Great Lakes Network
Issue Brief

Mercury in National Parks of the Upper Midwest

What is the Issue?

Research shows that mercury levels are elevated in many aquatic ecosystems of the upper Midwest, including most national parks in the Great Lakes Network (GLKN). Mercury is a persistent, bioaccumulative, neurotoxin of significant concern for human and wildlife health. Thus, all four states surrounding GLKN parks have consumption advisories for fish from inland lakes. Mercury levels in biota have been declining since about 1970 due, in part, to regulations on manufacturing and municipal and medical incinerators, but recent studies indicate mercury is again increasing in some species and areas. The primary source of human-caused mercury in the environment is currently coal-fired power generation (estimated at about 40%). There are no national standards on these emissions, so the U.S. Environmental Protection Agency (USEPA) has proposed new Mercury and Air Toxics Standards (MATS) for power plants. The USEPA estimates these new standards, if adopted, would remove 90% of the mercury being released by coal-fired power plants.

Because of the environmental and human health concerns, and because of the impending political and public debate, the science community launched a major effort to synthesize information on mercury in the Great Lakes region and to make it widely available to policy-makers and the public. This Brief highlights the major issues and information sources that park managers should be aware of.

How Mercury Enters Park Ecosystems

Mercury enters park ecosystems primarily from polluted air through rain, snow, and dust (Figure 1). This mercury is deposited onto forests, land and water, and eventually migrates to wetlands, lakes, and rivers where it is transformed (methylated) to highly toxic methylmercury by sulfate-reducing bacteria. All parks in the upper Midwest are at risk for high levels of mercury, but levels are particularly high in parks with abundant wetlands and water bodies that have low biological productivity, low pH, and high dissolved organic matter – characteristics that are conducive to the formation of methylmercury. Once formed, methylmercury magnifies in concentration with each level in the aquatic food web. For example, GLKN cooperators from the University of Wisconsin-La Crosse found predatory fish at Voyageurs National Park (VOYA) with methylmercury levels more than 10-million times greater than the lake water in which they lived.

Current Levels and Trends

In 2010, mercury levels in fish at three GLKN parks were above the USEPA human health threshold applied to the general population of adults eating 2.3 meals of fish per month (Figure 2). This included all four lakes sampled at VOYA and two of four...
lakes at both Sleeping Bear Dunes (SLBE) and Pictured Rocks (PIRO). Moreover, monitoring at Grand Portage (GRPO) in 2010 indicated a high percentage of methylmercury in stream water there – 61% versus an average of 10% or less in lakes at VOYA, Isle Royale (ISRO), PIRO, SLBE, and Indiana Dunes (INDU).

GLKN data also show that mercury levels in bald eagle nestlings' breast feathers are particularly high in the upper reaches of the St. Croix Riverway (U-SACN), where there is an abundance of wetlands (Figure 3). Mercury in bald eagle nestling feathers had declined by 2.4% annually between 1989 and 2009 at Apostle Islands (APIS) and along Lake Superior’s south shore. However, recent unpublished GLKN data suggest this downward trend may be reversing. Indeed, others report a significant upward swing in mercury levels of biota in some areas of the upper Midwest, including fish (beginning about 1992) and common loons (beginning about 2002).

What Does This Mean for Humans and Wildlife?

Fish consumption is the primary pathway for methylmercury exposure in humans and fish-eating wildlife. For humans, over-consumption of fish with methylmercury can cause health problems ranging from developmental and behavioral deficits in children to increased risk of cardiac disease in adults. Elevated levels of methylmercury in wildlife are linked to decreased reproductive success; cell and tissue damage; and altered behaviors, immune systems, hormone levels, and brain chemistry. There is recent evidence that bald eagles in the Great Lakes region, including samples from GLKN parks, are exposed to methylmercury levels capable of causing changes in brain chemistry, and that 14% to 27% of the eagles here may be at risk. Further, recent work by the UW-La Crosse affirms conclusions from earlier studies at ISRO that fish from some GLKN parks are exposed to methylmercury levels that cause changes in liver physiology and overall health.

Management Implications

National Park managers, resource professionals, and interpreters in the Great Lakes Network have many opportunities to inform the general public and policy-makers about mercury and its effects on humans, fish, and wildlife. It is important that the NPS continue to work with and encourage federal and state regulatory agencies – through a variety of formal and informal venues – to reduce mercury emissions.

Resources Cited


For More Information

Biodiversity Research Institute  
www.briloon.org/mercuryconnections/GreatLakes

Environmental Protection Agency  
www.epa.gov/mercury/

Great Lakes Inventory and Monitoring Network—Persistent Contaminants  
http://science.nature.nps.gov/im/units/glkn/

NPS Air Resources Division—Mercury/Toxics Effects  
www.nature.nps.gov/air/AQBasics/mercury.cfm

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