Warming of Lake Þingvallavatn and thermal processes in the lake

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Abstract

Lake Þingvallavatn is the second largest lake in Iceland, 83 km^2 (2.9 km^3 Gl), with a mean depth of 34 m and fed primarily by cold (3–4°C), spring-water inlets, amounting to ca. 90% of the total inlet (100 m^3/s). In this study we account for the thermal evolution of Lake Þingvallavatn, SW-Iceland, over a 55 year period, during 1962–2017. The data is extracted from 2 monitoring stations at the lake outlet, with 4–24 recordings of temperature per day most of the time. We also examined vertical thermal patterns at a pelagic station in the lake. Temperature of Lake Þingvallavatn has increased significantly for the past 30 years, congruent with a rise in air temperature in the catchment area. Annual mean lake temperature has risen on average by ca. 0.15°C per decade, similar to warming observed in other large, deep lakes in the northern hemisphere. Temperature has risen most profoundly in summer (June-August), with an increase of 1.3–1.6°C per month on average. Because of warming, thermal stratification in the pelagic zone during summer appears to be stronger than before, while freezing of the lake in winter occurs much less frequently, with thinner ice and shorter duration. The ecological consequences of the warming are discussed, some of which may already have taken effect, including increased nitrogen loads and changes in species composition and production patterns within the algal community.

Key words: climate warming, freshwater ecosystem, nutrients, phytoplankton, Lake Þingvallavatn, Iceland

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