United States Environmental Protection Agency

Fish and Shellfish Program NEWSLETTER

September/October 2019
EPA 823-N-19-008

In This Issue

https://www.epa.gov/fish-tech

This issue of the Fish and Shellfish Program Newsletter generally focuses on mercury.

Recent Advisory News

ADEQ Issues Fish Consumption Advisory for Lyman Lake in Apache County

On September 12, 2018, the Arizona Department of Environmental Quality (ADEQ), in association with the Arizona Game and Fish Department (AGFD), issued a fish consumption advisory for walleye caught from Lyman Lake in Apache County. This advisory recommends that walleye caught from Lyman Lake not be consumed. It is based on recent analysis of fish tissue data that indicated elevated levels of mercury.

Generally, any mercury contaminant levels found in water are significantly lower than those found in fish tissue. Therefore, fishing, bird watching, swimming, and other recreational activities at Lyman Lake are not affected by this advisory and are encouraged for enjoying the great outdoors.

Fish are an excellent source of protein and can be an important part of a healthy, diverse diet as they are low in saturated fat. The American Heart Association recommends people eat at least two fish or seafood meals every week.

Background

Fish Consumption Advisory: A fish consumption advisory recommends either limited or no consumption of fish when ADEQ determines contaminant levels in fish tissues taken from an Arizona waterway exceed state health standards. These advisories do not apply to commercial fish sold in markets.

Pollutant of Concern: Mercury in the environment can come from various sources and cause numerous health problems such as damage to the central nervous system, depending on the exposure. Infants and pregnant or nursing mothers are considered most at risk to possible health effects. Fish can accumulate elevated levels of mercury when larger fish consume smaller fish and insects.

Resources

- ADEQ Fish Consumption Advisories
- ADEQ Fish Consumption Advisory Fact Sheet
- ADEQ Fish Consumption Advisory Interactive Map
- Arizona Game and Fish Department Fish Consumption Advisories for Arizona Waters
- EPA-FDA Advice about Eating Fish and Shellfish

For more information, contact:

- ADEQ Public Information Officer at 602-771-2215 or pio@azdeq.gov.
- Nick Walter, AGFD, at 623-236-7214 or nwalter@azgfd.gov.

Source: https://azdeq.gov/press-releases/immediate-release-adeq-issues-fish-consumption-advisory-lyman-lake-apache-county

EPA News

EPA and Partners Release Data and Findings from Kootenai River Sampling Effort

Water quality and fish tissue results show elevated levels of selenium and nitrates associated with upstream sources

On September 23, 2019, the U.S. Environmental Protection Agency (EPA), in cooperation with the U.S. Geological Survey (USGS), released the results of a water quality study indicating elevated levels of selenium in water and fish and elevated nitrates in water in the Kootenai River. Elevated levels of both contaminants are associated with upstream sources in Canada's Elk Valley and Lake Koocanusa.

The study, part of a collaborative effort between federal, state, and tribal agencies to assess the Kootenai River watershed, is based on water chemistry and fish tissue samples taken on the river in Montana and Idaho from immediately below Libby Dam to the Canadian

Processing fish samples for community population assessments and tissue collections, Kootenai River at Troy, MT, September, 2018. Pictured is Jim Dunnigan, Montana Fish, Wildlife & Parks. (Photo courtesy of USGS)

border. Data contributing to the study were collected by USGS, the states of Idaho and Montana, and the Kootenai Tribe of Idaho.

"These data indicate upstream activities may be affecting water quality and aquatic resources in Montana and Idaho," said EPA Regional Administrator Gregory Sopkin. "The results, particularly selenium impacts to fish, underscore the need for a more detailed understanding of water quality and continued collaboration to protect Lake Koocanusa and the Kootenai River."

EPA has long been engaged in efforts to address water quality impacts to Lake Koocanusa, which straddles the border of British Columbia, Canada, and the state of Montana. Selenium and nitrate concentrations entering the lake from British Columbia's Elk River have been increasing since data collection began several decades ago. EPA initiated this study in 2018 to address questions posed by state and tribal partners and to better understand the presence, sources, and movement of selenium and nutrients in the Kootenai River watershed downstream of Libby Dam. USGS led the EPA-funded study, in collaboration with EPA, state, and tribal partners. EPA conducted the fish tissue analysis.

