



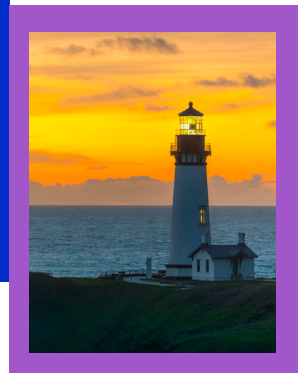
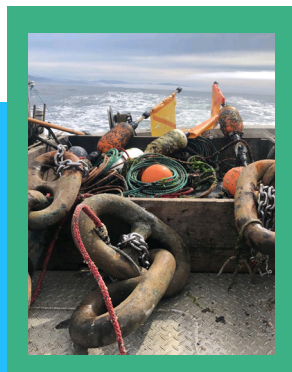
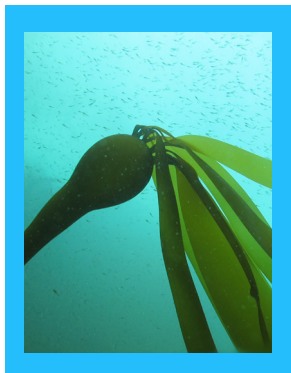
Oregon Coordinating
Council on Ocean
Acidification & Hypoxia



Oregon Ocean Change Action Plan

2026 - 2030

FIFTH BIENNIAL REPORT
September 2026





About this Document

This Oregon Ocean Change Action Plan was developed to stand alone and is submitted to the Oregon Legislature and to the Ocean Policy Advisory Council as the OAH Council's Fifth Biennial Report. The 2019 Oregon Ocean Acidification and Hypoxia Action Plan can provide additional foundational information. The effects of climate change on the ocean are greater than just ocean acidification and hypoxia, and thus we now focus on ocean change. Ocean change includes the significant consequences of climate change to our marine waters, such as increased acidification, sea level rise and coastal erosion, increased intensity of storms, and changes in ocean temperature, salinity, and currents. Ocean change impacts the health and distribution of marine species, alters marine and coastal ecosystems, influences rainfall and drought, and impacts all Oregonians. The purpose of this Action Plan is to recognize the impacts that we see today, minimize the impacts for tomorrow, and alter the trajectory of ocean changes to reduce the negative impacts on future generations – for Oregon, the Nation, and the world.

Oregon's Ocean Change Action Plan, as spearheaded by the OAH Council and in collaboration with the Oregon Climate Action Commission, will guide Oregon's efforts to combat the effects of ocean change. This work will help demonstrate that local actions are meaningful in fighting the global challenges of climate and ocean changes. The document is intended to guide the OAH Council and help both the Oregon Legislature and the Oregon Climate Action Commission in combating ocean change in Oregon.

Addressing ocean change requires collective action. In this document, the term "Partners" refers to federal, local, and Tribal governments, academic institutions, industry stakeholders, and Oregon's conservation non-governmental organizations. To improve readability citations are not provided in this document, but research that informed this action plan is provided in Appendix C.



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For electronic copies of the Action Plan and appendices visit the OAH Council's website:

oregonocean.info

For printed copies of the Action Plan please contact:

Oregon Department of Fish and Wildlife • Marine Resources Program
2040 Marine Science Drive • Newport, OR 97365 • 541-867-4741

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Letter from the OAH Council Co-Chairs

The ocean is vital to Oregonians – supporting a rich ecosystem, driving the economy through tourism, fishing, and recreation, and playing a crucial role in climate regulation and regional weather. Oregon’s ocean and coastal ecosystems are facing increasing challenges from the effects of climate change. Rising temperatures, ocean acidification, hypoxia, and other shifts in ocean chemistry are affecting marine species, fisheries, and coastal communities throughout the state. Ocean change has serious, real-life consequences to the ecosystem and the many ocean related businesses that depend upon a healthy and productive environment.

Because the ocean absorbs approximately 30 percent of the carbon dioxide (CO₂) released into the atmosphere, as levels of atmospheric CO₂ increase from human activity, the amount of CO₂ in the ocean also increases, making the waters more acidic. In 2007, Oregon was one of the first places in the world to observe the direct impacts of ocean acidification when larval oyster hatchery production collapsed. Acidification continues to challenge oyster production and has forced some producers in the region to relocate. Also of great concern is the increased frequency of hypoxic events – times when Oregon’s nearshore waters have low to no measurable oxygen. During multiple particularly severe events, fishermen retrieved their pots to find dead or suffocating crab. In those years, halibut and rockfish disappeared from many locations in Oregon waters, and National Oceanic and Atmospheric Administration (NOAA) scientists predict that suitable habitat for halibut is shrinking and may disappear from the Oregon coast by 2100.

As stewards of Oregon’s marine environment, we are committed to ensuring that we address ocean change through science, mitigation, and adaptation, protecting our oceans for future generations. Since its inception in 2017, the Oregon Coordinating Council on Ocean Acidification and Hypoxia (OAH) has served as the leading authority in identifying and elevating the urgent and profound impacts of climate change on Oregon’s estuaries and nearshore waters. The OAH Council remains committed to delivering updated reports to the Oregon Legislature every two years. We have developed the Oregon Ocean Change Action Plan to guide immediate and long-term actions critical to addressing the accelerating impacts of ocean change in Oregon. Here, we offer this Action Plan to serve as our legislatively mandated biennial report for 2026. A comprehensive list of the accomplishments of the OAH Council can be found in Appendix D. Funding for OAH has been absent recently; however, it is now in place as of August 2026, allowing staffing and renewed progress.





This Action Plan redefines the focus of the 2019 Oregon OAH Action Plan, improving our efforts to address the interconnected challenges of ocean changes impacting our marine ecosystems and coastal communities such as OAH, rising sea levels, marine heatwaves, and other significant oceanic changes, which affect our entire state. A key objective of this Action Plan is to align with the Oregon Climate Action Commission (OCAC). This plan will be presented to OCAC so we can coordinate with them to guide and advance its priorities for all of Oregon, ultimately, integrating ocean change actions into the broader state climate action framework. Through this, we are ensuring that Oregon's oceans and coastal communities are well-positioned to adapt to the evolving environmental challenges we face.

The adoption of this Action Plan marks an important step forward, building on years of progress to address OAH and the broader ocean changes impacting Oregon's ecosystems and communities. To sustain momentum and ensure long-term success, the OAH Council's leadership and coordination is essential. Continued support will help Oregon remain at the forefront of ocean change response and contribute to global efforts to protect our oceans for future generations.

On behalf of the OAH Council,

Laurie Juranek, PhD

**Professor
College of Earth, Ocean, and Atmospheric Sciences
Oregon State University**

Leif Rasmuson, PhD

**Marine Fishery Research Project Leader
Oregon Department of Fish and Wildlife**



Executive Summary



Oregon Ocean Change Action Plan

The Oregon Ocean Change Action Plan builds upon and refocuses the [2019-2025 Oregon Ocean Acidification and Hypoxia \(OAH\) Action Plan](#) submitted to the Oregon Legislature and the Oregon Ocean Policy Advisory Council. The Ocean Change Action Plan continues our commitment to building solutions for OAH impacts while acknowledging the wider range of ocean changes impacting our marine ecosystems and coastal communities to better prepare for the future. Every action presented in this plan requires state leadership and resources to implement projects that lead to a better understanding of ocean change and to purposeful and effective adaptation and mitigation.

Purpose of the Ocean Change Action Plan

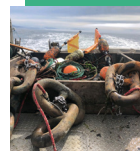
This Action Plan provides recommendations to the Oregon Legislature, Oregon Climate Action Commission, and other relevant groups to integrate ocean change actions into broader state climate action goals; specifically, those goals related to natural and working lands. The plan emphasizes the need to recognize the current impacts of ocean change, minimize future impacts, and work together to alter the trajectory of ocean changes for the benefit of current and future generations – for Oregon, the nation, and the world.

