EPA United States Environmental Protection Agency

Fish and Shellfish Program NEWSLETTER

July 2016
EPA-823-N-16-002

In This Issue

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

Recent Advisory News

California Consumption Advice

Shadow Cliffs Lake, Alameda County

In March 2016, the California state fish advisory for Shadow Cliffs Lake, located in Pleasanton and part of the East Bay Regional Park District in Alameda County, offered safe eating advice for black bass, carp, catfish, and sunfish species. The advice is based on mercury and polychlorinated biphenyl (PCB) levels measured in fish from Shadow Cliffs Lake.

Women 18–45 years and children 1–17 years

- Can eat 2 servings per week of catfish or sunfish species, or
- Can eat 1 serving per week of carp
- Should not eat black bass species

Women 46 years and older and men 18 years and older

- Can eat 6 servings per week of catfish or sunfish species, or
- Can eat 1 serving per week of black bass species or carp

For more information, visit: http://oehha.ca.gov/advisories/shadow-cliffs-lake.

Lexington Reservoir, Santa Clara County

In April 2016, the California state fish advisory for Lexington Reservoir, located in Santa Clara County near Los Gatos, offered safe eating advice for black bass, Rainbow Trout, Inland Silverside, sunfish species and Threadfin Shad. The advice is based on mercury levels measured in fish from Lexington Reservoir.

Women 18–45 years and children 1–17 years

- Can eat 7 servings per week of Rainbow Trout, or
- Can eat 2 servings per week of Inland Silverside or Threadfin Shad, or
- Can eat 1 serving per week of sunfish species
- Should not eat black bass species

Women 46 years and older and men 18 years and older

- Can eat 7 servings per week of Inland Silverside, Rainbow Trout or Threadfin Shad, or
- Can eat 3 servings per week sunfish species, or
- Can eat 1 serving per week of black bass species

For more information, visit: http://oehha.ca.gov/advisories/lexington-reservoir.

French Meadows Reservoir, Placer County

In May 2016, the California state fish advisory for French Meadows Reservoir, located northeast of Auburn in Placer County, offered safe eating advice for Brown Trout, crayfish species and Rainbow Trout. The advice is based on mercury levels measured in fish from French Meadows Reservoir.

Women 18–45 years and children 1–17 years

- Can eat 3 servings per week of Rainbow Trout, or
- Can eat 2 servings per week of crayfish species, or
- Can eat 1 serving per week of Brown Trout

Women 46 years and older and men 18 years and older

- Can eat 7 servings per week of crayfish species or Rainbow Trout, or
- Can eat 3 servings per week of Brown Trout

For more information, visit: http://oehha.ca.gov/advisories/french-meadows-reservoir.

Hell Hole Reservoir, Placer County

In May 2016, the California state fish advisory for Hell Hole Reservoir, located northeast of Auburn in Placer County, offered safe eating advice for Brown Trout, crayfish species, Kokanee Salmon and Lake Trout. The advice is based on mercury levels measured in fish from Hell Hole Reservoir.

Women 18–45 years and children 1–17 years

- Can eat 1 serving per week of Brown Trout 16 inches or less in length, crayfish species, or Kokanee Salmon
- Should not eat Brown Trout over 16 inches in length or Lake Trout

Women 46 years and older and men 18 years and older

- Can eat 3 servings per week of Brown Trout 16 inches or less in length or Kokanee Salmon, or
- Can eat 2 servings per week of crayfish species, or
- Can eat 1 serving per week of Lake Trout
- Should not eat Brown Trout over 16 inches in length

For more information, visit: http://oehha.ca.gov/advisories/hell-hole-reservoir.

Elkhorn Slough, Monterey County

In July 2016, the California state fish advisory for Elkhorn Slough, located near Monterey Bay in Monterey County, offered safe eating advice for Bat Ray, clams, Leopard Shark, Speckled Sanddab and surfperch. The advice is based on mercury and PCB levels measured in fish from Elkhorn Slough.

