

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

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**Project Title:**

**ENRTF ID: 038-AH**

Aquatic Habitats for Moose and Enhanced Lake Foodwebs

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

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

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**Total Project Budget: \$** 199,600

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

**Summary:**

Data is needed about which aquatic habitats moose prefer and how moose can potentially enhance nearshore lake foodwebs. This project will map critical aquatic habitats and measure lake foodweb effects.

**Name:** Joseph Bump

**Sponsoring Organization:** U of MN

**Title:** Associate Professor

**Department:** Fisheries, Wildlife, & Conservation Biology

**Address:** 135 Skok Hall, FWCB, 2003 Upper Buford Circle  
St. Paul MN 55108

**Telephone Number:** (612) 625-2255

**Email** bump@umn.edu

**Web Address**

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**Location**

**Region:** Northeast

**County Name:** Cook, Itasca, Koochiching, Lake, Lake of the Woods, St. Louis

**City / Township:**

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**Alternate Text for Visual:**

Two photos of moose feeding, above and below waterline; a 3-photo series of a lake enclosure demonstrating that moose affect aquatic plant structure; key questions this study will address.

<input type="checkbox"/>	Funding Priorities	<input type="checkbox"/>	Multiple Benefits	<input type="checkbox"/>	Outcomes	<input type="checkbox"/>	Knowledge Base	
<input type="checkbox"/>	Extent of Impact	<input type="checkbox"/>	Innovation	<input type="checkbox"/>	Scientific/Tech Basis	<input type="checkbox"/>	Urgency	
<input type="checkbox"/>	Capacity Readiness	<input type="checkbox"/>	Leverage	<input type="checkbox"/>		TOTAL	<input type="checkbox"/>	%
<input type="checkbox"/> If under \$200,000, waive presentation?								



**PROJECT TITLE:** Aquatic habitats for moose and enhanced lake foodwebs

**I. PROJECT STATEMENT:**

- Moose use aquatic habitats for multiple reasons (e.g. to consume salt-rich plants), but almost nothing is known about what sort of aquatic habitats moose prefer and how moose can potentially create positive feedbacks in near-shore habitats critical to not only moose but also other lake plants and animals.
- **Goal:** We'll identify key aquatic habitats for moose and measure how moose affect aquatic habitats in shallow ponds and lakes to assess the potential for positive feedbacks in habitat quality.
- **Why?** Aquatic habitats are critical moose habitat. By feeding in aquatic habitats moose may significantly affect a variety of abiotic (e.g., temperature, nutrients) and biotic (e.g., periphyton, macrophytes, invertebrates, fish) functions in small lake, stream, and pond ecosystems. Small water bodies are also critical for moose nutrition, thermoregulation, and survival. By determining aquatic habitat selection and key effects of moose on aquatic habitats, we can then assess feedbacks to the moose populations and other species that depend on small lakes and ponds.

**Our specific, direct outcomes are to:**

1. Determine key water bodies used by moose in the Northern Forest region of Minnesota;
2. Measure key effects of moose on aquatic habitat productivity and community structure; and
3. Provide educational programming material for outreach to the general public.

**We will achieve these goals and outcomes by:**

1. Mapping high-to-low moose use in water bodies with existing data from GPS collared moose;
2. Using existing data and new measurements to assess moose effects on aquatic plants and fish; and
3. Create a short documentary film on the importance of aquatic habitats to moose and how, in turn, moose can affect aquatic habitats, which may create key positive feedbacks that favor moose population health and other aquatic life.

**II. PROJECT ACTIVITIES AND OUTCOMES**

**Activity 1: Determine and map key water bodies that are used by moose in northeastern Minnesota.**

**Description:** We will collaborate with multiple agencies and tribes to synthesize and analyze moose location data to determine and map water bodies that are heavily used by moose, moderately used, and used infrequently. This effort will require synthesizing multiple data sources. Use will be ground truthed with field surveys.

