

M.L. 2017 Minnesota Aquatic Invasive Species Research Center Subproject Abstract

For the Period Ending June 30, 2020

SUBPROJECT TITLE: MAISRC Subproject 22: Copper-based control: zebra mussel settlement and non-target impacts

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

LEGAL CITATION: M.L. 2013, Chp. 52, Sec. 2, Subd. 06a; M.L. 2017, Chp. 96, Sec. 2, Subd. 06a

SUBPROJECT BUDGET AMOUNT: \$218,956

AMOUNT SPENT: \$214,526

AMOUNT REMAINING: \$4,430

Sound bite of Project Outcomes and Results

A 10-day low-dose copper treatment of an enclosed bay in Lake Minnetonka (Minnesota) was highly effective at reducing the abundance of zebra mussel veligers and preventing zebra mussel settlement success. The treatment did cause some nontarget effects including, but not limited to, reductions in native zooplankton and benthic invertebrate abundance.

Overall Subproject Outcome and Results

This study evaluated a low-dose copper treatment for zebra mussel (*Dreissena polymorpha* Pallas 1771) suppression by maintaining a mean copper concentration of 60 µg/L in waters above the thermocline for 10 consecutive days in St. Albans Bay (66.3-ha) of Lake Minnetonka, Minnesota. Robinson Bay (37.2-ha, Lake Minnetonka) was a control site. The volume of EarthTec QZ applied during five every-other-day applications was determined using copper concentrations measured in the field.

Treatment effects on zebra mussels lifestages were evaluated by analyzing changes in veliger abundance, juvenile settlement, benthic abundance, and adult survival. Treatment effects on nontargets were evaluated by analyzing changes in water chemistry properties, chlorophyll a, native fish (4 species) survival, native mussel (1 species) survival, native zooplankton abundance and richness, and native benthic invertebrate abundance and richness.

The copper concentration was maintained above 60 µg/L during the treatment period and returned to background levels between 60 and 90 days after treatment. The treatment adversely affected all life stages of zebra mussels throughout the study period. In the treated bay, veliger density was near zero 14 days after treatment, a strong reduction in juvenile settlement was observed, zebra mussel benthic density was sparse after treatment, and the odds of adult survival was substantially reduced. Detectable nontarget treatment-related effects included reductions in zooplankton abundance, chlorophyll a, and fathead minnow survival. Elevated copper residues in fish and mussel tissues were also observed. Decreases in benthic invertebrate abundance, secchi disk readings, and dissolved oxygen concentration were also observed after the treatment.

The data from this study can be used to assist in assessing if low-dose copper treatments are an appropriate zebra mussel management strategy for a waterbody. Any use of trade, firm, or product names in this report is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Subproject Results Use and Dissemination

Publications:

- Luoma J.A., Barbour M.T., and Severson T.J. (2020). Data Release: Copper-based control: zebra mussel settlement and non-target impacts. U.S. Geological Survey. Data Release. <https://doi.org/10.5066/P9B9NUQM>.

Presentations:

- Barbour M.T., Luoma J.A., Severson T.J., Wise J.K., and Dahlberg A. (2019). Low-dose copper-based control: zebra mussel settlement and non-target impacts. MAISRC Research and Management Showcase, University of Minnesota Continuing Education and Conference Center, Saint Paul, Minnesota.
- Dahlberg A., Phelps N., Waller D., Luoma J., and Barbour M. (2020). Low-dose copper-based control: zebra mussel settlement and non-target impacts (webinar). AIS Detectors Program, August 26, 2020, <https://www.maisrc.umn.edu/ais-detectors/webinars>.
- Dahlberg A., Phelps N., Waller D., Luoma J., and Barbour M. (2020). Low-dose copper-based control: zebra mussel settlement and non-target impacts (webinar). Invasive Mussel Collaborative, August 27, 2020.

Media:

- UMN Driven to Discover video: Guardians of the Lake (2019). <https://twin-cities.umn.edu/discover/guardians-lake>
- Zebra mussels research project planned for Lake Minnetonka this summer. Melissa Turtinen, Southwest News Media. 23 April 2019. https://www.swnewsmedia.com/lakeshore_weekly/news/local/zebra-mussels-research-project-planned-forlake-minnetonka-this-summer/article_750497a4-a492-5020-868b-6d752887fa0b.html
- St. Alban's, Robinson's bays will be site of zebra mussel research project. Sabina Badola, Sun Sailor. 16 April 2029. https://www.hometownsource.com/sun_sailor/free/st-alban-s-robinson-s-bays-will-be-site-of-zebra-musselresearch-project/article_fe8a1ea4-607c-11e9-aafc-63c0878d1728.html

Attachments:

- Zebra Mussel Control with Low-Dose Copper (handout)
- Photos from field work
- Effects Map