Response of freshwater microcosm communities to nutrients, fish, and elevated temperature during winter and summer

McKee, D., D. Atkinson, S. E. Collings, J. W. Eaton, A. B. Gill, I. Harvey, K. Hatton, T. Heyes, D. Wilson, B. Moss

Limnol. Oceanogr., 48(2), 2003, 707-722 | DOI: 10.4319/lo.2003.48.2.0707

ABSTRACT: Under conditions of stress, shallow freshwater ecosystems can undergo a state change characterized by the rapid loss of macrophytes and subsequent dominance of phytoplankton. Elevated water temperature may promote such change. Here we report the impact of two warming regimes (continuous 3° C above ambient and 3° C above ambient during summer only), with two nutrient loadings and the presence or absence of fish, on 48 microcosm ecosystems created to mimic shallow pond environments. We found that warming did not significantly encourage phytoplankton blooms, even in combination with increased nutrients and fish. Instead, macrophyte communities remained dominant. Macrophyte-associated invertebrates (gastropods and ostracods) increased in numbers in the warmed microcosms, potentially helping to stabilize the macrophyte communities. Nevertheless, warming produced trends in water chemistry that could be problematic. It increased phosphorus concentrations, total alkalinity, and conductivity. It decreased pH and oxygen saturation and increased the frequency of severe deoxygenation. These trends were largely independent of the other experimental treatments and support the suggestion that moderate warming has the potential to exacerbate existing eutrophication problems.