

**Environment and Natural Resources Trust Fund  
2019 Request for Proposals (RFP)**

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**Project Title:**

**ENRTF ID: 051-B**

Quantifying Microplastics in Minnesotas Inland Aquatic Ecosystems

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**Category:** B. Water Resources

**Sub-Category:**

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**Total Project Budget: \$** 277,419

**Proposed Project Time Period for the Funding Requested:** June 30, 2021 (2 yrs)

**Summary:**

We propose to quantify the amount, type, and source of microplastics in the water, sediment, and fishes of a range of Minnesota lakes in collaboration with MN DNR.

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**Name:** Kathryn Schreiner

**Sponsoring Organization:** U of MN - Duluth

**Title:** Assistant Professor

**Department:** Large Lakes Observatory

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Duluth MN 55812

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**Location**

**Region:** Statewide

**County Name:** Statewide

**City / Township:**

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**Alternate Text for Visual:**

This visual represents our project plan: to quantify the amount, type, and source of microplastics through scientific sampling of lake water and sediment and citizen science anglers submitting fish stomachs.

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity	_____ Readiness	_____ Leverage	_____ TOTAL _____%
_____ If under \$200,000, waive presentation?			



**PROJECT TITLE: Quantifying Microplastics in Minnesota's Inland Aquatic Ecosystems**

**I. PROJECT STATEMENT**

Microplastics, or small plastic pieces <5mm in size, have been found across terrestrial, aquatic, and marine environments worldwide. These small plastic particles can threaten their environment in a variety of ways:

- The microplastic size range overlaps with the size range of common food for birds, fish, and other aquatic life, leading to *false satiation*: i.e., the ingestion of plastic particles instead of needed food
- Microplastics can *sorb toxic chemicals*, which may be dangerous to aquatic food webs and humans who ingest fish
- Plastic particles affect the *aesthetics of the environment*, negatively impacting our naturally beautiful waterways and ecosystems

Despite these known environmental threats, microplastic abundance and uptake into fish populations has *never been studied in Minnesota inland waters*. Here, we propose to address this lack of knowledge with a coordinated three-component environmental study:

1. We will complete a survey of four Sentinel Minnesota inland lakes that span a continuum of temperature, environment, and proximity to human settlement. We will measure the amount and type of plastics in the sediment, waters, and fishes of those lakes once per year with the Minnesota DNR.
2. We will join forces with a team of Minnesota citizen scientists to collect and analyze plastics in fish stomachs over the course of the two-year study. We will coordinate this effort with Lake Associations from the target lakes.
3. In collaboration with Minnesota SeaGrant, we will compile outreach materials that combine our findings from this survey of inland lakes with findings from ongoing research on plastic pollution in Lake Superior. These outreach materials will be targeted to Lake Associations, DNR officials, local and regional scientists and stakeholders, and state of Minnesota citizens.

**II. PROJECT ACTIVITIES AND OUTCOMES**

**Activity 1: Collection and analysis of water, sediment, and fish samples for plastic type and abundance**

Lake water, sediment, and fish samples will be collected from four target lakes (Peltier, Elk, Ten Mile, and White Iron) in late summer 2019 and 2020. Because these lakes span a range of Minnesota environments, lake ecosystems, and human population densities, they will provide a baseline for the extrapolation of plastics pollution estimates to other Minnesota aquatic environments. Water, sediment, and fish samples will be collected and plastics will be extracted and analyzed. In Elk, Ten Mile, and White Iron Lakes, adult cisco and bluegill will be the target fish species. In Lake Peltier, where cisco are not present, adult bluegill will be the target fish species.

