



MEMORANDUM OF UNDERSTANDING  
BETWEEN  
THE STATE OF CALIFORNIA NATURAL RESOURCES AGENCY  
AND  
THE STATE OF OREGON GOVERNOR'S NATURAL RESOURCES OFFICE  
TO ESTABLISH THE WEST COAST OCEAN ACIDIFICATION  
AND HYPOXIA SCIENCE PANEL

Ocean acidification and hypoxia are not completely understood and may significantly affect the future of West Coast ocean ecosystems and biological resources. The purpose of this memorandum of understanding (MOU) is to establish an interdisciplinary West Coast Ocean Acidification and Hypoxia (WCOAH) Science Panel to inform decision makers about impacts of ocean acidification and hypoxia. The WCOAH Science Panel will synthesize and translate data and other information from this scientifically diverse and rapidly evolving field of research. The WCOAH Science Panel will also identify research and monitoring priorities to further advance knowledge of these complex issues.

### **The Need for a Responsive Advisory Process**

The states of California and Oregon require improved scientific understanding about the causes and implications of ocean acidification.<sup>1</sup> This need comes on the heels of similar but separate calls from multiple levels of government within each state tasked with making decisions that are either affected by or could impact ocean acidification. For example, state and federal water quality managers are increasingly under pressure to address ocean acidification as an impairment to ocean waters under the federal Clean Water Act. Resource managers and stakeholders are beginning to express concerns about the threat of ocean acidification to West Coast fisheries in addition to already-apparent threats to the shellfish industry. Earlier this year the West Coast Governors' Alliance on Ocean Health adopted a resolution that made ocean acidification a priority ocean and coastal health issue and called for the regional ocean observing system to help address it.<sup>2</sup> The Western Governors' Association in 2010 highlighted ocean acidification as an issue requiring substantial research to gain the scientific insights necessary to support the West Coast states' resource management needs.<sup>3</sup>

<sup>1</sup> California Ocean Protection Council Strategic plan: [http://www.opc.ca.gov/webmaster/ftp/pdf/2012-strategic-plan/OPC\\_042412\\_final\\_opt.pdf](http://www.opc.ca.gov/webmaster/ftp/pdf/2012-strategic-plan/OPC_042412_final_opt.pdf) and Potential Impacts of Global Climate Change in Oregon's Nearshore Ocean: Technical Supplement: [http://www.dfw.state.or.us/conservationstrategy/global\\_climate\\_change.asp](http://www.dfw.state.or.us/conservationstrategy/global_climate_change.asp)

<sup>2</sup> Memorandum of Understanding, West Coast Governors Alliance on Ocean Health & West Coast Ocean Observing Systems, October 2012: [http://www.westCoastOceans.org/media/Press\\_ReleasesList\\_serive/mouWCGA\\_OOSFINAL\\_1.pdf](http://www.westCoastOceans.org/media/Press_ReleasesList_serive/mouWCGA_OOSFINAL_1.pdf)

<sup>3</sup> Western Governors' Association. Climate Adaptation Priorities for the Western States: Scoping Report. June 2010. [http://www.westgov.org/component/docman/doc\\_download/1279-climate-adaptation-report](http://www.westgov.org/component/docman/doc_download/1279-climate-adaptation-report)

Ocean acidification is often discussed as the global lowering of ocean pH as a result of oceanic uptake of fossil fuel-derived CO<sub>2</sub> from the atmosphere. However, there is an emerging consensus in the scientific community that oceanic processes such as upwelling may contribute to regionally-distinct areas of lower pH in the ocean.<sup>4</sup>

Further, the relationship between acidification and hypoxia is just beginning to be understood. As research and our commensurate scientific understanding of these issues is advancing dramatically, it is challenging for decision makers to know when and how to engage the scientific community. It is thus timely for experts to come together and generate synthetic, cross-discipline products that serve the information needs of multiple levels of the policy and management community.

In fall 2012, the state of California convened an Ocean Acidification and Hypoxia Science Panel to address this need. Recognizing the West Coast-wide nature of ocean acidification and hypoxia concerns, in early 2013 the state of California, via the cabinet-level California Natural Resources Agency, invited the state of Oregon to expand the membership and scope of the panel to reflect the needs of both states. The work of a joint West Coast Ocean Acidification and Hypoxia Science Panel will complement the work of the state of Washington's Blue Ribbon Panel on Ocean Acidification, which released its final report on November 27, 2012.<sup>5</sup> The knowledge base established in Washington will provide a foundation for the work of a WCOAH Science Panel, and provide a better understanding of the status of the ocean acidification and hypoxia science. Scientists from Washington will participate in the process both to inform panelists about the Blue Ribbon Report and to collaborate on the emerging science related to ocean acidification and hypoxia. British Columbia has also appointed a liaison scientist, and we anticipate the U.S. and Canadian federal governments will appoint observers at a later time.

