Mercury in Aquatic Ecosystems

Idaho Water Science Center; Terry Maret, Supervisory Biologist; Dorene MacCoy, Biologist, 208-387-1300; http://id.water.usgs.gov/

Risk to Humans and Wildlife

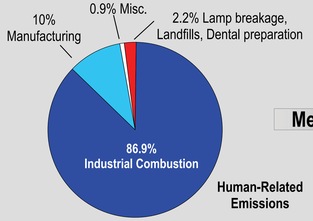
Mercury is a naturally-occurring element found in soil, rocks, lakes, streams, and oceans. Mercury is also released into the environment by human activities.

What determines the amount of mercury in fish?
- mercury sources
- methylation efficiency
- food-web complexity

Mercury Processes

Inorganic mercury in the environment can be converted by bacteria, through **methylation**, to a much more toxic organic form—methylmercury. Methylmercury binds tightly to the proteins in fish tissue.

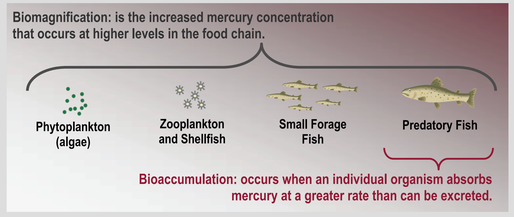
Inorganic, elemental mercury
Exposure: Inhalation
Effects: May cause tremors, gingivitis, and excitability.



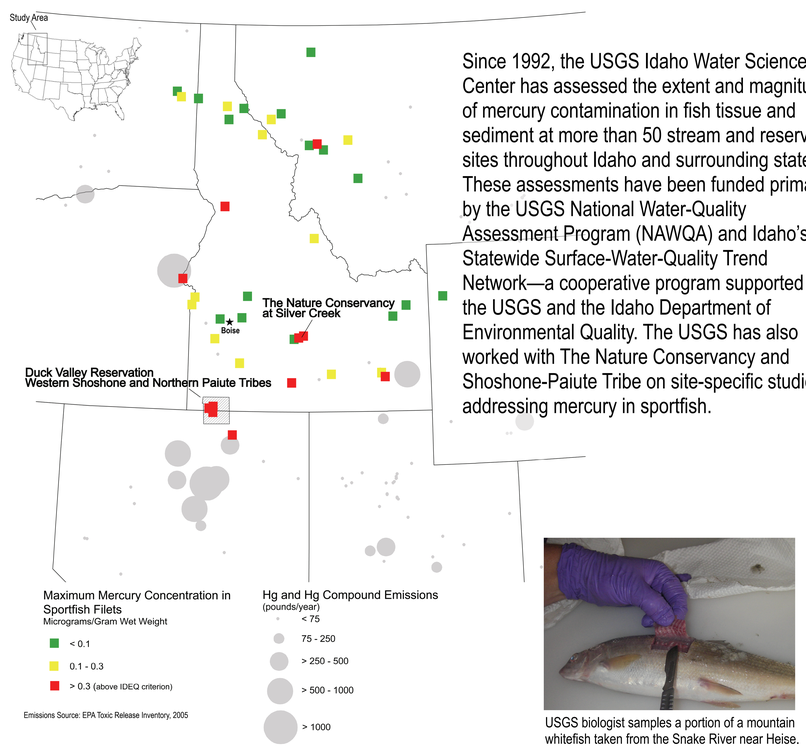
Methylation

Organic, methylmercury
Exposure: Ingestion
Effects: May damage the immune system, genetic and enzyme systems, and nervous system.

More than 95% of all mercury in fish is methylmercury which **biomagnifies** in the food chain and **bioaccumulates** in fish tissue.



USGS Mercury Studies In Idaho



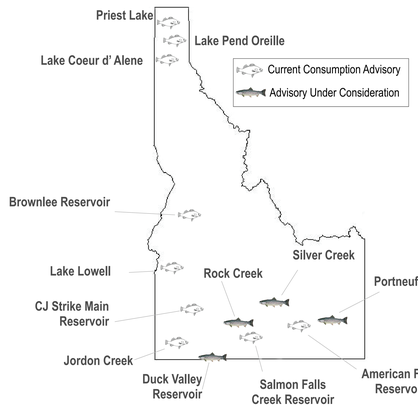
Since 1992, the USGS Idaho Water Science Center has assessed the extent and magnitude of mercury contamination in fish tissue and sediment at more than 50 stream and reservoir sites throughout Idaho and surrounding states. These assessments have been funded primarily by the USGS National Water-Quality Assessment Program (NAWQA) and Idaho's Statewide Surface-Water-Quality Trend Network—a cooperative program supported by the USGS and the Idaho Department of Environmental Quality. The USGS has also worked with The Nature Conservancy and Shoshone-Paiute Tribe on site-specific studies addressing mercury in sportfish.