Women 18–45 years and children 1–17 years

- Can eat 7 servings per week of clams or Speckled Sanddab, or
- Can eat 3 servings per week of surfperch, or
- Can eat 1 serving per week of Bat Ray under 24 inches wide
- Should not eat Bat Ray 24 inches wide or more, or Leopard Shark

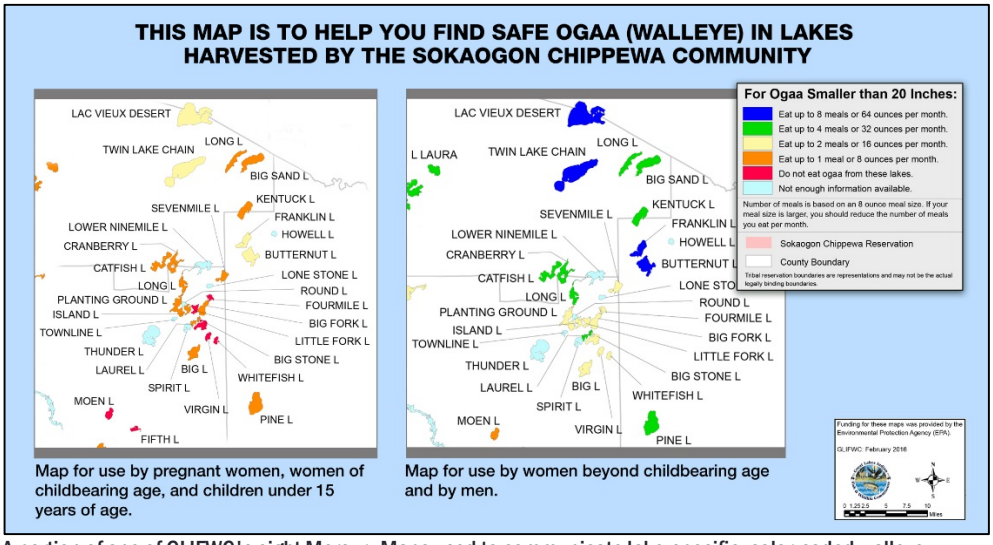
Women 46 years and older and men 18 years and older

- Can eat 7 servings per week of clams or Speckled Sanddab, or
- Can eat 4 servings per week of Bat Ray under 24 inches wide or surfperch, or
- Can eat 1 serving per week of Bat Ray 24 inches wide or more, or Leopard Shark

For more information, visit: http://oehha.ca.gov/advisories/elkhorn-slough.

Great Lakes Indian Fish & Wildlife Commission Maps

The harvest and consumption of ogaa (walleye) from inland lakes is an important part of the Anishinaabe bimaadiziwin, or traditional lifeway. Safe fish consumption information is communicated to tribal members via Great Lakes Indian Fish & Wildlife Commission's (GLIFWC's) Mercury Maps, available at http://glifwc.org/Mercury/mercury.html. The advice is based on mercury health risks and uniquely incorporates consideration of impacts on the traditions and culture of GLIFWC's member tribes. Advice is communicated using lake-specific, risk-based, culturally sensitive information via color-coded mercury maps. The maps combine text and graphics to encourage continued walleye harvest and consumption while limiting mercury intake. Each lake on the map is color coded to display how many meals of walleye per month have been deemed safe to eat from that lake. The advisories are based on data collected by GLIFWC and include state collected mercury data via cooperative data exchanges with state agencies. The maps provide facts about mercury levels in ogaa in ceded territory waters where member tribes commonly harvest these fish. The maps include advice for the general and sensitive populations. The maps are updated every two years.



A portion of one of GLIFWC's eight Mercury Maps used to communicate lake-specific, color-coded walleye consumption advice to their member tribes.

Oregon Health Authority Issues Statewide Advisory Recommending Limited Bass Consumption

The statewide advisory for bass was issued due to elevated levels of mercury found in fish tissue sampled from a number of water bodies across the state, including river systems. Bass are found across the state in many popular fishing waters, and the amount of data the state has for this species was adequate to warrant a statewide advisory. Meal recommendations were calculated for the general public (6 meals/month) and for at-risk populations

(2 meals/month). This statewide advisory and recommended meal allowances cover those water bodies that do not currently have an individual advisory in place for resident fish, including bass. For more information, visit http://healthoregon.org/fishadv.

