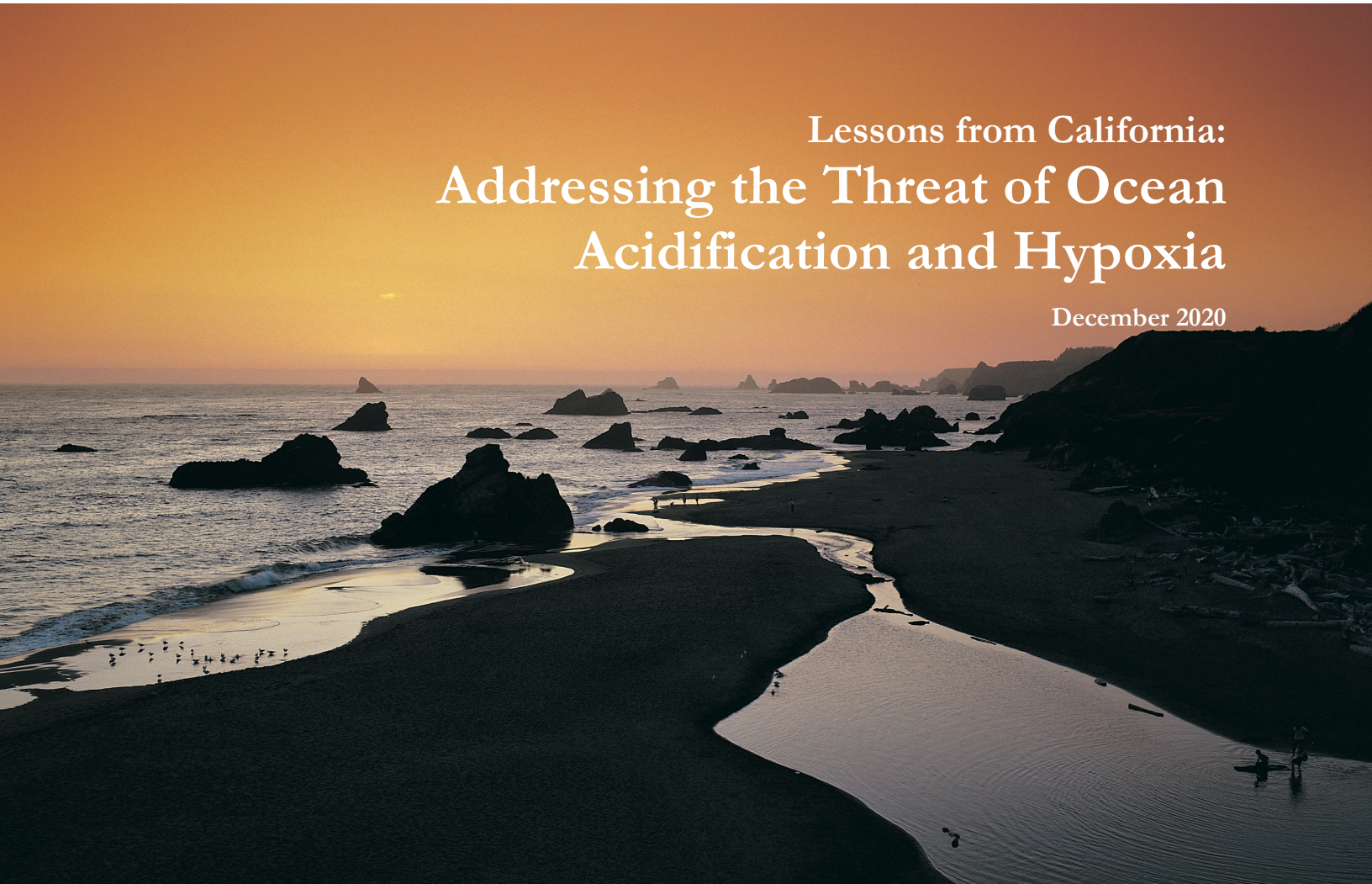




# Lessons from California: Addressing the Threat of Ocean Acidification and Hypoxia

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**L**ong regarded as a leader in climate policy and ocean conservation, the state of California has become a pioneer in the intersection of these fields. Over the past two decades, California has developed a comprehensive vision for ocean-climate action that can serve as a model to both subnational and national governments seeking to protect the ocean and use its power to combat climate change.

This series highlights some of the key actions California has taken on mitigation, adaptation, and climate finance. For more information on the suite of actions, see the California Ocean-Climate Guide (1).

Here we present information about an issue where California has been a true leader, ocean acidification and hypoxia.

## Ocean Acidification

Ocean acidification (OA) is the progressive change in ocean chemistry as excess carbon dioxide from the burning of fossil fuels dissolves into the sea, forming an acid. The California Current is naturally more acidified and lower in oxygen (i.e., more hypoxic) than most ocean surface waters because seasonal upwelling brings CO<sub>2</sub>-enriched waters to the surface. These natural conditions make California's waters particularly vulnerable to climate-driven ocean acidification and hypoxia (OAH).

