

# The foundation of aquatic life can rapidly adapt to global warming, new research suggests

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Important microscopic creatures which produce half of the oxygen in the atmosphere can rapidly adapt to global warming, new research suggests.

Phytoplankton, which also act as an essential food supply for fish, can increase the rate at which they take in [carbon dioxide](#) and release oxygen while in warmer water temperatures, a long-running experiment shows.

Monitoring of one species, a [green algae](#), *Chlamydomonas reinhardtii*, after ten years of them being in waters of a higher [temperature](#) shows they quickly adapt so they are still able to photosynthesise more than they respire.

Phytoplankton use chlorophyll to capture sunlight, and photosynthesis to turn it into chemical energy. This means they are critical for reducing carbon dioxide in the atmosphere and for providing food for [aquatic life](#).

It is crucial to know how these tiny organisms - which are not visible to the naked eye - react to climate change in the long-term. Experts had made predictions that that climate change would have negative effects on phytoplankton. But a new study shows green [algae](#) can adjust to warmer water temperatures. They become more competitive and increase the amount they are able to photosynthesise.

Algae examined by scientists which lived in warmer waters became

fitter, and more competitive, proving that these tiny creatures adapt well to climate change. This suggests that this species could continue to be a plentiful source of food for aquatic life even if temperatures rise.

Previous studies which sought to answer this question have been conducted only in laboratories rather than looking at how phytoplankton reacted to real conditions. In contrast this research, which has run so far for ten years, has allowed researchers to examine how the green algae fare in their natural environment, where they are exposed to a more complex environment, and competitors.

Scientists at the University of Exeter, working with colleagues from Imperial College, and Queen Mary, University of London, have for a decade monitored ten tanks home to the phytoplankton with freshwater heated to four degrees centigrade above the ambient temperature. This is the rate at which our climate will have been warmed by the end of the century. The temperatures of ten other tanks were kept at normal temperatures. All the tanks were kept outside the Freshwater Biological Association's river laboratory in Dorset. All twenty tanks were populated with the same types and proportion of various freshwater phytoplankton, zooplankton, invertebrates and plants. In the laboratory scientists tested how much the algae could photosynthesise, how fast they were growing, and how well they outcompeted organisms from the ambient ponds.

Lead author Dr Elisa Schaum said: "Phytoplankton may be microscopically small, but they are essential for all aquatic life. They provide food for zooplankton, which are then eaten by fish. Aquatic ecosystems produce the oxygen in every second breath we take, and are responsible for the oceans' capacity as a sink for carbon dioxide.

"Other research had suggested that increased temperatures can pose problems for some types of [phytoplankton](#). But we have shown that algae adapt very rapidly and that the mechanism underpinning their

evolutionary response is linked to higher rates of photosynthesis - they can produce more energy, and channel it into faster growth rates and a better capacity for competition with other algae. They divide once a day and live in large populations of thousands of cells per millilitre of water. This means evolutionary changes are made through a few hundred of generations within a couple of years.

"It is important to recognise that [climate change](#) is a serious threat to aquatic ecosystems. Although the green algae monitored in our study cope well with elevated temperature, and may be able to sustain populations of organisms that eat them, we do not know yet what will happen to other groups of algae, and whether or not they will adapt through the same mechanisms."

**More information:** C.-Elisa Schaum et al, Adaptation of phytoplankton to a decade of experimental warming linked to increased photosynthesis, *Nature Ecology & Evolution* (2017). [DOI: 10.1038/s41559-017-0094](#)

Provided by University of Exeter

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