

Lake Michigan District personnel conducted approximately 75 lake monitoring surveys from 1975 to the present. The purpose of this report is to summarize the data relating nutrient concentrations, particularly dissolved or ortho-phosphorous and the inorganic forms of nitrogen ($\text{NH}_4 + \text{NO}_3 + \text{NO}_2$ as N), to the productivity of a lake. How productive a lake is can be indicated by the accumulation of algae, imparting a green or brown color to the water and/or by the presence of aquatic vegetation. The more nutrients (nitrogen and phosphorous) the more abundant will be the concentration of algae or aquatic vegetation.

Nitrogen and phosphorous concentrations and the corresponding effect on algae and vegetation numbers has been documented by many researchers: (Sawyer, 1947; American Water Works Association, 1966; Volensweider, 1968; Edmondson, 1976; Lee, 1971; Ryther and Dunstan, 1971; Maloney et al., 1972; Powers et al., 1972; Martin and Goff, 1972; Shannon and Brezonik, 1972). Sawyer (1947) found phosphorous concentrations of 0.01 mg/l and nitrogen concentrations of 0.3 mg/l, particularly during spring turnover, sufficient to give the lake a high potential for an abundance of algae or aquatic vegetation.

Alkalinity or carbonate hardness, that portion of the hardness attributed to the bicarbonate plus carbonate, will be used to differentiate soft from hardwater lakes. Concentrations less than 80 mg/l as CaCO_3 will be given soft water designation, 80-125 mg/l as CaCO_3 moderately hard water and greater than 125 mg/l hard water. Alkalinity does not by

itself reflect the lakes productivity but indicates the geology of the watershed. A clay or limestone subsoil will traditionally create a hard water situation.

Productivity potential mentioned in the following discussion relate to Sawyer's formula. Approximately 55 lakes have been discussed, the other 20 are in those counties transferred to other districts.

Bear Lake, Waupaca County is a 194 acre, maximum 62 foot depth, hardwater, drainage lake. In 1975 Lake Michigan District DNR personnel monitored it on a quarterly basis. Nutrient levels, based upon Sawyer 1947, were excessive during the March and April sampling dates. Nitrogen exceeded the .3 mg/l level as well as phosphorous exceeding the .01 mg/l level, Phosphorous to a lesser degree than nitrogen. Algae and/or aquatic vegetation blooms would be expected with corresponding decreases in oxygen levels in the hypolimnion or lower depths. Significant dissolved oxygen stratification did occur during March and April with levels falling below 2 mg/l in the hypolimnion.

A vegetation survey in the summer 1975 revealed several varieties of macrophytes. Potamogeton or the pond weeds were abundant as well as Milfoil in the littoral zone. Some chara, vallisneria and a few bushy pondweeds (Najas) were also observed.

