



Environment and Natural Resources Trust Fund (ENRTF) M.L. 2019 ENRTF Work Plan (Main Document)

Today's Date: 25 August 2018

Date of Next Status Update Report: 15 January 2020

Date of Work Plan Approval:

Project Completion Date: 30 June 2022

Does this submission include an amendment request? No

PROJECT TITLE: Mercury and PFAS risk to Minnesota raptors

Project Manager: Matthew Etterson

Organization: Hawk Ridge Bird Observatory

College/Department/Division:

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City/State/Zip Code: Duluth, MN 55803

Telephone Number: 218.590.7029

Email Address: metterso@d.umn.edu

Web Address: <https://www.hawkridge.org/>

Location: NE MN, Statewide

Total Project Budget: \$250,000.00

Amount Spent: \$0

Balance: \$250,000.00

Legal Citation: M.L. 2019, Chp. xx, Sec. xx, Subd. xx

Appropriation Language:



Environment and Natural Resources Trust Fund (ENRTF)

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I. PROJECT STATEMENT:

We will quantify exposure to two environmental contaminants for 7 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:

- **Sharp-shinned Hawk (*Accipiter striatus*)**
- **Cooper’s Hawk (*Accipiter cooperi*)**
- **Red-tailed Hawk (*Buteo jamaicensis*)**
- **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. OVERALL PROJECT STATUS UPDATES:

First Update January 15, 2020



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Second Update June 15, 2021

Third Update January 15, 2021

Fourth Update June 15, 2022

Fifth Update January 15, 2022

Final Report between project end (June 30) and August 15, 2022

III. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1 Title:

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 seven species listed above. PFAS samples will be analyzed at SGS Axys (www.axysanalytical.com/) and Hg samples will be analyzed by Biodiversity Research Institute (www.briloon.org).

For adult birds, blood samples will be taken for PFAS and Hg analysis and feathers will be sampled for Hg. Duplicate feather samples will be used to evaluate consistency among feathers in Hg residues. Blood samples will be used to evaluate the relationship between blood Hg and feather Hg. For PFAS analysis, only blood samples will be taken from adults.

For 1st year birds, both blood and feather samples will be taken to evaluate the relationship between blood PFAS and feather PFAS. Similar procedures will be followed for Hg. Paired Hg and PFAS samples will allow us to evaluate the relationship between feather residues and blood concentration for juvenile birds (for whom we are certain that all feathers were grown during the previous breeding season).

When body size does not permit sufficient amount of blood to be taken from a single individual (a possible constraint for American Kestrel and Saw-whet Owl), samples will be pooled across individuals for composite analysis. This might also require us to sample different individual birds for Hg versus PFAS for these two smaller species, again to avoid taking too much blood from a single individual.

ENRTF BUDGET: \$161,546.50

Outcome	Completion Date
<i>1. Trap and sample up to 20 individuals each of 7 raptor species.</i>	<i>1 December 2019</i>
<i>2. Analyze 2019 samples for PFAS and Hg</i>	<i>1 February 2020</i>
<i>3. Repeat outcomes 1 & 2 in autumn/winter 2020/21 to augment samples from 2019/20</i>	<i>1 January 2021</i>
<i>4. Prepare publication for submission to peer-reviewed scientific journal</i>	<i>1 June 2022</i>

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 7 raptor species listed above will be collected and analyzed as described under Activity 1.



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For adult birds, blood samples will be taken for PFAS and Hg analysis and feathers will be sampled for Hg. Duplicate feather samples will be used to evaluate consistency among feathers in Hg residues. Blood samples will be used to evaluate the relationship between blood Hg and feather Hg. For PFAS analysis, only blood samples will be taken from adults.

For 1st year birds, both blood and feather samples will be taken to evaluate the relationship between blood PFAS and feather PFAS. Similar procedures will be followed for Hg. Paired Hg and PFAS samples will allow us to evaluate the relationship between feather residues and blood concentration for juvenile birds (for whom we are certain that all feathers were grown during the previous breeding season).

