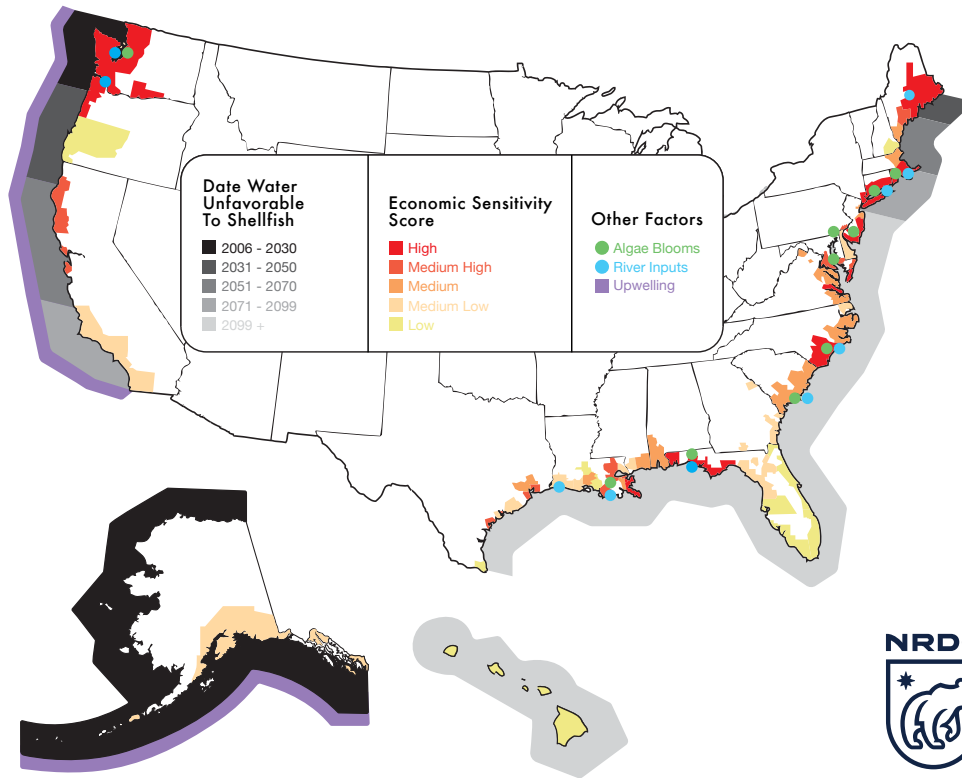


MAINE IS AT HIGH RISK FOR ECONOMIC HARM DUE TO OCEAN ACIDIFICATION ACCORDING TO NEW STUDY



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

MAP LEFT: Darker color = Higher risk
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 MAINE A HOTSPOT?

ECONOMIC DEPENDENCE



MOLLUSKS HELP FUEL THE ECONOMY.

Even not including lobsters in the study (see 'About the Study'), regions of Maine exhibit high economic vulnerability. This is due to the high value of clams, oysters, mussels, and scallops. Downeast Maine alone, generates \$20 million annually from clams, mussels, and scallops.

JOBS, JOBS, JOBS. Coastal Maine supports thousands of shelled mollusk fishermen. Downeast Maine supports the most, with an average of 2,000 fishing licenses per year to harvest bivalves (clams, oysters, mussels, scallops).

SHELLFISH ARE A LINCHPIN. Maine's fishing economy relies almost entirely on shellfish, especially after the collapse of groundfish stocks in the 1980s and 1990s.

OCEAN VULNERABILITY



COLD WATERS SPELL TROUBLE.

In Maine, waters are cold because, unlike much of the East Coast, it does not benefit from the warm waters of the Gulf Stream. This increases the threat from ocean acidification since carbon dioxide dissolves more easily in cold water and the acidity is naturally higher (i.e., pH lower).

RIVERS MATTER. Dozens of rivers flow into Maine's coastal waters—carrying relatively acidic fresh water. This further reduces the pH level and carbonate minerals that shellfish use to build their shells.

POLLUTION HELPS SOUR THE WATERS. In some areas lawns, leaky sewage systems, and farms can pour excess nutrients such as nitrogen into waterways. Like fertilizer, this pollution spurs excess algae growth. When the uneaten algae die, they decompose, releasing additional carbon dioxide and further raising the acidity.



PHOTO: Tim Peters 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 Maine policymakers—and residents—don't need to wait for global coordination, researchers say. They can make a difference now:

REDUCE WATERWAY POLLUTION through smarter farming and development techniques and by investing in sewage treatment upgrades, where necessary.

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

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.

DIVERSIFY MOLLUSK FISHING PORTFOLIOS to reduce risk, as sensitivity to ocean acidification will vary by species.

Maine has already taken an important step toward reducing its vulnerability to ocean acidification by assembling an expert Commission to study the impacts on the state's commercial shellfish harvest. The Commission issued recommendations in January 2015. For the sake of Maine's financial health, it is critical that policymakers take these recommendations seriously.

ABOUT THE STUDY

THE FINDINGS ARE part of "Vulnerability and Adaptation of U.S. Shellfisheries to Ocean Acidification," published today in *Nature Climate Change*.

The groundbreaking study identifies coastal communities most likely to be harmed by ocean acidification, revealing a national 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 regions.

Researchers studied harvests from shelled mollusks such as oysters, clams,

and scallops because these fisheries are likely to be the first harmed by ocean acidification in the United States. They mapped ocean locations experiencing the most rapid changes from rising carbon dioxide in the atmosphere. They identified places where local factors such as algae blooms exacerbate acidification, and mapped coastal communities most vulnerable to declining harvests. Finally, they identified 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?

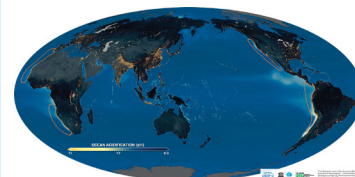
THE OCEANS NATURALLY absorb carbon dioxide from our atmosphere. Now, however, we've tinkered with that equation, dramatically increasing the amount of carbon dioxide entering the ocean through more than a century of burning fossil fuels.

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.

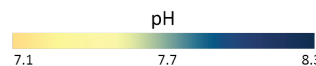
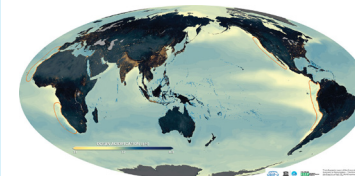
As ocean acidification accelerates, it now poses a serious threat to the web of life underwater.

RAPID DECLINE IN: OCEAN pH

OCEAN pH IN
1860



PROJECTED OCEAN pH IN
2100



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.