



Environment and Natural Resources Trust Fund

2026 Request for Proposal

General Information

Proposal ID: 2026-501

Proposal Title: Evaluating Forward-Facing Sonar Impacts on Minnesota Fish

Project Manager Information

Name: Gretchen Hansen

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

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Project Basic Information

Project Summary: Evaluating the impact of forward-facing sonar on angler catch rates and fish mortality across multiple species and lake types to inform sustainable management of Minnesota freshwater fish populations.

ENRTF Funds Requested: \$702,000

Proposed Project Completion: June 30, 2029

LCCMR Funding Category: Fish and Wildlife (D)

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.

Freshwater fish populations provide a multitude of benefits to Minnesotans including recreational angling and subsistence fishing. Fishing is an integral part of Minnesota culture and livelihoods. Managing sustainable fisheries requires a detailed understanding of how angler activities impact fish vulnerability to capture, harvest, and ultimately fish mortality, and designing regulations accordingly. Recently, the use of angler technology in Minnesota lakes, specifically forward-facing sonar, has increased. This technology is being used by anglers to locate and target fish populations and could increase fish mortality. In harvest-oriented fisheries, this increased capture efficiency could lead to increased harvest, and in catch-and-release fisheries increased captures could increase hooking mortality. The impacts of forward facing sonar on fish populations depend on the level of usage by anglers, the effect on catch rates in both open water and ice angling seasons, and population dynamics of the species. The appropriate management response to changes in angler catch rates due to new technology hinges upon answering these questions. Understanding if and how much angler technologies such as forward facing sonar influence capture and mortality of across multiple species and Minnesota lake types will enable scientifically informed management decisions towards maintaining fisheries for future generations to come.

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 employ a multi-step approach to evaluate how angler technologies such as forward-facing sonar (FFS) impact fish populations and potential management responses in Minnesota. We will collaborate with MN DNR partners to quantify the prevalence of FFS use among anglers and how it varies by target species and angling season using creel surveys. We will then evaluate the effects of FFS on fish vulnerability to capture and harvest across Minnesota lakes using an experimental test of angler technology efficiency for focal fish species including Musky, Walleye, and Black Crappie. Using this experimental data we will quantify average angler catch per hour between open water and ice angling seasons. Population abundance, fish size, and size distributions of fish captured during the experiment will also be analyzed to estimate population level vulnerability to capture in case study lakes. We will use this information to create simulated fishery scenarios to quantify how different combinations of technology use and fish abundances impact future fish capture and harvest rates. This work will measure the effects of technology use on fish at the individual and population level to enable rigorous assessment of the vulnerability of Minnesota fish populations to effects of changing technology.

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?

Outcomes of this project are standardized capture and harvest rates for angling with 2D and forward-facing sonar (FFS) for Walleye, Musky, and Crappie fisheries in both open water and ice angling seasons. The project results will quantify the prevalence of angler technology used by MN anglers across lakes, seasons, and angler avidity. Additional project outcomes include estimated mortality rates of fish captured with FFS and predictions of future fishery scenarios with increased technology use in different Minnesota lake types. We will collaborate with partners throughout project implementation to develop adaptive management plans for fisheries susceptible to overexploitation with technology.

Activities and Milestones

Activity 1: Determining the prevalence of angler technology usage by Minnesota anglers across species and seasons

Activity Budget: \$193,517

Activity Description:

The objective of this activity is to understand angler technology use trends for Minnesota anglers targeting recreational species of importance. Tasks will include a creel survey analysis of angling across seasons for targeted fisheries and comparison to standardized agency fish abundance data. Creel surveys by partners have collected general information about the frequency of FFS use in comparison to 2D sonar and no technology. We will assist in the analysis of these survey results to evaluate patterns and differences among species and angling seasons. We will compare technology use prevalence to fish population estimates to understand how angler effort and technology is distributed across the landscape. Outcomes of this survey analysis will include the overall prevalence of angler technology used by Minnesotans, frequency of FFS use in a year by anglers across seasons, catch - abundance relationships within lakes, and angler FFS use for Walleye, Crappie, and Musky fisheries. Results from this activity will be used to select experimental case study lakes. We will formalize results from this survey in an online scientific report to share with the general public and present findings at regional and national meetings of interests including Minnesota American Fisheries Society meeting.

