Environment and Natural Resources Trust Fund
2015 Request for Proposals (RFP)

Project Title: **ENRTF ID:** **087-D**

Small Fish, Big Problem: Understanding Minnesotas Baitfish Industry

Category: D. Aquatic and Terrestrial Invasive Species

Total Project Budget: $ 236,526

Proposed Project Time Period for the Funding Requested: 2 years, July 2015 - June 2017

Summary:

Movement of AIS and disease with baitfish is a major concern for mangers. In response, we will describe the movement network and implement a modeling tool for evidence-based decision making.

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Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Visual shows the movement of baitfish for one mid-sized producer in Minnesota. Other figures are provided highlighting the magnitude of the industry and potential risks.

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

PROJECT TITLE: Small fish, big problem: Understanding Minnesota's baitfish industry

I. PROJECT STATEMENT

Each year, hundreds of millions of baitfish (e.g. minnows) are wild-caught and farm-raised, sold through retail outlets, and eventually used as bait in countless bodies of water throughout Minnesota and beyond. **The potential to inadvertently transfer aquatic invasive species and emerging disease into new regions through the movement of baitfish is a significant concern for fisheries managers.** In fact, a 2013 MN DNR Report to the MN Legislature identified the harvest of wild caught baitfish as the highest risk factor for invasive carp introduction after direct hydrologic connection. The same concerns have been expressed in relation to emerging diseases, such as viral hemorrhagic septicemia, which may have been introduced into the Great Lakes via frozen baitfish. Despite those threats, the movement of baitfish remains largely undocumented (see attached figure) – putting Minnesota's precious natural resources and delicate ecosystems at risk.

Also at risk is the economic impact of baitfish, valued in excess of $5 million in direct sales, which is amplified at the retail sector and supports a multi-billion dollar recreational fishery. More than 300 individuals/businesses are licensed to harvest or produce baitfish in Minnesota and more than 1,000 bait shops licensed to sell the fish. Continued viability of this industry is important for the rural economy and culture of Minnesota.

To effectively manage threats in the event of an AIS (aquatic invasive species) or disease introduction to the baitfish supply chain, **managers and the industry need to understand the complex network of baitfish movements in Minnesota.** We propose the use of mathematical modeling, which has proven to be useful for exploring and understanding the movements of other animals and products. This approach allows managers to assess disease/movement dynamics in scenarios where it is not feasible to do a controlled study. Baitfish movements are particularly complex in nature because they are influenced by a myriad of social, economic, demographic, regulatory, and environmental factors that vary in time. Because those movements dictate the pattern of invasive species or disease spread in the event of an introduction, information on the characteristics of the contact network may be used to predict the spread of a hypothetical epidemic. **Once predicted, managers will have a tool in which they can rapidly implement a wide variety of theoretical control measures within the model to simulate potential outcomes.** For example, if a load of baitfish were to be infested with zebra mussels, the model could predict locations where the baitfish would subsequently move and outcomes for potential interventions ranging from complete prohibition to seasonal restrictions to maintaining the status quo.

Our ultimate goal is to protect the long-term health and sustainability of Minnesota's fish populations, while developing a safe and viable baitfish industry. This goal will be achieved by understanding and mathematically modeling the complex baitfish networks in Minnesota and developing a user-friendly modeling interface to simulate the impact of control interventions. More specifically, we will:

1. Characterize the network of wild-caught and farm-raised baitfish movement in Minnesota
2. Develop a mathematical model for the hypothetical spread of AIS and disease epidemics
3. Create user-friendly online tool to simulate threats and evaluate management options
4. Estimate the cost-effectiveness of alternative control strategies to mitigate the impact of the hypothetical introduction of invasive species and foreign diseases

To our knowledge this will be the first comprehensive effort to model a baitfish network. This will provide fisheries managers with a first of its kind decision support tool, helping to inform risk-based, strategic, and evidence-based management recommendations.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: *Characterize the network of wild-caught and farm-raised baitfish movement in Minnesota* **Budget: $96,500**

Pre-existing data sources, such as MN DNR license data will be organized. Baitfish industry stakeholders (i.e. producers, harvesters, bait shops) will be queried during a workshop, face-to-face interviews, and mail questionnaires to collect additional information not available in the databases. A mathematical network model will be developed and parameterized using the information collected in the dataset. The structure of the model will be presented to stakeholders, in which critical parameterization will be assessed and reviewed until reaching consensus in the audience.

