Impact of climate change and human activities on plankton community in an alpine lake on the Tibetan Plateau over the past 600 years

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Abstract

Alpine lake ecosystems are highly sensitive to climate change and human activities. The Tibetan Plateau hosts the largest group of alpine lakes on the Earth, which provide important ecological services to the plateau and neighboring regions. Most of the lakes on the plateau are assumed to be pristine because of little direct human interference. However, it remains unclear to what extent do the lake ecosystems have been affected by human activities during the Anthropocene. Here we present records of sedimentary pigments, fossil zooplankton, as well as climatic and environmental changes over the past 600 years at a meromictic lake, Dagze Co, on the central Tibetan Plateau to assess the influences of climate change and human activities on the plankton community. The pigment records revealed significant fluctuation in phytoplankton communities, which were mainly affected by changes in temperature, precipitation and nutrient concentration. The nutrient increase after 1850s was mainly caused by human activities. The zooplankton were mostly affected by the algal composition. The Artemia disappeared suddenly in 1980s, coinciding with the human occupation of the inflowing river. The results indicated that lake ecosystem at Dagze Co underwent significant variation because of climate change and human activities. This study also highlights the importance of the responses of alpine meromictic lakes to recent global environment change and anthropogenic activities.