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

Project Title: **ENRTF ID: 023-A**

Malaria in Migrant and Resident Birds of Minnesota

Category: A. Foundational Natural Resource Data and Information

Sub-Category:

Total Project Budget: $ 417,544

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

Summary:

New, harmful strains of avian malaria are spreading. Currently, there are no data on the occurrence of malaria in Minnesotan birds. This project will provide the first such data.

Name: Keith Barker

Sponsoring Organization: U of MN

Title: Associate Professor

Department: College of Biological Sciences

Address: 1479 Gortner Avenue

St. Paul MN 55108

Telephone Number: (612) 624-2737

Email barke042@umn.edu

Web Address

Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Migratory birds can transmit malaria between tropical and temperate bird populations, but we dont know how much this happens, or even what levels of infection in Minnesota birds might be.

_____ 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

We propose to make the first baseline assessment of the prevalence of avian malaria in Minnesota's wild birds.

- Migrant birds (such as blackbirds, warblers, robins, sparrows) move from subtropical and tropical regions to Minnesota in the spring, and are important agents in the dispersal of other organisms, including parasites and pathogens.
- Newly introduced strains of avian malaria have caused rapid declines in resident birds elsewhere and novel avian malaria strains could have a similar effect on native birds in Minnesota.
- It is unclear if migratory birds spread parasites, diseases, and other microbes to resident bird species (such as woodpeckers, chickadees, crows and jays).

Our **GOALS** are to:

1) Provide a baseline assessment of the prevalence of malaria parasites in migratory and resident birds in Minnesota.
2) Assess the potential roles of migratory birds to act as intermediaries in avian malaria transmission.
3) Determine if the prevalence of strains of malaria differ among migratory and resident birds.

Background:

Avian malaria is common in wild birds, with individual strains having a wide range of effects on survival and reproduction. However, introduction of novel malaria strains can have substantial impacts on wild bird populations, especially in resident birds with no prior exposure, as has been seen in the endangered birds of Hawaii. New, highly pathogenic strains appear to be spreading globally with possible impacts for naïve populations such as those found in Minnesota. Our understanding of how malaria is transported during migration in the western hemiphere, and to what extent malaria strains are transmitted between migrant and resident wild bird populations, is poor. To begin to address this knowledge gap, we will initiate surveillance for avian malaria in the wild birds of Minnesota. By having a baseline of malaria prevalence and strain composition, we can better detect novel and potentially destructive strains invading Minnesota and potentially prevent or lessen their impacts to wildlife. Additionally, by understanding transmission from migrant to resident species pools, we can better understand how diseases are likely to spread or persist, and determine ways to control or lessen the impact of new disease strains.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: *Sampling migrant and resident birds for avian malaria.* The objective of this activity is to gather samples of blood to assess the prevalence of avian malaria in migrant and resident birds. Because different species migrate to different ecosystems (i.e., deciduous forest, boreal forest, and grassland) in Minnesota, sampling will take place in each along a transect, with a total sample of 1,500 migratory and 1,500 resident birds. We have selected six WMAs along the transect to sample: Kunkel, Gendoro, Sand Prairie, Daniel Shay, Vision and Sedan, although we will adjust sampling in response to constraints and opportunities that arise. Cost per sample is roughly $33.

ENRTF BUDGET: $100,489

Outcome	Completion Date
1. Capture and sample ≥3000 breeding resident and migrant birds (May-July)	*August 2021*

Activity 2: *Genotyping and prevalence analysis.* The objective of this activity is to genotype samples for malarial strains. Sequencing two genetic markers will identify malarial infections, at a cost of $48.31 per bird, including

materials ($35.56 per bird) and labor ($12.75 per bird). Sequencing will provide the data necessary to understand species- and ecosystem-level prevalence as well as detecting transmission among migrant and resident populations.

ENRTF BUDGET: $ 144,930

Outcome	Completion Date
1. Perform PCR and sequencing for avian malaria strains	*November 2021*

Activity 3: *Prevalence analysis and publication.* Analysis of these data will provide a species- and ecosystem-level picture of the malaria prevalence, as well as revealing potential transmission between migratory and resident populations. We anticipate two peer-reviewed publications from this work, one for the species- and ecosystem level disease prevalence, and one outlining potential transmission. In addition, these data will be shared with Minnesota Department of Natural Resources, and a report detailing recommendations for how to approach and manage new disease transmissions will be provided.

ENRTF BUDGET: $172,125

Outcome	Completion Date
1. Analysis of data	*January 2022*
2. Writing results, submission of papers to peer-reviewed journals, report detailing recommendations to MN DNR	*June 2022*

III. PROJECT PARTNERS:

A. Partners receiving ENRTF funding

N/A

B. Partners NOT receiving ENRTF funding

N/A

IV. LONG-TERM- IMPLEMENTATION AND FUNDING:

This project will provide a valuable baseline survey of malarial prevalence in wild birds, and provide information on how the diseases may be moving among migrant and resident populations. Results will be shared in the form of peer-reviewed publications, as well as direct reports target to appropriate institutions such as the University of Minnesota Veterinary School and the Minnesota Department of Natural Resources. Continuation of this research will be funded by future applications to the NIH, NSF, and other agencies.

