

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

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**Project Title:**

**ENRTF ID: 005-A**

Mercury and PFAS Risk to Minnesota Raptors

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

**Sub-Category:**

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**Total Project Budget: \$** 282,093

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

**Summary:**

We will quantify exposure to two contaminants for 12 Minnesota raptors. Polyfluoralkyl substances (PFAS) and methylmercury (Hg) are bioaccumulative toxicants that cause reproductive failure in birds.

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**Name:** Matthew Etterson

**Sponsoring Organization:** Hawk Ridge Bird Observatory

**Title:** Research Ecologist

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**Location**

**Region:** Statewide, Northeast

**County Name:** Statewide

**City / Township:** Duluth, Mpls/St. Paul

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**Alternate Text for Visual:**

Visual shows background rates of mercury exposure to raptors trapped at Hawk Ridge Bird Observatory, Duluth MN. Selected species are highlighted to show expected differences in exposure.

<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: Mercury and PFAS risk to Minnesota raptors**

**I. PROJECT STATEMENT**

We will quantify exposure to two environmental contaminants for 12 species of Minnesota raptors. Mercury and polyfluoralkyl substances (PFAS) threaten the health of raptor species in Minnesota and worldwide.

- Both PFAS and Hg are **neurotoxins** and are known to cause **reproductive failure** in birds.
- In Minnesota, PFAS has received considerable recent attention due to water contamination near the Twin Cities, raising **human health concerns**.
- Raptors are at **elevated risk** due to their position atop the food chain

With the knowledge gained through this work, we will be able to compare exposure in Minnesota raptors to tissue concentrations known to cause adverse effects in other bird species.

PFAS is one of a class of Persistent Bioaccumulative Toxins (PBTs) used in industrial processes and fire suppression. It is globally distributed through atmospheric transport. Mercury enters the environment from point-source releases due to industrial processes and through combustion of coal for power generation. Both Hg and PFAS are present locally at highly contaminated sites and ubiquitously due to atmospheric deposition. Raptors, due to their predatory nature, are at unique and elevated risk of exposure to PBTs, which, by definition, concentrate in animal tissues; with each link in their food chain, predators consume and concentrate the toxicants contained in their prey.

Preliminary studies of Hg in raptors at Hawk Ridge Bird observatory (HRBO; T. Keyel. 2016, MS Thesis, Univ. MN Duluth) showed increased exposure to Hg among Minnesota raptors known to eat birds. With this research we will expand our Hg studies to other species and perform similar research on PFAS. Our species list will consist of:

- Bald Eagle (*Haliaeetus leucocephalus*)
- Sharp-shinned Hawk (*Accipiter striatus*)
- Cooper's Hawk (*Accipiter cooperi*)
- Northern Goshawk (*Accipiter gentilis*)
- Red-tailed Hawk (*Buteo jamaicensis*)
- Northern Harrier (*Circus hudsonicus*)
- Great Horned Owl (*Bubo virginianus*)
- Long-eared Owl (*Asio otus*)
- Northern Saw-whet Owl (*Agolius acadicus*)
- American Kestrel (*Falco sparverius*)
- Merlin (*Falco columbarius*)
- Peregrine Falcon (*Falco peregrinus*)

The work described in our proposal will help answer the following questions:

1. Are Minnesota's raptors exposed to PFAS and Hg?
2. How does exposure vary among species?
3. Do patterns of exposure differ among Minnesota's resident raptors and those that migrate through the state from elsewhere?
4. Are feathers (which are easier to collect) a reliable measure of blood concentrations of Hg and PFAS in raptors?

The effect of exposure to multiple environmental contaminants is an important and difficult topic in environmental toxicology. Individuals receiving safe exposures (i.e., below levels that cause adverse effects) to specific chemicals may nevertheless experience cumulative exposure to multiple chemicals that, in total, cause adverse effects. For example, previous work at The Raptor Center, has shown that almost all (90%) treated Bald Eagles have elevated lead, and our previous work at Hawk Ridge shows widespread exposure to mercury. The work we propose here will elucidate patterns of simultaneous exposure to both PFAS and Hg and give a more holistic picture of the risks faced by Minnesota's raptors exposed to multiple bioaccumulative contaminants.



**II. PROJECT ACTIVITIES AND OUTCOMES**

**Activity 1: Quantify exposure and health risk to raptors at Hawk Ridge Bird Observatory**

We will trap raptors at HRBO in Duluth MN in autumn 2019 and 2020. Our goal will be to trap and collect blood and feathers for up to 20 individuals each of the 12 species listed above. Tissue samples (both blood and feathers) will be analyzed at the University of Minnesota, or by contract laboratory selected through competitive bidding process.

