Ocean degradation accelerated by global warming

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Several recently released studies have documented the accelerating changes to Earth's oceans as a result of climate change, including a reduction in the oxygen content, which is threatening vast swaths of marine life. One of the most prominent is an article in the February 25 issue of *Scientific American*, headlined, "The Ocean is Running Out of Breath, Scientists Warn."

The research analyzes data collected by oceanographers at Germany's Helmholtz Center for Research over the past 50 years, which show that ocean oxygen levels have fallen an average of 2 percent worldwide and up to 40 percent in certain regions, such as the tropics.

This, the scientists note, "is the most pressing issue facing sea animals today." They specifically compare it to ocean acidification, the increase in ocean water acidity caused by global warming. It has been shown to wipe out coral reefs and have a profoundly negative impact on the lives and reproductive capacity of shell-based marine organisms such as crabs, oysters and mollusks. Oxygen loss in the oceans, the researchers argue, is more dangerous because it impacts every type of sea creature.

Oxygen is essential for the survival of all aquatic animals, just as it is for those on land. A human in an environment with 2 percent less oxygen than their body is used to might become light-headed or suffer altitude sickness. In an environment with 40 percent less oxygen, they will likely suffer hypoxia and possibly die.

While the changes in oceanic oxygen content have not been instant, and so the problems not as immediately drastic, they have been rapid enough to force species to migrate to more oxygen-rich areas, exposing them to new predators while disrupting the already existing ecosystem. Polar regions in recent years, for example, have suffered an invasion of species from lower latitudes seeking to escape increasingly inhospitable areas.

Earlier research also revealed that oxygen-poor waters make it more difficult for male fish to produce sperm and for those sperm to be as mobile as in normal waters. Alarmingly, this does not seem to reverse itself if oxygen levels increase, posing long-term threats to the sustainability of sea creature populations in areas with decreased oxygen content.

Another effect of oxygen deficiency includes impairing animals' ability to see and hear, impeding their ability to find food and escape from predators.

One of the causes of oxygen depletion is the use of fertilizers that end up in the rivers like the Mississippi. The river carries these nutrients into the Gulf of Mexico where they fuel the growth of algae which, in turn, deplete the level of oxygen in the waters. This creates regions known as "dead zones" in which marine plants and animals cannot live, let alone reproduce.

The more important cause of oxygen depletion, however, is the ongoing warming of the world's oceans. Warm water is unable to hold as much dissolved gas. Global warming also melts ice, which releases fresh water that rests on the surface of the more dense salt water generally found in oceans. This layer can keep water at the surface and in the ocean's depths from mixing, which is the only way that the deeper parts of the ocean have their oxygen stores replenished.

The studies also indicate that oxygen deprivation is now moving into areas previously believed to be less vulnerable, the open oceans and at the poles, showing that current ocean models need to be more carefully crafted to account for the effects of climate change.

One of the major consequences of oxygen depletion is falling fish populations. The habitat of the tropical

Atlantic tuna, for example, has declined by 15 percent between the years 1960 to 2010. As fish move into more oxygen-rich areas, they concentrate in these areas where fishermen find them. This has led to the illusion of abundance and to even more fish being harvested.

There has, as a result, been an overall decline in fish populations of 4.1 percent in the 38 different regions around the world studied by scientists at the University of California Santa Barbara. Their research, published in the March 1 issue of *Science,* titled, "Impacts of historical warming on marine fisheries production," details this population loss in 124 species between 1930 and 2010. The areas most impacted by climate change and overfishing, they wrote, have lost up to 35 percent compared to their early 20th century levels. If this trend continues, the hundreds of millions of human beings who use fish as a primary source of food and make their livelihood from fishing will suffer.

The large amount of oxygen loss in the world's oceans is also impacting plankton populations. These microorganisms are more sensitive than fish to any change in the oceans and play a key role in all life on Earth because of their unique position at the base of the aquatic food chain. As a result of global warming, not only have their populations declined, but they are also forced to swim into deeper waters to reproduce, in turn making it harder for creatures who live near the surface to use the plankton as food. As climate change continues unabated, the potential for a catastrophic loss of the ocean food chain, the basis for life on Earth, increases.

In an attempt to address the broader ocean deoxygenation problem, oceanographers organized an international conference in Kiel, Germany last September and drafted a resolution calling on world governments and the United Nations to "Limit global warming by decisive climate change mitigation actions." They based themselves on the earlier Monaco Declaration of 2008, which raised the question of ocean acidification.

As has been demonstrated in the aftermath of the Monaco Declaration, however, appeals to the various nation-states of the world solve nothing. Global warming and the resultant ocean acidification have continued apace and to some degree accelerated in the past 11 years. Scientists must instead turn to the international working class, the planet's only progressive and revolutionary social force, to undertake the necessary reorganization and scientific coordination of the world's resources to preserve Earth's oceans.