ENRTF BUDGET: \$88,453.50

Outcome	Completion Date
<i>1. Obtain up to 20/species of raptors treated at the Raptor Center, St. Paul, MN</i>	<i>31 December 2019</i>
<i>2. Submit 2019 samples for PFAS and Hg analysis</i>	<i>31 January 2020</i>
<i>3. Repeat outcomes 1 & 2 in autumn/winter 2020/21</i>	<i>31 January 2021</i>
<i>4. Prepare publication for submission to peer-reviewed scientific journal</i>	<i>1 June 2022</i>

First Update January 15, 2020

Second Update June 15, 2021

Third Update January 15, 2021

Fourth Update June 15, 2022

Fifth Update January 15, 2022

Final Report between project end (June 30) and August 15, 2022

IV. DISSEMINATION:

Description:

Scientific publications: We expect that this project will produce at least 1 peer reviewed journal article focusing on avian tissue residues for PFAS and Hg

Presentations: Results will be disseminated through local, regional, and national conferences.

Publicly available data will be hosted on the Hawk Ridge Bird Observatory website. Descriptions of main findings will be posted to the HRBO website and disseminated electronically through HRBO electronic newsletters to members.

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 January 15, 2020

Second Update June 15, 2021



**Environment and Natural Resources Trust Fund (ENRTF)
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Third Update January 15, 2021

Fourth Update June 15, 2022

Fifth Update January 15, 2022

Final Report between project end (June 30) and August 15, 2022

V. ADDITIONAL BUDGET INFORMATION:

A. Personnel and Capital Expenditures

Explanation of Capital Expenditures Greater Than \$5,000:

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: 2,800	Divide total personnel hours by 2,080 hours in 1 yr = = TOTAL FTE:1.35
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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: 0	Divide total contract hours by 2,080 hours in 1 yr = TOTAL FTE: 0
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VI. PROJECT PARTNERS:

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

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

B. Partners outside of project manager’s organization NOT receiving ENRTF funding

Name	Title	Affiliation	Role
Dr. David Evers	Chief Scientist, Executive Director	Biodiversity Research Institute	Hg analysis

VII. 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.



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VIII. REPORTING REQUIREMENTS:

- The project duration is 3 years and will begin on July 1, 2019 and end on June 30, 2022.
- Periodic project status update reports will be submitted January 1 and June 1 of each year.
- A final report and associated products will be submitted between June 30 and August 15, 2022.

IX. SEE ADDITIONAL WORK PLAN COMPONENTS:

- A. Budget Spreadsheet
- B. Visual Component or Map
- C. Parcel List Spreadsheet
- D. Acquisition, Easements, and Restoration Requirements
- E. Research Addendum

Attachment A:
 Environment and Natural Resources Trust Fund
 M.L. 2019 Budget Spreadsheet



Legal Citation:
 Project Manager: Matthew Etterson
 Project Title: Mercury and PFAS risk to Minnesota raptors
 Organization: Hawk Ridge Bird Observatory
 Project Budget: \$250,000.00
 Project Length and Completion Date: 3 Years, 30 June 2022
 Today's Date: 3 June 2019

