



**Environment and Natural Resources Trust Fund (ENRTF)  
M.L. 2013 Minnesota Aquatic Invasive Species Research Center  
Sub-Project Work Plan**

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**Date of Report:** June 9, 2017

**Date of Next Status Update Report:** January 31, 2018

**Date of Work Plan Approval:**

**Sub-Project Completion Date:** June 30, 2019

**Project Completion Date:** June 30, 2019

**Does this submission include an amendment request?** \_\_

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**SUB-PROJECT TITLE: MAISRC Sub-Project 15:** Determining Highest Risk Vectors of Spiny WaterFlea Spread

**Sub-Project Manager:** Dr. Valerie Brady

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**Location:**

Mille Lacs County, Minnesota

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<b>Total ENRTF Sub-Project Budget:</b>	<b>Sub-Project Budget:</b>	<b>\$122,640</b>
	<b>Amount Spent:</b>	<b>\$0</b>
	<b>Balance:</b>	<b>\$122,640</b>

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**Legal Citation:** M.L. 2013, Chp. 52, Sec. 2, Subd. 06a

**Appropriation Language:**

\$4,350,000 the first year and \$4,350,000 the second year are from the trust fund to the Board of Regents of the University of Minnesota to develop and support an aquatic invasive species (AIS) research center at the University of Minnesota that will develop new techniques to control aquatic invasive species including Asian carp, zebra mussels, and plant species. This appropriation is available until June 30, 2019, by which time the project must be completed and final products delivered.

## I. SUB-PROJECT TITLE: Determining Highest Risk Vectors of Spiny Water flea Spread

### II. SUB-PROJECT STATEMENT:

**Why:** Spiny water flea is a predatory species of zooplankton that represents a serious threat to the ecology and recreational value of Minnesota waters. As of 2015, spiny water flea (SWF) was reported in 36 lakes in Minnesota, including some of the largest basins (Superior, Kabetogama, Lake of the Woods, Mille Lacs, Rainy, Vermilion) that now unfortunately serve as potential source populations to uninfested waters. A major potential risk for the health of Minnesota lakes is that spiny water flea is a carnivore that feeds aggressively on native herbivorous zooplankton, a food resource that is shared as prey by many species of young fish including walleye, northern pike, and yellow perch. This potential competitive interaction with young fish could slow the growth and health of many native fish species in Minnesota. A second potential risk for the health of Minnesota lakes is that herbivorous zooplankton play key roles as grazers on algae, the microscopic plants that form the base of aquatic food webs. Higher concentrations of algae are directly related to lower water clarity. Thus, through removal of herbivorous zooplankton, spiny water flea threatens to reduce the health of fish through competition and to reduce water clarity through eliminating native grazers. These impacts could bring changes to Minnesota lakes that have serious implications for recreation and wildlife. Estimates are that >40% of northern Minnesota lakes provide suitable habitat for spiny water flea, indicating that management programs that foster best practices for containment are critical.

Human recreational activity is believed to be the primary vector of spread; however, little is known about the specific pathways by which dispersal occurs. Current best management practices direct recreationalists to clean, drain, and dry their equipment before moving it to another water body (this is the core message of the “Stop Aquatic Hitchhikers!” [SAH!] campaign). While this message should be effective if followed stringently, it is broad and fails to draw attention to what may be high risk equipment where decontamination effort could be focused or whose usage could be minimized or avoided altogether. Hence, while we have an opportunity to prevent further spread of spiny water flea in Minnesota, clear evidence-based educational messages and policies are urgently needed. A key aspect of spiny water flea behavior is that it migrates closer to a lake's surface at twilight to feed. This behavior increases its potential contact with surface-based equipment (e.g., boat live wells, bait buckets) that could boost the likelihood of a transport event. To increase the effectiveness of the SAH! campaign against the spread of spiny water flea, we need answers to two critical questions: 1) What forms of recreational equipment pose the highest-risk pathway for spiny water flea? 2) Does usage of recreational equipment at twilight (dusk) increase the dispersal risk of spiny water flea over midday equipment usage?

