United States Environmental Protection Agency

Fish and Shellfish Program NEWSLETTER

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In This Issue

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

Recent Advisory News

West Virginia's Fish Consumption Advisories Available for 2017

The West Virginia Department of Health and Human Resources (DHHR), through an interagency agreement, partners with the West Virginia Department of Environmental Protection (DEP) and the Division of Natural Resources (DNR) to develop consumption advisories for fish caught in West Virginia. Fish consumption advisories are reviewed annually and help West Virginia anglers make educated choices about eating the fish they catch.

The following 2017 advisory recommendation is the result of reviewing new and recent fish tissue data. Data collected from lakes and rivers in West Virginia show that a general statewide advisory of sport-caught fish is appropriate. A review of this information indicates that mercury, polychlorinated biphenyls (PCBs), and dioxin are the chemicals of greatest concern. For detailed information about these contaminants and the levels measured, consult the DHHR website at http://www.wvdhhr.org/fish.

Body weight and meal size are important factors in fish advisories. Use the chart below to find the meal size that corresponds to your body weight. This advisory is designed to keep the amount of chemicals you eat at a safe level.

Meal Sizes	
A person weighing between	Should eat no more than this amount per meal
Pounds	Ounces of precooked fish
20 or less	1.0
21–35	1.5
36–50	2.0
51–70	3.0
71–90	4.0
91–110	5.0
111–130	6.0
131–150	7.0
151 and over	8.0
Remember that 3.0 ounces of precooked fish is about the size of the palm of your hand or a deck of cards.	
Remember that 1.5 ounces of precooked fish is about one-half the size of the palm of your hand or one-half the size of a deck of cards.	

Follow the advice presented in this advisory, noting the differences between the **General Advisories** for all West Virginia waters and the more restrictive **Specific Advisories**.

General Advisories: 2017 West Virginia Statewide Consumption Advisories			
Water Body	**Species**	**Limit Your Fish Meals To:**	**Contaminants(s)**
All waters in West Virginia (except where listed in the Specific Consumption Advisories)	Hybrid Striped Bass	1 meal/month	Mercury PCBs
	White Bass		
	Black Bass (Largemouth, Smallmouth, and Spotted)	2 meals/month	
	Channel Catfish greater than 17 inches		
	Flathead Catfish		
	Rock Bass		
	Walleye, Sauger, and Saugeye		
	All Suckers		
	Channel Catfish less than 17 inches	1 meal/week	
	All other species		
	Rainbow Trout	No limit	

More restrictive advisories issued in 2017 affect the following water bodies:

Specific Advisories: 2017 West Virginia-specific Consumption Advisories			
Water Body	**Species**	**Limit Your Fish Meals To:**	**Contaminants(s)***
Bluestone River	Carp	1 meal/month	PCBs
Fish Creek	Smallmouth Bass, all sizes	1 meal/month	Mercury
Flat Fork Creek	Carp	Do not eat	PCBs
	Channel Catfish, all sizes		
	Suckers		
Kanawha River (downstream of I-64 bridge in Dunbar, including all backwaters, Armour Creek, Heizer Creek, Manila Creek, and lower two miles Pocatalico River)	Flathead Catfish, all sizes	Do not eat	Dioxin* Mercury PCBs
	Channel Catfish, all sizes		
	Carp		
	Hybrid Striped Bass		
	Suckers		
	All other species	1 meal/month	
Little Kanawha and Hughes River	Sauger	1 meal/month	Mercury
Upper Mud and Mt. Storm lakes, and Pinnacle Creek**	Follow Advisory Guidelines for West Virginia Statewide Consumption		Selenium
R.D. Bailey Lake	Channel Catfish greater than 17 inches	6 meals/year	PCBs
Shenandoah River	Carp	Do not eat	Mercury PCBs*
	Smallmouth Bass	1 meal/month	Mercury
Summersville Lake	Flathead Catfish, all sizes	1 meal/month	Mercury
	Walleye		
Sutton Lake	Black Bass, all sizes	1 meal/month	Mercury

Note:
*Contaminant(s): Meal limits are determined by the chemical with asterisk. Other chemicals, such as dioxin, (Hg) methylmercury may have an advisory at a less restrictive level.
**Measureable levels of selenium were detected in fish samples from the listed water bodies. The levels measured would suggest advisories that are less restrictive or consistent with the statewide consumption advice in place for mercury and PCBs.

For further information or the most current advice, consult the West Virginia DHHR website at www.wvdhhr.org/fish or call 304-558-2771.

