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Tiny algae, hugely resilient

Microalgae are microscopically small, single-celled algae species and an important source of food in the oceans. Dr Clara Hoppe of the Alfred Wegener Institute examines how changed living conditions as a result of climate change affect Arctic microalgae.

AWI biologist Dr Clara Hoppe has always had a plan B in place for her Arctic expeditions. "Three years ago, when I started to work in the Arctic, everyone told me to think carefully about what I should do in case the Kongsfjorden area in Svalbard freezes over and I can't leave with a small ship," says Clara Hoppe. Many times she ran through the scenario of thick ice blocking the way into the fjord. But plan B never materialised.

"So far, I have never experienced ice on the fjord. The water temperature was always above zero degrees Celsius," the 32-year-old tells us. The factors that make Clara Hoppe's job easier in practice, are also the subject of her research: She tries to understand how environmental conditions that are changing as a result of climate change, affect the microalgae of the Arctic Ocean. This includes the rise of the water temperature as well as the acidification of the oceans and changed light conditions in the water due to the decrease in sea ice.

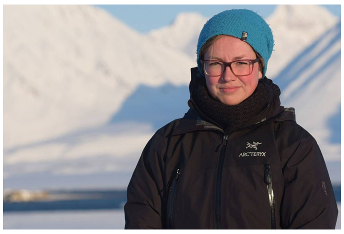
Unlike macroalgae, microalgae are not visible to the naked eye, they are microscopically small, single-celled algae species. They are so tiny that one millilitre of water can contain thousands of them. Because microalgae are an important source of food, such as for crustaceans like krill, a change in their growth, for example, could have far-reaching implications for the Arctic food web.

A special feature about Clara Hoppe's research: While traditional research on ocean acidification is often carried out in the laboratory, she and her team regularly take several hundred litres of water samples in the Arctic, which allows them to study a diverse community of several dozen algae species that are there at that time. "This greater diversity of species means that we can perform experiments to analyse, which of the many species benefit from climate change and which suffer from it. Also, the relationships between the species can be studied," Clara Hoppe explains.

Back in Bremerhaven, she, too, spends many hours in the lab. There she subjects the microalgae to different conditions: "For example, we raise the temperature or the carbon dioxide content of the water to observe how the different species from the Arctic respond to this." One of the things Clara Hoppe analyses is how much biomass the algae create. Do they store more carbon when conditions change? Or more nitrogen? The latter makes the algae much more valuable as a food.

Contact

Dr. Clara Hoppe



AWI biologist Dr Clara Hoppe (Photo: Rene Bürgi)

