



Environment and Natural Resources Trust Fund (ENRTF)

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

Today's Date: August 14, 2019

Date of Next Status Update Report: April 1, 2021

Date of Work Plan Approval:

Project Completion Date: June 30, 2023

Does this submission include an amendment request? No

PROJECT TITLE: Increase Golden Shiner Production to Protect Aquatic Communities

Project Manager: Dr. John Downing

Organization: University of Minnesota - Duluth

College, Department, or Division: Minnesota Sea Grant College Program

Mailing Address: 141 Chester Park Bldg., 31 West College Street

City, State, Zip Code: Duluth, MN 55812

Project Manager Direct Telephone Number: 218-726-8715

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Web Address: <http://www.seagrant.umn.edu/>

Location: Statewide

Total Project Budget: \$188,000

Amount Spent: \$0

Balance: \$188,000

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

Appropriation Language:

PROJECT STATEMENT:

In Minnesota, demand for Golden Shiners (*Notemigonus crysoleucas*) used as bait exceeds in-state production. Recent projections by bait dealers estimate a deficit of approximately 10,000 gallons of Golden Shiners annually. There is pressure from anglers, bait dealers, and legislators to import them from Arkansas and other states. However, importation can introduce aquatic invasive species such as invasive carps and fish diseases, which can negatively impact state waters and jeopardize valuable native fish species. This proposal will explore strategies to provide a sustainable in-state supply of Golden Shiners that would negate the need for importation. A dependable in-state supply of Golden Shiner will reduce the risk of introducing invasive species and fish pathogens through importation and the inadvertent activity of anglers who illegally bring Golden Shiner into Minnesota. Expansion of in-state Golden Shiner production could increase jobs and commerce in rural Minnesota communities.

Present laws prohibit the importation of baitfish for resale in Minnesota to prevent importation of invasive species and fish diseases. The recent report to the Minnesota Legislature titled "Minnow Importation Risk Report: assessing the risk of importing Golden Shiners into Minnesota from Arkansas" (Gunderson 2018) identified several key vulnerabilities and risks associated with importing Golden Shiner. The report recommends increasing production of Golden Shiner in Minnesota as a preferred alternative to importation (Gunderson 2018 pg. 57). This conclusion was endorsed by Minnesota Department of Natural Resources Commissioner Tom Landwehr in a February 2018 letter to legislators (included in Gunderson 2018).

Our proposal will examine four in-state strategies to increase production of Golden Shiners using exclusively indoor production or indoor production in combination with constructed grow-out ponds. The goal of moving production or partial production of Golden Shiner to indoor facilities is to extend the growing period and enable Golden Shiners to reach marketable size in 9 months or less. Indoor production prevents Golden Shiners from having to over-winter in natural ponds where mortality is high and growth very slow. Successful indoor production could provide Golden Shiners for bait year-round and a source to develop disease-free fish used in constructed grow-out ponds.

Project outcomes: 1) Identify and demonstrate best methods for in-state production of Golden Shiner that will address angler demand and reduce importation and 2) Communicate findings and recommendations to commercial producers by publishing a project report, a production (how-to) manual, and holding three workshops to transfer results of this project.

II. OVERALL PROJECT STATUS UPDATES:

First Update April 1, 2021

Second Update October 1, 2021

Third Update April 1, 2022

Fourth Update October 1, 2022

Fifth Update April 1, 2023

Final Report between project end (June 30) and August 15, 2023

III. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1 Title: Indoor spawning and culture of Golden Shiner

Description: Golden Shiners are an excellent candidate for indoor production because they are a hardy fish, spawn multiple times a year, and their spawning times can be manipulated by adjusting water temperature and lighting conditions. We propose to begin spawning Golden Shiners indoors and raising the juvenile fish to various sizes, which will then be transferred to other facilities for grow-out with the

goal of reaching marketable size in 9 months or less. To accomplish indoor production, we will start with mature Golden Shiners from Minnesota ponds. We will bring them into the hatchery, hatch the eggs, transition the newly hatched fry from yolk-sac stage to external feeding using small zooplankton and once the fry are eating the zooplankton, transition them to feed on a commercially available diet of dry food. This process has been researched and successfully implemented by Marc Tye (Tye 2012), a partner on this proposal. **Activity Outcome:** Provide year-round indoor production of Golden Shiner that will be transferred to aquaponics facilities or constructed ponds for grow-out (see Activity 2).

