# Understanding coastal fisheries of Lake Superior: is larval fish production supported by watershed sources?

Joel C. Hoffman*, Anne M. Cotter, Gregory S. Peterson, Timothy D. Corry, and John R. Kelly

US EPA National Health and Environmental Effects Research Lab, Mid-Continent Ecology Division, 6201 Congdon Blvd, Duluth, MN USA

*corresponding author; email: hoffman.joel@epa.gov; phone: 218-529-5420

**Abstract:** Fundamental questions remain regarding the mechanisms and processes that link the food webs of coastal wetlands, rivers and embayments to Lake Superior's coastal zone. The goal of our research is to identify allochthonous and autochthonous inputs that support larval fish production in Lake Superior coastal wetlands, rivers and embayments using the biogeochemical gradient that arises from the mixing of river and lake water. Our research has focused on two main objectives. First, to identify biogeochemical processes linking watersheds and coastal ecosystems, we have characterized cation and nutrient concentrations, as well as particulate organic matter distribution and quality, across the river-lake transition zone in a variety of south shore tributaries and embayments. Second, to characterize trophic pathways supporting young fishes, we are using a stable isotope mixing framework that is based on the biogeochemical gradient across the river-lake transition zone. The biogeochemistry of these systems varies widely, reflecting differences in tributary discharge and organic matter sources and fates. Using both nitrogen and carbon stable isotope data from young fishes, we were able to characterize major trophic pathways and identify regions where cross-ecosystem subsidies are occurring. For some fish species, stable isotope data were consistent with reliance on isotopically light organic matter sources, likely autochthonous phytoplankton and allochthonous terrestrial-derived riverine organic matter. Some fish species captured in wetlands, however, have isotopic signatures consistent with reliance on isotopically enriched littoral periphyton or Lake Superior primary producers. Differences between the carbon stable isotope gradient in fish and their invertebrate prey revealed that fish production was supported at multiple spatial scales. Thus, production of the fish assemblage within the transition zone is supported by multiple organic matter sources from across the watershed.