Environment and Natural Resources Trust Fund

2024 Request for Proposal

General Information

Proposal ID: 2024-278

Proposal Title: Genetic Detection of Endangered Mussels in the Mississippi

Project Manager Information

Name: Lauren Lynch

Organization: US Geological Survey - Ohio Water Microbiology Lab

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Project Basic Information

Project Summary: This project will create and optimize eDNA assays to detect the presence of 8 endangered or threatened mussel species around Buffalo Slough near Prairie Island Indian Community.

Funds Requested: $241,000

Proposed Project Completion: September 30, 2026

LCCMR Funding Category: Foundational Natural Resource Data and Information (A)

Project Location

What is the best scale for describing where your work will take place?

Region(s): SE

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project and In the Future

Narrative

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

Minnesota is home to 51 species of native freshwater mussels, 28 of which are endangered, threatened, or of special concern at the state level. Of these, 5 species are listed as Federally endangered—the Higgins Eye, the Sheepnose, Snuffbox, Spectaclecase, and Winged Mapleleaf. Currently, there is also a species that is endangered at the state level and is up for consideration to become endangered at the federal level—the Salamander Mussel. The mucket is threatened at a state level and the black sandshell is of special concern.

Prairie Island Indian Community are interested in determining if there are state and federally endangered mussels in the Mississippi River directly adjacent to their territory. Traditional sampling efforts for mussels are invasive, potentially destructive, and time and resource intensive. Additionally, primary mussel surveying efforts by the Prairie Island Indian Community are limited to observations of shells that have been discarded by animals such as river otters. Mussel surveying often relies on the use of morphological characteristics, which requires disturbing the organisms to collect data. Replacing or supplementing traditional survey methods with detection of eDNA in surface water samples can more efficiently and accurately determine the presence of endangered mussels.

What is your proposed solution to the problem or opportunity discussed above? Introduce us to the work you are seeking funding to do. You will be asked to expand on this proposed solution in Activities & Milestones.

The overall goal of the proposed work is to develop new tools to assist the Prairie Island Indian Community in identifying endangered mussels located near the Buffalo Slough of Sturgeon Lake. To reach this goal, specific objectives include:

- Developing eDNA assays for the following species: Higgins Eye (Lampsilis higginsii), Sheepnose (Plethobasus cyphyus), Snuffbox (Epioblasma triquetra), mucket (Actinonaias ligamentina), and black sandshell (Ligumia recta).
- Optimizing eDNA assays for the following species: Spectaclecase (Cumberlandia monodonta), Salamander mussel (Simpsonaias ambigua), and winged mapleleaf (Quadrula fragosa).
- Conducting a reconnaissance study to determine if these species of state and federally endangered and threatened mussels are present near Buffalo Slough, which is part of the Upper Mississippi River in the Prairie Island Indian Community territory, Minnesota.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

Results from this proposed work will benefit the Prairie Island Indian community, Minnesota Department of Natural Resources, and U.S. Fish and Wildlife Service by providing information about which state and federally endangered mussel species are present in this stretch of the Upper Mississippi River and how to best protect these populations. This study has the potential to serve as an example of how eDNA can be used for detection of endangered or invasive species in waterways.

Activities and Milestones

Activity 1: Development and optimization of eDNA assays

Activity Budget: $139,144

Activity Description:
Five of eight assays used in this proposed work will be developed at the USGS Ohio-Kentucky-Indiana Water Science Center Ohio Water Microbiology Laboratory (OWML). Assays will be developed for Higgins Eye, Sheepnose, Snuffbox, mucket , and black sandshell. The assay for the spectaclecase was developed and will be optimized for use at the OWML. Assays for the salamander mussel and the winged mapleleaf are currently being developed by the U.S. Geological Survey's Upper Midwest Environmental Science Center.
To develop assays Genetic sequences unique to each species will be acquired from the open-source National Center for Biotechnology Information (NCBI) GenBank database. Target gene sequences will be imported into a primer design software where in silico testing will be conducted to check for cross-reactivity with genetically similar species, as well as co-located species. Water samples will be collected from areas with known populations of the species in question with assistance from the Minnesota Department of Natural Resources and will be used to validate accuracy of the assays for use in the environment. The run conditions for each assay will be optimized using a synthetic DNA plasmid to ensure the most appropriate melting and annealing temperatures and cycling conditions are used.