Outcome	Completion Date
1. Year 1 sediment, fish, water collection	1 Sept 2019
2. Year 1 plastic sample extraction and analysis	30 June 2020
3. Year 2 sediment, fish, water collection	1 Sept 2020
4. Year 2 plastic sample extraction and analysis	1 May 2021

**ENRTF BUDGET:**  
**\$ 247,905**

**Activity 2: Integration with local and regional fishing organizations and citizen scientist plastic sample collection**

We will combine forces with local lake associations, county governments, and/or DNR water craft inspectors to enlist local property owners and fishermen as citizen-scientists to submit fish stomach samples for analysis. For lakes that have active Lake Associations, we will reach out to presidents to place information in Lake Association newsletters, and attend Lake Association meetings to disseminate information. For those lakes that do not have active Associations, we will contact county governments and DNR water craft inspectors to spread



## Environment and Natural Resources Trust Fund (ENRTF) 2019 Main Proposal Template

the word about our collection efforts. We will provide “Citizen Scientist Plastic Pollution Packs” (PPPs) which contain ID cards for anglers to fill out, sample collection vials, and a stamped padded envelope to return the samples to UMD for analysis. This will allow us to provide information on potential seasonal trends and differences between species on plastic pollution in inland lakes. At least one PI will visit each Lake Association twice during the duration of the project: at the beginning to explain our goals and reasons for the sample collection, and at the end to disseminate the results that we have.

Outcome	Completion Date
1. Contact local Lake Associations and County Governments, interface with local property owners and fishermen.	1 Sept 2019
2. Prepare Citizen Scientist PPPs for handout at Lake Association meetings, via DNR water craft inspectors, and/or direct mailings	1 Sept 2019
3. Collect Citizen Scientist PPPs with fish stomachs from local fishermen	1 Sept 2020
4. Prepare and analyze plastics from fish gut samples	1 May 2021

**ENRTF BUDGET:**  
**\$ 27,974**

### Activity 3: Outreach efforts on plastic pollution in Minnesota waters

Outreach efforts will be led by Minnesota SeaGrant through co-PI Kitsen. Results from this funded study of Minnesota’s inland waters as well as results from ongoing Lake Superior surveys led by PIs Schreiner, Minor, and Hrabik will be integrated to provide a full picture of plastics pollution in large and small aquatic systems in the state of Minnesota. These efforts will be focused on regional scientific groups as well as citizen groups.

Outcome	Completion Date
1. Prepare results for scientific publication and for regional scientific stakeholder meetings	30 June 2021
2. Final meeting with Lake Associations and local stakeholders to disseminate initial results	30 June 2021

**ENRTF BUDGET:**  
**\$ 1,540**

### III. PROJECT PARTNERS: B. Partners not receiving ENRTF funding

Name	Title	Affiliation	Role
Casey Schoenebeck	Fisheries Scientist	MN DNR	DNR Sentinel Lakes Coordinator

### IV. LONG-TERM- IMPLEMENTATION AND FUNDING:

This project represents an initial step in determining the total amount and potential sources of microplastics in inland Minnesota aquatic environments, and the specific impacts of plastics to Minnesota fisheries. It directly addresses two LCCMR funding priorities for this 2019 cycle:

- A. Foundational Natural Resource Data and Information
- B. Water Resources.

We intend to disseminate the results of this project through two different, important means:

- 1. Scientific publications, targeted toward the aquatic researchers, limnologists, ecologists, and environmental scientists who study these issues
- 2. Meetings and publications targeted toward the general public, specifically those citizens who assist us in the collection of samples from our target lakes.

We intend that the results obtained from this study will lead to further surveys across the state and provide a baseline of data of the source, fate, and importance of plastic pollution in Minnesota’s aquatic resources.

