Environment and Natural Resources Trust Fund
2020 Request for Proposals (RFP)

Project Title: **ENRTF ID: 167-DH**

How Effective and Protective are AIS Removal Methods?

Category: H. Proposals seeking $200,000 or less in funding

Sub-Category: D. Aquatic and Terrestrial Invasive Species

Total Project Budget: $ 110,699

Proposed Project Time Period for the Funding Requested: June 30, 2022 (2 yrs)

Summary:

The best way to prevent AIS spread in Minnesota is to stop the transfer of water and living material between lakes. We will test how well boat cleaning methods work

Name: Valerie Brady

Sponsoring Organization: U of MN - Duluth NRRI

Job Title: Dr.

Department: Natural Resources Research Institute

Address: 5013 Miller Trunk Highway

Duluth MN 55811

Telephone Number: (218) 788-2753

Email vbrady@d.umn.edu

Web Address: https://www.nrri.umn.edu/about-nrri/Valerie-Brady

Location:

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Our study design testing 4 AIS removal methods on two types of boats against the DNR-preferred boat cleaning method of high pressure power washing.

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____%

PROJECT TITLE: How Effective and Protective are AIS Removal Methods?

I. PROJECT STATEMENT

The best way to prevent AIS spread in Minnesota is to stop the transfer of water and living material between lakes. We will test how well boat cleaning methods work, provide DNR with a risk assessment, and provide recommendations for boat launch cleaning station improvement to prevent AIS spread.

The problem: Boat launch inspections and cleaning campaigns focus largely on the exteriors of boats and trailers with only minimal attention paid to boat interiors and other gear. But even small amounts of water moved between lakes may transfer spiny water fleas or zebra mussel larvae. Similarly, mud, **debris and water inside the boat could transport seeds, spiny water flea eggs, small snails or bits of invasive vegetation.** When we power-washed 5 boats used in our wetland research, we captured 4,498 total organisms and plant parts from them, including more than 24 invertebrate species such as the invasive zebra mussels and faucet snails. Faucet snails can carry a parasite that has caused waterfowl die-offs in MN; they are tiny, easily transported, reproduce abundantly, and can survive many days out of water. Anglers (1.4 million MN licenses in 2018) and other boating enthusiasts typically get water, zooplankton, and bits of plant material in their boats. Duck hunters and others going to more shallow, wetland areas may get their boats much dirtier and transport different AIS.

The solution: In an ideal world, all boats and gear transported between water bodies would be completely squeaky-clean and dry. Unfortunately, this is not feasible. **While drying kills all aquatic invasives, it can take 5+ days to get boats and gear completely dry in cool, humid weather.** Not surprisingly, many people do not wait 5 days and instead try to clean their boats. How well do these cleanings work? The unmanned (non-DNR) cleaning tools and stations being purchased and placed at boat launches range from no tools (e.g., hand removal) to waterless tools (e.g., brushes, tongs, vacuums) to low-pressure garden hoses. Previous assessments of their effectiveness have focused on boat and trailer exteriors, not on the contamination inside boats. **The worst-case scenario is a false sense of security created by poorly-performing cleaning methods.** The boat owner thinks all is clean enough and is unconcerned about moving to another lake, when in reality there are spiny water fleas stuck in the live well, invasive milfoil on the floor, or faucet snails on their boots.

We will test the effectiveness of the self-service (non-DNR) AIS removal methods at cleaning boat interiors against the DNR standard for cleaning, which is to use a high-pressure water spray (a.k.a., power wash) as the best way to remove AIS from boats. **Our results will help boat launch and lake managers choose the best cleaning tools for lake protection;** help AIS personnel and agency managers customize AIS removal strategies for particular user groups and water bodies; and help cleaning station manufacturers improve their tools.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Assess how well AIS removal methods clean boat interiors and gear **Budget: $100,149**

We will use a controlled experiment to determine the effectiveness of various removal methods at cleaning both a) recreational angler boat interiors and b) duck hunter boat interiors and gear.

Specifically, we will quantify the biotic material removed by these cleaning methods available at boat launches:

1) visual inspection and hand removal	3) low-pressure water rinse from a garden hose
2) waterless tools from a cleaning station	4) using all of these methods

Each of these cleaning methods will be compared to the DNR standard of power washing to determine what was missed. This design allows us to determine how much biotic material was removed by each method, and how much was missed (by comparison to what is removed by power washing). Our results will be unbiased and not influenced by cleaning station manufacturers.