Other contacts:

- West Virginia DNR website at http://www.wvdnr.gov/fishing/fishing.shtm or call 304-558-2771.
- West Virginia DEP website at http://www.dep.wv.gov/ or call 304-926-0495.
- U.S. Environmental Protection Agency (EPA) website at https://www.epa.gov/fish-tech.

Source: http://www.wvdhhr.org/fish/Current_Advisories.asp.

2017 Ohio River Fish Consumption Advisories

The protocol used to determine Ohio River fish consumption advisories is the product of the efforts of a multi-agency workgroup consisting of representatives from the six main stem states (Illinois, Indiana, Kentucky, Ohio, Pennsylvania, and West Virginia) as well as the EPA and the Ohio River Valley Water Sanitation Commission to develop consistent fish advisories along the Ohio River main stem. The online Ohio River advisory is available at www.orsanco.org/fca. Please refer to the website for recent updates.

For all fish not listed in the table below, please observe a one meal per week advisory due to mercury and other concerns. All listed advisories are issued to protect people who regularly eat sport fish, women of childbearing age, and children.

2017 Ohio River Consumption Advisory			
Ohio River Segment	**Species**	**Limit Your Fish Meals To:**	**Contaminants(s)**
Unit 1 Confluence of the Monongahela and Allegheny rivers to the Montgomery Locks and Dam	Common Carp Channel Catfish 18 inches and over	Do not eat	PCBs
	All Suckers Channel Catfish less than 18 inches Flathead Catfish White Bass	6 meals/year	PCBs
	Freshwater Drum	1 meal/month	PCBs Mercury
	Black Crappie White Crappie Largemouth Bass Smallmouth Bass Spotted Bass Sauger Saugeye Walleye	1 meal/month	PCBs
Unit 2 Montgomery Locks and Dam to the Belleville Locks and Dam	Channel Catfish 18 inches and over	Do not eat	PCBs
	Channel Catfish less than 18 inches Common Carp Striped Bass Hybrid White Bass	6 meals/year	PCBs
	Black Crappie White Crappie	1 meal/month	Mercury
	Freshwater Drum	1 meal/month	PCBs Mercury

2017 Ohio River Consumption Advisory			
Ohio River Segment	**Species**	**Limit Your Fish Meals To:**	**Contaminants(s)**
	All Suckers Flathead Catfish Largemouth Bass Saugeye Smallmouth Bass Spotted Bass Walleye	1 meal/month	PCBs
Unit 3 Belleville Locks and Dam to the JT Myers Locks and Dam	Channel Catfish 18 inches and over Striped Bass Striped Bass Hybrid	6 meals/year	PCBs
	Largemouth Bass 15 inches and over Smallmouth Bass 15 inches and over Spotted Bass 15 inches and over	1 meal/month	Mercury
	Flathead Catfish Freshwater Drum White Bass	1 meal/month	PCBs Mercury
	All Suckers Channel Catfish less than 18 inches Common Carp	1 meal/month	PCBs
Unit 4 JT Myers Locks and Dam to the Confluence with the Mississippi River	Freshwater Drum 14 inches and over Largemouth Bass Sauger Smallmouth Bass Spotted Bass White Bass	1 meal/month	Mercury
	All Suckers 19 inches and over Flathead Catfish Striped Bass Striped Bass Hybrid	1 meal/month	PCBs Mercury
	Blue Catfish over 20 inches Channel Catfish 18 inches and over Common Carp 22 inches and over	1 meal/month	PCBs

For further information or the most current advice, consult the states' websites:

- **Pennsylvania:** http://www.dep.pa.gov/Business/Water/CleanWater/WaterQuality/FishConsumptionAdvisory/Pages/default.aspx
- **West Virginia:** http://www.wvdhhr.org/fish/Current_Advisories.asp
- **Ohio:** http://www.epa.ohio.gov/dsw/fishadvisory/index.aspx
- **Kentucky:** http://fw.ky.gov/Fish/Pages/Fish-Consumption-Advisories.aspx
- **Indiana:** http://www.in.gov/isdh/23650.htm
- **Illinois:** http://dph.illinois.gov/topics-services/environmental-health-protection/toxicology/fish-advisories/map

Source: www.orsanco.org/fca.

EPA News

Mid-Columbia River Fish Toxics Assessment

The 2017 *Mid-Columbia River Fish Toxics Assessment: EPA Region 10 Report* provides a baseline understanding of toxic contamination in fish tissue in the Mid-Columbia River between the Bonneville Dam and the Grand Coulee Dam.

