Minnesota
Aquatic Invasive Species
Research Center

2019-2021 Project Update:

Zebra Mussel Control with Low-Dose Copper

Zebra mussels (Dreissena polymorpha) are one of the most problematic invasive species in Minnesota, causing significant ecological and economic impacts in bodies of water where they have established.

EarthTec QZ is an EPA-registered proprietary formulation of copper sulfate that has been used in Minnesota for controlling dreissenid mussels in open water systems.

In 2019, MAISRC and USGS researchers conducted an experimental application of low-dose copper in Lake Minnetonka. The concentration was substantially lower than previously used for adult zebra mussels in Minnesota lakes—60 parts per billion (ppb) vs. one part per million (ppm) of free copper. This 'suppression strategy' has shown promise in early-stage trials.

The objectives of the study were to determine the effectiveness of low-dose copper for reducing zebra mussel recruitment and to monitor the response of native biota.

Approach

Pre-treatment assessments of zebra mussel density, native zooplankton and benthic invertebrate communities were conducted in early July in the treated (St. Alban's) and control (Robinson) bays in Lake Minnetonka.

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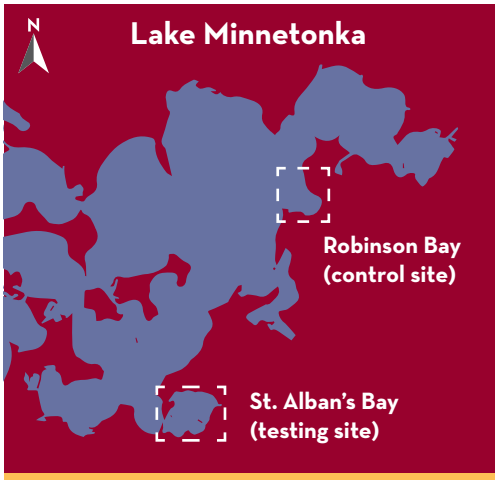


QUICK FACTS

- Low-dose, long duration treatment of 60 ppb of free copper maintained for 10 days.
- Treatments effectively reduced zebra mussel veliger density, juvenile zebra mussel recruitment, and live zebra mussel density in quadrat samples
- Non-target impacts varied during the course of the study.
- Follow up monitoring will occur in 2020 and 2021.

Approach cont.

Juveniles of four species of native fish, one species of native mussel, as well as adult zebra mussels were placed in submerged cages at several locations within each site to assess treatment-related impacts on survival and accumulation of copper in tissues. Settlement plates were placed at multiple sites within each bay to assess recruitment after the treatment.

Application of EarthTec QZ occurred in St. Alban's bay, Lake Minnetonka between July 22, 2019 and July 30, 2019. Researchers maintained a targeted concentration of 60 ppb for waters above the thermocline with five, every-other-day EarthTec QZ applications.

Preliminary Results

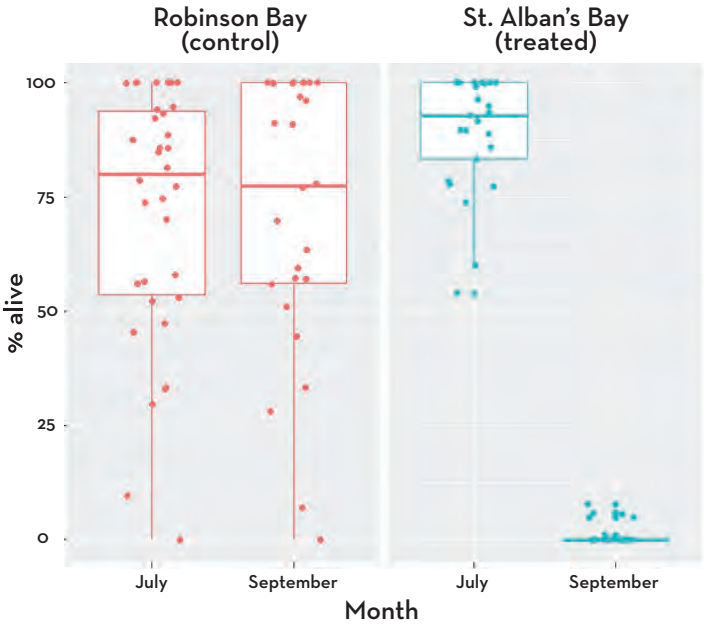
Data is under review and is preliminary; however, the results suggest that the treatment effectively reduced zebra mussel veliger density, juvenile zebra mussel recruitment, and live zebra mussel density in quadrant samples.

Potential treatment-related impacts to native species varied. Zooplankton mean density declined after exposure in the treated bay compared to an increase in the control bay. Similar trends were observed in abundance and family richness of benthic invertebrates that were collected. Chlorophyll A concentration increased about three-fold immediately after treatment, but returned to baseline levels two weeks post-treatment. No treatment-related adverse impacts were observed to the native mussels 24 hours after exposure.

Survival of caged native fish within the treated and control bays was similar except for fathead minnows. Mean fathead minnow survival was 84 and 38% in the control and treated bays, respectively. Of interest, the mean tissue copper residue in fathead minnows was higher than other fish species in the treated bay. Mean copper tissue residue was highest in zebra mussels, followed by native mussels.

Post-treatment monitoring is planned for 2020 and 2021 to determine the duration of the treatment effect on zebra mussel density in St. Alban's bay, to inform the need for retreatment, and to determine the recovery response of the native community.

Percent of living zebra mussels found



In the graph above, each dot represents results from one quadrat. The percentage refers to the number of living zebra mussels out of the total number of zebra mussels found. Quadrats with no found zebra mussels are excluded.

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