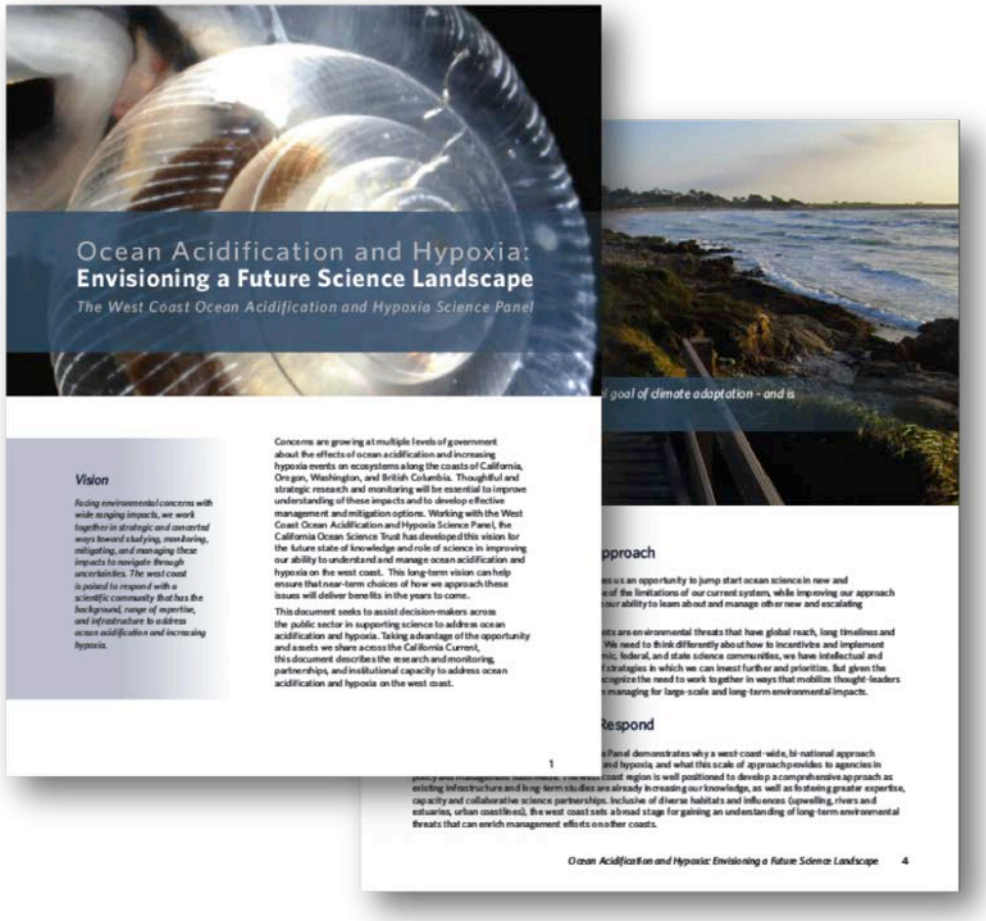


Looking Forward: Envisioning a New Path



Ocean Acidification and Hypoxia:
Envisioning a Future Science Landscape

The West Coast Ocean Acidification and Hypoxia Science Panel

Vision

Facing environmental concerns with wide ranging impacts, we work together in strategic and concerted ways toward studying, monitoring, mitigating, and managing these impacts to navigate through uncertainties. The west coast is poised to respond with a scientific community that has the background, range of expertise, and infrastructure to address ocean acidification and increasing hypoxia.

Concerns are growing at multiple levels of government about the effects of ocean acidification and increasing hypoxia events on ecosystems along the coasts of California, Oregon, Washington, and British Columbia. Thoughtful and strategic research and monitoring will be essential to improve understanding of these impacts and to develop effective management and mitigation options. Working with the West Coast Ocean Acidification and Hypoxia Science Panel, the California Ocean Science Trust has developed this vision for the future state of knowledge and role of science in improving our ability to understand and manage ocean acidification and hypoxia on the west coast. This long-term vision can help ensure that near-term choices of how we approach these issues will deliver benefits in the years to come.

This document seeks to assist decision-makers across the public sector in supporting science to address ocean acidification and hypoxia. Taking advantage of the opportunity and assets we share across the California Current, this document describes the research and monitoring, partnerships, and institutional capacity to address ocean acidification and hypoxia on the west coast.