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET		Budget	Amount Spent	Balance
BUDGET ITEM				
Personnel (Wages and Benefits)		\$ 79,128	\$ -	\$ 79,128
Banding assistant \$5,564 (88% Salary, 12% Benefits) 21% FTE (11/52 weeks) x 2 years	\$11,128			
Raptor center technician \$2,500 (78% Salary, 22% Fringe) 10% FTE x 2 years	\$5,000			
Analyst/Research Assistantship - Graduate Student, University of Minnesota Duluth \$40,000 (83% Salary, 17% Fringe) x 1.5 years (assume 5% inflation) (incl. summer stipend)	\$63,000			
Professional/Technical/Service Contracts				
		\$ 164,779	\$ -	\$ 164,779
Equipment/Tools/Supplies				
Envelopes for feathers & supplies (vials & needles & syringes) for blood sampling for Raptor Ctr	\$1,000			
Envelopes for feathers & supplies (vials & needles & syringes) for blood sampling for Hawk Ridge	\$1,000			
10 nylon 127mm mesh mist nets, 12m length @ \$109.25 ea	\$1,093			
Tissue shipping expenses (incl. dry ice preservation during shipping)	\$2,000			
Portable centrifuge for blood serum extraction	\$1,000			
		\$ 6,093	\$ -	\$ 6,093
Capital Expenditures Over \$5,000				
		\$ -	\$ -	\$ -
Fee Title Acquisition				
		\$ -	\$ -	\$ -
Easement Acquisition				
		\$ -	\$ -	\$ -
Professional Services for Acquisition				
		\$ -	\$ -	\$ -
Printing				
		\$ -	\$ -	\$ -
Travel expenses in Minnesota				
		\$ -	\$ -	\$ -
Other				
		\$ -	\$ -	\$ -
COLUMN TOTAL		\$ 250,000	\$ -	\$ 250,000

OTHER FUNDS CONTRIBUTED TO THE PROJECT	Status (secured or pending)	Budget	Spent	Balance
Non-State:		\$ -	\$ -	\$ -
State:		\$ -	\$ -	\$ -
In kind: Hg analysis provide by Biodiversity Research Institute	pending	\$ 26,400	\$ -	\$ 26,400

PAST AND CURRENT ENRTF APPROPRIATIONS	Amount legally obligated but not yet spent	Budget	Spent	Balance
Current appropriation:		\$ -	\$ -	\$ -
Past appropriations:		\$ -	\$ -	\$ -

Visual Component

Mercury and PFAS risk to Minnesota raptors

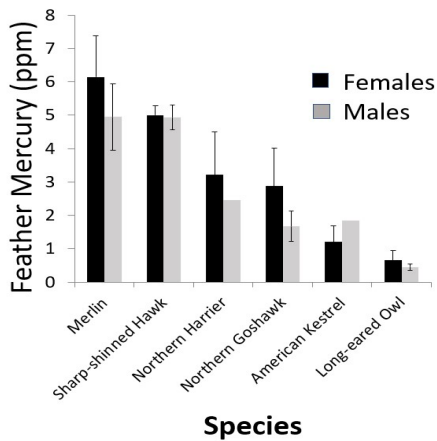


Figure 1. Preliminary data on methylmercury (Hg) exposure to adult raptors banded at Hawk Ridge Bird Observatory (2011 – 2014).



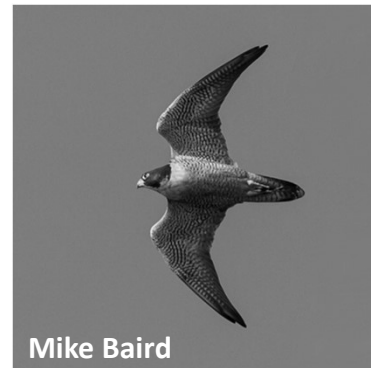
Merlin, a bird specialist, had the **highest** levels of **mercury** among all raptors surveyed at Hawk ridge



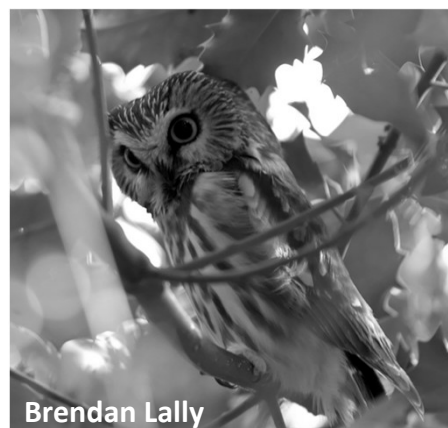
90% of Bald Eagles treated at the University of Minnesota Raptor Center have elevated lead.



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



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



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