



Comparing Mercury Levels of Red-Shouldered Hawks (*Buteo lineatus*) to Body Condition in Central Wisconsin

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Introduction

Red-shouldered hawks (*Buteo lineatus*) are medium sized raptors found throughout the eastern and central United States, California, and the eastern coasts of Mexico. Red-shouldered hawks primarily prey on small mammals, reptiles, and amphibians; however, they have been shown to prey on fish or occasionally small birds (Jacobs and Jacobs, 2002). Red-shouldered hawks nest in mature deciduous trees, mainly in heavily forested rural areas but have recently begun to occupy suburban areas; breeding pairs will nest in close proximity to water sources due to their reliance on amphibians as a food source (Dysktra et al, 2012; Stewart, 1949).

In Wisconsin, red-shouldered hawks are listed as a state-threatened species (Wisconsin DNR 2012). This status is primarily due to habitat loss from timber harvesting, human development, and wetland draining (Bednarz and Dinsmore 1982, Jacobs and Jacobs 2002, McLeod et al. 2000). It is possible that population declines can also be attributed to environmental contaminants, like mercury (Hg). In aquatic systems mercury can be introduced directly through point and diffuse sources, or through atmospheric deposition (Klerk et al. 2013, Schroeder and Munthe 1998). Mercury can have negative effects on reproduction, neurochemistry, physiology, and behavior in birds as well as other mammals. Baseline mercury levels have been studied in large birds of prey that consume primarily fish (Carlson et al. 2012), but mercury levels of species that consume more semi-aquatic species such as red-shouldered hawks have not been studied in-depth (Bourbour et al. 2019).

Objective

(1) Compare mercury levels of individual red-shouldered hawks to their mass and fat score as an indication of body condition

Methods

In June 2020, adult red-shouldered hawks were captured at their nests using a mist net and a live great-horned owl (Hamerstrom 1963, Kochert et al. 2011, Airola et al. 2019). The hawks were banded, weighed, and their wing cord, wing flat, and tail length were measured. Blood and feather samples were collected to measure total mercury levels (THg)

Blood was drawn with a small gauge needle through the brachial vein; ≤500 microliters (μl) of blood were collected in heparinized capillary tubes (King et al. 2010), placed in labeled centrifuge tubes, and stored in a freezer on the University of Wisconsin-Stevens Point (UWSP). Whole feathers were collected from different feather tracts including breast, crown, flank and back; 3-5 feathers were sampled from each hawk. One secondary flight feather was also sampled on each adult hawk by clipping the distal most 1.5-2.0 cm of the feather (Barnes et al. 2018). Samples were sent to Biodiversity Research Institute (BRI) in Portland, Maine for analysis.

Average Hg concentrations were determined for each bird using THg (mg/kg) determined by BRI. A Principle Component Analysis (PCA) was done using program R to compare mercury concentrations to tail length and wing cord measurements. A linear regression was run comparing weight to tail length and wing cord; 98% of variation in body condition was explained by PC1. A second linear regression was run comparing Hg concentrations to weight. The residuals of the second linear regression indicate an inverse relationship between Hg concentration and body condition.

Results

In June 2020 we captured six male and four female adult red-shouldered hawks. Analysis of mercury concentrations compared to residual values for body condition showed a loose correlation between poorer body condition and higher mercury levels.

Sex	Age	Weight	Wing Cord (mm)	Tail (mm)	Hg Concentration	Residuals
F	ATY	620	341	216	2.77	-34.396198
M	ATY	550	319	201	2.66	-0.679561
F	ASY	752	336	206	1.48	137.347311
M	ATY	576	330	210	1.99	-30.218301
F	ASY	661	341	216	2.46	6.60380159
M	ASY	546	327	195	2.04	-14.28967
M	ATY	532	325	203	2.76	-41.835633
M	ATY	564	318	190	4.24	43.3516657
F	ATY	686	355	218	2.23	-15.884063
M	ATY	489	320	195	1.97	-49.999352

Table 1. Summary of data from ten adult red-shouldered hawks in Central Wisconsin, including sex, age, weight, wing and tail measurements, calculated Hg concentrations, and residuals determined using linear regressions in R studio.



Figure 3. Fledgling red-shouldered hawks.



