USGS Western Ecological Research Center

Research Spotlight

New Guidelines and Tool for Assessing Mercury Contamination Using Bird Feathers

In a study published in the journal Environmental Toxicology and Chemistry, U.S. Geological Survey (USGS) biologists provide a detailed approach and guidelines for using bird feathers in mercury monitoring programs. From these results, USGS biologists were able to create a tool to help guide the appropriate experimental design, processing and mercury determination for feather mercury studies.

Feathers are widely used to assess mercury contamination in birds because feathers can be non-lethally collected and are easy to sample. However, few recommendations exist that provide guidance on using feathers to monitor mercury in a standardized and rigorous way. Because feather mercury concentrations can vary considerably between species, between individuals, between feathers in an individual, and even between the parts of a single feather, comparing mercury measurements in a scientifically sound way requires taking variation into account and ensuring that enough data are collected to reduce the effect of variation.

Using data from 40 bird species, USGS researchers found that whole feather mercury concentrations within a bird were between 5% and 500% variable, with body feathers, such as breast or back feathers, demonstrating lower variability than wing feathers. Mercury concentrations varied within feathers themselves, with mercury concentrations highest in the feather vane and lowest in the calamus.

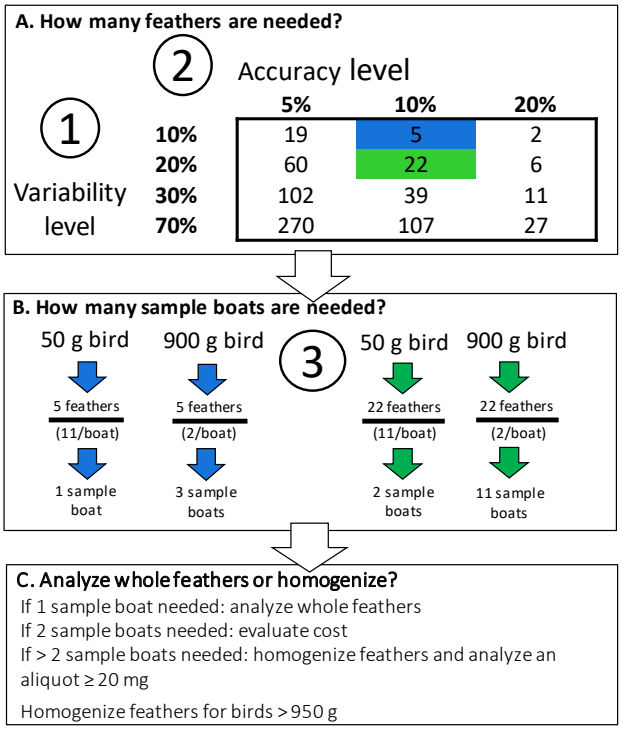
These observations underscore the importance of using similar methods to collect and process feathers for mercury determination, because methodological differences in feather processing may result in different mercury concentrations. The results indicate that increasing the number of feathers used in an assessment can limit the influence of variation.

WERC scientists have designed a tool based on their results that can help managers more accurately monitor mercury concentrations using bird feathers. The new tool is based on three components: 1) variability of feather mercury concentrations within an individual bird 2) desired accuracy of the measured mercury concentration, and 3) feather and bird size. Given these components, the tool provides the number of feathers and the laboratory processing methodology needed to reduce the effects of variability.

This study was supported by the U.S. Geological Survey Environmental Health Mission Area's Contaminant Biology Program.

This Spotlight Refers To:

Peterson, SP, JT Ackerman, M Toney, and MP Herzog. 2019. **Mercury concentrations vary within and among individual bird feathers: A critical evaluation and guidelines for feather use in mercury monitoring programs.** Environmental Toxicology and Chemistry, Critical Review Paper.
https://doi.org/10.1002/etc.4430



An illustration of a new tool to guide mercury assessment from bird feathers. First, estimated variability level (1) and desired accuracy level (2) are used to determine number of feathers (A). Then, number of feathers and bird size are used to calculate number of sample boats (B). Finally, number of sample boats is used to assess whether whole feathers or homogenized feathers should be used (C).

MANAGEMENT IMPLICATIONS

- Mercury contamination monitoring programs can access an excel-based tool for study design that allows researchers to manipulate several different inputs and generate specific guidance for assessing mercury in bird feathers.
- The new guidelines and tool can be used to standardize mercury assessments, broadly improving managers' ability to monitor environmental contamination.

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