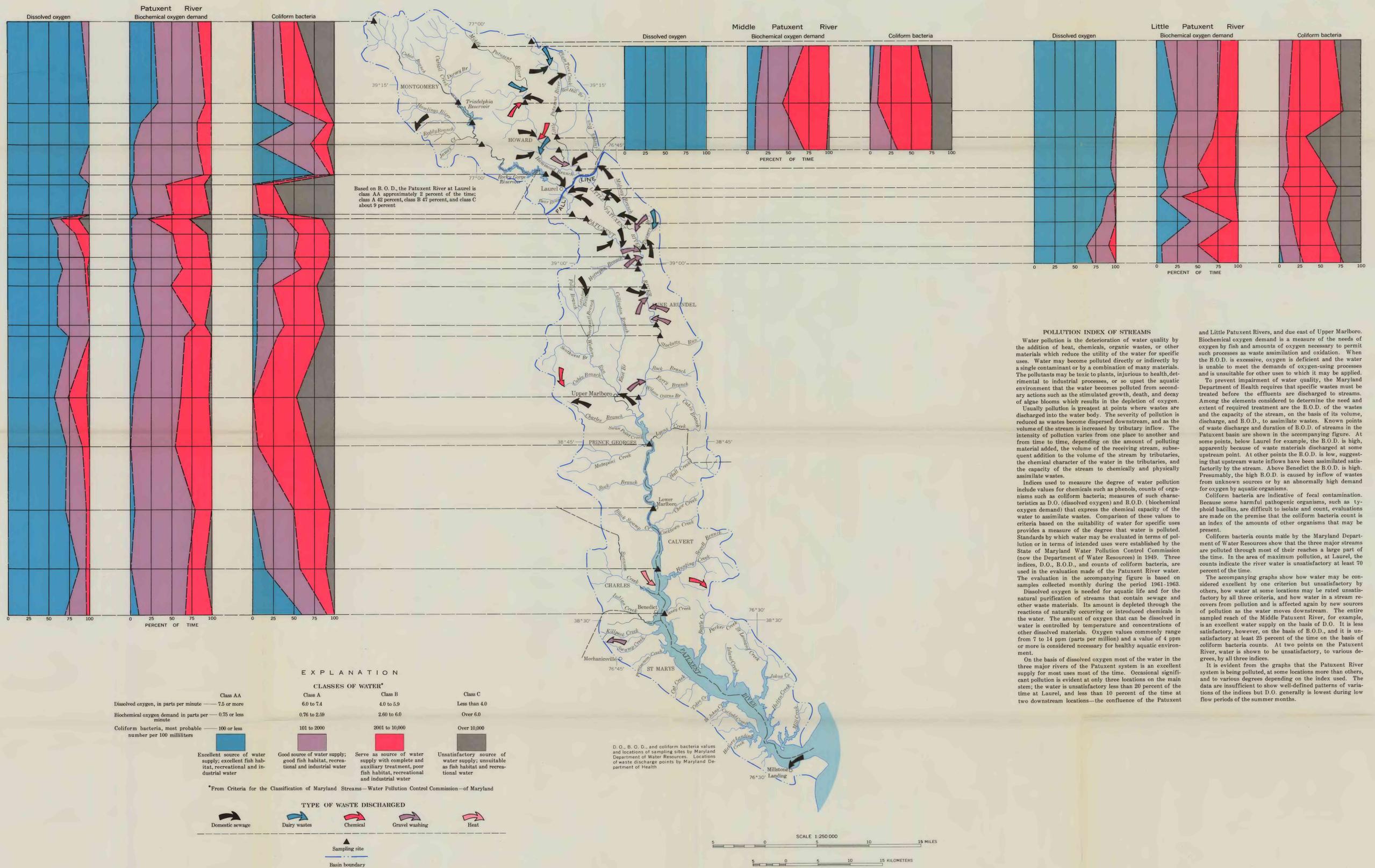


POLLUTION INDEX OF STREAMS

By
James W. Crooks and Deric O'Bryan



Based on B. O. D., the Patuxent River at Laurel is class AA approximately 2 percent of the time; class A 42 percent, class B 47 percent, and class C about 9 percent

POLLUTION INDEX OF STREAMS

Water pollution is the deterioration of water quality by the addition of heat, chemicals, organic wastes, or other materials which reduce the utility of the water for specific uses. Water may become polluted directly or indirectly by a single contaminant or by a combination of many materials. The pollutants may be toxic to plants, injurious to health, detrimental to industrial processes, or so upset the aquatic environment that the water becomes polluted from secondary actions such as the stimulated growth, death, and decay of algae blooms which results in the depletion of oxygen. Usually pollution is greatest at points where wastes are discharged into the water body. The severity of pollution is reduced as wastes become dispersed downstream, and as the volume of the stream is increased by tributary inflow. The intensity of pollution varies from one place to another and from time to time, depending on the amount of polluting material added, the volume of the receiving stream, subsequent addition to the volume of the stream by tributaries, the chemical character of the water in the tributaries, and the capacity of the stream to chemically and physically assimilate wastes.

