2019 Project Abstract
For the Period Ending June 30, 2022

PROJECT TITLE: Quantifying microplastics in Minnesota's inland lakes
PROJECT MANAGER: Kathryn Schreiner
AFFILIATION: Large Lakes Observatory, University of Minnesota Duluth
MAILING ADDRESS: 2205 E 5th St
CITY/STATE/ZIP: Duluth MN 55812
PHONE: 218-726-8680
E-MAIL: kschrein@d.umn.edu
WEBSITE: schreinerlab.com, mnplastics.org
FUNDING SOURCE: Environment and Natural Resources Trust Fund
LEGAL CITATION: M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 04d

APPROPRIATION AMOUNT: $ 200,000
AMOUNT SPENT: $200,000
AMOUNT REMAINING: $0

Sound bite of Project Outcomes and Results
This project has helped to determine the sources and fate of microplastics in inland lakes in Minnesota. This includes differences in loading between different watersheds and ecosystems, and differences in ingestion by different fish species.

Overall Project Outcome and Results
When this project was funded, our goal was to determine the amount and fate of microplastics in a set of Minnesota lakes that represent a variety of different types of watersheds, degrees of human influence, and ecosystem characteristics. Our partnership with the MN DNR Sentinel Lakes program allowed us to target lakes that already had long-term study data available, including mapped watersheds, lake temperature and residence time, and known fish populations. This three-year project sampled water column particulates, sediments, and fish (cisco, bluegill, and perch) from four Sentinel lakes in Minnesota (Peltier Lake, White Iron Lake, Ten Mile Lake, and Elk Lake) over the course of two summer field seasons. All four lakes contained microplastics in the water, sediments, and fish, indicating that like other locations throughout the world, microplastic pollution is widespread in the state. Our findings further indicate that the biggest drivers that increase microplastic loadings into lakes are more human infrastructure and building in the watershed, a longer water retention time, and more shoreline development. There appears to be little connection between concentrations of microplastics in the water column and sediments, though more research will be needed to confirm. Finally, filter feeding fish (like cisco) have increased gut microplastic concentrations with increased water column microplastic concentrations, though visual feeders (like bluegill and perch) do not and appear to be able to distinguish plastics from food in the water column. Taken together, these first results from Minnesota inland lakes provide clear information for scientist and managers and further give Minnesota residents vital information about the health of their inland lakes. All data from this project will be accessible on our project website once publications have been prepared.

Project Results Use and Dissemination
Results from this project have been disseminated to the scientific community through meeting presentations and scientific publications currently being prepared. We have maintained a project website that is available to the public, and which we have advertised in our outreach to the Lake Associations associated with our project lakes. Our website has information about our project, videos from public webinars, and will have data from our scientific publications once those are published. Our collaboration with scientists at the MN DNR has meant that the Sentinel Lakes program has access to our project data along with any interpretations or project publications.

Today's Date: 26 July 2022

Date of Next Status Update Report: Final Report

Date of Work Plan Approval: 5 June 2019

Project Completion Date: 30 June 2022

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

Project Manager: Kathryn M. Schreiner

Organization: University of Minnesota Duluth

College/Department/Division: Large Lakes Observatory

Mailing Address: 2205 E 5th St

City/State/Zip Code: Duluth, MN 55812

Telephone Number: 218-726-8680

Email Address: kschrein@d.umn.edu

Web Address:

Location: This project will involve work in 4 field locations representing 4 geographic regions within Minnesota: 1. Lake Peltier (Metro region), 2. White Iron Lake (Northeast region), 3. Elk Lake (Northwest region), and 4. Ten Mile Lake (Central region) in addition to laboratory facilities at the University of Minnesota Duluth.

Total Project Budget: $200,000

Amount Spent: $200,000

Balance: $0

Legal Citation: M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 04d

Appropriation Language: $200,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota for the Natural Resources Research Institute in Duluth to quantify the amount, type, and source of microplastics in the water, sediment, and fishes of a range of Minnesota lakes.

