

MICHIGAN

Water samples show nicotine, cocaine, antibiotics in Great Lakes waterways



[Keith Matheny](#)

Detroit Free Press

Published 6:02 a.m. ET March 7, 2022 | Updated 8:21 a.m. ET March 7, 2022

Artificial sweeteners, pharmaceuticals, pesticides and nonstick compounds were found in multiple water samples in the corridor between Lake Huron and Lake Erie, including the Detroit River and Lake St. Clair, a new study found.

Drugs detected in the water included nicotine, cocaine, antibiotics, acetaminophen pain reliever, the diabetes drug metformin, even contrast dye from CT scans, the study by Wayne State University's Healthy Urban Waters program and the University of Florida found. They're found in very minute concentrations, down to the parts per trillion.

Known as contaminants of emerging concern, many are only detectable now because of advancements in the sensitivity of laboratory technology. While some of the detected chemicals are known to cause public health or environmental harm, for the majority, it remains unstudied and unknown.

"I wanted to look in a real-world environment to see what was out there, what we should be concerned about," said Tracie Baker, an environmental toxicologist at the University of Florida and adjunct professor at Wayne State University.

"There was a lot of research in the past 50 years - since the Rouge River caught on fire - that's focused on legacy contaminants like heavy metals, dioxins, PCBs. What my group was interested in doing was looking more specifically at some of the emerging contaminants that we don't necessarily think about as toxic; that people aren't really looking for in our rivers and lakes."

Water samples were collected in the spring and fall of both 2018 and 2019 at six sites:

The mouth of the Clinton River;
Lake St. Clair Metropark

Northeast Belle Isle

Southwest Belle Isle

The mouth of the Rouge River near Zug Island

The Detroit River International Wildlife Refuge/Trenton Channel.



Environmental toxicologist Tracie Baker works in the laboratory at Wayne State University's Integrative Biosciences Center in this 2017 photo. *Wayne State University*

"We wanted them to be places where people were going, places of recreation," Baker said. "We also wanted areas near industry, drinking water intakes, and wastewater effluent."

Contaminants of emerging concern are known to enter the environment through runoff from residential, agricultural, industrial or military sites; particularly in significant rain events that lead to combined sewer overflows. Many of the compounds, such as prescription drugs, aren't fully broken down by humans, are secreted in their waste, and wastewater treatment plants aren't optimized to remove them – and there are no regulatory requirements that they be removed.

The Florida-Wayne State study, published last month in the peer-reviewed *Journal of Great Lakes Research*, detected and quantified 50 compounds across the six tested sites. Upstream sites showed more significant concentrations of pesticides and their breakdown products, likely arising from agricultural runoff. Pharmaceuticals and personal care products were found in higher concentrations near more populated areas, locations downstream of large wastewater treatment plant outflows.

Synthetic sweeteners acesulfame potassium and sucralose were detected in the highest concentrations of any compound class, most particularly at the two most downstream testing sites.

The sweeteners are commonly seen in wastewater effluent because they are water soluble and resistant to human metabolism, Baker said.

There's not much scientific research showing the sweeteners as having a negative impact on human health or the environment, "but there's not a lot of research that's been done on it, either," she said.

Antibiotics were found consistently across sampling at the two most downstream testing sites.

"The persistence of sulfamethoxazole in aquatic environments, even at low levels, can drive antibiotic resistance with implications for human, animal and ecosystem health," the study states.

Other pharmaceuticals consistently detected across sampling included:

- acetaminophen, a non-aspirin pain reliever;
- lidocaine, a topical local anesthetic;
- atenolol, a beta-blocker used to treat high blood pressure;
- gemfibrozil, a lipid regulator used to treat high cholesterol and triglycerides; iohexol, used as a contrast dye for CT scans and similar procedures.

Though not consistently detected, the diabetic medication metformin and the anticonvulsant carbamazepine were found at multiple sites and during multiple sampling events.

