



Environment and Natural Resources Trust Fund

2022 Request for Proposal

General Information

Proposal ID: 2022-155

Proposal Title: Catch and Reveal: Discovering unknown fish contamination threats

Project Manager Information

Name: Bridget Ulrich

Organization: U of MN - Duluth - NRRRI

Office Telephone: (218) 788-2748

Email: ulrichb@umn.edu

Project Basic Information

Project Summary: Harmful “forever chemicals” were recently discovered in rainbow smelt- what else are we missing? We seek to protect anglers and their families by uncovering unknown contamination threats to Minnesota fish.

Funds Requested: \$276,000

Proposed Project Completion: June 30 2025

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.

Recent reports of perfluoroalkyl substances (PFAS) in rainbow smelt have troubled Minnesota's anglers and their families. PFAS are widely present in consumer products, and they don't break down once they enter the environment. Instead, they can accumulate in fish and end up on our dinner tables. The implications span generations: PFAS have been linked with developmental health effects in children, and may compromise immune activity and impact COVID-19 vaccine efficacy in adults. As Minnesota seeks to lead the nation to reduce PFAS contamination, innumerable other contaminants are present in the environment— and we may not even realize they exist. For example, 6PPD-quinone, a mysterious chemical that caused mass Coho salmon deaths on the West Coast, eluded detection because it's not directly produced by humans. Rather, it's a "transformation product" formed from tire rubber left on road surfaces. Further, the Minnesota Department of Agriculture recently reported detection of cyanazine transformation products in Minnesota waterbodies. Cyanazine is an herbicide no longer used in the US, and its transformation products were likely missed by monitoring programs for years. Therefore, as Minnesota seeks to reduce known contamination, we also have the opportunity to "catch and reveal" unknown fish contamination threats.

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

To protect Minnesota's families and fisheries, water quality monitoring efforts must cast a wide net to both track down sources of known contaminants and uncover potentially hazardous unknown contaminants. We seek to identify chemical fingerprints across waterbodies impacted by different land uses that indicate potential threats to Minnesota's fisheries. We will go beyond current and planned monitoring efforts by coupling innovative field techniques with state-of-the-art chemical analysis methods. Specifically, we will use passive samplers (small vessels that take up contaminants over time when submerged in water) to capture contaminants that are likely to accumulate in fish while avoiding time-consuming and costly efforts to measure contaminants in fish tissue directly. Passive samplers will be deployed at sites across MN representative of waterbodies impacted by urban, industrial, and agricultural activities, as well as pristine waterbodies representing reference conditions. Contaminants collected on samplers will be measured using novel discovery-based chemical analysis techniques, enabling simultaneous measurement of known contaminants while acquiring a "snapshot" of all contaminants present in a sample- known or unknown. Finally, identified contaminants will be ranked according to potential threats to aquatic life by using databases and risk assessment tools to compile known or predicted bioaccumulation and toxicity potential.

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?

Our findings will provide a knowledge base for more comprehensive statewide contaminant monitoring and mitigation plans. Specifically, we will take a nontargeted approach to broadly observe contaminants lurking in MN waterbodies, in complement to conventional monitoring activities. Further, by ranking identified contaminants according to known or estimated hazards, our results will inform the prioritization of new contaminants to be included in existing monitoring and mitigation programs. These efforts will protect Minnesota's natural resources and lead to cleaner water and healthier fisheries. Moreover, protecting Minnesota's fisheries also means protecting our families, freshwater recreational opportunities, regional economies, and cultural identity.

Activities and Milestones

Activity 1: Development of passive sampling methods and field monitoring plans

Activity Budget: \$87,300

Activity Description:

Preliminary work will be required to develop data collection methods that are comparable across varying field conditions, as described below:

Task 1a: Development of passive sampling methods. Several types of commercially available passive samplers with varying modes of contaminant capture will be evaluated in laboratory experiments under a range of flow conditions with realistic natural waters. The sampler (or combination of samplers) that most comprehensively captures contaminants will be selected for deployment. Sampler collection frequencies that optimize contaminant capture and time resolution will be determined according to experimental data.

Task 1b: Development of deployment plan. We will work with regional managers to select field sites along MN streams that represent the following categories of expected land-use impacts: pristine, urban-impacted, industry-impacted, and agriculture-impacted. We will target locations with active stream gauges, expect sites to be distributed throughout Northeastern MN, Southern MN, and the Twin Cities Metro area. We will also develop a sensor deployment plan to continuously monitor other parameters important to fish and fish habitat health (temperature, dissolved oxygen, conductivity, pH, and turbidity).

The output of this activity will be a field monitoring plan to comprehensively collect water quality and contaminant data across Minnesota streams impacted by varying land uses.

