Project Title: **ENRTF ID:**   **031-AH**

Walleye Habitat Status to Guide and Prioritize Management

Category: H. Proposals seeking $200,000 or less in funding

Sub-Category: A. Foundational Natural Resource Data and Information

Total Project Budget: $ 198,784

Proposed Project Time Period for the Funding Requested: June 30, 2022 (3 yrs)

Summary:

To guide walleye management, we will quantify walleye habitat, evaluate walleye population status relative to habitat potential, and assess sensitivity to changing water clarity and temperature in 1,400 walleye lakes.

Name: Gretchen   Hansen

Sponsoring Organization: MN DNR

Title: Fisheries systems ecologist

Department:

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Web Address

Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Walleye are managed in over 1400 lakes in Minnesota. The status of walleye populations relative to habitat area can guide management . Lake sensitivity to changing conditions can guide future prioritization.

_____ 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?

I. PROJECT STATEMENT

Walleye are an important sport fish in Minnesota and are managed in over 1,400 lakes. Declining walleye populations in Midwestern lakes are a major concern, and walleye lakes must be managed with limited resources. To improve walleye management we propose to evaluate:

- **The status of walleye populations relative to their habitat potential, and**
- **The sensitivity of walleye habitat to changing water clarity and temperature.**

Walleye prefer low water clarity and cool water temperatures. Water clarity and temperature combine to determine the amount of suitable walleye habitat in a lake, known as its thermal-optical habitat area. Pilot work in Mille Lacs has related changes in thermal-optical habitat to walleye abundance and safe harvest. We propose to extend this work to other walleye lakes in Minnesota to guide state-wide management.

Status: Lakes with abundant habitat generally produce the most walleye. Quantifying the status of a lake's walleye habitat will help prioritize lakes for management based on their potential. Walleye population status relative to expectations based on habitat area can guide harvest policies – for example, regulations may be relaxed when abundance exceeds expectations, and restricted when abundance is lower than expected.

Sensitivity: Minnesota lakes are undergoing changes in water clarity and water temperature. The effect of these changes on walleye habitat will vary among lakes depending on their starting conditions and depth. Assessing the sensitivity of individual lakes to changes in water clarity and temperature will allow forward-looking proactive management that focuses limited resources on the most resilient lakes that are least likely to be negatively affected by changing conditions.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: *Classify 1,400 walleye lakes using walleye habit and population status assessments*
We will estimate current and historic thermal-optical habitat for 1,400 Minnesota walleye lakes using simulation models developed to predict lake temperature and light calibrated using observed data. We will directly measure habitat area using automated sensors in 15 walleye lakes spanning a gradient of conditions for model validation. We will use statistical models to quantify the relationship between habitat and estimates of walleye abundance collected by the MN DNR. We will classify lakes in which walleye populations differ from expectations based on habitat as either robust (more walleye than expected based on habitat), at-risk (fewer walleye than expected based on habitat), or low priority (low walleye abundance and low habitat).
ENRTF BUDGET: $89,878

Outcome	Completion Date
1. Assemble historical walleye, temperature, and water clarity data	*June 2020*
2. Estimate thermal optical habitat area for walleye lakes using simulation model validated by sensor measurements and historical data	*June 2021*
3. Quantify the overall relationship between walleye habitat and abundance	*December 2021*
4. Classify lakes as low priority, under-performing, or robust based on the status of walleye abundance and habitat	*December 2021*

Activity 2: *Assess the sensitivity of each of the 1,400 walleye lakes to changing water clarity and temperature*
Walleye habitat responds to changing clarity and temperature differently in different lakes depending on depth, shape, and current conditions. We will run additional simulations to quantify TOHA under a range of clarity and temperature conditions. From these simulations we will assess the breadth of conditions under which walleye habitat is predicted to be suitable. Lakes with abundant habitat across a wide range of conditions are more resilient to changing conditions; lakes in which habitat is abundant under only under a narrow range of conditions are at risk of losing walleye habitat if conditions change.

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ENRTF BUDGET: $57,288

Outcome	Completion Date
1. Estimate thermal optical habitat area for walleye lakes across a range of hypothetical water clarity and temperature scenarios	September 2021
2. Quantify the sensitivity of walleye habitat in each lake to changes in water clarity and temperature	December 2021
3. Classify lakes as resilient or at-risk based on their sensitivity to changing conditions	December 2021

Activity 3: *Develop and communicate management recommendations and prioritizations for Minnesota walleye lakes*
In order to produce actionable science, the status and sensitivity of Minnesota's walleye lakes must be linked to management. We will hold a two-day workshop for the project team and fisheries management representatives to develop a toolbox of management actions and a prioritization framework for each category of walleye lake.
ENRTF BUDGET: $51,618

Outcome	Completion Date
1. Workshop with fish management representatives to develop management guidance	January 2022
2. Present results and develop written management framework	June 2022
3. Peer-reviewed publication on the status and sensitivity of Minnesota walleye lakes	June 2022