Prioritized Actions



1. Support adaptation and resilience to ocean change in Oregon's coastal communities and ecosystems

- Protect, sustain, and restore native marine and anadromous fish, shellfish, and wildlife populations and their habitats
- Support data collection, analysis, and modeling of the effects of ocean change in Oregon
- Develop and implement best management practices for resilience to ocean change based on best available ecosystem, economic, and policy research



2. Advance scientific understanding to document oceanographic and biological conditions and socio-economic vulnerabilities to ocean change

- Invest in and evaluate the expansion of Oregon's oceanographic research sites
- Invest in monitoring biological and ecological responses to changing ocean conditions
- Assess socio-economic impacts of ocean change in Oregon



3. Develop and integrate strategies to reduce excess carbon dioxide (CO₂) and other causes of ocean change

- Enhance communication networks working on reduction of CO₂ emissions and other stressors driving ocean change
- Support research on effective and efficient ways to reduce and remove excess CO₂ in Oregon's estuaries and nearshore waters
- Implement measures to reduce and remove excess CO₂ from estuaries and nearshore waters



4. Communicate ocean change science, impacts, and solutions to raise awareness and support decision making

- Revise the existing OAH Communications Plan to encompass ocean change
- Promote responsible management of and the need to protect our ocean
- Promote local, sustainable seafood in Oregon
- Provide timely updates to Oregon Legislature, other policy-makers, and affected communities



5. Increase and sustain support for state agencies and their mobilization to address ocean change

- Governor issues a unifying direction to address Oregon's ocean change
- Governor's Natural Resource Office provides leadership, coordination, and policy guidance
- State agencies work to fill gaps in Oregon ocean change efforts
- State climate directives incorporate ocean change
- Continue coordination on efforts to address ocean change

Why is this Ocean Change Action Plan needed?

The Earth's climate and oceans are changing because human activities are emitting high levels of greenhouse gases into the atmosphere. These greenhouse gas emissions have led to rising global temperatures, subsequent ice melt, and changing water chemistry. Oregon is already experiencing increased air and water temperatures, disrupted precipitation patterns, and increased ocean acidification and hypoxia; these local changes that are consistent with global observations and projections. Increased air and water temperatures and more acidic, less oxygenated marine waters are already having cascading impacts across the state (**Figure i**) and the effects will only get worse. Oregon's coastal communities and ecosystems need expertise and capacity to develop coastal resilience and adaptation plans that enhance long term biological, ecological, and economic sustainability in response to these changing ocean conditions.

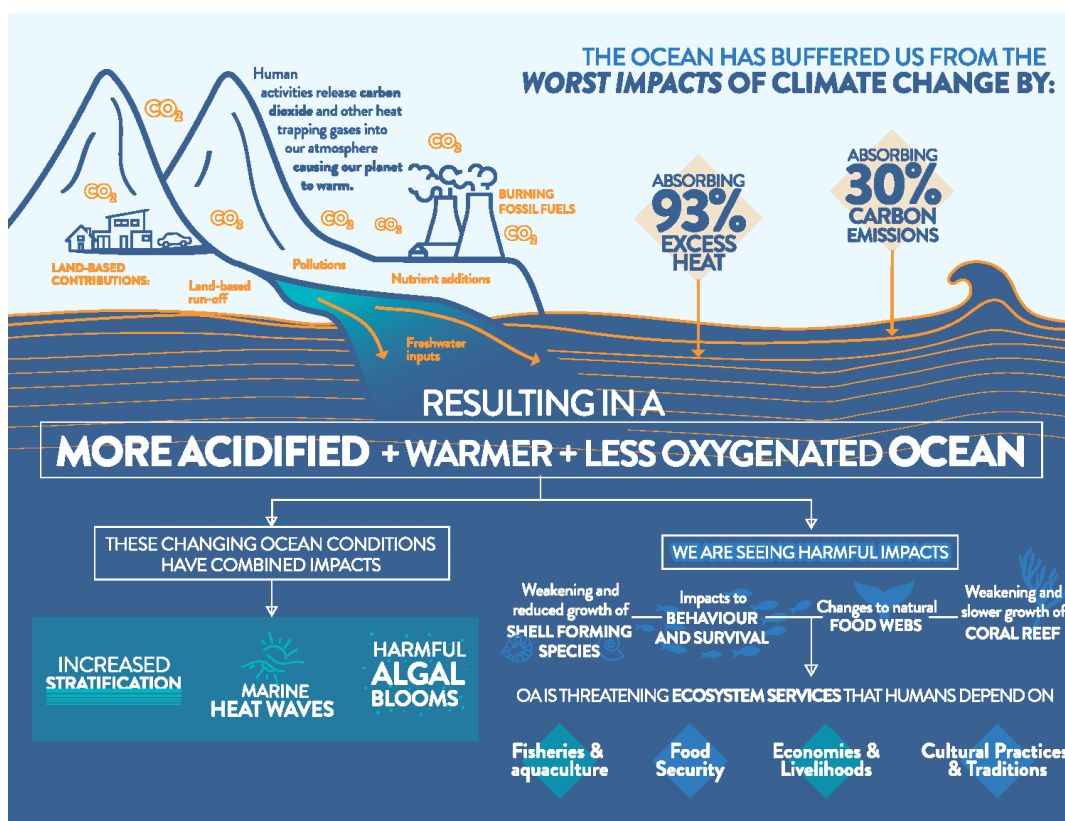


Figure i. Global impacts of climate change on the marine environment, highlighting the climate connections between the ocean, land, and atmosphere. *Graphic Credit: Sourced from the OA Alliance.*

Oregon's Path Forward

The Oregon Ocean Change Action Plan outlines strategies for our Partners and individual Oregonians to slow the impacts of ocean change and adapt to the changes already occurring. These actions will have essential local, national, and global impacts. Changing ocean conditions are harmful to ocean life, coastal communities, and the economic stability of the Oregonians who rely on a healthy ocean. Further, the ocean drives Oregon's weather across the state, and the effects of ocean change on weather are already being felt by all of us. The Action Plan will be presented to the Oregon Climate Action Commission, which will work with the OAH Council to guide the plan's implementation and integration into the broader state climate efforts.

Ocean change is a global problem and while it is important to act locally, Oregon needs to think globally and contribute to national and international actions. As an active participant in multiple global partnerships, Oregon is well-positioned to share expertise, drive innovation, and contribute meaningfully to the collective response needed to protect ocean health worldwide.

To learn more about ocean change science, impacts, and solutions, please visit oregonocean.info

The Effects of Ocean Change in Oregon

The Earth's climate and oceans are changing, and a significant contribution to those changes are human activities that emit greenhouse gases into the atmosphere. The damage from greenhouse gas emissions has already led to rising global temperatures, subsequent ice melt, and changing water chemistry. Oregon is already experiencing changes that are consistent with changes observed and projected globally, such as increased air and water temperatures, disrupted precipitation patterns, and increased ocean acidification and hypoxia (OAH).

Over the past century, Oregon's average annual air temperature has increased by approximately two degrees Fahrenheit. The ocean has absorbed roughly 90 percent of the heat and 30 percent of the carbon dioxide (CO₂) associated with greenhouse gas emissions and climate change. The absorption of CO₂ causes chemical reactions to take place in the ocean which lower the pH of the water, causing ocean acidification. This change in ocean chemistry makes it difficult for organisms to form shells and impacts fish survival, both which negatively impact food webs, fisheries, and coastal economies.

The waters off Oregon are naturally productive due to northern spring and summer winds that drive coastal upwelling—a process that moves surface waters offshore and brings deep ocean water to the surface. These deep ocean waters, often called “cold and old” waters, are naturally colder, higher in nutrients, higher in CO₂, and lower in oxygen than surface waters. They are considered old as they have been sequestered at depth, moving along the major ocean currents of the deep sea for decades, where the biological processes of respiration and decomposition increase the CO₂ and decrease the oxygen they carry. The CO₂ concentrations of these “cold and old” waters are further increased by additional uptake of anthropogenic CO₂ emissions before the currents dive deep into the ocean. The two processes combine to cause extremes in ocean pH that are harmful to organisms that form shells and other hard body structures made of calcium carbonate, such as Oregon's oysters, clams, and Dungeness crab. The strong coastal upwelling along the Oregon coast, which is intensifying due to climate change, makes our waters especially vulnerable to the impacts of OAH.