We will ensure that our tests are standardized and repeatable by creating a standardized test mixture containing a set number of dead spiny water fleas and vegetation bits in 3 gallons of water for each test and spread this mixture throughout a standard small fishing boat. We will then clean the boat on a large wash mat using one of the 4 cleaning methods and collect and preserve all material washed from the boat. This will be followed by a power wash (our control), and all this additional material washed from the boat will be collected and preserved to create a control sample to match the test sample. We will repeat this sequence 9 times for a total of ten replicates. We will then test the next cleaning method (10 times) against the power wash control. Ten replicates for each cleaning method will allow for statistical testing. The preserved samples will be counted and identified using microscopy. **We will then compare the counts from each cleaning method to their control from the power washing, allowing us to calculate a "percent missed" amount for each test** (4 cleaning methods x ten replicates = 40 separate tests, each paired with a power wash cleaning [40 power washes]).

We will also test how well the same four AIS removal methods work on the muddy boats and gear of waterfowl hunters. The experimental design will be the same: 4 cleaning methods x ten replicates, each paired with a power wash cleaning. For this test we will collect mud, snails and vegetation from a local waterfowl hunting hotspot and use that to muddy the interior of a duck hunting boat, duck decoys, waders and boots.

Outcome	Completion Date
1. Cleaning efficiency assessment of 4 AIS removal methods for angler-type boats.	November 2020
2. Living material removed from angler boat tests counted and identified.	February 2021
3. Cleaning efficiency assessment of 4 AIS removal methods for duck hunting-type boats.	November 2021
4. Living material removed from duck boat tests counted and identified.	February 2022
5. Statistical assessment of cleaning efficiencies for each type of use: angling and duck hunting.	March 2022

Activity 2: Information transfer to lake managers, agencies, and policy makers **Budget: $ 10,550**

Outreach to AIS and lake managers, inspectors and educators; agencies (e.g., MNDNR); cleaning station manufacturers; policy makers and the public about our findings.

Outcome	Completion Date
1. Provide recommendations for a) cleaning method effectiveness at removing different types of AIS; b) the best AIS removal methods and messaging for various user groups, equipment types, and AIS; and c) improving cleaning station tools and options.	May 2022
2. Outreach messages about gear cleaning to help reduce the spread of AIS.	May 2022
3. Presentation at MN Aquatic Invaders Summit, which is well attended by managers.	May 2022
4. Risk assessment webinar for agency AIS and lake management personnel.	May 2022
4. Yearly and final reports to LCCMR with recommendations and outreach messages.	June 2022

III. PROJECT PARTNERS AND COLLABORATORS: The CD3 Company is collaborating with us and providing in-kind match. They will provide a cleaning station and an engineer to assist us in configuring the cleaning station for optimal sample collection at no cost; match value $12,000.

IV. LONG-TERM IMPLEMENTATION AND FUNDING: This project will assess the effectiveness of 4 AIS removal methods to clean the interiors of angling and duck hunting boats. Managers across MN can use our results to determine what cleaning tools and methods will work best depending on lake usage and types of AIS present. Because this is an independent assessment of a typical non-DNR cleaning station, station manufacturers can use these results to increase the effectiveness of their cleaning stations. Long term, reduction in the transportation of water and biotic materials will slow the spread of AIS in Minnesota. This project will complement Mr. Doug Jensen's proposal to evaluate how targeted outreach messages improve use of boat cleaning stations.

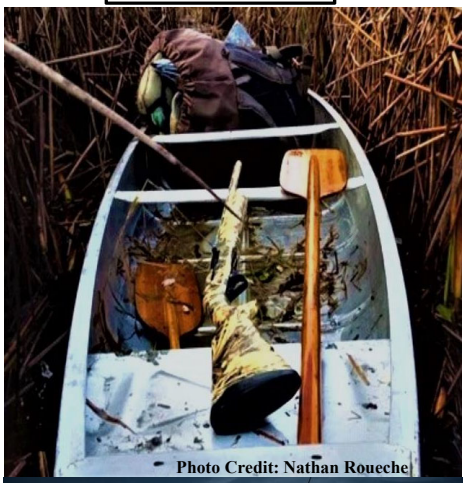
Attachment A: Project Budget Spreadsheet
Environment and Natural Resources Trust Fund
M.L. 2020 Budget Spreadsheet
Legal Citation:
Project Manager: Valerie Brady
Project Title: How Effective and Protective are AIS Removal Methods?
Organization: Natural Resources Research Institute, University of Minnesota Duluth
Project Budget: $110,699.00
Project Length and Completion Date: 2 years, June 30, 2022
Today's Date: April 7, 2019