Abstract

The Columbia River Basin is a priority watershed for states, tribes, federal agencies, and nonprofit organizations and was designated as a "critical ecosystem" that warrants protection in the EPA's 2006–2011 Strategic Plan (USEPA 2006a). Past studies by EPA and others have found significant concentrations of toxic contaminants in fish and the waters they inhabit throughout the basin (USEPA 2009). However, the Mid-Columbia River (MCR) main stem reach, between Bonneville Dam and Grand Coulee Dam, has not been described in terms of concentrations of contaminants in fish tissue. This study of the MCR is an effort to fill this information void.

A spatially distributed probabilistic sample design was used to select 42 sample sites along the MCR main stem to represent the entire 718-km (440-mile) reach. During the summers of 2008 and 2009, field crews collected two types of fish samples to represent both human health and ecological endpoints. Water quality and physical habitat data were also collected at each site. Fish tissue was analyzed for a variety of toxic contaminants. Water samples were analyzed for physical and chemical characteristics and trace elements.

Toxic contaminants were measured in fillet tissue for the human health endpoint and in whole fish tissue for the ecological endpoint. Using the probabilistic study design, the data were analyzed to produce statistical results that are expressed in terms of the extent of the MCR reach. The results were also compared to literature screening values (SVs) to put the results in context for interpretation. Multiple contaminants were found to exceed SV concentrations. Mercury, PCBs, and dichlorodiphenyltrichloroethane (DDTs) were responsible for most of the exceedances of human health SVs. Trace elements and DDTs were responsible for most of the exceedances of ecological SVs.

Human Health Findings

Tissue contaminant concentrations in fish fillet samples were compared to four types of SVs. Cancer and non-cancer SVs were calculated for two different consumption rates, one representing the general public and one representing people who consume fish at a higher rate. All the contaminants that exceeded human health SVs in fillets were widely detected. However, some widely detected contaminants did not exceed any of these SVs. The following are general results on the extent and magnitude of contaminant concentrations relevant to human health SVs in fish fillet samples collected from the MCR.

- Mercury was detected in all fillet samples, representing 100 percent of the MCR length. Concentrations exceeded the non-cancer SVs for both the general and the high fish-consuming populations in most of the MCR.
- PCBs exceeded cancer SVs for both the general and the high fish-consuming populations throughout the MCR reach. Non-cancer SVs were exceeded for both types of consumers in a substantial proportion of the reach.
- Total DDTs and dichlorodiphenyldichloroethylene (DDE) exceeded cancer SVs for both the general and high fish-consuming populations in a substantial proportion of the MCR reach.
- Several of the other chlorinated pesticides were frequently detected in tissue samples. Only dieldrin exceeded both of the cancer SVs in a substantial proportion of the MCR reach. Heptachlor epoxide and hexachlorobenzene also exceeded the cancer SVs but to a lesser spatial extent for both the general and high fish-consuming populations.

- Polybrominated diphenyl ethers (PBDEs) were frequently detected in fillet samples, but did not exceed any of the SVs.
- Dioxins and furans were rarely detected. The dioxin congeners with available SVs were not detected in the samples.

Ecological Findings

Tissue contaminant concentrations in whole fish samples were also compared to available SVs. Three types of SVs were compared: piscivorous avian wildlife (kingfisher and American kestrels), piscivorous wildlife (mink and otter), and general aquatic species SVs. The avian SVs are generally the lowest (most stringent) and therefore the ones most often exceeded in these tissue samples. The following are general descriptions of the extent and magnitude of contaminant concentrations in ecological SVs from whole fish samples collected from the MCR.

- Total DDTs and DDE exceeded both the kingfisher and general aquatic SVs in much of the MCR reach, while dichlorodiphenyldichloroethane (DDD) exceedances for kingfisher were more limited in extent.
- Total chlordane exceeded the kingfisher SV in a small percent of the MCR length, and was the only other chlorinated pesticide with an SV exceedance.
- Total PBDEs exceeded the SV for American kestrels (a bird species) in a small percentage of the MCR reach.
- Mercury wildlife SVs were exceeded for kingfisher in much of the MCR reach, and for otter and mink in a smaller proportion.
- Several metals (zinc, copper, and selenium) exceeded the general aquatic SVs in most of the MCR reach, while others (nickel, arsenic, and lead) exceeded them in a smaller proportion of the river.