Outcome	Completion Date
1. Descriptive summary of wild-caught and farm-raised baitfish demographics and movements in Minnesota	*February 2016*
2. A mathematical model to simulate AIS and disease spread via baitfish movement	*August 2016*

Activity 2: *Model experimentation and transfer to end users* **Budget: $140,026**

In collaboration with stakeholders, model outcomes will be presented and evaluated. General discussions on alternative strategies to mitigate risk will be conducted. Alternative control strategies will be implemented into the model and outcomes will be discussed. A user-friendly online tool will be created based on the model for AIS and disease simulations. Training workshops will be conducted to educate MN DNR staff and interested stakeholders on the use of the tool. Lastly, the tool will be deployed and implemented for its use by private and public organizations.

Outcome	Completion Date
1. Assessment on the impact of alternative strategies to control AIS and disease spread in MN	*February 2017*
2. A user-friendly online tool to model baitfish movement for management and mitigation of AIS and disease spread developed and use by private and public stakeholders	*June 2017*

III. PROJECT STRATEGY

A. Project Team/Partners: The University of Minnesota offers a unique environment to conduct the research necessary to develop the tool and associated educational and outreach aspects. The project team to be funded by the ENRTF includes Principal Investigator Nick Phelps (UMN-CVM), and Co-Investigators Meggan Craft (UMN-CVM), Eva Enns (UMN-SPH), Andres Perez (UMN-CVM), and Paul Venturelli (UMN-CFANS), one graduate student, and a contracted computer programmer. Members of the project team not to be funded by the ENRTF consist of MN DNR Division of Fish and Wildlife and David Fulton (MN Cooperative Fish and Wildlife Research Unit). The MN DNR has identified understanding the complex baitfish network in Minnesota as a high priority.

B. Project Impact and Long-Term Strategy: This is a research activity intended to create a mathematical modeling tool for management and mitigation of threats to aquatic natural resources of the state. We will formulate, parameterize, and implement the tool in a user-friendly online platform. Public and private stakeholders interested in making use of the tool, including the MN DNR, will be trained on its operation and abilities. Finally, the tool will be deployed to interested stakeholders for its use and long-term maintenance. While initially developed for the baitfish network, the tool could be modified to model other natural resource threats in the State and eventually, to other states and countries. In collaboration with the FAO of the United Nations and the USAID, we will seek for expansion at the national and international levels.

C. Timeline Requirements: Two years (July 2015 – June 2017) is required to collect and analyze one year of baitfish movement data, generate a network model based on these data, and develop a user-friendly online tool for use by the stakeholders. The project will be completed within this time allowed.

2015 Detailed Project Budget

Project Title: Small fish, big problem: Understanding Minnesota's baitfish industry

