Environment and Natural Resources Trust Fund

M.L. 2025 Approved Work Plan

General Information

ID Number: 2025-294

Staff Lead: Noah Fribley

Date this document submitted to LCCMR: June 18, 2025

Project Title: Operationalizing State Zooplankton Data to Support Lake Health

Project Budget: $423,000

Project Manager Information

Name: Jake Walsh

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

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Project Reporting

Date Work Plan Approved by LCCMR: June 24, 2025

Reporting Schedule: March 1 / September 1 of each year.

Project Completion: June 30, 2028

Final Report Due Date: August 14, 2028

Legal Information

Legal Citation: M.L. 2025, First Special Session, Chp. 1, Art. 2, Sec. 2, Subd. 03dd

Appropriation Language: $423,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to use long-term monitoring data to determine the relationship between zooplankton communities and ecosystem services, like fisheries health and water quality, and develop biotic indices for lake health.

Appropriation End Date: June 30, 2028

Narrative

Project Summary: We will operationalize valuable statewide monitoring data to understand how zooplankton support Minnesota fisheries and water quality. Results will streamline data collection, management, and preservation, and inform on lake health.

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

Minnesota's lakes are central to our identity and economies. Lake fisheries and water quality are intensively managed to protect this cultural and economic value. Both of these lake services are dependent on and linked by zooplankton – the tiny yet abundant free-floating crustaceans in lakes. Quantifying fundamental links to zooplankton has informed individual lake management cases, revealing the loss of fisheries services (e.g., slower walleye and yellow perch growth) and water clarity (e.g., 3 foot decline totaling millions of dollars in damages) with declines in zooplankton. Such cases highlight the potential benefits of operationalizing these data statewide.

The Minnesota Department of Natural Resources regularly monitors lake zooplankton communities on 35 lakes and has monitored over 300 lakes with the US EPA National Lakes Assessment, resulting in foundational data that could be critical for understanding and managing fisheries and water quality. The rapid, radiating response of zooplankton to stressors (e.g., climate change, invasive species, salt and nutrient pollution, management) make them ideal indicators for lake health, and questions remain regarding these responses to ecological change.

We will leverage these valuable datasets to provide a broader, statewide understanding of the integral but understudied role zooplankton play delivering freshwater ecosystem services.

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 operationalize state zooplankton data by linking zooplankton to critical lake ecosystem services. In doing so, we will expand decision-making support at a broader, statewide scale regarding a critical yet poorly understood biological community in Minnesota lakes.

We will use historical and ongoing monitoring data from the MN DNR Sentinel Lakes (25 lakes) and Large Lakes (10 lakes) programs, as well as 315 MN lakes from the semi-decadal US EPA National Lakes Assessment (NLA) program. Such monitoring and the research it fuels have provided cases quantifying the role of zooplankton in supporting fisheries and water quality in individual lakes, as well as the services lost in those lakes when zooplankton communities are threatened.

We will critically evaluate the role of zooplankton in lake water quality and important fisheries through long-term study of regular MNDNR monitoring efforts and a cross-sectional study of US EPA National Lakes Assessment data. We will then develop biotic indices that relate zooplankton community composition to ecosystem services such as water quality and important fisheries.

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?

Quantifying the effects of zooplankton on ecosystem services will be broadly relevant lake management. Biotic indices are foundational to the MN DNR Watershed Health Assessment Framework (WHAF), and our results could be integrated into existing databases and public-facing online tools. We will explore these opportunities with DNR WHAF staff. These indices will build on an LCCMR-funded paleolimnological study. Indices based on coarser taxonomy would allow for use of emerging automated analysis technology to increase sample-processing capacity. A byproduct of operationalizing data will be data management plans that protect and potentially expand access to MN DNR zooplankton data.

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

Activities and Milestones

Activity 1: Long-term study of MN zooplankton, fisheries, and water quality monitoring efforts

Activity Budget: $272,000

Activity Description:
We will collate data from the Large Lakes (10 lakes, 1994 - present) and Sentinel Lakes (25 lakes, 2007 - present) programs at the finest timestep possible. Long-term data and formal time series analysis are powerful tools for identifying potentially causal relationships. For lakes with higher-quality time series, formal time series models will be fit to estimate the relationships between water quality and fisheries, zooplankton, and other covariates (e.g., nutrients and water temperature). Less data-intensive approaches will be used in the broader set of lakes. Model results will be compared to other regional datasets (e.g., 11 NSF long-term study lakes in WI) to reduce uncertainty.

