FAR FROM BASIC

Locating Ocean Acidification Monitoring Gaps and Hotspots within the California Current

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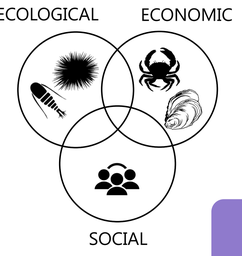
BACKGROUND

Ocean Acidification (OA) – 'the other CO_2 problem'

1/3 of anthropogenic carbon dioxide emissions are absorbed by the ocean

$CO_2 + H_2O \rightarrow$ Increased acidity



The Problem

Ocean acidification occurs when the ocean absorbs carbon dioxide from the atmosphere, causing seawater to become acidic. This decreases the calcium carbonate in seawater, making it difficult for marine organisms to build and maintain shells. Many marine organisms have economic, ecological, and social value in the California Current System. There is uncertainty about varying intensity and impacts of ocean acidification, and marine managers lack tools to consider its effects in management decisions.

OUR APPROACH

Develop a method to identify gaps in West Coast ocean acidification monitoring network

Locate and map acidification hotspots to determine which marine protected areas (MPAs) are most impacted

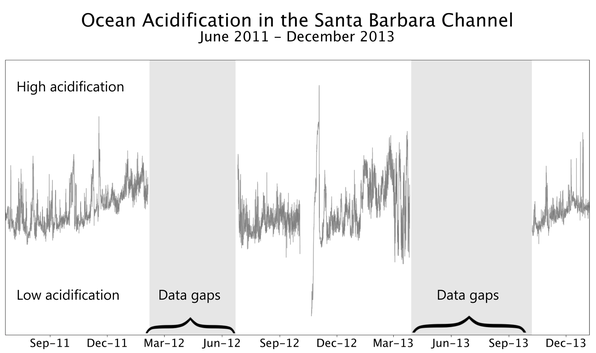


Figure 1. Ocean acidification in the Santa Barbara Channel. Data collected by the Santa Barbara Channel Long Term Ecological Research group at Alegria Reef.

What is a data gap?

Data gaps are areas or periods of time where existing data collection cannot capture adequate information to understand trends in ocean acidification.

What is a hotspot?

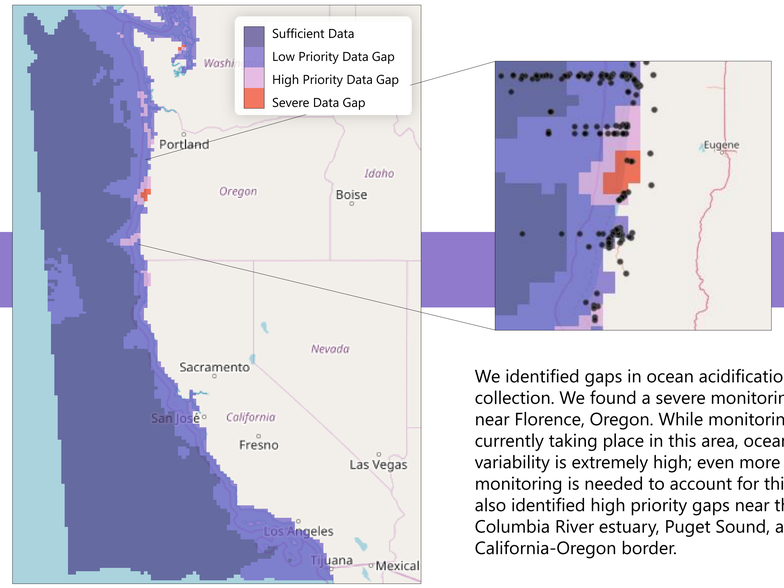
Hotspots are areas with levels of ocean acidification that negatively impact marine organisms.

How do you find them?

We used the West Coast Ocean Acidification and Hypoxia Monitoring Inventory to evaluate gaps in the overall network, gaps in high frequency monitoring, and gaps in collection of biologically relevant measurements. Priority gaps were identified as monitoring stations that were spatially distant from each other or with high oceanographic variability between them.

