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Landscape-Based Models that Predict July Thermal Characteristics of Lower Michigan Rivers

Kevin E. Wehrly, Michael J. Wiley

School of Natural Resources and Environment
The University of Michigan
Ann Arbor, Michigan 48109

and

Paul W. Seelbach

Institute for Fisheries Research
Michigan Department of Natural Resources
212 Museums Annex
Ann Arbor, Michigan 48109

Abstract.–Water temperature is one of the most important environmental factors affecting the physiology, life-history, and distribution patterns of stream biota. However, the ability to assess the influence of temperature on observed patterns of species distribution and abundance is hampered by a lack of site-specific temperature data collected across relatively broad geographic regions. In this paper, we present 2 models that can be used to estimate July thermal characteristics using landscape attributes for streams in the Lower Peninsula of Michigan.

We used multiple linear regression to construct models that predict July average weekly maximum and minimum stream temperatures from catchment- and local-scale landscape variables. Water temperature data were collected at 171 sites representing 12 major watersheds in Lower Michigan. Catchment- and local-scale landscape variables were obtained from existing maps using a Geographic Information System (GIS).

The best models predicting July thermal characteristics explained from 59-60 % of the spatial variation in stream temperatures. When outlier sites were removed, these models explained from 70-81 % of the spatial variation in stream temperatures. These models suggested that channel morphology, ground water accrual, and riparian forest cover were important variables controlling temperatures in Lower Michigan rivers.

The results of this study illustrate the importance of catchment- and local-scale attributes in controlling instream habitat, especially in heterogeneous landscapes. These models provide a cost-effective method to generate broad-scale temperature information. Such information can provide baseline data environmental impact assessment and can be used to guide management decisions.