Results

The sampling results showed elevated selenium levels in some of the 142 fish evaluated in the study. Levels in some mountain whitefish eggs exceeded EPA's recommended freshwater aquatic life criterion of 15.1 micrograms per liter (ug/L), the level at which fish reproduction may be harmed. Six of eight mountain whitefish exceeded the EPA criterion. In addition, one redside shiner exceeded EPA's whole-body criterion for selenium.

Selenium concentrations in water were elevated above background levels but did not exceed EPA recommended criteria for selenium in flowing waters. Selenium was not detected in water samples from Kootenai River tributaries unaffected by discharge from Lake Koocanusa, indicating that the source is the discharge of mine-related constituents from the lake. Nitrate was detected in water immediately below Libby Dam at nearly three times the concentrations observed in previous samples collected from 2000-2004, and significantly higher than those found on the tributaries. Previous studies show that most of the selenium and nitrate in Lake Koocanusa originates from coal mining in the Elk Valley.

Communities and tribes in Montana and Idaho depend upon good water quality and healthy fisheries. EPA's study indicates that the Kootenai River is being impacted by upstream mining in British Columbia and points to the need for continued monitoring to assess Kootenai River health and to track future trends. EPA is sharing the results of this study with state, tribal, and international partners, and will continue to support the development of information and measures to protect water quality.

Fish tissue samples were also analyzed for mercury, which can be harmful to people who consume fish. Mercury concentrations were generally below EPA fish tissue criteria for methylmercury except for three northern pikeminnow. Tribes and state agencies will consider whether fish advisories are appropriate.

Background

EPA issued revised national freshwater aquatic life criteria recommendations in 2016 for selenium in water and fish. The Montana Department of Environmental Quality (MDEQ) is currently working with the British Columbia Ministry of Environment and Climate Change Strategies and other parties, including EPA, to develop site-specific water quality criteria for selenium in Lake Koocanusa. MDEQ expects to submit revised selenium criteria to EPA for review next year. Montana also plans to adopt EPA-recommended selenium criteria for the Kootenai River below Libby Dam. Idaho has water quality standards for selenium in the Kootenai River that are consistent with EPA's 2016 recommendations.

For more information, visit: https://doi.org/10.5066/P9YYVV7R or contact Lisa McClain-Vanderpool at 303-312-6077 or mcclain-vanderpool.lisa@epa.gov.

For information on EPA's national chronic aquatic life criterion for the pollutant selenium in freshwater see https://www.epa.gov/wqc/aquatic-life-criterion-selenium.

Source: https://www.epa.gov/newsreleases/epa-and-partners-release-data-and-findings-kootenai-river-sampling-effort

Other News

Mercury Levels in Fish Are on the Rise

Climate change and overfishing likely to increase human exposure to toxic methylmercury in seafood

Warming oceans are leading to an increase of the harmful neurotoxicant methylmercury in popular seafood, including cod, Atlantic bluefin tuna, and swordfish, according to research led by researchers at Harvard University.

The scientists developed a first-of-its-kind, comprehensive model that simulates how environmental factors, including increasing ocean temperatures and overfishing, affect levels of methylmercury in fish. The researchers found that, while the regulation of mercury emissions has successfully reduced methylmercury levels in fish, spiking temperatures are driving those levels back up and will play a major role in the methylmercury levels of marine life in the future.

The findings are published in the journal *Nature*.

"This research is a major advance in understanding how and why ocean predators, such as tuna and swordfish, are accumulating mercury," said Elsie Sunderland, senior author of the paper.

"Being able to predict the future of mercury levels in fish has been difficult to answer because, until now, we didn't have a good understanding of why methylmercury levels were so high in big fish," said Amina Schartup, first author of the paper.

Based on the new model, the researchers predict that an increase of 1 degree Celsius (°C) in seawater temperature, relative to the year 2000, would lead to a 32% increase in methylmercury levels in cod and a 70% increase in spiny dogfish.

