DISSOLVED PHOSPHORUS AND INORGANIC NITROGEN IN THE WATER OF THE MISSISSIPPI RIVER

IN 1921 McHargue and Peter[2] published some results of quantitative studies of the mineral plant-food in natural waters. In their studies were included samples of water from the Mississippi River at Minneapolis, Minn., and Baton Rouge, Louisiana. These authors found that the phosphorus expressed as P_2O_5 at these two stations amounted to 0.25 and 0.15 ppm respectively. From the method employed by them it appears that they determined the total phosphorus in the filtered water rather than the soluble phosphorus only. According to these authors nitrate nitrogen was absent from the Minneapolis sample but occurred in the Baton Rouge sample to the extent of 0.8 ppm. Ammonia nitrogen was apparently not determined in the Minneapolis samples; in the Baton Rouge sample it was present in small quantities.

The present writer has for some time been interested in determining what inorganic constituent of pond water may be the factor that limits plankton production and hence fish production. A rather extensive series of determinations of the principal forms of inorganic nitrogen, and of the soluble and the total phosphorus has been made on the pond waters at Fairport, Iowa.[3] The results of these studies point towards the soluble phosphorus as the limiting factor. Nitrogen as free ammonia and as nitrates was always present but there were times when the soluble phosphorus was completely exhausted. Since these ponds are supplied with water from the Mississippi River, it seemed of interest to determine the variations in these constituents of the river water. These determinations have not been made as regularly as may be desired, but still they give some idea of the amount of free ammonia, nitrates, organic nitrogen, and soluble phosphorus present in the water of the Mississippi River.

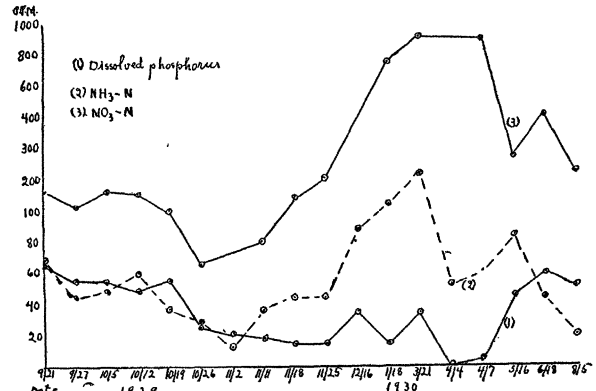

FIG. 1

The variations in the soluble phosphorus, nitrate nitrogen, and ammonia nitrogen for 1929–30 are presented graphically in Fig. 1 expressed in milligram per m^3. Only the soluble phosphorus by Denige's method is shown in the graph. The total phosphorus was not regularly determined but 15 determinations on unfiltered surface samples gave an average of 0.136 ppm; 8 bottom samples gave an average of 0.173 ppm.

The soluble phosphorus varied considerably. The maximum for the surface samples occurred on Sept. 21, 1929, and amounted to .065 ppm; the maximum for the bottom samples occurred on June 18, 1930, and amounted to 0.082 ppm. The minimum for both top and bottom samples occurred on April 4, 1930. At this time the soluble phosphorus had been reduced to a trace. These minimum values occurred simultaneously with an enormous increase in the phytoplankton. This again points toward the conclusion that the soluble phosphorus may at times be a limiting factor. The range of the ammonia nitrogen in the surface samples is from a minimum of 0.012 ppm to a maximum of 0.224 ppm. In the bottom samples this form of nitrogen varies from a minimum of 0.020 ppm to a maximum of 0.184 ppm. Nitrate nitrogen in surface samples ranged from 0.051 ppm to 0.914 ppm and in the bottom samples from 0.060 ppm to 0.776 ppm.

On the basis of an analysis of 44 samples of water it is concluded:

(1) Inorganic nitrogen is apparently not a limiting factor in the waters of the Mississippi River at Fairport, Iowa.

(2) Soluble phosphorus may at times become a limiting factor.

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[1] Published with permission of the U. S. Commissioner of Fisheries.

[2] J. S. McHargue and A. M. Peter, "The Removal of Mineral Plant-Food by Natural Drainage Water." Ky. Agri Ex. Sta., *Bull.* No. 237.

[3] A. H. Wiebe, "Investigations on Plankton Production in Fish Ponds." U. S. Bureau of Fisheries, *Doc.* 1082.

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