

Appendix D: Timeline of Accomplishments



The following is a comprehensive list of the accomplishments of the Oregon Coordinating Council on Ocean Acidification and Hypoxia (OAH Council) in reverse chronological order.

2026

The tenth Fisherman-Scientist Roundtable was held. (OAH Action Plan Step 4.2)

- There were over 40 attendees, and discussions were focused on climate and ocean conditions, on-the-water observations, informing West Coast groundfish stock assessments, and the socio-economic impact of fisheries.

2025

The ninth Fisherman-Scientist OAH Roundtable was held. (OAH Action Plan Step 4.2)

- There were over 40 attendees, and conversations included pinniped food habits, ocean conditions, the state of the scientific community to continue conducting research due to decreased federal funding and capacity, and how fishermen and scientists can work together to overcome limitations.

Dr. George Waldbusser's House Bill 3114 (HB3114) project to understand climate and ocean acidification (OA) impacts on Olympia oysters is ongoing. (OAH Action Plan Steps 3.1 and 3.2)

- The research team ran a "space for time" study in Yaquina Bay, utilizing environmental variations through the estuary to compare oyster growth.
- The preliminary findings illustrate that the locations do have differing pH and temperature conditions and that oysters grow at differing rates.
- The team will soon compare growth with CO₂ conditions and combine data into a more robust model.

The HB3114 project on breeding Pacific oysters for resistance to the effects of OA led by Dr. Chris Langdon is ongoing. (OAH Action Plan Step 3.1)

- The research team developed a novel flow-through larval rearing system that allowed them to determine the effects of acidified seawater on larval performance and spat production under highly controlled conditions.
- They also carried out a selection experiment to determine if progeny from stressed parents (exposed to acidified water during the larval phase and heat stress during the adult phase) would outperform progeny of non-stressed parents from the same families.
- Results indicated that acidified seawater adversely affected larval growth and spat production; however, they were not able to detect an improvement in performance of larvae from stressed parents when exposed to OA conditions.
- Comparison of field performances of progeny from stressed and non-stressed parents is in progress.

OA monitoring at Whiskey Creek Shellfish Hatchery is ongoing. (OAH Action Plan Step 1.1)

- Continued high-resolution measurement of the full carbonate system in hatchery intake waters from Netarts Bay has allowed Whiskey Creek managers to adaptively target favorable conditions for culture activities.
- Additionally, this monitoring has allowed Whiskey Creek staff to buffer waters with suboptimal chemical conditions after receiving advice on the appropriate mineral selection from OSU researchers.

OSU Hatfield Marine Science Center's (HMSC) project utilizing HB3114 funds to create a robust long-term OAH monitoring site on the HMSC campus located on Oregon's Yaquina Bay is ongoing. (OAH Action Plan Step 1.1)

- The data collected at the HMSC Climate Monitoring Station will create a baseline OAH dataset to track ecosystem shifts, inform management decisions in Oregon's critical estuaries, and improve public data literacy and estuary health awareness for the more than 150,000 annual visitors to HMSC.

The project on enhancing Ocean Acidification and Hypoxia (OAH) sampling on the Newport Hydrographic Line, led by Dr. Francis Chan of Oregon State University (OSU) and Jennifer Fisher of National Oceanic and Atmospheric Administration (NOAA), is ongoing. (OAH Action Plan Step 1.2)

- The Newport Hydrographic Line (a line of survey stations running East-West out of Yaquina Bay) time series is key to understanding the connectivity between changes in ocean- climate and ecosystem structure and function.
- The over 25 year time series provides fortnightly to monthly data collected on the continental shelf and slope off Newport, OR. Oxygen profile data have been collected since 2006 to monitor OAH.
- With the addition of HB3114 funding, monthly water samples are also being collected to establish a baseline of carbonate chemistry in Oregon's nearshore waters.
- These near-bottom samples have been collected since February 2023 from three nearshore stations.

2024

The eighth Fisherman-Scientist OAH Roundtable was held. (OAH Action Plan Step 4.2)

- Conversations included an overview of the California Current Ecosystem Status Report (ESR), forage fish, observations from fishers, Oregon's fishery revenue, social vulnerability, fishing industry resilience, and offshore wind energy.
- There was interest in better methods for capturing real-time observations from fishermen to improve data accuracy and timeliness. This is the purpose of the Ocean Change App which is in need of a host.

NOAA Fisheries researchers included experiential knowledge from fishermen at the eighth Fisherman-Scientist OAH Roundtable into the 2024-2025 California Current ESR which documents the connected and changing California Current Ecosystem to support ecosystem-based management.

The [Fourth Biennial Report](#) was submitted to the Oregon Legislature.

