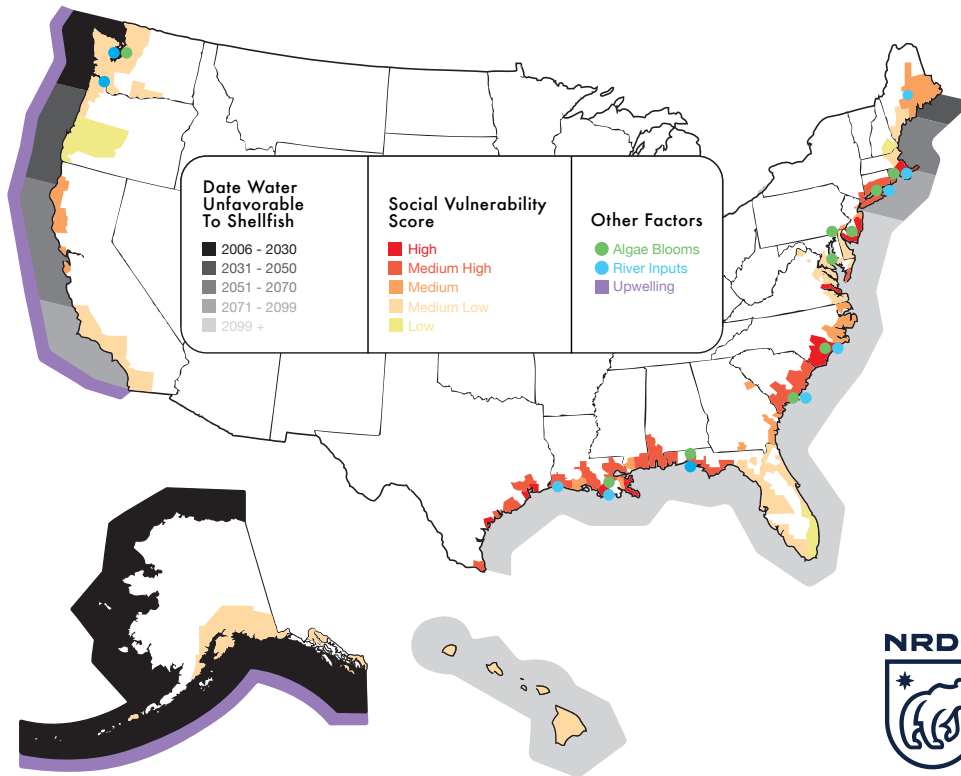


COUNTIES IN MARYLAND ARE VULNERABLE TO OCEAN ACIDIFICATION



According to a new assessment of the U.S. communities most vulnerable to ocean acidification, Maryland 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 MARYLAND A HOTSPOT?

ECONOMIC DEPENDENCE



REVENUES. Worcester and Dorchester counties in eastern Maryland land an average of \$7 million worth of shelled mollusks each year.

Surf clams, sea scallops, and quahogs top the list of valuable fisheries in this region. Charles and Prince George's counties in western Maryland alternatively specialize in estuarine coastal species—landing an average \$2.5 million worth of oysters and soft clams each year.

JOBS, JOBS, JOBS. Charles and Prince George's counties support a high number of shelled mollusk fishermen, with an average approximately 777 fishing commercial licenses per year (over the past five years) to harvest bivalves.

SHELLFISH A LINCHPIN ON THE EASTERN SHORE MD.

The fishing economy in Worcester and Dorchester counties rely almost entirely on shellfish, with 75 percent of commercial fish revenues coming from shelled mollusks (over the past five years).



OCEAN VULNERABILITY

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. The Chesapeake Bay has had a history of nutrient pollution and algae blooms.



PHOTO: Hand tonging for oysters on the Chesapeake Bay
PHOTO CREDIT: © Jay Fleming Photography

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 Maryland 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.

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.

Maryland has already taken an important step toward reducing its vulnerability to ocean acidification by assembling an expert task force on ocean acidification to study the impacts to state waters. The task force recently released its findings. It is important that policymakers take these recommendations seriously to help prepare vulnerable fishing communities in coastal Maryland.

ABOUT THE STUDY

THE FINDINGS ABOUT MARYLAND 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 bring in \$1 billion annually. The researchers urge policymakers to take action now to protect these areas.

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?

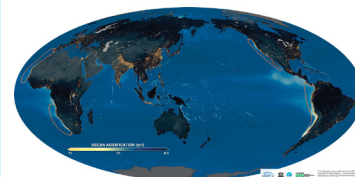
THE OCEANS NATURALLY absorb carbon dioxide from our atmosphere. Now, however, we've tinkered with that equation, dramatically increasing the amount of carbon dioxide entering the ocean through more than a century of burning fossil fuels.

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 organism and reduce populations.

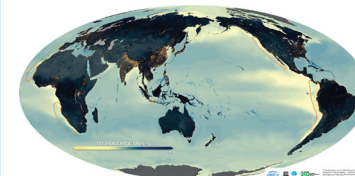
As ocean acidification accelerates, it now poses a serious threat to the web of life underwater.

RAPID DECLINE IN: OCEAN pH

OCEAN pH IN
1860



PROJECTED OCEAN pH IN
2100



pH
7.1 7.7 8.3

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.