**Goal:** The goals of this project are 1) to measure and rank recreational (mostly fishing) gear in its ability to spread the adult free-swimming spiny water flea using Lake Mille Lacs as the test lake; and 2) to widely disseminate the results, our recommendations, and gear-cleaning tips both in the Mille Lacs area and throughout the state to anglers, the tourism industry, AIS managers, agency staff and legislators, and lake associations.

**How:** The goal will be accomplished by deploying commonly-used forms of recreational equipment including anchor ropes, angling lines, bait buckets, downrigger cables, and live wells and then cleaning them and comparing the “load” (total number) of spiny water flea relative to the flea’s natural abundances in surrounding Mille Lacs lake water. We will use NRRI’s boats to test the different types of gear in Lake Mille Lacs. We will set out three different types of anchor rope and have three fishing poles each rigged with a different type of fishing line, with a hookless weight on the end. One boat will also be set up for downrigging gear to determine the numbers of spiny water flea that accumulate on the steel cable and the monofilament line. One of the boats will also have a bait bucket in the water and be running water into a live well.

At the same time as the fishing gear are in the water potentially encountering and being fouled by spiny water flea, we will determine the fleas’ abundance in the water using zooplankton nets. Spiny water flea will be

cleaned from all gear being tested, and will be collected out of the plankton nets to determine ambient flea densities. Collected spiny water flea will be preserved and returned to the laboratory for microscopic analysis.

Field work will be done from July to September 2018 in Lake Mille Lacs. Lake Mille Lacs has supported spiny water flea since 2009 and is a major sport-fishing and recreational destination in the Midwest, elevating its potential threat as a source population for new infestations in other lakes. For statistical rigor, we plan to collect 30 samples per type of gear during daylight and again during twilight (evening). We anticipate collecting approximately 1000 samples total from the recreational gear and the sampling nets. Analyzing spiny water flea numbers on each gear type versus the spiny water flea densities in the lake at the same time will allow us to create a ranking of the threat that each type of gear poses for spiny water flea spread to other water bodies. We will use this information to create specific outreach messages for the public, including reminder stickers with gear cleaning tips. We will provide this information to lake associations, lake managers, anglers, and recreationalists.

**Our long-term goal** is to provide science-based information that will improve the effectiveness of current best management practices used in Minnesota to minimize pathways for AIS introduction. Movement of recreational equipment between lakes is ostensibly the leading pathway of invasion for AIS. However, we currently do not know which types of recreational gear (anchor lines and types, angling lines and types, bait buckets, downrigger cables, and live wells) pose the most risk for transporting spiny water flea. Through experimental evaluation of the number of spiny water flea on these gear types, we will be able to rank the relative threat of alternative pathways for spiny water flea transport and introduction. This will allow managers, tourism industry workers, and lake recreationalists to have specific information about which types of gear are most likely to spread spiny water flea to uninfested lakes and will help inform outreach messages and prioritize cleaning efforts. We know that very thoroughly cleaning all equipment and gear is difficult and time-consuming. The outreach messages and tips we create will help inform users of flea-infested water bodies about which of their gear poses the greatest risk for spreading the flea during daytime and twilight usage and, thus, merits the most careful cleaning. We will also be able to suggest gear characteristics (e.g., rough vs. smooth ropes or lines) that are less likely to spread the flea. The reminder stickers will help everyone remember which gear to clean the most thoroughly, and what types of line and rope will collect fewer fleas. **Our long-term outcome** is to help slow the spread of spiny water flea to uninfested lakes.