**ENRTF BUDGET: \$50,800**

<b>Outcome</b>	<b>Completion Date</b>
1. Analyze existing data to determine and map high-to-low moose use across water bodies	<i>December 2019</i>
2. Meet with regional biologists to develop a field sampling plan & ground truthing	<i>March 2020</i>

**Activity 2: Assess moose effects on aquatic habitats, explore potential for positive feedbacks, and develop policy recommendations.**

**Description:** We will use multiple methods to measure how aquatic foraging by moose affects key lake or pond productivity attributes, plants, and fish diversity.

**ENRTF BUDGET: \$134,800**



Outcome	Completion Date
1. Measure moose foraging affects on aquatic habitat primary productivity and turbidity.	December 2020
2. Measure fish diversity associated with moose foraging in aquatic habitats	December 2020
3. Quantify aquatic plant coverage across a spectrum of high-to-low moose foraging	May 2021

**II. PROJECT ACTIVITIES AND OUTCOMES - continued**

**Activity 3: Create short documentary film on moose and aquatic habitats**

**Description:** We will storyboard, script, and collect footage for a short documentary film highlighting the importance of aquatic habitats to moose and illustrating the ways in which aquatic foraging by moose in turn affects small lakes and ponds.

**ENRTF BUDGET: \$14,000**

Outcome	Completion Date
1. Storyboard and script documentary film	May 2020
2. Collect footage	October 2020
3. Complete film editing	June 2021

**III. PROJECT PARTNERS:**

**A. Partners receiving ENRTF funding**

Name	Title	Affiliation	Role
TBD	Masters Student	University of Minnesota	Research Assistant
TBD	Co-project manager	University of Minnesota	Co-leader; fish specialist
Joseph K. Bump	Project leader	University of Minnesota	Project PI

**B. Partners NOT receiving ENRTF funding**

Name	Title	Affiliation	Role
Steve Windels	Research Biologist	National Park Service	Advise field sampling

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

This project will provide foundational data and information for aquatic habitat-monitoring for moose.

**V. TIME LINE REQUIREMENTS:**

Two years of support are needed to complete this project because at least two field seasons are necessary. The first half of year one will focus on moose location record compiling, database development, analysis, and aquatic habitat mapping. The second half of year one will focus on field site selection and aquatic habitat sampling and mapping. Year two will repeat the field sampling to capture inter-year variation and complete the educational programming materials for statewide outreach and dissemination of results.

## 2019 Detailed Project Budget

**Project Title: *Aquatic habitats for moose and enhanced lake foodwebs***

### IV. TOTAL ENRTF REQUEST BUDGET: 2 years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
<b>Personnel: <i>subtotal = \$164,900</i></b>	
TBD, Masters student, field work, analysis and modeling, paper publishing, and co-lead public outreach: (56% salary, 44% benefits) 50% FTE for 3 years.	\$ 89,900
TBD, co-project management, co-analysis, paper publishing, and co-lead public outreach and communication: (82.3% salary, 17.6% benefits) 50 % FTE for 2 years.	\$ 65,000
Undergraduate Wildlife Field Assistant to assist with field work and data entry: (100% salary) 30 % FTE for 2 years.	\$ 10,000
<b>Equipment/Tools/Supplies:</b>	
YSI sonde sensor package to measure lake primary productivity, turbidity, conductivity, temperature, dissolved oxygen, total algae.	\$ 17,700
Fyke nets (6 at \$500 each = \$3,000) to sample fish communities;	\$ 3,000
<b>Travel:</b>	
Mileage, lodging, for in-state travel by all project personnel to and from field sites for two seasons (multiple trips), data sharing partner offices (MN DNR, federal agencies, tribal wildlife agencies) and outreach presentation sites. All travel will adhere to the commissioner's plan. (1) Vehicle Rental = \$ 3,336 (2) Vehicle mileage = \$2,580 (3) Room rentals = \$ 4,084	\$ 10,000
<b>Additional Budget Items:</b>	
Publishing page costs for 2-3 peer-reviewed papers	\$ 4,000
<b>TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =</b>	<b>\$ 199,600</b>

