ASSESSMENT OF MANAGEMENT ALTERNATIVES FOR ALTERING THE THERMAL REGIME OF THE BETSIE RIVER, MICHIGAN

Abstract

The Betsie River in northern Michigan is classified as a marginal trout stream because in some reaches, instream summer temperatures exceed the tolerance limits for trout species. In 1989, Thompsonville Dam failed, which resulted in an additional 15 km of stream available to migratory steelhead *Oncorhynchus mykiss* adults and juveniles. However, water temperatures in the upper watershed may still limit the production and distribution of these fish. The objectives of this study were to: 1) describe the current thermal regime throughout the Betsie River watershed and characterize it in relation to juvenile steelhead life history requirements, 2) evaluate empirical water temperature models based on air temperature to predict instream temperatures throughout the watershed, and 3) develop a physical process temperature model to evaluate the thermal effects of removing a remaining low-head dam in the headwaters or, alternatively, the addition of cold water from the hypolimnion of the source lake. Under current channel conditions, summer temperatures in the upper Betsie River routinely exceed the optimal growth limits for steelhead and sometimes the upper incipient lethal level, with mean summer temperatures from 21-23°C and maximum temperatures up to 28°C. Although, instream water temperatures were strongly correlated with air temperatures (r^2 = 0.81 to 0.92), air temperature was a poor predictor of winter water temperatures. The physical process model predicted instream summer temperatures reasonably well and provided for simulation of management alternatives. Removal of Grass Lake Dam would likely result in mean daily summer water temperatures 2°C lower than under current conditions in both typical-flow and low-flow water years for the reach from Green Lake to Grass Lake. In the Grass Lake to Thompsonville reach, mean daily water temperatures were predicted to be less than 1°C

lower than under current conditions in a typical and low-flow year. The addition of hypolimnetic water would result in temperatures 4°C lower than under current conditions in the Grass Lake to Thompsonville reach. Although these management alternatives may provide better thermal habitat for juvenile steelhead during the summer in this 15 km reach of river, the trade-offs, including the loss of wetland habitat and fishery and recreational boating opportunities in the current impoundment, should be considered.