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# Effect of temperature increase on carbon cycling by aquatic fungal communities of a High Arctic fjord revealed by DNA-qSIP

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Arctic amplification of atmospheric warming and the Atlantification of the Arctic Ocean is causing major ecosystem impacts in the ocean but also in the interior of adjacent fjords. One of the most impactful results is the retreat of glaciers and, with it, a marine-to-land terminus shift. This glacier regime alteration has physical, biogeochemical, and ecological consequences. It involves changes in freshwater and sediment input, modifications in nutrient composition, and varying microbial communities being discharged into the fjord waters. Here we conducted an experiment to observe the response of fjord microbial communities to temperature rise, specifically focusing on organic carbon cycling by aquatic fungi in the High Arctic. Water column and sediments along a longitudinal transect of Kongsfjorden were sampled and examined to understand the utilization of amino acids by microbes and how the increase in temperature can affect cold-adapted communities. By using isotopic labeling of an organic substrate, we quantitatively estimated respiration, assimilation, and carbon use efficiency in different habitats along the fjord vertical section. Quantitative stable isotope probing (qSIP) revealed that some psychrophilic fungi found in the fjord water column, such as taxa associated with *Cadophora* (Leotiomycetes, Ascomycota), show a reduction in diversity but an increase in activity. We found that microbial response to temperature varies depending on the specific habitat; i.e., it depends on the depth and proximity to the fjord mouth, where the influence of a marine-terminating glacier is larger. In fact, terrestrial inputs, notably freshwater from deglaciation, create gradients of salinity, temperature, nutrients, and particles, resulting in community specialization in the water column. With a rapid regime shift, in this case accelerated temperature increase, resident microbial communities are affected, and thus ecosystem functioning is altered. Here we show that aquatic fungi have a potentially major role in organic carbon cycling in the water column of a High Arctic fjord, and that carbon use efficiency can be altered under higher temperature conditions. If psychrophilic fungi with high carbon stabilization potential can adapt to the inevitable warmer states without changing their carbon metabolism, they may become key players at the ecosystem level in responding to environmental change.