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Fish and Shellfish Program NEWSLETTER

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In This Issue

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

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

Recent Advisory News

2017 Fish Consumption Advisories Issued In California

In 2017, the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment (OEHHA) issued fish advisories for 18 California water bodies. Fish advisories recommend how often you can safely eat certain types of fish, and are based on the level of chemical contaminants measured in fish caught recreationally in a specific water body. In its advisories, OEHHA offers two sets of guidelines for consuming fish, one for each population:

- Women 18-45 years and children 1-17 years
- Men 18 years and older and women 46 years and older.

"Many fish have nutrients that may reduce the risk of heart disease and are an excellent source of protein," said Dr. Lauren Zeise, director of OEHHA. "By following our guidelines, people can safely eat fish low in chemical contaminants and enjoy the well-known health benefits of fish consumption."

One serving is eight ounces prior to cooking. For fish fillets, eight ounces is roughly the size and thickness of your hand. Children should be given smaller servings.

Eating fish in amounts slightly greater than the advisory's recommendations is not likely to cause health problems if it is done occasionally, such as eating fish caught during an annual vacation.

The following table lists the 18 advisories.

2017 Fish Advisories Issued in California				
			Servings per Week	
Waterbody (County) Advisory Issue Date	Contaminant	Fish Species	Women 18-45 Years Children 1–17 Years	Women 46 Years & Older Men 18 Years & Older
Anderson Reservoir (Santa Clara County) August 8, 2017	Mercury or PCBs	Black bass or Channel Catfish	0	1
		Carp	0	2
		Crappie or sunfish	1	2
Castaic Lagoon (Los Angeles County) January 20, 2017	Mercury or PCBs	Black bass	1	2
		Carp	2	2
		Sunfish	7	7
Castaic Lake (Los Angeles County) January 20, 2017	Mercury or PCBs	Channel Catfish	0	1
		Black bass	0	2
		Carp	2	3
		Sunfish	3	3
Jenkinson Lake (El Dorado County) April 5, 2017	Mercury	Black bass	1	2
		Sunfish	3	7
		Rainbow Trout	7	7
Lafayette Reservoir (Contra Costa County) August 1, 2017	Mercury or PCBs	Goldfish	0	2
		Black bass	1	2
		Channel Catfish	3	7
		Rainbow Trout	5	5
Lake Almanor (Plumas County) November 14, 2017	Mercury	Sacramento Sucker	0	1
		Black bass	1	4
		Rainbow Trout	2	5
		Inland Silverside	7	7
Lake Chabot (Alameda County) August 2, 2017	Mercury or PCBs	Black bass or carp	0	1
		Goldfish	0	2
		Sunfish	2	4
		Channel Catfish	2	7
		Rainbow Trout	7	7
Lake Evans (Riverside County) March 15, 2017	Mercury or PCBs	Channel Catfish	0	0
		Black bass or sunfish	4	4
		Carp	7	7
Lake Havasu (San Bernardino County) February 28, 2017	Mercury or Selenium	Striped Bass	2	2
		Black bass	2	4
		Sunfish	3	3
		Channel Catfish	3	7
		Carp	4	4
Lake Merced (San Francisco County) July 20, 2017	Mercury or PCBs	Channel Catfish	0	0
		Black bass	0	1
		Rainbow Trout	7	7

2017 Fish Advisories Issued in California				
			Servings per Week	
Waterbody (County) Advisory Issue Date	Contaminant	Fish Species	Women 18-45 Years Children 1–17 Years	Women 46 Years & Older Men 18 Years & Older
Lake San Antonio (Monterey And San Luis Obispo Counties) April 5, 2017	Mercury	Striped Bass	0	1
		Black bass or carp	1	2
		Channel Catfish	1	3
		Bullhead or Inland Silverside or White Catfish	3	7
Lake Temescal (Alameda County) December 12, 2017	Mercury or PCBs	Carp	0	0
		Black bass	1	3
		Sunfish	2	7
New Bullards Bar Reservoir (Yuba County) July 6, 2017	Mercury	Black bass or carp	0	1
		Kokanee Salmon or sunfish	2	5
		Rainbow Trout	2	6
New Hogan Lake (Calaveras County) January 20, 2017	Mercury	Black bass	0	1
		Channel Catfish	1	2
		Sunfish	1	3
O'Neill Forebay (Merced County) October 24, 2017	Mercury or PCBs	Catfish	1	1
		Black bass or Striped Bass	1	2
		Inland Silverside	6	7
San Luis Reservoir (Merced County) October 24, 2017	Mercury or PCBs	Black bass or carp or Striped Bass	0	1
		American Shad	1	2
		Tule Perch	2	5
Shasta Lake (Shasta County) February 27, 2017	Mercury or PCBs	Channel Catfish	0	1
		Black bass or Chinook (King) Salmon	1	2
		Carp	1	3
		Rainbow Trout	2	6
		Sunfish	3	7
Wiest Lake (Imperial County) June 13, 2017	Selenium	Crappie or sunfish	4	4
		Black bass	6	6
		Channel Catfish	7	7

