

**Environment and Natural Resources Trust Fund
2012-2013 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 035-C1

Integrated Control of Dreissenid Mussels in Minnesota Waters

Topic Area: C1. Invasive Species - Aquatic

Total Project Budget: \$ 454,522

Proposed Project Time Period for the Funding Requested: 2 yrs. July 2013 - June 2015

Other Non-State Funds: \$ 0

Summary:

Assessment of a commercially available molluscicide formulation for control of dreissenid mussels in natural waters and the use of molecular techniques for treatment optimization and dreissenid mussel detection.

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Sponsoring Organization: US Geological Survey, Upper Midwest Environmental Sciences Center

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Location

Region: Statewide

County Name: Statewide

City / Township: Statewide

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



Environment and Natural Resources Trust Fund (ENRTF) 2012-2013 Main Proposal

PROJECT TITLE: *Integrated Control of Dreissenid Mussels in Minnesota Waters*

I. PROJECT STATEMENT

There is an immediate need for safe and effective control measures to reduce the impact of dreissenid mussels (zebra *Dreissena polymorpha* and quagga mussels *D. rostriformis bugensis*) whose attachment and feeding behavior disrupt aquatic food webs and foul spawning habitats, behaviors that threaten native aquatic species like mussels and fish. The range expansion of dreissenid mussels within Minnesota lakes and rivers continues (e.g. 21 lakes were added to the list of infested waters in the last 3 years, bringing the total to about 90 waters with confirmed or interconnected dreissenid populations) while management agencies lack access to effective tools to control dreissenid mussel populations in open waters. One potential tool is the commercial product Zequanox® which contains the killed cells of a specific strain (*Pf-CL145A*) of the common soil bacterium *Pseudomonas fluorescens*. This product is registered by the U.S. Environmental Protection Agency for control of dreissenid mussels in defined discharges (e.g. in cooling and service water systems for industrial facilities). An additional 3-year, multi-agency (U.S. Geological Survey, U.S. Fish and Wildlife Service, and New York State Museum) research project is in progress to further assess the potential impacts of *Pf-CL145A* on native fish and mussel species during open water applications (**see** http://cida.usgs.gov/glri/projects/invasive_species/zm_control.html).

The overall goal of the proposed project is to develop an integrated approach to controlling dreissenid mussels in Minnesota waters. To achieve this goal, we will first prepare detailed maps of the zebra mussel populations in two infested Minnesota lakes (1 high and 1 low level infestation) using a combination of bathymetric (using high-resolution sonar systems to characterize habitat), physical (to determine zebra mussel densities) and molecular surveys (using environmental DNA [eDNA]). Next, we will select different habitats (in the high level infestation lake) in which to determine the efficacy of two *Pf-CL145A* application techniques (bottom injection versus complete water column application) for controlling zebra mussels in open water. Replicated enclosures (designed to limit water exchange) will be prepared in the selected lake at locations identified as having high zebra mussel populations with 1 of 3 treatments (control, *Pf-CL145A* bottom injection, *Pf-CL145A* complete water column [a single *Pf-CL145A* application at a rate determined from laboratory and mesocosm trials]) applied according to a randomized study design. Treatment effect will be assessed from surveys completed pre and post application with a focus on impacts on zebra mussel infestation/reinfestation and changes in non-target species present in the treated areas. This study will assess the efficacy (1) of two *Pf-CL145A* application methods to control zebra mussels in open water applications and (2) of eDNA relative to standard sampling methods as a tool to target dreissenid mussels for open water treatment. The efficacy of eDNA sampling for dreissenid mussel surveillance (i.e. early detection) will also be assessed by comparison to conventional sampling techniques.

II. DESCRIPTION OF PROJECT ACTIVITIES

Total budget: \$454,522

Activity 1: Identify *Pf-CL145A* treatment locations

Outcome	Completion Date
1. Identify study lakes and sampling locations	July 2013
2. Complete bathymetric, physical and eDNA surveys	September 2013
3. Complete bathymetric, physical and eDNA survey data processing	December 2013
4. Publish results	April 2014

Bathymetric, physical and eDNA surveys will be completed for in two infested Minnesota water bodies. Physical (e.g. divers) and eDNA sampling will be conducted over various habitat types (determined from bathymetric

survey). Physical and eDNA surveys will be compared to identify *Pf*-CL145A application locations and to determine the potential for eDNA as a treatment prioritization and evaluation tool.

