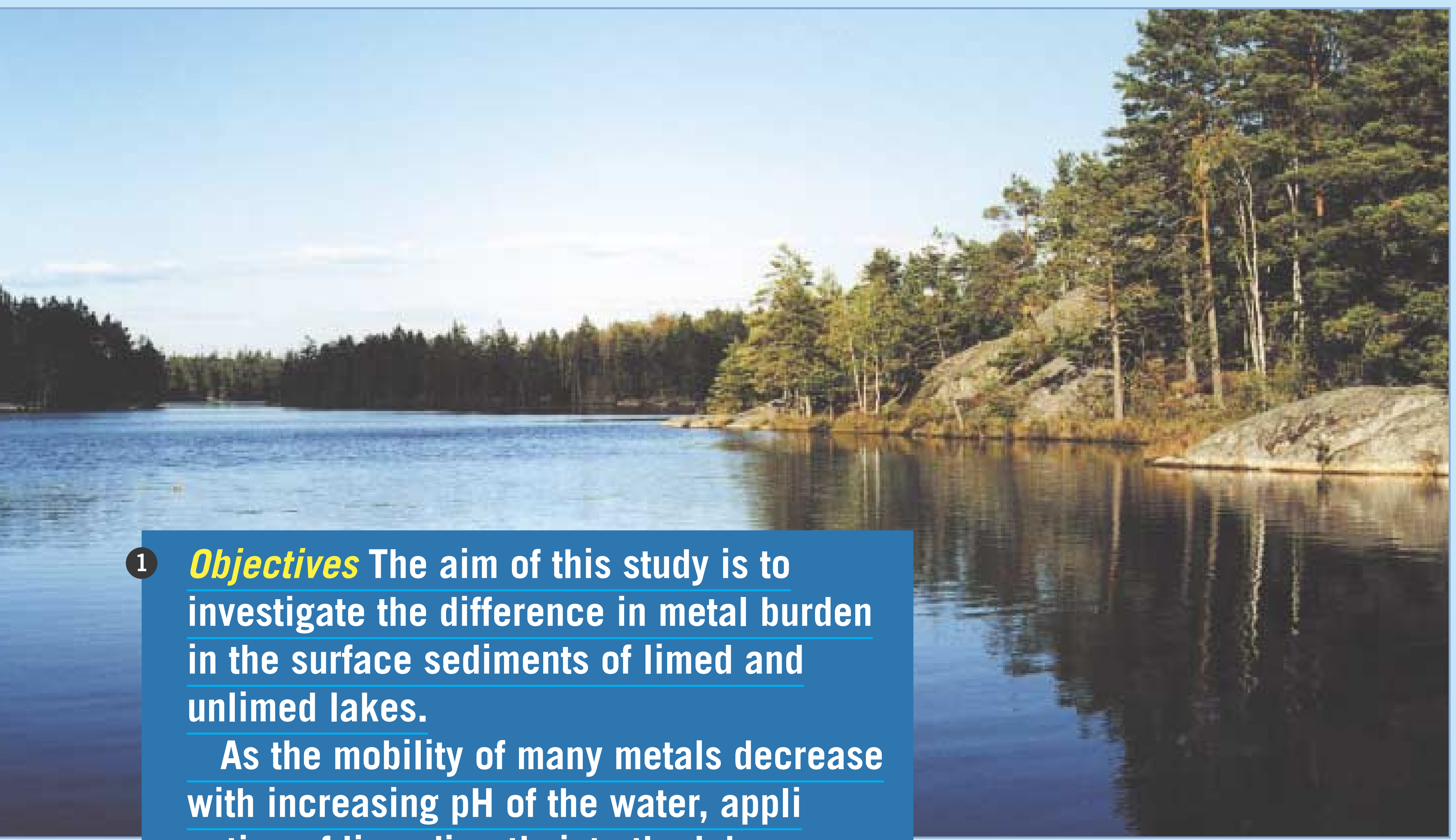
Comparison of metal burdens in sediments of limed and unlimed lakes

TERESIA WÄLLSTEDT, TOMAS WIDSTRÖM and HANS BORG
Institute of Applied Environmental Research (ITM), Stockholm University, SE-106 91 Stockholm, Sweden
Correspondence: teresia.wallstedt@itm.su.se

ISELAW

Integrated Studies of the Effects of Liming Acidified Waters



1 ***Objectives*** **The aim of this study is to investigate the difference in metal burden in the surface sediments of limed and unlimed lakes.**

As the mobility of many metals decrease with increasing pH of the water, application of lime directly into the lake should increase metal deposition to the sediments, whereas acidification should decrease the metal deposition.

Metal deposits in sediments are of interest when evaluating the possible risks of reacidification after terminated liming of lakes treated for a long period of time.