Combating the Effects of Ocean Change: mCDR and Blue Carbon

As our understanding of the consequences of ocean change continues to evolve, new lines of scientific inquiry are focusing on the suite of solutions that may be effective at countering the effects of CO₂ emissions, including marine carbon dioxide removal (mCDR) and blue carbon. The focus of mCDR is to remove CO₂ from the atmosphere and store it long-term in the ocean. Various mCDR approaches have been proposed, each with inherent efficacy, cost, and storage potential. Blue carbon is a form of mCDR that refers to the carbon captured by the ocean and coastal ecosystems. Implementation of blue carbon and mCDR approaches at the local scale to mitigate the effects of ocean change requires the guidance of Oregon's scientific community to ensure the best approaches are utilized. For additional information on mCDR and blue carbon approaches to sequestering carbon and combatting the effects of ocean change, please refer to the National Academies special report on this topic:

nap.nationalacademies.org/catalog/26278/a-research-strategy-for-ocean-based-carbon-dioxide-removal-and-sequestration.

These deep, upwelled waters that are rich in nutrients, high in CO₂, and low in oxygen also promote large blooms of phytoplankton. The strength and frequency of winds from the north is increasing with climate change, likely leading to even larger and longer phytoplankton blooms. When these blooms die, they decay as they sink to the bottom, consuming oxygen (and releasing CO₂) in the process. Since the decay occurs in already low oxygen water, the process uses up most of the remaining oxygen and creates hypoxic or sometimes anoxic (no oxygen) zones. A warming climate that is enhancing upwelling-favorable winds may also be driving increasingly widespread and longer duration of low oxygen, or hypoxic, events along the Oregon coast, along with increasing ocean acidification. OAH combined with other impacts of climate change on the ocean (“ocean change”), such as marine heat waves, harmful algal blooms, and increasing intensity of storms, pose a multi-stressor challenge for marine ecosystems and coastal communities.

Increased air and water temperatures and more acidic, less oxygenated marine waters will have cascading impacts across the state. Reduced snowpack and changes in precipitation patterns will result in higher winter flows, lower summer and fall flows, and increased and more severe flooding in rivers and streams throughout the state. Hotter freshwater, marine water, and air temperatures will impact fish and invertebrate populations. Sea level rise and erosion resulting in the “coastal squeeze” will threaten coastal homes, businesses, and communities and shoreline habitats for coastal wildlife. Increased frequency and magnitude of intense wildfires will threaten forests, homes, and communities. More people will migrate or travel to the coast to seek relief from heat, wildfires, and smoke, increasing strain on Oregon’s coastal communities.

Coastal communities need expertise and capacity to develop coastal resilience and adaptation plans that enhance long-term biological, ecological, and economic sustainability in response to these changing ocean conditions. Effective and locally relevant planning requires investments in collaborative planning and research with communities, scientists, and industry to identify, anticipate, and quantify risks from ocean change. Understanding the linkage between the effects of climate change and natural processes is critical. To respond to these changes, it is essential we monitor and study Oregon’s estuaries and nearshore waters.



What is at Risk? Changing Ocean Conditions and the Impacts to Oregon Recreational and Commercial Harvesters

The ability to crab, clam, and fish in Oregon is threatened by ocean change. Declining fish and invertebrate populations, harsher weather, and reduced harvest success are potential impacts. This will affect the enjoyment and satisfaction of those who rely on these activities for relaxation or as a source of food or livelihood.

Value of Oregon's Fisheries



Commercial Crab
\$70 million



Recreational Ocean Finfish
\$50 million



Commercial Nearshore Rockfish
\$20 million



Recreational Shellfish
\$20 million



Strain on infrastructure
from sea level rise,
storms and erosion



Reduced bag and
trip limits and
shortened seasons



Limited access to traditional
clamming, crabbing and
fishing locations



Increased operating costs
and market uncertainty



Marine
Resources

Artist: Lily Cronn



Oregon Coordinating
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What is at Risk? Changing Ocean Conditions and the Impacts to Oregon Coast Visitors

Ocean acidification, sea level rise, and other effects of climate change such as extreme weather, increased flooding and wildfires could cause tourism business closures and reduce visitors to the Oregon coast. This would lead to significant job losses and economic strain for coastal communities reliant on these activities.

In 2024 **\$2.5 Billion** was spent
by visitors
which supported **26,500 jobs**

37%

of visitors were
from Oregon



Erosion, sea level rise and increased storm intensity threaten coastal properties and transportation



Whale sightings dwindle, along with demand for charter boats



Narrowing beaches from rising seas and shoreline protection structures limit space for recreation and increase exposure to rogue waves



Local shellfish become scarcer and health risks from consumption rise



Wildlife in tidepools declines



Bird sightings decrease



Marine
Resources



Oregon Coordinating
Council on Ocean
Acidification & Hypoxia

Artist: Lily Cronn

The Policy of Ocean Change in Oregon

Since its establishment in 2017, the Oregon Coordinating Council on OAH (OAH Council) has served as the state's leading authority in identifying and addressing the profound changes Oregon's ocean is experiencing from climate change. The OAH Council has not only brought critical attention to these challenges but has also investigated the impacts on individuals, organizations, businesses, Tribes, and other affected communities, while advancing actions to support both adaptation and mitigation. Under the leadership of Governor Kate Brown in 2019, Oregon's first [OAH Action Plan](#) was adopted, providing a clear and strategic roadmap to guide efforts to confront OAH through 2025.

From that point on, Oregon has marked several noteworthy milestones in its ongoing efforts to address OAH and ocean change. Select milestones are highlighted in the next section and a comprehensive list of accomplishments can be found in Appendix D: Timeline of Accomplishments. Selected OAH events are also shown in **Figure 1**. These accomplishments not only demonstrate the state's commitment to combating climate change but also pave the way for continued progress in ocean conservation, coastal resilience, and adaptation strategies.

To provide updates on the efforts to address OAH and ocean change, the OAH Council remains committed to providing reports to the Oregon Legislature every two years. The OAH Council has developed this Oregon Ocean Change Action Plan to guide urgent and long-term actions addressing the accelerating impacts of ocean change in Oregon.

