Effects of Reacidification on Water Chemistry and Plankton in Previously Limed Lakes in the Tyresta National Park, Sweden

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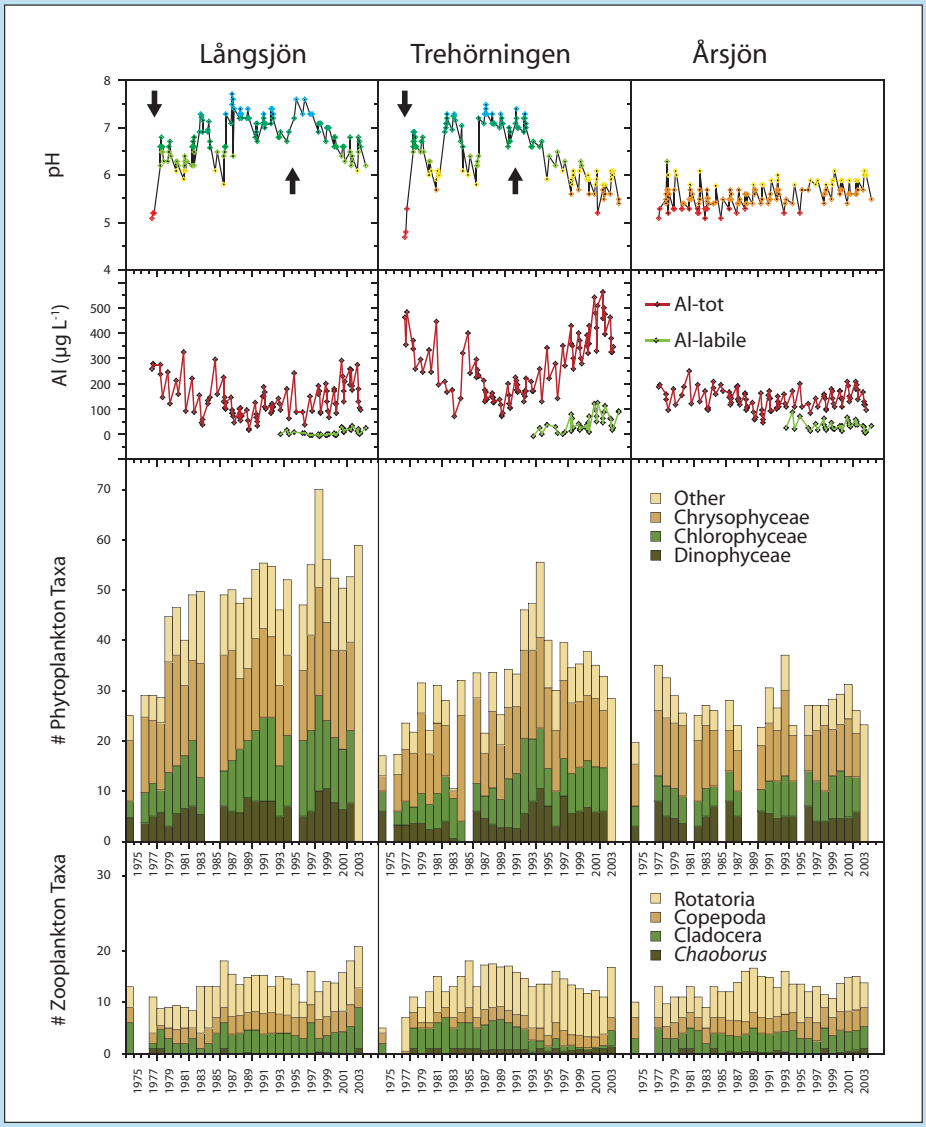
ISELAW

Integrated Studies of the Effects of Liming Acidified Waters

Objective: To study reacidification of limed inland waters is important. Lime treatment of acidified lakes is effective and very common in Sweden. However, liming costs money and in the era of declining acid deposition, we need to know more about what will happen in the environment when we stop liming.
We here present some results of an ongoing reacidification project, which is part of the Swedish ISELAW programme. The continual lime treatment since 1978 of two acidified lakes were terminated in 1991 and 1995 respectively. Water chemistry and plankton communities during and after the liming period were intensely monitored and compared with a nearby reference lake.

Figure: Timeseries of aluminium fractions and pH in surface water during May to September, 1974-2004. Number of plankton taxa represents annual mean of typically five monthly samples during May to September 1974-2003. Arrows indicate time of first and final liming.



Reacidification: The pH in both limed lakes declined (see figure), whereas pH in the reference lake has slowly increased during the last two decades, possibly because of lower long-range acid deposition. Alkalinity decreased rapidly to levels near zero during the first four years after the last liming in L. Trehörningen. In L. Långsjön alkalinity levelled off before reaching critically low levels
Metal mobilisation: Acidification often causes elevated and potentially toxic metal concentrations. Reacidification in the Tyresta lakes was accompanied by increased levels of Al, Pb, and Mn, but not Cu and Zn. In Trehörningen did also the concentration of Cd and, in particular, labile Al increase (see figure), which is acutely toxic to aquatic animals.

£Plankton: Plankton diversity increased gradually during the limed period. The fast reacidification in Trehörningen was followed by decreased plankton diversity. Cladocera were virtually extinct and dinoflagellates returned as the predominating phytoplankton (biomass). The slower reacidification in L. Långsjön did not affect the plankton negatively. Some rotifer species decreased markedly but the total diversity appears to have increased since 1995. The different effect on the lakes may be explained by the relatively high alkalinity and nutrient levels, as well as less mobilization of toxic metals in Långsjön in comparison with Trehörningen. Trophic interactions can also have influenced the development of different multi-year plankton successions. Trehörningen lacks fish and predatory Caoborus larvae were often abundant.

Conclusion: Our time series illustrate that liming can improve acidified conditions. However, a natural system is difficult to attain or revert to. Further studies are needed on reacidification of limed waters.

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