

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

For the Period Ending June 30, 2019

SUBPROJECT TITLE: MAISRC Subproject 14: Cost-effective monitoring of lakes newly infested with zebra mussels

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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: \$266,500

AMOUNT SPENT: \$225,553

AMOUNT REMAINING: \$40,947

Sound bite of Subproject Outcomes and Results

We evaluated five survey designs for estimating zebra mussel density. Double-observer surveys that allow for imperfect detection are optimal for lakes with low density; quadrat counts that assume perfect detection are optimal at higher densities. A training video, data collection worksheets, and an analysis tutorial were made available online.

Overall Subproject Outcome and Results

The current lack of standardized methods for surveying zebra mussels during their earliest stages of lake colonization limits our ability to track changes in density over time or to evaluate effectiveness of treatment programs (e.g., as required by DNR permits). We evaluated 5 different survey designs for estimating zebra mussel density (2 designs in 2017 and 3 designs in 2018), employing methods that utilize counts by two divers to estimate the probability of detecting mussels in the surveyed area. We also compared survey designs in terms of their density estimates, associated measures of uncertainty, and sampling efficiencies (time required to complete a survey), using data collected in 3 lakes of varying density and using a simulation study and analytical framework informed by our data. In 2017 in Lake Burgan, we estimated that a diver could detect between 5% and 41% of the mussels present in the surveyed area, depending on the specific diver and on whether the lake bottom was vegetated, with vegetation having the larger effect on detection. Accounting for low detectability of zebra mussels led to an estimate of density over three times higher than the observed density. Thus, for every zebra mussel detected by our divers, approximately two were missed. Using the data collected in 2018 and further simulation and analytical work, we found that double-observer survey designs that allow for imperfect detection are optimal when surveying lakes at low density, whereas quadrat counts that assume perfect detection are optimal at higher densities. We developed a training video, data collection worksheets, and an analysis tutorial so that others may implement our proposed survey designs in newly infested lakes. These tools benefit Minnesotans by providing better ways to monitor lakes infested with zebra mussels and to evaluate the effects of treatment options on zebra mussel density.

Subproject Results Use and Dissemination

We have developed several resources to facilitate uptake of our survey methods, including a website describing the project (<https://zebramusselsurveys.netlify.com/>), an instructional video demonstrating the survey methods (<https://www.youtube.com/watch?v=E3ui8SveBC0&feature=youtu.be>), data sheets and google forms for data entry (<https://zebramusselsurveys.netlify.com/forms>), and an analysis vignette or tutorial using open-source software to analyze data collected from our survey designs (<https://zebramusselsurveys.netlify.com/tutorial>).

We have submitted a paper to Freshwater Science describing the survey methods we used in our first field season, along with estimates of density in Lake Burgan in 2017; we received a favorable review, and it has been forwarded to the editor for final consideration. We are currently working on an additional manuscript comparing the different survey methods in terms of their sampling efficiency (time required to complete a survey) and the resulting density estimates and associated measures of uncertainty using data collected in 3 lakes of varying density and using a simulation study and analytical framework informed by our data.

We have presented our research results via oral and poster presentations at professional conferences (Upper Midwest Invasive Species Conference, Hawaii Conservation Conference), MAISRC Research & Management Showcase events (oral presentations and a “hands on” demonstration of our survey designs), and a MAISRC outreach event sponsored by the Pelican River Watershed District. In the fall of 2019, we plan to offer a MAISRC-sponsored webinar to discuss our work, allowing us to reach a broad audience of scientists and managers interested in zebra mussel monitoring and control efforts.