

## Climate change and nutrient fluctuations disrupt networks in lakes

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Topics: Biodiversity | Ecosystems | Climate Change & Energy

**Thanks to a unique data set from ten Swiss lakes, an international team of researchers led by Eawag has succeeded in reconstructing entire ecological plankton networks and determining how they respond to climate change and phosphate levels. The results make one sit up and take notice.**

In most lakes, there are millions of small creatures that generally remain hidden from our eyes. What they have in common is that they are suspended in water and move with the current. That is why, altogether, they are called plankton, which in Greek means “the one that wanders around.” Not only is there an incredible diversity of sizes and shapes among the plankton, but also of ways of life.

### Relationships provide stability

Plant plankton (phytoplankton), which include green algae and diatoms, use the sun as an energy source and produce the substances they need to grow with the help of sunlight, CO<sub>2</sub> and water. These primary producers form the basis of food webs in water bodies. The first to benefit from them are the animal plankton (zooplankton), which includes, for example, small rotifers and ciliates or water fleas that graze on algae. These creatures, in turn, provide the food base for predatory zooplankton species – which are subsequently eaten by larger predators such as fish.

But the interplay is not limited to eating and being eaten. Species also interact with each other, for example, by competing for sources of food or when they can thrive better under the protection of another species. All of these multiple interactions not only regulate the food web, but also provide stability to the entire aquatic ecosystem.

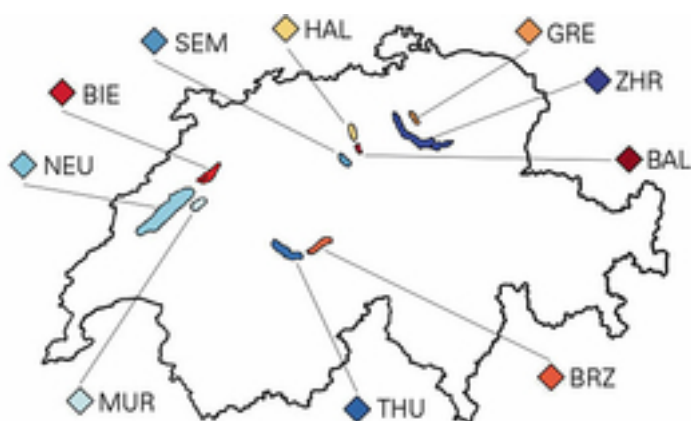


This study was made possible by a data set that is probably unique of its kind. Merz had at her disposal plankton samples from ten Swiss pre-alpine lakes, as well as measured values for water temperature and phosphate levels, which the Cantons collected monthly between 1977 and 2020 and made available to Eawag. With an innovative data analysis carried out at the Swiss National Supercomputing Centre (CSCS), Ewa Merz succeeded in reconstructing entire ecological plankton networks and determining their relationship to phosphate levels and water temperature.

### Including plankton in monitoring programmes

The study could mean double added value for the Cantons. “On the one hand, it is gratifying for them to see that the data they have carefully collected over so many years is being used. On the other hand, they are also interested in the results,” says Merz and emphasises the very good collaboration with the authorities.

The study also provides concrete recommendations for practical applications: “To prevent the food webs in the lakes from deteriorating even further, we would need to mitigate global warming on the one hand and strictly control nutrient inputs on the other. If we continuously monitor plankton communities, we can better anticipate major changes in the ecosystem. Our study shows that small grazers such as ciliates or rotifers are important indicators of such changes. Accordingly, they should be sampled in future lake monitoring programmes.”



The researchers had access to data from the following ten lakes: MUR: Lake Morat, NEU: Lake Neuchâtel, BIE: Lake Biel/Bienne, SEM: Lake Sempach, HAL: Lake Hallwil, GRE: Lake Greifen, ZHR: Lake Zurich, BAL: Lake Baldegg, BRZ: Lake Brienz, THU: Lake Thun (graphic: Ewa Merz et al, *Nature Climate Change*. [doi.org/10.1038/s41558-023-01615-6](https://doi.org/10.1038/s41558-023-01615-6)).

Cover picture: Warming of lakes reduces interactions in plankton networks – in the picture a microscope image is shown of a plankton community from Lake Greifen (Photo: Marta Reyes, Eawag).

### Original publication

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## Related Links

“Phytoplankton Ecology” research group

Frequently asked questions about blue algae / cyanobacteria

Real-time images of plankton in Lake Greifen

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