### V. OTHER FUNDS

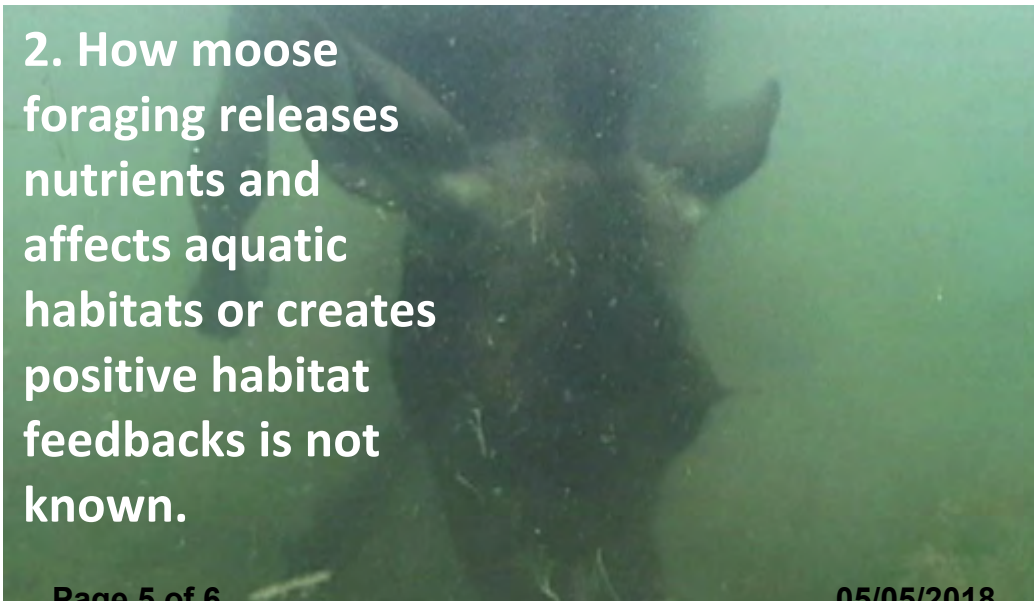
<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
<b>Other Non-State \$ To Be Applied To Project During Project Period:</b>	N/A	N/A
<b>Other State \$ To Be Applied To Project During Project Period:</b>	N/A	N/A
<b>In-kind Services To Be Applied To Project During Project Period:</b> <i>\$88,560</i> Forgone organized research indirect costs associated with this project (54% MTDC). \$5,000 from Gullion Chair and UMN research start-up funds to Project Lead JK Bump will be used for travel to present results at regional, national (e.g. The Wildlife Society) or international professional conferences (e.g. Conservation Biology). \$20,000 from UMN research start-up funds to Project Lead JK Bump will be used for summer salary to deliver 3 weeks of summer salary for the project (75% salary, 25% benefits) 6% FTE for 2 years. \$5,000 + \$20,000 = \$25,000	\$ 113,560	<i>Secured</i>
<b>Past and Current ENRTF Appropriation:</b>	N/A	N/A
<b>Other Funding History:</b>	N/A	N/A
<b>TOTAL OTHER FUNDS \$ PENDING AND SECURED =</b>	<b>\$ 113,560</b>	

# Aquatic habitats for moose and enhanced lake foodwebs

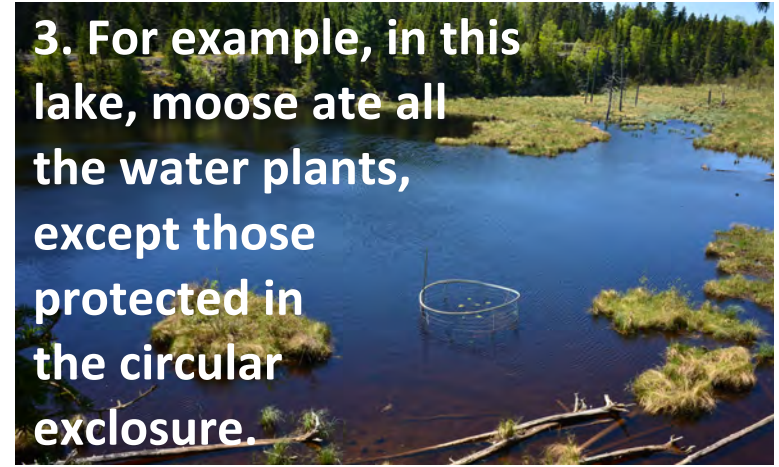
1. Aquatic habitats are critical for moose nutrition, but not mapped in Minnesota. We will identify important aquatic habitats.