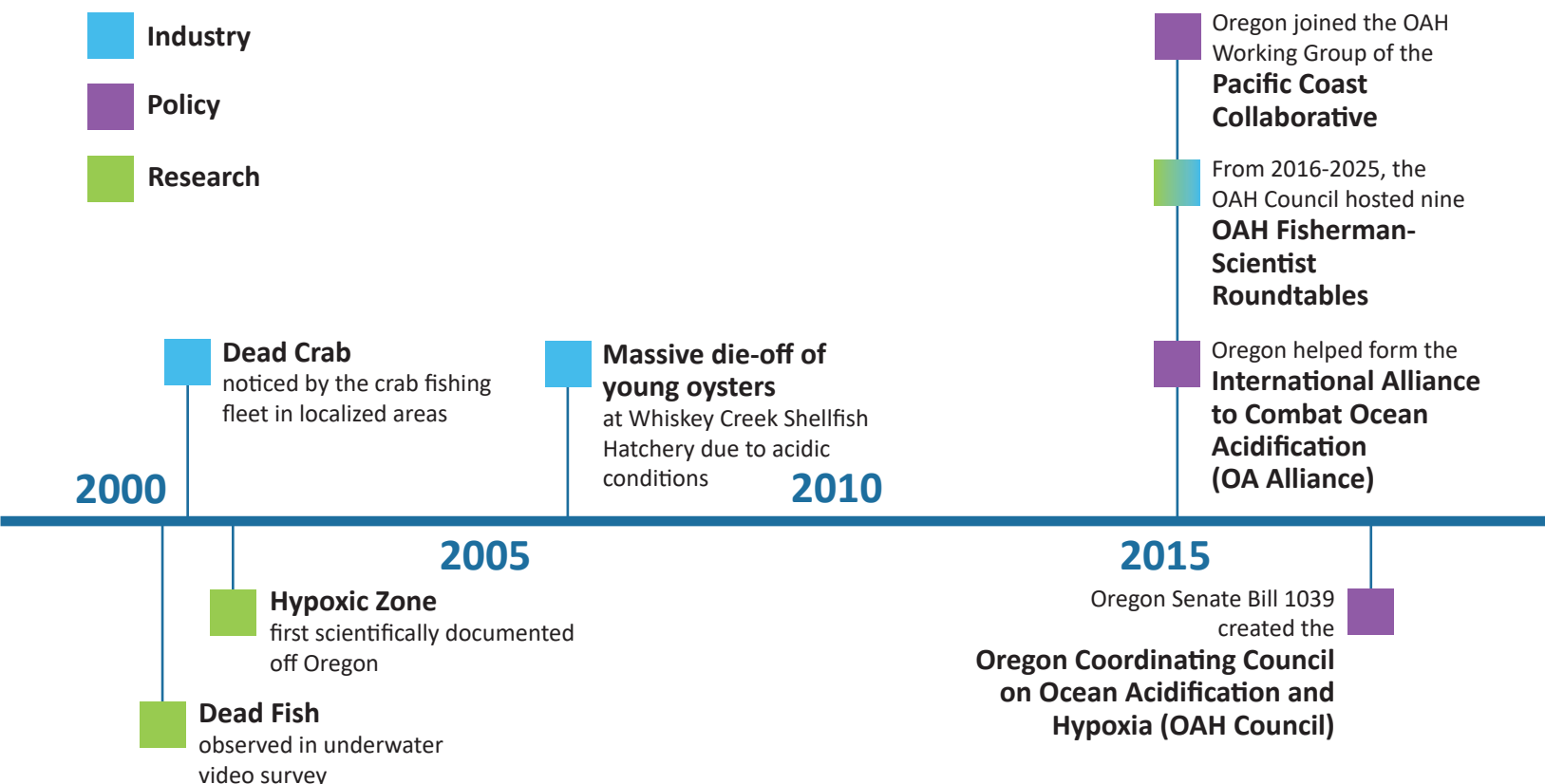


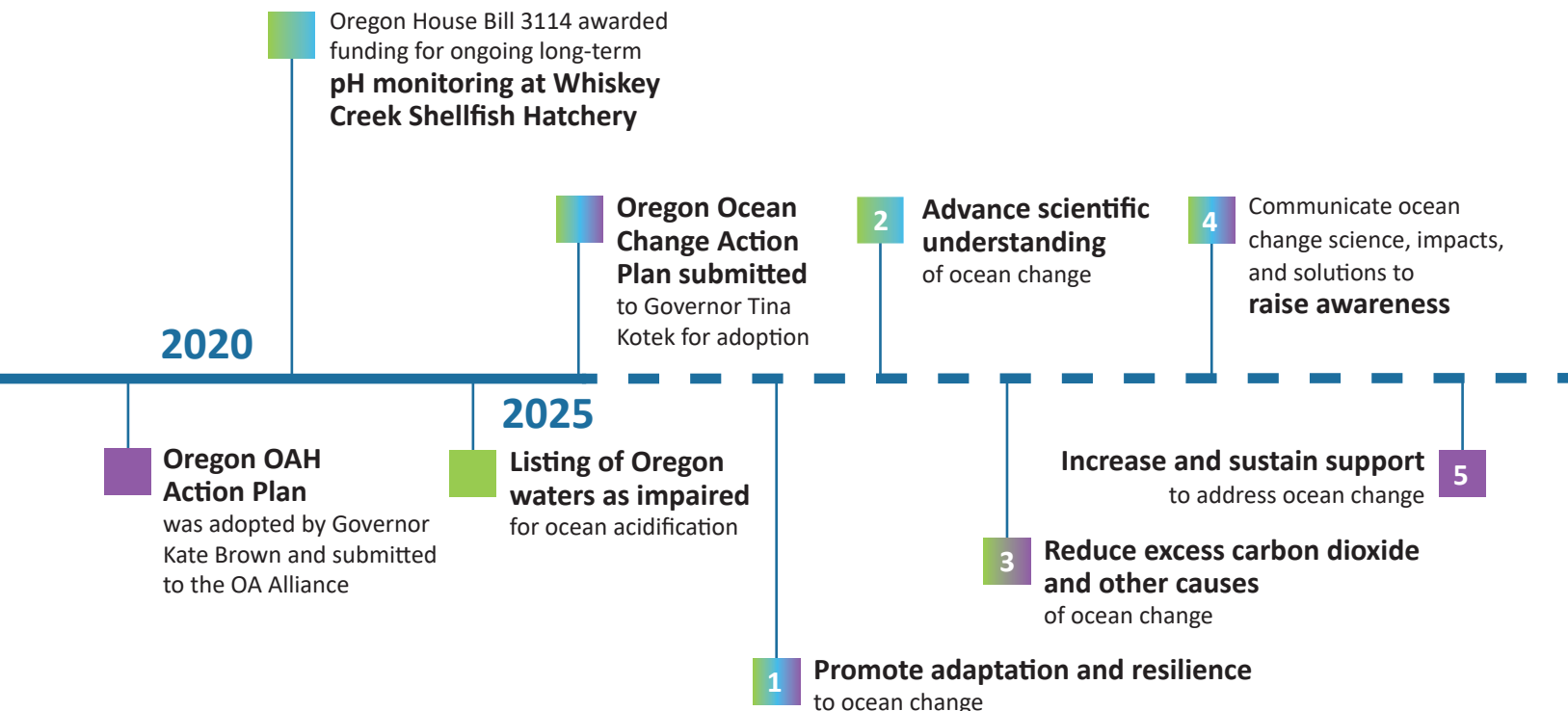
Figure 1. Oregon ocean acidification and hypoxia selected events timeline. Note the numbers in the future actions correspond to the Ocean Change Action Plan actions.

A key goal of this Action Plan is to align with the Oregon Climate Action Commission (OCAC), formerly the Oregon Global Warming Commission. OCAC is responsible for tracking and evaluating the impacts of climate change in Oregon, monitoring the state’s greenhouse gas (GHG) emissions and progress in reducing them, and assessing the effectiveness of Oregon’s policies and programs to reduce GHG emissions. While the OAH Council has been focused on the impacts of climate change on Oregon’s ocean, OCAC’s focus has been primarily on the impacts of climate change on Oregon’s terrestrial environments. However, OCAC does include representation from the fishing industry, and in its [2024 Natural and Working Lands Fund Biennial Report](#), OCAC included projects related to blue carbon and tidal wetland and seagrass conservation and restoration. Integrating the recommendations of this Action Plan into OCAC would better reflect the intrinsic links between Oregon’s weather and climate and the ocean.

The OAH Council has established a strong foundation for continued action. Ongoing collaboration with state agencies and their “Partners” – federal, local, and Tribal governments, academic institutions, industry stakeholders, and Oregon’s conservation non-governmental organizations (NGOs) – will be essential to implementing this plan. The OAH Council’s leadership and coordination is essential to sustain momentum and ensure Oregon remains at the forefront of responding to ocean change and contributes to global efforts to protect our oceans for future generations.

“Investing in research and coastal resilience isn’t just smart policy – it’s personal for communities and Oregonians that knowingly or unknowingly depend on our ocean – from food, recreation, navigation and security to simply the air we breathe. These prioritized actions put into focus the science, solutions, and state leadership needed to keep Oregon’s ocean, coast and people thriving.”