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 aquatic environments 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. OVERALL PROJECT STATUS UPDATES:

First Update March 1, 2020
We successfully completed our first field season in Summer 2019, visiting all four of our project lakes to collect fish (cisco, bluegill, and perch), sediment, and water. This was done in collaboration with DNR scientists and with our newly hired graduate research assistant. These samples have been processed and initial collection and counting of plastics has begun. Plastics were found in water samples of all four study lakes, with fibers being the most common in all lake water samples. We are still in the process of counting particles from sediments and fishes, and chemically analyzing the particles that have been collected for plastic type. We have made contact with Lake Associations on Ten Mile and White Iron lakes, writing articles for their newsletters about our project and gaining interest in the citizen science aspect of the project, which will begin at Fishing Opener in late spring 2020. We have also established a public website for interested citizens to learn about the project at mnplastics.org and plan to use that website as a forum for recruiting and training our citizen scientists. Preparations are underway to complete our second field season in summer 2020 with our DNR collaborators.

Second Update September 1, 2020
Despite COVID-19 setbacks, we have successfully completed our second summer 2020 field season. All four project lakes were visited to collect fish (cisco, bluegill, and perch), sediment, and water. This was done in collaboration with DNR scientists and our UMN Water Resources Science graduate student, Peter Conowall. Because of laboratory shutdowns in the spring and early summer, we are only now starting to process these samples. We plan on analyzing collected plastics from 2019 and 2020 this winter and spring. Because we were late starting analysis, our spent budget for Year 1 appears low – this money will be spent this winter and spring to pay for chemical analyses of our collected plastics. We also have update our public website

(mnplastics.org) with a recorded webinar and more information about our project, including spaces for our Citizen Scientists to sign up and make contact. We have had interest from Citizen Scientists from multiple project lakes already, and have started receiving fish samples for processing this winter and spring.

LCCMR has approved 12/21/20 extending the project timeline to the full appropriation, resulting in a project ending in June 2022

Third Update March 1, 2021
We continue to process and have begun analyzing our water, sediment, and fish samples. This task is primarily performed by our UMN Water Resources Science Student, Peter Conowall. Laboratories continue to be open, though we are still working through our backlog of samples. As of now, we have all water & sediment samples processed and ready for analysis, and we have begun analyzing our water samples. Preliminary water column plastic counts from all four lakes have been made though we are still determining the chemical makeup of that plastic. We also continue to receive citizen science fish gut samples which we have archived and will process over the summer along with our scientifically collected fish samples. Peter and I, along with our outreach coordinator Marte Kitson, also participated in a public webinar in January 2021 where we updated our lake association members and other interested members of the public on our project, showed our preliminary data, and answered questions about our findings.

AMENDMENT REQUEST MARCH 1, 2021
We are requesting that funds from our travel budget be shifted to the supplies and personnel budget lines.
- Supplies budget would be increased by $5,000 to a revised budget total of $20,420 and an available balance of $5,859
- Personnel budget would be increased by $9,187 to a revised budget total of $161,247 and an available balance of $89,002
- Travel budget would be decreased by $14,187 to an available balance of $0.

These changes are being requested because of unforeseen COVID implications to the project. Because university and DNR travel was severely limited over summer 2020, we were not able to visit Lake Associations in person like we had planned. We have increased our web presence on www.mnplastics.org to make up for this, and have received more citizen science samples to process than planned. This is requiring an increase in the supply line of the budget. To support the additional time of processing these samples due to COVID delays, the increase in the salary line is needed. There is no significant change in the activities or expected outcomes of the project.

Amendment approved by LCCMR 4/7/2021

Fourth Update September 1, 2021 (Submitted November 3, 2021)
Sample prep, processing, and microplastics counting has been completed for all samples (water, fish, and sediment from all four lakes from both field seasons). We are working through QA/QC of data now, counting blanks, and running preliminary statistics. Data seem to indicate that watershed size and residence time have the largest impacts on plastic amount in the water and sediment (more than human alterations of lakeshore), and that while filter feeder fish plastic intake is correlated with lake plastic concentration, for visual feeder fish there is no correlation. We are working on finalizing these results now and plan on presenting them in a variety of ways over the next few months:
1. In another public webinar to be advertised to our Lake Associations and citizen scientist team, which will likely happen in early 2022 and subsequently be uploaded to our project website (mnplastics.org)
2. In a scientific presentation at the May 2022 Joint Aquatic Sciences Meeting in Grand Rapids, MI
3. In scientific publications to be submitted to journals in spring 2022

Citizen science samples are also in the process of being processed and analyzed. Citizens who submitted samples have access to our sample progress dashboard on mnplastics.org. We anticipate finishing these samples by the end of 2021.

