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MERCURY IN TORCH LAKE: WHAT'S THE STORY?

Mercury (Hg) concentrations in Torch Lake sediments, water, and certain fish types are higher than in nearby lakes. Fish consumption advisories exist for Torch Lake walleye, northern pike, and suckers that are more restrictive than 2016 statewide guidelines because of their high mercury content.

WHY IS MERCURY A CHEMICAL OF CONCERN?

Exposure to mercury and mercury compounds may contribute to high levels in adults and children. Children and fetuses are especially vulnerable as exposure can cause impaired neurological development and cardiovascular problems. Additionally, mercury is passed from mothers to children during pregnancy and through breast feeding. Adults are susceptible to cardiovascular effects and some effects on the central nervous system. The U.S. Environmental Protection Agency (EPA) lists methylmercury, the most toxic form of mercury, as a possible carcinogen.

HOW AM I EXPOSED TO MERCURY?

People are exposed to the most toxic form of mercury, methylmercury, primarily by eating fish. Fish obtain methylmercury both directly from lake water and from eating smaller organisms. Older and bigger fish generally contain higher concentrations of methylmercury due to bioaccumulation, a process where concentrations of a substance increase up the food chain.

ARE THE FISH IN TORCH LAKE SAFE TO EAT?

The Michigan Department of Health and Human Services publishes fish consumption guidelines in its annual *Eat Safe Fish Guide*. Guidelines for Torch Lake from the 2016 edition differ depending on the size and type of fish caught. These suggest people should limit consumption of walleye to 6 to 12 servings per year, smallmouth bass and largemouth bass to 1 to 2 servings per month, northern pike to 2 servings per month, and suckers to 4 to 12 servings per month — all depending upon the size of the fish. A serving for a typical adult is about 8 ounces of fish. A serving for a child ranges from 2 to 4 ounces. See: *www.michigan.gov/eatsafefish*

WHAT ABOUT OTHER ACTIVITIES?

It is safe to swim and boat in Torch Lake. The mercury found in fish will not absorb through your skin.

Additionally, water from the local municipal drinking water supplies is not contaminated with mercury and is safe to drink.

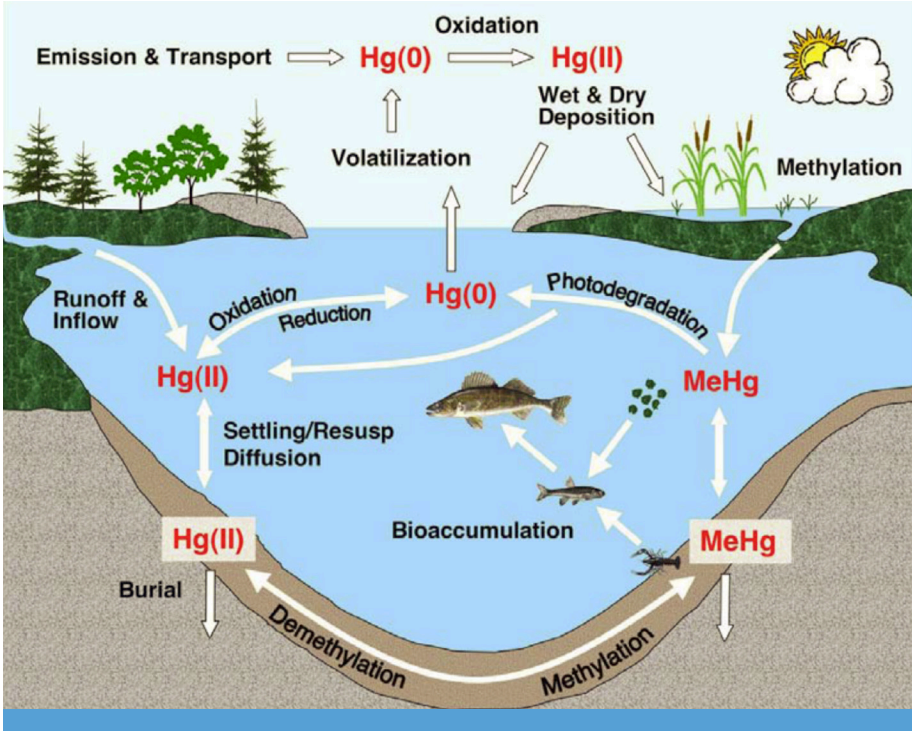
WHAT IS MERCURY?

Mercury is a naturally occurring metallic element that exists in low concentrations in all environments. It is the only metal that exists in a liquid state at room temperature. This unique trait also allows mercury to easily turn into a gas.

