# Craters of the Moon National Monument and Preserve (CRMO) 2023 Data Summary

The Dragonfly Mercury Project (DMP) is a national surveillance, monitoring, and research program that brings together citizen engagement and education with scientific efforts to understand mercury (Hg) risks to protected areas. 2023 was the third year that Craters of the Moon National Monument and Preserve participated in the DMP!

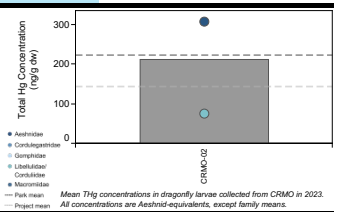



## Summary

*Unless noted, all Hg concentrations have been converted to their equivalent concentration in the family Aeshnidae (Eagles-Smith et al. 2020[1]).*

The geometric mean (± standard error) Hg concentration at CRMO in 2023 was 210.4 ± 33.5 ng/g dry weight (dw) compared to the overall (across all years of participation) park geometric mean Hg concentration of 222.5 ± 17.9 ng/g dw and the study-wide (2014–2023) geometric mean Hg concentration of 142.2 ± 0.7 ng/g dw.

Among the one site sampled from CRMO in 2023, geometric mean dragonfly Hg concentrations ranged from 210.4 to 210.4 ng/g dw.

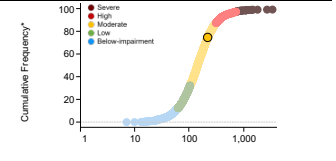



*Mean THg concentrations in dragonfly larvae collected from CRMO in 2023. All concentrations are Aeshnid-equivalents, except family means.*

## Integrated Impairment Index

The Integrated Impairment Index classifies Aeshnid-equivalent dragonfly total Hg (THg) concentrations into five categories based on the number of taxa estimated to exceed increasingly severe impairment benchmarks for fish, wildlife, and human health risk. Because the Integrated Impairment Index looks at potential risks to a variety of taxa it provides a more complete estimate of potential health risks than would be seen examining any single benchmark. See Eagles-Smith et al. 2020[1] for additional details.

- In 2023, the site sampled at CRMO was classified as 'moderate risk' for Hg impairment.
- Across all parks, 58% of sites sampled in 2023 were classified as 'moderate risk'.



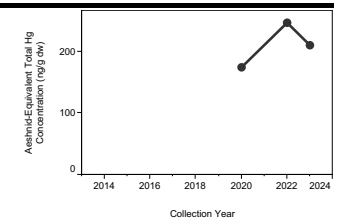

*Distribution of site mean Aeshnid-equivalent THg concentrations among the five Integrated Impairment Index categories. Sites sampled from CRMO in 2023 are highlighted. *The percent of sites across all parks that have lower Hg concentrations than each of the highlighted sites.*

## Temporal Variation in Dragonfly Hg

In 2023, the mean dragonfly THg concentration at CRMO was similar to the mean concentrations across all sites from 2020 and 2022.

*What are these data and what do they mean?*

- *We estimated annual mean dragonfly Hg concentrations using a model that accounted for site and year differences. A Tukey HSD test identified the differences among annual means.*
- *These estimates enable comparisons of Hg concentrations among years and provides insights into temporal variability despite variations in yearly site selection.*
- *These estimates also account for variation due to sampling site as individual site characteristics have an important influence on dragonfly Hg concentrations.*
- *Accounting for spatial and sample size variation results in increased estimate uncertainty and the need to cautiously interpret apparent trends.*

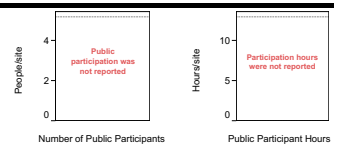



*Modeled annual mean THg concentrations in CRMO Aeshnid dragonfly larvae from 2014 to 2023.*

## Public Engagement

The DMP engages local communities and promotes scientific curiosity while harnessing the power of public science to study mercury pollution nationwide.[2]

In 2023, no public participation was reported for the dragonfly collections at CRMO. At the site sampled, 100% of dragonfly larvae from CRMO with field identifications were correctly identified to family.




*Average (bars) and total (numbers in bars) public participants (left) and public participant hours (right) contributing to dragonfly collection at CRMO in 2023. Dotted lines indicate average values across all parks that participated in 2023.*

## Summary Table

| Site | Site Code | Family | # of Samples | % Field ID Accuracy | Total Length Mean (mm) | Total Length Range (mm) | Total Hg Mean (ng/g dw) | Total Hg Range (ng/g dw) |
|---|---|---|---|---|---|---|---|---|
| Carey Lake WMA wetland | CRMO-02 | Aeshnidae | 10 | 100 | 32.6 | 24.4 - 38.2 | 308.0 | 226.7 - 386.6 |
| | | Libellulidae/ Corduliidae | 5 | 100 | 19.6 | 18.8 - 20.3 | 76.0 | 52.5 - 136.0 |