Fifth Update March 1, 2022 (Submitted April 6, 2022)
All samples (fish, water, and sediment) have been processed and analyzed, QA/QC is complete, and we have started work on final writeup and dissemination of the data. Data still points to watershed size and human impacts on shoreline as the biggest indicators of microplastic concentration in the water column, but interestingly there is no correlation between water column concentration and sediment concentration of microplastics – we think this may be due to our sampling strategy and low sample frequency of sediments (only two samples taken per lake per year). There is a clear indication that fish feeding strategy impacts how much microplastic is taken up by fish, with filter-feeding cisco plastic uptake correlated with water column microplastic concentration. No correlation between water column concentration and fish uptake is seen in the visual feeding fish (blue gill and perch). This has clear management implications for fish populations in Minnesota lakes.

Our dissemination plans include a scientific talk at the upcoming Joint Aquatic Sciences Meeting in Grand Rapids Michigan (May 14-20th), publication of our results in a scientific journal, a final webinar advertised to Lake Associations, as well as a talk to the MN DNR Sentinel Lakes team. We plan to finish most of these before project end on June 30th, though because of timing with publication or planning talks, some may be presented later in the summer or fall.

Final Report between project end (June 30) and August 15, 2022
When this project was funded, our goal was to determine the amount and fate of microplastics in a set of Minnesota lakes that represent a variety of different types of watersheds, degrees of human influence, and ecosystem characteristics. Our partnership with the MN DNR Sentinel Lakes program allowed us to target lakes that already had long-term study data available, including mapped watersheds, lake temperature and residence time, and known fish populations. This three-year project sampled water column particulates, sediments, and fish (cisco, bluegill, and perch) from four Sentinel lakes in Minnesota (Peltier Lake, White Iron Lake, Ten Mile Lake, and Elk Lake) over the course of two summer field seasons. All four lakes contained microplastics in the water, sediments, and fish, indicating that like other locations throughout the world, microplastic pollution is widespread in the state. Our findings further indicate that the biggest drivers that increase microplastic loadings into lakes are more human infrastructure and building in the watershed, a longer water retention time, and more shoreline development. There appears to be little connection between concentrations of microplastics in the water column and sediments, though more research will be needed to confirm. Finally, filter feeding fish (like cisco) have increased gut microplastic concentrations with increased water column microplastic concentrations, though visual feeders (like bluegill and perch) do not and appear to be able to distinguish plastics from food in the water column. Taken together, these first results from Minnesota inland lakes provide clear information for scientist and managers and further give Minnesota residents vital information about the health of their inland lakes. All data from this project will be accessible on our project website once publications have been prepared.

III. PROJECT ACTIVITIES AND OUTCOMES:

Activity 1: *Collection and analysis of water, sediment, and fish samples for plastic type and abundance*
Description: 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 continuum of aquatic environments and proximity to human settlement, 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.

Activity 1 ENRTF BUDGET: $ 169,929

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*

First Update March 1, 2020
Outcome 1 is fully complete: all Year 1 sampling happened according to schedule in summer 2019. Outcome 2 is partially complete. Plastic particles have been extracted from all water samples, and extraction is mostly complete from sediment samples, and has yet to start on fish samples. No chemical analysis has yet started. We have begun preparations for Outcome 3, to enable us to complete our summer 2020 fieldwork, and are on track to complete that outcome on time.

Second Update September 1, 2020
Outcome 3 is fully complete. Outcome 2 is partially complete still: all extractions are complete, but analysis has not yet started. Outcome 4 has been started: we have begun extractions from 2020 samples, but have not yet started analysis. We plan for Outcome 3 to be complete by our next reporting date (March 1, 2021) and for Outcome 4 to be complete or mostly complete by then as well.

Third Update March 1, 2021
Outcomes 2 and 4 are partially complete. All water column and sediment plastics have been processed and are ready for analysis, and analysis has started on some samples. Fish samples are set to be processed for analysis during the summer, and all analysis should be complete by the end of summer. After that, data processing, writing, and outreach presentations with final data will be prepared.

