

Nutrient Dynamics and Related Future Challenges in Kongsfjorden

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Abstract

The Arctic has warmed four times faster than the rest of the world due to Global Warming. In the model Arctic ecosystem of Kongsfjorden (Svalbard archipelago, 79 °N) warming has occurred more intensely in winter. A warmer winter has led ice-free fjord surface all year round. Under these conditions hydrodynamics are changed and, along with it, the biological and other physicochemical dynamics. Seaweeds start their production when light is available in the water column. Typically, this used to occur in May, after the ice break-up. Late spring-early summer used to be the season when both phytoplankton and the seaweeds forest would uptake the available nutrient and produce biomass. This production season ends during late summer due to nutrient limitation. The atmospheric workgroup has identified the spring as the time of the year with pronounced nutrient-N deposition in the fjord, and the glaciologist has measured that virtually all nutrient deposited over glaciers ends up in the fjord water system. Regarding biological primary production, timing of both light and N availability is key. An ice-free N-rich spring may anticipate the season of macroalgal forests productivity and removal of nutrients. We support evidence that macroalgae possess newly developed photosynthetic tissue at the end of the winter, ready to photosynthesise as soon as light is available in February-March. If N removal is intensified by productivity season anticipation, N-limitation could take place before the development of phytoplankton bloom, normally occurring in late Spring. Since most of the animal production relies on phytoplankton productivity, season anticipation of N-limitation has the potential to drastically change the ecosystem.