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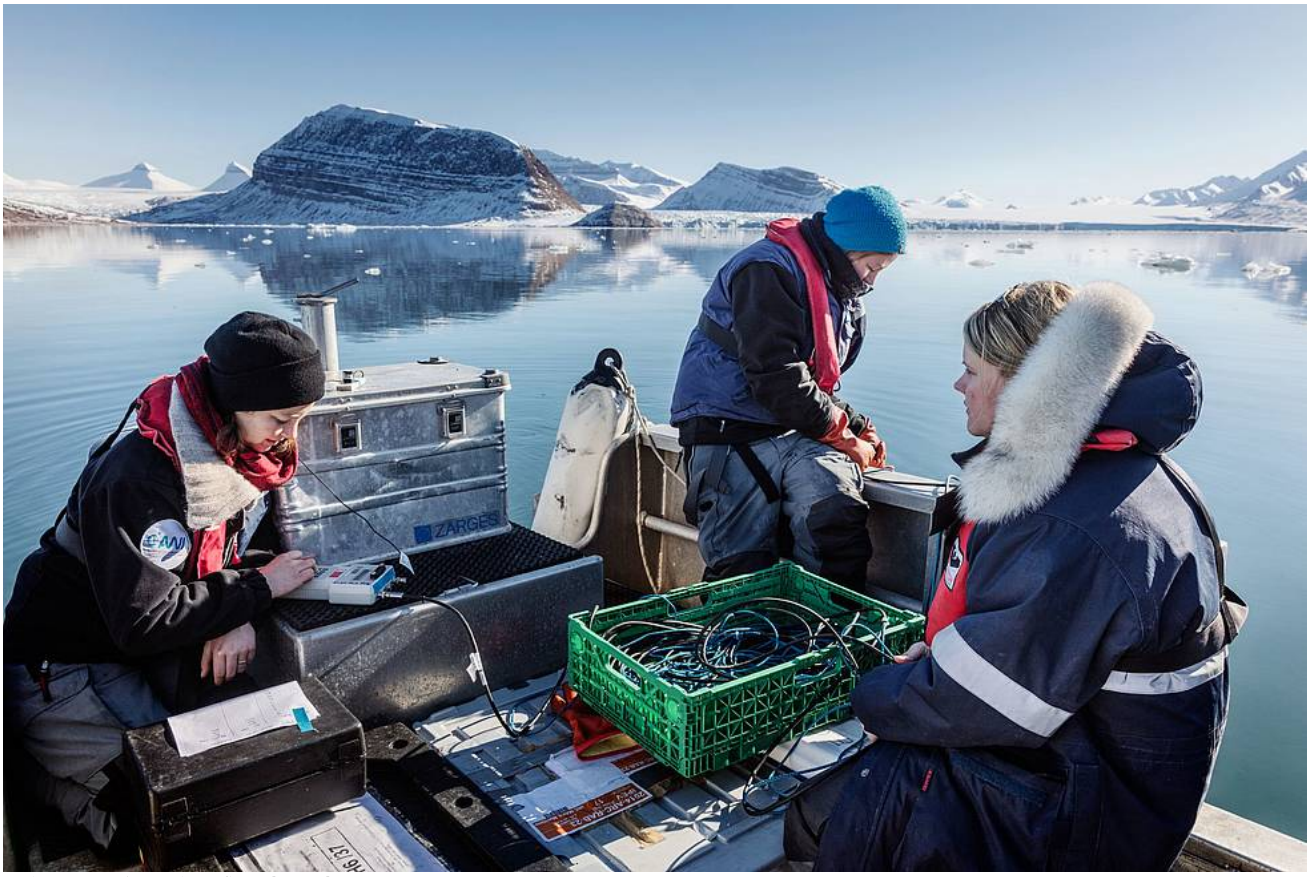
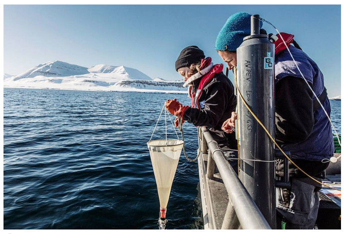
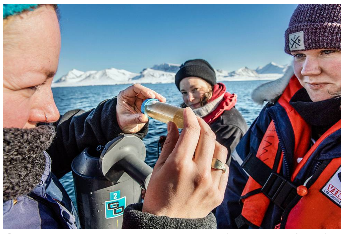


Taking samples in the Kongsfjord. (Photo: Paolo Verzone)

The most important microalgae in the Arctic are diatoms. They create a hard skeleton out of silica to protect themselves from predators. What happens when the water gets warmer or contains more carbon dioxide? If, for example, the diatoms build heavier skeletons, they would sink to the ground more quickly. This also includes the carbon they have fixed into biomass, which means that it would not be part of the global carbon cycle for many years.


Clara Hoppe and her team take several hundred litres of water samples every year. (Photo: Paolo Verzone)

These would all be conceivable scenarios. But the surprising thing is this: “I spent years at the microscope and noticed hardly any differences”, Clara Hoppe explains. This is intrinsically a good thing, but the biologist had to get used to it. “As a researcher, I am hardwired, as it were, to detect changes and effects. But in the end I realised that the fact that these organisms do not react as strongly as other species in other regions is incredibly exciting. I want to find out why this is the case. Why are Arctic microalgae so resilient? What are the mechanisms behind this?”

