Global warming is heating rivers, endangering human food supplies

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According to the World Wildlife Fund, river fisheries and related freshwater systems provide a major source of protein and livelihoods for hundreds of millions of people worldwide. Around 60 million livelihoods are supported by river fisheries alone. Given this, the health of rivers across the globe is of vital importance to humanity. A newly published report by a group of Chinese scientists ("Sustained deoxygenation in global flowing waters under climate warming." Qi Guan et al, *ScienceAdvances*, May 15, 2026) provides alarming evidence that one of the key elements in river health and the survival of much of riverine life—dissolved oxygen (DO)—is being negatively affected by global warming.

Fish and many other aquatic animals living in rivers acquire the oxygen necessary to their metabolism not by breathing oxygen directly from the atmosphere, as terrestrial animals do, but by extracting oxygen that is dissolved in the water. As water temperature rises, its capacity to hold oxygen decreases. Reduction in the level of dissolved oxygen to which these animals have adapted would cause physical distress or death. The resulting negative impact on riverine fish and other aquatic animal populations would severely restrict or potentially eliminate food resources on which millions of people around the world rely. The above-referenced study found that the rise in river temperatures is indeed happening.

The new analysis of massive amounts of data from more than 21,000 river systems around the world documents that nearly 80 percent have been losing dissolved oxygen over the last four decades. The process is especially advanced in tropical rivers. The researchers collected Landsat remote-sensing and other data for 21,439 river reaches (i.e., specific sections of rivers), covering the years 1985 to 2023, and subjected it to detailed statistical analysis. They found that DO levels declined at an average rate of -0.045 milligrams per liter per decade. Decline was observed in 78.8 percent of the rivers examined.

Dissolved oxygen levels were generally higher in Europe and North America, where DO levels reaching 10.07 ± 0.42 mg/liter and 9.78 ± 1.09 mg/liter, respectively, and lowest in South America and Africa, where it averages less than 7 mg/liter. Levels are most wide ranging in Asia and Oceania.

A DO level from 6–8 mg/L or higher is good for most fish, 3–5 mg/L is stressful for many species and below approximately 2 mg/L is deadly for many fish. The rate of decline is projected to increase during the remainder of the 21st century, to as much as 0.066 mg/L per decade on average. If global warming accelerates more rapidly than expected, the damage will be even greater.

By the end of the century South America and Africa, along with a range of other areas across the globe, will approach the level judged stressful for many species. The study points to India as among the most affected areas: "India's rivers suffer from the largest decline in fluvial DO concentrations, ultimately leading to DO levels that dropped below 5 mg/L by the end of 21st century."

The end of the century may at first seem far off. However, babies born now will only be in their mid-70s by 2100.

Oxygen levels were found to be among the lowest in rivers located in tropical regions. This is contrary to existing expectations which supposed that the process would be greatest in higher latitudes (i.e., closer to the poles), where relative atmospheric warming is occurring most rapidly. However, tropical rivers are already warmer than those farther from the equator and, therefore, already have lower levels of DO. Beginning

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from this lower baseline, the additional loss caused by global warming has relatively greater impact.

An additional finding is that low and high-flow conditions tend to cause less oxygen loss than normal flow.

Ultimately, additional analysis shows that global warming is the primary cause of deoxygenation in rivers, accounting for 62.7 percent of the observed changes. A further 12 percent is attributed to various other factors, such as wind speed and photosynthesis by aquatic plants (which produce oxygen), lumped under the term "ecosystem metabolism." Heatwaves compound the impact of the general global warming. The researchers found that that heatwaves account for 22.7 percent of deoxygenation. With the climate becoming increasingly variable, such events are expected to rise in frequency.

Lower dissolved oxygen (DO) levels in rivers can seriously stress fish and, if severe enough, cause die-offs. Some of the effects include reduced growth and activity, stress and weakened immune systems, reduced reproduction, loss of more vulnerable species and in the most extreme situations, known as hypoxia, massive die-offs of fish and other aquatic organisms.

The authors predict that the increasing loss of dissolved oxygen in rivers will proceed as the earth continues to warm. This poses a growing threat to a significant portion of the world's human population.

Globally, over 40 percent of all fish consumed are obtained from river systems. Wild riverine fisheries and floodplains supply up to 19 percent of the global wild fish catch, providing the equivalent of all dietary animal protein for 158 million people. Inland waters (rivers, lakes and wetlands) officially yield about 12 million tons of fish annually. However, because many small-scale river fisheries go unrecorded, experts estimate the actual catch could be up to 60 percent higher, feeding nearly 200 million people.

More than two-thirds of all farmed aquatic species (such as carp, tilapia and catfish) are freshwater species. These facilities rely heavily on river systems for water, nutrients and feed, making rivers foundational for about half of all fish consumed worldwide.

Riverine species are critical lifelines for indigenous communities and developing nations. In parts of Asia and Africa, populations rely on these species for more than half of their animal protein. They also provide vital micronutrients—like iron, zinc and omega-3 fatty acids—that are difficult to get from strictly land-based diets.

This is not to mention the use of river water for irrigation agriculture. The availability of river water for this purpose is becoming increasingly problematic as global warming causes more frequent and persistent droughts.

With global warming resulting from the uncontrolled emissions of greenhouse gases, global weather patterns are becoming increasingly extreme and unpredictable.

Unless urgent and concerted efforts are made to rapidly lower greenhouse gas emissions, the loss of riverine resources will inevitably result in mass population displacements with drastic social, economic political consequences. Capitalism demonstrates clearly and on a daily basis that is incapable of mounting such an effort. Only the working class, armed with a socialist program, can avert an otherwise catastrophic future.

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