What Is Ocean Acidification?

And How Will It Affect New Jersey?

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What causes ocean acidification?

Ocean acidification is often described as climate change's "equally evil twin." Like climate change, the principal cause of acidification in the open ocean is an increase in atmospheric carbon dioxide (CO_2), with potentially harmful ecological and economic consequences.

Carbon dioxide gas dissolves rapidly in seawater, setting off a chemical reaction that lowers pH and makes seawater more acidic. The ocean has absorbed roughly 30% of global CO_2 emissions since the beginning of the industrial era, lowering average ocean pH by 0.1 units – equal to a 30% increase in acidity. If CO_2 emissions continue at current rates, ocean pH levels are expected to fall another 0.3 to 0.4 pH units by the end of the century, representing an additional 120% drop and creating an ocean that is more acidic than at any time in the past 20 million years.

At current CO_2 emission rates, the ocean is expected to be

120%

more acidic in 2100 than today.

2

Acidification is an emerging threat to the marine ecosystem and economy.

How does ocean acidification affect marine life?

Acidification makes it more difficult for marine creatures such as oysters, clams, scallops, lobsters, and crabs to create shells. It can disrupt reproduction, growth, and metabolism in both shell-forming and non-shell-forming species and can leave marine organisms more vulnerable to disease, predation, and climate-related impacts such as warming waters.

3

What's at stake in New Jersey?

Ocean acidification has the potential to disrupt New Jersey's marine ecosystem, particularly fisheries, and the communities that depend on fishing and aquaculture for their livelihoods. While New Jersey isn't seeing significant impacts yet, ocean acidification is regarded as an emerging threat due in part to the importance of fishing and aquaculture to the state's economy.

New Jersey's commercial fishing industry is the fifth largest in the United States and provides more than 50,000 jobs. Commercial fishing, recreational fishing, and aquaculture contribute more than $2.5 billion annually to the state's economy. The most commercially important shellfish species in New Jersey include the Atlantic sea scallop, ocean quahog, Atlantic surfclam, blue crab, and eastern oyster. In the United States, southern New Jersey counties rank second in economic dependence on shelled mollusks.

Commercial fishing, recreational fishing, and aquaculture contribute

$2.5B+

annually to NJ's economy.

4

Critical research questions:

- What are the impacts of acidification at various life stages?
- What is the capacity of species to adapt or acclimatize to acidification?
- Are there thresholds at which species are lost to acidification?
- How does acidification affect the food web, population dynamics, and community structure?

What is known and not known about ocean acidification in NJ?

While much is known about ocean acidification generally, the impacts of acidification on many species commonly found in New Jersey waters and on the marine ecosystem as a whole remain largely uninvestigated.

Numerous studies have looked at the effects of acidification on eastern oysters, but the literature is sparse, if not altogether absent, on other commercially important species. Only one laboratory study focuses on acidification and sea scallops, New Jersey's most valuable shellfish harvest, and only two acidification studies have been conducted on ocean quahog, blue crabs, summer flounder, and longfin squid. Indeed, of the 35 managed species in the mid-Atlantic region, 69% (24 species) have not yet been investigated for acidification impacts.

5

How does ocean acidification combine with other stressors on New Jersey's coastal resources?

Ocean acidification doesn't happen in isolation. It occurs against the backdrop of other climate-related impacts such as warming temperatures and algal blooms that amplify acidification and add to the stress on marine life, especially in coastal waters. An increase in heavy downpours, for example, flushes naturally acidic freshwater into the ocean as well as pollutants such as fertilizer and wastewater that stimulate excess algae growth. The algae eventually die and are consumed by bacteria, which deplete oxygen in the water, leading to a dangerous condition known as hypoxia. The process also releases carbon dioxide, which, in turn, increases acidification. Periodic upwellings of deeper, colder, more acidic water are an additional source of acidification near the coast.

6

What can be done to address ocean acidification?

More monitoring and research are needed to better understand ocean acidification and its impacts on the marine ecosystem and economy. And because the ocean doesn't stop at New Jersey's borders, coordinating with scientists, policy makers, and other stakeholders throughout the mid-Atlantic region and beyond is essential for crafting an effective response.

Like climate change, the key to mitigating ocean acidification over the long term is to dramatically reduce carbon dioxide emissions by transitioning to renewable energy, practicing climate-smart agriculture, using sustainable building materials, eating a climate-friendly diet, and much else. Reducing the influx of land-based pollutants into the ocean, which has the additional benefit of reducing harmful algal blooms and hypoxia, will help reduce acidification in the near-shore environment, as will protecting and restoring "carbon sinks" such as salt marshes. In the meanwhile, much work remains to expand awareness of ocean acidification among policy makers, researchers, the fishing industry, and NGOs, and explore ways to help ocean-dependent communities adapt to changing conditions.

We must dramatically reduce carbon dioxide emissions.

7

Where can I learn more about ocean acidification in New Jersey?

NJ Scientific Report on Climate Change
nj.gov/dep/climatechange/docs/nj-scientific-report-2020.pdf

The NJDEP's *2020 New Jersey Scientific Report on Climate Change* dedicates a section to the chemistry of ocean acidification, the difference between open ocean acidification and coastal acidification, and the impacts of acidification on New Jersey and the mid-Atlantic region.

MACAN
midacan.org

The Mid-Atlantic Coastal Acidification Network (MACAN) is a nexus of scientists, tribal, federal, and state agency representatives, resource managers, and industry partners who coordinate observation, research, and modeling of ocean and coastal acidification.

MARACOOS
maracoos.org

MARACOOS is a regional association of partners who collect unique ocean and coastal data that is transformed into information products that support jobs, the economy, safety and well-being for the more than 78 million people living, visiting, and working in the mid-Atlantic region.

MARCO
midatlanticocean.org

The Mid-Atlantic Regional Council on the Ocean (MARCO) was established in 2009 by the governors of New York, New Jersey, Delaware, Maryland, and Virginia to improve ocean health and contribute to the region's high quality of life and economic vitality. MARCO shares four regional priorities: climate change adaptation, renewable energy, marine habitats, and water quality.

OA Alliance
oaalliance.org

The International Alliance to Combat Ocean Acidification (OA Alliance) brings together governments and organizations from across the globe to protect coastal communities and livelihoods from the threat of ocean acidification and other climate-ocean impacts.

ROA
roa.midatlanticocean.org

The Mid-Atlantic Regional Ocean Assessment (ROA) is an information resource developed to support the regional planning process from New York to Virginia. It provides key information on ocean planning, ocean ecosystem, and ocean uses for decision-makers, stakeholders, and the broader public.

Webinar: Acidification of New Jersey's Ocean & Coastal Waters
NJ Climate Change Resource Center, Rutgers University (njclimateresourcecenter.rutgers.edu)

A webinar hosted by the NJ Climate Change Resource Center during its 2020 Summer Climate Academy.

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