OEHHA currently offers over ninety advisories for water bodies throughout California, which are available on OEHHA's Fish Advisories webpage: http://www.oehha.ca.gov/fish/advisories. Pictorial versions of the fish consumption advice are also available for many water bodies in both English and Spanish. For water bodies that do not have site-specific advice, OEHHA recommends following the statewide advisory for eating fish from California's lakes and reservoirs without site-specific advice.

OEHHA is the primary state entity for the assessment of risks posed by chemical contaminants in the environment. Its mission is to protect and enhance public health and the environment by scientific evaluation of risks posed by hazardous substances.

For more information, contact Sam Delson at 916-324-0955 (office) or 916-764-0955 (cell).

Source: https://oehha.ca.gov/fish?attributes%5Bclass%5D%5B0%5D=btn-primary

Oklahoma Department of Environmental Quality Cautions Public About Eating Fish from Oklahoma Lakes: 2017 Updated Mercury in Fish Booklet

Fishing is a great pastime and tradition in Oklahoma. Fish provide many benefits that are essential for a healthy diet; however, some fish pose a higher risk from mercury contamination. The Oklahoma Department of Environmental Quality (OK DEQ) encourages Oklahomans to go fishing and enjoy eating the fish they catch. Just keep in mind that not all fish should be eaten in unlimited amounts. By following these guidelines, you can make safe, informed choices for you and your family and still enjoy the sport of fishing.

In 2017, fish from the following lakes have been tested and some species and size ranges have mercury levels high enough that consumption should be limited. Both new fish consumption advisories and updated advisories were issued.

Oklahoma Fish Consumption Advisories in 2017	
Waterbody Name	**Advisory Action in 2017**
Birch Reservoir	New Advisory
Boomer Lake	New Advisory
Broken Bow Reservoir	Updated Advisory
Canton Reservoir	Updated Advisory
Copan Reservoir	New Advisory
El Reno Lake	New Advisory
Greenleaf Reservoir	New Advisory
Hugo Reservoir	Updated Advisory
Lake Arcadia	New Advisory
Lake Heyburn	Updated Advisory
Lake McMurtry	New Advisory
Lake Murray	New Advisory
Lake Ponca	New Advisory
Lake Raymond Gary	New Advisory
Lake Wister	Updated Advisory
Lone Chimney Lake	New Advisory
McGee Creek Reservoir	Updated Advisory
Pawnee Lake	New Advisory
Pine Creek Reservoir	Updated Advisory
Rush Lake	Updated Advisory
Sardis Reservoir	Updated Advisory
Shell Lake	New Advisory
Waurika Reservoir	New Advisory
Wewoka Lake	Updated Advisory

The 2017 updated Mercury in Fish booklet, also called *A Guide to Healthy Fish Consumption in Oklahoma*, describes safe guidelines for consuming fish caught in Oklahoma lakes. Guidelines for each fish listed are divided into two categories:

- Sensitive Population: Women of childbearing age, pregnant or nursing mothers, and children up to age 15
- General Population: Males age 15 and older and women past childbearing age

Advisories are based on consumption amounts of:

- Two meals per month: Consume no more than two meals per month of fish in the size ranges listed. Meal size equals eight ounces (proportionally smaller for children).
- No meals per month: Do not consume fish within the size ranges listed.
- DO NOT EAT: All size ranges, both large and small, have mercury levels which make them unsafe to eat.
- No restriction: These fish have lower levels of mercury and can be eaten often safely.