The HB3114 project to develop science-based best management practices (BMPs) for co-management of Oregon submerged aquatic vegetation (SAV) and shellfish led by Dr. Melissa Ward was completed. (OAH Action Plan Steps 3.1 and 3.3)

- Co-management recommendations were developed through literature review, in person interviews, online surveys, and a two-day workshop, aiming to understand points and places of co-management opportunity or contention.
- Information from these processes was coalesced into a mapping tool currently available online, showing user group specific perceptions of SAV and shellfish co-management opportunities and challenges.
- This mapping tool can also be used to visualize spatially explicit overlaps between commercial shellfish harvest areas, recreational shellfish harvest areas, SAV habitat, and key management boundaries.
- More in-depth recommendations and guidance such as priority scientific needs, considerations for shellfish harvest practices, improved communication, and trust between key players, among many more, can be found in the final report.

Dr. Tarang Khangaonkar and Dr. Caitlin Magel's HB3114 project on evaluating the interaction of water quality and eelgrass in Coos Bay, Oregon using a biophysical model was completed. (OAH Action Plan Step 1.2)

- Building the biophysical model of Coos Bay allowed us to evaluate the impact of eelgrass extent scenarios on Coos Bay water quality, including pH, dissolved oxygen, and calcium carbonate saturation state, and results can inform eelgrass conservation and restoration.
- The model can now be used to explore additional research questions about changes in climate (e.g., marine heatwaves, sea level rise, drought), ocean processes (e.g., upwelling intensity), or land use (e.g., nutrient loading, freshwater flow timing and intensity) in Coos Bay.
- Future projects should consider whether improvements to the model structure or input data are needed to adequately address these questions.

Dr. Francis Chan's projects on intertidal and subtidal OAH monitoring in Oregon's marine reserves were completed. (OAH Action Plan Step 1.1)

- Funding from HB3114 allowed us to sustain measurements of pH and temperature in marine reserves through a network of partners that include The Nature Conservancy, Friends of Cape Falcon Marine Reserve, Friends of Otter Rock, Redfish Rocks Community, Surfrider, and others.
- We now have a clear understanding of the geography of OAH exposure that persists across years, with hotspots of exposure in the central coast and a refuge from the most severe low pH stress in the Port Orford region.
- We also have robust measurements of just how severe OA stress can be in rocky shore habitats due to frequent exposure to waters that are corrosive to carbonate minerals found in many intertidal organisms.
- Funding from HB3114 allowed us to sustain our most important hypoxia time series (begun in 2003) and make OAH measurements in (or just outside of) marine reserves. The latter was achieved through partnership with Oregon Department of Fish and Wildlife (ODFW) and crab fishermen.
- Through these partnerships, we now have strong clarity on the geography of exposure to OAH stressors across our state's marine reserves and the recognition of those reserves as sentinel sites for detecting and tracking ocean change.

The [OAH Communications Plan](#) and toolkit was developed. It inspires key audiences to act to reduce the projected trajectory of ocean and climate change and build a more resilient future through OAH mitigation and adaptation planning and policy. (OAH Action Plan Steps 4.1, 4.2, and 4.3)

The results from the HB3114 projects were made available to the public via recorded presentations, which can be found here: <https://tinyurl.com/HB3114FinalVideos>. (OAH Action Plan Step 4.2)

The seventh Fisherman-Scientist OAH Roundtable was held. (OAH Action Plan Step 4.2)

- Conversations included spatial stock structure and how it affects fisheries management, the seasonal cycle of OA off Oregon and Washington based on Ocean Observatories Initiative (OOI) observations, and marine heatwaves.
- The Fishermen's Ocean Change App was still under development but was in early beta testing.

In applying the ocean acidification and hypoxia methodologies using the data and tools available for the 2024 assessment, Oregon Department of Environmental Quality (DEQ) identified one ocean area (Cape Foulweather to Siltcoos River) as impaired for OAH and one area (mouth of the Columbia River to Cape Lookout) as impaired for ocean acidification only. These proposed impairments are now reflected on [DEQ's draft 2024 Integrated Report on Surface Waters](#) and 303(d) list of Impaired Waters needing a Management Plan. This is the first time an ocean area has been listed as impaired for ocean acidification in the United States. (OAH Action Plan Steps 2.2 and 2.3)

The OAH Council served on the advisory board for research funded by a NOAA Grant from 2020-2024: “Assessing Community Vulnerability to Ocean Acidification Across the California Current Ecosystem.” (OAH Action Plan Step 3.1.1)