Fourth Update September 1, 2021 (Submitted November 3, 2021)
All outcomes are complete. Preliminary data has been collected on plastic counts, morphology, color, and chemistry for all water, sediment, and fishes collected during Year 1 and Year 2 field seasons. Currently, we are working on data processing and QA/QC, writing up our findings, and building presentations for our public website, our Lake Association outreach, and scientific presentations. (Note that the budget still reflects unspent money in the "other" category, referring to py-GCMS analysis. This is due to a delay in charging the grant for samples that have already been run, essentially a paperwork delay.)

Fifth Update March 1, 2022 (Submitted April 6, 2022)
All outcomes are fully complete, with all data collected and QA/QC complete.

Final Report between project end (June 30) and August 15, 2022
All planned samples from water, fish, and sediment were collected. This included two water column samples and two sediment samples from each test lake in each year (16 sediment and 16 water samples total), as well as 10 fish of each species (cisco and perch/bluegill) in each lake each year (80 cisco and 80 perch/bluegill total). All of these samples were processed, identified via microscopy, and analyzed for plastic chemistry via py-GCMS.

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

Activity 2 ENRTF BUDGET: $ 28,011

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*

First Update March 1, 2020
Outcomes 1 & 2 are complete. We have made contact with Lake Associations and local anglers from three of our project lakes: White Iron, Ten Mile, and Peltier. (This Activity will not be completed for Elk Lake, which is located entirely within Itasca State Park and has no local community groups.) We prepared a newsletter article which was published in the WICOLA newsletter. We have also prepared a website (mnplastics.org) which will be used in place of our original plan of in-person meetings with Lake Associations: those meetings have been canceled due to pandemic shutdowns. This website includes all information we would have given in-person, as well as clearly labeled areas to volunteer to be a citizen scientist, directions on how to send in specimens, and how to follow updates on the analysis of the specimens that were sent in. Packs are being assembled now, with the goal that we will start to solicit citizen scientists in late spring/early summer 2020.

Second Update September 1, 2020
We continue to update our public website (mnplastics.org) as well as continue our robust contact with local stakeholders and lake associations. We prepared and gave a public webinar to interested stakeholders and currently have that webinar along with an FAQ from the open discussion after the webinar on our project website. As data is gathered and analyzed, we are uploading it to the website and plan to have another webinar with stakeholders in 2021 to disseminate more local lake data.

Third Update March 1, 2021
We continue to collect citizen scientist fish gut samples and update our public website (www.mnplastics.org). We held a public update webinar for our Lake Association colleagues in January 2021 to give them an update on the project and present our preliminary lake water column data. We are tentatively planning on a final webinar in fall 2021 to present our final results to the lake association members, and will continue to collect & process citizen scientist fish gut samples through summer 2021.

Fourth Update September 1, 2021 (submitted November 3, 2021)
Citizen scientist sample collection has ended, and we are prioritizing processing and analyzing citizen scientist samples over the next couple of months, so Outcomes 1, 2, and 3 are complete and we are working on Outcome 4. Citizens can track their samples on the dashboard on mnplastics.org. We are also planning on a final webinar and check-in to our Lake Associations in winter 2022, which will be uploaded to our mnplastics.org site after.

Fifth Update March 1, 2022 (Submitted April 6, 2022)
All citizen scientist samples have been logged and analyzed (all outcomes complete) though we are still working

on updating our public facing website for our citizen scientist team (mnplastics.org). This should be completed before project end on June 30th.

Final Report between project end (June 30) and August 15, 2022
We received citizen scientist samples mostly from White Iron Lake, which had the most involved Lake Association to partner with. These samples were processed and analyzed along with our scientific fish collection samples (Activity 1). While Covid interrupted many of our outreach efforts, meaning we were not able to collect as many citizen science samples as we hoped, the samples we did collect were still a vital part of our analysis. These fish gut samples are being combined with our scientific collection samples for a future publication focusing on fish ingestion of microplastics. Once collated, this data and the publication will also be available on our public website.

Activity 3: *Outreach efforts on plastic pollution in Minnesota waters*
Description: 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 let 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.

Activity 3 ENRTF Budget: $2,060

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*

First Update March 1, 2020
No updates yet on these outcomes. We intend to collect and analyze data from our collected samples and citizen scientist samples over winter 2020/21, preparing data and preliminary results for our project website and Lake Association newsletters. If pandemic-related shutdowns are lifted, we will meet in person with Lake Associations.

Second Update September 1, 2020
Outcomes 1&2 are complete, and Outcome 3 is ongoing. We continue to recruit Citizen Scientists and have a robust conversation going with our Lake Association contacts. We plan Outcome 4 to be complete by our March 1, 2020 update.

