

## **M.L. 2013 Minnesota Aquatic Invasive Species Research Center Subproject Abstract**

For the Period Ending June 30, 2019

**SUBPROJECT TITLE:** MAISRC Subproject 16: Sustaining walleye populations: assessing impacts of AIS

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**FUNDING SOURCE:** Environment and Natural Resources Trust Fund (ENRTF)

**LEGAL CITATION:** M.L. 2013, Chp. 52, Sec. 2, Subd. 06a

**SUBPROJECT BUDGET AMOUNT:** \$ 198,700

**AMOUNT SPENT:** \$ 197,569

**AMOUNT REMAINING:** \$1,130

### **Sound bite of Subproject Outcomes and Results**

We evaluated the impacts of zebra mussels and spiny waterflea on walleye and yellow perch. Age-0 walleye were >10% smaller at the end of summer following invasion by either AIS, but age-0 yellow perch growth was not consistently affected. Food resources supporting walleye and yellow perch varied among lakes.

### **Overall Subproject Outcome and Results**

Minnesota lakes experience ecosystem-level changes following the introduction of aquatic invasive species (AIS), specifically zebra mussels and spiny water fleas. However, the effects of these AIS on fish are poorly understood and vary among lakes. We evaluated the impacts of zebra mussels and spiny water fleas on walleye and yellow perch in Minnesota's nine largest walleye lakes. We compared age-0 walleye and yellow perch growth over 35 years, including pre- and post-invasion. Age-0 walleye were >10% smaller at the end of summer following invasion by either AIS. Age-0 yellow perch growth decreased following zebra mussel invasion, although this effect was not statistically significant. Smaller length at the end of the growing season was associated with decreased survival to later life stages for walleye in 7 of the 9 study lakes.

We used stable isotope analyses to understand which habitats and food resources support walleye and other fish and to assess their position in the food web in each lake. We documented a high degree of variability in the resources supporting all life stages of walleye. In general, juvenile walleye relied on offshore prey resources in invaded lakes. Combined with reduced growth rates, these results suggest that as zooplankton food resources decline following invasion, young walleye are not sufficiently accessing alternative prey resources to maintain pre-invasion growth rates. Variability in walleye diets among lakes may reflect differences in lake productivity or morphology, not necessarily the presence of AIS.

Our results demonstrate that zebra mussels and spiny water flea influence the growth rates of age-0 walleye and that a wide range of food resources and habitats support walleye in these lakes. Declines in growth rates of young walleye are an early signal of potential negative effects on walleye. This information can guide managers on the most effective and sustainable walleye harvest and stocking strategies in invaded lakes.

