

## Trust Fund 2009 Work Program

**Date of Report:** May 8, 2009  
**Date of Next Progress Report:**  
**Date of Work Program Approval:**  
**Project Completion Date:** June 30, 2011

### **I. PROJECT TITLE:** Controlling the Movement of Invasive Fish Species

**Project Manager:** Vaughan R. Voller  
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**Location:** Laboratory studies will be conducted at the Saint Anthony Falls Laboratory, Minneapolis and the St. Paul Campus of the University of Minnesota.

<b>Total Trust Fund Project Budget:</b>	<b>Trust Fund Appropriation:</b>	<b>\$</b>	<b>300,000</b>
	<b>Minus Amount Spent:</b>	<b>\$</b>	<b>0</b>
	<b>Equal Balance:</b>	<b>\$</b>	<b>300,000</b>

**Legal Citation:** M.L. 2009, Chp.143, Sec. 2 , Subd. 6d.

### **Appropriation Language:**

\$300,000 is from the trust fund to the Board of Regents of the University of Minnesota to develop and test sonic barriers that could be effective in preventing and controlling the movement of invasive carp in Minnesota's waterways. This appropriation is available until June 30, 2012, at which time the project must be completed and final products delivered, unless an earlier date is specified in the work program.

### **II. PROJECT SUMMARY AND RESULTS:**

Great ecological benefit for many Minnesota lakes will be gained if effective barriers can be constructed to control the movement of invasive carp. A class of barrier technology, that shows promise for this application, is based around the use of air bubble curtains that generate sonic and other fields. Not only do the physical fields, e.g., sound and displacement, generated by bubble curtains have the potential to be targeted to exploit the biology of carp, barriers based on bubble curtains can also be inexpensive, portable, and safe.

The goal of the current project is to design and assess the effectiveness of bubble curtain barrier technologies as a means of controlling carp movements in the connection channels of lake systems.

Two main outcomes are expected:

(1) Laboratory flume studies to demonstrate the effectiveness of bubble curtains as a potential barrier for carp movement. This will involve (i) measuring and analyzing carp responses to the physical fields generated by various bubble-curtains and (ii) the optimization of bubble curtain designs under various flow conditions.

(2) Preliminary determination of the effectiveness of bubble curtain barriers to control carp movement at the field scale. This testing will utilize the Outdoor Stream Laboratory (OSL) and main channel at the Saint Anthony Falls Laboratory; facilities that provide a field scale stream settings which can be tightly controlled and monitored. This approach will, through systematic testing and enhancement, assess the feasibility of carp barrier designs based on bubble curtains.

### **III. PROGRESS SUMMARY AS OF (date):**

### **IV. OUTLINE OF PROJECT RESULTS:**

#### **Result 1: Laboratory Investigation: Engineering**

**Description:** The objective of this phase of the study is to develop the necessary engineering infrastructure to allow for the building, design and optimization of bubble curtain barriers. The main goals are to (i) design and develop devices for creating bubble curtains in flume systems, (ii) to identify, measure the physical fields created by said bubble curtains, and (iii) to understand how these physical fields are modified by different operating (pressure, orifice placement, etc) and environmental (flow velocity, flow depth, temperature, etc) conditions.

**Summary Budget Information for Result 1:** Trust Fund Budget: \$ 101, 264  
Amount Spent: \$ 0  
Balance: \$ 101,264

<b>Deliverable</b>	<b>Completion Date</b>	<b>Budget</b>
<b>1.</b> Designs of diffusers for bubble curtains	3/31/2010	\$33,000
<b>2.</b> Quantitative description of the physical fields generated by sub-aqueous bubble curtains	9/30/2010	\$33,000
<b>3.</b> Quantitative description of the effects of design and environmental parameters on the physical fields generated by a bubble curtains	3/31/2011	\$35,264

**Completion Date:** 3/31/2011

**Result Status as of (3/31/2010):**

**Result Status as of (9/30/2010):**

**Result Status as of (3/31/2011):**

**Result 2:** Laboratory Investigation: Biology

**Description:** The objective is to determine whether bubble curtains produce sensory stimuli that can impede the directed movement of juvenile invasive common carp. Biological work will proceed in three steps: i) Determining if a bubble curtain can impede carp from moving either down- or up-stream in a laboratory flume running at a typical field depth; ii) Determining what sensory field is responsible for this impediment ; iii) Determining how to optimize this field(s) to impede carp movement in a laboratory flume.