## California's Action

California has created a regionally based collaborative, science task force, and comprehensive action plan to address ocean acidification and other climate-related changing ocean conditions.

## Context and Detail

In 2007, the U.S. West Coast shellfish industry noticed a dramatic increase in mortality of oyster larvae in commercial hatcheries. The shellfish growers joined forces with government and academic scientists and determined that the larval die-offs occurred when the seawater flowing into aquaculture facilities had low pH and carbonate availability, indicating that OA was the culprit. Recognizing the risk that OA poses to their industry, in 2010 a grassroots network of industry stakeholders and researchers developed the California Current Ocean Acidification Network (2).

Shortly after Washington State created the first-of-its-kind Blue Ribbon Panel on Ocean Acidification, the California Ocean Protection Council asked the California Ocean Science Trust to assemble the West Coast Ocean Acidification and Hypoxia Science Panel in partnership with Oregon, Washington, and British Columbia (3, 4). Over two years, the panel of 20 leading scientists developed and released a series of reports, culminating in its Major Findings, Recommendations, and Actions (4).

In 2016, in response to the panel's recommendations, the California Legislature supported this agency action and passed two bills, one establishing an Ocean Acidification Science Task Force (AB 2139) and the

other creating an Ocean Acidification and Hypoxia Reduction Program (SB 1363). The Ocean Acidification and Hypoxia Science Task Force is an interdisciplinary team of scientists from West Coast institutions that is tasked with ensuring that the state's OA and Hypoxia Reduction Program is based on the best available science. In 2018 an Ocean Acidification Action Plan was adopted, outlining a 10-year vision for addressing ocean acidification in California's waters with a series of pragmatic actions to work toward that vision (5).

Implementation priorities for the next five years include developing a monitoring system with publicly accessible data; mitigating CO<sub>2</sub> emissions and reducing nutrient pollution that can exacerbate OA locally; and mitigating aquatic CO<sub>2</sub> by preserving seagrass meadows, salt marshes, and kelp forests. These actions bring multiple co-benefits as well, including improving water quality, maintaining important habitats, and providing green spaces for California's citizens.

California's work on OAH has been facilitated and strengthened by the Pacific Coast Collaborative, a network of West Coast governance jurisdictions that are working together to build a low-carbon economy. As an early member of the West Coast OAH Monitoring Network, California has contributed to and benefited from its system-wide assessment and design of monitoring assets. Similarly, California was a co-founding member of the International Alliance to Combat Ocean Acidification (Alliance). This global alliance of more than 70 members shares information on local actions that can be taken to reduce the threat of ocean acidification to industry and the environment.

Both the Alliance and the state of California participated at last year's global climate change conference, the UNFCCC COP 25 in Madrid, highlighting the importance of subnational action and regional and global partnerships in supporting scientific research, sharing information, working with decision makers early on, and taking action to address climate change at multiple levels simultaneously.

## Lessons Beyond California

- Collaboration and ongoing funding to support scientific research and plan implementation have been key to California's OAH success to date. Science resources and funding for ongoing research are crucial to combating OAH.



- Many regions suffer from the same impacts of OAH due to similar currents and marine ecosystems. A network of jurisdictions and other actors facing similar issues, informed by best available knowledge, can provide leadership, support, shared resources, data collaboration, raise public awareness, and ensure that solutions are broadly effective. A network can also help raise public awareness about the harmful effects of OAH.
- Other jurisdictions may consider looking to the OA Alliance as a starting point for collaboration and resources (6).<sup>1</sup> The Alliance may offer an effective way for states, indigenous peoples' governing bodies, and subnational jurisdictions to partner and share knowledge. This kind of leadership can make a real difference in the global effort to fight climate change and protect our ocean.

## Citations

(1) Ocean-Climate Guide to Action. Ocean Conservancy. 2020. Available from: <https://oceanconservancy.org/climate/publications/ocean-climate-guide-action/>

(2) California Current Acidification Network. Available from: <https://c-can.info/about-us/>

(3) Ocean Acidification: From Knowledge to Action. Washington State Blue Ribbon Panel. 2012. Available from: <https://fortress.wa.gov/ecy/publications/documents/1201015.pdf>

(4) Major findings, recommendations, and actions. The West Coast Ocean Acidification and Hypoxia Science Panel. 2016. Available from: <http://westcoastoah.org/wp-content/uploads/2016/04/OAH-Panel-Key-Findings-Recommendations-and-Actions-4.4.16-FINAL.pdf>

(5) California Ocean Acidification Action Plan. Ocean Protection Council. Available from: <https://www.opc.ca.gov/oa-action-plan/>

(6) Action Plans and Case Studies. International Alliance to Combat Ocean Acidification. Available from: <https://www.oaalliance.org/actionplans/action-plans-and-case-studies/>

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<sup>1</sup>For more recommendations on replicating California's success, refer to <https://www.frontiersin.org/articles/10.3389/fmars.2019.00356/full>