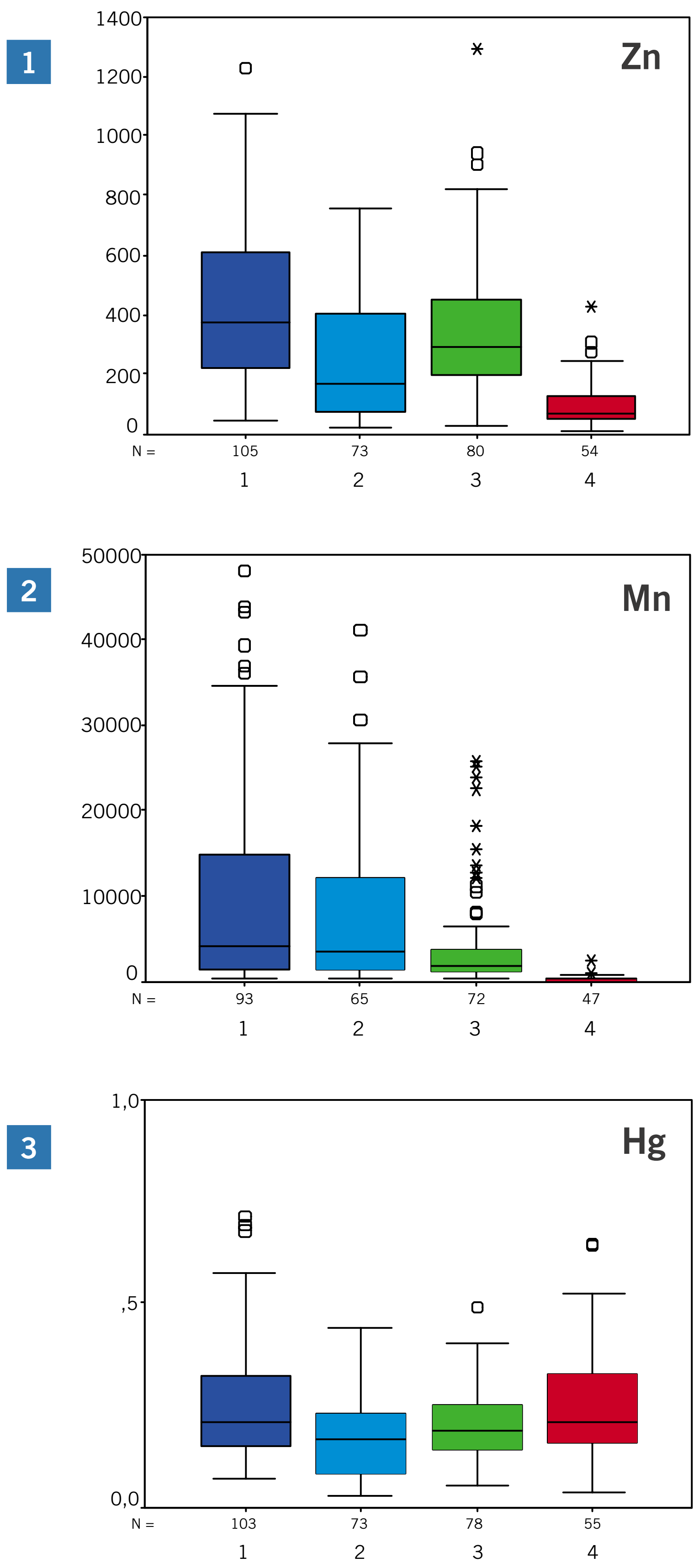
2 *Materials and Method*

15-20 surface sediment samples from each of 11 limed and 10 unlimed lakes in Sweden were collected during 1998 and 1999 and analysed for the content of the metals Fe, Mn, Zn, Cu, Pb and Hg.

3 ***Results*** The metal content in the surface sediments was found to be higher in lake-limed lakes than in acidified reference lakes ($p<0{,}01$) for all metals except Hg (Figs 1-3). The content of Zn, Pb and Hg was also higher in the lake-limed lakes compared to the wetland/upstream limed lakes and neutral reference lakes ($p<0{,}01$).

A multivariate analysis (PLS model with 4 significant components, R2X(cum)=0,690 R2Y(cum)=0,534 Q2(cum)=0,509) score scatter plot shows that the lakes fall quite well into four groups following treatment method or status as reference lake (Fig 4). A loading plot for the same components (Fig 5) shows that the content of all metals are positively correlated with lake liming whereas the group of acidified reference lakes has a strong negative correlation with the content of Fe, Mn and Zn.

The PLS model (e.g. contribution plots with 4 components) also shows that the content of organic material (LOI) is a very important factor for all metals. Besides that, lime treatment is the most important factor for Zn and Mn, for Mn together with the size of the catchment area. Pb, Cu and Hg are influenced by both air deposition (correlation to x- and y-coordinate), liming and hydrological/catchment characteristics.