OK DEQ regularly tests many lakes in the state; however, it is not possible to test every species of fish in every body of water. If a lake or species has not been tested then the following advice is recommended:

- Advice for the General Population: Since women beyond childbearing age and men older than 15 years of age are less at risk for the effects of mercury, these groups may continue to eat a variety of fish, including predators, as part of a healthy diet unless specifically advised otherwise.

Lake Texoma has been tested and found to have lower levels of mercury *(Photo courtesy of U.S. Army Corps of Engineers, Tulsa District)*

- Advice for the Sensitive Population: Women of childbearing age and children up to the age of 15 should consume no more than one meal per week of predator fish. Predator fish include largemouth, smallmouth, spotted, white, striped, or hybrid bass, walleye, saugeye, and flathead catfish.

The Good News: Fish provide many healthy benefits. Fish are a good source of protein, high in omega-3 fatty acids, high in vitamins and minerals, and low in fat. U.S. Environmental Protection Agency (EPA) and the U.S. Food and Drug Administration recommend women who are or may become pregnant, breastfeeding mothers, and children starting at the age of two, eat eight to 12 ounces of lower mercury fish per week.

The fish in the following Oklahoma lakes have been tested and have lower levels of mercury. Fish from these lakes can be eaten often without excessive exposure to mercury.

Bell Cow Lake	Sooner Lake	New Spiro Lake
Lake Hefner	Lake Eucha	Lake Texoma
Lake Overholser	Lake Konawa	Lake Fuqua
Chandler Lake	Lake Spavinaw	Okemah Lake
Holdenville Lake	Ft. Cobb	Lake Thunderbird
Robert S. Kerr Reservoir	Keystone Reservoir	Grand Lake
Dripping Springs Lake	Lake Talawanda #1	Okmulgee Lake
Lake Hudson	Ft. Gibson	Lake WD Mayo
Shawnee Twin Lakes	Lake Lawtonka	Guthrie City Lake
Lake Ellsworth	Lake Tenkiller	Lake Oolagah
John Wells Lake	Foss Reservoir	Wes Watkins Reservoir

If a lake is not included in the list above or in the following pages, OK DEQ may be testing it soon and updates will be issued.

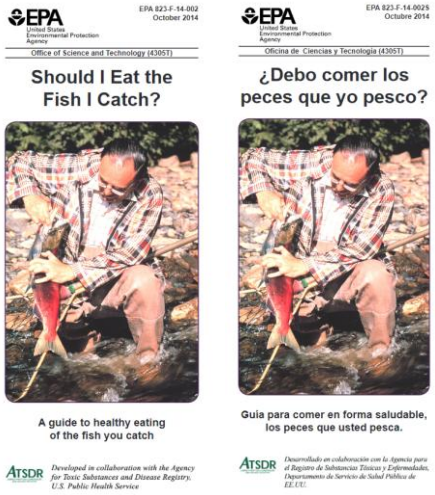
For more information call OK DEQ at 1-866-412-3057.

Source: http://www.deq.state.ok.us/CSDneW/fish/index.htm

EPA News

EPA's *Should I Eat the Fish I Catch* Brochure Available in English and Spanish

EPA works to make information accessible in a variety of formats to encourage people to eat fish as part of a healthy diet. These resources provide information on specific fish species that are safer to eat. The "Should I Eat the Fish I Catch" brochure helps fish consumers select and prepare fish that are low in chemical pollutants. By following these recommendations, people can continue to enjoy the benefits of eating fish. It is available in both English and Spanish and can be viewed here. This brochure may be reproduced without the EPA's permission at no charge and copies can be ordered by contacting the National Service Center for Environmental Publications at (800)490-9198 or at nscep@lmsolas.com.



"Should I Eat the Fish I Catch" brochures *(Images courtesy of EPA)*

For more information on staying healthy by eating wisely, visit https://www.epa.gov/choose-fish-and-shellfish-wisely/stay-healthy-eating-fish-and-shellfish-wisely.