ACTIVITY 1 ENRTF BUDGET: \$30,000

Outcome	Completion Date
<i>Refine indoor hatchery production of Golden Shiner eggs, fry, fryling, and adults.</i>	<i>May 1, 2023</i>

First Update April 1, 2021

Second Update October 1, 2021

Third Update April 1, 2022

Fourth Update October 1, 2022

Fifth Update April 1, 2023

Final Report between project end (June 30) and August 15, 2023

ACTIVITY 2 Title: Grow-out strategies for Golden Shiner

Description: Four grow-out strategies for rearing Golden Shiner to market size in Minnesota will be implemented. **Strategy 1.** Grow fish completely indoors using a recirculating aquaculture system (RAS) and feeding commercial food. Fish are hatched, grown, and harvested indoors. This system could provide disease free market-size Golden Shiners to the bait industry year-round. **Strategy 2.** This strategy couples indoor Golden Shiner production with aquaponics (i.e., growing fish and plants together). Golden Shiners are tolerant of the high nutrient loads and warmer temperatures needed to grow plants. Feed-trained fry derived from Minnesota Golden Shiners will be taken from the indoor hatchery and introduced into aquaponics systems. Use of Golden Shiners in aquaponics would also supply a year-round source not presently available. **Strategy 3.** Obtain fry (~ 1/4 inch) from the indoor hatchery and stock them directly into constructed ponds before the fry consume their yolk-sac. This is a relatively simple approach, similar to what is used by the MNDNR for Walleye fingerling production. This method may increase the length of the grow-out season in constructed ponds by approximately 1–2 months, thereby allowing fish to potentially reach market size in only one summer. **Strategy 4.** Rear fish indoors on commercial feed to fryling size (~ 3/4 - 2 inches), stock the constructed grow-out ponds in early spring, and harvest before freeze up. This could increase the length of the growing season by up to three months allowing harvest of market-size fish in one summer, without over wintering in ponds. **Activity Outcomes:** Indoor, year-round, production of market-size Golden Shiner within nine months or less using RAS and aquaponics. Outdoor production of market-size Golden Shiner using constructed ponds over one summer growing season.

ACTIVITY 2 ENRTF BUDGET: \$122,000

Outcome	Completion Date
<i>Determine which grow-out strategies are most productive for Golden Shiner in Minnesota.</i>	<i>Dec. 31, 2022</i>

First Update April 1, 2021
 Second Update October 1, 2021
 Third Update April 1, 2022
 Fourth Update October 1, 2022
 Fifth Update April 1, 2023

Final Report between project end (June 30) and August 15, 2023

ACTIVITY 3 Title: Monitor results and develop recommendations based on which strategies may best increase commercial production of Golden Shiner in Minnesota
Description: Monitor results by sampling Golden Shiners, water quality, and environmental conditions in tanks and/or constructed ponds for each strategy. Develop recommendations based on growth rates, food availability, survival of Golden Shiner, and estimated costs for each strategy. **Activity Outcomes:** Summarize project results in a final report, publish a production (how-to) manual, and host three workshops for growers, bait dealers, and legislators.

ACTIVITY 3 ENRTF BUDGET: \$36,000

Outcome	Completion Date
<i>Summarize project information and provide recommendations in a project report, publish a production (how-to) manual, and host three workshops at which we will distribute project information to growers, bait dealers, and legislators.</i>	<i>June 30, 2023</i>

First Update April 1, 2021
 Second Update October 1, 2021
 Third Update April 1, 2022
 Fourth Update October 1, 2022
 Fifth Update April 1, 2023

Final Report between project end (June 30) and August 15, 2023

IV. DISSEMINATION:

Description: We will summarize project results in a final report, publish a production (how-to) manual, and host three workshops where we will present and discuss our results with interested growers, bait dealers, legislators and citizens in the western, central and metro regions of Minnesota. The production (how-to) manual will be available in PDF format on the Minnesota Sea Grant website (<http://www.seagrant.umn.edu>) so any interested citizens can download and view the information. Hard copies will be available upon request and mailed to those that do not have internet access.