Charlie Plybon
Oregon Sr. Policy Manager, Surfrider Foundation



Select Milestones

Ongoing awareness of the impacts of OAH and ocean change continues to lead to regional, national, and international mitigation efforts. Over the past six years, the OAH Council has facilitated or completed many of the steps recommended in the [2019 OAH Action Plan](#) and the subsequent Biennial Reports. The achievements showcased here are of particular note for Oregon, the West Coast Region (including British Columbia), the nation, and the globe in combatting the ecosystem and socio-economic effects of OAH and ocean change.

Around Oregon

The OAH Council has coordinated many efforts for OAH and ocean change as highlighted in the previous 2020, 2022, and 2024 [Biennial Reports](#) and the [2021 Multiagency Report on OAH Programs and Needs](#). Three of these efforts resulted in Oregon standing out as a global leader in research and responses to OAH and ocean change.

Example 1: Monitoring pH in shellfish hatcheries to mitigate economic failure

After massive losses of young oysters by mariculture businesses in 2007, a collaboration between Whiskey Creek Shellfish Hatchery (Whiskey Creek) in Netarts Bay and Oregon State University (OSU) revealed that acidified waters were to blame. Nearshore waters are used by shellfish hatcheries to rear young oysters, but these waters are becoming too corrosive for this delicate life stage. This necessitates careful monitoring and adjustment of water conditions in rearing tanks. In 2009, Dr. Burke Hales at OSU developed the “Burke-O-Lator,” an instrument that measures partial pressure of CO₂ and dissolved inorganic carbon. This instrument is being used at oyster hatcheries so they can carefully control water chemistry, revolutionizing shellfish aquaculture’s response to OA.

House Bill 3114 (HB3114) supported the ongoing long-term monitoring efforts at Whiskey Creek, including system maintenance, water sampling, and data analysis. To date, Whiskey Creek appears to be experiencing some of the highest observed CO₂ levels since monitoring began. OA monitoring at Whiskey Creek is critical to maintain adequate water quality in the facility, to avoid problems previously experienced, and to support the continuation of Oregon’s production of juvenile oysters. 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. Continued operating software and system hardware maintenance have developed the autonomous analyzer (the “Burke-o-Lator”) into a far more stable and robust system than the previous prototype. OSU researchers have had a NOAA funded partnership with Whiskey Creek that sprung from this historical collaboration to explore more proactive approaches, both in alkalizing hatchery waters and in performing the necessary organismal-response incubations to assess the environmental impacts of alkalization.

“Ocean acidification is an existential threat to commercially important fisheries, from bivalves to Dungeness crabs, and likely has food web impacts on other important species like salmon and environments like Oregon’s iconic rocky intertidal coastline. Recognition of this impact only occurred after engagement of OSU scientists and commercial shellfish aquaculturists. That alliance led to the first commercial-scale Ocean Alkalinity Enhancement at Whiskey Creek Shellfish Hatchery, where the OSU-advised addition of soda ash remediated the OA effect and brought shellfish seed production to historically high levels. This approach is now standard in the shellfish industry. Without State of Oregon support for monitoring and synthesis of dynamic OA relevant data in aquaculture facilities, operators would be ‘in the dark’ as to the timing and extent of remediation activities.”

Dr. Burke Hales, Professor, College of Earth, Ocean, and Atmospheric Sciences, Oregon State University

Example 2: Listing of Oregon waters as impaired for ocean acidification, a first for the United States

Every two years as required by the Federal Clean Water Act, the Oregon Department of Environmental Quality (DEQ) creates the Integrated Report on Surface Water Quality, a comprehensive evaluation of Oregon's surface waters. In 2022, in consultation with [a technical workgroup of OAH experts](#) which included the OAH Council, DEQ's Integrated Report Team developed methodologies to assess impairment of narrative water quality criteria relevant to marine waters: Oregon's narrative biocriteria (ocean acidification assessment) and marine dissolved oxygen criteria (hypoxia assessment). Both ocean acidification and hypoxia methodologies include an approach that uses multiple lines of evidence to assess water quality impact with a comparison to natural background conditions. For the purposes of the Integrated Report, Oregon marine waters are defined as the area from the shore to three miles out into the Pacific Ocean and do not include estuaries.

In applying the ocean acidification and hypoxia methodologies using the data and tools available for the 2024 assessment, 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 reflected on [DEQ's draft 2024 Integrated Report](#) and 303(d) List of Impaired Waters needing a Management Plan and can be seen in the screenshot in **Figure 2**. This is the first time an ocean area has been listed as impaired for ocean acidification in the United States. The OAH Council played an important role in inspiring this work as a priority and encouraging DEQ to establish the technical workgroup to support the assessment process. By identifying these stressors to marine life as pollution to be regulated under the Federal Clean Water Act, DEQ's goal is to work collaboratively with existing state programs and with the scientific community to increase coastal resilience and to develop tools and approaches to better understand and mitigate the effects of OAH and changing ocean conditions at the state level.

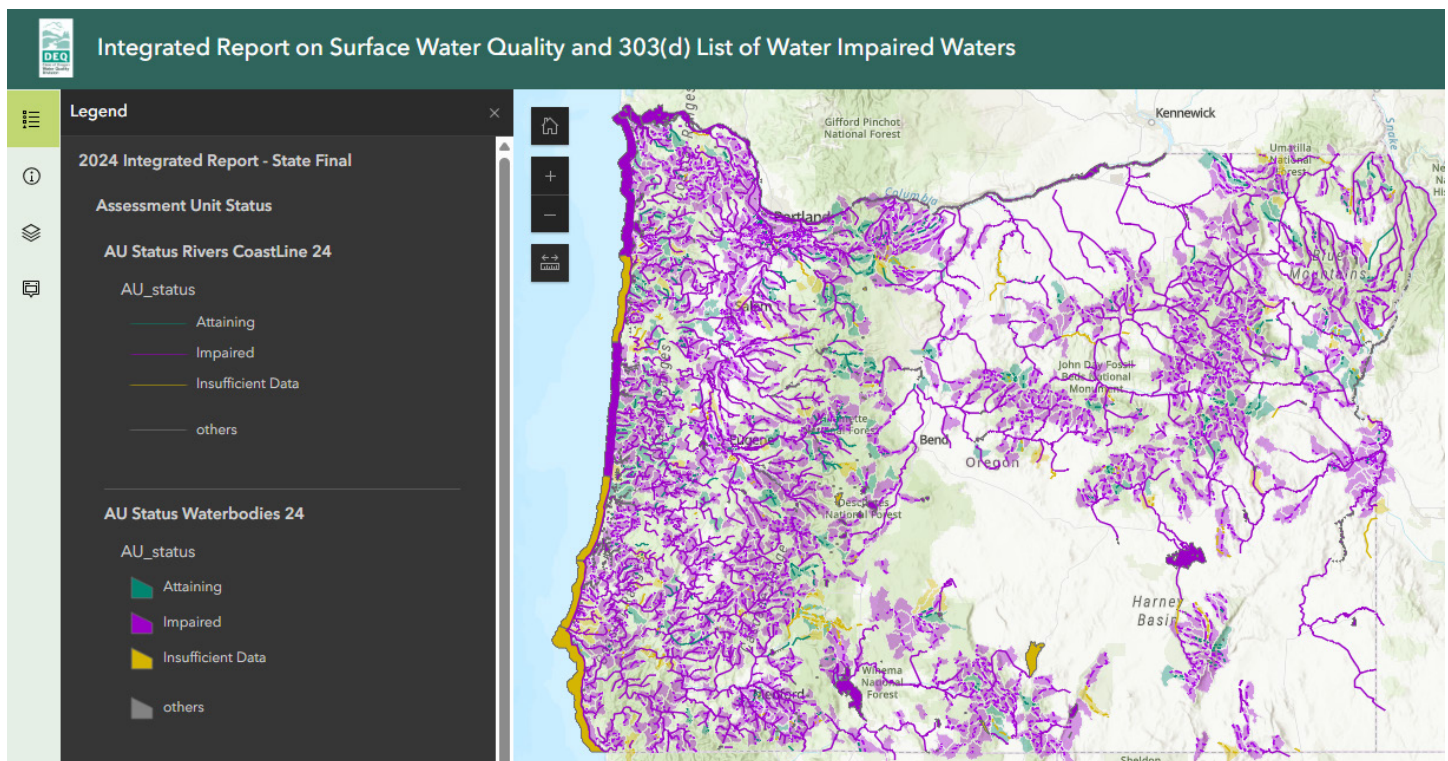


Figure 2. Screenshot of the interactive web map application that displays the Integrated Report on Surface Water Quality by overall status of an assessment unit. The purple color denotes areas that are impaired.