Activity Milestones:

Description	Approximate Completion Date
Meeting with MN DNR and partners	July 31, 2026
Analysis of creel survey results completed	July 31, 2027
Scientific report finalized for general public and journal publication	December 31, 2027

Activity 2: Quantifying capture rates differences between forward-facing sonar and 2D sonar for focal freshwater fish species in Minnesota Lakes

Activity Budget: \$308,493

Activity Description:

The objective of Activity 2 is to directly compare capture efficiency between FFS and 2D sonar for harvest and catch and release freshwater fish species. Tasks will include a multi-lake experimental test of angler catch rates for Walleye, Crappie, and Musky in both open water and through ice. We will estimate size-specific and species-specific catch rates and how they vary with technology use and lake conditions such as lake size and clarity. This experimental data analysis will enable identification of conditions under which FFS results in the greatest increase in fish vulnerability to capture. Outcomes of this experiment are standardized estimates of the difference between angler capture efficiency with and without FFS, size distributions of captures with FFS, and how FFS capture varies across open water and ice angling seasons for our targeted fisheries.

Activity Milestones:

Description	Approximate Completion Date
Case study lake selection in coordination with MN DNR	January 31, 2027
Experimental sampling in case study lakes across seasons	December 31, 2028
Experimental data analysis	May 31, 2029
Scientific report finalized for general public and journal publication	June 30, 2029

Activity 3: Predicting how angler technology use could impact harvest and mortality of fish populations

Activity Budget: \$199,990

Activity Description:

The objective of Activity 3 is to estimate how changes in fish vulnerability and catch rates due to FFS technology will impact fish populations across a range of species, population statuses, and lake conditions. Tasks will include creating fishery scenario models with different combinations of angler use of FFS, catch rates with and without FFS, and fish abundance informed by Activity 2. Scenario tools enable the user to predict how increased fishing capture with FFS may alter population levels in lakes from harvest and/or hooking mortality under different conditions and assumptions. Scenarios will be developed in coordination with MN DNR partners to ensure that key questions related to sustainable fisheries management are answered, and population-level parameters will be estimated from Activity 2 and drawn from other studies to represent outcomes across a range of possible conditions. We will develop an interactive tool to evaluate outcomes of different scenarios. Additionally, we will publish our results from the model scenarios in a scientific journal using open access format and an online data repository. Findings will be formalized in an agency report and available online for the general public.

Activity Milestones:

Description	Approximate Completion Date
Identification of relevant questions and scenarios	June 30, 2027
Literature review and existing data analysis for model development	June 30, 2028
Creation of fishery scenario models and model comparison of fishery outcomes	March 31, 2029
Scientific report finalized for general public and journal publication	June 30, 2029
Web-based scenario tool created and publicly available online	June 30, 2029

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Camille Mosley	University of Minnesota	Post doctoral research fellow. Lead experimental design, supervise technicians, lead data collection and analysis, lead scenario model development and analysis, collaborate with project partners for communication and dissemination of results.	Yes
Nicholas Rydell	Minnesota Department of Natural Resources	MN DNR Fisheries Specialist. Collaborate to conduct and analyze creel survey, consult on scenario development and management questions, collaborate on analysis, interpretation, and dissemination of results.	No
John Hoxmeier	Minnesota Department of Natural Resources	MN DNR Fisheries Research Supervisor. Will contribute to project design, compile existing MN DNR data, and facilitate the collection of new data. Additionally will act as liaison for the project to fisheries managers and MN DNR leadership.	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?

