

Wilhm J L & Dorris T C. Biological parameters for water quality criteria.

BioScience 18:477-81, 1968.

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In this paper, we proposed the establishment of water quality criteria by the evaluation of biological conditions existing in receiving streams [The SCI® indicates that this paper has been cited in over 125 publications since 1968]

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In the early 1960s, Troy Dorris and I became increasingly impressed with the importance of using aquatic organisms as indicators of water quality. We recognized that biotic communities exhibit striking differences in diversity at successive stages downstream in a polluted stream. Some species are unable to survive, others persist in reduced numbers, while a few attain great abundance. A distinctive series of populations can be identified until water quality and biotic diversity approach the normal situation.

After reviewing many articles on water quality in streams, we observed that the biotic community was often ignored despite its significance. This omission was partly due to the many methods used by biologists to summarize data. Many biologists prepared long lists of species associated with dif-

ferent stream zones. This method was not understandable to the layperson or acceptable to the engineer. Other biologists resorted to using various types of graphs that were often difficult to construct and interpret. Since engineers and laypeople find numbers more acceptable, we attempted to use a diversity index to summarize information about the numbers of species and individuals in different stream zones. We examined various indexes and found that an index derived from information theory was independent of sample size, dimensionless, and expressed the relative importance of each species. We demonstrated the usefulness of that index in a variety of polluted waters and proposed a relationship between the range of diversity and the extent of pollution.

We feel that the information theory index and the table of diversity ranges provide water pollution biologists with a needed tool. Thus, they were tested in numerous studies by water pollution biologists, and this is the primary reason the paper has been cited frequently. The paper develops the theory as well as applies the equation to real situations. Since publication of the paper, we further tested the index at over 200 different stations receiving a variety of effluents. The index was successful in the large majority of situations; however, we later cautioned that the index should not be the sole indicator of water quality but should be used in association with standard chemical tests.¹ Both approaches have advantages and provide considerable information when used simultaneously.

1 Wilhm J. Biological indicators of pollution (Whitton B A, ed) *River ecology*
Oxford Blackwell Scientific, 1975 p 375-402