Third Update March 1, 2021
We continue to work on these two outcomes. We have had two formal meetings with Lake Associations so far and are planning for a final results presentation in late fall 2021. Scientific publication preparation will happen during winter & spring 2022.

Fourth Update September 1, 2021 (submitted November 3, 2021)
Deadlines for these outcomes have been planned, as summarized in the general update above. We plan to disseminate results over the next few months in the following ways:
1. In another public webinar to be advertised to our Lake Associations and citizen scientist team, which will likely happen in early 2022 and subsequently be uploaded to our project website (mnplastics.org)
2. In a scientific presentation at the May 2022 Joint Aquatic Sciences Meeting in Grand Rapids, MI
3. In scientific publications to be submitted to journals in spring 2022

Fifth Update March 1, 2022 (submitted April 6, 2022)

No updates on our dissemination plans from the Fourth update above. Our abstract has been accepted for a talk at the Joint Aquatic Sciences meeting, which will happen in mid-May. We are in the beginning stages of preparing our data for a scientific publication, and plan to submit that manuscript in early June. In June, we also plan to make final updates to our mnplastics.org site for the lake associations (or any Minnesota resident) to reference. We will also be making plans to disseminate these results via webinar to Lake Associations.

Final Report between project end (June 30) and August 15, 2022
The data from this project was shared through a multi-tier dissemination system that targeted interested Minnesota citizens, manager stakeholders through the Minnesota DNR, and the wider scientific community. Covid interrupted our original dissemination plans to citizens and Lake Associations, and instead of visiting Lake Association meetings for outreach we ran two public webinars instead. The recordings from those webinars, as well as a transcript of our Q&A sessions, are available on our public website. Data from our project is currently available to our DNR Sentinel Lakes collaborators, and once publications are through the publishing process we will make them available to the general public on our website, in addition to their availability to other interested scientists.

IV. DISSEMINATION:

Description: 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.

The Minnesota Environment and Natural Resources Trust Fund (ENRTF) will be acknowledged through use of the trust fund logo or attribution language on project print and electronic media, publications, signage, and other communications per the ENRTF Acknowledgement Guidelines.

First Update March 1, 2020
No update on Dissemination means #1. We are still collecting data for these publications. We were forced to cancel our initial meetings with Lake Associations (dissemination means #2), and in its place we have published a newsletter article with the White Iron Chain of Lakes Association, as well as established a project website (mnplastics.org). We intend to continue our close collaboration with lake associations as well as regular website updates throughout the remainder of the project.

Second Update September 1, 2020
We continue to work on Dissemination means #2 by continuing contact with our Lake Associations, updating our mnplastics.org website, and having public webinars about our project and data. We are also continuing to recruit Citizen Scientists and are keeping good communication with those scientists as they continue to send us samples. We intend to have an update on Dissemination means #1 in our final report, due August 15 2021.

Third Update March 1, 2021
No update on Dissemination means #1, which will be finalized for our final report in summer 2022. We continue to work on Dissemination means #2 by hosting webinars for our Lake Association colleagues (last one was January 2021) and updating our public project website, mnplastics.org.

Fourth Update September 1, 2021 (submitted November 3, 2021)
We anticipate scientific publications to be prepared over winter and early spring 2022. We are planning on presenting the results of this study to a scientists and researchers at the Joint Aquatic Sciences Meeting in Grand Rapids, MI in May 2022. Results continue to be disseminated to the MN DNR Sentinel Lakes program lead (Casey Schoenebeck) informally, and we anticipate directly sending our presentation to the Sentinel Lakes program as well. We are planning on having our final public webinar, presenting our project results to citizens and Lake Associations, in winter 2022. For those that cannot attend the webinar, we will post it as well as answers to the Q&A session to our project website, mnplastics.org, along with previous webinars and information.

Fifth Update March 1, 2022 (submitted April 6, 2022)
We have begun scientific publication preparation and will submit our final manuscript likely in early June. We are still planning on the Joint Aquatic Sciences meeting in May. Informal presentations will be made to the MN DNR Sentinel Lakes Lead (Casey Schoenebeck) in May as well, and at that point we will explore making plans to present this project and data to the whole Sentinel Lakes team. We will spend the next two months updating and polishing our mnplastics.org website as well as planning for a summer / fall webinar to be given to lake associations and other interested MN residents.