Figures 1-3. **Metal contents (mg m^{-2}) in the 0-2 cm sediment layer for four groups of lakes.**
1) Lake limed
2) Wetland/Upstream limed
3) Neutral reference
4) Acidified reference

4 ***Conclusions*** **Direct lake liming increases the total content of at least Zn, Pb and Mn in the surface sediments compared to unlimed lakes. Wetland/upstream liming gives the same effect only for Mn.**

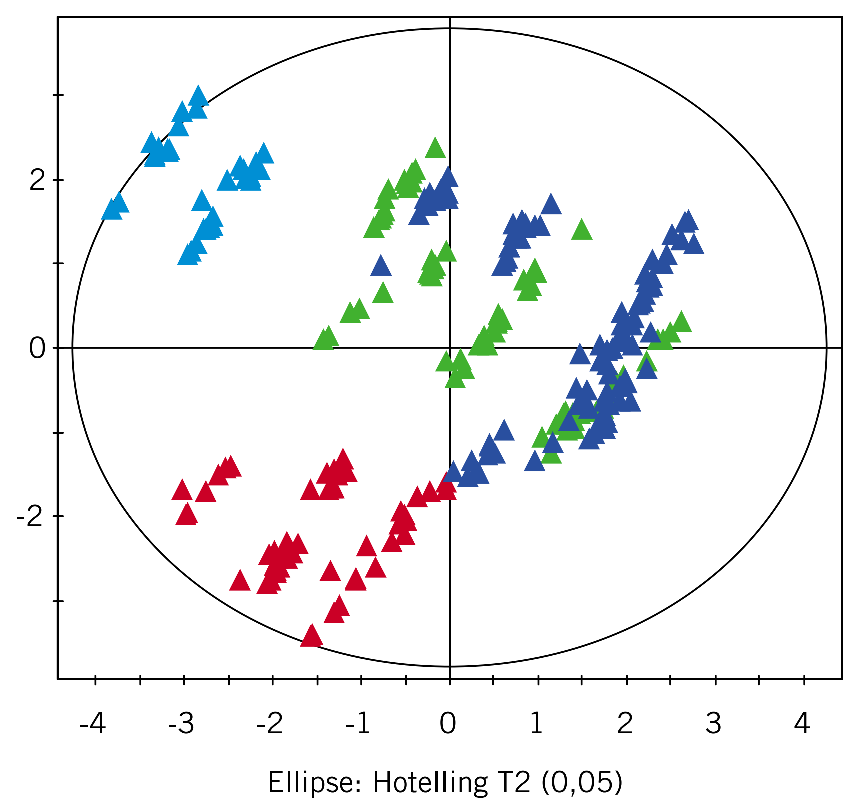


Figure 4.
PLS score plot t1/t2
▲ **Acidified reference**
▲ **Neutral reference**
▲ **Lake limed**
▲ **Wet land/Upstream limed**

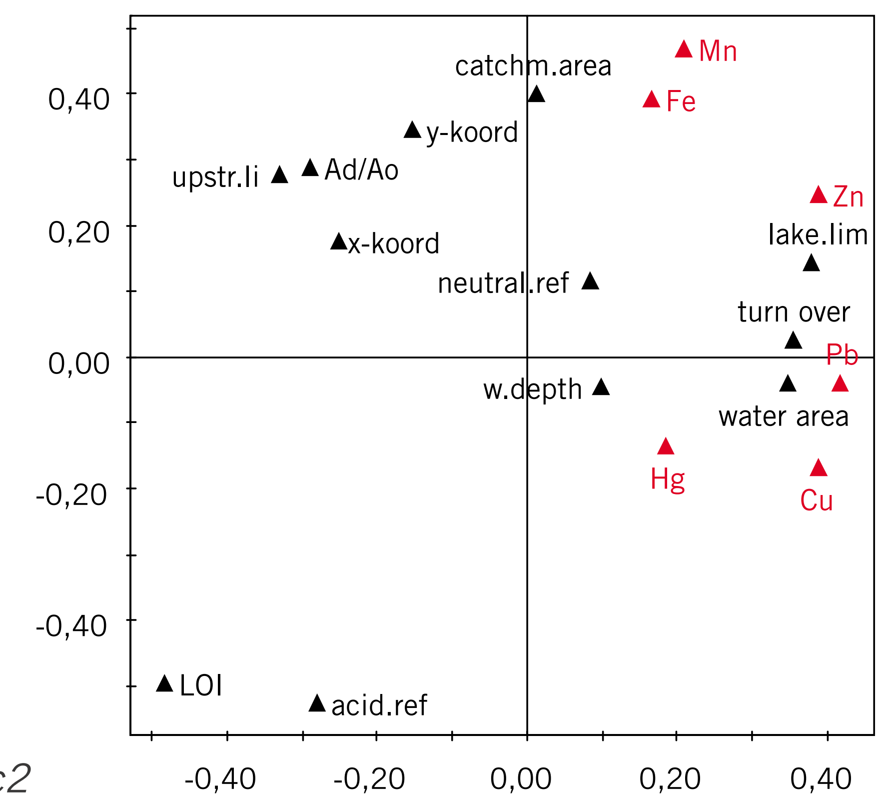


Figure 5.
*PLS Loading plot w*c1/w*c2*

Swedish Environment Protection Agency

Swedish National Board of Fisheries

Swedish University of Agricultural Sciences

Stockholm University