**ENRTF BUDGET: \$181,093**

Outcome	Completion Date
1. Trap and sample up to 20 individuals each of 12 raptor species.	1 December 2019
2. Analyze 2019 samples for PFAS and Hg	1 January 2020
3. Repeat outcomes 1 & 2 in autumn/winter 2020/21 to augment samples from 2019/20	1 January 2021

**Activity 2: Quantify exposure and health risk to raptors treated at The Raptor Center**

With our Raptor Center partners we will sample blood and feathers from injured raptors treated at the Raptor Center. Blood and feather tissue samples for up to 20 individuals of each of the 12 raptor species listed above will be collected and analyzed as described under Activity 1.

**ENRTF BUDGET: \$102,000.00**

Outcome	Completion Date
1. Obtain up to 20/species of raptors treated at the Raptor Center, St. Paul, MN	31 December 2019
2. Submit 2019 samples for PFAS, Hg, eDNA, and isotope analysis	31 January 2020
3. Repeat outcomes 1 & 2 in autumn/winter 2020/21	31 January 2021

**III. PROJECT PARTNERS:**

**A. Partners receiving ENRTF funding**

Name	Title	Affiliation	Role
Dr. Julia Ponder	Executive Director	The Raptor Center, University of MN	Sampling injured raptors

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

This proposal is a part of a larger effort to understand the influence of persistent bioaccumulative toxic chemicals on Minnesota’s birds of prey. Results of this work will allow us to evaluate whether and which of Minnesota’s raptor species are exposed to these dangerous contaminants. Exposure concentrations will be compared to concentrations known to cause effects in other birds to determine whether remediation is needed to protect our iconic birds of prey

**V. TIME LINE REQUIREMENTS:**

Tissue sample collection at HRBO will take place during the autumn migration season of 2019 and 2020. At the Raptor Center, tissue collection will take place continuously and until target sample sizes or 2 years are reached, whichever comes first. Sample analysis will take place in batches beginning immediately after the 2019 autumn season to allow us to modify sampling protocols based on initial results. Data analysis and reporting will take place from Spring 2021 through Spring 2022.

## 2019 Detailed Project Budget

**Project Title:**Mercury and PFAS risk to Minnesota raptors

### IV. TOTAL ENRTF REQUEST BUDGET 3 years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
Hawk Ridge Bird Observatory, Banding Assistant, 15 August - 1 November for 2 years	\$ 20,000
Analyst/Research Assistantship for UMD/IBS graduate student analyst (3rd year of project)	\$ 55,000
<b>Professional/Technical/Service Contracts:</b>	\$ 198,000
10% time for Raptor Center technician	\$ 5,000
PFAS analysis: 480 samples @ \$350/sample (estimated)	
Hg analysis: 480 samples @ \$50/sample (estimated)	
<b>Equipment/Tools/Supplies:</b>	
Envelopes for feathers & supplies (vials & needles & syringes) for blood sampling for Raptor Ctr	\$ 1,000
10 nylon 127mm mesh mist nets, 12m length @ \$109.25 ea	\$ 1,093
<b>Travel:</b>	\$ -
<b>Additional Budget Items:</b>	
Tissue shipping expenses (incl. dry ice preservation during shipping)	\$ 2,000
<b>TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST</b>	<b>\$ 282,093</b>

### 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>
<b>Other Non-State \$ To Be Applied To Project During Project Period:</b>	N/A	
<b>Other State \$ To Be Applied To Project During Project Period:</b>	N/A	
<b>In-kind Services To Be Applied To Project During Project Period:</b>		
Executive Director, Hawk Ridge Bird Observatory, 20% FTE for 3 years	\$7,600	<i>secured</i>
Banding Director, Hawk Ridge Bird Observatory, 20% FTE for 3 years	\$2,000	<i>secured</i>

# Visual Component

## Mercury and PFAS risk to Minnesota raptors

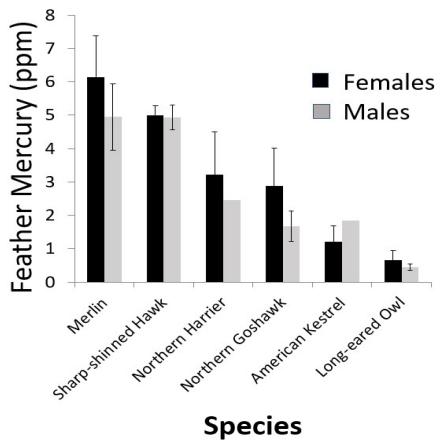


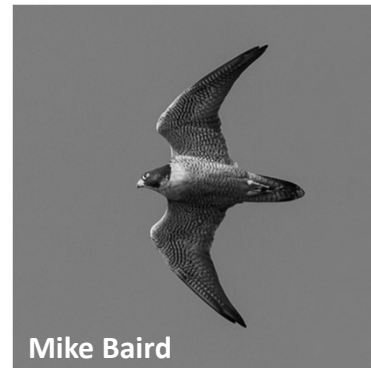
Figure 1. Preliminary data on methylmercury (Hg) exposure to adult raptors banded at Hawk Ridge Bird Observatory (2011 – 2014).



