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Nutrient Levels and Plankton Populations of Five Great Lakes Tributaries and Their Relation to Walleye Year Class Strength (Spawning Success)

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Abstract.–We monitored spring environmental conditions at the mouths of five Great Lakes tributaries from 1990 to 1994 with the purpose of identifying the factors conducive to walleye *Stizostedion vitreum* fry survival. Factors monitored included: 1) nutrient levels as characterized by concentrations of nitrate/nitrite, ammonia, phosphorus, silica, and total organic carbon (TOC); 2) plankton community composition, population density, and size structure; and 3) zebra mussel *Dreissina polymorpha* growth in suspended cages as a surrogate for growth of herbivorous zooplankton. Monitoring was conducted at the mouths of three rivers considered to be productive walleye spawning rivers; the Maumee River, an Ohio tributary to Lake Erie; the Thames River, a Lake St. Clair tributary in Ontario; and the Saginaw River, a Michigan tributary to Saginaw Bay, Lake Huron. Monitoring was also conducted at two rivers that currently host very small runs of walleye; the Clinton River, a Michigan tributary to Lake St. Clair; and the Huron River, a Michigan tributary to Lake Erie. We compared growth and survival of walleye fry in cages placed in the lower Clinton River to those reared in ponds. We estimated historical walleye year-class strength, based on catch data, and tried to correlate it with weather conditions and river discharge. We found few statistically significant differences in nutrient levels and plankton populations between years. However, differences between the rivers for the five year period were significant. The Saginaw, Maumee, and Thames rivers were characterized by warm to moderate mean water temperatures (16.9, 18.2, and 17.3 C), high nitrate/nitrite concentrations (1.08, 4.25, and 1.80 mg/L), high to moderate phosphorus concentrations (0.08, 0.16, and 0.05 mg/L), high to moderate TOC concentrations (11.13, 9.02, and 3.78 mg/L), and dense zooplankton populations (12.2, 6.9, and 4.9 individuals/L). Conversely, the Clinton and Huron rivers were typified by moderate to cold mean water temperatures (14.5 and 16.7 C), low nitrate/nitrite concentrations (0.33 and 0.43 mg/L), moderate to low phosphorus concentrations (0.04 and 0.06 mg/L), moderate to low TOC concentrations (2.61 and 4.49 mg/L), and less dense zooplankton populations (1.5 and 1.7 individuals/L). The Huron River had the most variable measures of environmental conditions. Walleye fry rearing experiments in ponds and cages showed that food conditions and growth in the lower Clinton River, a poor walleye river, were inferior. Analysis of weather and river discharge data indicates that strong walleye year classes in Lake Erie and Lake St. Clair are correlated with colder winters. No significant relationships were detected between Saginaw Bay walleye year-class strength and weather or river discharge data.