V. TIME LINE REQUIREMENTS:

This project is time sensitive for the collection during the spring (approximately April 1- June 30). If funded, this project is planned for three years and will commence July 2019.

VI. SEE ADDITIONAL PROPOSAL COMPONENTS:

A. Proposal Budget Spreadsheet

B. Visual Component or Map

2019 Proposal Budget Spreadsheet

Project Title: Malaria survey in migrant and resident birds

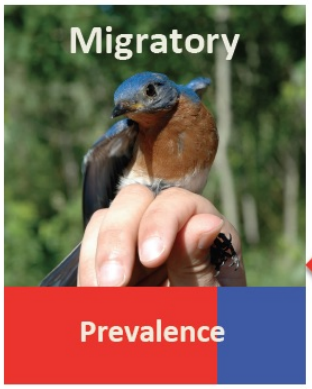
IV. TOTAL ENRTF REQUEST BUDGET *3* **years**

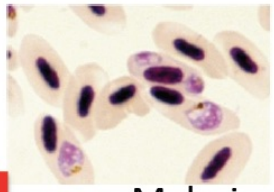
BUDGET ITEM	AMOUNT
Personnel: Postdoctoral researcher (79% salary, 21% benefits). 100% FTE for three years. Duties: runs day to day operations of the project, supervises the field teams (both years), head one of the field crews (first year) aids in molecular biology work, conducts analysis, writes reports. Budget includes 27.2% fringe.	$ 229,500
Three undergraduate field assistants (100% salary, 0% benefits). 27% FTE at $11 per hour. Duties: work on field crews for first migration season.	$ 77,220
Professional/Technical/Service Contracts:	$ -
Equipment/Tools/Supplies: such as: Mist nets and traps for bird capture ($2,400), and needles, swabs, hemocrit tubes, gloves and sample vials ($600)	$ 3,000
Equipment/Tools/Supplies: PCR and sequencing for two avian malarial loci, for 3000 specimens, at $17.78 per sample.	$ 106,680
Acquisition (Fee Title or Permanent Easements):	$ -
Travel: 2,100 miles of travel, at Univeristy of Minnesota reimbursement rate ($0.545 per mile)	$ 1,144
Additional Budget Items:	$ -
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 417,544

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

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ To Be Applied To Project During Project Period:	$ -	
Other State $ To Be Applied To Project During Project Period:	$ -	
In-kind Services To Be Applied To Project During Project Period: Indirect costs associated with this project ($417,544 x 54% MTDC)	$ 225,473	*secured*
Past and Current ENRTF Appropriation:	$ -	
Other Funding History:	$ -	

Malaria in Migrant and Resident Birds of Minnesota

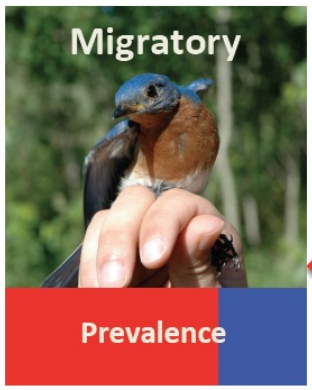


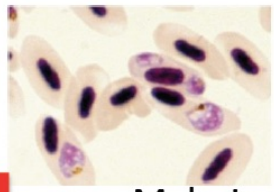


Malaria

Migration

Migration





Malaria

Project Manager Qualifications and Organization Description

F. Keith Barker

Address: Department of Ecology, Evolution and Behavior, 100 Ecology Building, 1987 Upper Buford Circle, St. Paul, Minnesota, 55108, Fax 612-624-6777, Tel 612-624-2737, E-mail barke042@umn.edu

Professional preparation:
Reed College, Portland, Oregon B.A. in Biology, 1993
University of Chicago, Ph.D. in Evolutionary Biology 1999

Professional appointments:
Bell Museum of Natural History, University of Minnesota, Minneapolis, Minnesota
Curator of Genetic Resources (2008-present)
Department of Ecology, Evolution and Behavior, University of Minnesota, St. Paul, Minnesota
Associate Professor (2008-present)
American Museum of Natural History, New York, NY
Research Associate in Ornithology (2003-present)

Qualifications:
The project manager currently manages the genetic resources collections (including an extensive blood sample collection), is interim curator of the bird collection and curator of genetic resources, and is in charge of database management for the scientific collections of the Bell Museum. His research focus is on genetic analysis of birds, using methods identical to most of those proposed for the current project. During his career he has published over 46 peer-reviewed scientific articles; in addition, he has received and managed multiple grants with budgets up to $340,000.

Organization description:
The Bell Museum of Natural History was established by state legislative mandate in 1872 to collect, preserve, skillfully prepare, display, and interpret our state's diverse animal and plant life for scholarly research and teaching and for public appreciation, enrichment, and enjoyment. Its governance belongs, by state legislative designation, to the University of Minnesota.

The exceptional scientific collections of the Bell Museum continue to grow as state agencies deposit biological specimens annually. Nearly 4 million specimens of mammals, birds, fishes, plants, mollusks, insects and fungi provide opportunities for research and learning. The Museum houses the world’s largest collection of Minnesota biodiversity. Academic curators are internationally known researchers with expert knowledge spanning the tree of life. The unique synergy of research, teaching, and public engagement, possible only on the campus of a great university, distinguishes the Bell Museum as a cradle of innovation in environmental science.