Members of the OAH Council attended the water quality modeling and management meeting focused on OA hosted by the Pacific Coast Collaborative (PCC) OAH Working Group. The meeting gathered OA experts and state and provincial water quality practitioners to discuss regional OAH observations and hydrodynamic models to better inform coastal resource management across the Pacific U.S. and Canadian coastlines. (OAH Action Plan Step 2.3)

2023

The International Alliance to Combat Ocean Acidification (OA Alliance) published their latest annual report, 2023 Highlights, Impact and Progress Report, celebrating major achievements, detailing actions that supported climate-ocean leadership for members, and outlining the OA Alliance’s objectives. The report mentioned Oregon’s involvement through participation in the “Accelerating Implementation of Climate-Ocean Policy in the U.S.” meeting and highlighted Oregon’s OAH Communication Plan. The full reports can be found here: www.oaalliance.org/progress-reports.

The United States released the [U.S. Ocean Acidification Action Plan](#), highlighting the nation’s leadership in reducing carbon emissions, investing in adaptive measures, and strengthening monitoring, research, and coordination research efforts. The Pacific Coast Collaborative’s OAH working group (of which the Oregon OAH Council is a part) informed the development of the OA Action Plan.

The sixth Fisherman-Scientist OAH Roundtable was held. (OAH Action Plan Step 4.2)

- Conversations included a crab abundance report, the 2023 OOI, the 2023 Ocean Conditions Report, biological observations from the Newport Hydrographic Line, a salmon report, climate ready fisheries, and interesting observations from the summer’s El Nino-Southern Oscillation.
- Participants emphasized the need for more social scientists to help inform the human dimensions aspect of climate ready fisheries.

HB3114 funding increased staffing for the ODFW Shellfish and Estuarine Habitat of Coastal Oregon (SEACOR) project for the 2022-2023 field seasons. (OAH Action Plan Step 1.2)

- This increased sampling efficiency and areal coverage for Tillamook Bay Estuary Assessment during those field seasons, and it included both intertidal (2022-2023) and subtidal (2023) sampling.
- The results of the survey were used to update the stock estimates of recreationally and commercially important bay clam populations of Tillamook Bay, last sampled in 2010-2012.
- The updated stock assessments were used by ODFW to adjust the quotas for the intertidal and subtidal (dive) clam fisheries.
- The results of the assessment were also shared with the legislatively mandated Tillamook Bay Clam Advisory Committee (TBCAC) and were used, in part, to generate the 31 TBCAC recommendations that were presented to the Oregon Legislature by ODFW in December 2023.

The OAH Council hosted the first ever OAH Symposium. Progress updates from all HB3114-funded projects were presented for over 80 stakeholders, natural resource managers, journalists, and members of the public. An online recording of this symposium is available here: <https://tinyurl.com/OAHSymposium2023>. (OAH Action Plan Steps 4.2)

Marine Water Quality Units and OAH Assessment Framework concept paper was finalized.

HB3114 funding was also used for estuary mapping in Tillamook Bay. (OAH Action Plan Step 1.2)

- The ODFW Shellfish Program purchased 2 new DJI Uncrewed Aircraft Systems (UAS) equipped with standard (RGB) and Multispectral camera systems.
- UAS flights were flown in areas of Tillamook Bay with known beds of the native eelgrass, *Zostera marina*, a protected habitat in Oregon estuaries, and high-resolution habitat maps of eelgrass and unvegetated areas in Tillamook Bay were produced.
- The new multispectral imaging systems tested during these flights show potential for rapid mapping of estuarine vegetation such as eelgrass.
- Imagery from these flights has already been used by ODFW to address emerging management issues such as permit reviews for proposed shellfish aquaculture activities.

The fifth Fisherman-Scientist OAH Roundtable was held. (OAH Action Plan Step 4.2)

- Conversations included updates on the development of the Fishermen's App, creating a "Oregon Ocean Observations" Facebook group, on the water observations, crab, salmon, and sablefish reports, and projections of future ocean conditions.
- Recommendations from the roundtable were to continue to foster improvements in communication between scientists and fishermen and to maintain collaborative research efforts.

2022

The PCC OAH Working Group hosted the West Coast OAH Symposium, bringing together nearly 60 attendees from state and provincial councils, steering committees, agencies, and ministries responsible for implementing OAH Action Plans over the next 5-10 years. The meeting focused on discussing strategies for implementing OAH Action Plan recommendations through an integrated climate and ocean policy framework.