Activity Milestones:

Description	Approximate Completion Date
Existing Assay Optimization	December 31, 2024
New Assay Development	March 31, 2025
Assay Implementation	April 30, 2025

Activity 2: Water Sample Collection and Analysis

Activity Budget: $97,409

Activity Description:
To determine the presence of the target mussel species in Sturgeon Lake, samples will be collected by field personnel during mussel brooding season in 2024 and 2025 at the five sites. Depth-integrated surface water samples will be collected according to USGS National Field Manual protocols. Field crews will be trained in sampling according to USGS National Field Manual prior to sample collection. Sampling will be done monthly in the spring and summer starting in July 2024. Ideally, samples will be collected during low flow conditions to not dilute the DNA excreted by the mussels. Samples will be sent on ice overnight to the OWML in Columbus, Ohio. Upon arrival, samples will be filtered and preserved until further analysis (indefinite hold at -70°C). Samples will be analyzed to determine concentrations of eDNA from six different mussel species. The U.S. Army Corps of Engineers (USACE) and Prairie Island Indian Community will assist with field work by supplying the boat and personnel for sample collection, as well as the shipping of samples to the OWML.

Activity Milestones:

Description	Approximate Completion Date
Water Sample Collection	September 30, 2025
DNA Extraction and Analysis	September 30, 2025
Data Analysis	December 31, 2025

Activity 3: Publication of results

Activity Budget: $4,447

Activity Description:

The USGS will submit quarterly reports to all funding organizations. Once a year, the USGS will organize planning sessions for the project with participating organizations and other interested parties, as well as any necessary project conference calls. Managers and research scientists will routinely examine the project, as is customary at the USGS. Results and methodology from this study will be published in a peer reviewed journal or Scientific Investigations Report in 2026. The results of this investigation will also be presented at scientific and public meetings.

Activity Milestones:

Description	Approximate Completion Date
Report Writing	March 31, 2026
Report Review	September 30, 2026
Publication and Presentations	September 30, 2026

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Dan Kelner	U.S. Army Corps of Engineers	Sample Collection	No
Gabe Miller	Prairie Island Indian Community	Sample collection and support	No

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this work be funded?
Results from this study will be given to Prairie Island Indian Community, Minnesota DNR, U.S. Army Corps of Engineers, U.S. Geological Survey, and any other interested parties. An open-source journal article will be the primary product of this work. Findings may then be incorporated as deemed fit by natural resource managers.

Project Manager and Organization Qualifications

Project Manager Name: Lauren Lynch

Job Title: Biologist

Provide description of the project manager's qualifications to manage the proposed project.
I have been involved in the development of eDNA assays for various endangered species of mussels in Ohio, as well as the development of eDNA assays for mayflies and caddisflies.

Organization: US Geological Survey - Ohio Water Microbiology Lab

Organization Description:
The Ohio Water Microbiology Lab will be operating in support of the Prairie Island Indian Community. This lab has been the USGS's premier lab for microbiological work for over 25 years

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Biologist		Assay optimization, development, field assistance and labwork			15%	0.18		$16,667
Microbiologist		assisting in assay development and report writing			0%	0.02		$1,948
Administrator		Admin assistance			0%	0.03		$2,674
lab staff		assistance in writing and reviewing report			0%	0.01		$356
							Sub Total	**$21,645**
Contracts and Services								
U.S. Geological Survey Ohio Water Microbiology Lab	Internal services or fees (uncommon)	Assay development, Assay optimization, sample analysis				0		$90,578
							Sub Total	**$90,578**
Equipment, Tools, and Supplies								
							Sub Total	-
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	2 trips, flight from Columbus to Minneapolis/St. Paul, 1 person, two nights at a hotel per trip, one rental car per trip, MI&E	trip to train field staff and view study sites for FY24 and FY25					$2,019

							Sub Total	**$2,019**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
	Publication	Formal review and publication of results	journal article is main product of project					$4,447
							Sub Total	**$4,447**
Other Expenses								
		Administrative Activities, technical expertise, facilities, and IT support	Project support					$122,311
							Sub Total	**$122,311**
							Grand Total	**$241,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	**-**
Non-State				
Cash	U.S. Geological Survey Center Matching Funds	Offset of	Secured	$50,000
In-Kind	U.S. Army Corps of Engineers CEMVP	Sampling efforts: personnel, boat, shipping	Pending	$21,000
In-Kind	Prairie Island Indian Community	Sample collection efforts	Secured	$9,000
			Non State Sub Total	**$80,000**
			Funds Total	**$80,000**

Attachments

Required Attachments

Visual Component

File: 33c7355a-266.pdf

Alternate Text for Visual Component

A map of surface water sampling site locations in and around Sturgeon Lake in Goodhue County, MN...

Optional Attachments

Support Letter, Photos, Media, Other

Title	File
Non-state Entity Letter USGS OWML	23f01f89-c71.docx

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Does your project have potential for royalties, copyrights, patents, or sale of products and assets?

No

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

N/A

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

N/A

Does your project include original, hypothesis-driven research?

No

Does the organization have a fiscal agent for this project?

No

Does your project include the design, construction, or renovation of a building, trail, campground, or other capital asset costing $10,000 or more?

No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services, as defined in Minnesota Statutes section 299C.61 Subd.7?

No