III. PROJECT PARTNERS:

B. Partners NOT receiving ENRTF funding

Name	Title	Affiliation	Role
Dr. John Fieberg	Associate professor	UMN	Quantitative modeling expert, graduate student co-advisor
Dr. Jordan Read	Data science branch chief	USGS	Data science, modeling, physics expert
Dr. Luke Winslow	Post-doctoral associate	Rensselaer Polytechnic Institute	Data science, modeling, water clarity expert

IV. LONG-TERM- IMPLEMENTATION AND FUNDING:

Currently, more than 1,400 lakes are managed for walleye in Minnesota. Understanding the potential for current and future walleye production is critical for successful management now and into the future. Quantifying the performance of each lake relative to expectations based on habitat and their sensitivity to changes in water clarity or temperature will allow managers to set realistic and appropriate goals for walleye populations and harvest, and identify lakes that are likely to be resilient to future changes. This project will supplement the MN DNR's existing lake assessment program by incorporating ecosystem data. We will leverage the existing MN DNR sampling program and supplement with our own sampling of ecosystem conditions, much of it automated to maximize efficiency. We anticipate that future funding requests may be submitted to LCCMR to investigate mechanisms behind observed relationships between walleye habitat and populations.

V. TIME LINE REQUIREMENTS:

Phase 1: Data assembly, model development and sensor deployment (July 2019-December 2020)
Phase 2: Quantifying lake-specific habitat estimates, relationships with walleye abundance, and sensitivity of walleye habitat to changing water clarity and temperature (January 2021-December 2021)
Phase 3: Development of management toolbox and communicating results (January 2022-June 2022)

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2019 Proposal Budget Spreadsheet

Project Title: Walleye habitat status to guide and prioritize management

IV. TOTAL ENRTF REQUEST BUDGET *3* years

BUDGET ITEM (See "Guidance on Allowable Expenses")	AMOUNT	
Personnel: *Field and lab technician for assisting with field work and data collation; 0.288 FTE for each of 3 years: $15/hr, 13% fringe*	$	30,510
Professional/Technical/Service Contracts: Graduate assistantship at University of Minnesota for 3 years, includes tuition, assitantship, and fringe.	$	130,331
Equipment/Tools/Supplies: Light/temperature loggers and required hardware ($3,800); ropes, cables, anchors, bouys for deploying sensors ($1,000), PAR sensor and hardware ($1,475), Temperature/Dissolved oxygen meter and required hardware ($2,025), PPE for tech and student ($400)	$	8,700
Acquisition (Fee Title or Permanent Easements):	NA	
Travel - MN: Fieldwork to deploy and retrieve sensors, collect other lake-specific data to support modeling, and assist with fish sampling as needed. Total based off estimated 4 weeks of field work per year for two people; for each of 2 years 1,000 miles@$0.55/mi + 32 lodging nights@100/night (actual costs reimbursed) + 32 days of meals @$36/day (meal estimate based on DNR maximum; actual costs will be reimbursed)= [$13,720]). Hosting workshop in central MN location for project team and MN DNR managers to develop management guidance based on project results [$4000]. Travel to in-state conferences and meetings (4 meetings/conferences/workshops @$500 each)[$2000]	$	19,720
Additional Budget Items: Open-access publication fees	$	2,000
Additional Budget Items: * Direct and Necessary expenses: HR Support (~$1,277), Safety Support (~$264), Financial Support (~$781), Communications Support (~$1,251), IT Support (~$2,891), and Planning Support (~$1,059) necessary to accomplish funded programs/projects	$	7,523
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$	198,784

* Direct and Necessary expenses include Department Support Services (Human Resources, IT Support, Safety, Financial Support, Communications Support, and Planning Support). Department Support Services are described in the agency Service Level Agreement and billed internally to divisions based on rates that have been developed for each area of service. These services are directly related to and necessary for the appropriation. Department leadership services (Commisioner's Office and Regional Directors) are not assessed. Those elements of individual projects that put little or no demand on support services such as large single-source contracts, large land acquisistions, and funds that are passed through to other entities are not assessed Direct and Necessary costs for those activities.

