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Utility of Species-specific, Multiple Linear Regression Models for Prediction of Fish Assemblages in Rivers of Michigan's Lower Peninsula

Troy G. Zorn

Michigan Department of Natural Resources, Marquette Fisheries Research Station
484 Cherry Creek Road, Marquette, Michigan 49855

Paul W. Seelbach

Michigan Department of Natural Resources, Institute for Fisheries Research
212 Museums Annex Building, Ann Arbor, MI 48109-1084

Michael J. Wiley

University of Michigan, School of Natural Resources and Environment
Ann Arbor, Michigan 48109-1115

Abstract.–Models for predicting abundance of fishes in rivers are desired by fishery managers and the public to facilitate protection and management of stream resources, and are also used to gauge our scientific understanding of systems. Movement toward ecosystem management has stressed the need for models to predict fish assemblage structure in rivers, but such models are rare. Since fish assemblages are essentially collections of individual populations, we explored development of species-specific, predictive models for 68 commonly-occurring fishes in rivers of Michigan's Lower Peninsula using multiple linear regression techniques. We developed models for each species from All Sites (AS models) and from Sites Of its Occurrence (SOO models) in the database. We incorporated data describing site-, reach-, catchment-, and drainage network-scale aspects of habitat, species distribution ranges, and abundances of co-occurring fishes at sites to produce best predictive models. We developed two sets of significant regression models for the 68 species. Most commonly occurring variables were similar in both sets of models and included catchment area, July mean temperature, channel gradient, total phosphorus, substrate, and variables indicating connections to specific upstream and downstream aquatic habitats. Variables characterizing anthropogenic land use change and habitat connectivity were often significant for fishes in models. Landscape-scale habitat variables were slightly more common in AS models, while local-scale habitat variables occurred in higher proportions in SOO models. Strong effects of piscivores on fish abundance were not apparent in either set of models. The SOO models generally had fewer variables, explained more variance, and had lower estimation error than the AS models. Preliminary success in applying the SOO models to a river in which the list of occurring species is available and their generally good fit suggest that these models (in combination with some simple, species-specific tests to identify likely occurring fishes) show promise for predicting fish assemblage structure in Lower Michigan streams.