Environment and Natural Resources Trust Fund (ENRTF)

M.L. 2020 ENRTF Work Plan (Main Document)

Today's Date: February 14, 2020

Date of Next Status Update Report: March 1, 2021

Date of Work Plan Approval:

Project Completion Date: June 30, 2023

Does this submission include an amendment request? No

PROJECT TITLE: Freshwater Sponges and AIS: Engaging Citizen Scientists

Project Manager: Venugopal Mukku

Organization: University of Minnesota Crookston

College, Department, or Division: Math, Science and Technology Department

Mailing Address: 2900 University Avenue

City, State, Zip Code: Crookston, MN, 56716

Project Manager Direct Telephone Number: 218-281-8097

Email Address: mukku002@umn.edu

Web Address: https://freshwatersponges.crk.umn.edu

Location: Statewide

Total Project Budget: $400,000

Amount Spent: $0

Balance: $0

Legal Citation: M.L. 2020, Chp. xx, Sec. xx, Subd. xx

Appropriation Language:

PROJECT STATEMENT:

This project addresses the LCCMR funding priorities by 1) identifying compounds from freshwater sponges that will be used to combat the spread of aquatic invasive species (AIS) such as zebra mussels 2) Incorporating Minnesota's citizen involvement in the collection and identification of freshwater sponges and 3) stimulating STEM education for students in Minnesota.

Statement about lower funding recommendation: The initial budget request was reduced by $60,000. Therefore, in order to accommodate the lower funding recommendation, the budget has been reconfigured with some personnel changes. The major portion of the deficit is covered by reducing the postdoctoral position from three to two years. In order to keep the momentum of the project, an additional student will be recruited each summer to be trained by the PIs and the postdoctoral person. Additional savings have been achieved by leveraging existing University resources.

Need: As a result of 2017 LCCMR funding, two previously undocumented species of freshwater sponges were identified from the lakes and rivers of Minnesota in the ten county region around Crookston. Gas Chromatography - Mass Spectrometry (GC-MS) analysis of some sponge extracts revealed that some sponges produce a compound (oleamide) that was reported to have antifouling properties. Antifouling chemicals inhibit the attachment and growth of barnacles and other marine organisms on a ship's hull. We hypothesize that one or more of the naturally occurring antifouling compounds from sponges may inhibit the spread of zebra mussels. Natural antifouling compounds have an added advantage in that they are biodegradable. The utilization of antifouling compounds found in Minnesota freshwater sponges contributes to addressing AIS as noted in Minnesota Statute 84D, specifically addressing 84D.02: aiding in preventing and curbing the spread of invasive species such as zebra mussels.

The current project was highlighted in the Minnesota DNR's Conservation Magazine in July 2017, which sparked scientific curiosity among Minnesotans. Over 50 citizens and schools reported locations of sponges and/or requested more information about the project. The proposed project will integrate the clearly expressed public interest with one of the funding priorities of LCCMR and will provide Minnesotans with opportunities to be directly involved in learning about the habitat and collection of freshwater sponges. Incorporating citizen scientists will enable the project team to expand the geographical focus of the project to the entire state. The project team will leverage the experience of the new Center for Citizen Science at the University of Minnesota Twin Cities. Additionally, the team will focus on stimulating STEM education for students in Minnesota.

II. OVERALL PROJECT STATUS UPDATES:

First Update March 1, 2021

Second Update August 30, 2021

Third Update February 28, 2022
Fourth Update August 29, 2022
Fifth Update February 27, 2023
Final Report between project end (June 30) and August 15, 2023

III. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1 Title:
Incorporate Minnesota's citizen involvement in the collection and identification of freshwater sponges.

Description:

Numerous rivers and lakes in Minnesota remain to be explored for freshwater sponges. Collections will continue with the additional focus of citizen scientist involvement. Town hall meetings will be held at strategic locations across the state to explain the freshwater sponge project, and encourage citizen scientist participation. Using developed specimen collection packets, citizens will be able to collect sponge samples and mail them to UMC for taxonomic (research addendum section 4.1.3) and chemical (research addendum sections 4.2.2 and 4.2.3) analyses. . Dr. Robert Blair, Professor & Extension Specialist, University of Minnesota Twin Cities will assist the team by arranging town hall meetings and coordinating with the University of Minnesota's Extension Master Naturalist program.

