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

Project Title: **ENRTF ID:** **003-A**

Using Chemical-Tracking Techniques to Improve Sturgeon Management

Topic Area: A. Fisheries & Wildlife Research

Total Project Budget: $ 398,191

Proposed Project Time Period for the Funding Requested: 3 yrs, July 2013 - June 2016

Other Non-State Funds: $ 0

Summary:

We will compare chemical concentrations in archived sturgeon pectoral fin rays to water chemistries of connected river systems in order to determine the movement patterns of sturgeon in Minnesota.

Name: Jeffrey Ziegeweid

Sponsoring Organization: U.S. Geological Survey

Address: 2280 Woodale Dr
Mounds View MN 55112

Telephone Number: (763) 783-3113

Email jrziege@usgs.gov

Web Address http://mn.water.usgs.gov/index.html

Location

Region: Statewide

County Name: Statewide

City / Township:

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

PROJECT TITLE:

Using Chemical-Tracking Techniques to Improve Sturgeon Management

I. PROJECT STATEMENT:

Populations of federally-threatened sturgeons in Minnesota were decimated by overharvest, pollution, and flow regulation in the early twentieth century. Although successful re-introductions have taken place in the Red and St. Louis Rivers, most sturgeon populations have not rebounded despite improvements to water quality, habitat, and flow regimes. Little is known about sturgeon migration patterns, and because sturgeon can migrate long distances among connected river systems, restoration and tracking efforts are difficult and expensive. In addition, sturgeon in Minnesota inhabit several state and international border waters, such as the Red, Rainy, St. Croix, and Mississippi Rivers, and sturgeon use tributary rivers on both sides of the borders for spawning. Because North Dakota, Wisconsin, and Canada have different harvest regulations than Minnesota, the management of shared sturgeon stocks becomes complicated. Management efforts are further complicated by the threat of invasive species, such as Asian carp. The proposed bubble barrier at the mouth of the St. Croix River designed to stop the spread of Asian carp could prevent migration of sturgeon between critical spawning and feeding habitats on the St. Croix and Mississippi Rivers. Isolating sturgeon populations could make them more vulnerable to collapse should flow and water quality conditions change because of changes in land use and/or climate.

In order to better manage shared stocks and sustain populations while protecting against invasive species, additional information is needed about the timing, distance, and duration of sturgeon migrations. Movements of sturgeon can be identified by linking the unique chemical signatures in the waters of different rivers to annual chemical deposits in sturgeon pectoral fin rays. Sturgeon pectoral fin rays can be sampled non-lethally and are currently collected and archived by several Minnesota Department of Natural Resources Fisheries monitoring programs. In this study, we propose to use previously-collected pectoral fin rays, historical water-chemistry data, and new water-chemistry data to identify migration patterns of lake and shovelnose sturgeons among connected river systems in Minnesota.

The goal of this study is to combine current water-quality and fisheries data from rivers throughout Minnesota to better identify sturgeon migration patterns between critical habitats as they age and begin to reproduce. This goal will be achieved through a variety of activities. First, pectoral fin rays will be obtained from Minnesota DNR archives for each river basin inhabited by sturgeon. These pectoral fin rays will be analyzed for annual concentrations of strontium (Sr), barium (Ba), and manganese (Mn) at the USGS National Laboratory using Laser Ablation Inductively-Coupled Plasma-Mass Spectrophotometry (LA ICP-MS). Next, historical water-chemistry data and sturgeon-capture data will be used to identify locations for additional water-chemistry (Sr, Ba, and Mn) sampling. Historical water-chemistry sites will be sampled to examine temporal changes in water chemistry, and sturgeon-capture locations will be sampled for water chemistry to examine spatial variability within each river.

Water-chemistry and pectoral fin ray data will indicate the timing and duration of sturgeon movements among rivers and major tributaries (see attached map). These data can be used by fisheries managers to evaluate current harvest regulations, determine partitioned sturgeon habitat use of border waters, evaluate the susceptibility of populations to land use or climate changes, and determine the potential effects of Asian carp management on sturgeon populations.

