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Benthic Macroinvertebrate Responses to Reduced Summer Streamflows in a Northern Michigan Stream

Todd C. Wills[1], Edward A. Baker[2], Andrew J. Nuhfer[1], and Troy G. Zorn[2]

[1]*Michigan Department of Natural Resources*
Hunt Creek Fisheries Research Station
1581 Halberg Road
Lewiston, MI 49756

[2]*Michigan Department of Natural Resources*
Marquette Fisheries Research Station
488 Cherry Creek Road
Marquette, MI 49855

Abstract.–We evaluated the response of benthic macroinvertebrates in a Michigan trout stream to flow reduction by diverting water from a 602-m reach of Hunt Creek from June through August of 1994, 1997, and 1998. We also assessed the utility of the Physical Habitat Simulation system (PHABSIM) in predicting the response of benthic insects to water withdrawals by testing the assumption of a positive linear relationship between modeled habitat (weighted usable area, WUA) and the density of 13 benthic insect families. Our findings showed that the density of filter feeding and grazing insect taxa, as well as insects classified as obligate erosional zone taxa, declined significantly in the dewatered (treatment) zone (TZ) when 90% of flow was diverted. Density of Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa in the TZ was significantly lower when 90% of water was diverted as compared to density at baseflow or when flow was reduced by 50%. The density of all insects in an upstream reference zone riffle (RZ), where flow was not altered, did not change between experimental periods. Although overall reductions in the density of benthic insects at 90% flow reduction coincided with lower PHABSIM predictions of WUA, we found poor linear correlation between WUA at different flows and the density of the 13 benthic insect families for which WUA was modeled. The low proportion of variation explained by WUA for all families modeled suggests that WUA alone is not an accurate predictor of benthic insect density. Resource managers should consider the potential consequences of water withdrawals to all components of stream communities, including benthic macroinvertebrates. However, caution should be applied when using the labor-intensive PHABSIM system in high-quality trout streams such as Hunt Creek, because most relationships between WUA and benthic insect density were insignificant.

Introduction

Increasing water withdrawals for agricultural, industrial, and domestic purposes in Michigan may adversely affect stream communities. The area of land irrigated for agricultural purposes in Michigan increased from 39,255 ha to 159,042 ha statewide between 1974 and 1997 (USDA