Faculty/researchers will also travel to schools in Northwest Minnesota to engage students and teachers in STEM activities related to freshwater sponges. Freshwater sponge-focused activities will be designed to get students interested in scientific inquiry and stimulate participation in local and regional science fairs.

ACTIVITY 1 ENRTF BUDGET: $ 208,500

Outcome	Completion Date
1. Develop information/collection packets to send to the public to broaden the search for sponges throughout the state	March 2021
2. Collection of sponges from lakes/rivers within each major basin/watershed in MN. This will be coordinated by Dr. Schroeder and the post-doctorate associated with the help of students	October 2022
3. Initiate/perform outreach activities using town halls, schools, etc. to teach about sponges and encourage citizen engagement in the project.	June 2023

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Activity 2: Identify compounds produced by freshwater sponges that could be used to combat the spread of aquatic invasive species (AIS) such as zebra mussels

Description:

Freshwater sponges, as well as water and sediment samples, will be collected. Sponges will be freeze-dried prior to chemical extractions. Organic components of these samples will be analyzed using chromatographic techniques (e.g., GC-MS with NIST library, LC-MS). Inorganic components will be analyzed using chromatographic (e.g., IC) and spectroscopic (e.g., ICP-MS) techniques.

All sponge extracts will be tested for their potential antifouling activity using zebra mussel attachment and *in vitro* assays. Compounds of interest will be identified using GC-MS and LC-MS and isolated in order to fully test their efficacy.

ACTIVITY 2 ENRTF BUDGET: $ 136,000

Outcome	Completion Date
1. Examine the chemical ecology of freshwater sponges	January 2021 to June 2023
2. Isolate antifouling compounds and perform biological assays to assess the antifouling ability of sponge extracts	June 2023

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Activity 3: Stimulate STEM education for students in Minnesota

Description: During phase 1 of the freshwater sponge project, two community colleges and a few high schools reached out to us and we have been training their students in the study of sponges. UMC annually conducts the Western Regional Science Fair and school children from the ten surrounding counties compete in the Fair. We will collaborate with interested school districts and e high school science teachers to stimulate STEM education. This is in addition to training our own undergraduate students.

ACTIVITY 3 ENRTF BUDGET: $ 55,500

Outcome	Completion Date
1. Stimulate STEM-related experiences to high school students, partner with additional community colleges, and train undergraduate students in Minnesota	June 2023
2. Assess the impact of STEM-related opportunities at all levels of education	June 2023

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IV. DISSEMINATION:

Description:
The results of this project will be inherently disseminated to citizens in Minnesota who chose to participate in the project. The results of the project will also be presented at the town hall meetings to provide attendees with information about how their involvement in the project will continue to provide information about organism diversity in Minnesota. The incorporation of this project into the Zooniverse platform will also allow citizens be involved in the project and be updated with the results of the project. Citizens will be able to utilize the Zooniverse platform at https://www.zooniverse.org. A listserv will be set up via University of Minnesota Crookston communications office at https://www.crk.umn.edu/units/university-relations. Additional information can be obtained by visiting freshwater sponges website at https://freshwatersponges.crk.umn.edu.

Undergraduate students will still be heavily involved in this research, despite the importance of including Minnesota's citizens, the students will be presenting their results via poster and oral presentations at any number of local, regional, and national conferences and symposia. UMC hosts an undergraduate research day each year in which students discuss the research projects they work on to their peers and other faculty. Recently, UMC students have presented their research findings at both regional and national meetings (e.g., American Chemical Society, National Council of Undergraduate Research). Similarly, UMC faculty have been presenting at many of these and other conferences (e.g., Society of Environmental Toxicology and Chemistry). We plan to continue our attendance at these conferences in order to disseminate our findings for this project.

We have also been in contact with various state agencies as a result of the initial sponge project. We will continue to work closely with the Minnesota Department of Natural Resources (DNR) and Pollution Control Agency. The DNR will be especially interested in any anti-fouling compounds that we identified from the freshwater sponges. We have also contacted Nicholas Phelps at the University of Minnesota Aquatic Invasive Species Center about the project. He mentioned that this research could be a potential partner project and we are interested in working with the center to help disseminate the results of this project.

Lastly, we have tried to publicize the project through various media outlets. We will continue to try to do this as well as this is another way to let the people of Minnesota know about the project and how it is contributing to Minnesota's natural resources because of funding through the ENRTF.