"This study brings together different kinds of data with models in a way that will have a direct impact on how we manage fisheries," says Hedy Edmonds, a program director in National Science Foundation's Division of Ocean Sciences, which funded the research.

For more information, contact the National Science Foundation Public Affairs at (703) 292-7090 or media@nsf.gov.

Source: https://www.nsf.gov/discoveries/disc_summ.jsp?cntn_id=299037&org=NSF&from=news

Isotopic Tracers in Fish in Northeast Provide Clue to Mercury Sources

On August 20, 2019, the USGS Regional Stream Quality Assessment (RSQA) released a new study reporting that isotopes of mercury in fish can indicate the source of that mercury.

The isotopic signature of mercury in fish in urban regions of the Northeast indicates that the mercury comes from current and legacy point sources, such as industrial activities. In more rural areas, the mercury signature in fish indicates that the mercury has undergone long-range atmospheric transport.

Mercury is a potent neurotoxin that accumulates in the tissue of fish and other organisms, and humans can be exposed to mercury by consuming fish that have bioaccumulated mercury. There are numerous statewide and waterbody-specific fishing advisories across the U.S. for mercury. In areas with many potential mercury sources, such as the Northeast, one challenge is to determine which sources are the greatest contributors to mercury in fish. Identification of mercury sources can inform management actions in regions with mercury fishing advisories and improve our understanding of the bioavailability of mercury to fish and the rest of the food web.

Using 69 fish from 23 small streams in the Northeast and three isotopic tracers of mercury in the fish tissue, researchers determined that point sources, such as industrial emissions, were the predominant source of mercury in fish in urban areas with a relatively large amount of current or past industrial activity. In contrast, mercury in fish in rural streams was from atmospheric deposition of mercury onto the land surface that then washes into streams with stormwater runoff. These patterns were consistent across both game and prey fish. This is one of the first studies to use mercury isotopes in fish tissue to track mercury sources.

Rainbow trout [*Oncorhynchus mykiss*] was one of the sampled fish species. *(Photo courtesy of U.S. Fish and Wildlife Service)*

Sediments also had mercury isotopic compositions that corresponded to land use, but the compositions were different than those in fish collected at the same site. This indicates that mercury in both fish and sediment is affected by factors such as land use and proximity to point sources, but that mercury in fish and sediment are not necessarily directly linked as has been commonly assumed.

For more information, contact Sarah E. Janssen, Research Chemist at the Upper Midwest Water Science Center, at 608-821-3976 or sjanssen@usgs.gov.

Source: https://www.usgs.gov/center-news/isotopic-tracers-fish-northeast-provide-clue-mercury-sources?qt-news_science_products=1#qt-news_science_products

Recently Awarded Research

$3 Million Grant Funds Study of Colombian River Contamination, Effects on Locals

The Atrato River in Colombia has been tainted by decades of illegal mining, leading to mercury contamination and other pollutants.

On February 13, 2019, Robert Stempel College of Public Health and Social Work at the Florida International University (FIU) — in collaboration with Universidad de Córdoba and Universidad Tecnologica del Choco Diego Luis Cordoba, both in Colombia — was awarded a $3 million grant to evaluate the degree of contamination throughout the river basin and how it is impacting the health of local populations.

The FIU portion of the project will be led by Carlos Espinal, director of the Global Health Consortium; Tomás R. Guilarte, Dean of Stempel College; and Piero R. Gardinali, marine environmental toxicologist and professor in the College of Arts, Science & Education.

“The people who live in the Atrato River Basin have been exposed to decades of mercury contamination in their daily lives, and the effects will be felt for generations to come,” Guilarte says. “Our hope is that by understanding the levels of contamination and where it exists, we can be part of the solution and alleviate some of the damage that has been caused.”

The project is being funded by Colciencias, Colombia’s administrative department of science, technology, and innovation, the government agency that supports fundamental and applied research in the country. The goal of the project is to evaluate the health conditions of the population that lives in the Atrato River Basin and their relative exposure to environmental contaminants resulting from both legal and illegal gold mining.

