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EFFECTS OF SEWAGE EFFLUENTS ON FISHES IN UPPER PATUXENT RIVER, MARYLAND

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ABSTRACT

A survey on fish population was made in the upper Patuxent River, situated between the metropolitan centers of Washington, D. C. and Baltimore, Maryland, in the summer of 1966. This stream has received effluents of eight secondary domestic sewage treatment plants. Data obtained by two series of fish collections with a 10-foot-and-one-fourth-inch mesh seine during June 17-July 14 and August 5-24 were compared with water quality data (dissolved oxygen, conductivity, and pH). The effects of sewage effluent on the fish species diversity and fish abundance in this stream were evaluated.

Results of this study indicate that chlorinated sewage effluent reduced species diversity and fish abundance immediately below the seven effluent outfalls where dissolved oxygen remained at 4.2-10.6 ppm and pH value was 6.9-8.9 (above the limit of fish tolerance). Species diversity and fish abundance gradually increased downstream below the Laurel sewage outfall (the largest) from one species and one fish to 13 species and 194 fish in a 3.6-mile section of the stream while the dissolved oxygen gradually decreased from 6.5 ppm to 3.5 ppm and the pH value only changed from 7.4 to 7.2. This demonstrates that dissolved oxygen, regarded as the most damaging factor for fish in sewage pollution, was not a decisive factor for fish distribution below a chlorinated sewage outfall. Sewage toxicity (perhaps mainly chlorination) appears to be the causative factor.

In the various polluted areas located downstream (13 stations), where dissolved oxygen ranged from 7.5 ppm to 3.0 ppm and sewage toxicity decreased to such a degree that it was no longer harmful to fish life, a change in species composition with a fairly constant number of species was found at each station. Species diversity was similar to that found at three unpolluted upstream stations where dissolved oxygen was above 8.5 ppm. This suggests that a species shift rather than a reduction in species diversity is the principal effect of sewage pollution due to organic deoxygenation of the water and the additional nourishment. The species shift suggests two phenomena: (1) The number of ecological niches for fish species in a stream may not be affected by the reduction in dissolved oxygen (not applicable below 3 ppm) and by the increased nutrients as a result of sewage pollution. Niche structure, however, will be changed. (2) There is a continuous spectrum in the minimum range of oxygen requirements for each species in a fish community. The open habitat left by the pollution-sensitive species can be taken over by a pollution-tolerant species. This also suggests that there is no actual border line such as 5 ppm or 6 ppm, the current dissolved oxygen criteria for fish, that can guarantee safe propagation of all species.