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.

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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: 12476	Divide total personnel hours by 2,080 hours in 1 yr = TOTAL FTE: 6

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

Enter Total Estimated Contract Personnel Hours for entire duration of project: N/A	Divide total contract hours by 2,080 hours in 1 yr = TOTAL FTE: N/A

VI. PROJECT PARTNERS:

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

1. **Venugopal Mukku, UMN Crookston, Ph.D., Chemistry -** Project Manager. Responsible for isolating and characterizing antifouling compounds from freshwater sponges (Activity 2), supervising a postdoctoral associate and coordinating the project activities as program manager.

2. **Anthony Schroeder, UMN Crookston, Ph.D., Biology.** Responsible for biological work and for working with Minnesota Master Naturalists (Activity 1)

3. **Timothy Dudley, UMN Crookston, Ph.D., Chemistry.** Responsible for activities aimed at stimulating STEM education in Minnesota (Activity 3).

4. **Postdoctoral associate**. Primarily freshwater sponge collections (Activity 1), working with outreach program (Activity 1), assisting in analyses (Activities 23), and manuscript preparations. All will supervise students and all will receive ENRTF funds.

B. Partners outside of project manager's organization NOT receiving ENRTF funding

1. Robert Blair, Ph.D., Professor & Extension Specialist, University of Minnesota Twin Cities. Responsible for coordinating town hall meetings and training Master Naturalists.
2. Lucy Fortson, Ph.D., Associate Professor, University of Minnesota Twin Cities will coordinate the Zooniverse portion of the proposal.
3. A total amount of $8,000 will be paid to the outside partners through University of Minnesota Crookston business office.

VII. LONG-TERM- IMPLEMENTATION AND FUNDING:

The long-term goal of the proposed study is to expand on our understanding of the species of the freshwater sponges found in Minnesota, while also providing an opportunity for citizen scientist involvement and STEM promotion. This project will begin to identify connections between freshwater sponges and their environment via chemical analyses. The project also has great potential to find and develop a natural biocide to help combat the spread of zebra mussels. Results will be disseminated through scientific presentations by faculty and students, peer-reviewed publications, and presented to interested state agencies.

VIII. REPORTING REQUIREMENTS:

- Project status update reports will be submitted February 28 and August 31 each year of the project
- A final report and associated products will be submitted between June 30 and August 15, 2023

IX. SEE ADDITIONAL WORK PLAN COMPONENTS:

A. Budget Spreadsheet (Attached)

B. Visual Component or Map (Attached)

C. Parcel List Spreadsheet (N/A)

D. Acquisition, Easements, and Restoration Requirements (N/A)

E. Research Addendum (will be submitted later)

Attachment A: Project Budget Spreadsheet
Environment and Natural Resources Trust Fund
M.L. 2020 Budget Spreadsheet
Legal Citation:
Project Manager: Venugopal Mukku
Project Title: Freshwater Sponges and AIS: Engaging Citizen Scientists
Organization: University of Minnesota Crookston
Project Budget: $400,000
Project Length and Completion Date: 3 years; June 30, 2023
Today's Date: Febraury 14, 2020

