National Park Service
U.S. Department of the Interior

Air Resources Division
Natural Resource Stewardship & Science
Denver, Colorado

# Talking Points

## *Mercury in Fish from 21 Western and Alaskan National Parks*

Full report and citation available at http://pubs.usgs.gov/of/2014/1051/
Fact sheet/more talking points at http://nature.nps.gov/air/studies/docs/Hg-Fish-USGS_041414_final.pdf

1. **What is mercury and where does it come from?**

Mercury is a toxic, global contaminant that threatens resources the National Park Service (NPS) is charged with protecting. Although there are natural sources of mercury such as volcanoes, most of the mercury that affects parks comes from burning fossil fuels like coal in power plants. Waste incinerators, oil and gas wells, and mining operations are other human-caused sources of mercury. Human activities have greatly increased the amount of mercury currently cycling in the atmosphere, soils, lakes, and streams. It is estimated that up to 75% of the mercury entering the atmosphere is from anthropogenic sources such as combustion, steel, iron, coke, and lime production, smelting, petroleum refining, and mercury cell chlor-alkali production. Ninety-five to 100 percent of mercury in fish is methylmercury, the bioavailable form of mercury. Toxic effects of methylmercury include reduced reproductive success, impaired growth and development, behavioral abnormalities, reduced immune response and decreased survival. The forms of mercury are classified as a persistent, bioaccumulative, and toxic (PBT) by the US Environmental Protection Agency (EPA). Previous studies suggest that the contaminants are carried in air masses from sources as far away as Europe and Asia, and as near as the local county.

2. **What is the relationship between mercury atmospheric deposition and mercury concentrations in fish?**

Mercury is emitted to the air in the elemental or inorganic form and in the environment, biological (microbial) processes convert these bio-unavailable forms into methylmercury, which is toxic and accumulates up the food chain. Because methylmercury production is controlled by microorganisms that depend on certain environmental conditions, the conversion is not consistent or predictable. Therefore, deposition is not directly related to methylmercury production, bioaccumulation, or mercury levels in fish. Methylmercury bioaccumulates (builds-up) in organisms faster than the organism's body can get rid of it. Larger animals higher on the food chain accumulate more mercury, a process called biomagnification. Biomagnification is why mercury in top-level predators like large fish, eagles, or even humans can have up to a million times more mercury than the lake or stream water in which they live or hunt.

**3. Were the levels of mercury found in park fish dangerous or surprising?**

This study found levels of mercury in fish that exceeded health thresholds for potential impacts to fish, birds, and humans. Four percent of sport fish exceeded the EPA's human health criterion. Mercury concentrations in fish exceeded the most conservative fish toxicity benchmark at 15 percent of all sites, and levels exceeded the most sensitive health benchmark for fish-eating birds at 52 percent of all sites. These findings are similar to the Western Airborne Contaminants Assessment Project (WACAP) in that elevated levels of mercury were detected in fish and other ecosystem components in similarly situated western national parks. In that regard, the news isn't surprising. However, this study reported on mercury concentrations at an additional 16 parks, and detected mercury in all 1,486 fish samples. One of the more notable findings is that mercury levels in fish from the smallest fish class at Zion and Capitol Reef (UT) national parks were surprisingly comparable to mercury levels in parks with the largest fish. This is noteworthy because it expected that prey fish from the smallest fish class would not contain mercury concentration at or near the magnitude of mercury concentration in predatory fish from the largest fish class.

**4. Are the fish in the parks safe to eat?**

Although fish mercury concentrations were elevated in some sites, the majority of fish across the region had concentrations that were below most benchmarks associated with impaired health of fish, wildlife, and humans. Neither the US GS nor the National Park Service regulate environmental health guidelines, but the NPS is currently coordinating with state officials regarding potential fish consumption advisories. State fish consumption guidelines consider both the risks associated with mercury exposure and the benefits of fish consumption, such as improved cardiac health from increased omega-3 fatty acid consumption or potential reduced intake of unhealthy fats due to food substitutions. Fish consumption advice varies by state.

**5. Will the parks post fish consumption advisories due to mercury?**

The NPS operates under a Department of Interior (DOI)-wide policy to communicate fish consumption advisories on DOI-managed lands, including national parks. The National Park Service is working with the NPS Office of Public Health to best communicate fish consumption advisories; if and when the state issues a fish consumption advisory on park lands. States will be able to make a sound determination on advisories after evaluating the raw data. NPS is taking a variety of precautionary approaches to ensure that visitors have the information needed to make their own decisions about whether to eat the fish they may catch in park waters. Advisories are communicated via methods including park newsletters, webpages, and kiosks.