Activity 2: Evaluate *Pf*-CL145A application techniques

Outcome	Completion Date
1. Complete laboratory and mesocosm evaluations of <i>Pf</i> -CL145A application techniques	August 2013
2. Publish results	January 2014

Laboratory and mesocosm studies will evaluate potential bottom injection application techniques to limit the amount of *Pf*-CL145A required during field application.

Activity 3: Complete *Pf*-CL145A field application and assessment

Outcome	Completion Date
1. Identify location of enclosures in selected lake	September 2013
2. Perform pre-treatment surveys of enclosures	September 2013
3. Perform field treatments with <i>Pf</i> -CL145A	October 2013
4. Perform post-treatment physical and eDNA surveys (spring/fall)	October 2014
5. Publish results	December 2014

Efficacy of dreissenid mussel control using *Pf*-CL145A treatments will be assessed using replicated exposures, pre- and post-treatment surveys, and multiple treatment techniques. Exposures will be conducted in replicated enclosures within a natural water body in the fall after anticipated veliger presence. Pre- and post-exposure surveys will be conducted to determine treatment success.

III. PROJECT STRATEGY

A. Project Team/Partners

USGS

- Mark Gaikowski, M.S., La Crosse, WI, Project manager
- James Luoma, B.A., La Crosse, WI, co-principal investigator
- Jon Amberg, Ph.D., La Crosse, WI PCR technical expert
- Richard Kiesling, Ph.D., Mounds View, MN hydrologist

MN DNR Ecological and Water Resources

- Gary Montz, St. Paul, MN, Research Scientist, Aquatic Invertebrate Biologist
- Nathan Olson, Fergus Falls, MN Invasive Species Specialist

Western Wisconsin Technical College

- Diane Waller, Ph.D., La Crosse, WI, co-principal investigator

Viterbo University

- Kim Fredricks, Ph.D., La Crosse, WI, project design and implementation

New York State Museum Field Research Laboratory

- Denise Mayer, Ph.D., Cambridge, NY, project design and implementation

Marrone Bio Innovations

- Sarahann Rackl, Ph.D., Davis, CA, project design
- Megan Gunvalson, M.S., Coon Rapids, MN, project design and implementation

B. Timeline Requirements

Year 1 (2013): Test site location, bathymetric, physical and eDNA surveys, laboratory and mesocosm application technique development, pre-treatment population assessments, *Pf*-CL145A application, preliminary reporting

Year 2 (2014): Post-treatment population assessments, publication of results

C. Long-Term Strategy and Future Funding Needs

Results from this proposal may result in future funding needs for larger scale demonstration applications of *Pf*-CL145A to control dreissenid mussels.

2012-2013 Detailed Project Budget

IV. TOTAL ENRTF REQUEST BUDGET 2 years (2013, 2014)

BUDGET ITEM (See list of Eligible and Non-Eligible Costs, p. 11)	AMOUNT
Personnel:	\$ -
Luoma (UMESC), project co-principle investigator (80% salary & 20% benefits) 30% FTE	\$ 39,600
Amberg (UMESC), PCR expert, analysis (70% salary & 30% benefits) 15% FTE	\$ 17,500
Waller (UMESC/WWTC), project co-principle investigator (93% salary & 7% benefits) 50% FTE	\$ 51,200
Fredricks (VU) project design, implimentation (93% salary & 7% benefits) 25% FTE	\$ 17,200
UMESC field biologists project implimentation (70% salary & 30% benefits) 30% FTE x two employees	\$ 40,000
UMESC research assistants project implimentation (93% salary & 7% benefits) 100% FTE x 2 employees x 2.5 180-d appointments	\$ 103,000
Contracts:	
Contracts: SCUBA dive support, 15 days x \$1,000/day	\$ 15,000
Minnesota Water Science Center, high-resolution substrate mapping (\$30,000 per lake)	\$ 60,000
Mayer (NYSM) project design, implimentation (salary and benefits) 10% FTE	\$ 20,000
Equipment/Tools/Supplies:	\$ -
Test material (pf-CL145A)	\$ 20,000
eDNA kits, reagent, sampling equipment (600 samples x \$20/sample)	\$ 12,000
Laboratory and mesocosm tanks, application equipment	\$ 10,000
Field enclosure supplies, sampling gear	\$ 20,000
Expendable supplies	\$ 5,000
Survey/transect equipment, tools, nets	\$ 2,500
Acquisition (Fee Title or Permanent Easements):	N/A
Travel:	\$ -
Mapping \$123/day x 10 days x 4 people	\$ 4,920
Sampling, eDNA/conventional \$123/day x 30 days x 2 people	\$ 7,380
Pre-treatment surveys \$123/day x 5 days x 5 people	\$ 3,074
Treatment \$123/day x 5 days x 5 people	\$ 3,074
Post-treatment assessment surveys \$123/day x 5 days x 5 people	\$ 3,074
Additional Budget Items:	\$ -
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 454,522