Grants from HB3114 were awarded to:

- Dr. Francis Chan of OSU to enhance subtidal and intertidal OAH monitoring at Oregon's Marine Reserves and OAH sampling on the Newport Hydrographic Line. (OAH Action Plan Steps 1.1 and 1.2)
- Dr. Robert Cowen of HMSC to establish a long-term OAH monitoring station in Yaquina Bay, including data collection and dissemination system. (OAH Action Plan Step 1.1)
- Dr. Tarang Khangaonkar and colleagues from the University of Washington along with partners from the South Slough National Estuarine Research Reserve, the University of Oregon, and the Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians to evaluate the interaction of water quality and eelgrass in Coos Bay using a biophysical model. This project enhanced Oregon's ability to inform estuarine conservation and management. (OAH Action Plan Step 1.2)
- Dr. Melissa Ward and colleagues from San Diego State University and partners from Oregon State University to develop science-based BMPs for co-management of Oregon submerged aquatic vegetation and shellfish. This project supports the conservation and restoration of estuarine submerged aquatic vegetation while supporting shellfish aquaculture and native shellfish populations. (OAH Action Plan Steps 3.1 and 3.3)
- Dr. George Waldbusser of OSU to map the dynamics of OAH in the Yaquina Bay estuary and the related biological responses in native Olympia oysters. (OAH Action Plan Steps 3.1 and 3.2)
- Pathways Collaborative to develop messaging that helps the public understand the science, impacts, and solutions associated with ocean acidification and hypoxia. (OAH Action Plan Steps 4.1, 4.2, and 4.3)
- ODFW to continue estuary and habitat surveys in Tillamook Bay. (OAH Action Plan Step 1.2)
- Dr. Burke Hales of OSU to continue OA monitoring at Whiskey Creek Shellfish Hatchery. (OAH Action Plan Step 1.1)
- Dr. Chris Langdon of OSU to investigate the effects of OAH on Pacific oyster larvae from select families derived from the Molluscan Broodstock Program at HMSC. This research contributes to the development of oyster strains that are more resilient to ocean stressors, including OAH. (OAH Action Plan Step 3.1)

The [Third Biennial Report](#) was submitted to the Oregon Legislature.

The fourth Fisherman-Scientist OAH Roundtable was held. (OAH Action Plan Step 4.2)

- Conversations at the 2021 and 2022 roundtable sessions resulted in a pilot-project effort to build a mobile device “Fishermen’s App”, which will allow fishermen and recreationalists to document their observations of unusual sightings at sea and share with their peers, scientists, and managers on shore.
- ODFW hosted a Sea Grant Summer Scholar in 2022 to begin a pilot project on this app.

DEQ formed a technical workgroup to assist with developing science-based methodologies for assessing both ocean acidification and hypoxia in Oregon’s waters. The OAH Council played an important role in assisting with identifying technical group participants, securing a Sea Grant fellow to support the workgroup, and participating in the technical group. (OAH Action Plan Steps 2.2 and 2.3)

The OAH Council served on the advisory board for research funded by a Lenfest Grant from 2019-2022: “Geospatial Patterns and Species Impacts of Changing Ocean Chemistry on the West Coast” (OAH Action Plan Step 3.1.1)

2021

The third Fisherman-Scientist Roundtable on OAH and Ocean Change was held. The goal was again to share new observations, build stronger collaborations and connections, raise concerns and questions about the changes in the ocean, and plan for next steps on research and policy. (OAH Action Plan Step 4.2)

The [Multiagency Report on OAH Programs and Needs](#) was submitted to the Oregon Legislature. It outlined the existing programs and policies that were already at work to address OAH impacts for eight of Oregon’s state agencies. The report also identified potential opportunities and resource enhancements that would better prepare Oregon for future ocean change. (OAH Action Plan Steps 5.1 and 5.3)

HB3114 created a grants program for OAH projects through collaboration with Oregon Ocean Science Trust (OOST) and the OAH Council. Focus areas included science and monitoring, resilience and management, and communications.

At the State of the Coast, an annual meeting engaging interested coastal community members in “hot topics” during an ocean-focused day of talks, workshops, and networking, the OAH Council brought commercial fishermen together in a facilitated panel discussion to share their observations on ocean change, the challenges they face, information needs, and ideas for collaboration. (OAH Action Plan Step 4.2)

2020

Oregon Executive Order 20-04 directed State agencies to take actions to reduce and regulate greenhouse gas emissions to combat climate and ocean change – including OAH. Specifically, the Governor’s order updates State carbon reduction goals, setting targets of a 45 percent reduction below 1990 levels by 2035 and an 80 percent reduction by 2050. It also directs agencies to alter building codes to prioritize energy efficiency, decrease reliance on fossil fuels, and make provisions for reducing state-wide food waste.