Example 3: Fishermen awareness and collaboration

Since 2016, the Oregon Department of Fish and Wildlife (ODFW), Oregon Sea Grant, OSU, and the OAH Council have hosted nine Fisherman-Scientist OAH Roundtable meetings. These meetings foster dialog between the fishing industry and marine scientists about our changing ocean and support research collaborations and potential solutions to issues caused or exasperated by ocean change. One product that has come out of these meetings is an “Ocean Change” phone and tablet application (app). ODFW worked with students at OSU to develop this app and conduct early beta-testing. However, work on the app is currently on hold until a proper home is identified. The goal of the app is to have ocean users provide peers and scientists with real-time ocean change indicator information, expanding ocean change monitoring through citizen science. The roundtables are now highly anticipated by both scientists and fishermen alike and have resulted in productive collaborations among previously disconnected stakeholder groups.

Recently, scientists and fishermen have been able to collaborate on monitoring ocean conditions. This not only increases the scale and resolution of our observations, but it also increases awareness within the fleet about OAH. With funding from HB3114, OSU researchers have developed sensors that can be added to crab pots to measure dissolved oxygen levels. Fishermen benefit from immediately knowing if conditions are hypoxic where they are fishing (increasing the efficiency of their gear), and scientists gain insight into the extent of the hypoxic zones. This illustrates the immense benefits we experience when industry and science work together.

Around the West Coast Region, Nation, and Globe

Along the U.S. West Coast and as part of the California Current Integrated Ecosystem Assessment, NOAA Fisheries researchers and collaborators develop an annual report, the California Current Ecosystem Status Report (ESR), to document the connected and changing California Current Ecosystem and support ecosystem-based management. Researchers were able to include experiential knowledge from fishermen at the Fisherman-Scientist Roundtable meetings hosted by the OAH Council into the [2024-2025 California Current ESR](#).

Since it was established in 2008, the [Pacific Coast Collaborative](#) brings together governments of British Columbia, Wahington, Oregon, and California in the fight against climate change. Through this group, an OAH Working Group was formed to respond to changes in our oceans. This working group brings together those responsible for implementing OAH Action Plans to discuss strategies for implementation through an integrated climate and ocean policy framework. The group recently rebranded to the Ocean Change Working Group in late 2025 with the purpose of addressing the threats of changing conditions on the California Current large marine ecosystem and West Coast communities. The group works together on a coordinated approach to build resilience to the multiple effects of human-caused climate impacts on the ocean, including acidification, marine heat waves, oxygen loss, ecosystem and species changes, and harmful algal blooms.

In 2023, NOAA and the United States (U.S.) Department of State produced the [United States Ocean Acidification Action Plan](#). This document highlights the nation’s leadership in reducing carbon emissions, investing in adaptive measures, and strengthening monitoring, research, and coordination efforts to understand and reduce the impacts of ocean acidification.

The U.S. is a member of the [International Alliance to Combat Ocean Acidification](#) (OA Alliance), an international association of governments that are dedicated to taking urgent action to protect coastal communities and livelihoods from the threat of ocean acidification and other climate-ocean impacts. Oregon is a founding member and on the executive boat of this alliance.

Oregon Ocean Change Action Plan

Since the OAH Council began its work, the challenges facing our ocean have continued to intensify. New and compounding stressors – such as marine heat waves and longer lasting harmful algal blooms – now threaten Oregon’s coastal and marine ecosystems. To meet these evolving threats, this Ocean Change Action Plan builds upon and refocuses the [2019-2025 Oregon OAH Action Plan](#) submitted to the Oregon Legislature and the Oregon Ocean Policy Advisory Council to ensure Oregon remains at the forefront of addressing the accelerating impacts of ocean change.

The 2019 OAH Action Plan articulated five priority actions for addressing OAH impacts at all levels, from science to policy, from education to adaptation. In creating this Ocean Change Action Plan, the OAH Council considered the status of priority actions and the need to broaden their scope to include additional types of ocean change. Furthermore, these actions were restructured to align with the recommendations from OCAC’s [Oregon Climate Action Roadmap to 2030](#).

Prioritized Actions

1. Support activities and initiatives that **promote adaptation and resilience** to ocean change in Oregon’s coastal communities and ecosystems
2. **Advance scientific understanding** by investing in Oregon’s capacity for research and monitoring to document oceanographic and biological conditions and socio-economic vulnerabilities to ocean change
3. Develop and integrate strategies to **reduce excess carbon dioxide (CO₂) and other causes** of ocean change
4. Communicate ocean change science, impacts, and solutions to **raise awareness** and support decision-making
5. **Increase and sustain support** for state agencies and their mobilization to address ocean change





ACTION 1: Support activities and initiatives that promote adaptation and resilience to ocean change in Oregon's coastal communities and ecosystems

Adaptation and resilience will allow coastal communities to thrive and grow as marine industries are threatened by ocean change. A strategic way of fostering resilience is to promote community-driven adaptation measures because these integrate the insights and efforts of coastal residents into our collective response. Some examples of adaptive strategies in Oregon's coastal communities are the ongoing habitat protection and restoration projects for blue carbon and submerged aquatic vegetation, which includes aquatic grasses (seagrasses), kelp, and attached macro-algae. Further state investments in these projects could serve multiple functions, including helping offset the carbon emissions that lead to climate change while maintaining the nursery functions the habitats provide for economically important species. The OAH Council continues to serve as a facilitator in aligning and coordinating these efforts across our state, ensuring a unified approach to addressing pressing environmental challenges. As we move forward, it is paramount that we continue to prioritize and support these critical activities by taking timely and impactful action to encourage resilience in Oregon's marine resources and coastal communities.

Action 1 was derived from the previous Theme 3: Create Resilience and Action 3 from the [2019 OAH Action Plan](#). Action 1 aligns with Recommendation 1 from OCAC's [Oregon Climate Action Roadmap to 2030](#): Support robust and continuous implementation of existing climate programs and regulations.

VISION Oregon agencies and local and Tribal governments account for ocean change in management decisions and support Oregon's coastal communities, economies, and ecosystems to be resilient to future changes.

Step 1 State agencies, in consultation with their Partners, identify strategies to protect, sustain, and restore native marine and anadromous fish, shellfish, and wildlife populations and their habitats in Oregon’s estuaries and nearshore waters.*

- Allocate state funding for competitive grants and/or match to identify how to achieve ecosystem and economic resilience for Oregon. Examples of project topics include:
 - Productivity of nursery habitat for economically valuable shellfish species
 - Restoration and protection of submerged aquatic vegetation and native shellfish that provide ecosystem services
 - Restoration and protection of water quality throughout Oregon’s estuaries and nearshore waters
 - Effects of ocean change on marine organism life history characteristics and stages of sensitivity to identify vulnerable species
 - Local action plans to help Oregon’s coastal communities and marine industries achieve economic resilience to ocean change

Step 2 Allocate state funds to support data collection, analysis, and modeling to inform strategies and/or actions that promote ecosystems that are resilient to ocean change.*

- Develop maps to address information needs to promote resilience in decision-making in estuaries and nearshore waters such as:
 - Submerged aquatic vegetation and native species (such as oysters and abalone) habitat and core distribution areas – including historical and persistent regions
 - Priority areas for habitat restoration and habitat protection
- Allocate state funding for competitive grants and/or match to conduct ecosystem modeling of estuary and nearshore ecosystems, including hydrodynamic and biogeochemical processes as well as submerged aquatic vegetation.
 - Possible regions that could be considered for blue carbon and/or carbon mitigation offsets (if such programs are developed in Oregon)
 - To inform aquaculture practices in Oregon’s bays and estuaries

Step 3 Agencies will develop and implement best management practices (BMPs) for resilience to ocean change, based on best available ecosystem, economic, and policy research (as determined in Step 1) relevant to Oregon’s estuaries and nearshore waters.