The project will include surveying more than 6,000 local inhabitants of the area, testing their hair, blood, and urine. The project will also test local water, sediments, plants, and food sources such as fish.

On a recent trip to Colombia, both Guilarte and Espinal met with Colciencias to discuss possible future collaborations between the organization and Stempel College.

The Atrato River is the largest river in Colombia with more than 150 tributary rivers and 3,000 streams. It is a natural wonder with immense reserves of gold, silver, and platinum. The highly impoverished region is home to a predominately Afro-Colombian population that has been found to suffer from disproportionate levels of cancer and neurodegenerative diseases such as Alzheimer's disease and Parkinson's disease, that are believed to be the result of exposure to the chemicals used for mining and lack of clean water in the region.

According to Mercury Watch, Colombia is the country with the highest rate of mercury and cyanide contamination in the Americas, and a third of its total 180 tons per year are poured into the Atrato River.

In 2018, a landmark decision by the Colombian government ruled that the Atrato River Basin has the rights to protection, conservation, maintenance, and restoration. As part of the ruling, the government is working to locate the sources of contamination and hold responsible parties accountable for their actions.

"Clean water is a basic necessity for populations to live and essential to a healthy ecosystem. Our work in the Atrato River Basin will help us better understand the degree of contamination to the ecology and the people who reside there," said Espinal. "This is the first step in cleaning the area and ensuring that the living conditions are safe."

For more information, contact Jessica Drouet at jschenck@fiu.edu.

Source: https://news.fiu.edu/2019/3-million-grant-funds-study-of-colombian-river-contamination-effects-on-locals

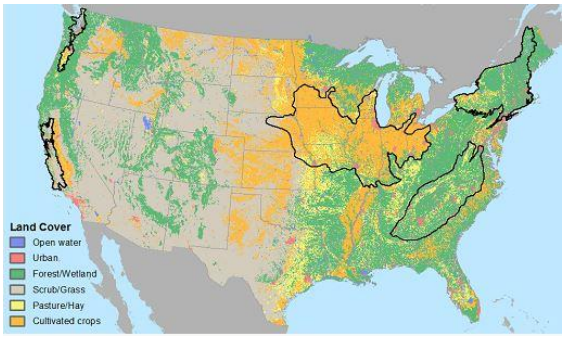
Tech and Tools

What's In Your Stream? Get Online to Find Out!

On August 8, 2019, USGS released a new update to an online interactive tool for learning about pesticides, nutrients, and overall stream health in major regions of the U.S. It is available from USGS RSQA.

In addition to results for the Northeast and Pacific Northwest regions, users now can access results for the Midwest and Southeast regions made available in 2018.

By clicking on a stream sampling site, users can access a "scorecard" that gives a snapshot of water-quality, habitat, and stream-health metrics for that stream. The site also allows users to visually compare results across a region and nationally among regions. The Results Viewer app depicts



How is stream ecology affected by chemical and physical stressors in small streams? The USGS is addressing this question through studies of relations between stressors and stream ecology across large regions of the U.S. Users can click on a region on RSQA maps to learn more and access data on water and sediment quality of streams. *(Screenshot of map courtesy of USGS)*

data collected at the stream sites assessed. Sites are displayed on the map using an easy-to-understand color key that shows low, medium, and high levels of each metric. The Download Data app allows users to select and download project data of interest by site or by constituent.

Results available now cover four of the five USGS RSQAs. For each region, samples were collected at about 100 small streams and tested for a wide range of contaminants. Scientists also surveyed stream habitat, algae, fish, and bottom-dwelling invertebrate communities, such as mayfly and damselfly larvae. Streambed sediment was collected at every site for chemical analysis and toxicity testing. Results for the fifth and final region, Coastal California, will be available later this year.

Publications and study design information also are available at the RSQA website. The information from the assessment can be used by the public and by land and resource managers to better understand the relative effects of water quality and other stressors on aquatic organisms in streams.

Explore other water-quality tools and learn more about water quality across the Nation at the USGS National Water-Quality Assessment (NAWQA) Project website.