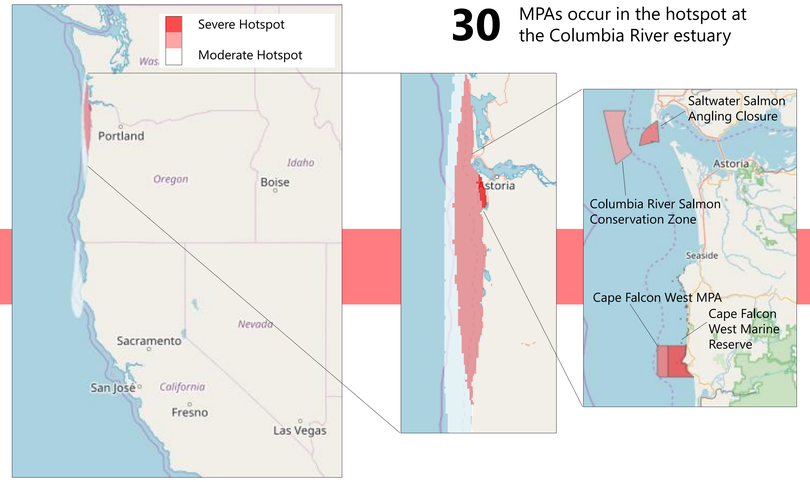
We used data from NOAA Ocean Acidification Cruises to interpolate ocean acidification values and map hotspots. We identified MPAs in hotspots and low ocean acidification areas.

MONITORING GAP ANALYSIS



We identified gaps in ocean acidification data collection. We found a severe monitoring gap near Florence, Oregon. While monitoring is currently taking place in this area, ocean variability is extremely high; even more monitoring is needed to account for this. We also identified high priority gaps near the Columbia River estuary, Puget Sound, and the California-Oregon border.

HOTSPOT AND MPA ANALYSIS



30 MPAs occur in the hotspot at the Columbia River estuary

Using data from the 2013 NOAA West Coast Ocean Acidification Cruise, we identified MPAs that are most impacted by ocean acidification. Due to the extreme hotspot at the Columbia River Mouth, MPAs on the Oregon – Washington border are most affected by OA.

CONCLUSION

1. **Closing data gaps will increase our regional understanding of ocean acidification**
2. **Consistent data will strengthen analysis of where hotspots occur**
3. **Improved monitoring and evaluation will facilitate strategic management of ocean acidification**

CLOSING THE GAPS

How can this information improve the consistency of ocean acidification monitoring along the West Coast?

Upgrade existing monitoring assets

Some data gaps can be filled by modifying existing monitoring buoys. Gaps in high frequency data can be filled by increasing monitoring frequency. Adding sensors to monitoring sites can ensure the collection of biologically significant data.

Pair biological and physical monitoring

This will help us understand how changes in ocean acidification directly impact marine organisms and the health of entire ecosystems. Understanding the link between acidification and biological implications is key to including ocean acidification in management decisions.

Ensure public access to data

Access to data collected along the entire coast will improve collective understanding of ocean acidification as a regional problem. When the most recent data is available to researchers and decision makers, policies can reflect the most recent science.

MANAGEMENT MOVING FORWARD

How can MPA managers take steps to respond to ocean acidification?

Strengthen ability of marine communities to adapt to ocean acidification through MPAs

MPAs in hotspots may help organisms develop genetic tolerance to OA, while MPAs in coldspots may strengthen marine communities by protecting from human pressures. A network of MPAs with varying OA levels may create adaptive ecosystems that can deal with the stress of OA.

Remove CO_2 in seawater through seagrass and kelp restoration

When aquatic plants photosynthesize, they remove CO_2 from seawater. This decreases acidity and may help marine organisms form their shells. Restoring aquatic plants like seagrass and kelp can reduce OA locally and sequester carbon in ocean sediments for many years.

Reduce local water pollutants that intensify ocean acidification

Pollutants that enter the ocean attract respiring bacteria, which produce CO_2 and intensify OA conditions. Reducing water pollutants from fertilizer, sewage, and coastal erosion decreases the threat of OA in coastal waters.

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More information can be found at http://resilienseas.weebly.com or by contacting gp-westcoastseas@bren.ucsb.edu.

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