Other News

Oregon's Statewide Aquatic Tissue Toxics Assessment Report

In August 2017, the Oregon Department of Environmental Quality (ODEQ) Laboratory and Environmental Assessment Program published a statewide assessment report on toxic compounds in fish tissue across Oregon. This report is the second of the ODEQ Statewide Water Quality Toxic Monitoring Program's three part assessment of toxic contaminants in Oregon's waters. The first part detailed toxic contaminants in water, while the third part will summarize these compounds in sediment. The August 2017 report is the first statewide assessment of toxics in fish tissue completed in Oregon.

ODEQ Statewide Water Quality Toxics Monitoring Program, which began in 2008, identified four main goals:

1. Gather information to characterize the presence and concentration of chemicals of concern in Oregon's waters
2. Use this information to identify sources of these chemicals
3. Present and make available information gathered for public benefit
4. Work with ODEQ internal groups, community groups, and Oregon citizens to identify opportunities for reducing these pollutants

To achieve these goals, the ODEQ Laboratory and Environmental Assessment Program developed a monitoring plan using a rotating basin approach to conduct a reconnaissance sampling of the state's waters over five years. The monitoring, sampling, and analytical methods evolved over the course of the study. Initial sampling focused solely on water and fish tissue. However, the completion of the water sampling in 2013 resulted in collections of water, sediment, finfish, and shellfish. Several state-of-the-art analytical methods were added over time.

Specific information on methods and complete analyte lists for each method are found in the project's quality assurance plan and yearly sampling and analysis plans. These documents are available upon request from the ODEQ laboratory.

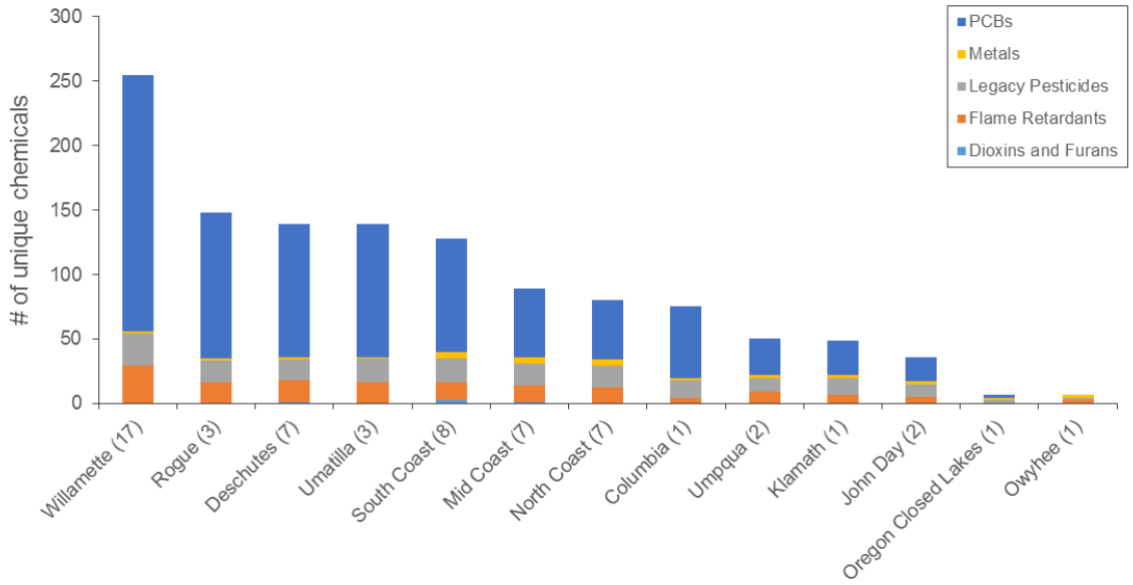
Findings

From 2008 to 2015, the ODEQ laboratory analyzed tissue samples from 58 sites across the state. These sites included coastal estuaries, large rivers, and small streams. This study analyzed over 330 unique chemicals in finfish and shellfish tissue, which required nine different analytical methods. Key findings:

- 268 unique chemicals detected in tissue samples statewide
- Most detected chemicals at very low concentrations and below applicable criteria or screening values for human consumption