II. DESCRIPTION OF PROJECT ACTIVITIES:

Activity 1: Gather historical water-chemistry and sturgeon-capture data *Budget $11,193*

Outcomes:
1. Identification of areas for additional water-chemistry sampling
2. Understanding of the temporal variability associated with water-chemistry of each river
3. Identification of critical habitats that are frequently used by sturgeon

Activity 2: Collect and analyze additional water samples *Budget $212,084*

Outcomes:
1. Determination of present water chemistries of each river
2. Comparison of present water-chemistry data to historical data for additional temporal variability
3. Examination of spatial relationship between historical water-chemistry sites and sturgeon-capture locations

Activity 3: Analyze annual chemical deposits in fin rays from major river basins *Budget $87,027*

Outcomes:
1. Identification of annual variations in fin ray chemical deposits using LA ICP-MS
2. Validation of fin ray chemical deposit analyses using fish recapture and telemetry data
3. Identification of ages of fish during migrations between rivers

Activity 4: Relate timing and frequencies of movement to population structure *Budget $87,887*

Outcomes:
1. Determination of critical habitats for both juvenile and adult sturgeon
2. Assess threats to population sustainability if barriers to migration are installed
3. Produce either a journal article or a USGS Scientific Investigations Report

III. PROJECT STRATEGY:

A. Project Partners

1. *U.S. Geological Survey:* provide federal cooperative funds totaling approximately 35% of the total cost of the project (requesting other 65% from LCCMR, ENTRF), manage project, provide historical data, conduct water sample collection, conduct water-chemistry and pectoral fin ray chemical analyses, perform statistical analyses, interpret data, and write report. Jeffrey Ziegeweid (Principle Investigator) - USGS Minnesota Water Science Center, Mounds View, Minnesota; Alan Koenig- Central Mineral and Environmental Resources Science Center Laser-Ablation ICP-MS Laboratory, Lakewood, Colorado.

2. *Minnesota DNR Fisheries Offices:* provide archived pectoral fin rays and associated sturgeon-capture data. Jerry Johnson and Joel Stiras- East Metro; Daniel Dieterman- Lake City, John Frank- Hinckley; John Lindgren- Duluth; Tom Burri- International Falls; Phil Talmage and Tom Heinrich- Baudette; James Wolters- Detroit Lakes.

B. Timeline Requirements

Historical water-chemistry and sturgeon-capture data will be compiled and water-sampling locations will be selected from July 1, 2013 through September 30, 2013. Archived pectoral fin rays will be acquired and analyzed at the Central Mineral and Environmental Resources Science Center between October 1, 2013 and September 30, 2015. Sturgeon fin rays will be analyzed from each of the Red, Rainy, Namakan, St. Louis, Minnesota, St. Croix, and Mississippi River basins. Water-chemistry sampling and analyses will occur between October 1, 2013 and September 30, 2015. Data analysis, data interpretation, and report writing would start on October 1, 2015 and be completed by June 30, 2016.

C. Long-Term Strategy and Future Funding Needs

This project is largely based on the archived collections of many long-term Minnesota DNR Fisheries monitoring programs, which will presumably continue beyond the scope of this project. Should invasive species control barriers be implemented in the future, this study would provide the background information necessary to examine the effects of these control barriers on populations of native, migratory sturgeons.

Project Title: Using Chemical-Tracking Techniques to Improve Sturgeon Management

2012-2013 Detailed Project Budget

Project Partners: U.S. Geological Survey and Minnesota Department of Natural Resources