After encouragement from the OAH Council, ODFW and Department of Land Conservation and Development (DLCD) both included new ocean change measures in their proposed 2021-2023 biennium budgets to the Governor’s Office. (OAH Action Plan Step 5.2.1)

The [Second Biennial Report](#) was submitted to the Oregon Legislature.

The OAH Council developed an online library of outreach materials focusing on commercial species vulnerable to OAH, the science of OAH, and Spanish translations of materials – made publicly accessible on the OAH Council website. (OAH Action Plan Step 4.2.3)

A working group was established to build a long-term oceanographic monitoring site in Yaquina Bay to complement a historical time-series. (OAH Action Plan - Step 1.1.1)

The OAH Council participated in the development of the ODFW’s Climate and Ocean Change Policy, which includes measures to protect ocean fisheries and habitats as well as reduce the agencies energy requirements. (OAH Action Plan Step 2.2.3)

Per the Federal Clean Water Act, Oregon DEQ assessed the condition of Oregon’s waters and documented water quality in the 2020 Biennial Integrated Report. With the submission of this assessment, Oregon became the first state in the nation to evaluate and include OAH ocean water conditions as part of its assessment of Oregon’s waters under the Federal Clean Water Act. Through this action the State formally recognized that OAH is a real and present danger and cause for concern for our coastal communities and ecosystems. The OAH Council played an important role in identifying this work as a priority. (OAH Action Plan Steps 2.2 and 2.3)

The OAH Council advised the West Coast Ocean Data Portal on OA data synthesis in order to provide information for adaptation and resiliency planning within Oregon communities. (OAH Action Plan Step 3.2.1)

The OAH Council participated in Oregon’s Territorial Sea Plan, Part 3: Rocky Habitat Management Plan Update. This plan was developed by the Ocean Policy Advisory Council (OPAC) and now includes new information and considerations for ocean change, OAH adaptation planning, and protections for submerged aquatic vegetation. (OAH Action Plan Step 3.1.1)

The OAH Council served on the advisory board for research funded by a NOAA Grant from 2018-2020: “Vulnerability and Adaptation to Ocean Acidification among Pacific Northwest Mussel and Oyster Stakeholders” (OAH Action Plan Step 3.1.1)

The OAH Council participated in and reviewed Oregon’s 2020 Climate Adaptation Framework, providing suggestions to DLCD on how to further incorporate OAH and other ocean changes into the framework. (OAH Action Plan Step 2.2.3)

At the State of the Coast, the OAH Council hosted a session on communicating the risks and impacts of OAH and climate change in ways that connect with Oregonians’ personal experiences. (OAH Action Plan Step 4.2)

2019

The [Oregon OAH Action Plan \(2019-2025\)](#) was submitted to the Oregon Legislature and adopted by Governor Kate Brown.

The OAH Council consulted with the Governor’s Office on a new executive directive that encourages state agencies to consider addressing OAH in their regulatory and management frameworks. The Governor wrote a letter to the OA Alliance adopting Oregon’s 2019 OAH Action Plan. (OAH Action Plan Step 5.1.1)

An advisory working group was convened with regional education specialists and industry to identify OAH outreach needs. (OAH Action Plan Step 4.1.1)

The OAH Council participated in and reviewed DEQ's 2018/2020 Water Quality Assessment Integrated Report by providing public comment on the draft assessment and hypoxia data sources for future analysis. (OAH Action Plan Step 2.2.3)

2018

The OAH Council began meeting.

The [First Biennial Report](#) was submitted to the Oregon Legislature, providing recommendations to address OAH in Oregon.

Partners of the Oregon Ocean Monitoring Group (OOMG), a group of ocean monitoring experts and stakeholders (consisting of state and federal resource managers, academics, industry, and NGOs), began facilitating data collection for the innovative and collaborative OAH monitoring pilot project in Tillamook Bay. This two-year project grant was funded by the Oregon Watershed Enhancement Board (OWEB) and led by the Tillamook Estuaries Partnership.

2017

The Oregon Legislature created the OAH Council with the passage of Oregon Senate Bill 1039. Through this action, the State committed both attention and resources toward understanding OAH science, impacts, and solutions.

The second Fisherman-Scientist Roundtable on OA was held to further the momentum from the first meeting. Fishermen and marine scientists shared new observations and progress made in practice, research, and policy.

OOMG began meeting with the aim of increasing OAH monitoring in Oregon.

2016

The first Fisherman-Scientist Roundtable on OA was held to build stronger connections and understanding through sharing observations, concerns, and questions about changes occurring in the ocean.

The OA Alliance was formed by the state governments of California, Oregon, and Washington and the Province of British Columbia in Canada.

2015

Oregon joined the OAH Working Group through PCC.