Indices used to measure the degree of water pollution include values for chemicals such as phenols, counts of organisms such as coliform bacteria; measures of such characteristics as D.O. (dissolved oxygen) and B.O.D. (biochemical oxygen demand) that express the chemical capacity of the water to assimilate wastes. Comparison of these values to criteria based on the suitability of water for specific uses provides a measure of the degree that water is polluted. Standards by which water may be evaluated in terms of pollution or in terms of intended uses were established by the State of Maryland Water Pollution Control Commission (now the Department of Water Resources) in 1949. Three indices, D.O., B.O.D., and counts of coliform bacteria, are used in the evaluation made of the Patuxent River water. The evaluation in the accompanying figure is based on samples collected monthly during the period 1961-1963.

Dissolved oxygen is needed for aquatic life and for the natural purification of streams that contain sewage and other waste materials. Its amount is depleted through the reactions of naturally occurring or introduced chemicals in the water. The amount of oxygen that can be dissolved in water is controlled by temperature and concentrations of other dissolved materials. Oxygen values commonly range from 7 to 14 ppm (parts per million) and a value of 4 ppm or more is considered necessary for healthy aquatic environment.

On the basis of dissolved oxygen most of the water in the three major rivers of the Patuxent system is an excellent supply for most uses most of the time. Occasional significant pollution is evident at only three locations on the main stem; the water is unsatisfactory less than 20 percent of the time at Laurel, and less than 10 percent of the time at two downstream locations—the confluence of the Patuxent and Little Patuxent Rivers, and due east of Upper Marlboro.

Biochemical oxygen demand is a measure of the needs of oxygen by fish and amounts of oxygen necessary to permit such processes as waste assimilation and oxidation. When the B.O.D. is excessive, oxygen is deficient and the water is unable to meet the demands of oxygen-using processes and is unsuitable for other uses to which it may be applied. To prevent impairment of water quality, the Maryland Department of Health requires that specific wastes must be treated before the effluents are discharged to streams. Among the elements considered to determine the need and extent of required treatment are the B.O.D. of the wastes and the capacity of the stream, on the basis of its volume, discharge, and B.O.D., to assimilate wastes. Known points of waste discharge and duration of B.O.D. of streams in the Patuxent basin are shown in the accompanying figure. At some points, below Laurel for example, the B.O.D. is high, apparently because of waste materials discharged at some upstream point. At other points the B.O.D. is low, suggesting that upstream waste inflows have been assimilated satisfactorily by the stream. Above Benedict the B.O.D. is high. Presumably, the high B.O.D. is caused by inflow of wastes from unknown sources or by an abnormally high demand for oxygen by aquatic organisms.

Coliform bacteria are indicative of fecal contamination. Because some harmful pathogenic organisms, such as typhoid bacillus, are difficult to isolate and count, evaluations are made on the premise that the coliform bacteria count is an index of the amounts of other organisms that may be present.

Coliform bacteria counts made by the Maryland Department of Water Resources show that the three major streams are polluted through most of their reaches a large part of the time. In the area of maximum pollution, at Laurel, the counts indicate the river water is unsatisfactory at least 70 percent of the time.

The accompanying graphs show how water may be considered excellent by one criterion but unsatisfactory by others, how water at some locations may be rated unsatisfactory by all three criteria, and how water in a stream recovers from pollution and is affected again by new sources of pollution as the water moves downstream. The entire sampled reach of the Middle Patuxent River, for example, is an excellent water supply on the basis of D.O. It is less satisfactory, however, on the basis of B.O.D., and it is unsatisfactory at least 25 percent of the time on the basis of coliform bacteria counts. At two points on the Patuxent River, water is shown to be unsatisfactory, to various degrees, by all three indices.

It is evident from the graphs that the Patuxent River system is being polluted, at some locations more than others, and to various degrees depending on the index used. The data are insufficient to show well-defined patterns of variations of the indices but D.O. generally is lowest during low flow periods of the summer months.

WATER RESOURCES OF THE PATUXENT RIVER BASIN, MARYLAND

By
James W. Crooks, Deric O'Bryan, and others
1967