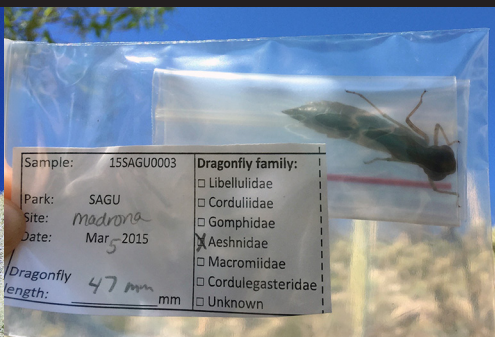


Dragonfly Mercury Project

What's Next?



Overview

The National Park Service (NPS) Air Resources Division (ARD) hosted a meeting with the University of Maine (UMaine) and U.S. Geological Survey (USGS) on March 3-5, 2015 in Tucson, Arizona to discuss next steps for the Dragonfly Mercury Project (DMP). The DMP is entering its 4th season of NPS-wide involvement and citizen scientist engagement. Over 40 national parks and 800 citizen scientists have participated, contributing more than 4,000 volunteer hours. In addition to connecting people to parks and supporting youth engagement, results from the DMP increase our understanding of airborne mercury (Hg) effects and the extent of Hg pollution, and shed light on Hg risk across the national parks. Funding for sampling expires in 2015 and Phase I results will be published in 2016. The Tucson Meeting presented preliminary Phase I findings and outlined a Phase II continuation strategy, including funding opportunities.

Phase I vs. Phase II

Phase I = (2011-2015)

Sampling of dragonfly larvae as of 2014 and through 2015, establishing protocols and initiating park engagement. Results provide the spatial and site data to elucidate the risk to park resources and answer some preliminary research questions.

Phase II = (2016-beyond)

Sampling of dragonfly larvae from 2016 forward, transitioning the DMP from “Project” to “Program,” whereby continuous monitoring using citizen scientists contributes to Hg research and enhanced educational opportunities.

Phase I: Early Findings

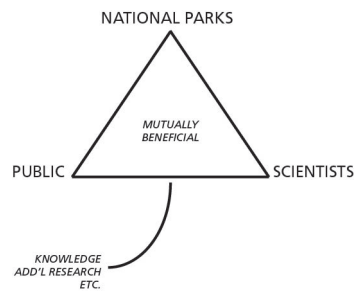
- Seasonal variation in dragonfly Hg concentrations at a site is small relative to differences among location, suggesting dragonfly can be collected at any time;
- Dragonfly Hg is well correlated to fish Hg where data are available. Thus dragonflies may be a surrogate for fish and promote greater comparability of Hg in aquatic food webs;
- Dragonfly Hg is extremely variable on a park-wide scale. Therefore data collected at one or more park sites cannot represent other sites;
- Variability in dragonfly Hg levels can be used to model ecoregion or park specific drivers;
- Dragonfly Hg is driven more by methylmercury production and bioaccumulation than by Hg deposition;
- Sites with significant drivers of Hg methylation (e.g., dissolved organic carbon) will respond more quickly and at larger magnitudes to Hg emissions reductions;
- Ecosystem characteristics can be used to predict what sites likely have elevated dragonfly Hg levels and where targeted Hg sampling could occur;
- Dragonfly Hg can be higher in rivers/streams than in lakes/ponds, and low elevations have higher dragonfly Hg than high elevation;
- Dragonfly Hg varies by family (due to different energetic needs). This can be dealt with statistically and is not a problem;
- Citizen scientists are proficient at identifying dragonfly to family (accuracy rate: 93%);
- In instances where several dragonfly larvae families are present, the study would benefit from an increased sample size of each family;
- Size of dragonflies influences dragonfly Hg levels less than site, and thus collection of dragonfly of various lengths is not a problem.

Phase I: Status

The 2015 DMP field season is underway. More than 55 NPS units plan to participate. The participating units are categorized into Tier I, II, and III parks. Tier I are new parks; selected according to their location and potential to fill current data gaps. These parks sample the full

suite of media (dragonfly, water, sediment). Tier II parks serve as replacement parks for Tier I parks. Tier III are returning parks and contribute by collecting only dragonfly larvae, mainly to foster relationships with citizen science groups. There are 17 Tier I, 5 Tier II, and 34 Tier III parks.

Phase II: Strategy



The DMP is a highly cost-effective study that leverages citizen participation to implement a national scale assessment of Hg bioaccumulation in bio-sentinel organisms. Under the current funding scheme, the cost is \$320,000 for 40 parks. The full cost of a study of this magnitude that relied solely upon USGS or UMaine technical staff to conduct all aspects of data collection would exceed \$1,000,000. Furthermore, the DMP highlights how the NPS manages air, water, and biological resources, and provides an avenue to convey this message to thousands of youth.

While current funds support data analysis and interpretation through 2016, funding to support the sampling component expires at the end of the 2015 field season. The Phase II strategy is to: (1) procure funds for the 2016 sampling year and beyond, (2) build the citizen science “Dragonfly Mercury Program,” (3) enhance educational goals, and (4) set the foundation for related Hg research. Possible funding sources include the National Geographic Society, Dept. of the Interior, National Parks Foundation, Centennial Challenge, National Fish and Wildlife Foundation, The Nature Fund, YES!, NOAA, Patagonia, and The North Face.

The total cost to operate the Phase II “Dragonfly Mercury Program” is estimated up to \$165,000 per

year. This cost includes a program coordinator’s salary, lab analysis, scientist oversight, and reporting. The cost also assumes in-kind support from NPS units and citizen scientists. The DMP envisioned under Phase II would be re-evaluated every 4 years to gauge effectiveness and value to the NPS and other stakeholders.

The DMP operates as a mutualistic relationship: It’s a win-win-win. Citizen scientists gain new perspectives and practice civic skills, while the scientists gain from additional data and a better understanding of the spatial distribution of Hg. Participation enables the NPS to foster teachable moments on air and water quality - enlightening a new generation about the connection of all living things and the influence humans have upon natural systems - and connects people to parks using parks as classrooms/labs. Phase II intends to build upon these relationships and contribute to related research on Hg in the national parks.

Phase II research ideas include future studies on: toxicological thresholds (to define Hg levels of concern and risk to food web), depuration (to quantify Hg loss through growth), Hg isotopes (to distinguish sources), influence of Mercury and Air Toxics Standards (MATS) on dragonfly Hg, SW ecosystems, and citizen science outcomes.

Centennial Connection

The DMP aligns well with NPS Centennial goals like connecting with and creating next generation stewards. Additionally, the DMP furthers the Find Your Park campaign because contributing

to science is a great way to #FindYourPark! The 2015 DMP aims to reach 1,000 citizen scientists, contributing over 5,000 volunteer hours. Youth comprise the majority of the DMP demographic.

Next Steps

Phase I products include: final report, peer-reviewed manuscripts (spatial analysis, citizen science, dragonfly-water chemistry relationship, isotopes, intensive parks, etc.), Final Issue Brief, webmapper to display data, webinar, and educational materials (e.g., videos, flash cards).

Phase II will kick-start with the launch of the “Find-DMP-Funding” campaign. This will occur in advance of the 2016 Centennial. Solicitations and a renewed vigor to establish partnerships will follow. A shift in the project/program research scope and direction may likely result.

For More Information

Project Webpage:
http://www.nature.nps.gov/air/studies/air_toxics/dragonfly/index.cfm

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