Figure 4. Adult male red-shouldered hawk.

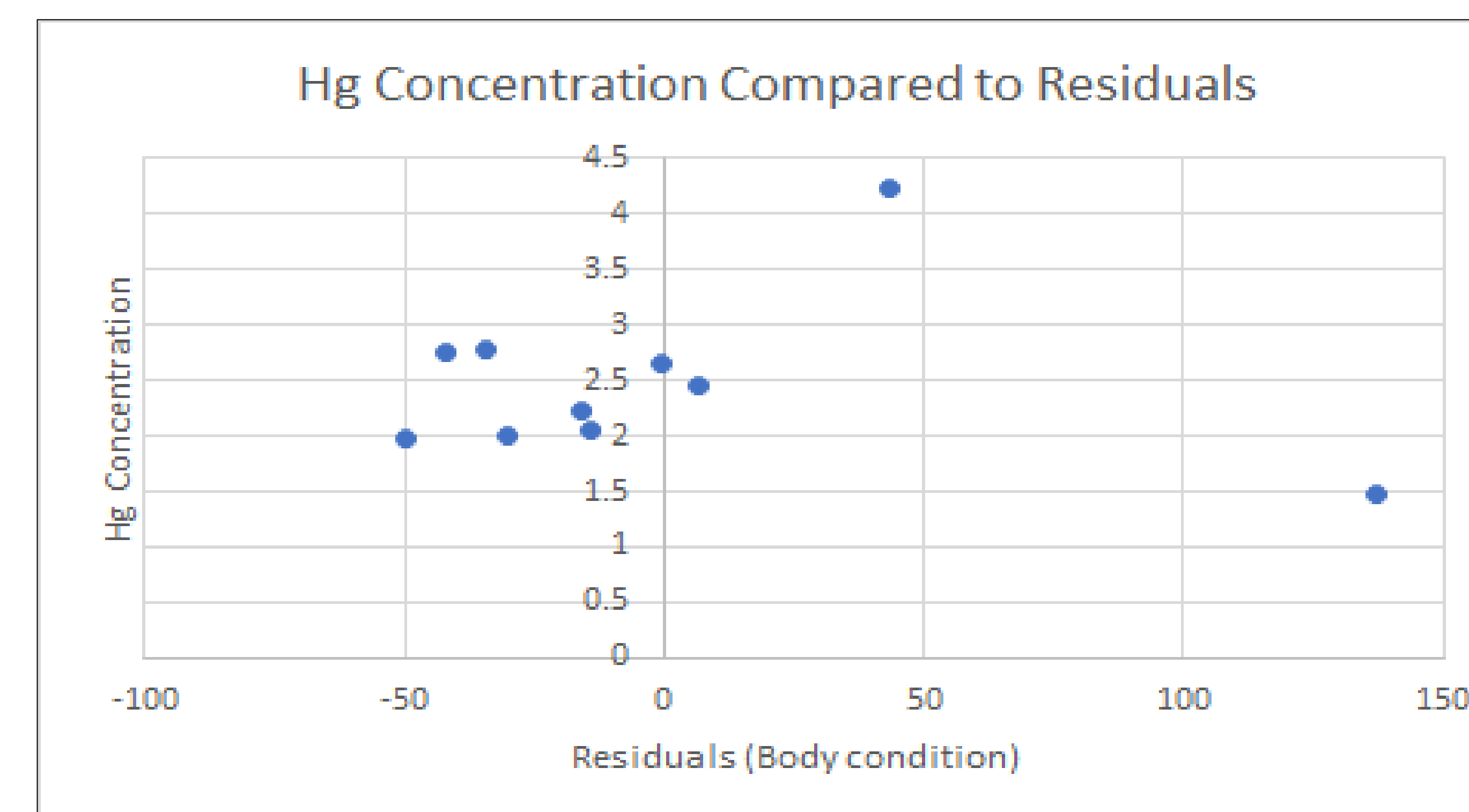


Figure 2. Scatter plot comparing residuals (indicating body condition) to Hg concentrations.

Discussion

This study and future studies could aid in indicating the effects of mercury contamination on red-shouldered hawks. This sample size was small, future studies should be done so a larger sample could yield more definitive results.

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