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

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
Other Non-State $ To Be Applied To Project During Project Period:	NA	
Other State $ To Be Applied To Project During Project Period:	NA	
In-kind Services To Be Applied To Project During Project Period: Game and Fish funds $161,147 ($131,060 salary and $30,087 fringe for DNR support of Project manager Hansen [24% FTE], Logsdon [10% FTE], Hobrook [11% FTE], and Schmalz [5% FTE]. Fieberg salary [1% FTE, $2,856 salary + $957 Fringe]; UMN Indirect costs [$43,368]; Read Salary [5% FTE, $18,720 salary + 3,183 fringe]	$ 230,231	*Secured*
Past and Current ENRTF Appropriation: Sub-Project Budget of M.L. 2013-06a: Aquatic Invasive Species Research Center - subproject title: Sustaining walleye populations: assessing impacts of AIS	$ 197,200	Secured
Other Funding History: Northeast Climate Science Center grant for lake temperature model development awarded to partner J. Read: *An Integrated Assessment of Lake and Stream Thermal Habitat Under Climate Change*	$ 150,000	*Secured*

Walleye are managed in over 1,400 walleye lakes in Minnesota

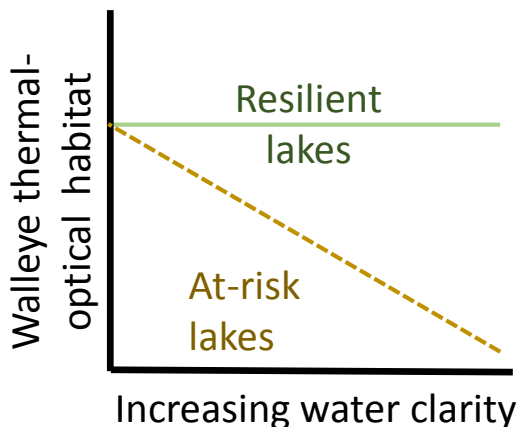## The status of walleye populations relative to habitat area can guide management actions
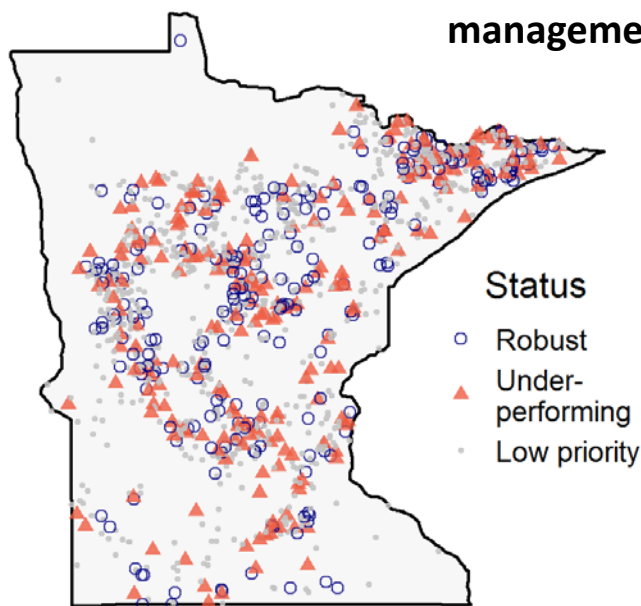
Hypothetical classification

Status
- Robust
- Under-performing
- Low priority

Robust lakes
Promote walleye fishing opportunities

Under-performing lakes
Manage conservatively

Low priority lakes
Focus management on other species

Lake sensitivity to changing conditions can guide future prioritization

Walleye thermal-optical habitat

Resilient lakes

At-risk lakes

Increasing water clarity or temperature

Resilient lakes
High-priority for walleye management; protect from other stressors

At risk lakes
Monitor closely, manage conservatively

05/06/2018   **ENRTF ID: 031-AH**

Project manager qualifications: Dr. Gretchen Hansen

Dr. Gretchen Hansen will serve as project manager and oversee all project activities. In addition to her role as a fisheries systems ecologist at the MN DNR, Dr. Hansen is an adjunct assistant professor at the University of Minnesota's Department of Fish, Wildlife, and Conservation biology, and therefore will serve as the primary advisor to the graduate student working on this project. Dr. Hansen has a Ph.D. in limnology and marine science and M.Sc. in Fisheries and Wildlife. She has spent the past decade working at the interface of science and policy in understanding ecosystem changes affecting Midwestern lakes. As a leading researcher working to understand trends in walleye populations, Dr. Hansen has worked on the effects of climate change, invasive species, and water clarity on walleye and other sport fish. She currently serves as project manager for a collaborative multi-agency team on a MAISRC project studying the impacts of zebra mussels and spiny water flea on the food webs of Minnesota's largest walleye lakes. Many of her research projects bring together experts in fisheries management, ecosystem dynamics, and computer ecology to address real-world management problems with cutting-edge science solutions. Dr. Hansen has a strong publication track record and a commitment to communicating effectively with stakeholders.

Project manager's organization description: Minnesota Department of Natural Resources, Fisheries Research

The mission of the Minnesota Department of Natural Resources (DNR) is to work with citizens to conserve and manage the state's natural resources, to provide outdoor recreation opportunities, and to provide for commercial uses of natural resources in a way that creates a sustainable quality of life.

Within the Minnesota DNR, fisheries research scientists tackle the most important management problems facing fisheries managers and anglers today. Researchers assist fisheries managers in understanding the scientific unknowns to improve fishing, and effectively manage aquatic resources. Researchers conduct experiments that answer specific questions posed by managers, anglers, and academics.