

large population. The populations saved in this way might play an important part in the restoration of fisheries to waters where fish have been exterminated by acidification or other causes.

The future value of any species or organism cannot be foreseen. Therefore, the extinction of any species could be a great loss to man. As the extinction of a species can never be remedied, the threat of extinction of any species by acid rain would justify lake liming or virtually any other feasible protective measure regardless of immediate costs or benefits.

If a population of fish is considered an especially suitable source of stock for the rehabilitation of acidified rivers or lakes, then liming or other measures to protect its natural habitat would be justified to protect it from acidification. Liming of an acidified habitat would also be justified if it were inhabited by a population which was genetically unique and consequently for which no replacement could be found if it were exterminated.

### 9.2.2 Liming Programs

#### 9.2.2.1 Sweden

Sweden has conducted the greatest number of experiments on lake liming of any country. A 5-year program designed to evaluate both lake and stream liming was completed in 1981 and a final summary report was prepared (National Fisheries Board and National Environmental Protection Board 1981). During the 5-year period, 304 projects were started which involved over 700 lakes and streams. While there were some negative aspects to the results, the program was deemed to be a success by the National Board of Fisheries. Success was generally measured in terms of a favourable response in the sport fish, mainly salmon, trout and arctic char, although some lakes were treated with environmental conservation as the prime objective. Limestone has been applied at rates of 100-200 kg/ha of lake surface which corresponds to 50-75 kg/ha of watershed per year. Application on land required up to 100 times this amount to give an acceptable runoff quality. Application directly to water was found to be the most economical treatment method (Bengtsson et al. 1980).

Hultberg and Andersson (1982) reported detailed studies on six lakes in two areas of Sweden. Four lakes were limed and two held as reference lakes. Although they reported favourable biological results, there was concern over continued biological and chemical damage from liming, resulting from the input of aluminum in acidified runoff from the watershed. Most of the lakes and streams had a relatively small number of species of fish (three or four). The improved water quality generally resulted in increased numbers of fish, and hence an improved sport fishery. Bengtsson (pers. comm.)