

1979 LAKE MICHIGAN DISTRICT  
LAKE MONITORING ACTIVITIES

LMD Water Quality personnel monitored ten lakes on a quarterly basis in 1979. In addition, three bench mark lakes were monitored for the Bureau of Inland Lake Renewal. The purpose was to provide a data base on lakes that did not have quarterly chemistry data in the past five years. There were two exceptions: John Lake in Oconto County has been monitored by the District for Central Office the past few years and the Machikanee Flowage has been monitored for the past two years in conjunction with the Scott Paper settlement. Area fish managers requested the additional eight lakes. A supplement to the 1979 Preliminary Basin Assessment outlines the purpose for monitoring each lake. Each lake will be individually summarized.

Nutrient concentrations, particularly dissolved or ortho-phosphorus and the inorganic forms of nitrogen ( $\text{NH}_4 + \text{NO}_3 + \text{NO}_2$  as N) will be related to lake productivity or the abundance of algae and vegetation. The relative abundance of vegetation was assessed for each lake during the summer. In addition, chlorophyll a was measured to indicate the concentration of algae. Nitrogen and phosphorus concentrations will be related to Sawyer's (1947) levels of 0.015 mg/l for ortho-phosphorus and 0.3 mg/l for inorganic nitrogen to predict increases in algae and/or vegetation. Nitrogen-phosphorus ratios, chlorophyll a concentrations for summer and fall and secchi disc readings are used to indicate the trophic level of each lake. The DNR task force committee on lake studies has arrived at total nitrogen/total phosphorus ratios greater than 11, chlorophyll a concentrations less than 14 ug/l, and mid summer secchi disc readings greater than 1.5 M. to indicate very good or oligotrophic lake conditions. A reduction in any of these criteria progresses toward a more mesotrophic, or in extreme cases, eutrophic state. These criteria will be interpreted for each lake to assess the particular trophic level of the lake.

Becker Lake in northeast Calumet County, T-19N, R-20E, Section 12(4), is a 31 acre, maximum 51 feet deep, hard water seepage Lake. Quarterly water chemistry samples were taken in 1979 by Lake Michigan District DNR personnel. Alkalinities ranged from a low of 126 mg/l to a high of 180 mg/l, the average was 146 mg/l. Alkalinity or carbonate hardness, that portion of the hardness attributed to the bicarbonate plus carbonate, is used to differentiate soft from hardwater lakes. Concentrations less than 80 mg/l as CaCO<sub>3</sub> will be designated soft water, 80-125 mg/l moderately hard and greater than 125 mg/l hard water. Alkalinity can indicate gross pollution but for the most part it is a reflection of the geology or soils of the watershed. Beckers Lake is a hardwater lake with alkalinities typical of other surface waters in the area.

Nutrient or phosphorus and nitrogen concentrations were excessive on all quarterly samples. Sawyer (1947) set limits, referred to in the introduction, for the spring turnover; when they are exceeded there is a good potential for increases in algae and or rooted vegetation. The effect on Beckers as a result of high spring nutrient concentrations was an increase in organic matter. Chlorophyll a concentrations were extremely high, 79 ug/l on the August 8th sample date. The correction for pheophyton was 65 ug/l. Pheophyton is a natural degradation product of chlorophyll and often occurs in significant quantities in phytoplankton. The summer secchi reading was only 0.7 m. A vegetation survey on this sample day revealed almost all emergents, Sedges, Rushes, Cattail and Arrowhead. The only submergent was Flatstem Pondweed confined to the south shore littoral. Some floating Nuphar was also observed. Limited visibility due to excessive algae reduced the number of submerged macrophytes.

During the winter and summer stratification periods oxygen depletion in the hypolimnion was significant (see figure 1). The decomposition of organic matter by oxygen consuming bacteria contributes to low dissolved oxygen in the hypolimnion. Reduced penetration of the sun due to ice and snow in the winter and excessive algae in the summer also contributes to oxygen depletion.

Nitrogen-Phosphorus ratios greater than eleven indicate oligotrophic conditions. The ratio in the hypolimnion ranged from 1.4 in the summer to 9.4 in the fall. Epilimnion ratios ranged from 8.1 in the fall to 30 in the summer. Nitrogen-Phosphorus ratios on Beckers Lake indicate that phosphorus is present in excess. Secchi disc readings were less than 1 meter in late summer due to the abundance of algae, also emphasizing the excess nutrient problem.

Beckers Lake is in an advanced stage of eutrophication based on chemical and biological samples in 1979. The primary source of nutrients appears to be agriculture practices in the watershed. The watershed was not delineated at the time the lake was monitored, however, the surrounding area contains a number of dairy farms with associated row crops.

These practices are generally associated with nutrient loadings during periods of runoff.

SCS and SWCD personnel will be contacted to make them aware of the Becker Lake problems.

Fig. 1

Mg/L. Dissolved O<sub>2</sub> - TEMPERATURE C°

Dissolved O<sub>2</sub> mg/L. - TEMPERATURE C°

DEPTH IN METERS

DEPTH IN METERS

BECKERS Lake  
Calumet Co.

x TEMPERATURE  
o Dissolved O<sub>2</sub>

February 13, 1979

MAY 1, 1979

August 8, 1979

October 30, 1979

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