- Topics that BMPs might address include the role of aquaculture, coastal development and infrastructure, dredging, restoration, and monitoring in supporting resilience to ocean change.

“Our club members have witnessed the changes in ocean conditions and are increasingly concerned about the current and future effects of OAH. We feel a robust research program to investigate and anticipate changes in species distribution and ocean survival of juvenile salmonids is of vital importance. Our members and our community rely on ocean fishing opportunity for recreation, fresh food, tourist income and fishing related commerce.”

Dave Kuehn

President of the Oregon South Coast Fishermen, Brookings, Oregon

*Implementation of these recommendations is subject to a budget process involving the Governor, State agencies, and Legislature.



ACTION 2: Advance scientific understanding by investing in Oregon’s capacity for research and monitoring to document oceanographic and biological conditions and socio-economic vulnerabilities to ocean change

Increasing the spatial and temporal resolution of Oregon’s ocean monitoring program will ensure that our understanding of ocean change accounts for all the variation we know exists throughout Oregon’s estuaries and nearshore waters and across seasons. This requires frequent observations in the state-managed nearshore waters from Washington to California. We will be unable to effectively account for how the ocean is changing near each of the highly unique coastal communities without a comprehensive and strategic observing network that represents all of Oregon’s estuaries and nearshore waters. Alternatively, a complete set of observations will allow agencies to develop region-specific adaptive management plans for natural resources such as water quality and fisheries. Expanding ocean observations is essential to improving our ability to forecast regional ocean changes with greater precision. These insights will directly enhance resilience by empowering science-informed decision-making and strengthening our capacity for adaptive management.

Action 2 was derived from the previous Theme 1: Advance Scientific Understanding and Action 1 from the [2019 OAH Action Plan](#). Action 2 aligns with Recommendation 4 from OCAC’s [Oregon Climate Action Roadmap to 2030](#): Support further study and analysis to inform decision makers and continue to guide effective climate action over time.

VISION Through sustained research and monitoring Oregon understands the ecosystem and socio-economic vulnerabilities to ocean change and the effectiveness of adaptation and mitigation actions.

Step 1 Allocate state funds to new and existing oceanographic research sites to monitor Oregon’s changing ocean.*

- Allocate funds to allow oceanographic monitoring to continue in Oregon’s estuaries.
- Allocate funds to allow intertidal and subtidal oceanographic monitoring to continue in Oregon’s nearshore waters.
- Establish oceanographic monitoring in other economic, research, and management hubs in Oregon such as Coos Bay and Port Orford.

Step 2 Allocate state funds to invest in monitoring biological and ecological responses to changing ocean conditions.* For example:

- Ensure that critical long-term monitoring time-series, such as the Newport Hydrographic Line, are maintained with secure funding sources.
- Continue to use the assessment methodologies for marine waters developed by DEQ to assess Oregon’s estuaries and nearshore waters.
- Augment ODFW’s Shellfish and Estuarine Assessment of Coastal Oregon (SEACOR) and habitat teams to increase frequency and spatial scale of shellfish and submerged aquatic vegetation observations.
- Augment ODFW funding for fishery independent surveys to continue adding data on Oregon’s changing nearshore waters.
- Frequently observe and assess nearshore intertidal and subtidal habitats using remotely sensed information coupled with biological monitoring of the areas.

Step 3 Allocate state funds to a socio-economic assessment to determine Oregon’s vulnerabilities to ocean change.*

- Fund competitive grants and/or matching funds (e.g. through the Oregon Ocean Science Trust or Oregon Sea Grant) and use results to inform decision-making and investments.

“Federal and state investments in advanced monitoring and modeling of coastal ecosystems have paved the way for DEQ to assess water quality impacts of changing ocean conditions on aquatic life. Mitigating water quality impacts from changing ocean conditions will require scientists and managers to work together to distinguish the influence of human activities at local and global scales from natural cycles.”

Kaegan Scully-Engelmeyer, Ph.D., Water Quality Standards Specialist
Oregon Department of Environmental Quality

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ACTION 3: Develop and integrate strategies to reduce excess carbon dioxide (CO₂) and other causes of ocean change

Reducing the causes of ocean change is essential to protecting the resources that sustain the industries central to Oregon's coastal communities. Notably, the OAH Council and the State of Oregon have had the long-term goal of reducing CO₂, greenhouse emissions, and other drivers of ocean change to help ensure a sustainable future.

Action 3 was derived from the previous Theme 2: Reduce Causes and Action 2 from the [2019 OAH Action Plan](#). Action 3 aligns with Recommendation 2 from OCAC's [Oregon Climate Action Roadmap to 2030](#): Adopt updated state greenhouse gas goals consistent with the best available science.

VISION To achieve ecosystem and economic benefits for both ocean and inland systems, Oregon has measurably reduced CO₂ emissions, greenhouse gases, and other causes of ocean change.

"Climate and ocean chemistry changes create another layer of uncertainty for coastal communities and industries, which already deal with more uncertainty than most."

Aaron Ashdown
Captain of F/V Misty and Commissioner, Port of Port Orford, Oregon

Step 1 Work with the Governor’s Natural Resource Office to establish regular communication and coordination pathways with State agencies and other relevant regional groups to address excess CO₂ and other stressors driving ocean change locally and globally.

- Relevant state agencies include:
 - Oregon Department of Fish and Wildlife (ODFW)
 - Department of Land Conservation and Development (DLCD)
 - Department of Environmental Quality (DEQ)
 - Oregon Department of Agriculture (ODA)
 - Department of State Lands (DSL)
 - Oregon Department of Forestry (ODF)
 - Oregon Health Authority (OHA)
 - Oregon Department of Energy (ODOE)
 - Oregon Department of Geology and Mineral Industries (DOGAMI)
 - Oregon Parks and Recreation Department (OPRD)
 - Oregon Department of Transportation (ODOT)
 - Oregon Department of Education (ODE)
- Other relevant regional groups include:
 - Oregon Climate Action Commission (OCAC)
 - Oregon Ocean Science Trust (OOST)
 - Oregon Sea Grant
 - Oregon Ocean Policy Advisory Council (OPAC)
 - Oregon Watershed Enhancement Board (OWEB)
 - Oregon’s 4-year universities
 - Oregon’s conservation NGOs
- Continue and expand participation in organizations and collaborations working to reduce excess CO₂ and promote ocean change adaptation and mitigation. Entities include:
 - Pacific Coast Collaborative (PCC)
 - International Alliance to Combat Ocean Acidification (OA Alliance)
 - West Coast Ocean Alliance (regional ocean partnership)
 - Oregon Ocean Alliance

Step 2 Allocate state funds to support scientific research leading to recommendations on effective and efficient ways to reduce and remove excess CO₂ in estuaries and nearshore waters.*

- Fund competitive grants (e.g. through OOST, OWEB, Oregon Sea Grant, or the Oregon Conservation and Recreation Fund (OCRf)); use outcomes to inform decision-making and future investments. Example projects include marine carbon dioxide removal (mCDR) and blue carbon.

Step 3 Relevant state agencies, in coordination with OCAC, track trends in greenhouse gas emissions and implement recommendations to reduce and remove excess CO₂ in estuaries and nearshore waters and encourage action, as identified in Step 2 and other relevant processes.