We will meet regularly with MN DNR partners to ensure that our approach aligns with their priorities and questions regarding the population-level impacts of forward-facing sonar. Results will be shared through open-access publications, presentations at conferences, in public seminars targeting anglers (in person and virtual), and a website where visitors can visualize fish population responses under multiple scenarios. Because of widespread interest in the impacts of forward-facing sonar, we expect that additional work will be of interest to multiple agencies and angler groups that would be funded by multi-state sources such as Fish and Wildlife Service multi-state grants.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Uncovering the Past to Protect Minnesota's Walleye Fisheries	M.L. 2024, , Chp. 83, Art. , Sec. 2, Subd. 04m	\$1,121,000

Project Manager and Organization Qualifications

Project Manager Name: Gretchen Hansen

Job Title: Associate Professor

Provide description of the project manager's qualifications to manage the proposed project.

Dr. Gretchen Hansen is an associate professor of fisheries ecology in the UMN-TC Department of Fisheries, Wildlife, and Conservation Biology. Dr. Hansen has extensive experience developing tools for fisheries management and has established collaborative relationships with partners in state, federal, and non-profit conservation agencies and organizations. Her work is not only scientifically rigorous but is also relevant for policy makers and stakeholders and has directly influenced fisheries policies. Dr. Hansen is an active member of national, regional, and state-level teams and working groups related to science based management of aquatic ecosystems, including the Midwest Glacial Lakes Partnership Science and Data Team, the Red Lake Fisheries Management committee as a technical expert, the Minnesota Department of Natural Resources Walleye Zebra Mussel task force, and the advisory board for the Minnesota Long Term Lake Monitoring program. She conducts high quality, high impact, and actionable science— as evidenced by publication and high citation rates in peer reviewed journals (n=76, 4336 citations). Dr. Hansen has secured over \$5.3M

in extramural funding from international, federal, regional, and state sources since joining the University of Minnesota faculty in 2018. Dr. Hansen has been invited to give several keynote addresses and seminars, and her research has regularly appeared in the media. Dr. Hansen has experience supervising students, post-doctoral researchers, and staff engaged in research and application of results.

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

Organization Description:

The University of Minnesota Twin Cities is the state's land-grant university and one of the most prestigious public research universities in the nation. The research mission of the University is to seek new knowledge that can change how we all work and live. We apply our research and expertise to meet the needs of Minnesota, our nation, and the world through partnerships in addressing society's most pressing issues.

Within the University of Minnesota, faculty, staff, and students of Department of Fisheries, Wildlife, and Conservation Biology work on applied and fundamental problems related natural resource management and conservation. The mission of the Department of Fisheries, Wildlife, and Conservation Biology is to inspire and create solutions for biological conservation and management in a diverse and changing world. Our goals are 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.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Project Manager		Lead all aspects of project, including study design, supervision of staff and students, data collection and analysis, interpretation and communication of results, and engagement with partners.			36.6%	0.24		\$51,986
Graduate Student		To conduct statistical analyses, assist with fieldwork, and coordinate with partners on implementation and integration of research. Cost includes 50% assistantship for 3 years plus Graduate student fringe is 23.2% plus tuition for 6 semesters totaling \$60,778			23.2%	3		\$178,606
Research Scientist		To coordinate and lead field work with state partners, coordinate data acquisition, assist with analysis and communication.			36.6%	3		\$309,409
Undergraduate technicians (4)		To assist with field work and data entry (15.25/hr for 24 weeks field work and data entry/management, each student total = 32hrs/week))			0%	0.78		\$46,848
							Sub Total	\$586,849
Contracts and Services								
University of Minnesota Natural Resources Research Institute Water Quality Testing	Internal services or fees (uncommon)	Water chemistry analysis for 16 study lakes at 3 sites per lake in summer and winter . Costs calculated based on per sample cost for Dissolved organic carbon (\$17.44), Total phosphorus + Total Nitrogen (\$49.80), chlorophyll-A (\$32.30), turbidity (\$11.70), Total Suspended Solids (\$21.90) and filtration (\$9.10).				0		\$13,655
							Sub Total	\$13,655
Equipment, Tools, and Supplies								
	Tools and Supplies	Fishing gear: Fishing rods, lures, line, aerators, nets, pliers, buckets	Fishing equipment for ice fishing and open water fishing for Crappie,					\$3,441

