



Friends of ACADIA

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Volume 8 No.3

Journal

A Magazine of Acadia National Park and Surrounding Communities

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Michael Bank

MERCURY AND ACADIA STREAM SALAMANDERS

Mercury is a naturally occurring element in the environment. Sources include volcanoes, geothermal areas, soils, marine salt spray, and forest fires. Inputs to the atmosphere from these natural sources can be significant for localized areas; however, the U.S. Environmental Protection Agency reports that an estimated 60%-75% of all mercury emissions are from human sources, mainly from fossil fuel combustion (coal-fired plants) and solid waste incineration. In the United States these human sources emit an estimated 150 tons of mercury annually.

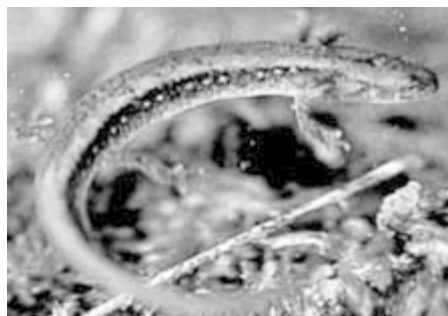
Mercury is emitted into the atmosphere in a gaseous form and can be carried by wind currents far from its original source. The long-range transport potential of pollutants, including mercury, has led to widespread pollution in adjacent environments, and in even the most remote ecosystems. Mercury enters aquatic ecosystems via atmospheric deposition and is biologically and chemically converted to methylmercury, the biologically active form that also is toxic to animals, including humans. Understanding the health effects of mercury is critical to humans, and protecting women and children is of primary importance.

Each year 60,000 children are born at a high risk of adverse neurological effects from mercury exposure. Currently, approximately seven million women (about 8% of American females) have enough mercury in their blood to pose a threat to a developing fetus. Therefore, mercury contamination can be considered to be both a public health and environmental issue creating a strong justification for long-term, broad-scale mercury research and monitoring of watersheds and aquatic ecosystems.

National parks provide great field laboratories for tracking the health of park resources, and serve as important monitor-

ing sites for comparing aquatic ecosystems located adjacent or close to mercury emission sites.

Freshwater ecosystems with high temperatures, acidity, and dissolved organic carbon levels facilitate methylmercury bioaccumulation and biomagnification. This form of mercury can be highly toxic to aquatic organisms, impairing productivity, growth and development, and potentially causing death in some cases. Even in areas that appear pristine and remote or are far removed from emission sources, fish and their long-lived predators commonly have elevated mercury concentrations. Acadia National Park is a perfect example. The park is situated in the extreme northeastern United States and receives deposition of atmospheric mercury, as well as other pollutants, originating from sources far away, including mid-western and northeastern metropolitan areas.



Salamander Larvae

Mercury contamination of amphibians has received little attention despite worldwide population declines. These toxic chemicals may interact synergistically with other stressors such as habitat degradation, UV-B radiation, and global climate change to affect amphibian populations. Because of these population declines, the United States Geological Survey's Amphibian Research and Monitoring Initiative, the Declining Amphibian Population Task Force, the University of

Maine, and the Eastern National Parks and Monuments Association are sponsoring research in both Acadia and Shenandoah National Parks to determine population abundance and mercury concentration levels in two-lined salamanders (*Eurycea bislineata*), an amphibian commonly found in headwater stream ecosystems.

These stream-dwelling salamanders serve as both predators of small invertebrates and as prey for larger animals in stream ecosystems. Unlike their larval counterparts who are strictly aquatic, adult two-lined salamanders are often found at the stream channel edge under partially submerged rocks. Adults breathe through their moist skin and through membranes found in their mouth and throat, whereas larvae rely solely on gills for breathing.

In contrast to vernal pool amphibian species, most stream salamanders have a long, slow-growing larval period of two or more years. This characteristic, in addition to their abundant, stable populations, make stream salamander communities ideal candidates for monitoring water quality and riparian and watershed degradation, especially in areas where fish populations are rare or absent.

The research project was designed to compare mercury contamination and population abundance of two-lined salamanders among streams with different fire histories in Acadia. Streams located in the relatively undisturbed coniferous forests (spruce-fir woodlands) of the park's western sector were surveyed for stream salamanders, as were streams flowing through the birch and aspen dominated stands of northeastern MDI that were burned by the 1947 fire that swept Bar Harbor. By studying streams and conducting chemical analyses of salamanders from the burned and unburned regions of

Christopher J. Leary photo

the park we hope to gain a further understanding of the habitats used by two-lined salamanders and how disturbances from the past influence mercury bioaccumulation and habitat use patterns in this species.

We have found that mercury levels were relatively high considering the small size (<1 gram) and young age (generally 1-2 years) of the larvae that we collected and analyzed. Our data also show that, on average, mercury concentrations in salamander larvae were higher in streams located in unburned watersheds compared to those in watersheds burned by the 1947 Fire, presumably because the fire reduced the amount of mercury available to the animals. We also found that populations were larger in the burned watersheds suggesting that these streams are likely more productive for salamanders, potentially as a result of more food made available by more leaves—a critical energy source for streams—from these deciduous dominated watersheds.



Robin E. Jung photo

Salamander Adult

This project is currently in its final stages, and the investigation's findings have gained considerable attention from both federal and academic scientists. The findings also have persuaded the National Park Service that this species may be a good

eco-indicator for long-term amphibian population monitoring programs, and for evaluating bioaccumulation of mercury in stream ecosystems for northeastern parks where they are found.

Mercury contamination continues to be a daunting challenge for policymakers, natural resource managers, and scientists alike. The mercury pollution issue at Acadia is no exception. Currently it is unknown what the future has in store for air and water quality at Acadia, especially as the Clean Air Act undergoes review for potential changes by policymakers.

Amphibian population declines on a worldwide basis may suggest serious environmental degradation, especially considering that these declines have been shown to be outside natural population fluctuations and appear to be greater than other vertebrate species. Monitoring population trends with regard to the degree and extent of contamination by mercury might aid in evaluating amphibian responses to certain stressors. However, monitoring will only track the degree of the contamination problem. Direct reductions of mercury accumulation in the environment likely depend on improvements in air quality emissions from other regions. This is especially true for areas like Acadia National Park that are highly susceptible to mercury contamination. Sound environmental policies that reduce pollutant emissions must be adopted in order to meet these challenging goals. ♪

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THE HEART OF THE MATTER

Saint George killed the last dragon, and he was called a hero for it. I've never seen a dragon, and I wish he would have left at least one. Saint Patrick made a name for himself by running the snakes out of Ireland, leaving the place vulnerable to rodent infestation. This business of making saints out of men who exterminate their fellow creatures has got to stop. All I'm saying is, it's starting to get a little lonely up here at the top of the food chain.

— from *The Big Picture*, by A. Whitney Brown,
American comedian and author

The Burning Tree

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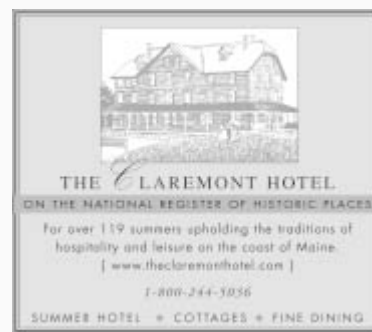
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