Final Report between project end (June 30) and August 15, 2022
Dissemination to the public (through our website linked above) is complete, as well as to our DNR Sentinel Lakes collaborators. Because the scientific publishing process takes 1-2 years for review and publication, we anticipate those publications being fully available on our website in 2023. Dissemination to the wider scientific community will also occur through those publications as well as through multiple presentations that were given at the Joint Aquatic Sciences Meeting in Grand Rapids, MI in May 2022.

V.   ADDITIONAL BUDGET INFORMATION:
A. Personnel and Capital Expenditures

Explanation of Capital Expenditures Greater Than $5,000: N/A

Explanation of Use of Classified Staff: N/A

Total Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation:

Enter Total Estimated Personnel Hours for entire duration of project: 3,744	Divide total personnel hours by 2,080 hours in 1 yr = TOTAL FTE: 1.8

Total Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: N/A

VI. PROJECT PARTNERS:

A. Partners outside of project manager's organization receiving ENRTF funding
N/A

B. Partners outside of project manager's organization NOT receiving ENRTF funding
Casey Schoenebeck, Fisheries Scientist, MN DNR. Program role: DNR Sentinel Lakes Coordinator

VII. 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 to Minnesota fisheries. It directly addresses two LCCMR funding priorities for the 2019 cycle:
   A. Foundational Natural Resource Data and Information
   B. Water Resources

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.

VIII. REPORTING REQUIREMENTS:

- Project status update reports will be submitted March 1 and September 1 each year of the project
- A final report and associated products will be submitted between June 30 and August 15, 2022

IX. SEE ADDITIONAL WORK PLAN COMPONENTS:

    A. Budget Spreadsheet
    B. Visual Component or Map

Attachment A:
Environment and Natural Resources Trust Fund
M.L. 2019 Budget Spreadsheet Final
Legal Citation: M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 04d
Project Manager: Kathryn Schreiner
Project Title: Quantifying microplastics in Minnesota's Inland Aquatic Ecosystems
Organization: University of Minnesota Duluth
Project Budget: $200,000
Project Length and Completion Date: 36 months, 30 June 2022
Today's Date: 26 July 2022