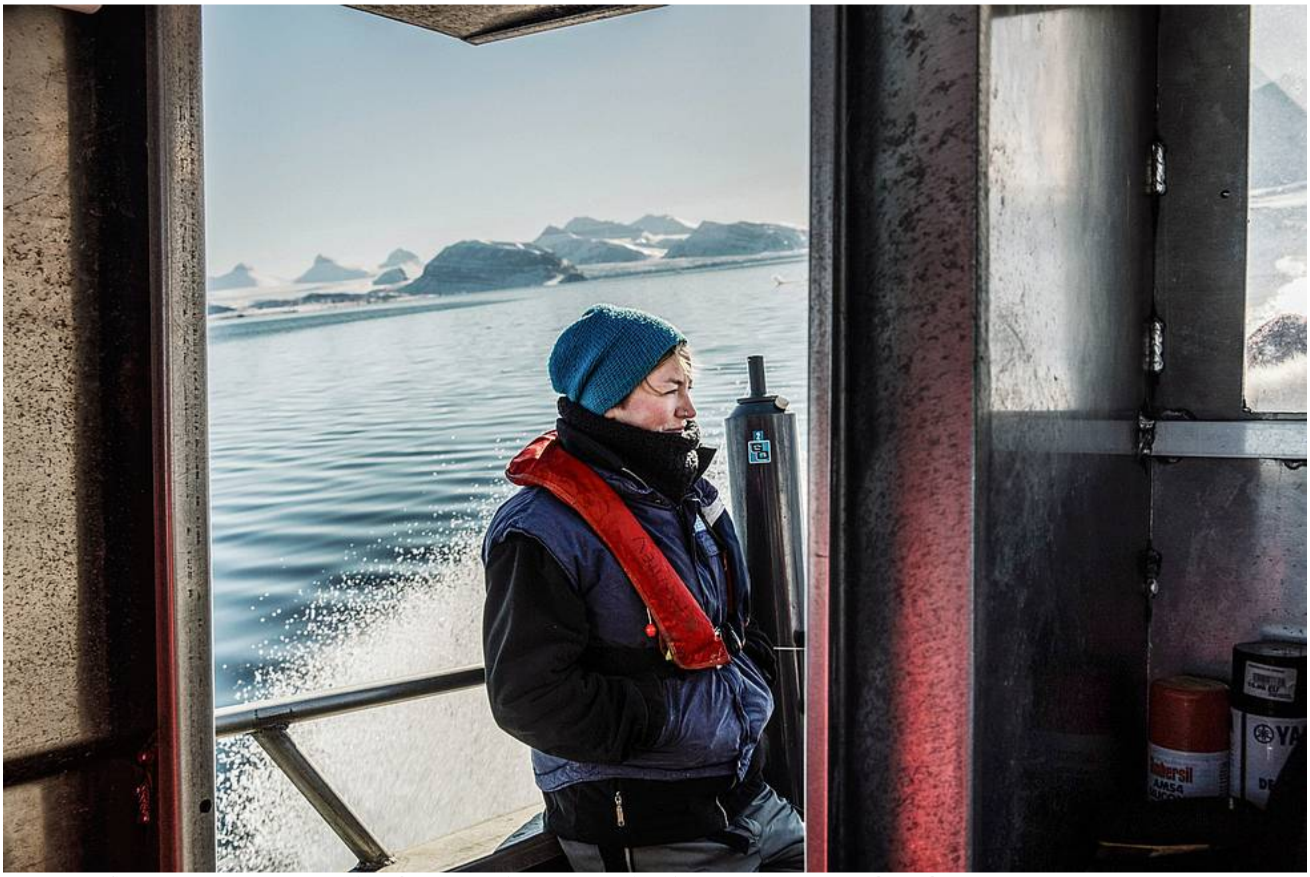

Clara Hoppe has been observing how Arctic microalgae react to climate change since years. (Photo: Paolo Verzone)

She already has a hypothesis: The microalgae respond differently to environmental changes such as temperature rises. Even within a species, not every microalgae deals with it in the same way. It seems that this flexibility makes the species community as a whole more robust. The greater the diversity within a species, the better the microalgae are able to soften the effects of environmental changes.

“This is a bit like good teamwork,” the biologist says. “To achieve a better overall result, it’s often better to have a team of individuals with different skills and preferences, because whoever is best at something does the job.”

Over time, in a community of algae, the individuals who best adjust to the respective conditions represent a greater percentage of a population and thus make up for the “deficits” of the others. And that could be why the productivity of the algae community can stay the same in the long term.

That’s as far as her hypothesis goes. In practice, Clara Hoppe will continue to go out into the Kongsfjorden to find answers to her questions – but she worries less and less about having to execute plan B.



To be able to find all the answers to her questions, Clara Hoppe will return to the Kongsjord many times to come. (Photo: Paolo Verzone)