

Alpine lakes beginning to show effects of climate change

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Results showed that in the 2000s alpine lakes became clearer, warmer, and mixed to deeper depths, relative to the 1990s.

A recent study forecasts that increased climatic variability poses serious consequence for both the biodiversity and ecosystem function of high-elevation lakes.

David Schindler, world renowned ecologist, former University of Alberta graduate student Brian Parker and Rolf Vinebrooke, a professor in the Department of Biological Sciences, have shown that changes to the climate have also caused similar and concurrent changes in the features of alpine lakes, regardless of their ecological histories.



"Our demonstration of the environmental sensitivity of alpine lake ecosystems highlights both their vulnerability and usefulness as indicators of the effects of global warming and the predicted increases in climatic variability," said Schindler.

The study, conducted during two climatically different groups of years between 1991and 2003, measured the physical, chemical, and biological attributes of two reference lakes and two experimentally restored alpine lakes in Banff National Park.

Results showed that in the 2000s-years with colder winter temperatures and higher winter snowfall, later snowmelt, shorter ice-free seasons and drier summers-alpine lakes became clearer, warmer, and mixed to deeper depths, relative to the 1990s. Further, phytoplankton biomass declined significantly in the lakes as a consequence of decreased nutrient availability.

However, increased concentrations of dissolved organic carbon in lake water stimulated the appearance of small mixotrophic algal species which can acquire their nutrients through a mixture of plant- and animallike behaviours. These beings thrive on the dissolved organic carbon, partially offsetting the decline in photosynthetic phytoplankton and increasing algal species richness.

The authors speculate that this change at the base of the aquatic food chain will have important effects on species higher in the food chain that depend on the algae for food.

"The climate regime in the 2000s altered the character and the function of high-elevation aquatic ecosystem," said Schindler. "Forecasts of increased temperature and climatic variability in the future pose serious ramifications for both the biodiversity and ecosystem function of highelevation lakes."



While climate-driven aquatic changes have been observed from polar sites, less is known about the climatic sensitivity of alpine lakes and streams.

"The impacts of future change in climate on alpine ecosystems are particularly worrisome given that variation in climate is expected to be most pronounced at high elevations around the world."

Provided by University of Alberta

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