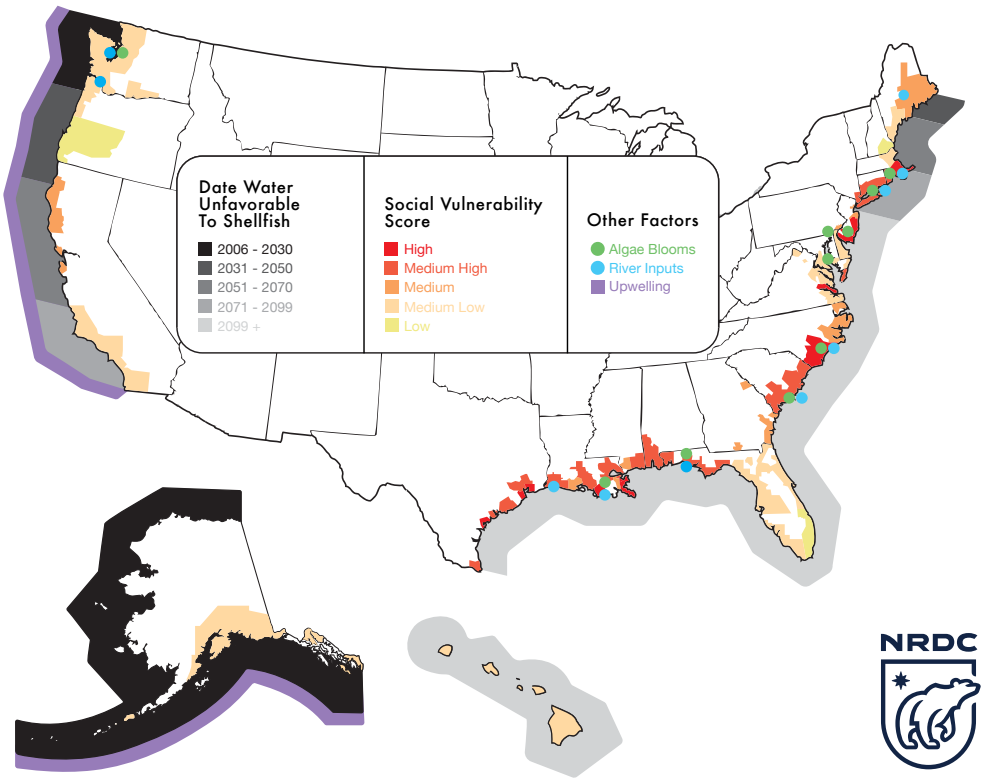
VIRGINIA IS HIGHLY VULNERABLE TO OCEAN ACIDIFICATION



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

ECONOMIC DEPENDENCE

CASH CROP. Two regions of Virginia are highly dependent on shelled mollusk fisheries. In Central Virginia, York, Charles City, and James City counties as well as the cities of Newport News and Hampton have the third highest economic dependence on shelled mollusks in the United States. Commercial shellfish harvests have brought in an average of $67 million annually over the past ten years in these counties. Eastern Virginia (Northampton and Accomack counties) ranks 10th in economic dependence with an average of $14 million annually.

RISING AQUACULTURE INDUSTRY. In addition to a thriving commercial fishing industry, Virginia also boasts a burgeoning aquaculture community with oyster sales more than doubling over the past six years. Of 120 aquaculture operations in Virginia, 80 focus on harvesting oysters and clams, comprising more than 75 percent of the state's $41.5 million in aquaculture sales.

SHELLFISH A LINCHPIN. Shelled mollusks play a central role in the fishing economy of York county, Hampton, and Newport News, with 90 percent of commercial fish revenues coming from shelled mollusks (over the past five years).

OCEAN VULNERABILITY

RIVERS MATTER. Poorly buffered rivers with relatively acidic fresh water—such as the Rappahannock and James Rivers—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 acidity even higher. The Chesapeake Bay has had a history of nutrient pollution and algae blooms.

PHOTO CAPTION: Kegotank Farm owner, Alyson Myers, harvests oysters on the Eastern Shore of Virginia.
PHOTO CREDIT: Photo/Judy G. Rolfe

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 Virginia 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.

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 that them.

ABOUT THE STUDY

THE FINDINGS ABOUT VIRGINA 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 $1 billion 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 CO_2 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.

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WHAT IS OCEAN ACIDIFICATION?

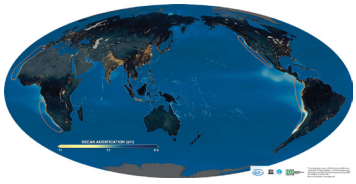
THE OCEANS NATURALLY absorb carbon dioxide from our atmosphere. Now, however, we've tinkered with that equation, dramatically increasing the amount of carbon dioxide entering the ocean through more than a century of burning fossil fuels.

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.

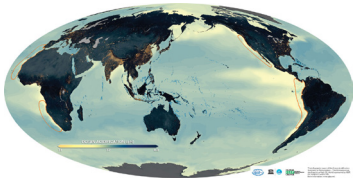
As ocean acidification accelerates, it now poses a serious threat to the web of life underwater.

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 CO_2 World* sponsored by IGBP, IOC-UNESCO, and SCOR for more information www.igbp.net.