

Clever fish keep cool

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Blue-green damselfish may opt to relocate to cooler waters as ocean temperatures rise. Credit: Jodie Rummer, James Cook University

Ocean warming is occurring at such a rapid rate that fish are searching for cooler waters to call home.

A group of international scientists has new evidence that coral reef fish - which struggle to adapt to the warmer ocean temperatures brought about by [global climate change](#) - may instead opt to relocate to cooler parts of the ocean.

In experiments using a common coral reef fish, the blue-green damselfish, *Chromis viridis*, was acclimated to 2-4 degrees Celsius above their normal summer temperatures over a 27-week period.

"When fish have to deal with increased temperature, there are physical consequences. They need more energy to cope, and they may not be able to handle stress or reproduce or even grow," says marine scientist Jacob Johansen of The University of Texas at Austin.

Fish that were acclimated to the highest temperatures lost 30 percent of their body weight and some of them died, according to the University of Copenhagen's Adam Habary, the lead author of a study published this week in the journal *Global Change Biology*.

"But we found that, when given the slightest chance, fish can seek out temperatures that they've evolved to be in over thousands of years, to mitigate the impact of increasing temperatures and not sacrifice critical physiological processes," says Johansen

Most prior research has focused on the capacity for animals to adapt to increasing temperatures, given that animals have adapted to changes in temperature in the past. However, previous adaptations happened at evolutionary timescales, about 1 degree Celsius temperature change per million years. Global climate change is occurring at a much faster rate, with [sea surface temperature](#) predicted to increase 2 to 4 degrees Celsius by the end of the 21st century.

Marine fish are faced with a tough decision. They will need to adapt or

move to avoid death.

Instead of looking into how fish can adapt, the new research took a different approach by asking, what if fish moved? In fact, what if entire ecosystems were capable of moving to the cooler temperatures, toward the poles or to deeper water?

There is already evidence that many coral reef fish and pelagic fish such as tuna are moving in response to warmer ocean waters, and that this is beginning to affect global fisheries. "Our study provides a mechanistic explanation for why fish may move, and a way of testing it," Johansen says.

Picking up and moving may not be the silver bullet for some species, particularly those [coral reef fish](#) that are dependent on reefs for habitat. Corals cannot move pole-ward as fast as the temperature increases are predicted to happen, so corals and coral-dependent fish will have to adapt or move to deeper waters where living conditions are less than ideal.

In addition, ocean warming does not occur as a steady slide upward on the thermometer. It often occurs as severe and increasingly frequent heating events. "It's these transient periods that are causing the most damage," Johansen notes. This was seen earlier this year on the Great Barrier Reef, when temperatures rose as much as 4 degrees Celsius for several weeks, causing widespread coral bleaching and severe physiological stress in many fish.

Johansen and fisheries biologists from the University of Copenhagen and James Cook University collaborated on the just-published study titled "Adapt, move or die - how will tropical coral reef fishes cope with [ocean warming](#)."

More information: Adam Habary et al, Adapt, move or die - how will tropical coral reef fishes cope with ocean warming?, *Global Change Biology* (2016). [DOI: 10.1111/gcb.13488](https://doi.org/10.1111/gcb.13488)

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