- Largest variety of chemicals detected in the Willamette Basin, followed by the Rogue Basin
- Legacy pesticides detected in each basin with the highest percent of detections in the Columbia Basin
- Mercury measured at levels above Oregon Health Authority (OHA) Fish Advisory guidelines and ODEQ water quality criterion in each basin sampled
- Mercury the most commonly detected group, present at 100 percent of sites, followed by flame retardants, present at 95 percent of sites
- Legacy pesticides detected at higher concentrations in mussels and oysters than in softshell clam species
- Inorganic arsenic (one of the metals in the image below) measured at levels of concern above OHA Fish Advisory guidelines in shellfish in each coastal basin leading to issuance of OHA consumption advisory
- Highest concentrations of inorganic arsenic found in the siphon skins of gaper and softshell clams

In 2016, OHA published guidance regarding the consumption of fish tissue. The screening values are based on a consumption rate of 30 grams per day (g/day) and a body weight of 70 kilograms. These screening values are used throughout this report for all analytes with the exception of mercury. For mercury, the Human Health criterion adopted by ODEQ in 2011 was used. This criterion was based on a consumption rate of 175 g/day rather than the OHA consumption rate of 30 g/day to protect subsistence fishers.



Number of unique chemicals detected in each basin by chemical group. Parentheses indicate the number of sampling sites per basin. Mercury is included in the Metals chemical group in this figure. *(Figure 3 of ODEQ's Statewide Aquatic Tissue Toxics Assessment Report, August 2017)*

Next Steps

ODEQ will use data from this study to inform and develop future tissue sampling efforts. These efforts will be tied to the water quality toxics monitoring efforts. This approach aims to monitor each basin in the state over the course of five years. The current rotation began in 2015 in the Klamath, North Coast, Umpqua, and Rogue basins. In 2016, crayfish samples were collected in the Willamette, John Day, Powder, Walla Walla, and Grande Ronde basins in place of finfish. By sampling a relatively sedentary organism compared to most finfish, it is thought that samples will provide a more holistic representation of the aquatic environment. Additional tissue samples will be collected and analyzed in conjunction with partner agency sampling efforts.

For more information, contact Lori Pillbury at Pillsbury.lori@deq.state.or.us.

Source: http://www.oregon.gov/deq/FilterDocs/wqmtissueaq.pdf

Scientists Puzzled By Mercury's Jump In Great Lakes Fish

March 25, 2017, Detroit Free Press

Though advisories about toxic mercury in fish have continued in Michigan and the surrounding Great Lakes, with recommendations to limit consumption of certain species to a few times per month, the amount of mercury found in fish tissues has dropped steadily over decades since the 1970s. That corresponded with the reduction of pollution coming from Midwestern smokestacks as regulations tightened, pollution prevention technology improved, and coal-fired factories and power plants went offline.

But over the last several years, that started changing. Scientists are finding mercury levels rising in large Great Lakes fish such as walleye and lake trout. It's occurring with fish in some locations but not others. Researchers are still trying to figure out why.

The mercury levels are not surpassing EPA thresholds, but researchers want to determine if what they are seeing is a temporary trend or a trajectory that's only going to worsen.

The answer has large ramifications for Michigan's vital sports fishing industry. Anglers spent $2.4 billion in trip-related expenses and equipment in 2011, according to the Michigan Department of Natural Resources.

Lake trout (*Salvelinus namaycush*) *(Image courtesy of U.S. Fish and Wildlife Service)*

EPA has found that mercury in water has the potential to cause kidney damage from short-term exposures at levels above the maximum contaminant level of just 0.002 parts per million. Mercury can inhibit brain development in fetuses and children, and harm immune systems and adult heart function.

Environment and Climate Change Canada, a similar agency to EPA, looks at data collected from multiple fish species and herring gull egg monitoring across the Great Lakes. One of the

survey sites for gull eggs is on Canada's Fighting Island, in the Detroit River near Wyandotte, said Agnes Richards, a research scientist with Environment and Climate Change Canada.

"We've been monitoring since the 1970s, and the (mercury contamination) trends overall have been declining — as have been the emissions of mercury into the atmosphere and deposition into the lakes," she said. "We decided to look at recent trends, from 2000 to 2015. What we found is, at some specific sites, trends have reversed."

The researchers published a finding of their studies in late December 2017.

The issue has been noticed on the Michigan side of the Great Lakes as well.