### III. SUB-PROJECT STATUS UPDATES:

**Sub-Project Status as of January 31, 2018:**

**Sub-Project Status as of July 31, 2018:**

**Sub-Project Status as of January 31, 2019:**

**Sub-Project Status as of July 31, 2019:**

**Overall Sub-Project Outcomes and Results:**

### IV. SUB-PROJECT ACTIVITIES AND OUTCOMES:

**ACTIVITY 1:** Determine risk of spiny water flea transfer by recreational gear in Lake Mille Lacs

**Description:**

We will test recreational (mostly fishing) gear in Lake Mille Lacs from July to September of 2018. By mid-July, spiny water flea populations will likely have increased to a level that will allow us to test how various gear types entangle spiny water flea. We are focusing on angling equipment because of the large number of people that

fish Lake Mille Lacs. In addition, anchors are used widely by the general public in association with boating, so we felt it was appropriate to test anchor rope types as well.

We anticipate making 6 sampling trips. During each sampling trip we will deploy commonly-used forms of angling equipment, including three types of anchor ropes, three types of angling lines, bait buckets, downrigger cables and lines, and livewells. We will not be adding lures to any fishing lines because actually hooking fish would complicate proper sampling and counting of spiny water fleas entangled on the fishing lines and cables. To determine background densities of spiny water flea in the water during each sampling event, we will sample water column densities using a vertically-towed plankton net.

For each sampling event, we will begin by deploying several replicates of each of the types of anchor lines attached to a small cement anchor to soak in the lake water for at least an hour. We anticipate creating five groupings of anchor line sets, each set containing one of each of the three types of anchor line. This will give us enough data for statistical analysis. Each anchor rope group will be marked with a large marker buoy, similar to those used to mark fishing nets, as a warning to other boaters to avoid the area. At each location where anchor ropes are set, we will take a plankton tow to determine the number of spiny water fleas in the surrounding water.

The other gear will be tested as they are used, by towing them slowly through the water. The boat with the various types of fishing gear will troll slowly while also pumping water into a live well and towing a bait bucket. After the gear have been towed 500 meters, all lines will be hauled in and preserved as separate samples to be examined later under the microscope. This set of tests will be repeated four times, providing five replicates for each gear type for use in statistical analyses. At the end of each sampling trip, all gear will be carefully decontaminated (we have a careful and thorough gear decontamination protocol), along with the boat and trailer; we do not want to spread spiny water flea to another lake ourselves.

We will also test whether gear entanglement by spiny water flea differs between daylight and twilight by pairing each daylight sampling trip with a twilight sampling trip (paired trips are planned to occur within a day or two of each other, if not the same day, but will be weather-dependent). We plan 6 paired trips (6 daylight sampling events and 6 twilight sampling events) from July through September.

**Summary Budget Information for Activity 1:**

**ENRTF Budget: \$ 93,759**  
**Amount Spent: \$ 0**  
**Balance: \$ 93,759**

**Activity Completion Date:**

<b>Outcome:</b> A large dataset on the number of spiny water flea associated with various angling/boating gear will be provided to MAISRC and MNDNR AIS specialists.	<b>Completion Date</b>
<b>1.</b> Test anchor ropes, angling lines, bait buckets, downrigger cables, and live wells in Lake Mille Lacs for entanglement with spiny water flea on 6 different daylight and evening trips, as well as collect water column samples of spiny water flea.	Fall 2018
<b>2.</b> Microscopically examine samples in the lab and count the number of spiny water flea on each gear type.	Dec. 2018
<b>3.</b> Determine spiny water flea transfer risk from each gear type using appropriate statistics.	April 2019
<b>4.</b> Write detailed report of results and conclusions; provide report to agency AIS personnel.	June 2019
<b>5.</b> Write peer-reviewed manuscript for submission to a scientific journal to inform other AIS researchers of findings.	June 2019