Conclusions and Recommendations

- Bioaccumulative contaminants are an ongoing problem in the MCR as in many other parts of the United States. Nationally, the number of fish advisories for mercury, PCBs, and DDTs continues to increase (USEPA 2011).
- Elevated mercury concentrations are very similar to those found in rivers across the United States. Likewise, PBDE levels were reflective of other large U.S. river systems (Blocksom et al. 2010).
- MCR fish tissue concentration of DDTs stand out as being extremely elevated compared to what is found in the rest of the United States, even in other agriculturally intense locations. Although DDTs and the other persistent chlorinated pesticides are likely related to historical agricultural applications, efforts can be made to reduce their mobilization and transport into the MCR. Improved land management practices have significantly reduced concentrations of DDT in fish tissue in some portions of the Columbia Basin (Washington Department of Ecology 2014).
- Important fish tissue contaminants of concern and their ranking are virtually the same for both the general and high fish consumers. This suggests the same triggers for improving environmental conditions/reducing contaminants are present regardless of the intensity of use of the fisheries resource.
- This study establishes a baseline for toxic contamination in fish tissue in the MCR. Repeated at intervals, studies of this type would help to determine trends in contamination so that future assessments of the Columbia River will be able to provide more robust understanding of the relationship between contaminants and associated human activity, natural phenomena, and environmental change.

About this Report

This assessment does not evaluate risk. The purpose was to create a baseline understanding of toxic contamination in fish tissue in the MCR. Continued assessments can help to determine trends in contamination and provide a more robust understanding of the relationship between contaminants and associated human activity, natural phenomena, and environmental change.

Both the states of Oregon and Washington maintain fish consumption advisories for the fish species included in this study. Salmon and steelhead were not included in this study, and are a recommended best choice according to the EPA and the U.S. Food and Drug Administration (FDA).

Related Information

- Eating Fish: What Pregnant Women and Parents Should Know (FDA-EPA advice regarding eating fish)
- State of Oregon Fish Advisories
- State of Washington Fish Advisories

Download the Full Report

- Mid-Columbia River Fish Toxics Assessment (PDF) (164 pp, 10 MB, March 2017, EPA-910-R-17-002)

For more information, contact Lillian Herger at Herger.Lillian@epa.gov or Gretchen Hayslip at Hayslip.Gretchen@epa.gov.

Study Citation: Herger, L., L. Edmond, and G. Hayslip. 2017. *Mid Columbia River Fish Toxics Assessment: EPA Region 10 Report*. EPA-910-R-17-002. U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

Sources: https://www.epa.gov/columbiariver/mid-columbia-river-fish-toxics-assessment; https://www.epa.gov/fish-tech/reports-and-fact-sheets-about-fish-consumption-and-human-health#reports.

Other News

Pharmaceuticals Commonly Detected in Small Streams in the Southeastern United States

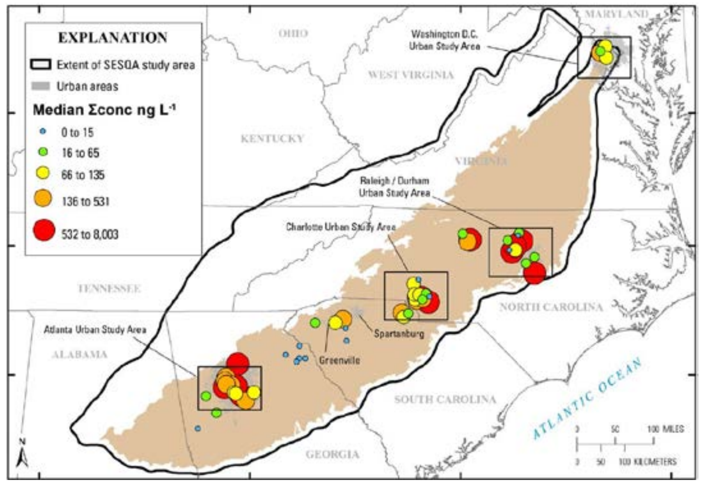
Pharmaceuticals are widespread in small streams in the Southeast, according to a new study by the U.S. Geological Survey (USGS). In 2014, the USGS sampled 59 small streams in portions of Alabama, Georgia, North Carolina, South Carolina, and Virginia for 108 different pharmaceutical compounds and detected one or more pharmaceuticals in all 59 streams. The average number of pharmaceuticals detected in the streams was six.

Previous research indicated that wastewater treatment facility discharges were the most likely source for pharmaceutical chemicals in surface water. However, the findings in this study, reported in the journal *Environmental Science and Technology Letters*, indicate other sources as well—only 17 of the 59 streams have any reported wastewater discharges.

"The widespread occurrence of pharmaceuticals in these small streams irrespective of wastewater discharges indicates the need for approaches for preventing pharmaceutical contamination that extend beyond effluent treatment," said Paul Bradley, a USGS research hydrologist and the lead author of the study. "Sources of pharmaceuticals to these small streams likely include aging sewer infrastructure and leakage from septic systems."