We will use multivariate methods to develop biotic indices that relate zooplankton community composition to ecosystem services such as water quality and important fisheries. We will work with MNDNR to tailor indices to existing programs, databases, and online visualization tools. In particular, we will use results to streamline sample collection and processing (e.g., via testing automated counting and sample analysis).

To ensure this information is preserved, we will develop a data management plan for the datasets used and produced in this project, and create a plan for sample preservation and archival.

Activity Milestones:

Description	Approximate Completion Date
Collate statewide zooplankton, fisheries, and water quality monitoring data; meet regularly with MNDNR staff	June 30, 2026
Assess role of zooplankton in the provisioning of lake ecosystem services, prepare products for publication	June 30, 2028
Zooplankton biotic indices of lake ecosystem services, work with MNDNR to explore integration into programs	June 30, 2028
Data management plan for zooplankton monitoring programs and plan for sample preservation	June 30, 2028

Activity 2: Space-for-time study of US EPA National Lakes Assessment data

Activity Budget: $131,000

Activity Description:
We will evaluate the role of zooplankton in lake water quality using a cross-sectional study of US EPA National Lakes Assessment (NLA) data (315 MN lakes, ~150 per assessment; assessments in 2007, 2012, 2017, 2022). Data for all key response variables and covariates from Activity 1 are collected in the NLA, and we will use a similar multilevel structural equation modeling approach to estimate the effects of zooplankton on water quality. We will test and further develop biotic indices that relate zooplankton community composition to water quality. Zooplankton are a key biological indicator of lake health in the NLA.

Some lakes in the NLA have been resampled with new assessments. In these cases, we will estimate the relationship between changes in zooplankton communities and changes in lake water quality between assessments. Estimating drivers of change is a better tool for inferring causal relationships than correlation among lakes within assessments.

While the NLA does not collect fisheries-related data, a comprehensive, regional fish catch dataset (collation led by Dr.

Hansen) could provide enough cases where fisheries data was collected from a lake in an assessment year to expand Activity 2 into important MN fisheries.

Activity Milestones:

Description	Approximate Completion Date
Collate USA EPA National Lakes Assessment Zooplankton data	June 30, 2026
Investigate the relationship between zooplankton and lake services both within and between NLA assessments	June 30, 2028
Test and refine zooplankton biotic indices, working with MNDNR to integrate into programs	June 30, 2028
Work with MN PCA and MNDNR Zooplankton Specialist to develop data management plan	June 30, 2028

Activity 3: Outreach and Dissemination

Activity Budget: $20,000

Activity Description:
We will build upon existing collaborations to integrate results into MNDNR programs, and we will further disseminate results to the public and lake associations, and Tribal management staff. We will publish findings in open-access, peer-reviewed journals. All data products will be made available to the MNDNR and the public. Costs are associated with travel for dissemination and personnel time for meetings with stakeholders and developing research products.

Co-PI Dr. Heidi Rantala (MNDNR Fisheries Research Scientist) will liaise between the project and Fisheries staff and leadership for regular meetings. MNDNR WHAF program staff have expressed interest in the project and will will discuss zooplankton-based biotic indices tailored to the Program.

We will present the research at a practitioner-focused conference (e.g., Minnesota Lake Management Society). We will coordinate a webinar to disseminate findings with lake associations (e.g., with Minnesota Lakes and Rivers Advocates).

We will reach out to Tribal and GLIFWC staff early to discuss overlapping interests. Dr. Walsh is a Fond du Lac Band of Lake Superior Chippewa descendant and a member of the Native American Fish and Wildlife Society. He will present findings at the National or Great Lakes Conference, which are well attended by Tribes within MN.