**6. Who is most sensitive to the harmful effects of mercury?**

Exposure to high levels of mercury in humans may cause damage to the brain, kidneys, and the developing fetus. Children and pregnant women are especially at risk from the toxic effects of mercury.

**7. Is the water safe to drink?**

When properly treated for environmental pathogens such as *Giardia*, the water is safe for backcountry use by humans.

**8. What does this mean for the wildlife that eats fish?**

High mercury concentrations in birds, mammals, and fish can result in reduced foraging efficiency, survival, and reproductive success. While only 5 percent of the fish had mercury concentrations exceeding the benchmark associated with toxic effects on fish, 35 percent of the fish sampled were above a benchmark for risk to sensitive fish-eating birds such as osprey. Although the study did not directly assess risk to mammals such as mink and river otter, the data suggests that mammals may also be at risk to mercury.

**9. Can mercury be cleaned up?**

It is not practical for us to consider the methods for removing these contaminants. The national parks are used by the scientific community as places to obtain baseline environmental data. In other words, environmental changes in national parks probably represent changes found across the country. The national parks serve as the laboratory for measuring these changes.

**10. What can be done to improve the situation?**

Identifying sources of mercury and partnering with regulatory agencies to reduce emissions are steps to help improve the situation. The same follows for potential waterborne mercury (e.g., mine discharge). However, environmental factors, including the food web connection, in effect disconnect the emission-deposition linkage, and become paramount. Therefore, small amounts of deposition can be biomagnified and become problematic. Managing exposure to both human and wildlife health could include assessing risk by fish size. Additional assessments that identify deposition and mercury methylating hotspots could locate areas of priority.

**11. What does this study tell us about other the risk to other water bodies in the parks?**

Results from the two intensively studied parks revealed up to 20-fold variation in fish mercury concentrations among lakes within an individual park. The limited number of sites sampled in most other parks is inadequate to fully characterize mercury risk, and multi-site sampling is necessary to best characterize risk. Fish mercury concentrations vary greatly both among and within parks, suggesting that patterns of mercury risk are driven by processes occurring at site-specific, local, and global scales. The beta USGS methylmercury risk mapper is the current best tool available to predict risk between water bodies (i.e., HUCs, hydrologic unit codes) within and among parks.

**12. Are there national efforts to regulate mercury?**

Yes. In 2011, the EPA finalized the Mercury and Air Toxics Standards (MATS) to reduce mercury and other toxic air pollution from coal and oil-fired power plants. Additionally, the Clean Water Act regulations specify effluent limits on mercury for classes and categories of industries. Other laws relating to mercury include the Mercury Export Ban Act and the Mercury-Containing and Rechargeable Battery Management Act, in addition to other acts such as the Safe Drinking Water Act and the Resource Conservation and Recovery Act.

**13. What do the USGS and NPS plan to do with this new information? How or will this information be used in other forums?**

The information will be published in peer-reviewed journal article, and incorporated in to the Western North American Mercury Synthesis project. Current efforts are underway to integrate the findings in to EPA's Fish Forum, a state and federal consortium on fish consumption advisories and the communication thereof. In addition, there are also implications for the international arena and global mercury treaties, but responses to such inquiries highly depend upon political leadership. While there are no immediate plans for follow up studies, future targeted research and monitoring across park habitats would help identify patterns of mercury distribution across the landscape and facilitate informed management decisions aimed at reducing the ecological risk posed by mercury contamination in sensitive ecosystems protected by the NPS.

**14. Is this news new, or surprising?**

It is not new news that mercury is found in fish. It is well known that toxins, such as mercury, are found in fish that threaten human and wildlife health. More than 16 million lake acres and 1 million river miles are under fish consumption advisories due to mercury in the United States and 81 percent of all fish consumption advisories issued by the US Environmental Protection Agency (EPA) are because of mercury contamination. However, this is the first study to document mercury concentrations in fish in a wide spatial extent from remote, mainly high elevation, sites. These sites – the national parks – are protected areas and considered to be relatively pristine and removed from environmental contaminants.

**15. What is the bottom line?**

The take home message is this: chemicals emitted into the air can be widely dispersed and become persistent, unintended contaminants in the environment affecting a range of species, including humans. The NPS would like to see less contaminants in park ecosystems, especially for contaminants like mercury where concentrations in fish are above thresholds for potential negative health effects on wildlife, and in some cases, people.