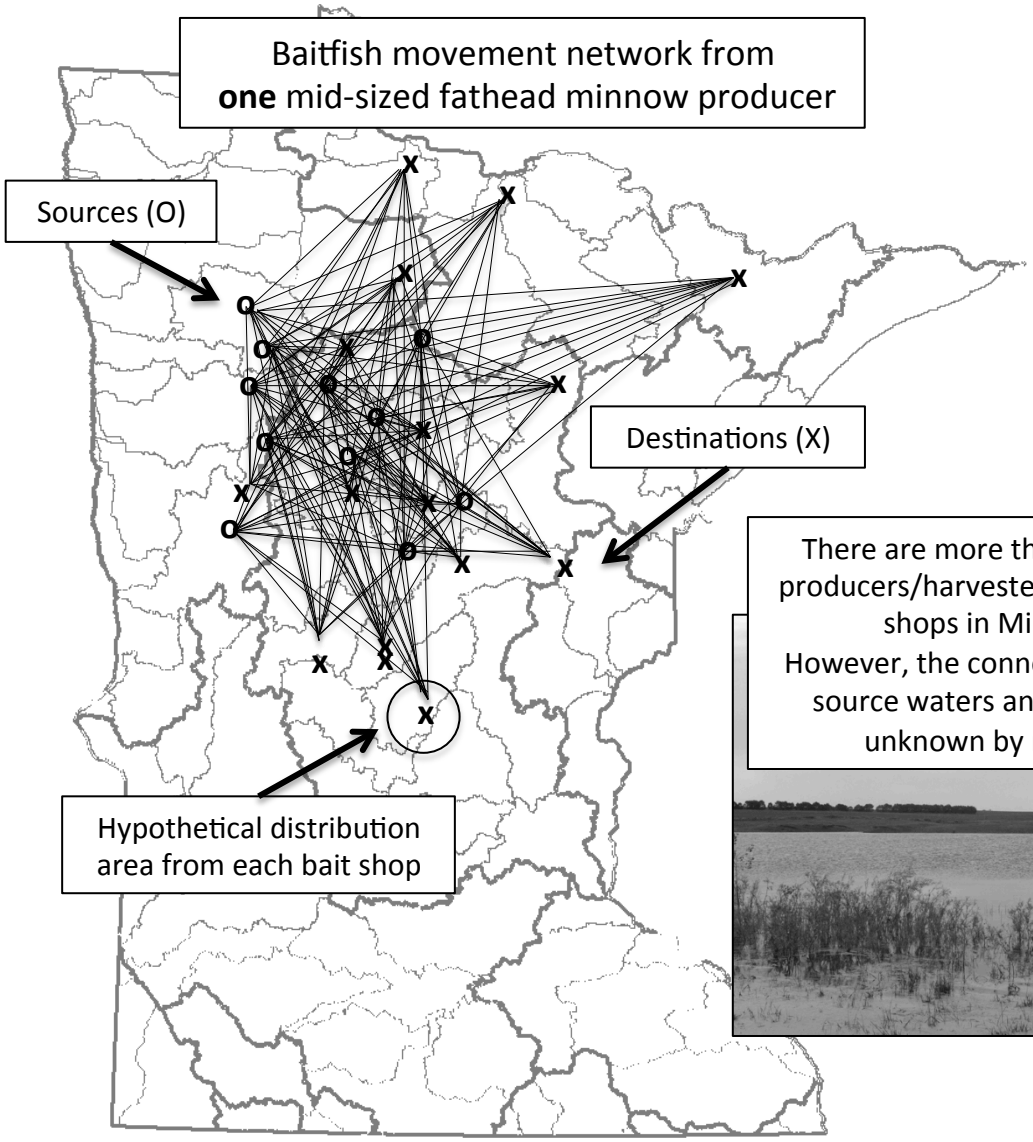
IV. TOTAL ENRTF REQUEST BUDGET *2* **years**

BUDGET ITEM	AMOUNT
Personnel:	
Nicholas Phelps (PI): 10% FTE per year (plus 33.6% fringe)	$ 26,152
Meggan Craft: 5% FTE per year (plus 33.6% fringe)	$ 13,358
Andres Perez: 5% FTE per year (plus 33.6% fringe)	$ 15,828
Paul Venturelli: 5% FTE per year (plus 33.6% fringe)	$ 10,072
Eva Enns: 5% FTE per year (plus 33.6% fringe)	$ 13,891
Graduate Student: 50% FTE per year (plus 79.43% fringe)	$ 81,975
Contracts:	
A computer programmer (TBD) will be contracted during the project period to develop user-friendly online interface for the baitfish movement model.	$ 55,000
Equipment/Tools/Supplies:	
Computer software (TBD) and online hosting fees for model development and implemenation	$ 7,500
Travel:	
In-state travel to collect demographics on baitfish movement, includes attendence to host 2 workshops and ~15 face-to-face interviews.	$ 5,250
Additional Budget Items:	
Workshop: two workshops will be held to 1) Collect data and 2) Demonstrate application and implemenation. Costs associated with each workshops include: room rental and lunch for participants (25 people).	$ 7,500
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 236,526