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 April 1, 2021

Second Update October 1, 2021

Third Update April 1, 2022

Fourth Update October 1, 2022

Fifth Update April 1, 2023

Final Report between project end (June 30) and August 15, 2023

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: 3,370 hrs	Divide total personnel hours by 2,080 hours in 1 yr = TOTAL FTE: 1.62
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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: 1,581 hrs	Divide total contract hours by 2,080 hours in 1 yr = TOTAL FTE: 0.75
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VI. PROJECT PARTNERS:

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

Marc Tye, Owner, Tye Fish Solutions, Golden Shiner Indoor Production Specialist; **Barry Thoele**, Owner, Lincoln Bait, bait producer, aquaponics producer, facility owner/manager (constructed ponds and tanks)

B. Partners outside of project manager's organization NOT receiving ENRTF funding: **Sean Sisler** – MNDNR, Aquaculture Coordinator

VII. LONG-TERM- IMPLEMENTATION AND FUNDING: We anticipate that Golden Shiner growers and bait dealers will implement and fine-tune the results of this project. We predict growers will be better positioned to fund their businesses based on the profit gained through the increased production and sale of Golden Shiners to anglers. We expect increased production within Minnesota to significantly reduce the demand for Golden Shiner importation.

VIII. REPORTING REQUIREMENTS:

- Project status update reports will be submitted April 1 and October 1 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 - Enclosed

B. Visual Component or Map - Enclosed

C. Parcel List Spreadsheet

D. Acquisition, Easements, and Restoration Requirements

E. Research Addendum

Attachment A: Project Budget Spreadsheet
 Environment and Natural Resources Trust Fund
 M.L. 2020 Budget Spreadsheet

Legal Citation:

Project Manager: Dr. John Downing

Project Title: Increase Golden Shiner Production to Protect Aquatic Communities

Organization: University of Minnesota Duluth (for MN Sea Grant)

Project Budget: \$188,000

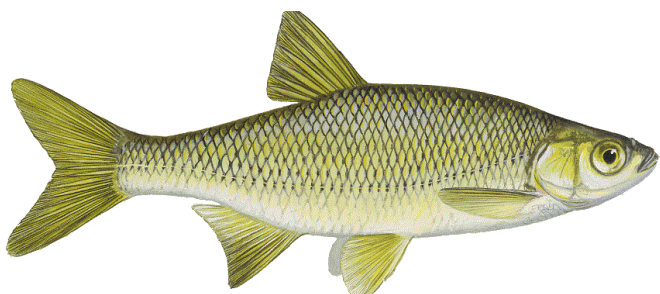
Project Length and Completion Date: 3 years - June 30, 2023