Activity Milestones:

Description	Approximate Completion Date
Explore utility and necessary components of potential zooplankton biotic index in collaboration with WHAF staff	June 30, 2026
Reach out to GLIFWC and Tribal staff regarding zooplankton in fisheries and lake management.	June 30, 2027
Presentation at practitioner-focused conference (e.g., MN Lake Management Society).	June 30, 2028
Webinar for MN lake associations to discuss findings	June 30, 2028
Test and refine biotic index for potential inclusion in WHAF program	June 30, 2028
Present findings at Native American Fish & Wildlife Society Conference (Dr. Walsh is a member).	June 30, 2028
Draft publication on zooplankton provisioning of lake ecosystem services for peer-reviewed journal	June 30, 2028
Publish secondary data products in open access data repository.	June 30, 2028

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Gretchen Hansen	UMN Department of Fisheries, Wildlife, and Conservation Biology	Assistant Professor. Co-PI.	Yes
Heidi Rantala	MN DNR Division of Fisheries and Wildlife	Fisheries Research Scientist. Co-PI.	No

Dissemination

Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.
Dissemination to MNDNR: Co-PI Dr. Heidi Rantala (MNDNR Fisheries Research Scientist) will act as a liaison between the project and MNDNR fisheries staff and leadership. We will work closely with MNDNR Fisheries staff to ensure that products are relevant to managing valuable MN fisheries through regular meetings at each stage of the project. Kylie Cattoor (MNDNR Zooplankton Specialist) helped write this proposal and will be involved in each stage of the project as many milestones in both Activity 1 and 2 align with Zooplankton Specialist duties. We have been in contact with Beth Knudsen (MNDNR Watershed Health Assessment Framework Coordinator), who is interested in the project and is open to meeting with the project team to discuss interest in developing zooplankton-based biotic indices tailored to the WHAF Program. All data products will be made available internally to MNDNR staff and, if determined suitable by relevant DNR data stewards, made publicly available in the MN Geospatial Commons. Data management plans will be developed for each research product for long-term sustainability.

Dissemination to the public and lake associations: We have budgeted travel funds to present the research at a practitioner-focused conference, ideally one well-attended by the many local government and citizen groups engaged in MN lake management (e.g., the Minnesota Lake Management Society or the North American Lake Management Society Symposia). We will coordinate a webinar to disseminate findings with lake associations in collaboration with a group such as Minnesota Lakes and Rivers Advocates.

Tribal engagement: Interactions with Tribal staff and members will be informed by guidance documents prepared by Great Lakes Tribal and Federal representatives (Tribal Adaptation Menu Team 2019; US Caucus of the Traditional Ecological Task Team 2021). Dr. Walsh is a descendant of the Fond du Lac Band of Lake Superior Chippewa, and Tribal engagement and co-production of science is foundational to his research program. Dr. Walsh is also a member of the Native American Fish and Wildlife Society, and we budgeted funds to present findings at the National or Great Lakes Regional Conference. We will reach out to Tribal and Great Lakes Indian Fish and Wildlife Commission staff early to discuss the role of zooplankton in Tribal fisheries management, opportunities for collaboration and information-sharing, and the cultural importance of zooplankton, especially for lakes within or adjacent to reservation or ceded lands.

Finally, we will publish our findings in open-access, peer-reviewed journals. We will work with UMN communications and outreach staff to develop and advertise press releases related to the publications. All data and code used in publications will be made publicly available in repositories (e.g., the Data Repository for U of M, GitHub).

ENRTF will be acknowledged in all dissemination activities and products as per the ENRTF Acknowledgement Guidelines.

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?

These results can be implemented into existing MN DNR staffing and programming. Many outputs could be tailored to existing MNDNR databases and outward facing data visualization tools (e.g., WHAF). The zooplankton indices and data management plans will provide long-term benefits to the MN DNR Statewide Zooplankton Specialist. The results here will generate hypotheses and research questions for experiments regarding the role of zooplankton in lake management. Such work would be funded through LCCMR as well as through the Minnesota Aquatic Invasive Species Research Center, the Midwest Climate Adaptation Science Center, and the Midwest Glacial Lakes Partnership.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Principal Investigator		Manage project, advise graduate student			37.1%	0.63		$135,550
Co-Principal Investigator, Dr. Gretchen Hansen		Consult on fisheries-related research aims			37.1%	0.12		$25,992
Graduate Student Research Assistant		Collect and analyze data, work with team to design research and outputs, prepare reports, publications, and data products			25.1%	2.25		$254,534
							Sub Total	**$416,076**
Contracts and Services								
							Sub Total	**-**
Equipment, Tools, and Supplies								
							Sub Total	**-**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Conference Registration Miles/ Meals/ Lodging	Estimate example: travel to Duluth, MN for a five-day conference. Conference Registration: $500; Mileage: 0.67*151*2 = $202.34; Lodging: 4 nights * 300 = $1,200; Meals: 2 days at 0.75 per diem, 3 days	Present results at in-state, practitioner-focused conference					$4,516