EPA News

EPA's Great Lakes Fish Monitoring and Surveillance Program

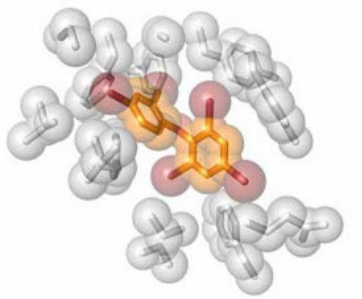
The Great Lakes Fish Monitoring and Surveillance Program (GLFMSP) is a long term monitoring program established in the 1970s. The program collects whole lake trout and walleye from each of the Great Lakes, on an annual basis, and analyzes them for chemical contaminants to assess ecosystem health. The program includes multiple components such as the Open Lakes Trend Monitoring Program, which focuses on long-term trends of legacy pollutants such as PCBs, organochlorine pesticides, and mercury; and the Emerging Contaminant Surveillance Program, which focuses on the identification and prioritization of new and emerging chemicals for prioritization for monitoring and to share with state and tribal health agencies. The latest trends of mercury in fish generally show a decline, with a few exceptions in lakes Huron and Erie, possibly related to food web changes and/or algal blooms. The GLFMSP maintains a long-term fish tissue archive and the data is publically available: https://www.epa.gov/great-lakes-monitoring/great-lakes-fish-monitoring-and-surveillance. An upcoming publication on mercury in top predator fish in the Great Lakes will document trends from 2004 to 2015 and explore how global mercury inputs are affecting levels in the Great Lakes.

Other News

Pollutants in Fish Inhibit Human's Natural Defense System

In a new study, environmental pollutants found in fish were shown to obstruct the human body's natural defense system to expel harmful toxins. The study was published in the April 15 issue of the journal *Science Advances*.

A protein found in cells of nearly all plants and animals, called P-gp, acts as the cell's bouncer by expelling foreign chemicals from the body. P-gp is well known for its ability to transport therapeutic drugs out of cancer cells and, in some cases, rendering these cells resistant to multiple drugs at once. To determine how effective P-gp is at ridding cells of industrial and agricultural pollutants found in seafood, collectively known as persistent organic pollutants (POPs), the Scripps research team conducted a biochemical analysis of P-gp proteins from humans and mice against POPs. The scientists focused on POPs most commonly found in human blood and urine, and also detected in the muscle tissues of wild-caught yellowfin tuna. The pollutants included older "legacy" compounds such as the pesticide DDT (dichlorodiphenyltrichloroethane) as well as newer industrial chemicals, such as flame retardants.

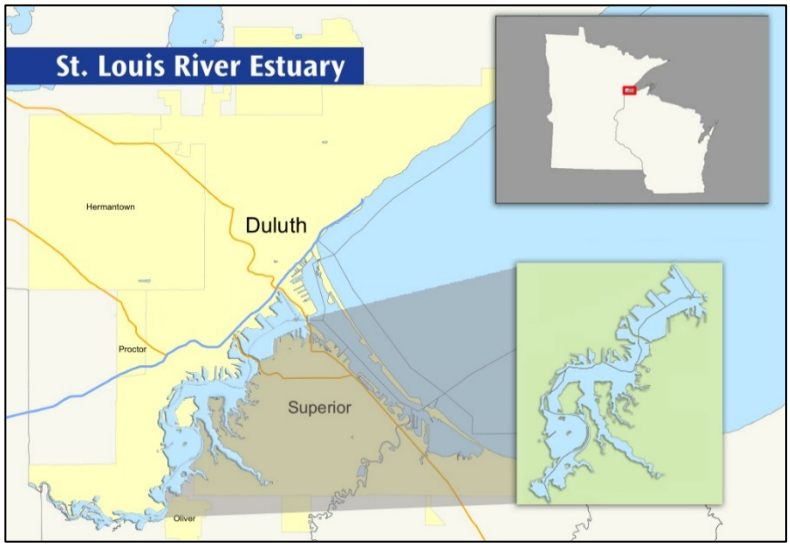


Close-up of the flame retardant PBDE-100 (orange-red) bound to mouse P-gp (grey). (*Image courtesy of UC San Diego)*