USGS biologist samples a portion of a mountain whitefish taken from the Snake River near Heise.

Fish Contamination & Consumption Advisories

Fact: To reduce the risk of mercury exposure, eat smaller, nonpredatory fish.

There are currently nine mercury-related fish consumption advisories in Idaho. Idaho Department of Health and Welfare issues these advisories based on guidelines set by the Food and Drug Administration and the Environmental Protection Agency. A fish advisory does not mean you should stop eating fish from your favorite lake or river. It simply means that you should monitor the *amount* of certain kinds of fish that you eat. Fish are an excellent source of protein and are high in omega-3 (good) fats. (www.idahohealth.org)



http://healthandwelfare.idaho.gov/portal/alias__Rainbow/lang__en-US/tabID__3391/DesktopDefault.aspx
Some consumption advisories are based on multiple contamination sources, including mercury.

Fact: If no additional mercury is ingested, the human body can eliminate half of its accumulated mercury in 70 days.

Mercury Contamination in Fish in the United States

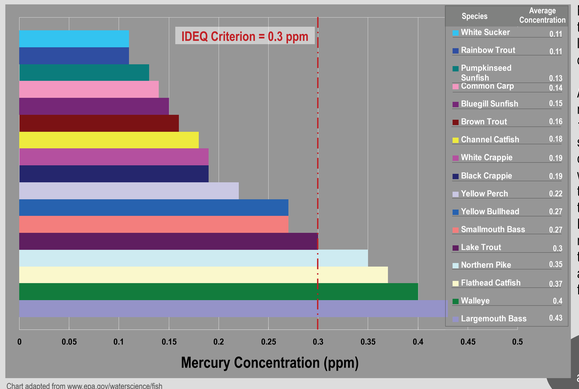


Chart adapted from www.epa.gov/waterscience/fish

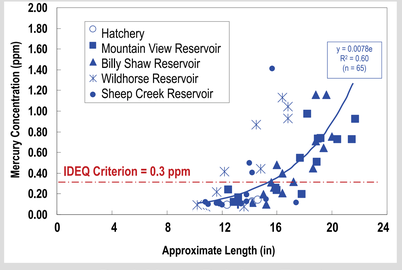
Nearly all fish and shellfish contain trace amounts of mercury. Mercury levels vary considerably depending on fish species and size.

Average values presented here represent adult fish filets from at least 100 sampling sites. Fish eating species that are higher in the food chain such as largemouth bass and walleye have on average about 4X the mercury concentration of rainbow trout or suckers. The U.S. Environmental Protection Agency's mercury criterion of 0.3 ppm in fish tissue was recently adopted by IDEQ as the mercury water quality standard for protection of human health.

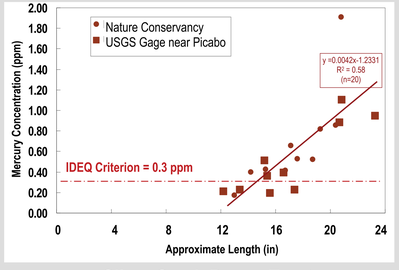
Fact: Canned albacore tuna has an average mercury concentration of 0.39 ppm.

Mercury Contamination in Trout: Southern Idaho, 2007

Recently, the USGS, Nature Conservancy and Western Shoshone and Northern Paiute Tribes have worked cooperatively to sample seven sites throughout Southern Idaho and Northern Nevada. The charts below show mercury levels in trout (Southern Idaho and Northern Nevada) are well above the national average. Both of these studies show a strong relationship between fish size and mercury concentration in filet tissue.



Duck Valley Rainbow Trout



Silver Creek Brown Trout

In general, shallow reservoirs and wetlands have the highest concentrations of mercury in fish tissue. Duck Valley reservoirs and Silver Creek exhibit many of the factors that promote the methylation process.

What factors are enhancing the methylation process in Southern Idaho?

- Shallow, standing water
- Highly variable water level
- Abundance of fine sediment
- Excessive plant growth
- Low pH (acidic waters)
- High dissolved organic carbon
- Low dissolved oxygen