**Merlin**, a bird specialist, had the **highest** levels of **mercury** among all raptors surveyed at Hawk ridge



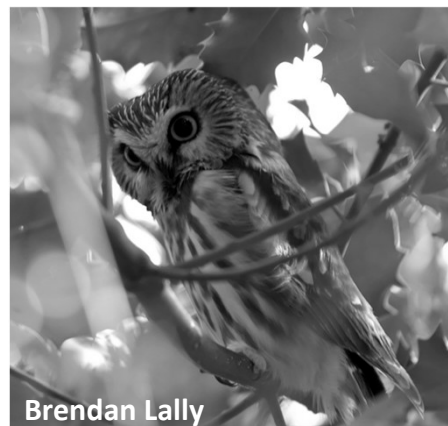
**90% of Bald Eagles** treated at the University of Minnesota Raptor Center have elevated lead.



**Peregrine Falcons** are still recovering from **catastrophic declines** from bioaccumulative organochlorines



**Sharp-shinned Hawk**, a bird specialist, had the second highest mercury levels of birds tested at Hawk Ridge



**Northern Saw-whet Owl**, a mammal specialist, is expected to have relatively low levels of exposure to bioaccumulative contaminants

## Project Manager Qualifications and Organization Description

Project Title: Mercury and PFAS risk to Minnesota raptors

### **Project manager qualifications**

Dr. Matthew Etterson is the chair of the Research Committee at Hawk Ridge Bird Observatory, Duluth, MN, USA. He holds a Ph.D. from the University of Minnesota (2000, Conservation Biology) and a BA from Yale University (1987, Mathematics and Philosophy). Dr. Etterson has over 45 publications in avian ecology, on diverse topics such as ecotoxicology, reproductive ecology, and sampling methodology. Dr. Etterson is an Adjunct Assistant Professor in the Biology Department and Integrated Biological Sciences Program at the University of Minnesota Duluth. Dr. Etterson is also employed as a full time Research Ecologist at the United States Environmental Protection Agency, Duluth, MN (not a party to this grant), where he works on ecological risk assessment of contaminants.

The HRBO Executive Director, Janelle Long, oversees the full organization operations and administrative duties. Janelle has been the E.D. for ten years and holds a B.S. in Wildlife Management and Biology from UW-Stevens Point and M.Ed. in Environmental Education from UM-Duluth.

### **Hawk Ridge Bird Observatory**

#### **Mission**

The mission of the Hawk Ridge Bird Observatory is to protect birds of prey and other migratory birds in the Western Lake Superior Region through research, education, and stewardship.

#### **History**

Before 1950, the only people who witnessed the raptor migration were local gunners who used the birds for target practice. The killing stopped through efforts of the Duluth Bird Club (now the Duluth Audubon Society). The club publicized the illegal shooting and had the prohibition against shooting within the city limits enforced.

The first hawk watch was organized in 1951. As the magnitude of the migration became apparent, observation increased from a few days in mid-September to daily counts from August through November. In 1972, the Duluth Audubon Society, with a loan from the Minnesota Chapter of The Nature Conservancy, donated funds to the City of Duluth to purchase the highest part of the Ridge. The city acquired approximately 250 adjacent acres in 1973 to serve as a buffer for the Nature Reserve. Under a trust agreement with the City, the Hawk Ridge Bird Observatory manages the 365 acres as a nature reserve, open to the public for study and enjoyment.

The first systematic count from the main overlook began in 1972, also the year the banding research station opened. A naturalist program began in 1974. Friends of Hawk Ridge was established in 1979 to support the programs and research conducted on the Ridge. In 2004, Hawk Ridge Bird Observatory was incorporated as a 501 (c) 3 non-profit organization and as the management entity for Hawk Ridge Nature Reserve.

Hawk Ridge is now known as one of the major sites for observation of raptor migration. Visitors come from all over the world in the fall. Indeed, our guest register has entries from thousands of visitors who have come from all 50 states and from over 40 foreign countries.