Activity Milestones:

Description	Completion Date
Passive sampler and analysis methods verified in the laboratory	February 28 2023
Field sites selected and sampling plan finalized	February 28 2023
Sensors, samplers, and other field equipment acquired	March 31 2023

Activity 2: Deployment and monitoring of passive samplers and sensors

Activity Budget: \$157,632

Activity Description:

Passive samplers and in-stream, high-frequency sensors will be deployed and monitored over two field seasons as described below:

Task 2a: Deployment and maintenance of monitoring equipment. Sensors and samplers will be securely installed within streams at easily accessible locations, allowing field crews to maintain sensors and download data approximately every other week from April - October. The frequency of sampler collection will be determined during Activity 1 to optimize contaminant capture and time resolution. To inform contaminant load calculations, we will also measure water height and measure discharge to create rating curves for each stream.

Task 2b: Discovery-based analysis of captured contaminants. Contaminants extracted from samplers will be analyzed using discovery-based chemical analysis techniques, yielding “snapshots” of virtually all detectable compounds present. Briefly, candidate contaminant “peaks” will be deciphered from acquired data, and then established workflows will be

performed to link observed mass spectra (a chemical fingerprint) with potential contaminant identities. Confidence of identities will be ranked according to established methods, and concentrations will be measured if analytical standards are readily available.

The output of this activity will be a summary of measured water quality parameters and detected contaminants (known and newly identified) in streams across varying land uses.

Activity Milestones:

Description	Completion Date
Passive samplers and sensors deployed	April 30 2023
Collection of samplers and sensor data completed	November 30 2024
Measurement of known contaminants and identification of unknown contaminants completed	March 31 2025

Activity 3: Assessment of potential fish contamination threats and dissemination of findings

Activity Budget: \$31,068

Activity Description:

Task 3a: Compile a ranked list of potential fish contamination threats. The potential hazards of detected contaminants will be quantified according to known or predicted indicators of aquatic toxicity and bioaccumulation potential. Briefly, we will search the US EPA’s ECOTOXicology Knowledgebase (ECOTOX) for toxicity data for detected contaminants, compile known aquatic toxicity indicators, and use data for structurally similar compounds to estimate indicators for cases where no toxicity data exists. Contaminant bioaccumulation potential (an indicator of the likelihood of contaminants to accumulate in fish) will be estimated using standardized software (e.g., EPA’s Epi Suite). A weighted ranking system will be applied to create a prioritized list of detected contaminants according to aquatic toxicity and bioaccumulation potential, and trends in hazard potential and land-use impacts will be evaluated. The list will also be cross-checked with contaminant lists from current monitoring programs to identify potentially problematic gaps.

Task 3b: Disseminate findings. Our results and recommendations for expanded contaminant monitoring programs will be summarized in a final report. Findings will be disseminated to resource managers, stakeholders, and the public through state and regional agency presentations, community gatherings, media stories, NRRI and UMD communications, conference presentations, and peer-reviewed scientific articles.

Activity Milestones:

Description	Completion Date
Compilation of known or predicted bioaccumulation and toxicity potential for identified contaminants completed	May 31 2025
Final report detailing findings and recommendations submitted	June 30 2025

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Christopher Filstrup	Natural Resources Research Institute	Dr. Filstrup will be responsible for leading stream monitoring efforts and assisting with sampling design, data analysis and interpretation, and dissemination of findings. Filstrup supervises the operation of NRRI's Central Analytical Laboratory, a state-certified water quality laboratory, and has been studying lakes and streams for more than two decades.	Yes
Brian Barry	Natural Resources Research Institute	Dr. Barry will serve as a liaison between researchers and the recreational fishing community. Dr. Barry is a chemist and avid angler, and will connect researchers with members of the recreational fishing community to assist with dissemination of results.	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 be funded?

In reflection of NRRI's commitment to sustaining Minnesota's natural resources, we will continue to disseminate our findings and advise resource managers beyond the project duration. This will lead to future implementation of evidence-based, statewide contaminant monitoring programs that more effectively target potential threats to fisheries and families alike. Development of discovery-based chemical analysis methods are ongoing at NRRI, and are funded as a part of the US EPA's Great Lakes Restoration Initiative (GLRI). Beyond project completion, we intend to seek funding opportunities for solutions-oriented research to mitigate contamination threats uncovered as a part of our findings.