Today's Date: August 14, 2019



ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET		Budget	Amount Spent	Balance
BUDGET ITEM				
Personnel (Wages and Benefits)		\$ 104,165	\$ -	
John Downing- Project Direction and Administration \$33,076 (74% Salary, 26% Fringe) 4% FTE for each of 3 yrs				
Don Schreiner and/or TBD Fisheries/Aquaculture Specialist \$52,389 (74% Salary, 26% Fringe) 25% FTE for each of 3 yrs				
Undergraduate Student Worker - TBD - Field and lab assistance \$18,700 (100% salary) 37.5% FTE for each of 2 yrs				
		\$ -		
Professional/Technical/Service Contracts				
Tye Fish Solutions - Marc Tye, owner - Single Source - Produce Golden Shiners for grow-out and grow fish indoors for entire life-cycle. \$10 K/yr for 3 yrs Justification -Tye Fish Solutions is the only business in Minnesota that we are aware of that produces Golden Shiner (a highly sought after bait fish) indoors and has the capacity to produce a variety of different life stages (eggs, fry, fryling, fingerling and adults). The results of Marc Tye's work has been published in the peer-reviewed literature (Tye 2012), and he has agreed to work with our group to supply Golden Shiner for this project. Based on internet searches and inquiries with other growers in the Minnesota bait and/or aquaculture industry we have found no other businesses that grow the different life stages of Golden Shiner indoors, that are required for this study. It is illegal to import Golden Shiner from other states. Competitive Pricing - We discussed our project requirements with Dr. Chris Hartleb, University of WI- Stevens Point, and Director of the Northern Wisconsin Demonstration Facility in Bayfield WI and asked him to estimate project costs if we were to do this work in his facility. Tye Fish Solutions: The estimated facility cost to grow Golden Shiner indoors with a recirculating aquaculture system (RAS) for 1 year would be approximately \$5,000. Personnel or consultant cost ranges from \$50-\$100/hr. At 20% FTE @ \$50/hr personnel cost would be \$20,800/yr. Total estimate for work performed by Tye Fish Solutions is \$25,800/yr.		\$ 30,000		
Lincoln Bait - Barry Thoele, owner - Single Source - Provides grow out facilities, both indoor tanks and outdoor ponds. \$10K/yr for 2.5 yrs. Justification - Lincoln Bait has the required facilities and knowledge to carry out the experimental work necessary for this project. Once fry and frylings are hatched and grown indoors they will be transferred from Tye Fish Solutions to Lincoln Bait indoor tanks and grow-out ponds. Lincoln Bait has the variety of pond sizes required for this work. Barry Thoele has worked with aquatic researchers to conduct various experiments on rearing bait (Gunderson et al. 2008) and has demonstrated his ability to follow data collection protocols in an appropriate manner so rearing conditions are documented and useful results are reported. Competitive Pricing - See above for source of competitive pricing - Lincoln Bait - The estimated facility cost to grow Golden Shiner in experimental ponds is approximately \$10,000/yr. Personnel or consultant cost ranges from \$50-\$100/hr. At 15% FTE for 7 months @ \$50/hr personnel cost would be \$9,048/yr. Total estimate for work performed by Lincoln bait is \$19,048/yr.		\$ 25,000		
2 Aquaponics Growers TBD - \$2,000K/yr for 2 years - Contracts will be determined through a competitive selection process - Aquaponics growers will be recruited to participate in this project by email or letter notification. We will seek interested growers who have the required facilities, are willing and able to follow appropriate scientific protocols, and will provide their services within our budget.		\$ 8,000	\$ -	
Supplies - Measuring boards, scale, sample containers, sample preservatives, etc.		\$ 3,500	\$ -	
Printing - Handouts for outreach meetings and manual for growers		\$ 2,839	\$ -	
Travel expenses in Minnesota				
-Mileage for initial planning meetings and facility preparation (likely in Twin Cities area) 2 trips to 3 groups @ 200 miles/trip = 1200 mi@0.58/mi = 696 -Mileage for sampling fish from ponds (Lincoln Bait in Staples area), hatchery (Tye Fish solutions near Mankato) and aquaponics (in Twin Cities area and TBD) 8 trips/yr for 3 yrs @ 300 miles/trip=7200 mi@0.58/mi = 4176 -Mileage for Outreach Meetings 3 trips (likely Twin Cities and Alexandria areas) each to 2 groups @ 300 mi/trip=1800 mi @0.58/mi=1,044 -Est. lodging ~ 30 overnights@\$100 -Est. meals/per-diem for each trip above (some overnight) ~124 /days @45/day=\$5,580		\$ 14,496		
COLUMN TOTAL		\$ 188,000	\$ -	\$ -
SOURCE AND USE OF OTHER FUNDS CONTRIBUTED TO THE PROJECT				
	Status (secured or pending)	Budget	Spent	Balance
Non-State:			\$ -	
State: MN DNR Aquaculture specialist Sean Sisler 40 hrs/year for 3 years, \$50/hr	secured	\$ 6,000	\$ -	
In-Kind: University of MN unrecovered Indirect Cost at 54% MTDC	secured	\$ 101,607	\$ -	\$ 101,607
Other ENRTF APPROPRIATIONS AWARDED IN THE LAST SIX YEARS				
	Amount legally obligated but not yet spent	Budget	Spent	Balance
		\$ -	\$ -	\$ -

Increase Golden Shiner Production to Protect Aquatic Communities



Demand for Golden Shiners used as bait exceeds in-state production and there is pressure from anglers to import them.



However, importation can introduce aquatic invasive species and carry disease, which can negatively impact our state waters and jeopardize valuable native fish species.

4 Strategies to Increase In-State Golden Shiner Production

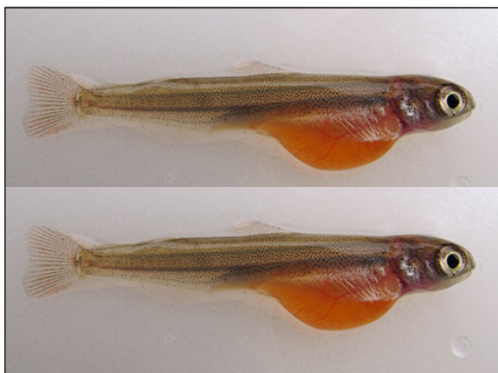
Raise indoors for their entire lifecycle



Couple production with aquaponics



Grow indoors to fry size (1"), then transfer to ponds



Grow indoors to fryling size (2"), then transfer to ponds



Outcomes and Products

Increase in-state production of Golden Shiner to meet angler demand and eliminate need to import

Document results, determine best strategies, and produce a report. Develop systems for commercial production

Host 3 workshops for growers, bait dealers and legislators to transfer project information