Environment and Natural Resources Trust Fund

2024 Request for Proposal

General Information

Proposal ID: 2024-279

Proposal Title: Uncovering the Past to Protect Minnesota's Walleye Fisheries

Project Manager Information

Name: Adam Heathcote

Organization: Science Museum of Minnesota - St. Croix Watershed Research Station

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Project Basic Information

Project Summary: We will reconstruct historical lake conditions to identify factors linked to successful walleye fisheries and guide effective management in the face of warming temperatures, invasive species, and nutrient loading.

Funds Requested: $1,121,000

Proposed Project Completion: June 30, 2027

LCCMR Funding Category: Water Resources (B)

Project Location

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

Statewide

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 lakes are changing, and human activities create stressful conditions for walleye and the aquatic organisms they depend on. Information about how lakes respond to changing conditions is scarce and only considered once impacts are large. While there are monitoring programs across Minnesota, most of those efforts do not cover timescales necessary to understand the impacts of changing conditions on walleye populations. We seek to understand the conditions associated with walleye fisheries that perform far better than expectations.

To manage walleye fisheries, we need to understand the drivers that supported successful fisheries in the past. Walleye are impacted by increasing temperatures, nutrients, and invasive species. These changes impact lake ecology in complicated ways because Minnesota lakes are subjected to multiple stressors at once. Algae, zooplankton, and fish are connected to each other through the food web, so negative effects on one ripple across trophic levels. Unfortunately, long-term information on food webs are rare, and the specific conditions that support successful walleye lakes in Minnesota are largely unknown. The sensitivity of our walleye fisheries changes in the past and in the future needs to be understood to efficiently and effectively manage, maintain, and protect these important economic, cultural, and environmental resources.

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.

We will use information on historical conditions to understand the factors that support successful walleye populations. This project will document changes in a group of important walleye lakes using fossil remains and historical archives to understand what happened in individual lakes decades before monitoring programs began. Pairing these data and historical fisheries records will give us a better picture on how Minnesota lakes are changing from the smallest algae to our most prized game fish. It will also help us understand key links within these food webs.

Focusing on successful walleye fisheries will promote effective management in the face of environmental change. This can be used to manage individual lakes, but we can also better understand trends in all walleye lakes and how they relate to larger-scale changes in Minnesota. We will partner with managers, anglers, and lake lovers across Minnesota to understand how lakes are different than they were in the past and where they are headed. We can look at relationships between fossil remains and historical fisheries data to understand which conditions in a lake are associated with fish populations, which walleye populations are the most resilient to change, and what lakes are most sensitive to future perturbations.

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?

1. Protect and conserve lakes with food webs and fisheries that are resilient to multiple stressors
2. Prevent further damage to lakes and food webs that are under threat by stressors
3. Use information about food webs and disturbances to improve and enhance fisheries and lake quality

Activities and Milestones

Activity 1: Use lake sediment cores to reconstruct the response of walleye lakes to multiple disturbances

Activity Budget: $600,503

Activity Description:
We will measure lake characteristics and food webs traits from 15 walleye lakes in north-central, western, and southwestern Minnesota using lake sediment cores to go "back in time" to measure historical and current trends in the lakes. Different disturbances leave different clues in the sediment about lake history by affecting the food web – the numbers and types of algae, zooplankton, and insects – as well as the chemistry of the sediments. We will use this information to recreate food webs and walleye habitat conditions, paired with historical fisheries data, going back hundreds of years.

The lakes in this study are selected from a group of lakes that are part of a MNDNR Fisheries enhanced surveying program, intended to increase our understanding of the effects of zebra mussels on walleye lakes. The lakes range in size from 290 – 14,000 acres, vary in productivity, and are important walleye lakes. Some of the lakes have zebra mussel populations, while some do not. We will use sediment cores from the lakes to reconstruct the food web, nutrient conditions, and lake productivity using zooplankton and insect remains, remains of algae and their pigments, and sediment chemistry to determine the age of the sediments.