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Budget	Amount Spent	Balance
BUDGET ITEM			
Personnel (Wages and Benefits)	$ 335,000	$ -	$ 335,000
Project Manager. Venu Mukku: $43,032 (74% salary, 26% fringe); 11% FTE each year. 1 month salary in year 1 and 2 and 2 months salary in year 3. Supervise students, coordinate the project, compile and file reports, disseminate results.			
Co-Principal Investigator. Timothy Dudley: $46,300; (74% salary, 26% fringe). 11% FTE each year. 1 month of salary for first two years and 2 months for third year. Supervise students, develop curricula, compile and file reports, and organize the dissemination of results.			
Co-Principal Investigator. Anthony Schroeder: $38,973; (74% salary, 26% fringe); 11% FTE each year. 2 months salary in year 1 and 1 month salary in years 2 and 3. Responsible for activity 3.			
Undergraduate students. $82,418; 2 students during each academic year (two at 10 hours per week at $12.50 per hour for 32 weeks ($8000/year*3=$24,000) (100% salary, no fringe) 3 students each summer full time (40 hours per week at $13.52 per hour for 12 weeks ($12,984/year*3=$58,418) (100% salary, no fringe)			
Postdoctoral Associate: $124,300; (salary 80%, fringe 24.3%). 100% FTE for 2 years. The University of Minnesota post-doc will have recently completed Ph.D. in Environmental Ecology/chemistry or a closely related field.			
Equipment/Tools/Supplies			
Supplies for freshwater sponge and water collections by investigators (tubes, bags, supplies to fix and store samples) (~100 sponge samples and ~100 water samples/$45 per sample)	$ 5,500	$ -	$ 5,500
Supplies to develop sponge collection kits for sending to citizen scientists (Tubes, mailing boxes, reagents for fixing sponges) (~200 samples/$45 per sample)	$ 8,100	$ -	$ 8,100
General chromatography (analytical chemistry) supplies (e.g. columns, standards, quartz tubes, reagents)	$ 7,100	$ -	$ 7,100
Maintenance contract for GC-MS ($6600/year for the GC that will be used at UMC to run samples)	$ 13,200	$ -	$ 13,200
Supplies for zebra mussel bioassays (Culturing reagents and other consumables) (~300 assays at $25 per assay)	$ 4,500	$ -	$ 4,500
Reagents for DNA sequencing (Primers, Big Dye Reagent, tubes) and cost to perform DNA sequencing (~300 sponge samples between citizen collections and investigator collections at $15 per sample)	$ 3,750	$ -	$ 3,750
Chemicals for sponge morphology and chemical extractions (~300 samples at $15 per sample)	$ 3,500	$ -	$ 3,500
Instrument use and access for water and sponge analyses (LC-MS/MS; ICP-MS) (~300 samples at $20 a sample)	$ 6,000	$ -	$ 6,000
Printing			
Cost for printing infographs and other documents for citizens	$ 2,250	$ -	$ 2,250
Travel expenses in Minnesota			
Mileage costs (58 cents per mile; ~14,000 miles total) for traveling to sampling sites for sponge collections and for outreach events	$ 6,600	$ -	$ 6,600
Other			
Shipping costs for sending prepaid collection kits to citizens, shipping samples for chemistry analysis and DNA sequencing	$ 2,500	$ -	$ 2,500

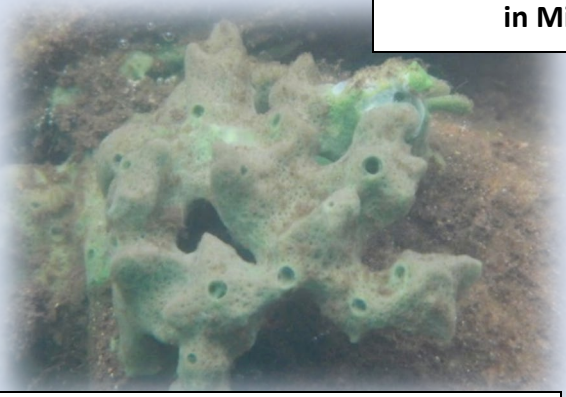
Hotel strays for multiple day collection trips, attending townhall meeting etc.	$ 2,000		
COLUMN TOTAL	$ 400,000	$ -	$ 400,000

SOURCE AND USE OF OTHER FUNDS CONTRIBUTED TO THE PROJECT	**Budget**	**Spent**	**Balance**
Non-State:	$ -	$ -	$ -
State:	$ -	$ -	$ -
In kind: Indirect costs (waived)	$ 212,000	$ -	$ 212,000

Other ENRTF APPROPRIATIONS AWARDED IN THE LAST SIX YEARS	**Budget**	**Spent**	**Balance**
Anthony Schroeder has a service contract for proposal (M.L. 2016, Chp. 186, Sec. 2, Subd. 04d).	$ 33,000	$ 28,311	$ 4,689
Current ENRTF Appropriation: M.L. 2017, Chp. 96, Sec. 2, Subd. 03m	$ 258,000	$ 125,781	$ 132,219

Freshwater Sponges and AIS: Engaging Citizen Scientists

Citizen Scientists Provided Information to Assist in Identifying and Locating Freshwater Sponges in Minnesota's Lakes and Rivers



Collected Freshwater Sponges Identified and Analyzed in the Laboratory by UMC Students and Faculty

UMN Center for Citizen Science Assists in Sharing Project Findings with Citizen Scientists

Students and Faculty Analyze Samples for Natural Biofouling Compounds Capable of Mitigating AIS such as Zebra Mussels