**Activity Status as of January 31, 2018:**

**Activity Status as of July 31, 2018:**

**Activity Status as of January 31, 2019:**

**Activity Status as of July 31, 2019:**

**Final Report Summary:**

**ACTIVITY 2:** Outreach, messaging, and MAISRC service

**Description:**

The goal of this activity is to clearly, accurately, and memorably communicate our findings to those who need to put them into practice. We will create an outreach presentation and have an article in MAISRC's AIS Spotlight e-newsletter to inform AIS managers, agency staff, lake associations, angling associations, and members of the tourism industry about our recommendations on gear cleaning and gear choice. We will create a special "training" presentation for those who work with the public on AIS spread prevention (e.g., DNR summer AIS boat launch personnel, Dock Boys and Girls, etc.). We will produce a one-page results summary as a handout; this could go on AIS websites (MAISRC [www.maisrc.umn.edu](http://www.maisrc.umn.edu), Minnesota Sea Grant <http://www.seagrant.umn.edu/>) to be easily downloaded. Minnesota Sea Grant is developing a legislative briefing newsletter to maintain regular contact with state legislators, expected to be sent out quarterly. In partnership with MAISRC, we will write up our findings and recommendations for inclusion in this newsletter to inform policy makers of our results.

We plan to publish a scientific article (see Activity 1) and participate in the 2018 and 2019 MAISRC showcase events to inform other AIS researchers and agency personnel of our results. Our data will be made available to other AIS researchers and AIS managers upon request.

To reach the public, we are partnering with the Sea Grant communications staff, MAISRC outreach staff, and UMN extension staff to create radio and TV PSA-type ads highlighting what anglers should do. We will purchase spring/summer TV and radio ad time for the Mille Lacs area. We will also send out press releases about our findings to get our message into newspapers (including Outdoor News) and radio and TV stations. These videos will also be made available on the MAISRC and Sea Grant websites. We hope to reach more anglers and boaters by writing a popular science article for Minnesota Sportsman or Cabin Life magazines.

Hearing our recommendations one time is not likely to embed them into the memories of boating and fishing enthusiasts. Thus, we will use social media (MAISRC's and Minnesota Sea Grant's Facebook and Twitter accounts) to send reminders, and will create a messaging sticker. We envision that our sticker will reinforce and perhaps slightly nuance the current outreach message to recreationalists. For example: "Clean, Drain, Dry, and don't forget your anchor rope!" or "Flea problems? Try smoother lines and ropes". These stickers will be developed by Minnesota Sea Grant's graphic designer in collaboration with MAISRC, UMN Extension staff, and Wildlife Forever. We plan to make the stickers fun, eye-catching and long-lasting (waterproof, UV-protected, etc.). We have budgeted to print up to 10,000 stickers and will place them at bait shops, gas stations near boat launches, and where fishing licenses are sold.

We will participate in 1-2 MAISRC committees as service to MAISRC and to ensure close collaboration with their group.

**Summary Budget Information for Activity 2:**

**ENRTF Budget: \$ 28,881**

**Amount Spent: \$ 0**

**Balance: \$ 28,881**

**Activity Completion Date:**

<b>Outcome:</b> Managers, anglers, the tourism industry, and Mille Lacs lake associations will know how to prevent the spread of spiny water flea from Lake Mille Lacs to other lakes.	<b>Completion Date</b>
1. In collaboration with MAISRC, U Extension staff, and Wildlife Forever, create up to 10,000 waterproof, UV-protected stickers with plain-English outreach messages for anglers and boaters on gear cleaning. For example: "Clean, Drain, Dry, and don't forget your anchor rope!" Stickers will be placed at bait shops, gas stations near boat launches, and where fishing licenses are sold.	May 2019
2. In collaboration with MAISRC, the Aquatic Nuisance Species taskforce, and Sea Grant outreach staff, we will create radio and TV PSA-type ads highlighting what anglers should do; purchase spring/summer ad time for the Mille Lacs area.	June 2019
3. Presentations to AIS managers, agency staff, lake associations, tourism industry (esp. Dock Boys and Girls), policy makers, and fishing groups. Also, social media outreach messages targeted to connect with anglers and boaters.	June 2019
4. Outreach article for Minnesota Sportsman (or similar) magazine.	June 2019
5. Service for MAISRC, including participation in the 2018 and 2019 Showcase Events and participation on 1-2 committees.	June 2019

**Activity Status as of January 31, 2018:**

**Activity Status as of July 31, 2018:**

**Activity Status as of January 31, 2019:**

**Activity Status as of July 31, 2019:**

**Final Report Summary:**

**V. DISSEMINATION:**

**Description:**

We have incorporated dissemination of our findings into our project itself as Activity 2. Please see a thorough description of our outreach and dissemination plan under Activity 2.

