Study outlines threat of ocean acidification to coastal communities in US

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Oysters at hatcheries in Oregon and Washington are showing the effects of ocean acidification. Credit: Oregon State University

Coastal communities in 15 states that depend on the $1 billion shelled mollusk industry (primarily oysters and clams) are at long-term economic risk from the increasing threat of ocean acidification, a new report concludes.

This first nationwide vulnerability analysis, which was funded through the National Science Foundation's National Socio-Environmental Synthesis Center, was published today in the journal *Nature Climate Change*.

The Pacific Northwest has been the most frequently cited region with vulnerable shellfish populations, the authors say, but the report notes that newly identified areas of risk from acidification range from Maine to the Chesapeake Bay, to the bayous of Louisiana.

"Ocean acidification has already cost the oyster industry in the Pacific Northwest nearly $110 million and jeopardized about 3,200 jobs," said Julie Ekstrom, who was lead author on the study while with the Natural Resources Defense Council. She is now at the University of California at Davis.

George Waldbusser, an Oregon State University marine ecologist and biogeochemist, said the spreading impact of ocean acidification is due primarily to increases in greenhouse gases.

"This clearly illustrates the vulnerability of communities dependent on shellfish to ocean acidification," said Waldbusser, a researcher in OSU's College of Earth, Ocean, and Atmospheric Sciences and co-author on the paper. "We are still finding ways to increase the adaptive capacity of these communities and industries to cope, and refining our understanding of various species' specific responses to acidification.

"Ultimately, however, without curbing carbon emissions, we will eventually run out of tools to address the short-term and we will be stuck with a much larger long-term problem," Waldbusser added.

The analysis identified several "hot zones" facing a number of risk factors. These include:

- The Pacific Northwest: Oregon and Washington coasts and estuaries have a "potent combination" of risk factors, including cold waters, upwelling currents that bring corrosive waters closer to the surface, corrosive rivers, and nutrient pollution from land runoff;
- New England: The product ports of Maine and southern New Hampshire feature poorly buffered rivers running into cold New England waters, which are especially enriched with acidifying carbon dioxide;
- Mid-Atlantic: East coast estuaries including Narragansett Bay, Chesapeake Bay, and Long Island Sound have an abundance of nitrogen pollution, which exacerbates ocean acidification in waters that are shellfish-rich;
- Gulf of Mexico: Terrebonne and Plaquemines Parishes of Louisiana, and other communities in the region, have shellfish economies based almost solely on oysters, giving this region fewer options for alternative - and possibly more resilient - mollusk fisheries.

The project team has also developed an interactive map to explore the vulnerability factors regionally.

One concern, the authors say, is that many of the most economically dependent regions - including Massachusetts, New Jersey, Virginia and Louisiana - are least prepared to respond, with minimal research and monitoring assets for ocean acidification.

The Pacific Northwest, on the other hand, has a robust research effort led by Oregon State University researchers, who already have helped oyster hatcheries rebound from near-disastrous larval die-offs over the past decade. The university recently announced plans to launch a Marine Studies Initiative that would help address complex, multidisciplinary problems such as ocean acidification.

"The power of this project is the collaboration of natural and social scientists focused on a problem that has and will continue to impact industries dependent on the sea," Waldbusser said.

Waldbusser recently led a study that documented how larval oysters are sensitive to a change in the "saturation state" of ocean water - which ultimately is triggered by an increase in carbon dioxide. The inability of ecosystems to provide enough alkalinity to buffer the increase in CO_2 is what kills young oysters in the environment.

More information: *Nature Climate Change*. DOI: 10.1038/nclimate2508

Provided by Oregon State University