### **Subproject Results Use and Dissemination**

- A manuscript documenting the results of our historical growth analysis has been submitted to the peer-reviewed journal *Biological Invasions* (submitted draft attached).
- We have delivered several presentations at scientific conferences, meetings with managers, and to the public:
  - Bethke, B. September 2017. From little bugs to big fish: beginning to understand how AIS disrupt sport fisheries. Minnesota Aquatic Invasive Species Research Center Showcase, St. Paul, MN
  - Hansen, GJA. June 2017. Sustaining walleye populations: assessing impacts of AIS on food webs. Minnesota DNR Large Lakes meeting. Isle, MN.
  - Hansen, GJA. January 2018. Systems change in Midwestern lakes. Minnesota DNR Roundtable meeting. Bloomington, MN.
  - Ahrenstorff, T, B. Bethke, H. Rantala, and G. Hansen. June 2018. Sustaining walleye populations: assessing impacts of AIS on food webs. Minnesota DNR Research meeting. Glenwood, MN.
  - Hansen, GJA. March 2018. Ecosystem changes and effects on Walleye management. Lake of the Woods Fisheries Input group. Baudette, MN.
  - Hansen, GJA. February 2018. Systems change in Midwestern lakes. Minnesota DNR Fisheries Academy. Camp Ripley, MN.
  - Hansen, G. J. A., T. Ahrenstorff, B. Bethke, V. Brady, J. Dumke, W. French, J. Hirsch, K. Kovalenko, R. Maki, H. Rantala. 2018. Effects of zebra mussels and spiny water flea on sport fish in Minnesota's nine largest walleye lakes. Upper Midwest Invasive Species Conference. Rochester, MN.
  - Hansen, G. J. A., B. Bethke, T. Ahrenstorff, V. Brady, J. Dumke, W. French, J. Hirsch, K. Kovalenko, R. Maki, H. Rantala. 2018. You are what you eat! Beginning to understand how AIS disrupt sport fisheries. Minnesota Aquatic Invasive Species Research Center Annual Showcase. St. Paul, MN.
  - Bethke, B.J. 2018. From little bugs to big fish: beginning to understand how AIS impact sport fisheries. Emily Lakes Association Meeting. Cross Lake, MN.
  - Ahrenstorff, T. G.J.A. Hansen, B. J. Bethke, T. Ahrenstorff, W. French, J. Hirsch, H. Rantala, K. Kovalenko, J. Dumke, V. Brady, R. Maki, T. Wagner. 2019. Walleye and yellow perch first year growth changes with zebra mussel and spiny water flea invasion in Minnesota's large lakes. Minnesota and Dakota Chapters of the American Fishery Society Annual Meeting, Fargo, ND.
  - Hansen, G.J.A., B. J. Bethke, T. Ahrenstorff, W. French, J. Hirsch, H. Rantala, K. Kovalenko, J. Dumke, V. Brady, R. Maki, J. LeDuc. 2019. Effects of zebra mussel and spiny water flea on sport fish in Minnesota's large walleye lakes. Minnesota and Dakota Chapters of the American Fishery Society Annual Meeting, Fargo, ND.
  - Bethke, B.J. G.J.A. Hansen, T. Ahrenstorff, H. Rantala, H. Kelly, W. French, J. Hirsch, K. Kovalenko, R. Maki, J. Dumke, V. Brady. 2019. Fisheries food web effects of zebra mussels and spiny water flea in large north temperate lakes. Society for Freshwater Science Annual Meeting, Salt Lake City, UT.
  - Hansen, G.J.A., B. J. Bethke, T. Ahrenstorff, W. French, J. Hirsch, H. Rantala, K. Kovalenko, J. Dumke, V. Brady, R. Maki. 2019. Effects of zebra mussel and spiny water flea on sport fish in Minnesota's nine largest walleye lakes. Minnesota Department of Natural Resources Large Lakes Meeting, Walker, MN.
- Our work has been covered in the popular press and University media:

- *DNR Launches high-tech study of food webs in Minnesota's largest walleye lakes.* Tony Kennedy, **Star Tribune**. 19 August 2017 <http://www.startribune.com/dnr-launches-high-tech-study-of-food-webs-in-minnesota-s-largest-walleye-lakes/441088893/>
- Minnesota scientists dive deep to learn why walleye are stressed. Dan Gunderson, **Minnesota Public Radio**. 18 July 2017 <https://www.mprnews.org/story/2017/07/18/scientists-digging-deeper-to-understand-factors-affecting-walleye>
- Are lake invaders affecting walleye? June Breneman, **NRRI news**. 27 July 2017 <https://www.nrri.umn.edu/natural-resources-research-institute/news/ais-walleye>
- We worked with MAISRC communications staff to develop a project fact sheet (Attached), which we distributed to interested citizens and to DNR offices.
- We have maintained an active social media presence (on Twitter) describing our ongoing research. The MNDNR and NRRI public information staff are in contact with the MAISRC communications coordinator to facilitate posting of information to social media posts of all three organizations.
- We worked with MAISRC staff to develop a video describing our work, viewable here: <https://www.maisrc.umn.edu/news/walleye-video>

Attachment 1: growth manuscript in review

Attachment 2: Fact sheet