**Status as of January 31, 2018:**

**Status as of July 31, 2018:**

**Status as of January 31, 2019:**

**Status as of July 31, 2019:**

**Final Report Summary:**

**VI. SUB-PROJECT BUDGET SUMMARY:**

**A. Preliminary ENRTF Budget Overview:**

\*This section represents an overview of the preliminary budget at the start of the project. It will be reconciled with actual expenditures at the time of the final report. See the Sub-Project Budget document for an up-to-date project budget, including any changes resulting from amendments.

<b>Budget Category</b>	<b>\$ Amount</b>	<b>Explanation</b>
Personnel:	\$ 98,730	1 PI, 0.14 FTE and 2 co-PIs, 0.04 and 0.20 FTE for 2 yrs; 3 field techs- yr 2 only, 0.60 FTE; 1 lab tech, 0.30 FTE for 2 yrs; 1 researcher, 0.16 FTE for 2 yrs; 3 ppl in communications-yr 2 only, 0.09 FTE to work on outreach component
Professional/Technical Services and Contracts:	\$9,816	NRRI Machine shop- materials & labor to fabricate aluminum equipment arch to hold rods and gear being tested (\$1816); Print Shop- ~10,000 water/sun proof stickers (\$2000); PSA ads for television and radio in MSP market toward Mille Lacs (\$6000)
Equipment/Tools/Supplies:	\$4,456	Lab supplies (\$285) such as vials, forceps, nitrile gloves, ethanol preservative, etc.; field supplies (\$2636) such as, but not limited to, rope, containers for storing samples, electrical components to power light bar, nets, boat fuel, wheel bearing grease, decontamination of boat and trailer (hot water washes), batteries, emergency GPS subscription for 3 months, sunscreen, bug headnets, hand sanitizer, etc.; field gear for testing (\$1535) such as but not limited to bait buckets, rope, fishing line, downriggers, fishing rod/reels, tackle, swivels, etc.
Capital Expenditures over \$5,000:	\$0	
Travel:	\$9,638	MN fieldwork (\$8755) to include use of 2 NRRI trucks @ \$0.535/mi, truck+trailer fee of \$15/day, meals & lodging for 6 ppl according to UM travel policy for 10 nights; Outreach presentations (\$883) in Mille Lacs area to include mileage on NRRI vehicle @ \$0.535/mi & vehicle fee of \$10/day to deliver outreach stickers to bait shops, gas stations, boat launch, fishing license sales locations, etc.
Other:	\$0	
<b>TOTAL ENRTF BUDGET:</b>	<b>\$122,640</b>	

**Explanation of Use of Classified Staff:** None

**Explanation of Capital Expenditures Greater Than \$5,000:** None

**Number of Full-time Equivalent (FTE) Directly Funded with this ENRTF Appropriation:** 1.5

**Number of Full-time Equivalent (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation:** None

**B. Other Funds:**

Source of Funds	\$ Amount Proposed	\$ Amount Spent	Use of Other Funds
<b>Non-state</b>			
	\$0	\$0	
<b>State</b>			
Unrecovered indirect, calculated as Yr 1 base \$32,668*53%=\$17,314; Yr 2 base \$89,972*54%=\$48,585	\$65,899	\$	This is not intended to be a required match for purposes of LCCMR
<b>TOTAL OTHER FUNDS:</b>	<b>\$65,899</b>	<b>\$</b>	

*Add or remove rows as needed*

**VII. SUB-PROJECT STRATEGY:**

**A. Sub-Project Team/Partners:**

The NRRI project team consists of Dr. Valerie Brady, Josh Dumke, an aquatic invertebrate taxonomist, and several experienced lab/field technicians. Brady is an aquatic macroinvertebrate and aquatic ecosystem researcher who has managed a number of aquatic ecology research projects. She will lead the project and ensure coordination and collaboration with all project partners. Dumke is a fisheries ecologist and field crew chief who will oversee and coordinate the field research and technicians on the project. Field technicians will do much of the field sampling while working with Dumke, Brady, and Dr. Branstrator. The taxonomist and lab technicians will process all samples. NRRI staff are largely grant-supported and thus are requesting MAISRC/ENRTF funds for salary support. NRRI has much of the equipment needed for this project, including appropriate boats and trailers, trucks, research-grade microscopes, and lab space.

