

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

Project Title:

ENRTF ID: 034-C1

Evaluating Effects of Pf-CL145A on Native Aquatic Animals

Topic Area: C1. Invasive Species - Aquatic

Total Project Budget: \$ 146,800

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

Other Non-State Funds: \$ 0

Summary:

Assessment of impacts of a commercially available molluscicide formulation on the reproduction and development of native fish as well as impacts on larval aquatic insect survival.

Name: Mark Gaikowski

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: Evaluating effects of *Pf*-CL145A on native aquatic animals

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 water distribution pipes). An additional 3-year, multi-agency (U.S. Geological Survey, U.S. Fish and Wildlife Service, and New York State) research project is in progress to identify 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).

However, a more thorough understanding of the potential impacts of commercial formulations of *Pf*-CL145A on non-target native species is warranted to provide decision support information to management agencies regarding the feasibility of treating open waters with *Pf*-CL145A. The overall goal of this project is to evaluate the potential impacts of *Pf*-CL145A on the reproductive success of native fish populations and the potential acute exposure effects to larval aquatic insects at exposure rates anticipated for use during open water applications. Specifically, we will use fathead minnows *Pimephales promelas* as a model species to assess the potential risk of open water application of *Pf*-CL145A to the reproductive success of native fish. Adult fathead minnows (F0 generation) will be exposed to *Pf*-CL145A during reproduction to determine potential effects on reproductive output. Hatch success will be assessed from eggs produced by exposed adults and from exposed eggs from unexposed adults. A subset of fry (F1 generation) from exposed F0 adults will be reared to adulthood for subsequent exposure and assessment of reproductive output and hatch success. We will also assess the potential impacts of *Pf*-CL145A on larval aquatic insects (mayflies [*Hexagenia sp.*] and caddisflies [order *Trichoptera*]). These insects are a common food source for many aquatic animals. Acute toxicity studies will be completed to assess the exposure risk of a commercial formulation of *Pf*-CL145A during open water application to larval aquatic insects using standard toxicity assays with exposures that mimic proposed *Pf*-CL145A open water applications followed by a minimum 96-hour post-exposure observation period.

II. DESCRIPTION OF PROJECT ACTIVITIES

Total budget: \$146,800

Activity 1: Effects of *Pf*-CL145A on fathead minnow (FHM) reproduction

Outcome	Completion Date
1. Determine reproductive success (egg deposition and % egg hatch) of adult FHM (F0 generation) following exposure to <i>Pf</i> -CL145A during spawning	October 2013
2. Compare growth of fry from exposed and unexposed F0 adult FHM	February 2014
3. Determine reproductive success (egg deposition and % egg hatch) of adult FHM (F1 generation) following exposure to <i>Pf</i> -CL145A during spawning	October 2014

4. Publish results	December 2014
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Adult fathead minnows (F0 generation) will be exposed to a single static application of *Pf*-CL145A at multiples of the rate projected for use in open water applications (e.g. 0, 1, 2X the rate). All exposures will be completed in a laboratory setting. Fish will be observed for spawning activity for up to 30 days after treatment. The number of eggs deposited on each spawning tile will be determined and the tiles will be monitored to determine percent hatch. A subset of the resulting fry (F1 generation) from each treatment group will be reared to adult to compare development and future reproductive success to that of untreated controls using the same exposure procedures as those used for the F0 generation.

Eggs from naïve fish will be exposed to a single static application of *Pf*-CL145A at multiples of the rate projected for use in open water applications (e.g. 0, 1, 2X the rate) at different times during egg development to assess the potential impact of *Pf*-CL145A open water application on fish embryo development. A subset of the resulting fry from each treatment group will be reared to adult to compare development between exposed and control groups.

Activity 2: Effects of *Pf*-CL145A on survival of Aquatic Insects

Outcome	Completion Date
1. Determine survival of mayflies exposed to <i>Pf</i> -CL145A	Sept 2014
2. Determine survival of caddisflies exposed to <i>Pf</i> -CL145A	Sept 2014
3. Publication of results	Dec 2014

Mayfly and caddisfly (when available) nymphs will be collected in the spring (March/April), summer (June/July) and fall (September/October) from the upper Mississippi River. Acute toxicity studies will be completed to assess the potential effect of open water application of *Pf*-CL145A to control dreissenid mussels on larval aquatic insects. Toxicity studies will be completed at the collection temperature and at a reference temperature (12 ± 2°C).

III. PROJECT STRATEGY

A. Project Team/Partners

USGS Upper Midwest Environmental Sciences Center

Mark Gaikowski, M.S., La Crosse, WI, Project manager
James Luoma, B.A., La Crosse, WI, co-principal investigator

MN DNR Ecological and Water Resources

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

Viterbo University

Kim Fredricks, Ph.D., La Crosse, WI, co-principal investigator

Western Wisconsin Technical College

Diane Waller, 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

B. Timeline Requirements

Year 1 (2013) – F0 fathead minnow exposure (April – September)
Year 2 (2014) – F1 fathead minnow exposure, aquatic insect exposure (April – November)

C. Long-Term Strategy and Future Funding Needs

Results from this proposal may result in future needs for determination of the impacts of commercial formulations of *Pf*-CL145A on native fish and insect populations in a natural setting.

2012-2013 Detailed Project Budget

IV. TOTAL ENRTF REQUEST BUDGET (2013, 2014)

BUDGET ITEM (See list of Eligible and Non-Eligible Costs, p. 11)	AMOUNT
Personnel:	\$ -
Fredricks (VU) co-principle investigator, project design, implementation (93% salary & 7% benefits) 80% FTE	\$ 40,300
Luoma (UMESC), project co-principle investigator (80% salary & 20% benefits) 10% FTE	\$ 10,000
Waller (UMESC/WWTC), project design, implementation (93% salary & 7% benefits) 10%	\$ 5,500
UMESC biologist, project implementation (70% salary & 30% benefits) 25% FTE	\$ 16,000
UMESC research assistants project implementation (93% & 7% benefits salary) 100% of two 180-d temporary positions	\$ 45,000
Contracts:	n/a
Equipment/Tools/Supplies:	\$ -
Test material (Pf-CL145A)	\$ -
Laboratory tanks, application equipment	\$ 10,000
plumbing supplies, tubing, etc	\$ 12,500
pumps	\$ 2,500
field collection gear	\$ 4,000
Acquisition (Fee Title or Permanent Easements):	N/A
Travel:	\$ -
Insect collection	\$ 1,000
Additional Budget Items:	\$ -
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 146,800

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	\$ 70,464	<i>Secured</i>
Other State \$ Being Applied to Project During Project Period:	N/A	N/A
In-kind Services During Project Period: Project manager time, Pf-CL145A material	\$ 20,000	N/A
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.