The most common pharmaceutical chemicals detected are:

- Metformin: Used to treat Type II diabetes, this chemical was detected in 89 percent of samples;
- Lidocaine: Used as a pain reliever, this chemical was detected in 38 percent of samples;
- Acetaminophen: Used as a pain reliever, this chemical was detected in 36 percent of samples;
- Carbamazepine: Used to treat seizures, this chemical was detected in 28 percent of samples;
- Fexofenadine: Used as an anti-histamine, this chemical was detected in 23 percent of samples; and
- Tramadol: An opioid pain reliever, this chemical was detected in 22 percent of samples.



Cumulative median concentrations of pharmaceutical chemicals detected during the sampling conducted in June of 2014 in 59 small streams. The four urban study areas are shown in boxes, with details in the study. *(Image courtesy of USGS)*

Although much uncertainty remains as to how pharmaceuticals affect aquatic organisms, some adverse effects have been documented. Antibiotic/antibacterial contaminants, detected in at least 20 percent of streams, can affect aquatic microbial communities, altering the base of the food web. Antihistamines, frequently detected in this study, affect neurotransmitters for many aquatic insects. And metformin, nearly ubiquitous in the streams studied, can affect the reproductive health of fish.

The chemicals with the highest concentrations are those listed above, but none exceeded human health benchmarks. In addition to the individual chemicals listed, the two groups of compounds most frequently detected were nicotine-related compounds (71 percent of samples) and caffeine-related compounds (detected in 49 percent of samples).

This study is one of several regional stream-quality assessments by the USGS National Water Quality Assessment (NAWQA) Project. Findings will provide the public and policy-makers with information regarding which human and natural factors are the most critical in affecting stream quality. Regions studied include the Midwest (2013), the Southeast (2014), the Pacific Northwest (2015), and the Northeast (2016). The California (2017) field study is nearing completion. Data analysis and interpretation are ongoing for the Northeast and California studies.

Support for this work was provided by the USGS National Water Quality Program's NAWQA Project. Additional support was provided by the USGS Toxic Substances Hydrology Program.

Study Citation: Bradley, P.M., C.A. Journey, D.T. Button, D.M. Carlisle, J.M. Clark, B.J. Mahler, N. Nakagaki, S.L. Qi, I.R. Waite, and P.C. VanMetre. 2016. Metaformin and other pharmaceuticals widespread in wadeable streams of the Southeastern United States. *Environmental Science & Technology Letters* 3(6):243–249.

For more information, contact Alex Demas, Public Affairs Specialist (Office of Communications and Publishing), at APDemas@usgs.gov, 703-648-4421; or Paul Bradley, Hydrologist, at PBradley@usgs.gov, 803-750-6125.

Source: https://www.usgs.gov/news/pharmaceuticals-commonly-detected-small-streams-southeastern-united-states.

The Genetics Behind the Killifish's Adaptation to Pollution

Killifish living in four polluted U.S. East Coast estuaries have adapted quickly to survive high levels of toxic industrial pollutants. In a new study, researchers explored the complex genetics involved in the Atlantic killifish's resilience, bringing us one step closer to understanding how they rapidly evolved to tolerate normally lethal levels of environmental contaminants. Exploring the evolutionary basis for these genetic changes may provide new information about the mechanisms of environmental chemical toxicity in both animals and humans.

A new study, published in the journal *Science*, used powerful genomic approaches to sequence and then scan the entire killifish genome from multiple fish populations, allowing an unbiased search for genes involved in chemical tolerance. The findings provide information about which genes are linked with tolerance to specific chemicals and how genetic differences may affect an organism's sensitivity to environmental contaminants.

The study, led by Andrew Whitehead, PhD, at the University of California, Davis, built on decades of research into the killifish's ability to survive industrial contamination. Superfund Research Program (SRP)-funded scientists at Woods Hole Oceanographic Institution (WHOI) collaborated on the study, which was also funded by the National Science Foundation, the National Institute of Environmental Health Sciences (NIEHS) Oceans and Human Health program, and the EPA.

A Genetic Basis for Resilience

The Atlantic killifish is non-migratory and abundant in U.S. East Coast salt marsh estuaries, including sites contaminated with complex mixtures of persistent industrial pollutants, such as PCBs, dioxins, and polycyclic aromatic hydrocarbons. Killifish living in highly polluted areas can tolerate concentrations up to 8,000 times higher than similar killifish living at sites that are not polluted. To better understand the genetic basis for this adaptation, researchers analyzed 384 whole killifish genome sequences and compared genomes from killifish in non-polluted sites to genomes of killifish from polluted sites in New Bedford Harbor, Massachusetts; Newark Bay, New Jersey; Connecticut's Bridgeport area; and Virginia's Elizabeth River.