Project Timeline: July 2013 - June 2016

IV. TOTAL ENRTF REQUEST BUDGET (3 years)

BUDGET ITEM	AMOUNT
Personnel:	$ -
Hydrologists (Project Lead, Supervisor, Report Specialist, 2 Report Reviewers) 75% salary, 25% benefits; 3160 hours, 5 people)	$ 213,380
Hydrologic Technician (Field Support; 75% salary, 25% benefits; 1000 hours, 1 person)	$ 65,430
Equipment/Tools/Supplies:	$ -
Pectoral fin ray processing supplies (polishing equipment, microscope slides, fixative)	$ 9,495
Laboratory supplies (calibration standards, acids, reagents)	$ 11,200
Travel:	$ -
Vehicles (One truck and one boat; 3 months per year for 2 years)	$ 6,647
Lodging Per Diem (Statewide travel to water-sampling sites)	$ 12,648
Meal Per Diem (Statewide travel to water-sampling sites)	$ 8,290
Additional Budget Items:	$ -
Pectoral fin ray laboratory analyses (Laser-ablation Spectrophotometry)	$ 8,960
Water chemistry laboratory analyses (Inductively-Coupled Plasma Mass Spectrometry)	$ 47,040
Shipping (pectoral fin ray and water chemistry samples to the lab in Colorado)	$ 2,968
Printing (Publication costs for final report)	$ 12,133
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 398,191

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ Being Applied to Project During Project Period:	$ -	
U.S. Geological Survey federal cooperative match contribution	$ 220,970	Pending
In-kind Services During Project Period:	$ -	
Minnesota DNR providing fish parts (archived sturgeon pectoral fin rays)	N/A	Secured