For additional information, contact:

- Barbara Mahler, Research Hydrologist, USGS National Water Quality Program Communications Coordinator, Texas Water Science Center, at 512-927-3566 or bjmahler@usgs.gov.

- Pete Van Metre at pcvanmet@usgs.gov for additional information on the web tool.

Source: https://www.usgs.gov/center-news/whats-your-stream-get-online-find-out?qt-news_science_products=1#qt-news_science_products

Recent Publications

Journal Articles

The list below provides a selection of research articles focusing on mercury.

- **The implications of following dietary advice regarding fish consumption frequency and meal size for the benefit (EPA + DHA and Se) versus risk (MeHg) assessment**
  Afonso C., I. Bernardo, N. M. Bandarra, L. L. Martins, and C. Cardoso. 2019. The implications of following dietary advice regarding fish consumption frequency and meal size for the benefit (EPA + DHA and Se) versus risk (MeHg) assessment. *International Journal of Food Sciences and Nutrition* 70(5):623-637.

- **Predictors of mitochondrial DNA copy number and damage in a mercury-exposed rural Peruvian population near artisanal and small-scale gold mining: An exploratory study**
  Berky, A. J., I. T. Ryde, B. Feingold, E. J. Ortiz, L. H. Wyatt, C. Weinhouse, H. Hsu-Kim, J. N. Meyer, and W. K. Pan. 2019. Predictors of mitochondrial DNA copy number and damage in a mercury-exposed rural Peruvian population near artisanal and small-scale gold mining: An exploratory study. *Environ Mol Mutagen* 60 (2):197-210.

- Estimated exposure to mercury from fish consumption among women anglers of childbearing age in the Great Lakes region
  Connelly N. A., T. B. Lauber, P. J. McCann, J. Niederdeppe, and B. A. Knuth. 2019. Estimated exposure to mercury from fish consumption among women anglers of childbearing age in the Great Lakes region. *Environmental Research*, 171:11-17.

- Ecological drivers of mercury concentrations in fish species in subsistence harvests from Kotzebue Sound, Alaska
  Cyr, A. P., J. A. López, M. J. Wooller, A. Whiting, R. Gerlach, and T. O'Hara. 2019. Ecological drivers of mercury concentrations in fish species in subsistence harvests from Kotzebue Sound, Alaska. *Environmental Research* 177: 108622

- A model of mercury distribution in tuna from the Western and Central Pacific Ocean: Influence of physiology, ecology and environmental factors
  Houssard P., D. Point, L. Tremblay-Boyer, V. Allain, H. Pethybridge, J. Masbou, B. E. Ferriss, P. A. Baya, C. Lagane, C. E. Menkes, Y. Letourneur, and A. Lorrain. 2019. A model of mercury distribution in tuna from the Western and Central Pacific Ocean: Influence of physiology, ecology and environmental factors. *Environmental Science & Technology* 53(3):1422-1431.

- Chemical and physical controls on mercury source signatures in stream fish from the northeastern United States
  Janssen S. E., K. Riva-Murray, J. F. DeWild, J. M. Ogorek, M. T. Tate, P. C. Van Metre, D. P. Krabbenhoft, and J. F. Coles. 2019. Chemical and physical controls on mercury source signatures in stream fish from the northeastern United States. *Environmental Science & Technology* 53(17): 10110-10119.

- Nutrients mediate the effects of temperature on methylmercury concentrations in freshwater zooplankton
  Jordan M. P., A. R. Stewart, C. A. Eagles-Smith, and A. L. Strecker. 2019. Nutrients mediate the effects of temperature on methylmercury concentrations in freshwater zooplankton. *Science of The Total Environment* 667:601-612.

- Mercury exposure in mother-children pairs in a seafood eating population: Body burden and related factors
  Karatela, S., N. Ward, and J. Paterson. 2019. Mercury exposure in mother-children pairs in a seafood eating population: Body burden and related factors. *International Journal of Environmental Research and Public Health* 16(12):2238.

