The Influence of Scale, Design, and Indicators in Watershed Assessment Outcomes

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Biographical Sketches of Authors

Edward T. Rankin is a Senior Research Associate for the Center for Applied Bioassessment & Biocriteria (CABB) in Columbus, Ohio. He previously worked for 18 years for the State of Ohio Environmental Protection Agency as a fishery ecologist in their Ecological Assessment Section. He has worked on projects related to assessing the effects of multiple stressors on aquatic life in streams, development and application of stream habitat assessment methodologies and development and application of biological criteria.

Chris O. Yoder is involved in the national development of biological assessments and biocriteria, including multimetric index development for large rivers and wadeable streams. He is presently the principal investigator of a cooperative agreement with the U.S. EPA, Office of Water for monitoring and assessment, indicators, and biological criteria development and implementation. He was most recently Manager of the Ecological Assessment Section at Ohio EPA (1989 – 2001) and supervisor and staff member since 1976. His experience also includes service on national, regional, and state working groups and committees dealing with monitoring and assessment, environmental indicators, biological assessment, biological criteria, and WQS development and implementation. Recently he served as a member of the National Research Council committee on the role of science in the TMDL process. He has 33 years of experience in the assessment of fish assemblages and other aquatic organism groups, their associated habitats, and 28 years in water quality management including the integration of multiple indicators of stress, exposure, and response.

Abstract

The geometric watershed sampling design developed and implemented by Ohio EPA provides an opportunity to examine the issues of scale, design, and indicators usage in the outcomes of watershed assessments. The geometric sampling design is a dense selection of sites determined by halving the drainage area at the mouth of the watershed which is then continued down to a watershed size of as small as 1-2 sq mi. Biological (fish and macroinvertebrates), habitat, and water column chemistry data are typically collected at each station and integrated with other information from the watershed. Stations are assessed for attainment of aquatic life uses and a weight of evidence approach is used to identify causes and sources of impairment at stations. Basic questions about how watershed assessment design influences the knowledge and outcomes about specific management issues were approached by iterative analysis of the assessment outcomes for aquatic life use issues. For example, at what point does adding spatial resolution to the watershed sampling design cease to offer unique information for one or more management purposes? Do different management objectives influence this? How do these choices influence the environmental accuracy of the watershed assessment? Are there implications and consequences to broader issues such as indicator, criteria, and tool development?