

## With warmer water, fish need more oxygen than their gills can supply



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Marline Cimons, Washington Post • April 23, 2018 10:25 am

As climate change continues to heat up the oceans, many species of fish are expected to decrease in size, some by as much as 30 percent, according to a study by scientists in Canada released last summer. Fish can't grow without oxygen, and it will be difficult for them to get enough of it from the warming waters, according to the research.

Being coldblooded, fish can't regulate their body temperature. When ocean water becomes warmer, fish metabolism speeds up. When this happens, they need more oxygen to sustain bodily functions. They breathe through their gills, which extract dissolved oxygen from the water and then excrete carbon dioxide. But the surface area of the gills doesn't grow at the same pace as the rest of a fish's body.

"There is a point where the gills cannot supply enough oxygen. . . . So the fish just stops growing larger," says study co-author William Cheung, science director of the Nereus Program, a collaboration between Japan's Nippon Foundation and the University of British Columbia.

Co-author Daniel Pauly, a scientist with Sea Around Us, a University of British Columbia research initiative, explains that fish are

constrained by their gills in the amount of oxygen they can extract from the water. “With increasing temperatures, fish require more oxygen but get less,” he says.

This could hit the fishing industry hard, resulting in the loss of an estimated 3.4 million metric tons of potential catch for each degree Celsius (1.8 degrees Fahrenheit) of atmospheric warming, according to Cheung. “Some parts of the world, such as in the tropics, are going to see even larger decreases,” he says. “This will have substantial impacts on the availability of fish for people,” he says.

Scientists are starting to clear up one of the biggest controversies in climate science

For an opinion piece published in 2013, researchers in Britain analyzed long-term data on fish in the North Sea and found that species such as haddock and sole had decreased in maximum body size in the past few decades, “and such shrinkage of size was significantly related to ocean warming in that region, even after correcting for the effects of fishing,” Cheung says.

The oxygen shortage will hurt the entire ocean ecosystem, in particular larger species at the top of the food chain, he adds. “Big fish eat small fish,” Cheung says. “They’re affected because their prey are affected.”

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