Working with researchers at UC San Diego's Skaggs School of Pharmacy and Pharmaceutical Science and School of Medicine, the researchers discovered that all ten pollutants interfered with the ability of P-gp to protect cells. The study was also the first to show how one of the ten pollutants, PBDE-100, commonly used as a flame retardant in upholstery foam and plastics, binds to the transporter protein. The POP binds to the protein in a similar way as chemotherapeutics and other drugs, but instead of being transported out of the cell, the bound POP ultimately inhibits the protein's ability to perform its defense function. The National Institute of Environmental Health Sciences, Waitt Foundation, and National Science Foundation funded the study. Researchers from Sekisui XenoTech, LLC also contributed to the research study: http://www.labmanager.com/news/2016/04/pollutants-in-fish-inhibit-human-s-natural-defense-system#.V2rBIPkrJD9.

Recently Awarded Research

Sea Grant Funds Mercury Pollution Research in the Great Lakes



St. Louis River Estuary. (*Image courtesy of Wikimedia; I-535_(MN-WI)_map.svg: 25or6to4)*

The University of Wisconsin—La Crosse (UWL) is among four colleges that received a $478,000 grant that will shed a light on mercury contamination in a highly industrialized area of the Great Lakes. The two-year grant from The University of Wisconsin Sea Grant Institute will allow UWL and a team of researchers from three other universities, to take a closer look at high levels of mercury contamination in the St. Louis River Estuary. The area runs into the western arm of Lake Superior between Duluth, Minnesota, and Superior, Wisconsin. The grant-funded research aims to understand why fish have high mercury content in this area, as well as to identify where the mercury contamination hot spots are.

Researchers will receive about $76,000 of the total funds to explore whether mercury hot spots translate to high levels of mercury and methylmercury in the organisms that live there. They will measure mercury concentrations in aquatic organisms such as snails and insects that live on top of the river sediment. UWL is collaborating with UW-Madison, University of Minnesota-Duluth and Gustavus Adolphus College in Minnesota on the project. Learn more: http://news.uwlax.edu/sea-grant-institute-funds-uwl-mercury-pollution-research-in-the-great-lakes/.

Connecticut Sea Grant Research

The Connecticut Sea Grant College Program is funding two research projects for approximately $150,000 each for the period of 2016 to 2018. The University of Connecticut Department of Marine Sciences will examine mercury concentrations and methylation in water and sediments, and how it accumulates into marine fish and shellfish.

They will sample multiple locations along the Connecticut coast that differ in mercury sediment concentration levels. They hope to explain how the nutrients (nitrogen and phosphorus) in coastal water bodies influence mercury methylation and accumulation in marine life.

The University of Connecticut Department of Marine Sciences will investigate the combined effects of warming waters and ocean acidification on a key species of copepod, *Acartia tonsa*. Copepods, small zooplankton, are the most abundant animals in the ocean and Long Island Sound, and are a primary food source for larger animals such as fish. Source: http://seagrant.uconn.edu/about/research.php.

Acartia tonsa. (*Image courtesy of Wikimedia; Uwe Kils)*

Recent Publications

Journal Articles

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

Human Dietary Exposure

- Disparity between state fish consumption advisory systems for methylmercury and U.S. Environmental Protection Agency recommendations: A case study of the south central United States
  Adams, K.J., R.W. Drenner, M.M. Chumchal, and D.I. Donato. 2016. Disparity between state fish consumption advisory systems for methylmercury and U.S. Environmental Protection Agency recommendations: A case study of the south central United States. *Environmental Toxicology and Chemistry* 35(1):247–251.

- Fish consumption among women anglers of childbearing age in the Great Lakes region
  Connelly, N.A., T.B. Lauber, J. Niederdeppe, and B.A. Knuth. 2016. Fish consumption among women anglers of childbearing age in the Great Lakes region. *Environmental Research* 150:213–218.

