Evidence of lower productivity in long term limed lakes as compared to unlimed lakes of similar pH

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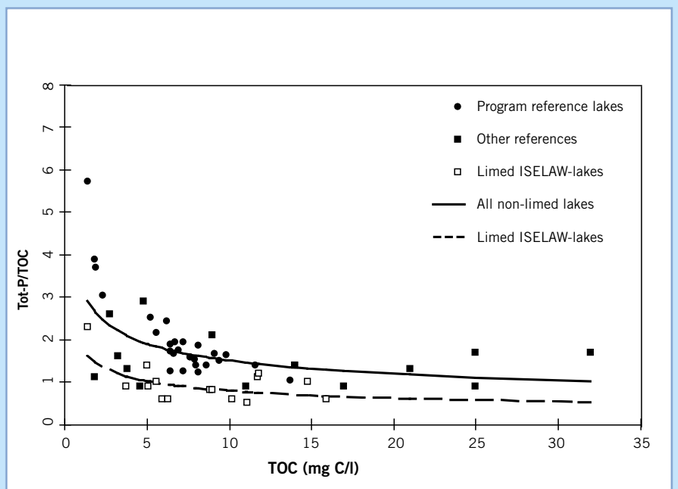


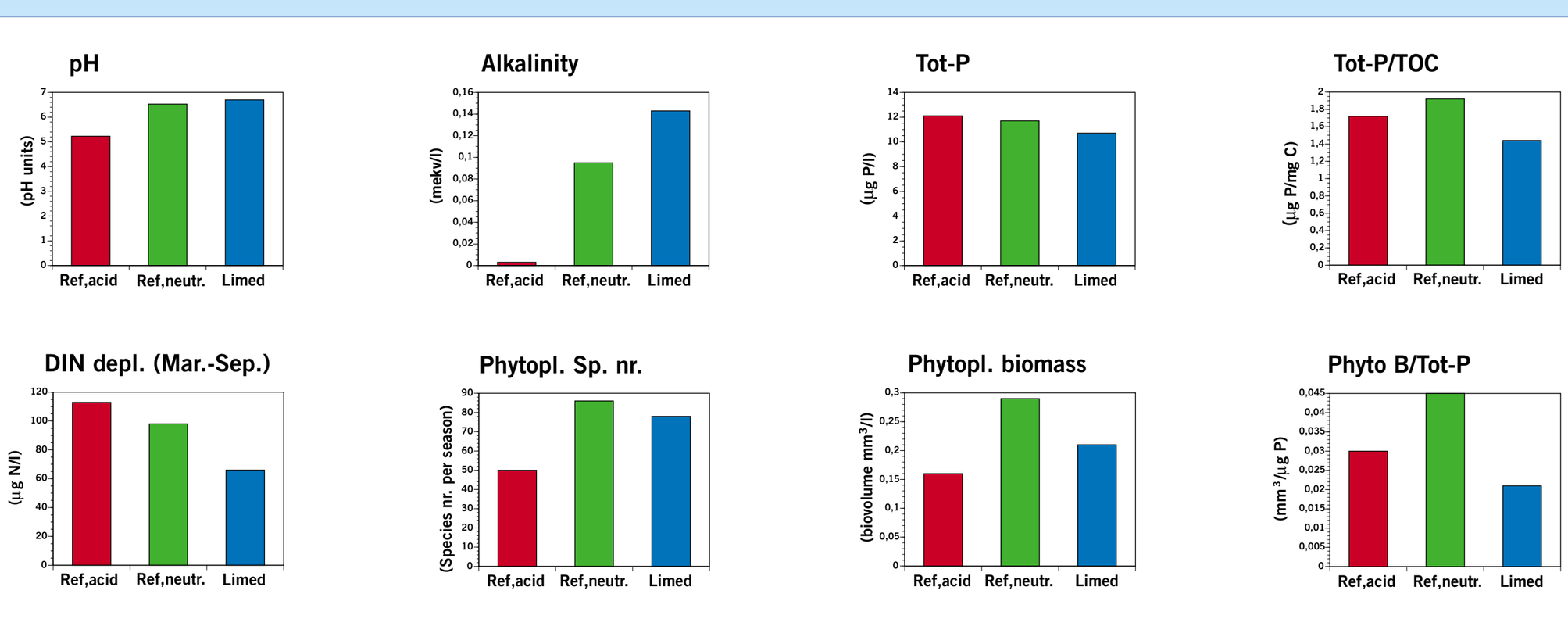
The limed lakes typically have low phosphorus concentrations as related to organic matter (TOC) as shown by the Tot-P/TOC-ratio in limed vs. unlimed reference lakes from within the ISELAW-programme and from other studies.

1 ***Objective*** **Possible changes in lake productivity and nutrients due to long term liming were adressed in this study.**

2 ***Introduction and methods*** Ecosystem development in lime-treated waters in Sweden has been followed since 1989 in a programme for integrated studies of the effects of liming in acidified waters (ISELAW). Nutrient and biotic conditions were assessed in 14 long term (>10 y) limed Swedish lakes to find out the potential effects of liming. Parallell studies of 24 reference lakes (17 neutral – pH 6.0-7.0 – and 7 acid lakes –pH<5.5) were used to reveal differences between the 3 studied groups.

3 ***Results*** The liming clearly increased pH and buffering capacity (alkalinity) in the formerly acid lakes as compared to acid references and even as compared to the neutral references. Limed lakes showed a phosphorus depletion which contrasts to the increased phosphorus supply often following within a few years after lime treatment. After prolonged liming, the levels of total phosphorus are lower as compared to neutral reference lakes at identical TOC, and the phosphorus/TOC -ratio is consequently lower in limed lakes. Depletion of dissolved inorganic nitrogen during the summer is also lower in limed as compared to neutral reference lakes. Phytoplankton biomass and species number are also lower in the limed lakes as compared to unlimed neutral references. Furthermore, the bacterial number per unit TOC is lower in the long term limed lakes, possibly as a result of phosphorus limitation. As to the higher trophic levels, the benthic soft-bottom fauna of limed lakes (specifically the sublittoral fauna) is poorer in terms of species diversity and abundance. Also fish community composition indicates lower productivity in the limed lakes.

4 ***Conclusions*** **The comparison between acid and limed lakes indicates reached improvements in nutrient and biotic conditions. An equivalent status between limed and neutral reference lakes is seldom achived despite the high pH and buffering capacity in the limed lakes. Taken together there is evidence that the trophic level and productivity is lower in limed lakes. Phosphorus availability now is in focus for further studies.**



ISELAW

Integrated Studies of the Effects of Liming Acidified Waters

Swedish Environment Protection Agency

Swedish National Board of Fisheries

Swedish University of Agricultural Sciences

Stockholm University