Dr. Donn Branstrator, UMD Biology Department and MAISRC fellow, is a respected spiny water flea expert and zooplankton researcher. He will provide specific knowledge about spiny water flea behavior, habits, and habitat preferences to this project. He will train the field sampling team and accompany them on many of the sampling trips. Branstrator has a 9-month faculty appointment and is requesting one month of summary salary support from MAISRC/ENRTF. He will provide plankton sampling nets so that these do not have to be purchased.

As appropriate, we intend to donate the angling gear purchased for this project to groups who help kids and the physically-challenged go fishing.

**B. Sub-Project Impact and Long-term Strategy:**

This proposal is designed to leverage funding that we have been awarded by St. Louis County. That project will investigate spiny water flea transfer risk from the dark, stained waters of Island Lake near Duluth. By doing a similar project on a clear water lake such as Lake Mille Lacs, we hope to determine how much differences in water clarity affect spiny water flea ensnarement on gear and, thus, the broader applicability of our results. Spiny water flea are known to migrate up and down in the water column to a lesser extent in clear water lakes; spiny water flea are also visual predators on smaller zooplankton. Both factors could affect flea entanglement on gear and cause different results for risk of transfer by recreational gear from the two different types of lakes (stained water and clear water).

**Our long-term goal** is to provide science-based information that will improve the effectiveness of current best management practices used in Minnesota to minimize pathways for AIS introduction. Movement of recreational equipment between lakes is the leading pathway of invasion for AIS. However, we currently do not know which types of recreational gear (anchor lines and types, angling lines and types, bait buckets, downrigger cables, and live wells) pose the most risk for transporting spiny water flea. Through experimental evaluation of spiny water



flea entanglement on these gear types, we will be able to rank the relative threat created by these different gear types for spiny water flea transport and introduction to other lakes. This will allow managers, tourism industry workers, and lake recreationalists to have specific information about which types of gear are most likely to spread spiny water flea to uninfested lakes, and will help inform outreach messages and prioritize cleaning efforts.

Surveys show that most people who routinely use our waterways are aware of AIS and want to prevent their spread. However, very thoroughly cleaning all equipment and gear is difficult and time-consuming. The outreach messages and products we create will help inform users of flea-infested water bodies about which of their gear poses the greatest risk for spreading the flea during daytime and twilight usage and, thus, merits the most careful cleaning. We will also be able to suggest gear characteristics (e.g., rough vs. smooth ropes or lines) that are less likely to spread the flea. The reminder stickers will help everyone remember which gear to clean the most thoroughly, and what types of line and rope will collect fewer fleas. **Our long-term outcome** is to help slow the spread of spiny water flea to uninfested lakes.

**C. Spending History: None**

<b>Funding Source</b>	<b>M.L. 2008 or FY09</b>	<b>M.L. 2009 or FY10</b>	<b>M.L. 2010 or FY11</b>	<b>M.L. 2011 or FY12-13</b>	<b>M.L. 2013 or FY14</b>

**VIII. ACQUISITION/RESTORATION LIST: N/A**

**IX. VISUAL ELEMENT or MAP(S): N/A**

**X. ACQUISITION/RESTORATION REQUIREMENTS WORKSHEET: N/A**

**XI. RESEARCH PROPOSAL:**

See attached research proposal.

**XII. REPORTING REQUIREMENTS:**

**Periodic project status update reports will be submitted no later than January 31 and July 31 each year (every six months) during 2018 and 2019. A final report and associated products will be submitted within two months of the anticipated sub-project completion of June 30, 2019.**