- Preliminary results of mercury levels in raw and cooked seafood and their public health impact
  Costa, F.N., M.G.A. Korn, G.B. Brito, S. Ferlin, and A.H. Fostier. 2016. Preliminary results of mercury levels in raw and cooked seafood and their public health impact. *Food Chemistry* 192:837–841.

- Mercury risks versus nutritional benefits of tribal commercial fish harvests in the Upper Laurentian Great Lakes
  Dellinger, M.J., and M.P. Ripley. 2016. Mercury risks versus nutritional benefits of tribal commercial fish harvests in the Upper Laurentian Great Lakes. *Human and Ecological Risk Assessment: An International Journal* 22(4):1036–1049.

- Mercury, selenium and fish oils in marine food webs and implications for human health
  Gribble, M.O., R. Karimi, B.J. Feingold, J.F. Nyland, T.M. O'Hara, M.I. Gladyshev, and C.Y. Chen. 2016. Mercury, selenium and fish oils in marine food webs and implications for human health. *Journal of the Marine Biological Association of the United Kingdom* 96(1):43–59.

- Fish consumption, brain mercury, and neuropathology in patients with Alzheimer disease and dementia
  Kröger, E., and R. Laforce, Jr. 2016. Fish consumption, brain mercury, and neuropathology in patients with Alzheimer disease and dementia. *The Journal of the American Medical Association* 315(5):465–466.

- Association of seafood consumption, brain mercury level, and APOE ε4 status with brain neuropathology in older adults
  Morris, M.C., J. Brockman, J.A. Schneider, Y. Wang, D.A. Bennett, C.C. Tangney, and O. van de Rest. 2016. Association of seafood consumption, brain mercury level, and APOE ε4 status with brain neuropathology in older adults. *The Journal of the American Medical Association* 315(5):489–497.

- Human exposure to methylmercury from crayfish (*Procambarus clarkii*) in China
  Peng, Q., B.K. Greenfield, F. Dang, and H. Zhong. 2016. Human exposure to methylmercury from crayfish (*Procambarus clarkii*) in China. *Environmental Geochemistry and Health* 38(1):169–181.

- Assessment of health risk from heavy metal contamination of shellfish from the Persian Gulf
  Raissy, M. 2016. Assessment of health risk from heavy metal contamination of shellfish from the Persian Gulf. *Environmental Monitoring and Assessment* 188(1):55.

- Cord blood methylmercury and fetal growth outcomes in Baltimore newborns: Potential confounding and effect modification by omega-3 fatty acids, selenium, and sex
  Wells, E.M., J.B. Herbstman, Y.H. Lin, J. Jarrett, C.P. Verdon, C. Ward, K.L. Caldwell, J.R. Hibbeln, F.R. Witter, R.U. Halden, and L.R. Goldman. 2016. Cord blood methylmercury and fetal growth outcomes in Baltimore newborns: Potential confounding and effect modification by omega-3 fatty acids, selenium, and sex. *Environmental Health Perspectives* 124(3):373–379.

- Low-level gestational exposure to mercury and maternal fish consumption: Associations with neurobehavior in early infancy
  Xu, Y., J.C. Khoury, H. Sucharew, K. Dietrich, and K. Yolton. 2016. Low-level gestational exposure to mercury and maternal fish consumption: Associations with neurobehavior in early infancy. *Neurotoxicology and Teratology* 54:61–67.

Mercury Concentrations

- Mercury in marine fish, mammals, seabirds, and human hair in the coastal zone of the southern Baltic
  Beldowska, M., and L. Falkowska. 2016. Mercury in marine fish, mammals, seabirds, and human hair in the coastal zone of the southern Baltic. *Water, Air, & Soil Pollution* 227:52.

- Total mercury (T-Hg) in *Anomalocardia brasiliana* (Mollusca) under different biological and environmental conditions
  da Silva-Cavalcanti, J.S., M.F. da Costa, and H.A. Kehrig. 2016. Total mercury (T-Hg) in *Anomalocardia brasiliana* (Mollusca) under different biological and environmental conditions. *Latin American Journal of Aquatic Research.* 44(2):267–274.