Project Manager and Organization Qualifications

Project Manager Name: Bridget Ulrich

Job Title: Research Program Leader

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

The Duluth News Tribune recently featured an interview with Dr. Bridget Ulrich in a front-page article about contamination threats to Lake Superior. While Dr. Ulrich grew up on the Iron Range in Virginia, and while her early career work brought her around the world, her strong passion for protecting Minnesota's waters drew her back to her home state. Dr. Ulrich obtained a Bachelors degrees in chemical engineering from the University of Minnesota Twin Cities; and went on to obtain a Master's degree in Chemical and Bioengineering at the Swiss Federal Institute of Technology in Zurich, Switzerland; and then a PhD in Environmental Engineering at the Colorado School of Mines. She has since returned to Northern Minnesota, where she is now an Aqueous Geochemist and Research Program Leader at the Natural Resources Research Institute in Duluth. Dr. Ulrich's research expertise is in environmental organic chemistry and the application of low-cost materials for water treatment, and she specializes in removal of organic contaminants (such as pesticides and PFASs, or "forever chemicals") from water. She has over a decade of research experience, and has 14 peer-reviewed scientific articles with hundreds of citations that demonstrate her contributions to her field. She is currently the analytical chemistry lead on a five year multi-million dollar EPA-funded project to analyze persistent organic contaminants in Great Lakes sediments, which is the topic that recently attracted the attention of the Duluth News Tribune.

Organization: U of MN - Duluth - NRRI

Organization Description:

The Natural Resources Research Institute (NRRI) is a U.S. based research institute established by the Minnesota state

legislature within the University of Minnesota Duluth. NRRI is an applied research organization that works to develop and deliver the understanding and tools needed to utilize our mineral, forest, energy and water resources in a balanced and environmentally responsible manner. NRRI is a unique, multidisciplinary, applied research institute focused on Minnesota's many natural resources. Associated with the University of Minnesota Duluth with research facilities in Duluth and Coleraine, NRRI is a leading research arm of the greater University of Minnesota community. The Institute was created to be an economic development engine for the state. NRRI delivers solutions to allow responsible use of Minnesota's resources, provides information and tools for sound environmental decisions and assists existing and entrepreneurial business and industry evolve and prosper. Ultimately, NRRI is here to collaborate broadly in creating resilient, vital Minnesota communities.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Project manager and analytical lead		Overall project management, oversight of chemical analysis and data acquisition.			26.7%	0.42		\$54,671
Field work coordinator		Oversight of planning and implementation of field work.			26.7%	0.42		\$44,857
Environmental chemist		Development of passive sampling methods and performance of chemical analyses			24.1%	0.6		\$42,790
Postdoctoral researcher		Data analysis, contaminant threat assessment, and report preparation			20.3%	0.5		\$34,172
Undergraduate research assistants		Four undergraduate research assistants to visit field sites, download data, and collect and ship samplers.			0%	0.48		\$17,582
Recreational fishing community outreach liaison		Facilitate dissemination of findings to recreational fishing community			26.7%	0.03		\$3,917
							Sub Total	\$197,989
Contracts and Services								
							Sub Total	-
Equipment, Tools, and Supplies								
	Equipment	Hydrolab sonde data logger: 4 @ \$4500 = \$18,000; Sensors: 4 @ \$3500 = \$14,000	Data loggers and sensors will be deployed at field sites to continuously monitor water quality parameters					\$32,000
	Tools and Supplies	Passive samplers and analytical supplies required for analysis of approximately 350 samples at approximately \$100/sample.	Passive samplers are needed to collect contaminants, and solvents, analytical standards, and laboratory consumables required to perform chemical analyses.					\$34,800

	Tools and Supplies	Field supplies required to perform approximately 20 site visits	Supplies required to collect and transport passive samplers and maintain and monitor sensors					\$7,661
							Sub Total	\$74,461
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	Mileage for 40 total out-and-back trips (20 trips, 2 sampling teams) with an average distance of 136 miles at a rate of \$0.56/mile.	Frequent travel to field sites by multiple sampling teams will be required to carry out proposed field activities.					\$3,050
							Sub Total	\$3,050
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
							Sub Total	-
Other Expenses								
		Overnight shipping for approximately 20 shipments from the Twin Cities Metro area to Duluth at approximately \$25/shipment.	Overnight shipping of samplers to NRRl for chemical analysis will be required to prevent contaminant degradation during storage					\$500
							Sub Total	\$500
							Grand Total	\$276,000

Classified Staff or Generally Ineligible Expenses

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

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	-
Non-State				
In-Kind	UMN unrecovered indirect costs are calculated at the UMN negotiated rate for research of 55% modified total direct costs.	Indirect costs are those costs incurred for common or joint objectives that cannot be readily identified with a specific sponsored program or institutional activity. Examples include utilities, building maintenance, clerical salaries, and general supplies. (https://research.umn.edu/units/oca/fa-costs/direct-indirect-costs)	Secured	\$151,800
			Non State Sub Total	\$151,800
			Funds Total	\$151,800

Attachments

Required Attachments

Visual Component

File: [0c344c87-ab3.pdf](#)

Alternate Text for Visual Component

A young child on a lake in Minnesota, proudly displaying his catch and asking "Is this fish safe to eat?"

Optional Attachments

Support Letter or Other

Title	File
UMD SPA Transmittal Letter	230e607a-77e.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?

Yes, Sponsored Projects Administration

Catch and Reveal: Discovering Unknown Fish Contamination Threats



Is this fish
safe to eat?