



Interactive effects of temperature and nutrient limitation on the response of alpine phytoplankton growth to ultraviolet radiation

Doyle, Shaina A., Jasmine E. Saros, Craig E. Williamson

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ABSTRACT: We performed bag-enclosure experiments for 7 d in a lake in the Beartooth Mountains (in Montana and Wyoming) using natural phytoplankton assemblages. Ultraviolet radiation (UVR) (exposed or blocked), temperature (6° C and 14° C), and nutrients (nitrogen, phosphorus, and nitrogen plus phosphorus) were manipulated in a factorial design to determine how these factors interact to affect phytoplankton growth. Four major phytoplankton taxa (two diatoms, one chrysophyte, and one dinoflagellate) were found in the water samples across all treatments. Greater growth rates were observed at the higher temperature for all taxa, except the chrysophyte. UVR depressed the growth rates of all phytoplankton at 6° C regardless of nutrient conditions. In contrast, at 14° C, a negative effect of UVR was not observed for any species in the absence of nutrient additions; only with the addition of nutrients did UVR exposure depress the growth of one diatom species and the dinoflagellate. Our results suggest that in alpine lakes, the effects of UVR exposure on phytoplankton depend on temperature and nutrient availability, indicating that climate change and enhanced atmospheric nitrogen deposition are likely to alter UV-temperature-nutrient relationships of plankton in high-UV systems.

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