As a gas, mercury is transported rapidly around the globe. Natural sources of mercury emissions to the atmosphere include volcanos, the arctic snowpack in spring, and the ocean.

Multiple human activities also result in mercury emissions to the atmosphere. These activities include coal combustion, artisanal gold mining, other metal mining and refining activities, and municipal and medical waste incineration.

Mercury often enters ecosystems from the atmosphere. In environments with low oxygen concentrations — such as wetlands, moist soils, and the bottoms of many lakes — some of the mercury is transformed by bacteria to methylmercury. This form is much more toxic to humans and wildlife as it is readily absorbed and easily bioaccumulates.



The mercury (Hg) cycle in a lake consists of inputs, outputs, and many reactions within the lake. Fish accumulate only methylmercury (MeHg), but it is generally observed that higher inputs of all forms of mercury lead to higher concentrations of MeHg in lakes and in fish. "Resusp" stands for re-suspension. (Figure from Engstrom DR. 2007. Fish respond when the mercury rises. Proc Natl Acad Sci USA 104: 16394-5)

WHY IS MERCURY HERE?

There are two sources of the mercury in Torch Lake: distant sources such as emissions from coal plants across the globe, and residues from local mining activities.

All lakes in Michigan are impacted by mercury emissions from distant sources. It remains unclear how much of the mercury in Torch Lake fish is from local sources, although mine water discharges to the Traprock River are known to contribute more mercury to the lake than distant sources.

Locally, mercury was released to the atmosphere by copper smelting as well as through coal burning needed to process the ore. Some of the emitted mercury was deposited to lakes, forests, and wetlands downwind of the smoke stacks. A portion of the deposited mercury became methylated and was transported in streams to Torch Lake.

The copper ores on the Keweenaw Peninsula all contain mercury. As a result, by-products from processing the ore, including stamp sands and mine tailings, also contain mercury. It remains unknown how much of this mercury is transformed and cycled through the environment. Additionally, researchers are unsure how much ultimately becomes methylated, the form most easily absorbed by organisms.

Mine water drainage continues to serve as a source of mercury to Torch Lake. Osceola Mine in Laurium discharges saline water containing high levels of mercury into Hammell Creek that drains ultimately into Torch Lake.

Mercury and Torch Lake – the Bottom Line

- Mercury concentrations in Torch Lake sediments, water, and certain fish types are higher than in nearby lakes.
- Mercury concentrations in Torch Lake fish are high enough to result in fish consumption guidelines.
- Mercury comes from both distant and local sources.
- Mine drainage is a significant source of mercury to Torch Lake.
- The major source of methylmercury in fish remains unknown.

ABOUT THIS PROJECT

Intensive copper mining took place on the Keweenaw Peninsula from 1845 through 1968. Mining shaped the people and the environment of the Copper Country, as it is known, and continues to influence the region today.

On the social side, mining influenced individual lives. Where and how people lived, their social status, their health, and their longevity were all influenced by mining activity. Mining also affected community population and dynamics, dictating the locations of towns, social structures, and transportation systems.

On the environmental side, mining influenced the shape of the land surface and waterways, the quality of the air as well as surface and ground water. It also exposed humans and ecosystems to a variety of pollutants.

Torch Lake, one hub of mining-related activities, has become the center of efforts by regulatory agencies to mitigate harmful impacts from mining activities. This project was conducted by researchers at Michigan Technological University and funded by Michigan Sea Grant. Researchers assembled and evaluated available information, identified critical information gaps, and, by working with local stakeholders and government agencies, helped determine possible pathways for improving conditions in and around Torch Lake.

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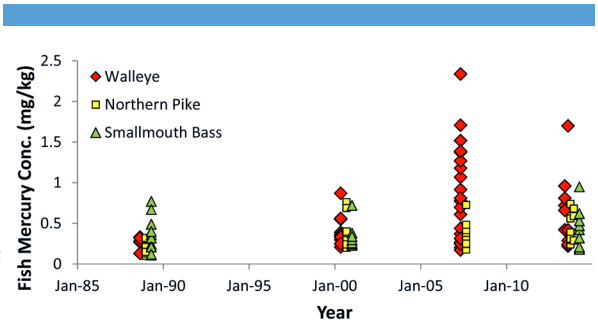

Mercury in Torch Lake fish has been high (> 0.3 mg/kg) since at least 1988. There is no evidence of a decline in mercury content in northern pike or smallmouth bass. Changes in mercury content of walleye likely result from fish community changes resulting from stocking.

Sea Grant Michigan

Michigan Sea Grant helps to foster economic growth and protect Michigan's coastal, Great Lakes resources through research, education and outreach.

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