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State \$ Being Applied to Project During Project Period: USGS overhead expenses (48%); secured, pending Federal appropriation	\$ 218,171	Secured
Other State \$ Being Applied to Project During Project Period:	N/A	N/A
In-kind Services During Project Period: Travel, computer, Pf-CL145A, Project manager salary	\$ 42,000	
Remaining \$ from Current ENRTF Appropriation (if applicable):	N/A	N/A
Funding History: GLRI Grant	\$ -	

Program Manager

1. Name: Gaikowski, Mark P.
2. Present Position: Supervisory Biologist GS-401/14
3. Education:

<u>Degree and Major</u>	<u>Date</u>	<u>School</u>
M.A. Biology	05/1994	University of South Dakota
B.S. Biology	12/1991	University of South Dakota
4. Experience: Supervisory Biologist. U.S. Geological Survey, Upper Midwest Environmental Sciences Center (UMESC). August 2009 to present. I manage a multifaceted research branch at the UMESC which includes biologists, research fish biologists, microbiologist, research physiologists and chemists conducting research to support the registration of fishery management chemicals including the chemicals used to control sea lamprey populations in the Laurentian Great Lakes and drugs used to control diseases of fish reared in private and public aquaculture. Studies also assess the effects of human and veterinary pharmaceutical products on aquatic organisms. I oversee and approve research protocols for work conducted under strict Good Laboratory Practice regulations of the U.S. Environmental Protection Agency and the U.S. Food and Drug Administration.
5. Research Specialties: Aquatic Toxicology.
6. Current Primary Research Assignments: Develop species-specific toxicants and targeted delivery of agents to control Asian carps and dreissenid mussels. Develop molecular surveillance technologies to determine the presence/absence of aquatic invasive species like Asian carp or dreissenid mussels.
7. Contract Research or Special Assignments: Use of Aquaflor[®] in channel catfish, rainbow trout and tilapia (5 studies); evaluate the potential effects of *Pseudomonas fluorescens* (Pf-CL145A) exposure to native fish and mussels.
8. Publications, Reports & Other Public Expression: Co/author of 29 journal articles, >60 completion reports and >90 scientific presentations.

Organization description

The U.S. Geological Survey (USGS) is a science organization that provides impartial information on the health of our ecosystems and environment, the natural hazards that threaten us, the natural resources we rely on, the impacts of climate and land-use change, and the core science systems that help us provide timely, relevant, and useable information. The USGS serves the Nation by providing reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life.

The Upper Midwest Environmental Sciences Center (UMESC) is one of the leading USGS research centers conducting ecological research to support the Department of the Interior's and other local, state and federal resource agencies management of natural resources, fish, and wildlife. For more than a half century we've served the public and our partners by generating quality relevant scientific products and information for the improved management of our natural resources, including water, wildlife and land. We help protect these invaluable resources to improve our health and recreational opportunities for both today's and tomorrow's generations.

UMESC scientists work on the control of aquatic invasive species such as Asian carp, zebra mussels, and sea lamprey. Other research is conducted on the effects of contaminants (both industrial compounds such as PCBs and dioxins, and emerging contaminants such as pharmaceuticals) on fish and wildlife. We are concerned about the wildlife, and how these contaminants move through the environment to potentially affect human health. We also study threatened and endangered species such as amphibians and native freshwater mussels. The Mississippi River is an invaluable resource providing drinking water, recreation, transportation, and aesthetics to millions of Americans. Our research and monitoring assesses the health, status and trends of the Upper River and helps determine how large complex river systems function. This work provides critical information needed by river managers to improve this magnificent resource while maintaining its multiple uses.

