

reported that, in some cases, nonsport fish species responded the most dramatically.

Bengtsson et al. (1980) summarized some of the problems with lake neutralization as follows:

"Obtaining yearly leaching of a certain amount of bicarbonate or an acceptable yearly pH-medium value is not the problem. The problem is to keep an acceptable value at high flow (i.e., during snowmelt). At this time the lake waters become highly stratified with the cold acid melting-water on top. As a result it does not mix with the water below which is of better quality.

The running waters carrying this melting-water represent an even greater problem. To neutralize the acidified melting-water, either large overdosing is needed when applied to water or on land or every year lime has to be applied on the snow pack.

Moreover, the acidification is not just a pH-problem but is also coupled to the anthropogenic pollution of metals deposited from the atmosphere and the increased leaching of metals from acidified soils.

The toxicity of most metals is higher in neutral than in acid water. Thus, when liming an acid lake the organisms suffer a transition period before the metals have precipitated. Aluminum leached from the soil is highly aggressive to fish gills in the pH range 4.5 - 6 and liming has even killed salmon and trout when the aim was to save the fish."

The situation in North America may be even more complicated because generally, the lakes contain more species of fish than many of the Scandinavian lakes. The potential for disruption of the aquatic food chain is greater. It could happen that fish populations would survive in the treated lakes but the normal distribution of species might be altered. For example, inputs of aluminum might disrupt the life cycle of some species more than others, changing the ecological balance among species.

9.2.2.2 Norway

The Norwegian government is conducting a liming project at Lake Hovvatn in southern Norway. The lake is about one square kilometre and has a mean residence time of 1.1 years. The drainage basin is interspersed forest and bog with numerous granite outcroppings. The project was begun in May 1980 with background sampling at two month intervals at five lake stations and five inlet streams. Analyses include pH, alkalinity, conductivity, all major ions and metals. Zooplankton and phytoplankton are also being monitored. In March 1981, the lake was treated with 240 metric tons of agricultural limestone spread on the ice near the shore. As the ice melted in