Activity Milestones:

Description	Approximate Completion Date
Collect, date, and analyze sediment cores from 15 lakes	December 31, 2026
Measure changes in lake productivity in 15 lakes using fossil and geochemical proxies from dated	June 30, 2027
Develop model to reconstruct historical optical walleye habitat quality for 15 lakes using algal proxies	June 30, 2027

Activity 2: Link walleye populations to lake and food web characteristics to identify indicators of successful walleye fisheries in Minnesota

Activity Budget: $430,326

Activity Description:
Reconstructing historic walleye populations and lake food webs require that we develop and validate new tools. We will use information from Activity 1 to quantify historical changes in walleye habitat and productivity associated with multiple stressors. We will identify relationships between fish populations and zooplankton size and community composition under current conditions that can be used to reconstruct historical food webs and associated fish populations. Our approach will identify indicators of successful walleye populations and how they are affected by multiple stressors.

We will summarize information about the changes in the food webs and productivity of the study lakes and how they relate to specific disturbances (long-term warming of lakes, land use changes, and zebra mussel introductions). We will share this information with lake associations, fisheries managers, and all Minnesotans using reports, presentations, and outreach activities. This information will help us understand how our lakes have changed, how disturbances that stress lakes cause that change, and what we can do to protect, conserve, and improve Minnesota lakes.

Activity Milestones:

Description	Approximate Completion Date
Reconstruct historical walleye habitat based on lake productivity	June 30, 2027
Develop a predictive model for walleye production based on zooplankton community and size structure	June 30, 2027
Summarize findings about changes to lake productivity and food webs	June 30, 2027

Activity 3: Inform Minnesotans on the importance of water quality, food webs, and global change on walleye fisheries

Activity Budget: $90,171

Activity Description:

The future health of Minnesota's prized walleye lakes is a cross-cutting issue that is important to Minnesotans of all backgrounds. The results of this project will be disseminated to the public in a number of unique ways, including the development of freely available outreach materials and open access scientific publications. The Science Museum of Minnesota will also work in collaboration with tribal resource managers on the adaptation of the Science Museum of Minnesota's Sediment Core kit, available to schools from the Science Museum of Minnesota's Lending Library. This kit will be adapted to include results from this study to teach students about the importance of maintaining healthy food webs to support walleye fishery populations. These kits will also be available by loan to all schools and provided directly to the tribal partners on this project for their use in school and community programming.

Activity Milestones:

Description	Approximate Completion Date
Develop outreach materials (reports, factsheets, other tools) to share with Minnesotans, lake associations, and managers	June 30, 2027
Update Science Museum Sediment Core educational kit with results from this study	June 30, 2027
Fabricate 3 sediment core kits to be made available to stakeholders	June 30, 2027

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Gretchen Hansen	University of Minnesota	Develop relationships between lake conditions and walleye populations that can be used to reconstruct historical fish communities. This includes data compilation from existing sources, field work to collect zooplankton, lab work to identify and measure zooplankton, data analysis, communication of results.	Yes
Heidi Rantala	Minnesota Department of Natural Resources	Compile MNDNR fisheries and zooplankton data. Assist with field collection of sediment cores, analyses of fossil animal remains, statistical analyses, interpretation of data, and the creation of outreach materials and reports. Share information about the project and project results with stakeholder groups, partners, and agency scientists and leadership.	No
Jeffrey Reed	Minnesota Department of Natural Resources	Complete historical fisheries records including analysis of historical photo archives, assist with field sampling, and assist with outreach efforts.	No
Pat Brown	Red Lake Nation Department of Natural Resources	Coordinate fieldwork on Upper and Lower Red Lake and synthesize historical walleye fisheries data from Red Lake DNR	Yes
Kate Hagsten	Leech Lake Division of Resource Management	Leech Lake DRM will provide technical support and facilitate the incorporation of traditional knowledge of the walleye fishery on Leech Lake. They will also coordinate and support the participation of local students and community members with the field work and synthesis of this project.	Yes

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?