- Key contributors to variations in fish mercury within and among freshwater reservoirs in Oklahoma, USA
  Dong, Z., R.A. Lynch, and L.A. Schaider. 2016. Key contributors to variations in fish mercury within and among freshwater reservoirs in Oklahoma, USA. *Environmental Science: Processes & Impacts* 18(2):222–236.

- Influence of physiological gastrointestinal parameters on the bioaccessibility of mercury and selenium from swordfish
  Jadán-Piedra, C., M.J. Clemente, V. Devesa, and D. Vélez. 2016. Influence of physiological gastrointestinal parameters on the bioaccessibility of mercury and selenium from swordfish. *Journal of Agricultural and Food Chemistry* 64(3):690-698.

- Mercury accumulation, and the mercury-PCB-sex interaction, in Lake Whitefish (*Coregonus clupeaformis*)
  Madenjian, C.P., M.P. Ebener, and D.P. Krabbenhoft. 2016. Mercury accumulation, and the mercury-PCB-sex interaction, in Lake Whitefish (*Coregonus clupeaformis*). *Environments* 3(1):7.

- Evidence of mercury biomagnification in the food chain of the cardinal tetra *Paracheirodon axelrodi* (Osteichthyes: Characidae) in the Rio Negro, central Amazon, Brazil
  Marshall, B.G., B.R. Forsberg, M. Thomé-Souza, R. Peleja, M.Z. Moreira, and C.E.C. Freitas. 2016. Evidence of mercury biomagnification in the food chain of the cardinal tetra *Paracheirodon axelrodi* (Osteichthyes: Characidae) in the Rio Negro, central Amazon, Brazil. *Journal of Fish Biology* 89(1):220-240.

- Bioaccumulation of mercury in fish as indicator of water pollution
  Moiseenko, T.I., and N.A. Gashkina. 2016. Bioaccumulation of mercury in fish as indicator of water pollution. *Geochemistry International* 54(6):485–493.

- Mercury and selenium in fish of Fountain Creek, Colorado (USA): Possible sources and implications
  Nimmo, D.R., S.J. Herrmann, J.S. Carsella, C.M. McGarvy, H.P. Foutz, L.M. Herrmann-Hoesing, J.M. Gregorich, J.A. Turner, and B.D. Vanden Heuvel. 2016. Mercury and selenium in fish of Fountain Creek, Colorado (USA): Possible sources and implications. *SpringerPlus* 5:437.

- Collaborative study on determination of mono methylmercury in seafood
  Valdersnes, S., P. Fecher, A. Maage, and K. Julshamn. 2016. Collaborative study on determination of mono methylmercury in seafood. *Food Chemistry* 194:424–431.

Other

- Is it appropriate to composite fish samples for mercury trend monitoring and consumption advisories?
  Gandhi, N., S.P. Bhavsar, S.B. Gewurtz, K.G. Drouillard, G.B. Arhonditsis, and S. Petro. 2016. Is it appropriate to composite fish samples for mercury trend monitoring and consumption advisories? *Environment International* 88:80–85.

- Antagonistic growth effects of mercury and selenium in *Caenorhabditis elegans* are chemical-species-dependent and do not depend on internal Hg/Se ratios
  Wyatt, L.H., S.E. Diringer, L.A. Rogers, H. Hsu-Kim, W.K. Pan, and J.N. Meyer. 2016. Antagonistic growth effects of mercury and selenium in *Caenorhabditis elegans* are chemical-species-dependent and do not depend on internal Hg/Se ratios. *Environmental Science & Technology* 50(6):3256–3264.

Upcoming Meetings and Conferences

146th Annual Meeting of the American Fisheries Society
August 21–25, 2016
Kansas City, Missouri

18th International Conference on Shellfish Restoration
November 16–19, 2016
Charleston, South Carolina

Pacific Coast Shellfish Growers Association 70th Annual Shellfish Conference and Tradeshow
October 11–14, 2016
Chelan, Washington

67th Annual Northwest Fish Culture Concepts: A Workshop for Fish Culturists
December 6–8, 2016
Centralia, Washington

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 (NLFA) 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.