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LAKE CHAMPLAIN FISH ECOLOGY: A MESOCOSM APPROACH TO THE GREAT LAKES

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ABSTRACT:

Our research has made significant inroads on understanding the impediments to restoration of self-sustaining populations of lake trout and the ecology of the macroinvertebrate *Mysis diluviana* in Lake Champlain, with direct application to the Great Lakes. Early mortality from thiamine deficiency due to consumption of alewife by lake trout is a leading hypothesis for failed restoration efforts in the Great Lakes; as predicted, we documented a rapid decline in egg thiamine in lake trout after invasion of alewife in Lake Champlain in 2003. However, we demonstrated that lake trout free embryos may be able to acquire thiamine before the onset of deficiency symptom by feeding on zooplankton. Moreover, we discovered rapid and sustained recruitment of wild juvenile lake trout in 2015 that began in 2012, after alewife invasion. Differences in growth and vertical and geographic distribution between wild and stocked juvenile lake trout suggests prolonged impacts of hatchery rearing on behavior. We used acoustic telemetry to support the hypothesis that male lake trout spend more time on spawning sites than females, and that lake trout tend to stray among spawning sites (61 to 74% non-homing). Our research on *Mysis*, a key mid-trophic level omnivore, suggests a substantial portion of the population remains on the bottom at night, drawing into doubt the validity of night pelagic sampling as representative of *Mysis* populations, and suggesting benthic habitats and brown (detrital-based) food webs may play more important roles in the lake food web than previously assumed. Such results suggest missing production in Great Lakes food web models may be an artifact of a mis-match between *Mysis* behavior and sampling design. Finally, we investigated the potential genetic consequences of whole-lake habitat fragmentation created by construction of 10 causeways in Lake Champlain between 1850 and 1900. Four species (slimy sculpin, tessellated darter, rainbow smelt, and lake whitefish) have not undergone population sub-structuring, but semi-isolation has resulted in demographic differences among rainbow smelt and lake whitefish populations in the isolated basins.