"Out of 19 data sets, we see eight where we can see a significant trend" of mercury levels rising in certain fish, said Joseph Bohr, aquatic biologist for the Michigan Department of Environmental Quality's Water Resources Division, which does its own fish monitoring.

On Lake Michigan, walleye and lake trout from Grand Traverse Bay show increases, Bohr said. On Lake Huron, walleye from Saginaw Bay and lake trout from Thunder Bay have rising levels. Mercury levels in Lake Erie walleye have also risen. The average rate of increase is about two percent per year in the fish, he said.

But at least for now, the mercury spikes are in isolated locations.

"We have 11 other data sets where we're not showing any significant increase," Bohr said.

Scientists only have hypotheses regarding why this is occurring. The trend of warming Great Lakes could be a factor, said Shane de Solla, an ecotoxicologist with Environment and Climate Change Canada and co-author on the recent study.

Methylmercury tends to be absorbed into fish tissues. As small fish eat contaminated insects, and medium-sized fish eat the smaller fish, and large game fish eat the medium fish, those mercury concentrations get magnified exponentially, a process known as bioaccumulation.

"The lakes are slightly warmer, and that increases the production of methylmercury," de Solla said.

The region's more frequent and intense storms in recent years could also be a factor, Richards said.

"That results in a lot of flooding, and the re-suspension of sediments," she said. "What was buried before can become exposed, and that can increase the conversion of mercury to methylmercury."

And invasive species in the Great Lakes likely also play a role.

"It's really significantly changed the food web," Bohr said.

The timelines for the explosion of invasive zebra and quagga mussel populations in the Great Lakes, as well as the round goby, a small fish, rather neatly correlate with the reversal of declining mercury levels in sport fish, he noted.

"You can't just ignore that," he said.

Further evidence of invasive species' disruption of fish diets as a possible culprit for the mercury mystery comes from carp. In Grand Traverse, Saginaw, and Thunder bays, unlike walleye and lake trout, carp aren't showing rises in their mercury levels, Bohr said. From the St. Clair River, through Lake St. Clair and the Detroit River, carp are even showing decreases in mercury, he said.

That's significant, because bottom-feeding carp are eating different meals than the large sport fish.

Zebra mussels (*Dreissena polymorpha*) (top) and Quagga mussels (*Dreissena bugensis*) (bottom) *(Images courtesy of U.S. Fish and Wildlife Service)*

"They're low on the food chain," Bohr said. "They're just mucking around on the bottom eating insects, basically."

One researcher stated that he does not "see anything catastrophic in the next little while." But if the mercury numbers do continue to increase in Great Lakes fish, "it could become a problem again."

That highlights the importance of continued monitoring, Richards said, "to see if this is a slight oscillation or a growing trend."

For more information, contact Agnes Richards, Environment and Climate Change Canada, at agnes.richards@canada.ca, and Joseph Bohr, Michigan Department of Environmental Quality, at BOHRJ@michigan.gov.

Study citation: Blukacz-Richards, E. A, Visha, A., Graham, M. L., McGoldrick, D. L., de Solla, S.,R., Moore, D. J., & Arhonditsis, G. B. (2017). Mercury levels in herring gulls and fish: 42 years of spatio-temporal trends in the Great Lakes. Chemosphere, 172, 476-487. Available online at: http://www.sciencedirect.com/science/article/pii/S0045653516318926.

Source: https://www.freep.com/story/news/local/michigan/2017/03/24/mercury-rising-scientists-puzzled-metals-jump-great-lakes-fish/99306786/

Recently Awarded Research

Centers of Research Excellence in Science and Technology-Postdoctoral Research Fellowship: Linking Physiology and Demography in the Eastern Mosquitofish, *Gambusia holbrooki*

The National Science Foundation Centers of Research Excellence in Science and Technology-Postdoctoral Research Fellowship (CREST-PRF) has awarded $200,000 to the CREST Center for Aquatic Chemistry and the Environment (CAChE) at Florida International University. The award will support a project focused on how mercury affects organisms' physiology, vital rates, and local population growth. The Everglades, a network of interconnected freshwater ecosystems that includes local areas contaminated by mercury and its methylated or organic form, methylmercury, will provide a natural laboratory for this study. The eastern mosquitofish, *Gambusia holbrooki*, will be used as a model species to document the demographic and population consequences of physiological stress induced by water contaminants (mercury). Since the eastern mosquitofish play a critical role in the Everglades food webs, this project will advance our knowledge and understanding of how human-induced contaminants affect aquatic biota. Findings from this study will be useful for designing conservation and restoration activities. In addition, this research project will be integrated into the education and outreach program at the Center.

