LENFEST OCEAN PROGRAM

A research project
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Austin Trigg,NOAA

NEW RESEARCH TO ANALYZE GEOSPATIAL PATTERNS AND SPECIES IMPACTS OF CHANGING OCEAN CHEMISTRY ON THE WEST COAST

The effects of ocean acidification (OA)—or the decrease in pH in oceans caused by the uptake of anthropogenic carbon dioxide (CO_2) from the atmosphere—pose a substantial threat to the health of marine organisms and coastal ecosystems on the U.S. West Coast. For example, OA can cause reduced growth, reproduction, and survival in many species of economic, ecological, and cultural importance species in the region, including clams, oysters, crabs, and abalone. Other changes in ocean chemistry, such as declines in dissolved oxygen or increases in water temperature, can amplify these effects.

Over the last decade, West Coast states have worked to develop science-based tools and partnerships to address OA. However, more targeted information is needed to help managers know where, when, and how to act. The Lenfest Ocean Program is funding Dr. Tessa Hill of University of California, Davis and a team of researchers to analyze and map the geospatial patterns of OA and other environmental stressors and identify where organisms along the West Coast are vulnerable.

TARGETED INFORMATION ON MULTIPLE STRESSORS

California, Oregon, and Washington have been proactive in developing policies to combat OA. Resource managers in Washington are working with scientists, the shellfish aquaculture industry, and others to implement recommendations of the Washington State Blue Ribbon Panel on Ocean Acidification. Oregon convened the Coordinating Council on Ocean Acidification, an interagency working group to develop a statewide OA Action Plan. And the California Ocean Protection Council adopted its OA Action Plan in late 2018, which includes strategies to evaluate OA adaptation measures, reduce CO_2 emissions, and increase national and global engagement on the topic.

> **"WE WILL VISUALIZE WHERE AND WHEN OA AND OTHER STRESSORS THREATEN COASTAL SPECIES TO HELP MANAGERS TARGET THEIR ACTIONS."**
>
> - Tessa Hill

The next step is improving managers' ability to hone in on where and when to act and to identify what policies will be most effective. For example, West Coast shellfish farmers and resource managers are interested in determining which regions of the coast are best suited for sustainable aquaculture. The Dungeness crab fishery and fishery managers have expressed interest in better understanding the risks OA and other stressors pose to Dungeness crabs.

Oceanographic and ecological monitoring on the West Coast can now show where OA and other stressors interact and pose risks to valuable species. This information will spur progress in the ongoing efforts of all three states and will inform coordination with federal partners.

RESEARCH TO UNDERSTAND THE GEOGRAPHY OF STRESS AND VULNERABILITY

In this project, researchers will address two key questions:

1. What are the geospatial patterns of OA and interacting environmental stressors for coastal areas of the U.S. West Coast?
2. Where and how are culturally, commercially, and ecologically valuable species vulnerable to overlapping environmental stressors, including OA, hypoxia (deoxygenation), and rising temperatures?

Phase One - Mapping Vulnerability: The research team will assemble existing oceanographic data on OA and other parameters, including temperature and dissolved oxygen. With these data, researchers aim to understand how these stressors vary in coastal waters seasonally and across years. The researchers will then conduct a meta-analysis of the scientific literature on the responses of marine organisms to changing ocean chemistry, with a focus on four groups of animals: sea urchins, abalone, crabs, and clams. The researchers will compare what they learn from the meta-analysis with the oceanographic data, including how physical conditions vary in time and space. This process will shed light on where and when important coastal species are most vulnerable. The research team will produce maps to show areas of high stress and vulnerable species.

Phase Two - Testing Effects on Dungeness Crabs: In this phase, the researchers will test the effects of OA, dissolved oxygen, and temperature on Dungeness crabs. The team will collect juvenile and adult crabs and rear them in aquaria where exposure to low pH and low oxygen waters can be manipulated under different temperature conditions. The aim is to understand the interactive effects of different stressors on both male and female crabs throughout their life history. The team will also integrate this with the outcomes of phase one to understand the vulnerability of Dungeness crab across the California Current.

To ensure results are impactful, the research team will collaborate with the shellfish aquaculture industry, state natural resource managers, and federal agencies throughout the project. The research team will also convene two workshops – one at the beginning and one at the end of the project – that bring together managers, policymakers, stakeholders, and non-profit organizations to discuss research plans, and ultimately project results. The project started in March 2019 and will take place over three years.

RESEARCH TEAM

- Tessa Hill, Professor, University of California, Davis
- Brian Gaylord, Professor, University of California, Davis
- Eric Sanford, Professor, University of California, Davis
- Kristy Kroeker, Associate Professor, University of California, Santa Cruz
- Ana Spalding, Assistant Professor, Oregon State University
- Liz Whiteman, Executive Director, California Ocean Science Trust

CONTACT

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