Erie, microbial

WATER QUALITY IN LAKES

Major world lakes have essentially two types of origin: one type is tectonic and includes the Caspian, Aral, Victoria, Baikal, Tanganyika, and Malawi lakes. The second type is of glacial origin such as the Laurentian Great Lakes of North America, Ladoga, Vanern, Great Slave, and Great Bear lakes. The first ranked 20 lakes in Table 7 represent 64% of the total lake area of the world (about 2.6×10^6 km^2) and 91% of the total lake volume (about 179,000 km^3 of which 46% is saline). The Laurentian Great Lakes of North America and Lake Baikal in Russia each contain approximately 20% of the world's surface freshwater. Saline lakes (TDS >3 g L^{-1}) have no outlets and are found in endorheic regions. Soft water lakes are generally of the Ca^{++} - HCO_3^- type which dominates in most rivers. A few lakes, mostly fed by direct rain inputs, may have very low solute content (Tahoe, Crater Lakes in Western USA). Saline lakes may have very peculiar ionic composition (Na^+ - HCO_3^-; Ca^{++} - SO4^{--}; Mg^{++} - SO_4^{--}; Na^+ - Cl^-) depending on crystallization of minerals during evaporation and on the chemical composition of their tributaries (Ref. 8).

Lake Eutrophication

Excessive nutrient concentrations, usually of phosphorus, leads to eutrophication of lakes. Eutrophication, especially in extreme cases, leads to algal blooms which are often followed by low oxygen levels when the algal material decays. High concentrations of algae cause taste and odour problems in drinking water, and some types of algae are toxic to animals.

In the 1960's, excessive nutrient enrichment, especially in the Lower Great Lakes (Erie, Ontario) of North America, led to the world's largest and most successful phosphorus control management scheme. Implemented in the 1970's, phosphorus was eliminated in detergents both by the US and Canadian sides of the lakes and strict controls were placed on the phosphorus content of effluents from sewage treatment plants. Phosphorus loadings were calculated so that phosphorus management could focus on the relative importance of point (sewage treatment) and non-point (mainly agricultural) sources.

Monitoring and assessment of all sources of phosphorus loads to Lake Erie over the past 20 years clearly shows a decrease in loads to levels below the recommended standard established by the International Joint Commission.

Corresponding to the regulations restricting phosphorus loads to Lake Erie, comprehensive surveillance and monitoring programmes studying the chemistry and biology of the lake were undertaken. Concentrations of total phosphorus in Lake Erie have significantly reduced since 1970. Prior to these controls Lake Erie was assessed as an eutrophic lake with frequent periods of anoxia in the bottom waters of the central basin. Serious concerns were expressed for the long term health of the lake and for the economic viability of the fishery. Water quality management programs have proven extremely effective in controlling and, in fact reversing the trends in nutrient levels in the

Great Lakes. Lake Erie has moved from being eutrophic to mesotrophic status. Reductions in the frequency and occurrence of algal blooms, an improvement in the clarity of the water, and an improvement in the stocks of fish are amongst the benefits derived from the programme.