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REF

LAKE

PSYCHIC

REVIEW



## SUMMARY--LAKE MICHIGAN STUDY

Over the last ten to fifteen years, Lake Michigan has been showing increasing evidence of subtle enrichment. The gross pollution has been subsiding, but most areas of the nearshore, littoral, zone have been adversely impacted. This enrichment has reached a stage, where many of the Lake's nearshore and embayment areas would be classified as mesotrophic or eutrophic. The open water, especially in the central and northern areas, are in transition between oligotrophic and mesotrophic conditions with the southern basin being more mesotrophic.

The early results from the 1976 and 1977 study indicates some bright spots in the struggle to prevent a premature aging of Lake Michigan. Remedial and abatement programs have produced positive improvements in nearshore areas formally impacted by discharges. Beaches in the North Shore Sanitary District of Lake County Illinois and north Chicago have been regularly open for public bathing except after bad storms when beaches are closed for a day or two. The incidence of taste and odor problems at Chicago water intakes has decreased as a result of the industrial pollution abatement programs in the Calumet area.

While enrichment of Lake Michigan waters is a major concern, total phosphorus concentrations along the entire Indiana shoreline of Lake Michigan are surprisingly the lowest in the entire southern basin. This seems to reflect the benefits of the 1973 Indiana detergent phosphate ban. Productivity, as measured by chlorophyll, is lower in this nearshore zone than in other similar areas. This is expected since phosphorus is the "limiting factor" for growth of algae.

The rapid upward accumulation of phosphorus in Lake Michigan waters appears to have been slowed. Data records from the Chicago Water Filtration Plant show a significant change in the upward trend starting in the early seventies. Algae species and populations are returning to those characteristics of Lake Michigan waters in the early 1950's.

Chloride concentrations are growing more rapidly over the last ten to fifteen years than ever before. This accumulation rate is approximately four times that estimated for the period 1860 to 1910, and approximately twice that estimated for the period 1910 to 1960. The current rate corresponds to approximately 900,000 to 1,050,000 metric tons of chlorides per year. Nearly half of this load comes from salts used for road deicing.

Silica has been declining. The results of 1976 - 1977 showed it has reached its lowest measured concentrations to date. This decrease is due to expanding populations of diatoms which use silica in their exoskeleton. Due to biological demand, silica concentrations exhibit a seasonal cycle. As the season progresses, the surface waters are depleted of silica. The total silica in the entire water column remains reasonably constant, but the silica available in the photic zone is sharply reduced. Concern exists that diatoms may be replaced by other less desirable forms - blue green and green algae - as the predominate Lake Michigan phytoplankton.

The other major concern is the presence of PCB's, DDT, and other highly toxic chemicals in the lake. PCB levels in lake Michigan have not increased in 1976 and may have started to decline. DDT levels are continuing to decline and are now at 10% of their 1969 levels - a 90% reduction.

Green Bay is a highly productive, enriched body of water. The southern-most stations showed eutrophic conditions in the area impacted by the Menominee River around Menominee-Marinett with conditions deteriorating towards Green Bay, Wisconsin, where the Fox River discharges. Little Bay De Noc from Escanaba, Michigan northward can be classified as mesotrophic to

eutrophic. Big Bay De Noc and areas where interchange with Lake Michigan water occurs are mesotrophic. Green Bay acts as a source of nutrients to Lake Michigan. This degrades Lake Michigan water quality and has observable negative impacts near and southwards from the channels connecting Green Bay to Lake Michigan.

Milwaukee Harbor is still organically enriched based on this study. This enrichment is concentrated and impacts a zone out two miles beyond the harbor breakwater. Observations further indicate that the organic loadings further degrades Lake Michigan water quality at a distance greater than two miles, especially following heavy onshore rains. The harbor is in a general state of eutrophication.

Southern Lake Michigan showed improvement in the total phosphorus measurements. Average total phosphorus concentrations along the entire Indiana shoreline of Lake Michigan are the lowest in the entire southern basin in the offshore waters. Low concentrations of phosphorus were evident within four miles of shore. Nearshore the values increased into the mesotrophic range. However, these values were lower by half than the average values in Green Bay near Menominee-Marquette.

**ENRICHMENT:** Sewage effluent or agricultural runoff adding nutrients (nitrogen, phosphorus, carbon compounds) to a water body, greatly increasing the growth potential for algae and aquatic plants.

**EUTROPHICATION:** The slow aging process of a lake evolving into a marsh and eventually disappearing. During eutrophication the lake is choked by abundant plant life. Human activities that add nutrients to a water body can speed up this action

**OLIGOTROPHIC LAKES:** Deep clear lakes with low nutrient supplies. They contain little organic matter and have a high dissolved oxygen level.

**MESOTROPHIC:** Having a moderate amount of nutrients. Intermediate condition.