

Oxygen in the World's Oceans is Declining, Scientists Reveal Dangers and Solutions

In the past 50 years, the amount of water in the open ocean without oxygen has gone up more than four-fold. In coastal water bodies, including estuaries and seas, low-oxygen sites have increased more than 10-fold since 1950. Protecting sensitive species, controlling eutrophication and climate change and improving monitoring are some solutions to the problem, according to researchers from, among others, Lund University.

- “Sufficient oxygen in bottom waters is necessary for a well-functioning healthy ecosystem,” says Professor Daniel Conley at Lund University working together with an international team of scientists in the *Global Ocean Oxygen Network (GO₂NE)*.
- “The decline in oxygen can cause major changes in ocean productivity, biodiversity, and biogeochemical cycles as we have observed in the dead zones of the Baltic Sea.”

This oxygen loss – or deoxygenation – is one of the most important changes occurring in an ocean increasingly modified by human activities that have raised temperatures, increased CO₂ levels and nutrient inputs, and have altered the abundances and distributions of marine species.

Analyses of measurements at sites around the world indicate that oxygen minimum zones in the open ocean have expanded by several million square kilometers and that hundreds of coastal sites now have oxygen concentrations low enough to limit the distribution and abundance of animals, and also alter the cycling of important nutrients.

Climate change is the key culprit in the open ocean. Scientists expect oxygen to continue dropping as the Earth warms. As the ocean gets warmer, the water holds less oxygen. Excess nutrient levels from land create algal blooms, which use up the oxygen as they die and decompose. In an unfortunate twist, animals also need more oxygen in warmer waters, even as oxygen is disappearing.

To address the problem with deoxygenation scientists recommend that the issue be addressed from three angles:

- **Address the causes: nutrient pollution and climate change.** To halt the decline in oxygen, the world needs to rein in both climate change and nutrient pollution. While neither issue is simple or easy, the steps needed to win can benefit people as well as the environment.
- **Protect vulnerable marine life.** With some low oxygen unavoidable, it is crucial to protect at-risk fisheries from further stress. This could mean creating marine protected areas or no-catch zones in areas animals use to escape low oxygen, or switching to fish that are not as threatened by falling oxygen levels.
- **Improve low-oxygen tracking worldwide.** Enhanced monitoring, especially in developing countries, together with numerical models will help pinpoint which places are most at risk and determine the most effective solutions.

The GO₂NE team with Professor Daniel Conley has published the findings in the scientific journal *Science*, and the article is called Declining oxygen in the global ocean and coastal waters

<http://science.sciencemag.org/content/359/6371/eaam7240>

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The *Global Ocean Oxygen Network (GO₂NE)* is a scientific working group organized by the Intergovernmental Oceanographic Commission, part of the United Nations Educational, Scientific and Cultural Organization (UNESCO). The group was established in 2016, its scientists come from around the world and are committed to providing a global and multidisciplinary view of deoxygenation, advising policymakers on countering low oxygen and preserving marine resources.

Figure

Low-oxygen zones are spreading around the globe. Red dots mark places on the coast where oxygen has plummeted to 2 milligrams per liter or less, and blue areas mark zones with the same low-oxygen levels in the open ocean. (Credit: GO₂NE working group. Data from World Ocean Atlas 2013 and provided by R. J. Diaz)

Figure

When the oxygen content of bottom water gets low, eventually only bacteria are able to survive on the seabed. Here is the so-called dead layer, which consists of white sulfur bacteria (Peter Bondo Christensen).