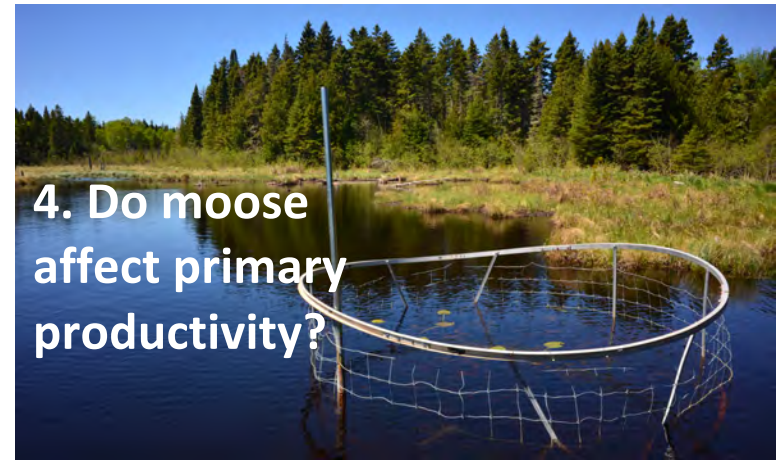
2. How moose foraging releases nutrients and affects aquatic habitats or creates positive habitat feedbacks is not known.



3. For example, in this lake, moose ate all the water plants, except those protected in the circular enclosure.



4. Do moose affect primary productivity?



5. Do moose influence fish habitat and communities?





## Aquatic habitats for moose and enhanced lake foodwebs

### PROJECT MANAGER QUALIFICATIONS:

Dr. Joseph K. Bump is an Associate Professor and the *Gordon W. Gullion Chair in Forest Wildlife Research and Education* in the Department of Fisheries, Wildlife, and Conservation Biology at the University of Minnesota. Bump's expertise is in wildlife ecology, management, and conservation, with a focus on large mammals. He has worked on moose related research and management since 2003. Most recently, he and two graduate students completed a project that employed year-round aquatic exclosures to study moose herbivory on aquatic plants on Isle Royale National Park, Michigan; the first study of its kind. The Michigan assessment resulted in at least 4 peer-reviewed publications, numerous presentations, and directly informed state and federal management and conservation. Bump is an active member in The Wildlife Society, Ecological Society of America, and the American Society of Mammalogists.

### *Professional preparation*

**Michigan Technological University**, Ph.D., Forest Science - wildlife ecology focus, Rolf O. Peterson, 2008

**University of Wyoming**, M.Sc., Zoology and Physiology, Statistics minor, James R. Lovvorn, 2003

**University of Michigan**, B.Sc., Biology with Honors Thesis, Gerald R. Smith, 1999

### *Editorships at peer-review journals in the field*

2013 - present Subject Matter Editor, *PLOS ONE*

2011 – present Subject Matter Editor, *Oikos*

### *Journal peer review*

Science; Proceedings of the Royal Society; Ecology Letters; Ecology; Ecography; Ecological Research; Oecologia; Oikos; Journal of Animal Ecology; PLOS ONE; Journal of Mammalogy; Animal Behavior; Journal of Wildlife Management; Wildlife Monographs; Rapid Communications in Mass Spectrometry; Current Anthropology; Naturwissenschaften.

### PROJECT MANAGER RESPONSIBILITIES:

Dr. Joseph K. Bump will provide overall leadership, coordination, and oversight for each aspect of this project. Bump will be the primary advisor and mentor for the graduate student, researcher, and undergraduates supported by this project.

### ORGANIZATION DESCRIPTION:

The Department of Fisheries, Wildlife, and Conservation Biology at the University of Minnesota Twin Cities provides world-class training and expertise to contribute to the management, conservation, and sustainable use of fisheries and wildlife resources. Our goal is to use innovative teaching, research, and outreach to respond to societal needs for information and education pertaining to natural resources.