Resilience and adaptive mechanisms of Arctic phytoplankton under heatwaves: Acclimation, microevolution and community resilience

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Trait adjustments of phytoplankton communities to changing environmental conditions can take place through responses on several fundamental ecological levels. These include physiological acclimation of single genotypes, evolution through sorting among genotypes of the same species, and selection within the entire multi-species community. Which of these different levels responds to environmental change can have large ecological and biogeochemical implications, but especially in protists, these levels are extremely difficult to disentangle. Arctic phytoplankton at base of the foodweb in one of the most rapidly warming regions on the planet, are faced with especially large changes, but often show high resilience. Among these changes are more frequent and intense heatwaves, which expose organisms to vast temperature fluctuations. In dedicated experimental setups of different ecological complexity, we investigated how phytoplankton responds and adjusts to heatwaves, and on which of the mentioned levels shifts can be observed. We resolved not only physiological features and productivity, but also composition on the species as well as the intraspecific level, using a novel molecular approach to efficiently examine the composition of protist populations in diverse contexts. This setup provides a comprehensive approach to investigate how phytoplankton communities respond to stable and fluctuating temperature scenarios, physiologically and ecologically.