- Heavy metals in fish and its association with autoimmunity in the development of juvenile idiopathic arthritis: A prospective birth cohort study
  Kindgren, E., C. Guerrero-Bosagna, and J. Ludvigsson. 2019. Heavy metals in fish and its association with autoimmunity in the development of juvenile idiopathic arthritis: A prospective birth cohort study. *Pediatric Rheumatology* 17(1):33.

- Change in mercury speciation in seafood after cooking and gastrointestinal digestion
  Liao W., G. Wang, W. Zhao, M. Zhang, Y. Wu, X. Liu, and K. Li. 2019. Change in mercury speciation in seafood after cooking and gastrointestinal digestion. *Journal of Hazardous Materials* 375:130-137.

- Tracking declines in mercury exposure in the New York City adult population, 2004–2014
  McKelvey, W., B. Alex, C. Chernov, P. Hore, C. D. Palmer, A. J. Steuerwald, P. J. Parsons, and S. E. Perlman. 2018. Tracking declines in mercury exposure in the New York City adult population, 2004–2014. *Journal of Urban Health* 95(6): 813-825.

- Scaling mercury biodynamics from individuals to populations: Implications of an herbivorous fish on mercury cycles in streams
  McManamay, R. A., F. Linam, T. J. Mathews, S.C. Brooks, and M.J. Peterson. 2019. Scaling mercury biodynamics from individuals to populations: Implications of an herbivorous fish on mercury cycles in streams. *Freshwater Biology* 64(5):815–831.

- Factors influencing fish mercury concentrations in Iowa rivers
  Mills, N., M. J. Weber, C. L. Pierce, and D. Cashatt. 2019. Factors influencing fish mercury concentrations in Iowa rivers. *Ecotoxicology* 28(2):229-241.

- Climate change and overfishing increase neurotoxicant in marine predators
  Schartup, A. T., C. P. Thackray, A. Qureshi, C. Dassuncao, K. Gillespie, A. Hanke, and E. Sunderland. 2019. Climate change and overfishing increase neurotoxicant in marine predators. *Nature* 572:648-650.

- Exposure to mercury among 9-year-old Spanish children: Associated factors and trend throughout childhood
  Soler-Blasco R., M. Murcia, M. Lozano, X. Aguinagalde, G. Iriarte, M.-J. Lopez-Espinosa, J. Vioque, C. Iñiguez, F. Ballester, and S. Llop. 2019. Exposure to mercury among 9-year-old Spanish children: Associated factors and trend throughout childhood. *Environment International* 130:104835.

- Prenatal and early postnatal exposure to total mercury and methylmercury from low maternal fish consumption
  Ursinyova, M., V. Masanova, I. Uhnakova, L. P. Murinova, H. Patayova, K. Rausova, T. Trnovec, J. Stencl, and M. Gajdos. 2019. Prenatal and early postnatal exposure to total mercury and methylmercury from low maternal fish consumption. *Biological Trace Element Research* 191(1):16-26.

- Timber harvest alters mercury bioaccumulation and food web structure in headwater streams
  Willacker J. J., C. A. Eagles-Smith, B. M. Kowalski, R. J. Danehy, A. K. Jackson, E. M. Adams, D. C. Evers, C. S. Eckley, M. T. Tate, and D. P. Krabbenhoft. 2019. Timber harvest alters mercury bioaccumulation and food web structure in headwater streams. *Environmental Pollution* 253:636-645.

Upcoming Meetings and Conferences

13th World Congress on Aquaculture and Fisheries
October 28–29, 2019
Tokyo, Japan

80th Midwest Fish and Wildlife Conference
January 26–29, 2020
Springfield, Illinois

Catfish 2020 - The Third International Catfish Symposium
February 18–20, 2020
Little Rock, Arkansas

Additional Information

This monthly newsletter highlights current information about fish and shellfish.

For more information about specific advisories within the state, territory, or tribe, contact the appropriate state agency listed on EPA's National Listing of Fish Advisories website at https://fishadvisoryonline.epa.gov/Contacts.aspx.

For more information about this newsletter, contact Sharon Frey (Frey.Sharon@epa.gov, 202-566-1480).

Additional information about advisories and fish and shellfish consumption can be found at https://www.epa.gov/fish-tech.