We will share our findings through presentations, reports, social media, outreach materials, and statewide reach of the Science Museum of Minnesota with concerned Minnesotans, stakeholder groups, and state and tribal agencies, to provide information and guide management of Minnesota lakes. This project will build on previous work in partnership with communities and other researchers to understand threats to Minnesota waters and what we all can do to protect our fisheries and these invaluable resources.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Determining Risk of a Toxic Alga in Minnesota Lakes	M.L. 2018, Chp. 214, Art. 4, Sec. 2, Subd. 06f	$200,000
Invasive Didymosphenia Threatens North Shore Streams	M.L. 2021, First Special Session, Chp. 6, Art. 5, Sec. 2, Subd. 06g	$197,000
Unprecedented Change Threatens Minnesota's Pristine Lakes	M.L. 2021, First Special Session, Chp. 6, Art. 5, Sec. 2, Subd. 20a1	$482,000
Rainy River Drivers of Lake-of-the-Woods Algal Blooms	M.L. 2022, , Chp. 94, Art. , Sec. 2, Subd. 04e	$608,000
Salt Threatens Minnesota Water Quality and Fisheries	M.L. 2022, , Chp. 94, Art. , Sec. 2, Subd. 04l	$1,228,000

Project Manager and Organization Qualifications

Project Manager Name: Adam Heathcote

Job Title: Director

Provide description of the project manager's qualifications to manage the proposed project.
Dr. Adam Heathcote has worked as a research scientist for over 8 years at the Science Museum of Minnesota's St. Croix Watershed Research Station (SCWRS) and has a Ph.D. in Ecology and Evolutionary Biology and a B.S. in Animal Ecology. He has led numerous statewide, national, and international research projects focusing on aquatic ecology and paleolimnology and has previously led and successfully completed ENRTF projects focusing on harmful algal blooms and aquatic invasive species in Minnesota lakes. Dr. Heathcote also leads the SCWRS radiometric laboratory where he oversees one of the most productive lake sediment core dating laboratories in the world. Dr. Heathcote has a proven record of managing complex scientific projects and multi-institution collaborations and always emphasizes the broad dissemination of scientific results via open-access peer-reviewed publication, public forums, traditional and social media, and direct stakeholder engagement.

Organization: Science Museum of Minnesota - St. Croix Watershed Research Station

Organization Description:
The Science Museum of Minnesota (SMM) is a private, non-profit 501(c)3 institution dedicated to encouraging public understanding of science through research and education. The St. Croix Watershed Research Station is the environmental research center of the SMM with the mission "we do the science that helps make our rivers and lakes clean" through research and outreach. The SCWRS supports an active year-round program in environmental research and graduate-student training, guided by a dedicated in-house research staff with direct ties to area universities and colleges. It collaborates closely with federal, state, and local agencies with responsibility for managing the St. Croix and upper Mississippi rivers and is a full partner with the National Park Service for resource management in parks of the western Great Lakes region. Its research has played a central role in setting management policy for the St. Croix and Mississippi rivers, for establishing water-quality standards for Minnesota lakes and for developing long-term monitoring plans for the National Park Service.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Director of Department of Water and Climate Change		Project management, field work, synthesis, outreach and reporting		X	26%	0.51		$59,197
Senior Scientist		Fieldwork, analytical, synthesis, diatom and zooplankton identification			26%	1.26		$147,992
Postdoctoral Fellow		Project coordination, field work, synthesis, and outreach			26%	2		$138,121
Laboratory Technician		Field assistance and laboratory analysis			26%	2		$106,404
STEM Education Manager		The STEM Education Managers will supervise SMM staff, assign tasks, and oversee delivery of key project milestones.			26%	0.03		$6,000
Program Specialist		The Program Specialists will work with non-SMM partners as well as Library, Materials, and Instruction staff to coordinate development of project deliverables, create task lists, establish timelines, and evaluate progress day to day.			26%	0.04		$6,000
Materials Coordinator		The Materials Coordinators will support equipment prototyping and iteration, working closely with Library and Instruction staff as well as non-SMM partners.			26%	0.04		$6,000
Library Coorindator		The Library Coordinators will work closely with other SMM staff and non-SMM partners to develop instructional materials kits and educational resources that align with project goals.			26%	0.07		$10,000
Learning & Instruction Specalist		The Learning and Instruction Specialists will work closely with other SMM staff and non-SMM partners to develop instructional materials kits and educational resources that align with project goals.			26%	0.08		$12,000
							Sub Total	**$491,714**
Contracts and Services								