Project Title: Using Chemical-Tracking Techniques to Improve Sturgeon Management

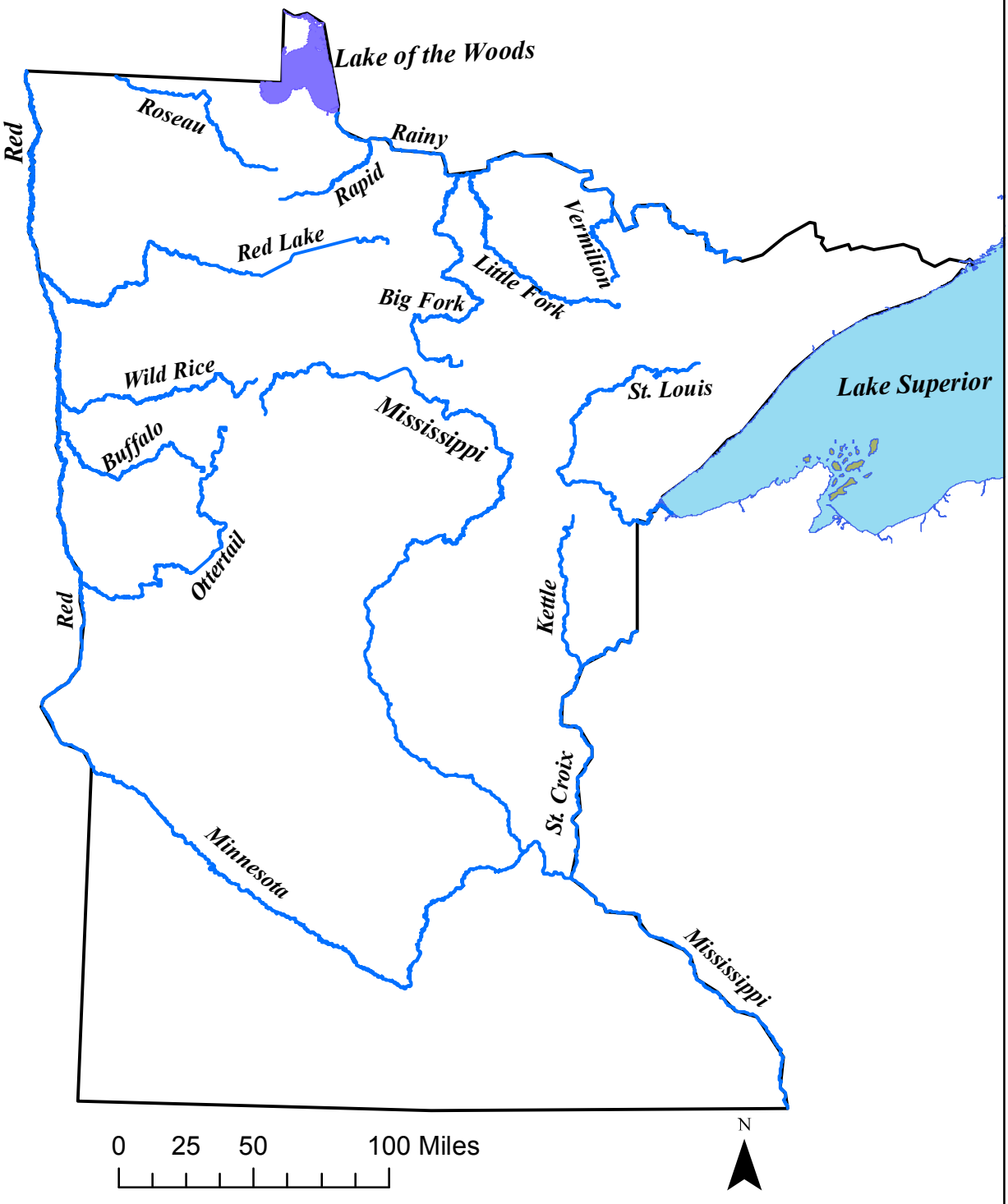

Figure 1. Map showing proposed rivers that will be investigated.

Project Manager Qualifications

Project Title: Using Chemical-Tracking Techniques to Improve Sturgeon Management

Project Manager: Jeffrey Ziegeweid, Hydrologist, U.S. Geological Survey MN Water Science Center

Education

- 2006 M.S. Forestry and Natural Resources (Fisheries Emphasis) - University of Georgia
- 2004 B.S. Biology (Aquatic Science Emphasis) & Chemistry - University of Wisconsin-La Crosse

USGS Experience

USGS MN Water Science Center, Investigations Section, Mounds View, MN, September 2010- Present

- Currently managing several projects:
  1) Develop a hydraulic model of the Namakan Reservoir for improved water-level management using water-level, water-velocity, and bathymetry data; **Partners:** International Joint Commission, Environment Canada, USGS Nebraska Water Science Center
  2) Understand mechanisms of nutrient-loading and trophic dynamics in Lake St. Croix by collecting and interpreting flow, water-quality, and sediment data; **Partners:** Science Museum of Minnesota, Metropolitan Council Environmental Services
  3) Model current and future oxygen- and temperature-based fish and mussel habitat in Lake St. Croix by collecting and interpreting water-quality and flow data; **Partner:** National Park Service

USGS MN Water Science Center, Data Section, Grand Rapids, MN, June 2008-August 2010

- Collected, analyzed, and published continuous, real-time stream flow data used by the National Weather Service, the Minnesota Department of Transportation, and the U.S. Army Corps of Engineers

Publications

- Ziegeweid, J.R. and M.C. Black. 2010. Hematocrit and plasma osmolality values of young-of-the-year shortnose sturgeon following acute exposures to combinations of salinity and temperature. *Fish Physiology and Biochemistry* 36: 963-968.
- Ziegeweid, J.R., C.A. Jennings, D.L. Peterson, and M.C. Black. 2008. Effects of salinity, temperature, and body size on the survival of juvenile shortnose sturgeon. *Transactions of the American Fisheries Society* 137: 1490-1499.
- Ziegeweid, J.R., C.A. Jennings, and D.L. Peterson. 2008. Thermal maxima for juvenile shortnose sturgeon acclimated to different temperatures. *Environmental Biology of Fishes* 82: 299-307.
- Ziegeweid, J.R. 2006. Ontogenetic changes in salinity and temperature tolerances of young-of-the-year shortnose sturgeon, *Acipenser brevirostrum*. M.S. Thesis. University of Georgia.

Leadership

- 2005 & 2006 Executive Committee Member- Georgia Chapter- American Fisheries Society
- 2005 & 2006 President of UGA Fisheries Society (Official AFS Student Sub-Unit)
- 2002 & 2003 Student Representative for the Midwest Chapter of the Society of Environmental Toxicology and Chemistry (SETAC)

Organization Description: U.S. Geological Survey Minnesota Water Science Center

At the USGS Minnesota Water Science Center, our mission is to collect, analyze and disseminate the impartial hydrologic data and information needed to wisely manage water resources for the people of the United States and the State of Minnesota. We operate local and statewide networks, we analyze processes through investigations and research, and we maintain real-time and historical databases. We publish peer-reviewed interpretive and data reports, and we promote informed decision-making with our federal, state, local, and tribal partners.