**Summary Budget Information for Result 2:** Trust Fund Budget: \$ 109,352  
Amount Spent: \$ 0  
Balance: \$ 109,352

Deliverable	Completion Date	Budget
1. Testing and documentation of the effectiveness of bubble curtains to impede the movement of juvenile carp in a laboratory flume. Questions: What is level of deterrence? Why does the curtain it deter movement? How can it the repulsive effects be optimized	3/31/2011	\$109, 352

**Completion Date:** 3/31/2011

**Results status of (3/31/2010):**

**Results status of (9/30/2010):**

**Results status of (3/31/2011):**

**Result 3:** Field channel investigation

**Description:** The objective of this phase is to integrate the engineering and biological studies in results 1 and 2 to construct an outdoor carp barrier which employs a bubble curtain(s). This study will be conducted in the Outdoor Stream Laboratory Stream Lab (OSL) and main channels at SAFL which are highly controlled and monitored facilities mimicking field conditions. The main goal is to test the effectiveness of bubble curtain barriers in stream conditions.

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**Summary Budget Information for Result 3:** Trust Fund Budget: \$ 89,384  
Amount Spent: \$ 0  
Balance: \$ 89,384

<b>Deliverable</b>	<b>Completion Date</b>	<b>Budget</b>
<b>1.</b> Testing and documentation of the effectiveness of bubble curtain barriers to deter the movement of carp in small streams (SAFL OSL and main channel)	6/30/2011	\$ 44,384
<b>2.</b> Identification of the bubble diffuser designs that have the best potential to create bubble curtain based carp barriers for small streams. (SAFL OSL and main channel)	6/30/2011	\$45,000

**Completion Date:** 6/30/2011

**Result Status as of** (9/30/2010

**Result Status as of** (3/31/2011):

**Result Status as of** (6/30/2011):

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## **V. TOTAL TRUST FUND PROJECT BUDGET:**

**Personnel:** \$ 261,000

(Note: includes 30% lab fee on \$18,240 salaries of SAFL employees = \$5472)

**Equipment/Tools/Supplies:** \$ 36,000

Details of estimated expenditures

--Modifications of Flumes (2-3 small laboratory flumes) (includes, refurbishing, plumbing, sound installation, instrumentation); \$7,000

--Modification of SAFL Outdoor Stream Lab and Main channel (includes, hardware for channel design, Instrumentation for monitoring environmental conditions -water quality, temperature, flow-, compressors for bubble generation); \$7,000

--Manufacture of 4-5 diffusers to create bubble curtains; \$3,000

4 Hydrophones (to measure and create sound, B&K 8103 or similar, \$1000 per) \$4,000

--Video Camcorder with DVD recording and infrared capabilities \$800

--Lap-top computer with lab-view software dedicated to data collection and signal processing from hydrophones \$1,500

--Cost of fish (~1500 juvenile carp with fed-ex shipping and handling, \$3 per fish) \$4500

--Fish Storage Tank, \$1,500

--Fish Care and feeding, \$4,000

--General experimental supplies (tubing, data storage devices, clamps, etc). \$2,700

**Travel:** \$ 3,000

(\$ 2,000 will go toward allowing Duluth based PI to attend 6-8 meetings in MSP – made up of mileage and one-night in a hotel per visit- \$1,000 for post doc travel)