		at full per diem = 2*0.75*79 + 3*1*79 = $355.50. Total: $2,257.84 per person x 2 people = $4,515.68						
							Sub Total	**$4,516**
Travel Outside Minnesota								
	Conference Registration Miles/ Meals/ Lodging	Estimate example: travel for one conference to Sault St. Marie, MI for 2023 NAFWS Great Lakes Regional Conference. Conference Registration: $500; Flights: $1,000; Lodging: 4 nights * 160.50 = $642; Meals: 2 days at 0.75 per diem, 3 days at full per diem = 2*0.75*59 + 3*1*59 = $265.50. Total: $2,407.50	Present results at one of the Native American Fish & Wildlife Society National or Great Lakes Regional Conference.	X				$2,408
							Sub Total	**$2,408**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$423,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Travel Outside Minnesota	Conference Registration Miles/Meals/Lodging	Estimate example: travel for one conference to Sault St. Marie, MI for 2023 NAFWS Great Lakes Regional Conference. Conference Registration: $500; Flights: $1,000; Lodging: 4 nights * 160.50 = $642; Meals: 2 days at 0.75 per diem, 3 days at full per diem = 2*0.75*59 + 3*1*59 = $265.50. Total: $2,407.50	Fisheries and water quality related results will be important for Tribal natural resources managers. Many regional and Minnesota Tribal managers attend the NAFWS National Conference. This will be only one potentially out-of-state conference over the course of the project.

Non ENRTF Funds

Category	Specific Source	Use	Status	$ Amount
State				
In-Kind	Game and Fish Fund	Minnesota DNR Fisheries Research Scientist Heidi Rantala will provide 104 hours of in-kind support of this project for each of three years, for a value of $16,755. Dr. Rantala will contribute to project design, compile existing MNDNR data, perform statistical analyses, and help create reports and outreach materials for the project. She will lead and participate in outreach events and act as liaisons for the project to fisheries managers and MNDNR leadership. This project will provide an opportunity to utilize the large MNDNR zooplankton dataset to better understand Minnesota lakes and fisheries.	Secured	$16,755
			State Sub Total	**$16,755**
Non-State				
			Non State Sub Total	**-**
			Funds Total	**$16,755**

Total Project Cost: $439,755

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: 5d16549c-8b3.pdf

Alternate Text for Visual Component

The Visual Component includes (from top to bottom) the project title, a diagram showing the importance of zooplankton for supporting fisheries and water quality, a project statement related to leveraging state monitoring data, and a list of four project goals....

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

Title	File
Partner letter for Heidi Rantala	af4ee926-1cb.pdf
Endorsement Letter from UMN Sponsored Projects Administration	f270f611-11a.pdf
2025-294 Research Addendum revised_final	e2656e1e-de2.pdf

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

To adjust the budget from the $445,000 proposed to the $423,000 recommended for funding, we cut the publication cost support (-$12,273) and slightly reduced the PI summer salary (-$9,727, -0.06 FTE over three years). We still plan to publish results in manuscripts submitted to open-access, peer-reviewed journals.

Additional Acknowledgements and Conditions:

The following are acknowledgements and conditions beyond those already included in the above workplan:

Do you understand and acknowledge the ENRTF repayment requirements if the use of capital equipment changes?

N/A

Do you understand that travel expenses are only approved if they follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

Yes, I understand the UMN Policy on travel applies.

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

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 pre-design, design, construction, or renovation of a building, trail, campground, or other fixed capital asset costing $10,000 or more or large-scale stream or wetland restoration?

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 as "the provision of care, treatment, education, training, instruction, or recreation to children")?

No

Provide the name(s) and organization(s) of additional individuals assisting in the completion of this project:

Dr. Gretchen Hansen (UMN), Dr. Heidi Rantala (MN DNR), Kylie Cattoor (MN DNR), Patrick McDonald (UMN), Kelsey Grachek (UMN)

Do you understand that a named service contract does not constitute a funder-designated subrecipient or approval of a sole-source contract? In other words, a service contract entity is only approved if it has been selected according to the contracting rules identified in state law and policy for organizations that receive ENRTF funds through direct appropriations, or in the DNR's reimbursement manual for non-state organizations. These rules may include competitive bidding and prevailing wage requirements

N/A