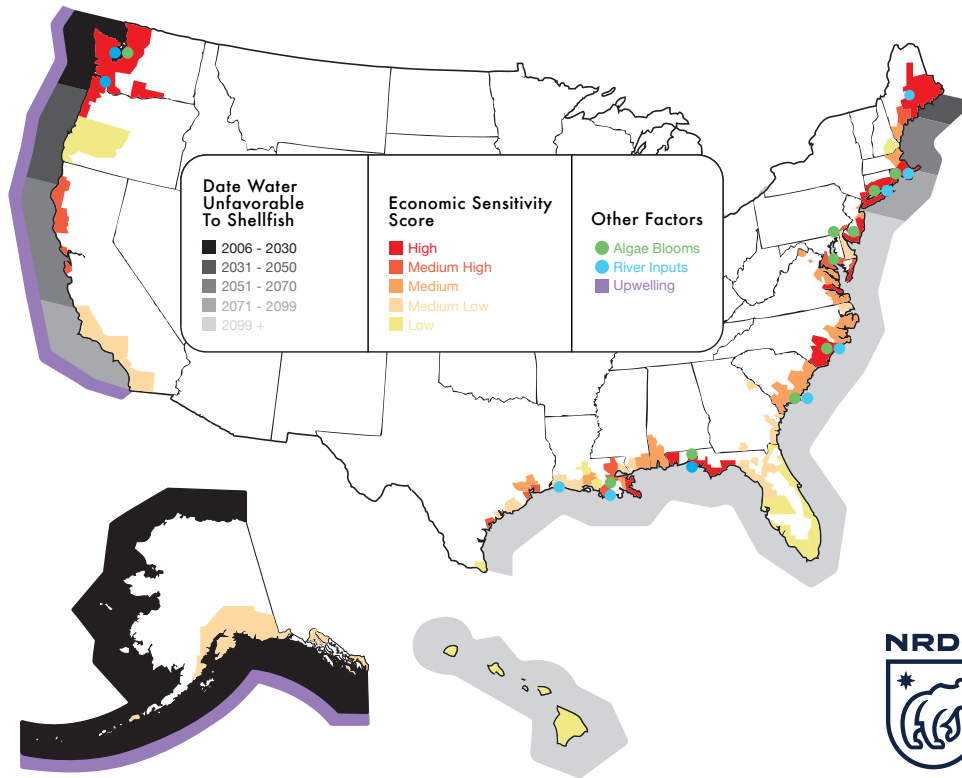


RHODE ISLAND IS AT HIGH RISK FOR ECONOMIC HARM DUE TO OCEAN ACIDIFICATION



According to a new assessment of the U.S. communities most vulnerable to ocean acidification, Rhode Island is at high risk of economic harm. Communities and governments can still take action, researchers say.

MAP LEFT: The long-term economic impacts of ocean acidification are expected to be most severe in regions where ocean areas are acidifying soonest (black) and where the residents rely most on local shellfish for their livelihood (red). Local factors such as algae blooms from nutrient pollution, local upwelling currents, and poorly buffered rivers (green, purple, blue) can amplify acidification locally.



adapted by NRDC from Ekstrom *et al.*, 2015

WHY IS RHODE ISLAND A HOTSPOT?

ECONOMIC DEPENDENCE



CASH CROP. Rhode Island ranks seventh in economic dependence on shelled mollusks in the United States. Shellfish harvests have brought in an average of \$14 million annually over the past ten years. However, the economic benefits extend well beyond the value of the harvest. Top-earning species are sea scallops, quahogs, and the eastern oysters.

JOBS JOBS JOBS. Rhode Island supports a high number of shelled mollusk fishermen, with an average of 700 fishing commercial licenses per year (over the past five years) to harvest bivalves—a disproportionately large number for such a small state.

OCEAN VULNERABILITY



RIVERS MATTER. Poorly buffered rivers with relatively acidic fresh water—such as the Blackstone/Seekonk River—further reduce the pH level and availability of carbonate minerals for shellfish to build their shells. (see sidebar)

POLLUTION HELPS SOUR THE WATERS. In some areas farms, lawns, and leaky sewage systems pour excess nutrients such as nitrogen into waterways, which spurs excess algae growth. When the uneaten algae die, they decompose, releasing additional carbon dioxide and raising the acidity even higher. Narragansett Bay has a history of problems with nutrient pollution and algae blooms.