**TOTAL TRUST FUND PROJECT BUDGET: \$300,000**

**Explanation of Capital Expenditures Greater Than \$3,500:**

## **VI. PROJECT STRATEGY:**

### **A. Project Partners:**

Vaughan Voller, Civil Engineering and SAFL (PI) \$17,500

Miki Hondzo, Civil Engineering and SAFL (Co-PI) \$15,000

Allen Mensinger, Biology, UMD (Co PI), \$16,000

Peter Sorensen, Fisheries, Wildlife and Conservation Biology (Co-PI) \$15,000

TBA(Post-Doc) \$117,059

Mike Plante SAFL (Machinist) \$4,639

Chris Ellis SAFL (Engineer) \$19,073

Adam Recknor SAFL (Accountant), \$4,056

TBA Graduate Student, \$52,673

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

Common carp (*Cyprinus carpio*) comprises over half the biomass in a third of Minnesota lakes. The feeding habits of this species significantly disrupt lake sediments leading to an over-enrichment of nutrients. This process, referred to as eutrophication dramatically reduces water quality. Research on the common carp is actively supported by the LCCMR and two watershed districts and is demonstrating that the root of the problem are common carp 'nursery' lakes which feed into larger lakes through small creeks. However, while presently funded/ ongoing research is suggesting solutions to suppress carp reproduction and abundance in these nurseries, the utility of this work could be held back by an inability to stop young carp from re-infesting cleared systems through the inter-connected creeks. Fish barrier technologies that show promise for this application are those based around air bubble curtains. Not only do the physical fields, e.g., sound and displacement, generated by bubble curtains have the potential to be targeted to exploit the biology of carp, barriers based on bubble curtains can also be inexpensive, portable, and safe. To date, however, there has been no public domain research on appropriate design guidelines for optimizing air bubble curtain barrier technologies. The main objective of this proposal is to address this shortfall and provide design guidelines for the use of bubble curtain barriers in small inter-connecting creeks. In addition to providing a potential ecological management tool for the control of common carp already in Minnesota lakes this project may also provide key information toward building effective tools for the Asian carp; a species which poses a very similar suite of challenges.

**C. Other Funds Proposed to be spent during the Project Period:**

Salary support for the participation of the manager of the Outdoor Stream Lab at SAFL in this project will be covered by funds from SAFL. In addition basic operating costs for this major research facility will be also be covered by SAFL

**D. Spending History:**

**VII. DISSEMINATION:**

1. Publications in peer-reviewed literature
2. Presentations at scientific meetings
3. Web site, <http://personal.ce.umn.edu/~voller/>

**VIII. REPORTING REQUIREMENTS:**

Periodic work program progress reports will be submitted not later than 3/31/2010(Note due to hiring logistics project will not start until Aug 30, 2009), 9/30/2010, 3/31/2011, 6/30/2011. A final work program report and associated products will be submitted between June 30 and August 1, 2011 as requested by the LCCMR

<b>Project Title:Novel barrier technologies for invasive species of fish</b>											
<b>Project Manager Name:</b> <i>Vaughan Voller</i>											
<b>Trust Fund Appropriation:</b> \$ <i>300,000</i>											
<b>2009 Trust Fund Budget</b>	<b><u>Result 1 Budget:</u></b>	<b>Amount Spent</b> <i>(date)</i>	<b>Balance</b> <i>(date)</i>	<b><u>Result 2 Budget:</u></b>	<b>Amount Spent</b> <i>(date)</i>	<b>Balance</b> <i>(date)</i>	<b><u>Result 3 Budget:</u></b>	<b>Amount Spent</b> <i>(date)</i>	<b>Balance</b> <i>(date)</i>	<b>TOTAL BUDGET</b>	<b>TOTAL BALANCE</b>
	<i>Laboratory Investigation: Engineering</i>			<i>Laboratory Investigation: Biology</i>			<i>Field channel investigation.</i>				
<b>BUDGET ITEM</b>											
<b>PERSONNEL: wages and benefits</b>	86,687			95,891			72,950			255,528	
Vaughan Voller(PI) 4%FTE (\$17,500)											
Miki Hondzo(Co-PI) 4%FTE (\$15,000)											
Allen Mensinger(Co PI) 6%FTE (\$16,000)											
Peter Sorensen(Co-PI) 4%FTE(15,000)											
TBA(Post-Doc) 100%FTE (\$117,000)											
Mike Plante (Machinist) 4%FTE (includes a 30% charge for lab fees) (\$3,568)											
Chris Ellis(Engineer) 8%FTE(includes a 30% charge for lab fees)(\$14,672)											
Adam Recknor(Accountant) 3%FTE(\$4,056)											
TBA Graduate Student 45% FTE (1.5 years of project)(\$52,673)											
<b>Lab Fees</b> (the use of employees of SAFL is subjected to a 30% charge to cover lab fees)	2,077			461			2,934			5,472	
Chris Ellis Engineer 30% of \$14,672=\$4,401											
Mike Plant Machinist 30% of \$3,568=\$1,071											
<b>Non-capital Equipment / Tools</b> (Detailed breakdown of cost provided under section V on project work plan)	7,000			7,000			7,000			21,000	
<b>Supplies</b> (Fish and other experimental supplies, detailed breakdown provides under section V on project work plan)	5,000			5,000			5,000			15,000	
<b>Travel expenses in Minnesota</b> (details provided in section V of project work plan)	500			1,000			1,500			3,000	
<b>COLUMN TOTAL</b>	<b>\$101,264</b>	<b>\$0</b>	<b>\$101,264</b>	<b>\$109,352</b>	<b>\$0</b>	<b>\$109,352</b>	<b>\$89,384</b>	<b>\$0</b>	<b>\$89,384</b>	<b>\$300,000</b>	<b>\$0</b>