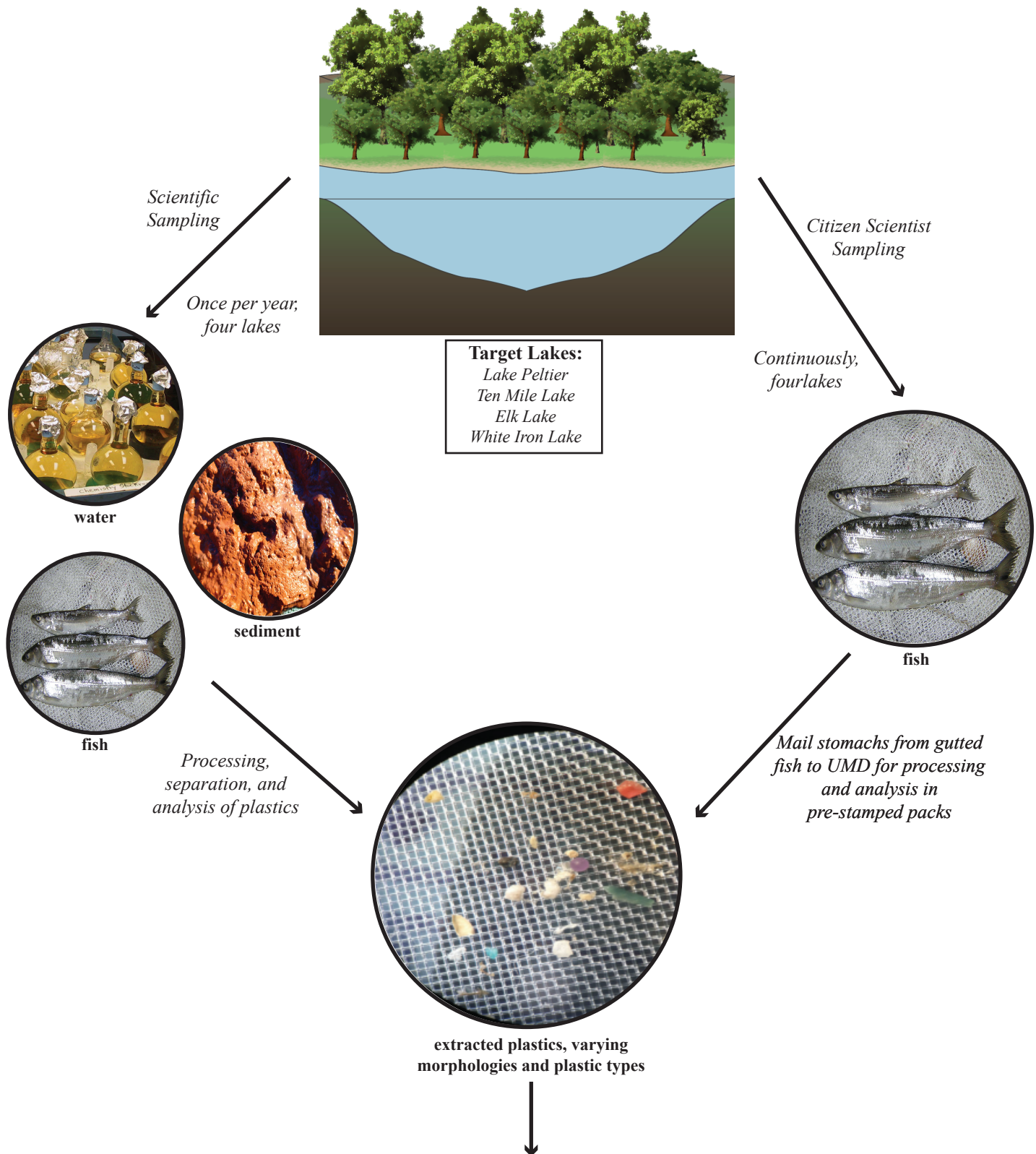| ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	REVISED Budget 5 April 2021	Amount Spent	Balance
BUDGET ITEM			
Personnel: **Kathryn Schreiner, principle investigator, 1 summer month of salary + fringe each year for 2 years ($22,258)** **Elizabeth Minor, co-PI, 1/2 summer month of salary + fringe each year for 2 years ($15,971.50)** **Thomas Hrabik, co-PI, 1/2 summer month of salary + fringe each year for 2 years ($15,971.50)** **Marte Kitson, co-PI, 10% of salary and fringe each year for 2 years ($11,271)** **3 graduate students, 2 years of 50% summary salary only ($36,870)**	$ 161,247	$ 161,247	$ -
Professional/Technical/Service Contracts			
N/A			
Equipment/Tools/Supplies			
Field supplies, sample processing supplies including gloves, solvents, glassware for 400 samples ($11,905) Citizen Science pack supplies, including envelopes & stamps, collection vials, and gloves for 300 PPPs	$ 20,420	$ 20,420	$ -
Capital Expenditures Over $5,000			
N/A			
Fee Title Acquisition			
N/A			
Easement Acquisition			
N/A			
Professional Services for Acquisition			
N/A			
Printing			
N/A			
Travel expenses in Minnesota			
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)	$ 1,038	$ 1,038	$ -
Other			
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	$ 17,295	$ -
COLUMN TOTAL	$ 200,000	$ 200,000	$ -

OTHER FUNDS CONTRIBUTED TO THE PROJECT	Status (secured or pending)		Spent	Balance
Non-State:			$ -	
State:			$ -	
In kind:			$ -	

PAST AND CURRENT ENRTF APPROPRIATIONS	Amount legally obligated but not yet spent		Spent	Balance
Current appropriation:			$ -	
Past appropriations:			$ -	

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

Scientific Sampling

Once per year, four lakes

Target Lakes:
Lake Peltier
Ten Mile Lake
Elk Lake
White Iron Lake

Citizen Scientist Sampling

Continuously, fourlakes

water

sediment

fish

fish

Processing, separation, and analysis of plastics

Mail stomachs from gutted fish to UMD for processing and analysis in pre-stamped packs

extracted plastics, varying morphologies and plastic types

Disseminate results to:

1. **Local stakeholder citizen scientists** *through Lake Association meetings and information sessions*
2. **State of Minnesota aquatic scientists** *through Minnesota Water Resources conferences and presentations*
3. **The wider scientific community** *through peer-reviewed scientific publications*