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## Ecosystem effects of thermal manipulation of a whole lake, Lake Breisjøen, southern Norway (THERMOS project)

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**Abstract.** We conducted a 3-year artificial deepening of the thermocline in the dimictic Lake Breisjøen, southern Norway, by means of a large submerged propeller. An adjacent lake served as untreated reference. The manipulation increased thermocline depth from 6 to 20 m, caused a significant increase in the heat content, and delayed ice-on by about 20 days.

There were only minor changes in water chemistry. Concentrations of sulphate declined, perhaps due to greater reduction of sulphate at the sediment-water interface. Concentrations of particulate carbon and nitrogen decreased, perhaps due to increased sedimentation velocity. Water transparency increased. There was no significant change in concentration of phosphorus, the growth-limiting nutrient.

There were few significant changes in principal biological components. Phytoplankton biomass and productivity did not change, although the chlorophyll-*a* concentration showed a small decrease. Phytoplankton species richness increased, and the species composition shifted. Growth of periphyton increased. There was no change in the macrophyte community. The manipulation did not affect the zooplankton biodiversity, but caused a significant shift in the relative abundance (measured as biomass) in the two major copepod species. The manipulation did not affect the individual density, but appeared to have changed the vertical distribution of zoobenthos. Fish populations were not affected.

The lake is oligotrophic and clearwater and the manipulation did not change the supply of phosphorus, and thus there were only minor changes in lake chemistry and biology. Effects might be larger in eutrophic and dystrophic lakes in which internal processes are stronger.

▣ [Final Revised Paper](#) (PDF, 1445 KB) ▣ [Discussion Paper](#) (HESSD)

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