Eastern mosquitofish (*Gambusia holbrooki*) *(Image courtesy of U.S. Geological Survey)*

The overarching goal of the research is to determine whether the organism's physiological response to environmental stress regulates individual and population performance. Although other studies have examined the demographic consequences of stress in aquatic organisms, studies considering multiple life-history traits (e.g. growth, survival, and reproduction) are scarce. Furthermore, research examining how local population dynamics are affected by variation in patterns of resource allocation due to physiological stress, are warranted. This study will also test the life-history trade-off hypothesis as the basis to understand species' adaptation to environmental conditions by measuring the relationship between organisms' physiological conditions and demographic and population performance. This project will address such gaps by measuring, both in the field and in controlled lab experiments, the demographic response of *Gambusia holbrooki* to mercury-induced physiological stress. The demographic data (growth, survival, and reproductive output) will be used to develop stage-based population matrix models to estimate population growth rates under different physiological pressures. By combining empirical physiological data with demographic modeling, the proposed study will be among the first to test such a relationship directly. The outcomes of this study will provide quantitative evidence of the success (or failure) of using physiological measurements as a biomarker to determine the effects of water contaminants in the demography and life-history traits of aquatic organisms.

The project began on December 1, 2017, and its estimated completion date is November 30, 2019.

Source: https://www.nsf.gov/awardsearch/showAward?AWD_ID=1720727&HistoricalAwards=false

EPA Awards $5.2 Million to Protect and Restore San Francisco Bay

On October 10, 2017, EPA awarded about $5.2 million for water protection and restoration projects in the San Francisco Bay Area.

San Francisco Bay is a designated "estuary of national significance" under the Clean Water Act. The bay and its tributary streams, situated in an urban area with more than seven million people, provide crucial fish and wildlife habitat at the heart of the larger Bay-Delta Estuary. The bay's users and nearby residents are all affected by threats to its ecological health, including legacy pollutants like mercury and polychlorinated biphenyl (PCBs), polluted stormwater, and the challenges of drought and climate change.

The five main areas of the San Francisco Bay Detla Watershed *(Image courtesy of EPA)*

The following organizations are some that received EPA grants for projects that benefit San Francisco Bay and its watersheds:

Contra Costa County Flood Control and Water Conservation District will receive $1.5 million for the restoration of Lower Walnut Creek. This project will restore up to 110 acres of tidal wetlands and an additional 100 acres of transitional habitat (areas that will become wetlands as sea levels rise).

San Francisco Recreation and Parks Department will receive $1.2 million for remediation work at India Basin Waterfront Parks. This project will restore an area of tidal marsh with shoreline access by removing about 3,500 cubic yards of sediment contaminated with PCBs, copper, lead, mercury, and nickel.

Zone 7 Flood Control Agency will receive $1.1 million for watershed restoration work on Alameda Creek. This project will include constructing more than 2,000 feet of stream bank setbacks and floodplain areas, improving flood protection and steelhead trout habitat.

EPA also awarded a combined $878,245 to the Association of Bay Area Governments (ABAG) to protect and restore water quality in and around the bay. This includes a $600,000 National Estuary Program grant for the implementation of the San Francisco Estuary Partnership's Estuary Blueprint. The Blueprint addresses issues such as rising sea levels, habitat loss, and urban pollutants through projects that include pollution prevention education for boaters and stormwater infrastructure development.

ABAG will also receive a $278,245 wetland grant to work in partnership with the San Francisco Estuary Institute on the development of a Bay Area wetland regional monitoring plan. The plan will provide a consistent way to measure over time how tidal wetlands are responding to both restoration efforts and stressors (such as sea level rise).

For more information about EPA's San Francisco Bay Water Quality Improvement Fund, visit: http://www.epa.gov/sfbay-delta/sf-bay-water-quality-improvement-fund.

