

Multiple U.S. states at economic risk from ocean acidification, study warns

Niina Heikkinen, *Environment & Energy Publishing*, 2-24-15

The majority of U.S. shellfisheries are at risk from rising levels of ocean acidification, potentially posing a significant economic threat to the \$1 billion industry, according to a new national assessment.

The research constitutes the first time that scientists have analyzed how changing ocean chemistry driven by global changes in atmospheric CO₂ levels could have an impact on local economies in 15 coastal U.S. states.

Ocean acidification occurs as carbon dioxide from the atmosphere dissolves into ocean water, lowering the water's pH. This higher acidity can make it more difficult for shellfish like oysters and clams to build their shells and can even make water corrosive enough that the shells dissolve.

Scientists estimate that the world's oceans absorb roughly a quarter of the planet's human-caused carbon emissions. That amount is only expected to increase if global carbon emissions remain unchecked.

According to the Intergovernmental Panel on Climate Change, the concentration of hydrogen ions in ocean water (a higher concentration means more acidity) is likely to increase 100 to 150 percent by the year 2100. Simultaneously, concentrations of calcium carbonate, the essential building blocks of many types of shells, are expected to go down.

While scientists are aware of the negative impacts that higher ocean acidity can have on marine life, much less is known about what effect ocean acidification would have on the people and communities that rely on mollusks like clams, mussels and oysters.

So in addition to evaluating biological sensitivity, the researchers looked at a variety of factors to determine economic impacts. They evaluated how much states were involved in climate adaptation efforts, the level of diversity of catches, local dependence on the shellfish industry for employment, and access to relevant scientific research.

Their research was published yesterday in *Nature Climate Change*, and an interactive map illustrating their findings is also available online.

Threat spans from Alaska to unprepared Cape Cod

Vulnerable regions included the East and Gulf coasts, as well as the Pacific Northwest, though the risk factors varied for different areas.

Shellfisheries in the Pacific Northwest were vulnerable to rising acidity because of local environmental factors like upwelling currents and cold water temperatures that allowed more CO₂ to dissolve into the ocean's surface.

However, fisheries in the Northeast and Gulf Coast were at higher risk because they had much less ocean acidity monitoring and preparedness for changing ocean conditions, according to the report.

Southern Alaska was expected to see the biggest impacts the soonest, followed by the north-central West Coast and the Gulf of Maine in the Northeast.

Southern Massachusetts had the highest sensitivity to rising ocean acidity because of its level of economic reliance on the industry. The area has the highest mollusk harvest revenues on anywhere in the United States, as well as the second-highest number of fishing licenses and the fourth-highest proportion of total seafood revenue based on mollusks. At the same time, the state has taken relatively little action to address ocean acidification, according to the report.

Though a wide range of areas are expected to see economic impacts from increased ocean acidification, the researchers did not rank which areas would ultimately face the greatest losses.

"It's really hard to do that because we have limited data about species responses [to higher ocean acidity]," said George Waldbusser, an assistant professor of ocean ecology and biogeochemistry, and one of the authors of the study. "The best we can do is point to the fact that certain areas have these specific risk factors."

There is also much less information about how factors like excess nutrients or influx of river water could affect shellfish survival in areas like the Gulf of Mexico. It has only been relatively recently that scientists have recognized that these factors affect ocean acidity.

A \$110M hit to Pacific Northwest oyster industry

As someone who studies natural sciences, Waldbusser said he was surprised by the level of social impact that ocean acidification has around the country.

Because the Pacific Northwest has invested more into helping the shellfish industry adapt, the region might actually do better than financial losses to the industry suggest.

"Ocean acidification has already cost the oyster industry in the Pacific Northwest nearly \$110 million and jeopardized about 3,200 jobs," said Julie Ekstrom, the lead author of study, in a press release. At the time of the study, Ekstrom was working with the Natural Resources Defense Council, and he has since moved to the University of California, Davis, to work as the director of the Climate Adaptation Program.

More funding for research on ocean acidity might be available soon, pending the approval of President Obama's fiscal 2016 budget, which allocates \$30 million for the National Oceanic and Atmospheric Administration to study ocean acidification.

The researchers pointed out that though ocean acidification is clearly problematic, it is just one of a number of factors like warming ocean temperatures and pollution that also affect ocean health. That dynamic complicates research.

"The next step is to develop targeted efforts tailored to reducing social and ecological vulnerabilities and addressing local needs," the authors wrote.