### V. TIME LINE REQUIREMENTS: We request two years of LCCMR funding, 1 July 2019 to 30 June 2021.

## 2019 Proposal Budget Spreadsheet

**Project Title: Quantifying Microplastics in Minnesota's Inland Aquatic Ecosystems**

### IV. TOTAL ENRTF REQUEST BUDGET two (2) years

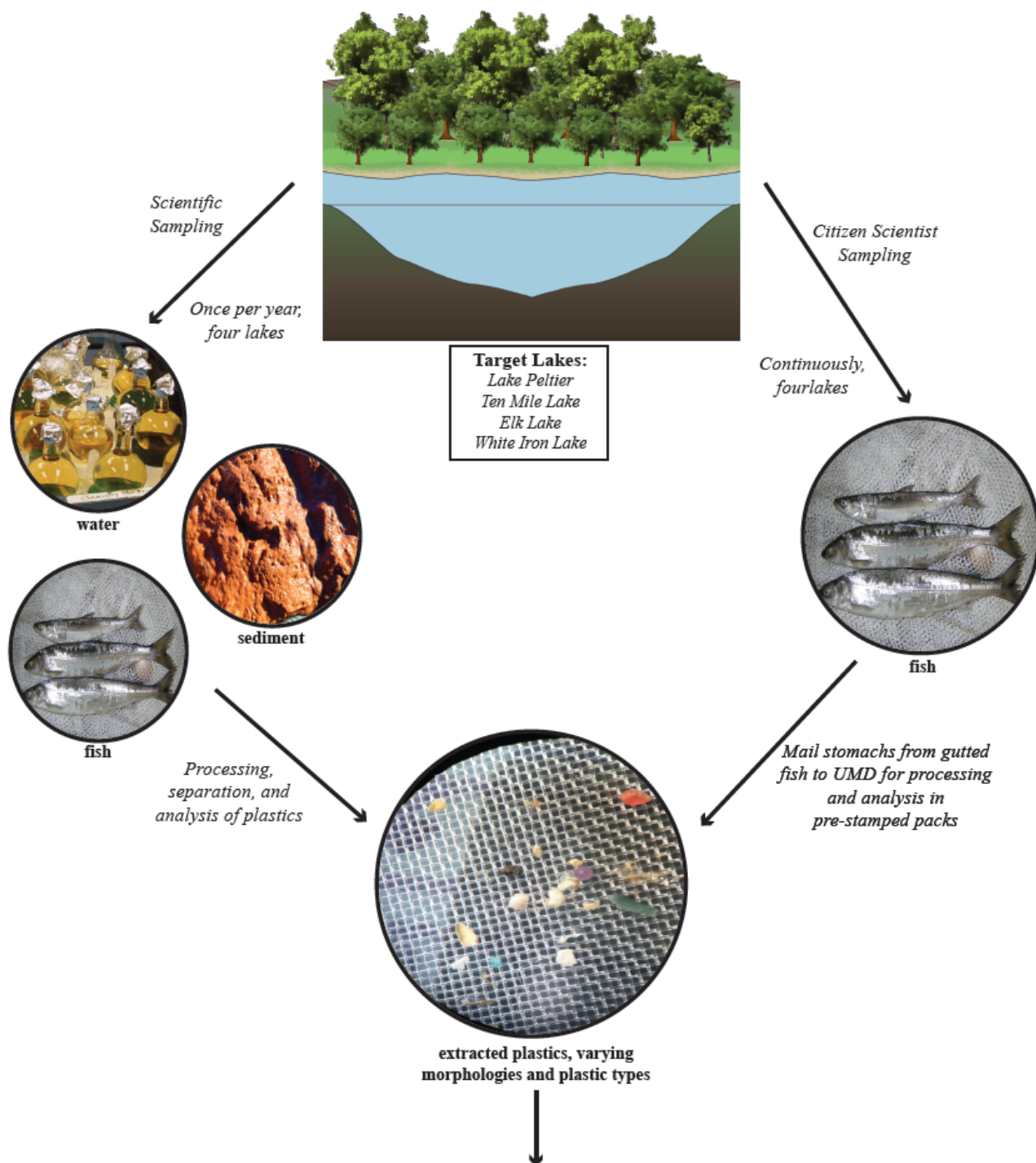
<b>BUDGET ITEM</b> (See "Guidance on Allowable Expenses")	<b>AMOUNT</b>
<b>Personnel:</b> Kathryn Schreiner, principle investigator, 1 summer month of salary + fringe each year for 2 years (\$22,258) Elizabeth Minor, co-PI, 1 summer month of salary + fringe each year for 2 years (\$31,943) Thomas Hrabik, co-PI, 1 summer month of salary + fringe each year for 2 years (\$31,943) Marte Kitson, co-PI, 10% of salary and fringe each year for 2 years (\$11,271) 1 graduate student, 2 years of tuition plus stipend & fringe (\$79,601) Laboratory technician for pyrolysis GCMS, 33% of salary each year for 2 years (\$49,718)	\$ 226,734
<b>Professional/Technical/Service Contracts:</b> N/A	N/A
<b>Equipment/Tools/Supplies</b> Field supplies, sample processing supplies including gloves, solvents, glassware for 400 samples (\$10,150) Citizen Science pack supplies, including envelopes & stamps, collection vials, and gloves for 300 PPPs (\$3,000) Specialized net with small pore size for collection of microplastics from a small boat (\$5,000) Outreach materials - posters and brochures for scientific and citizen outreach (\$515)	\$ 18,165
<b>Acquisition (Fee Title or Permanent Easements):</b> N/A	N/A
<b>Travel (calculated using published federal travel rates):</b> Travel to 4 field sites, including fuel, 1 night hotel stay for 4 people, and meals each year (\$12,180) Travel to county governments and Lake Association meetings for 2 people each year (\$3,045)	\$ 15,225
<b>Additional Budget Items:</b> Pyrolysis-GCMS analysis to determine type of plastic of collected samples, assuming \$40 per sample and 200 samples per year. Analysis to be performed at the Large Lakes Observatory, UMD (\$16,240) Total organic carbon analysis of water samples from each lake, assuming 20 samples per year and \$10 per sample. Analysis to be performed at the Large Lakes Observatory, UMD (\$406) Elemental analysis (%OC and %N) of sediment samples from each lake, assuming 20 samples per year and \$16 per sample. Analysis to be performed at the Large Lakes Observatory, UMD (\$649)	\$ 17,295
<b>TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =</b>	<b>\$ 277,419</b>