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Budget	Amount Spent	Balance
BUDGET ITEM			
Personnel (Wages and Benefits)*	$ 106,393	$ -	$ 106,393
V Brady, Principal investigator; $8,290 (74.0% salary, 26.0% benefits); 3.0% Yr 1, 4.5% Yr 2			
J Dumke, co investigator; $35,703 (74.0% salary, 26.0% benefits); 18% Yr 1, 23% Yr 2			
H Wellard Kelly, co investigator; $25,258 (77% salary, 23% benefits); 21% Yr 1, 22.5% Yr 2			
R Hell, lead taxonomist; $14,719 (77% salary, 23% benefits); 10% Yr 1, 12.5% Yr 2			
2 techs+ 1 temp/casual+1 student; $22,423: 2 techs @ (77% salary, 23% benefits); 1 temp/casual@ (91.8%effort,8.2% salary); 1 student @ (100%salary); 10% Yr 1, 14.2% Yr 2			
***Note: NRRI research staff salaries are largely paid from external (non-University) sources.**			
Equipment/Tools/Supplies			
Field Support Supplies: Containers for water test mixture=$123, Tubs for mud test mixture=$42, Live well=$200, Duck decoys = $120, Extra Nitex mesh material =$144, Filters =$300, Supplies for pressure washer=$100, Nitrile Gloves $22, Sample vials=$290, Ethanol preservative =$90, Large capture mat for pressure washing =$1,000. Total =$2,431.0	$ 2,431	$ -	$ 2,431
Lab supplies: Durable field pencils $5, Waterproof markers $5, Waterproof paper (100 sheets) $15, 5 Gallon pails $50.00. Total=$75.00.	$ 75		$ 75
Travel expenses in Minnesota			
Field work: Travel to wetland site 20 miles x 0.58/mile x 2 trucks x 15 trips = $348.00, plus NRRI truck fee $10/day and trailer fee $5/day for 15 days = $225.00. Total =$573.0	$ 573	$ -	$ 573
Outreach travel: Mileage=200 x0.58x 1 trip + NRRI truck fee of $10/day for 2 days=$136.0; per diem travel day=41.25*2=$82.5. Outreach Total=$218.5 Minnesota Aquatic Invaders Summit (TC): Mileage=320x0.58 + NRRI truck fee $10/day for 2 days=$205.6. 2 people overnight TC = Two hotel rooms @$94.00/night=$188.00. Per diem for 2 travel days= $41.25 x 2 days x 2 people= $165. Registration x 2 people x $225.00=$450.00. Summit costs total =$1,008.6. Grand total= $1,227.1	$ 1,227		$ 1,227
COLUMN TOTAL	$ 110,699	$ -	$ 110,699

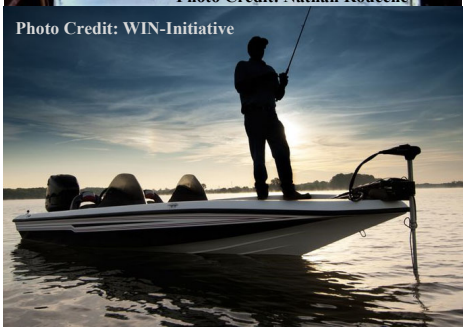
SOURCE AND USE OF OTHER FUNDS CONTRIBUTED TO THE PROJECT	Status (secured or pending)	Budget	Spent	Balance
Non-State:		$ -	$ -	$ -
State:		$ -	$ -	$ -
In kind:		$ -	$ -	$ -
In-kind Services To Be Applied To Project During Project Period: unrecovered indirect, calculated as base $110,661 x 54%=$59,777	Secured	$ 59,777	$ -	$ 59,777
In-kind Services To Be Applied To Project During Project Period: Match from CD3 company: includes free use of CD3 trailer and tools for 4 weeks, monthly lease rate=$2,000. Time donation of the CEO (40 hrs) and company engineer (40 hrs) to assist in altering the station for sample collection, in-kind contribution = $10,000. See attached letter.	Promised	$ 12,000	$ -	$ 12,000

Other ENRTF APPROPRIATIONS AWARDED IN THE LAST SIX YEARS	Amount legally obligated but not yet spent	Budget	Spent	Balance
M.L. 2013, Ch. 52, Sec 2, Subd 06a: UMN-MAISRC: Aquatic Invasive Species Research Center (PI N Phelps). Subproject : Determining Highest-Risk Vectors of Spiny Waterflea Spread. PI V Brady. 2017	$ 41,636	92,932	$ 51,296	$ 41,636
M.L. 2017, Ch. 96, Sec 2, Subd 06a, F817AIS: UMN-MAISRC: Aquatic Invasive Species Research Center Phase II (PI N Phelps). Subproject 15: Determining Highest-Risk Vectors of Spiny Waterflea Spread, cont. PI V Brady. 2019	$ 26,581	26,581	$ -	$ 26,581