University of Minnesota	Sub award	Develop relationships between lake conditions and walleye populations that can be used to reconstruct historical fish communities. Personnel: $284,009 (Professor Hansen summary salary, researchers, 36.8% fringe, graduate student 24.1% fringe), Supplies: $18,750, Travel (in-state fieldwork): $12,416, printing of outreach materials: $500, Boat Maintenance: $2,000				3.3		$309,983
Red Lake Department of Natural Resources	Sub award	Providing access to Red Lake (boat, technical assistance), synthesizing historical Red Lake Walleye Fisheries database				0.09		$15,000
Science Museum of Minnesota - St. Croix Watershed Research Station	Internal services or fees (uncommon)	210-Pb dating of 15 sediment cores ($2,400/core), Loss on ignition on 15 sediment cores ($800/core), diatom identification on 225 samples ($600/sample), Sediment TP on 225 samples ($45/sample), fossil zooplankton on 225 samples ($200/sample)				0		$238,125
University of Regina or competitive bid	Professional or Technical Service Contract	Fossil algal pigments ($135/sample) and stable isotopes analysis ($20/sample) on 225 samples				-		$34,875
Leech Lake Department of Resource Management	Sub award	This sub award is to facilitate the interaction of Leech Lake DRM staff, community members, and students from the Leech Lake Tribal College with this project.				-		$15,000
							Sub Total	**$612,983**
Equipment, Tools, and Supplies								
	Tools and Supplies	Sample cups, analytical reagents, sediment core tubes	Collecting and analyzing samples from 15 sediment cores					$5,567
	Tools and Supplies	Raw materials for fabrication of sediment core demo kit	Provide 3 educational models for use in the SMM lending library and for stakeholder groups					$5,000
							Sub Total	**$10,567**
Capital Expenditures								

							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Travel for 5 trips with three people, including 30 hotel stays ($98/night), per diem for 45 full days ($36/day), and 2,010 total miles ($0.585/mile)	Collecting sediment cores from walleye lakes across Minnesota					$5,736
							Sub Total	**$5,736**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$1,121,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Personnel - Director of Department of Water and Climate Change		Project management, field work, synthesis, outreach and reporting	This funding would be only for research conducted specific to this proposed project. This is a partially grant-funded position.

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
In-Kind	Jeff Reed and Heidi Rantala will each provide 0.10 FTE in FY25, FY26, and FY27 for a total of $67,053 (Reed 0.1 FTE annual salary $8909, fringe $2271; Rantala 0.1 FTE annual salary $8909, fringe $2262)	Dr. Rantala will compile and distribute MNDNR data, assist in field work, identify fossil animal remains, perform statistical analyses, and help create reports and outreach materials for the project. Jeffrey Reed will compile, MNDNR historical fisheries data and historical photograph database.	Pending	$67,053
In-Kind	Unrecovered indirects (55%) from the University of Minnesota subaward	Covering for overhead of facilities and administration	Pending	$140,867
			State Sub Total	**$207,920**
Non-State				
In-Kind	Unrecovered indirects (40.09%) from Science Museum of Minnesota Direct expenses	Covering for overhead of facilities and administration	Pending	$328,718
			Non State Sub Total	**$328,718**
			Funds Total	**$536,638**

Attachments

Required Attachments

Visual Component

File: dbe4312c-ef5.pdf

Alternate Text for Visual Component

How can we manage for more resilient walleye populations? What makes walleye populations in some Minnesota lakes more resilient to environmental stressors? Understanding characteristics of successful walleye populations will promote effective management of one of Minnesota's most prized natural resources in the face of environmental change....

Optional Attachments

Support Letter, Photos, Media, Other

Title	File
SMM Authorization Letter	854b6cb9-1fa.pdf
University of Minnesota Letter of Support	1ae67917-8b8.pdf
Minnesota DNR Letter of Support	72280267-179.pdf
Red Lake DNR Letter of Support	7dff31c1-12f.pdf
Leech Lake Division of Resource Management Letter of Support	f995b57e-a1e.pdf

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?

Yes

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