### V. OTHER FUNDS *(This entire section must be filled out. Do not delete rows. Indicate "N/A" if row is not applicable.)*

<b>SOURCE OF FUNDS</b>	<b>AMOUNT</b>	<b>Status</b>
<b>Other Non-State \$ To Be Applied To Project During Project Period:</b>	N/A	
<b>Other State \$ To Be Applied To Project During Project Period:</b>	N/A	
<b>In-kind Services To Be Applied To Project During Project Period:</b> University Overhead (54% on all research dollars)	\$ 149,806	<i>Secured</i>
<b>Past and Current ENRTF Appropriation:</b>	N/A	
<b>Other Funding History:</b>	N/A	

# A Survey of Microplastics in Minnesota's Inland Aquatic Food Webs

*A cooperative project combining the expertise of University of Minnesota scientists and local Citizen-Scientist Stakeholders*



## Project Manager Qualifications and Organization Description

**Kathryn M. Schreiner (PI):** Dr. Schreiner is an Assistant Professor with a joint appointment between the Large Lakes Observatory (LLO) and the Department of Chemistry & Biochemistry at the University of Minnesota Duluth. Dr. Schreiner specializes in environmental chemistry and organic geochemistry, specifically in aquatic environments. Along with **Elizabeth Minor (co-I)**, professor at LLO and the Department of Chemistry & Biochemistry, Schreiner has spent two years focusing on the quantification and identification of plastics from Minnesota aquatic environments, and published novel protocols for the collection and analysis of plastics pollution, including the first plastics quantitative plastics data from Lake Superior. **Thomas Hrabik (co-I)**, professor in the Department of Biology at UMD, has many years of experience in studying the behavior and ecology of fishes in Minnesota lakes, including the MNDNR Sentinel Lake system, focusing on cisco and other cold water fish. **Marte Kitson (co-I)** has been leading scientific outreach, communication, and education initiatives specifically in the aquatic sciences through her appointment at Minnesota SeaGrant since 2010.

The University of Minnesota Duluth, and specifically the Large Lakes Observatory, is perfectly equipped to address the questions outlined in this study. The organic geochemistry laboratory at the LLO, managed by PI Schreiner, is equipped with a Gerstel pyrolysis unit interfaced onto an Agilent 6890 gas chromatograph mass spectrometer (py-GCMS) to perform the plastic identification and quantification analyses. The chemical and biological limnology laboratories are equipped with microscopes, hoods, glassware, and other equipment necessary for the picking and cleaning of plastics from environmental samples. The Hrabik laboratory in the UMD Department of Biology, is equipped with supplies for cleaning and gutting fishes and for preparing fish stomachs for chemical analysis. Finally, the LLO has a CosTech elemental analyzer for determining the carbon content of sediments and a Shimadzu Total Organic Carbon analyzer for determining the carbon content of environmental waters. The LLO additionally has office space, computer resources, and laboratory prep space appropriate to the completion of the proposed project.