IOW press release, 21 January 2026

Fungi Infect Nitrogen-Fixing Cyanobacteria

Under the lead of the Leibniz Institute for Baltic Sea Research Warnemünde (IOW) the influence of parasitic fungi on the physiology and survival of cyanobacteria in the Baltic Sea was investigated. Such infections are known from lakes. Due to the high nutrient load in the Baltic Sea, there are high levels of cyanobacteria, some of which are toxic (algal blooms). In addition, the decomposition of algal blooms leads to oxygen depletion. Cyanobacteria are important for the nitrogen cycle, as some fix nitrogen and thus further increase nutrient concentrations in the Baltic Sea. The findings were recently published in the journal Nature Communications.

Parasitic fungi alter the nitrogen cycle

The IOW researchers analyzed the phytoplankton *Dolichospermum*, an ecologically important nitrogen-fixing cyanobacterium, and examined its susceptibility to infection by parasitic fungi (Chytridiomycota). They conducted the study together with colleagues from the Swedish Museum of Natural History in Stockholm and the University of Natural Resources and Life Sciences in Vienna (BOKU). Cyanobacteria are part of the phytoplankton, which drives primary production in the ocean by converting carbon dioxide into biomass through photosynthesis. The researchers found that the fungi primarily infect specialized cells within the cyanobacterial filaments—namely, storage cells and nitrogen-fixing cells—while largely sparing the vegetative cells responsible for photosynthesis. By targeting these specialized cells, the fungi gain access to the cyanobacterium's carbon and nitrogen reserves. Extrapolations showed that up to one-fourth of the newly fixed nitrogen was transferred from *Dolichospermum* to the fungal parasite. This substantial loss of carbon and nitrogen may directly impair the survival of the cyanobacteria and influence the intensity and persistence of algal blooms in the Baltic Sea.

Which impact does the fungal infection have on the Baltic Sea food web?

Phytoplankton, including cyanobacteria, form the base of the aquatic food webs and serve as food for zooplankton. However, filamentous cyanobacteria such as *Dolichospermum* are difficult for zooplankton to ingest. Fungal infection changes this dynamic: infected filaments tend to fragment, making them more accessible as a food source. Moreover, the fungi transform the nutritionally poor and partly toxic cyanobacterial biomass into fungal zoospores. These zoospores are rich in sterols and polyunsaturated fatty acids, making them a high-quality, energy-rich food source for other organisms. In this way, parasitic fungi may enhance the transfer of energy and nutrients through the Baltic Sea food web.

How frequently do fungal infections occur?

Between June and September from 2022 to 2024, *Dolichospermum* was detected in 33 out of 52 weekly water samples from the Baltic Sea. More than half of these samples contained *Dolichospermum* populations infected with fungi. Due to living as a parasite, the fungi thrive during times with high algal cell mass which increases with rising nutrient loads in the Baltic Sea. This demonstrates that fungal infections of *Dolichospermum* are common and that it is therefore essential to investigate the consequences of this infection in more detail. The present study provides an important data basis for this. According to IOW scientist Isabell Klawonn, the lead of the DFG funded Emmy-Noether-Working group and corresponding author of the study, it is very important to investigate the so far unexplored influences of marine fungi on algal blooms. She explains: "Previous research has mainly focused on nutrient availability and water temperature as

drivers of nitrogen-fixing cyanobacteria, some of which are toxic. Our findings show that parasitic fungi can also significantly influence cyanobacterial growth and activity, and therefore deserve much more attention." In addition to *Dolichospermum*, the researchers also detected fungal infections in other bloom-forming cyanobacteria in the Baltic Sea, namely *Nodularia* and *Aphanizomenon*. The study provides an important foundation for future research into how fungal parasites shape algal blooms, nutrient cycling, and food-web interactions in coastal ecosystems. Algal blooms are most intense in coastal areas, which means that high rates of fungal infections can be expected here.

Original publication:

Feuring, A., Lawrence, C. D., Salcedo, J., Whitehouse, M. J., Vogts, A., Zoccarato, L., Klawonn, I. (2026). Fungal parasites infecting N_2-fixing cyanobacteria reshape carbon and N_2 fixation and trophic transfer. Nature Communications. https://doi.org/10.1038/s41467-025-67818-x

Scientific contact:
Dr. Isabell Klawonn | Tel.: +49 381 5197 212 | Email: isabell.klawonn@iow.de

IOW Media contact:
Dr. Sonja Ehlers | Tel.: +49 381 – 5197 109 | presse@iow.de

The Leibniz Institute for Baltic Sea Research Warnemünde (IOW) investigates natural and anthropogenic changes in coastal and marginal seas using a system-wide and interdisciplinary approach, ranging from fundamental to applied research. The Baltic Sea serves as an ideal case study on the institute's doorstep. An important mission of the IOW is to engage in knowledge-based dialogue with policy-makers, stakeholders, and society, thereby contributing to the sustainable development of coastal seas. www.iow.de