By pairing killifish from polluted and non-polluted sites, the researchers revealed hundreds of genome regions where the pollutant-resistant killifish appeared to undergo natural selection. Several of the regions had changes in all four resistant populations and included genes involved in the previously identified aryl hydrocarbon receptor (AHR) signaling pathway, which is responsible for regulating a number of biological responses. However, rather than finding a single change in an AHR gene, the researchers found changes in a variety of genes involved in the AHR pathway.

According to the study authors, the convergence on the AHR pathway in the four distinct populations suggests that there are likely a limited number of evolutionary ways for adaptation to pollution to occur. However, within those constraints, there is more than one molecular solution, as reflected in the differences in some selected genes in the different populations. The new findings also suggest that the killifish's genetic diversity makes them unusually well-positioned to quickly adapt and survive in radically altered habitats.

Two brightly-colored male mummichogs (*Fundulus heteroclitus heteroclitus*), or small killifish, swim around a duller female mummichog. *(Image courtesy of NOAA)*

Human Health Implications

Like fish, humans have an AHR, which controls the body's response to some drugs and pollutants. Previous studies in mice, birds, and some fish show that variation in AHR itself can control sensitivity to dioxin-like chemicals. Although there is some inter-individual genetic variation in AHRs among humans, the differences in AHR do not fully account for differences in chemical susceptibility or resilience. Another study demonstrates, in a natural population, that genetic variation in other genes encoding proteins in the AHR pathway may also contribute to variations in sensitivity among individuals and populations. This informs future research to better explain how genetic differences among humans and other species may contribute to differences in sensitivity to environmental chemicals.

WHOI biologists and study authors Mark Hahn, PhD, and Sibel Karchner, PhD, have been studying killifish resistant to contamination in New Bedford Harbor since 1995 as part of the Boston University (BU) SRP Center, in collaboration with researchers from the EPA's Atlantic Ecology Division in Rhode Island. The new study built on earlier work from the BU SRP Center focused on characterizing the PCB-resistant New Bedford Harbor fish and identifying and characterizing genes in the AHR signaling pathway that may be responsible for tolerance to environmental contaminants.

For more information, contact Mark Hahn at MHahn@whoi.edu.

Study Citations:

- Reid, N., D.A. Proestou, B.W. Clark, W.C. Warren, J.K. Colbourne, J.R. Shaw, S.I. Karchner, M.E. Hahn, D.E. Nacci, M.F. Oleksiak, D.L. Crawford, and A. Whitehead. 2016. The genomic landscape of rapid repeated evolutionary adaptation to toxic pollution in wild fish. *Science* 354(6317):1305–1308.
- Reitzel, A.M., S.I. Karchner, D.G. Franks, B.R. Evans, D.E. Nacci, D. Champlin, V.M. Vieira, and M.E. Hahn. 2014. Genetic variation at aryl hydrocarbon receptor (AHR) loci in populations of Atlantic killifish (*Fundulus heteroclitus*) inhabiting polluted and reference habitats. *BMC Evolutionary Biology* 14(6).

Source: https://tools.niehs.nih.gov/srp/researchbriefs/view.cfm?Brief_ID=265.

Recently Awarded Research

NOAA and Sea Grant Fund $800,000 in Research to Understand Effects of Ocean Changes on Iconic Northeast Marine Life

Research being conducted by New Hampshire Sea Grant is focused on understanding the effects of ocean acidification on clams. *(Image courtesy of NOAA)*

National Oceanic and Atmospheric Administration's (NOAA's) Ocean Acidification Program and the Northeast Sea Grant Programs joined together to prioritize and fund new research on how ocean acidification is affecting marine life including lobsters, clams, oysters, mussels, and sand lance that are so important to the northeast region. Funding includes $800,000 in federal funds from the two programs with an additional $400,000 non-federal match.

NOAA and Sea Grant drew on the work of the Northeast Coastal Acidification Network to set these priorities. The Network is made up of concerned fishermen, scientists, resource managers, and representatives from federal and state agencies who work together to identify critical vulnerabilities in the northeast, including regionally important and economically significant marine resources that are vital to the many livelihoods and the culture of New England.

Some of the research will include:

A project led by Dianna Padilla, a PhD researcher from Stony Brook University has been awarded $185,435 to explore whether blue mussels can adapt to changes in ocean chemistry. Blue mussels live across a wide geographic range in a variety of habitats and are a commercially important species, used in aquaculture in New England. The investigators will examine mussels throughout their lives, across multiple generations, to assess their ability to adapt and determine if mussels from certain areas of Long Island Sound are better able to cope with varying acidification conditions. This information can then be used to help shellfish growers determine where to collect mussels to spawn for seed and improve stocks of mussels for aquaculture in the long run.