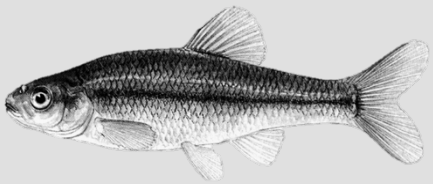
V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ To Be Applied To Project During Project Period:	NA	
Other State $ To Be Applied To Project During Project Period:	NA	
In-kind Services To Be Applied To Project During Project Period:	NA	
Funding History:	NA	
Remaining $ From Current ENRTF Appropriation:	NA	

Small fish, big problems:
Understanding Minnesota's baitfish industry



There are more than 300 baitfish producers/harvesters and 1,000 bait shops in Minnesota!
However, the connections between source waters and bait shops is unknown by managers.



~436 million fathead minnows were produced in Minnesota in 2012!
Six other species were also harvested from the wild.

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Introduction of AIS and disease in the baitfish network could result in rapid dissemination. However, no current method for assessing spread or management options exist.

PROJECT MANAGER QUALIFICATIONS AND ORGANIZATION DESCRIPTION

Nicholas Phelps, Project Manager, is an Assistant Professor in the Department of Veterinary Population Medicine at the University of Minnesota College of Veterinary Medicine. He also has an appointment with University of Minnesota Extension as the aquaculture specialist and a faculty member of the MN ENRTF supported MN Aquatic Invasive Species Research Center. He earned a Ph.D. in Veterinary Medicine (University of Minnesota), an M.S. in Aquaculture/Fisheries with an emphasis on fish health (University of Arkansas–Pine Bluff), and a B.S. in Aquatic Biology (Bemidji State University). His research focuses on emerging threats to fisheries sustainability and production, which lie at the intersection of animals, humans, and environmental health. Dr. Phelps has ongoing research in aquatic invasive species control, risk management, emerging virus discovery, diagnostic development, and significant efforts focused on detection, control, and management of the viral hemorrhagic septicemia virus of fish. Dr. Phelps has also led several aquatic invasive species prevention workshops for the baitfish industry in recent years.

The collective experience and organizational support of the project team members will ensure successful completion of the proposed project goals.

ORGANIZATIONAL DESCRIPTION

The diverse and multidisciplinary team assembled to better understand the Minnesota baitfish industry is comprised of three schools/colleges at the University of Minnesota, one state agency, and one federal unit. All individuals are conveniently located in St. Paul to facilitate close collaboration and communication. Drs. Nicholas Phelps, Meggan Craft, and Andres Perez are faculty members of the Department of Veterinary Population Medicine in the College of Veterinary Medicine. The Department of VPM merges clinical and population sciences with veterinary diagnostic medicine to create opportunities to address today's most pressing issues in animal health and sustainability. Drs. Paul Venturelli and David Fulton are faculty members of the Department of Fisheries, Wildlife and Conservation Biology in the College of Food, Agriculture, and Natural Resources Sciences. The Department of FWCB studies the biology and ecology of some of the most interesting and diverse organisms and ecosystems in the world. Their goal is to respond to societal needs for information and education pertaining to the conservation of our natural resources and to ensure excellent teaching, research, and outreach programs. Dr. Fulton is also the Assistant Leader of the MN Cooperative Fish and Wildlife Research Unit, a USGS funded research/education/technical outreach organization located at the University of Minnesota. Dr. Eva Enns is a faculty member in the School of Public Health, Division of Health Policy and Management. The SPH's mission is to advance health – from scientific discovery to public impact – by enhancing population health and preventing disease in the U.S. and globally. This is achieved through excellence in education, research and community engagement. Lastly, the MN Department of Natural Resources Section of Fisheries is responsible for managing the diverse fisheries in Minnesota's 5,400 game fish lakes and 15,000 miles of streams and rivers.