*Implementation of these recommendations is subject to a budget process involving the Governor, State agencies, and Legislature.



ACTION 4: Communicate ocean change science, impacts, and solutions to raise awareness and support decision-making

When tackling an issue as large as ocean change, it is important to have as many people working toward solutions as possible. This requires public engagement, community involvement, and education. The OAH Council is striving to increase communication about ocean change science and policy with all Oregonians and make information more readily available to the public.

By empowering coastal communities with knowledge, they can work alongside policy makers, resource managers, and scientists to ensure coastal communities are ready for the changing future. Ultimately, this will lead all parties to better understand vulnerabilities within the community. Using a diverse knowledge pool including traditional ecological knowledge and experiential knowledge from ocean users will ensure the plans to mitigate and respond to our changing oceans are effective for all individuals. Understanding these vulnerabilities and mitigating them through strategic planning and action will lead to more robust and resilient coastal communities for all Oregonians.

Action 4 was derived from the previous Theme 4: Expand Public Awareness and Action 4 from the [2019 OAH Action Plan](#). Action 4 aligns with Recommendation 3 from OCAC's [Oregon Climate Action Roadmap to 2030](#): Advance a set of additional climate actions – the TIGHGER Actions – that can help Oregon meet an accelerated greenhouse gas emission reduction goal of 45 percent below 1990 levels by 2030, specifically Sub-Recommendation C.

VISION Information on ocean change science, impacts, and solutions supports decision-making across the state and leads to publicly-supported approaches to ocean change adaptation and mitigation.

Step 1 **Revise the existing OAH Communication Plan to encompass ocean change so that state agencies and their Partners can implement it.**

- Broaden Communications Plan messaging for target audiences.
- Promote the need to protect our ocean by the general public and seafood associated businesses.
- Promote responsible management by local governments and the hospitality industry.
- Promote local, sustainable seafood in Oregon.

Step 2 **State agencies and relevant Partners provide timely updates to the Oregon Legislature, other policy-makers, and affected communities in Oregon to inform decisions on how best to invest in ocean change research, adaptation, and mitigation.**



“Climate action isn’t just an environmental imperative, it’s an economic one. Visitors come to the Oregon Coast for the fresh seafood, wild landscapes, and unforgettable outdoor experiences that define our region. But ocean acidification, warming waters, and extreme weather are threatening the very ecosystems and industries our communities and visitors rely on. When shellfish die-offs disrupt our seafood supply or wildfires close access to beaches and trails, the impacts ripple across the entire tourism economy. Protecting our coast from ocean change means protecting thousands of jobs and billions in revenue that sustain coastal communities.”

Arica Sears
Deputy Director, Oregon Coast Visitors Association



ACTION 5: Increase and sustain support for state agencies and their mobilization to address ocean change

Addressing the impacts of ocean change demands a multifaceted approach that recognizes the necessity for ongoing scientific research, adaptive management strategies, and forward-thinking policy decisions. It is important to have effective coordination between state agencies and their Partners so we can achieve these goals and tackle these issues together. This collaboration ensures a cohesive and adaptive approach to safeguarding our oceans and coastal communities against the adverse effects of changing climate and ocean conditions. Prioritizing scientific rigor and fostering interagency collaboration paves the way for innovative solutions and resilient policies that can effectively mitigate and manage ocean change and the related impacts. Additionally, legislators play a pivotal role in addressing the complex challenges posed by ocean change and the associated negative effects.

Action 5 was derived from the previous Theme 5: Build Sustained Support and Action 5 from the [2019 OAH Action Plan](#). Action 5 aligns with Recommendation 5 from OCAC's [Oregon Climate Action Roadmap to 2030](#): Strengthen governance and accountability for Oregon climate action.

VISION Oregon state agencies have integrated ocean change response into their priorities, budget, staffing, and management decisions.

- Step 1** The Governor issues a unifying direction to relevant state agencies and legislatively mandated climate councils and commissions to use this Action Plan to address ocean change.*
- Step 2** The Governor’s Natural Resources Office provides leadership, coordination, and policy guidance to agencies on ocean change action priorities.*
- Step 3** State agencies implement measures to fill gaps, as described in agency ocean change planning (Step 1).
- Update and extend the 2021 Multiagency Report on OAH Programs and Needs to be more inclusive of ocean change and add other relevant agencies such as the Oregon Department of Education and Oregon Department of Transportation.
- Step 4** The Oregon Climate Adaptation Framework, the Oregon Climate Action Roadmap, and other climate directives from OCAC incorporate ocean change, a major driver of Oregon’s climate.
- Step 5** Maintain funding for the OAH Council so they can continue coordination on ocean change actions.*
- Consider adding the OAH Council as a member of OCAC to strengthen the ability of these two groups to combat ocean change.

“Over the past eight years, Oregon has made strong progress in coordinating an effective response to ocean acidification and hypoxia. Key achievements include the OAH Council’s 2019 Action Plan, regular fisherman-scientist roundtables, the growth of the Oregon Ocean Science Trust, and increasing integration of OAH recommendations into natural resource agencies’ planning. This success is worth celebrating—and continued, coordinated implementation will drive even greater progress.”

Sarah Reif
Habitat Division Administrator, Oregon Department of Fish and Wildlife

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Conclusions

To date, Oregon has tackled ocean change largely through collaborations between state agencies and their Partners to address the impacts of OAH. Since OAH is just one of the many effects of climate change on the ocean, the OAH Council recommends the focus be redirected to address ocean change. OCAC recommends ways to coordinate state and local efforts to reduce Oregon's greenhouse gas emissions, and to help the state, local governments, businesses, and Oregonians prepare for the effects of climate change. The OAH Council, recommends building on the work since the 2019 OAH Action Plan by using this Ocean Change Action Plan to help Oregon remediate and adapt to ocean climate change.

Successful implementation of this plan will require continued leadership from the Governor's office, OAH Council, OCAC, state agencies, and their Partners. Coordination and leadership are critical to sustaining momentum and ensuring Oregon remains a leader in responding to ocean change and contributing to global efforts to protect our oceans for future generations.

"The longer I fish the more I realize how dynamic the ocean and climate systems are. Continuing scientific and collaborative research to gather data is essential today in order to answer questions in the future. One wise fisherman once told me "the only constant is change". With this in mind one realizes how important research and data collection is over the long-term in order to best adapt to future changes for all ocean users."

Georgon (Poggy) Lapham
Owner/Operator of F/V Michele Ann, Newport, Oregon



Take Action



Oregon Coordinating
Council on Ocean
Acidification & Hypoxia

The Oregon Ocean Change Action Plan outlines actions that Oregon will take to adapt to and mitigate ocean change impacts. We need all Oregonians to help make a difference facing this global problem.

Here is how **YOU** can make a difference:



Build Resilience to Ocean Change

- Work with industry, managers, and researchers to develop ocean change specific adaptation and mitigation steps
- Support local, sustainable, and adaptable coastal business growth as ocean change impacts occur



Help Monitor Ocean Change

- Establish local and regional community-based monitoring networks
- Join an existing research or management survey as a volunteer



Reduce Excess Carbon and Prevent Ocean Change Stressors

- Plant and maintain trees and restore coastal habitats
- Support State regulatory and voluntary programs to improve water quality
- Be mindful of your personal carbon footprint and reduce where you can: food waste, water usage, home heating/cooling/lighting, and driving patterns



Learn about Ocean Change Science and Solutions

- Encourage local schools and universities to teach about ocean change
- Attend science and policy lectures, speaker series, and outreach events
- Use your network to share information about ocean change science, impacts, and solutions



Encourage and Participate in Public Processes

- Support your local communities, cities, or organizations to join coalitions and formulate their own ocean acidification or ocean change Action Plans
- Speak with and organize letters to your state and local government representatives for ocean change action

To learn more, please visit: [***oregonocean.info***](http://oregonocean.info)



Submitted to the Oregon Legislature,
the Ocean Policy Advisory Council, and
the Oregon Climate Action Commission