Another project at Stony Brook University, under the leadership of Bassem Allam, PhD, has received $199,927, to compare how different bivalves respond to acidification. Bivalves such as oysters and clams, represent the most important marine resource in several northeast states and production of bivalve seed has recently suffered significant losses due to ocean acidification in some of the largest hatcheries in the nation. Researchers will identify genetic features associated with resilience in an aim to provide the aquaculture industry with tools to select resilient shellfish stocks.

Richard Wahle, PhD, at the University of Maine and his collaborators at Bigelow Laboratory for Ocean Sciences and the University of Prince Edward Island have received a grant of $200,000 to study how young lobster respond to ocean warming and acidification across New England. With 90 percent of the landings harvested from the Gulf of

Maine, climate change has already brought about major shifts in the distribution and timing of New England's lobster fishing. Wahle's team will look at the behavior, physiology, and gene expression of larval lobster in different temperature and acidification conditions that mimic those expected in the next century in the Northeast.

Hannes Baumann, PhD, and colleagues at the University of Connecticut have received a grant of $198,393 to study the sensitivity of the Northern sand lance to ocean warming, acidification, and low oxygen. Unbeknownst to many visitors to Stellwagen Bank National Marine Sanctuary, who marvel at humpback whales, seals, bluefin tuna, and marine birds, most of these animals concentrate in the sanctuary because of sand lance. "Sand lance are a small forage fish that we call the 'backbone of the sanctuary' because they are at the base of the food chain," said Baumann, and "despite their importance to the ecosystem, their sensitivity to climate and ocean change is unknown."

Source:
http://research.noaa.gov/News/NewsArchive/LatestNews/TabId/684/ArtMID/1768/ArticleID/11858/NOAA-and-Sea-Grant-fund-800000-in-research-to-understand-effects-of-ocean-changes-on-iconic-Northeast-marine-life.aspx.

Recent Publications

Journal Articles

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

- **A review of the occurrence of pharmaceuticals and personal care products in Indian water bodies**
  Balakrishna, K., A. Rath, Y. Praveenkumarreddy, K.S. Guruge, and B. Subedi. 2017. A review of the occurrence of pharmaceuticals and personal care products in Indian water bodies. *Ecotoxiciology and Environmental Safety* 137:113–120.

- **Pharmaceutical metabolism in fish: Using a 3-D hepatic in vitro model to assess clearance**
  Baron, M.G., K.S. Mintram, S.F. Own, M.J. Hetheridge, A.J. Moody, W.M. Purcell, S.K. Jackson, and A.N. Jha. 2017. Pharmaceutical metabolism in fish: Using a 3-D hepatic in vitro model to assess clearance. *PLoS ONE* 12(1):e0168837.

- **Bioaccumulation of pharmaceuticals and personal care products in the unionid mussel *Lasmigona costata* in a river receiving wastewater effluent**
  de Solla, S.R., È.A.M. Gilroy, J.S. Klinck, L.E. King, R. McInnis, J. Struger, S.M. Backus, and P.L. Gillis. 2016. Bioaccumulation of pharmaceuticals and personal care products in the unionid mussel *Lasmigona costata* in a river receiving wastewater effluent. *Chemosphere* 146:486–496.

- **Exposure to the contraceptive progestin, gestodene, alters reproductive behavior, arrests egg deposition, and masculinizes development in the fathead minnow (*Pimephales promelas*)**
  Frankel, T.E., M.T. Meyer, D.W. Koplin, A.B. Gillis, D.A. Alvarez, and E.F. Orlando. 2016. Exposure to the contraceptive progestin, gestodene, alters reproductive behavior, arrests egg deposition, and masculinizes development in the fathead minnow (*Pimephales promelas*). *Environmental Science & Technology* 50(11):5991–5999.

- **Assessing potential vulnerability and response of fish to simulated avian predation after exposure to psychotropic pharmaceuticals**
  Hedgespeth, M.L., P.A. Nilsson, and O. Berglund. 2016. Assessing potential vulnerability and response of fish to simulated avian predation after exposure to psychotropic pharmaceuticals. *Toxics* 4(2):1–13.

- **Home alone—The effects of isolation on uptake of a pharmaceutical contaminant in a social fish**
  Heynen, M., T. Backström, J. Fick, M. Jonsson, J. Klaminder, and T. Brodin. 2016. Home alone—The effects of isolation on uptake of a pharmaceutical contaminant in a social fish. *Aquatic Toxicology* 180:71–77.