PHOTO CAPTION: Jules Opton-Himmel runs Walrus & Carpenter Oysters in Ninigret, RI.

PHOTO CREDIT: © Jason Houston

WHAT CAN WE DO?



Alaska fishermen send urgent message to save the oceans from ocean acidification. | PHOTO: Lou Dematteis/Spectral Q

THE MOST EFFECTIVE STEP toward healthier oceans is to stop pumping carbon dioxide into the sea from cars, factories, and power plants. But Rhode Island policymakers—and residents—don't need to wait for global coordination, researchers say. They can make a difference now:

REDUCE the amount of pollution from nutrients such as nitrogen that flows into waterways through smarter farming and development techniques and by installing upgraded sewage treatment.

INVEST in shellfish aquaculture techniques to help protect mollusks from corrosive waters during their sensitive larval phase.

HELP NATURE CULTIVATE ocean acidification-resistant bivalves by selecting and breeding strains that are naturally more resistant to the ocean changes. Rhode Island has numerous marine labs and research institutions that can help identify mitigation measures.

INCREASE FUNDING for targeted research and monitoring programs that help protect the shellfish industry, such as the National Oceanic and Atmospheric Administration's Sea Grant program and the Federal Ocean Acidification Research and Monitoring program.

ESTABLISH AN OCEAN ACIDIFICATION TASK FORCE. States such as Maine, Maryland, and Washington have taken an important step toward reducing their vulnerability to ocean acidification by assembling an expert commission to evaluate economic and ecological risks and to identify measures to mitigate them.

ABOUT THE STUDY

THE FINDINGS ABOUT RHODE ISLAND are contained in a new paper, "Vulnerability and Adaptation of U.S. Shellfisheries to Ocean Acidification," published today in *Nature Climate Change*. The study breaks new ground by identifying the communities along our nation's shores that will most likely suffer long-term economic harm from ocean acidification, revealing a mosaic of vulnerability.

Coastal communities in 15 states are at high economic risk from ocean acidification due to their dependence on U.S. shelled mollusk fisheries, which brings in billions of dollars annually. The researchers urge policymakers to take action now to protect these regions.

Researchers studied harvests from shelled mollusks such as oysters, clams, and scallops, which will likely be the first U.S.

fisheries harmed by ocean acidification. They mapped locations in the ocean experiencing the most rapid changes from rising CO₂ in the atmosphere. They identified places where local factors such as algae blooms contribute to acidification, and mapped coastal communities that would be most vulnerable to declining harvests. Finally, they identified places where all these variables overlapped.

This work was supported by the National Socio-Environmental Synthesis Center under funding received from the National Science Foundation DBI-1052875.

WHAT IS OCEAN ACIDIFICATION?

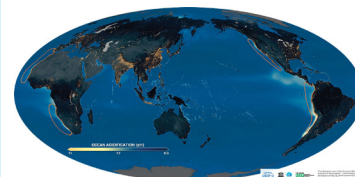
THE OCEANS NATURALLY absorb carbon dioxide from our atmosphere. Now, however, we've tinkered with that equation, dramatically increasing the amount of carbon dioxide entering the ocean through more than a century of burning fossil fuels.

When carbon dioxide dissolves into the ocean, it triggers chemical reactions that reduce the pH (increasing its acidity) while also reducing the availability of compounds such as carbonate. Carbonate is crucial because many shellfish and corals need it to build their skeletons and shells. With less of it, organisms expend more energy on shell-building and less on eating and basic survival. This can harm the and reduce populations.

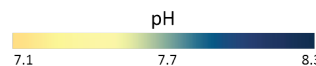
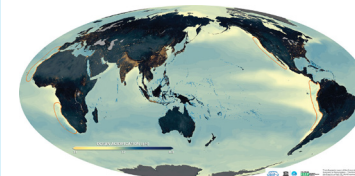
As ocean acidification accelerates, it now poses a serious threat to the web of life underwater.

RAPID DECLINE IN: OCEAN pH

OCEAN pH IN
1860



PROJECTED OCEAN pH IN
2100



INFOGRAPHIC: This infographic is part of the *Ocean Acidification Summary for Policy Makers - Third Symposium in an Ocean in a High CO₂ World* sponsored by IGBP, IOC-UNESCO, and SCOR for more information www.igbp.net.