Test boats:



Duck hunting boat type

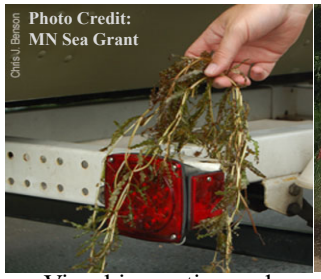


Angler boat type

AIS removal methods:

Boat on wash capture mat

Method 1:



Visual inspection and removal by hand

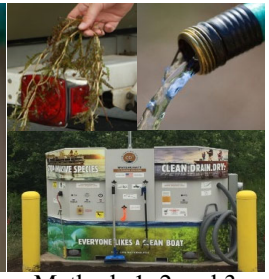
Method 2:

Visual inspection and cleaning station tools (e.g. tongs, air blower, vacuum, and scrub brush)

Method 3:

Visual inspection and low-pressure water hose

Method 4:



Methods 1, 2 and 3 combined

Number removed by each method:

Zooplankton like Spiny water flea

Plant material like Eurasian water milfoil

Invertebrates like Faucet snail

Compared with:

High-pressure power washer

F. Project Manager Qualifications and Organization Description

Dr. Valerie J. Brady, a Senior Research Program Manager at the University of Minnesota Duluth's Natural Resources Research Institute, has been leading research on aquatic invertebrates, food webs, and invasive species since her dissertation research on zebra mussel effects on wetland food webs in Lake Huron coastal wetlands in the mid-1990's. Recently she has coordinated large research and monitoring programs across the coastlines of the Great Lakes assessing the health of the Great Lakes coastal zones and wetlands. She has a current MAISRC grant investigating spiny water flea entanglement on fishing gear. She has successfully managed numerous federal and state grants collectively worth over $3M.

Ms. Holly Wellard Kelly of UMD NRRI has 15 years of experience in aquatic ecology, including identifying aquatic invertebrates, zooplankton, and algae to monitor aquatic ecosystem health. Recently, she led the effort to refine the experimental design of St. Louis County and MAISRC projects investigating spiny water flea entanglement of fishing gear, including writing the methods documents for those projects. She also has experience managing and training technicians, analyzing data, and writing reports and publications.

Mr. Josh D. Dumke is a Senior Research Scientist at UMD NRRI. Mr. Dumke has over 10 years of experience in aquatic ecology, fisheries, and performing field collection, as well as 5 years' experience coordinating and supervising technicians working on large aquatic projects. Relevant experience includes fish and invertebrate field collection and identification, safe boating practices on large lakes (including the Great Lakes), management and training of field staff, data analysis, writing SOP's and technical reports, and boat/equipment decontamination procedures to prevent the spread of aquatic invasive species during research endeavors.

The **Natural Resources Research Institute** (NRRI) is a part of the University of Minnesota Duluth. The Microscopy Laboratory, co-directed by Dr. Valerie Brady, is a 2,500 square foot facility within NRRI. Laboratory staff include aquatic macroinvertebrate, algae, and diatom taxonomists and fisheries ecologists. Staff are experienced at assessing organism assemblages from a variety of aquatic habitats, evaluating aquatic habitat conditions, and establishing biological indicators of the health of fish, amphibian, macroinvertebrate, diatom and periphytic communities. Equipment includes a variety of high quality research-grade microscopes, some with digital imaging capabilities for training, archiving images, and estimating sample biomass. NRRI field sampling equipment includes a fleet of five open water sampling vessels and two shallow water, flat bottom water craft; a variety of devices for sampling invertebrates, water quality and benthic substrates; water quality probes and meters; shallow-water electrofishing equipment; and passive fish collection equipment (Fyke trap nets, purse and standard seine nets). NRRI owns a high-pressure hot water washing unit for gear decontamination along with a rubber containment mat large enough to contain the wash water from any of our boats and trailers.

The **University of Minnesota Duluth (UMD)** is a comprehensive four-year plus graduate teaching and research university located in Duluth, MN, St. Louis County. The university's sponsored programs administration office oversees extramural funding and allows the university to successfully manage many federal and state grants, including all reporting and tracking. NRRI has dedicated accounting staff who assist researchers with tracking spending on grants and ensuring that spending follows specifications in grant budgets and timelines.