- **Anti-anxiety drugs and fish behavior: Establishing the link between internal concentrations of oxazepam and behavioral effects**
  Huerta, B., L. Margiotta-Casluci, S. Rodríguez-Mozaz, M. Scholze, M.J. Winter, D. Barceló, and J.P. Sumpter. 2016. Anti-anxiety drugs and fish behavior: Establishing the link between internal concentrations of oxazepam and behavioral effects. *Environmental Toxicology and Chemistry* 35(11):2782–2790.

- **Human and veterinary pharmaceuticals in the marine environment including fish farms in Korea**
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- **Bioaccumulation of five pharmaceuticals at multiple trophic levels in an aquatic food web—Insights from a field experiment**
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- **Occurrence and potential biological effects of amphetamine on stream communities**
  Lee, S.S., A.M. Paspalof, D.D. Snow, E.K. Richmond, E.J. Rosi-Marshall, and J.J. Kelly. 2016. Occurrence and potential biological effects of amphetamine on stream communities. *Environmental Science & Technology* 50(17):9727–9735.

- **Acute toxicity and histopathological effects of naproxen in zebrafish (*Danio rerio*) early life stages**
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- **Do pharmaceuticals bioaccumulate in marine molluscs and fish from a coastal lagoon?**
  Moreno-González, R., S. Rodríguez-Mozaz, B. Huerta, D. Barceló, and V.M. León. 2016. Do pharmaceuticals bioaccumulate in marine molluscs and fish from a coastal lagoon? *Environmental Research* 146:282–298.

- **Pharmaceuticals in grocery market fish fillets by gas chromatography–mass spectrometry**
  Mottaleb, M.A., C. Stowe, D.R. Johnson, M.J. Meziani, and M.A. Mottaleb. 2016. Pharmaceuticals in grocery market fish fillets by gas chromatography–mass spectrometry. *Food Chemistry* 190:529–536.

- **Comparison of measured and predicted bioconcentration estimates of pharmaceuticals in fish plasma and prediction of chronic risk**
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- **Life-cycle exposure of fathead minnows to environmentally relevant concentrations of the β-blocker drug propranolol**
  Parrott, J.L., and V.K. Balakrishnan. 2017. Life-cycle exposure of fathead minnows to environmentally relevant concentrations of the β-blocker drug propranolol. *Environmental Toxicology and Chemistry* 36(6):1644–1651.

- **Testing the "read-across hypothesis" by investigating the effects of ibuprofen on fish**
  Patel, A., G.H. Panter, H.T. Trollope, Y.C. Glennon, S.F. Owen, J.P. Sumpter, and M. Rand-Weaver. 2016. Testing the "read-across hypothesis" by investigating the effects of ibuprofen on fish. *Chemosphere* 163:592–600.

- **Bioaccumulation and trophic magnification of pharmaceuticals and endocrine disruptors in a Mediterranean river food web**
  Ruhí, A., V. Acuña, D. Barceló, B. Huerta, J.R. Mor, S. Rodríguez-Mozaz, and S. Sabater. 2016. Bioaccumulation and trophic magnification of pharmaceuticals and endocrine disruptors in a Mediterranean river food web. *Science of The Total Environment* 540:250–259.

- **Combined environmental risk assessment for the antiviral pharmaceuticals ganciclovir and valganciclovir in Europe**
  Straub, J.O. 2017. Combined environmental risk assessment for the antiviral pharmaceuticals ganciclovir and valganciclovir in Europe. *Environmental Toxicology and Chemistry*.

- **Bioaccumulation and bioconcentration of carbamazepine and other pharmaceuticals in fish under field and controlled laboratory experiments. Evidences of carbamazepine metabolization by fish**
  Valdés, M.E., B. Huerta, D.A. Wunderlin, M.A. Bistoni, D. Barceló, and S. Rodriguez-Mozaz. 2016. Bioaccumulation and bioconcentration of carbamazepine and other pharmaceuticals in fish under field and controlled laboratory experiments. Evidences of carbamazepine metabolization by fish. *Science of the Total Environment* 557–558:58–67.

Upcoming Meetings and Conferences

World Aquaculture
June 26–30, 2017
Cape Town, South Africa

13th International Conference on Mercury as a Global Pollutant
July 16–21, 2017
Providence, Rhode Island

American Fisheries Society 147th Annual Meeting
August 20–24, 2017
Tampa, Florida

37th International Symposium on Halogenated Persistent Organic Pollutants (POPs)—Dioxin 2017
August 20–25, 2017
Vancouver, Canada

7th International Symposium on GIS/Spatial Analyses in Fishery and Aquatic Science
August 21–25, 2017
Hokkaido, Japan

18th International Conference on Diseases of Fish and Shellfish
September 4–8, 2017
Belfast, United Kingdom

9th U.S. Symposium on Harmful Algae
November 11–17, 2017
Baltimore, Maryland

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.