For more information about EPA's National Estuary Program, visit: https://www.epa.gov/nep.

For more information about EPA's Wetland Program Development Grants, visit: https://www.epa.gov/wetlands/wetland-program-development-grants.

For more information about this award, contact Michele Huitric at 415-972-3165 or huitric.michele@epa.gov.

Source: https://www.epa.gov/newsreleases/us-epa-awards-52-million-protect-and-restore-san-francisco-bay

Recent Publications

Journal Articles

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

- A multi-metal risk assessment strategy for natural freshwater ecosystems based on the additive inhibitory free metal ion concentration index
  Alves, C.M., C.M.H. Ferreira, E.V. Soares, and H.M.V.M. Soares. 2017. A multi-metal risk assessment strategy for natural freshwater ecosystems based on the additive inhibitory free metal ion concentration index. *Environmental Pollution* 223:517-523.

- Genotoxicity and oxidative stress in fish after a short-term exposure to silver nanoparticles
  Bacchetta, C., A. Ale, M.F. Simoniello, S. Gervasio, C. Davico, A.S. Rossi, M.F. Desimone, G. Poletta, G. López, J.M. Monserrat, and J. Cazenave. 2017. Genotoxicity and oxidative stress in fish after a short-term exposure to silver nanoparticles. *Ecological Indicators* 76:230-239.

- Oxidative stress profiles in brain point out that a higher susceptibility of fish to waterborne divalent mercury compared to dietary organic mercury
  Cardoso, O., S. Puga, F. Brandão, J. Canário, N.J. O'Driscoll, M.A. Santos, M. Pacheco, and P. Pereira. 2017. Oxidative stress profiles in brain point out that a higher susceptibility of fish to waterborne divalent mercury compared to dietary organic mercury. *Marine Pollution Bulletin* 122(1-2):110-121.

- Trophic decline and distribution of barium in a freshwater ecosystem
  Donald, D.B. 2017. Trophic decline and distribution of barium in a freshwater ecosystem. *Hydrobiologia* 784(1):237-247.

- Effects of chronic exposure to waterborne copper and nickel in binary mixture on tissue-specific metal accumulation and reproduction in fathead minnow (*Pimephales promelas*)
  Driessnack, M.K., A. Jamwal, and S. Niyogi. 2017. Effects of chronic exposure to waterborne copper and nickel in binary mixture on tissue-specific metal accumulation and reproduction in fathead minnow (*Pimephales promelas*). *Chemosphere* 185:964-974.

- The impact of freshwater metal concentrations on the severity of histopathological changes in fish gills: A statistical perspective
  Fonseca, A.R., L.F. Sanches Fernandes, A. Fontainhas-Fernandes, S.M. Monteiro, and F.A.L. Pacheco. 2017. The impact of freshwater metal concentrations on the severity of histopathological changes in fish gills: A statistical perspective. *Science of The Total Environment* 599-600:217-226.

- Kinetics of deposition, acute toxicity and bioaccumulation of copper in some freshwater organisms
  Ghosh, A., A. Kaviraj, and S. Saha. 2016. Kinetics of deposition, acute toxicity and bioaccumulation of copper in some freshwater organisms. *Bulletin of Environmental Contamination and Toxicology* 97(6):820-825.

- Associations between metal exposure and lesion formation in offshore Gulf of Mexico fishes collected after the Deepwater Horizon oil spill
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Upcoming Meetings and Conferences

19th International Conference on Shellfish Restoration & Shellfish Reef Restoration Network Meeting
February 19–21, 2018
Adelaide, Australia

110th Annual National Shellfisheries Association Meeting
March 18–22, 2018
Seattle, Washington

9th International Charr Symposium
June 18–21, 2018
Duluth, Minnesota

International Conference on Engineering and Ecohydrology for Fish Passage
December 10-14, 2018
New South Wales, Australia

Aquaculture America 2018
February 19-22, 2018
Las Vegas, Nevada

9th International Crustacean Congress (ICC 9)
May 22–25, 2018
Washington, District of Columbia

148th Annual Meeting of the American Fisheries Society – Communicating the Science of Fisheries to Diverse Audiences
August 19–23, 2018
Atlantic City, New Jersey

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.