			Muskellunge, and Walleye fisheries in experimental lakes and data collection of fish metrics (size, weight, etc.)					
	Tools and Supplies	Fish sampling gear: field scales, length boards, scale envelopes, plastic bags and vials	Supplies for collecting size, weight, and age data on fish collected in experimental angling.					\$1,731
	Tools and Supplies	Winter outerwear for researchers and technicians in cold conditions on experimental lakes during sampling	Winter outwear including jacket and bib. Gear for researchers/technicians for waterproofing and weather protection during ice fishing experimental angling.					\$1,500
	Equipment	Ice fishing sled (2)	Sled for carrying ice fishing and fish measuring equipment over the ice during hard water experimental sampling					\$300
	Equipment	Ice fishing shelter (2)	Ice fishing tent for experiment to simulate ice angling conditions by Minnesota anglers and store equipment, windows for safety					\$1,540
	Equipment	Ice Auger (2)	Augers to drill holes in the ice for hard water experimental angling sampling with sonar					\$1,200
	Equipment	Trolling motors (2)	Mini Kota trolling motors for open water season experimental sampling of fish using rod and reels					\$3,600
	Tools and Supplies	Boat gasoline	Gasoline for boat for field work related to deploying loggers, collecting water quality samples, collecting fish samples.					\$260
	Tools and Supplies	Marine Battery (2)	Battery for trolling motors and sonar equipment for boats.					\$660
	Tools and Supplies	Boat paddles (2)	Paddles for safety if motor gives out or too shallow for outboard/trolling motor					\$200
	Tools and Supplies	Inflatable life jackets (4)	Inflatable life jackets for researcher safety during all fieldwork conducted					\$600
	Equipment	2D sonars, transducer, and cables (2 units - Lowrance)	Sonar for experimental angling experiment to test forward facing sonar efficiency during open and hard water seasons. Equipment to mount technology on both experimental research vessels.					\$7,996
							Sub Total	\$23,028

Capital Expenditures								
		Forward-facing sonars, transducer, and cables (2 units- Garmin)	Sonar for experimental angling experiment to test forward facing sonar effieceny during open and hard water seasons. Equipment to mount technology on both experimental research vessels.	X				\$15,470
		Research boat (pre owned 14ft aluminum boat with outboard motor and trailer included)	Boat for testing forward facing sonar effeicncey for rod and reel angling during the open water season. Trailer for 14ft boat to launch and travel to experimental lakes	X				\$10,000
							Sub Total	\$25,470
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	Fieldwork to conduct experimental angling in case study lakes during open water and ice-covered seasons. Travel to and from 16 study lakes in winter and summer, and lodging for lakes further than 3 hours. Costs estimated for 2 ppl* 3 travel weeks for year 1, 12 travel weeks for year 2, and 3 travel weeks for year 3. Total based off weekly costs of 600 miles@\$0.70/mi () + 4 lodging nights per person @\$165/night per person+ 5 days of meals @\$69/day per person (meal estimate based on state per diem rate; actual costs will be reimbursed)	Fieldwork to visit case study lakes to conduct experimental angling with different technologies and collect fish data in support of project objectives.					\$37,632
	Miles/ Meals/ Lodging	Travel for two people to attend two outreach and MN DNR fisheries technology meetings in each of three years. Costs estimated per meeting as 400 miles@\$0.70/mi + 2 lodging nights@\$165/night per person + 1 day of meals @\$68/day + 2 travel days of meals @\$51 day (meal estimate based on University per diem rate; actual costs will be reimbursed)	Travel for two people to attend two outreach and MN DNR fisheries technology meetings in each of three years to co-analyze creel and experimental research findings and integrate project results into fisheries conservation planning tools.					\$7,680