1

goal of climate adaptation - and is

pproach

us an opportunity to jump start ocean science in new and
of the limitations of our current system, while improving our approach
our ability to learn about and manage other new and escalating

ts are environmental threats that have global reach, long timelines and
We need to think differently about how to incentivize and implement
ic, federal, and state science communities, we have intellectual and
strategies in which we can invest further and prioritize. But given the
cognize the need to work together in ways that mobilize thought-leaders
managing for large-scale and long-term environmental impacts.

Respond

Panel demonstrates why a west-coast-wide, bi-national approach
nd hypoxia, and what this scale of approach provides to agencies in
coast region is well positioned to develop a comprehensive approach as
existing infrastructure and long-term studies are already increasing our knowledge, as well as fostering greater expertise,
capacity and collaborative science partnerships. Inclusive of diverse habitats and influences (upwelling, rivers and
estuaries, urban coastlines), the west coast sets a broad stage for gaining an understanding of long-term environmental
threats that can enrich management efforts on other coasts.

Ocean Acidification and Hypoxia: Envisioning a Future Science Landscape 4

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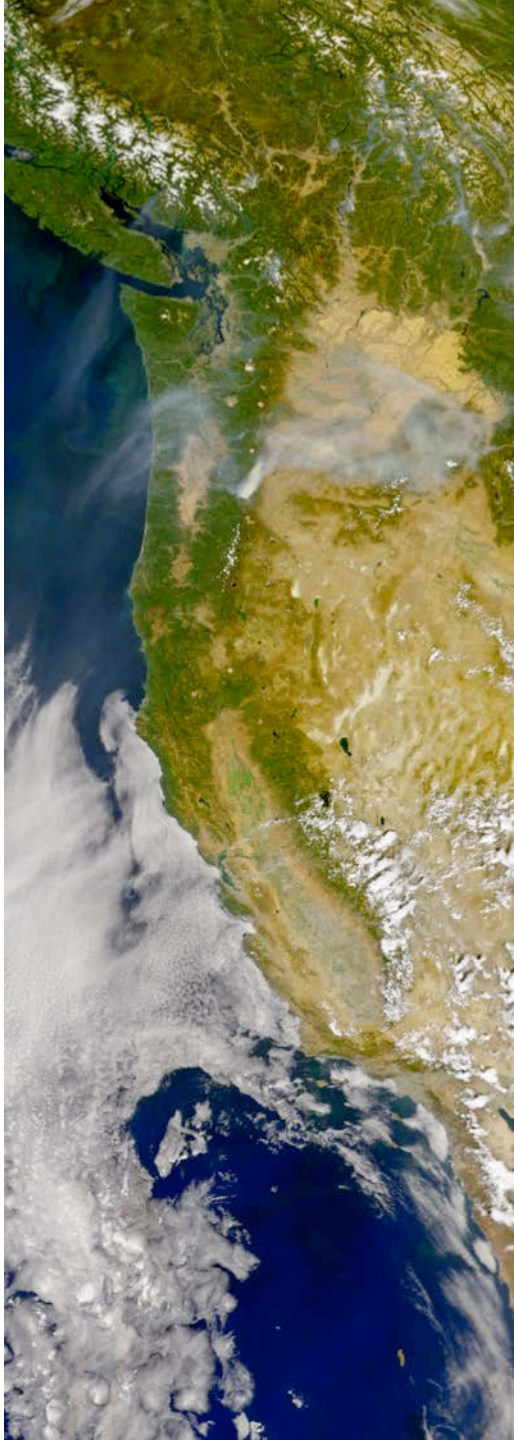

Five things we know about ocean acidification and hypoxia in Oregon

DRAFT

- ✓ Ocean water is rapidly becoming more acidic.
- ✓ Coastal Oregon and the West Coast are particularly vulnerable to OA and Hypoxic Zones.
- ✓ Organisms that use carbonate in their shells are showing negative impacts from OA – today.
- ✓ Different species react differently to changing seawater chemistry.
- ✓ Oregon's economy is already being negatively impacted by OA.

- ***Coupled OAH stressors are heading our way, and can upend the gains and goals in coastal management***

- ***We need to accelerate our understanding of ecosystem vulnerability (e.g. take advantage of deep west coast collaborations in OAH science, OAH monitoring 2.0…etc.)***

- ***This understanding will be fundamental for the range and effectiveness of solutions that we can generate (i.e. move us ahead of the curve)***

The West Coast Ocean Acidification & Hypoxia Science Panel

Finalizes work Nov. 2015

Institute for Natural Resources

CALIFORNIA OST Ocean Science Trust

Connecting Science to Ocean Management

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