### **Objectives of the WCOAH Science Panel**

The WCOAH Science Panel will:

1. Synthesize the current scientific knowledge on ocean acidification and hypoxia relevant to the West Coast coastal and marine environment, including potential risks to biological resources and emerging management strategies.
2. Identify the research and monitoring needed to contribute to a West Coast-wide assessment of ocean acidification and hypoxia, address information and data gaps critical to resource management decisions, and support managers in addressing these issues going forward.
3. Work with supporting institutions in both states to translate this information into timely, relevant, and useful formats that facilitate use by managers and other decision makers.

---

<sup>4</sup> Nicolas Gruber, Claudine Hauri, Zouhair Lachkar, Damian Loher, Thomas L. Frölicher, and Gian-Kasper Plattner. 2012. Rapid Progression of Ocean Acidification in the California Current System. *Science*. 1216773. Published online 14 June 2012.

<sup>5</sup> Blue Ribbon Panel on Ocean Acidification. Ocean Acidification: From Knowledge to Action, Washington State's Strategic Response. November 2012. Available at: <http://www.ecy.wa.gov/water/marine/oceanacidification.html>.



4. Do anything else that is reasonably necessary to advance the objectives of this MOU.

### **Interdisciplinary Expertise for Effective Science Integration**

The WCOAH Panel will include experts, selected via appropriate processes in each state, from the ocean acidification and hypoxia research community. The panel is expected to call upon other scientists to contribute additional specialized knowledge.

The California Ocean Science Trust (OST) and the Institute for Natural Resources at Oregon State University (INR), using their expertise in understanding manager needs and stewarding cross-disciplinary panels to generate new knowledge will guide and staff the panel.

### **West Coast Ocean Acidification and Hypoxia Science Panel Members**

The experts tasked with participation on the WCOAH Science Panel are the following:

- **Dr. Alexandria Boehm** (chair), Stanford University – Coastal Water Quality
- **Dr. Jack Barth**, Oregon State University – Physics of Oceans and Atmospheres
- **Dr. Liz Chornesky**, Independent Consultant – Science to Policy and Management
- **Dr. Francis Chan**, Oregon State University – Hypoxia
- **Dr. Andrew Dickson**, Scripps Institution of Oceanography – Chemical Oceanography
- **Dr. Richard Feely**, NOAA Pacific Marine Environmental Laboratory – Chemical Oceanography
- **Dr. Burke Hales**, Oregon State University – Ocean Ecology and Biogeochemistry
- **Dr. Tessa Hill**, UC Davis – Biogeochemistry
- **Dr. Gretchen Hofmann**, UC Santa Barbara – Marine Biology
- **Dr. John Largier**, UC Davis – Coastal Physical Oceanography
- **Dr. George Somero**, Stanford University – Ecological Physiology
- **Dr. Martha Sutula**, So. California Coastal Water Research Project – Hypoxia/Nutrient Pollution
- **Dr. Waldo Wakefield**, Oregon State University, NOAA Fisheries NW Fisheries Science Center – Fisheries Science
- **Dr. George Waldbusser**, Oregon State University – Ocean Ecology and Biogeochemistry
- **Dr. Steve Weisberg**, So. California Coastal Water Research Project – Water Quality/Science to Policy and Management
- **Dr. Liz Whiteman**, California Ocean Science Trust – Marine Ecology/Science to Policy and Management

### **Liaison Scientists**

Liaison scientists who will consult to the WCOAH Science Panel include the following:

- **Dr. Terrie Klinger**, University of Washington – Marine Ecology and Policy
- **Dr. Jan Newton**, University of Washington – Oceanography

- **Dr. Thomas F. Pedersen**, University of Victoria (British Columbia) – Marine Geochemistry

### Duration and Timeline


This memorandum of understanding will go into effect upon signing and be terminated six months after publication of the WCOAH Science Panel's final report, anticipated sometime in 2015, or by request of either party.

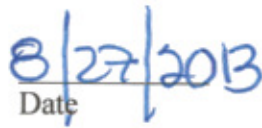
### Execution

This memorandum of understanding is executed between the California Natural Resources Agency and the Office of Oregon Governor John A. Kitzhaber as of the day, month, and year first above written.

STATE OF CALIFORNIA NATURAL  
RESOURCES AGENCY

BY: \_\_\_\_\_

  
John Laird  
Secretary for Natural Resources  
California Natural Resources Agency

  
Date

STATE OF OREGON, OFFICE OF THE  
GOVERNOR

BY: \_\_\_\_\_

  
Richard M. Whitman  
Natural Resources Policy Director  
Office of Governor John A. Kitzhaber

08/27/2013

\_\_\_\_\_  
Date