	Conference Registration Miles/ Meals/ Lodging	Travel for in state meetings and conferences 1 person attending 1 per year in years 2 and 3. Costs estimated as \$250 registration fee, 400 miles@\$0.70/mi + 2 lodging nights@\$165/night + 1 day of meals @\$68/day + 2 travel days of meals @\$51 day (estimates based on University per diem rates, actual costs will be reimbursed)	Travel for one person to travel to an in state conference (e.g., the Minnesota chapter of the American Fisheries Society or the Water Resources Conference) to present and communicate results					\$2,060
							Sub Total	\$47,372
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
	Publication	Open access publication fee for peer reviewed journal article	Publishing research results in open access journal so that the public can read results without being behind a paywall					\$3,200
							Sub Total	\$3,200
Other Expenses								
		Boat Maintenance	Maintenance of lab-owned boats used for field sampling, including winterizing and regular maintenance					\$2,426
							Sub Total	\$2,426
							Grand Total	\$702,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Capital Expenditures		Forward-facing sonars, transducer, and cables (2 units- Garmin)	<p>This purchase is not a generally ineligible expense. Sonar purchase is directly related to and necessary for producing the project outcomes described in the proposal. Equipment will be used solely for the project activities as described in the proposal during the entire duration of the grant.</p> <p>Additional Explanation : Project manager Gretchen Hansen will ensure that the equipment is used throughout its useful life to achieve project objectives. If appropriate, equipment could be used for future ENTRF projects within the University of Minnesota focused on fisheries management.</p>
Capital Expenditures		Research boat (pre owned 14ft aluminum boat with outboard motor and trailer included)	<p>Boat required for conducting field experiments on lakes throughout Minnesota. We will seek to purchase a pre-owned boat/trailer/motor package to keep costs down.</p> <p>Additional Explanation : Project manager Gretchen Hansen will ensure that the equipment is used throughout its useful life to achieve project objectives. If appropriate, equipment could be used for future ENTRF projects within the University of Minnesota focused on fisheries management.</p>

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
In-Kind	Minnesota Department of Natural Resources Division of Fish and Wildlife	Minnesota DNR Fisheries staff will provide in-kind support for this project. Specifically, John Hoxmeier, Fisheries Research Supervisor, and Nicholas Rydell, Fisheries Specialist, will contribute to project design, compile existing MN DNR data, and facilitate the collection of new data. They will act as liaisons for the project to fisheries managers and MN DNR leadership with an in-kind contribution of DNR salary and benefits: Fisheries Research Supervisor and Fisheries Specialist. Both staff will contribute 80 hours each annually totaling \$28,836 in kind for approximately 480 hours of work.	Secured	\$28,836
			State Sub Total	\$28,836
Non-State				
In-Kind	University of Minnesota foregone indirect costs (54% MTDC)	Administrative costs associated with support of research activities including payroll and human resources, finance, facilities, and IT. If this award is reduced from the requested amount, the proposed cost sharing will be reduced proportionately. Cost calculated based on total award amount not including graduate tuition (60,778 over three years) or capital expenses (25,470).	Secured	\$332,506
			Non State Sub Total	\$332,506
			Funds Total	\$361,342

Total Project Cost: \$1,063,342

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [f957bdd9-09c.pdf](#)

Alternate Text for Visual Component

Visual shows project overview and outcomes. "How do we prevent freshwater fish overexploitation with new angler technologies?" Solution: Quantify Forward Facing Sonar Capture Efficiency and Simulate Future Fishery Outcomes. The graphic includes project institution and partner logos of the University of Minnesota and Minnesota Department of Natural Resources....

Supplemental Attachments

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

Title	File
MN DNR support letter	750cdb32-962.pdf
Sponsored projects approval to submit sonar	b254177b-be2.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

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 proposal:

Camille Mosley

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