The stimulant caffeine, found in coffee, tea and soft drinks, was also consistently found across sampling events near Zug Island, the study found. Previous studies have shown caffeine exposures at elevated levels create toxicity and anxiety-like behavior in a variety of species, including fish and other aquatic organisms. Research further shows the outcomes are worse for exposed animals when they are also subjected to artificial sweeteners at the same time, the study states.



Alex Haimbaugh, a doctoral student at Wayne State University's Baker Water Laboratory, collects water samples off a boat in the Detroit River on Oct. 21, 2019, as part of the study of contaminants of emerging concern in the Great Lakes corridor between lakes Huron and Erie. *Tracie Baker*

Nicotine, cocaine and their breakdown products were also detected near the Zug Island site, but at relatively small concentrations and not consistently across sampling events. As nicotine is often used as an insecticide, it has the potential to impact zooplankton, the tiny aquatic organisms at the bottom of the food web upon which fish rely, the study found.

"I was surprised by the number of pharmaceuticals - antibiotics, and the contrast agent really surprised me," Baker said.

Per- and polyfluoroalkyl substances, or PFAS - the nearly ubiquitous nonstick compounds used in industry and consumer products now known as "forever chemicals" because of their resistance to breaking down in nature - were also found in the Wayne State/Florida study, at every testing site.

Two of the most well-known PFAS compounds, known as PFOS and PFOA, have been phased out of most industrial and consumer uses in the U.S. in recent years, as more is learned about their harmful health and environmental effects. They've been replaced by supposedly safer "short-chain" PFAS compounds, the name deriving from them having fewer carbon atoms. But research is now showing the short-chain PFAS compounds also persist in nature without breaking down and also harm public health.

The Wayne State-Florida study found 12 PFAS compounds, short- and long-chain, in water and sediment samples across the tested sites.

"Those are easily, by far, what we are seeing the most of," Baker said. "Because they are forever chemicals, they are just staying around for a long time. But now we are also starting to see the shorter chains, now that they are being used in production and products."

Examination of contaminants of emerging concern in our environment is important work, said Michael Murray, a biology instructor at Augusta University in Georgia and an adjunct professor in the University of Michigan's School of Environment and Sustainability, who was not involved in the Wayne State-Florida study. Murray, for more than 20 years until last fall, also served as staff scientist with the nonprofit National Wildlife Federation's Great Lakes Regional Center.

"There is definitely a lot we don't know on the human health end," he said. "But I think for a lot of chemicals, we know even less on the ecological end, fish and wildlife.

"PFAS is thousands of chemicals - potentially over 9,000 - and we really don't have even basic toxicity information on but maybe a couple of dozen or so."

Murray noted that many of the emerging contaminants are medicines and personal care products ending up in the environment through wastewater. But wastewater treatment plants weren't designed to capture them, and are under no regulatory obligation to do so.

But the region's largest wastewater treatment facility, run by the Great Lakes Water Authority, is paying some attention to contaminants of emerging concern. The authority collaborated with Baker on the study's examination of its effluent streams, and has a "rigorous industrial pre-treatment program that controls contaminants, including PFAS, directly at their source before entering waste streams," Cheryl Porter, chief operating officer for GLWA's Water and Field Services, said in a statement to the Free Press.

The agency also conducts occasional "unregulated contaminant monitoring sampling events," including a recent one for estrogen compounds and compounds often found in personal care products, Porter said.

"EPA uses the data obtained to determine where these contaminants occur and whether they need to be regulated," she said.

New and improved facilities at GLWA's Water Works Park and at its Lake Huron treatment plant "will provide us with the opportunity to further test and advance our treatment process beyond (only regulatory) compliance," Porter said.

Baker said her group is now beginning to look at how contaminants of emerging concern impact the organisms that live around them.

"This was kind of the beginning to know what's out there, and where are we finding it," she said. "Now we are looking in fish, in the blood and in the muscle of different fish species, focusing on fish that someone might eat."

The best solution to these contaminants is to capture them at the source where they are generated, or to not use them at all, and instead use some safer alternative, Murray said.

"We can clean up contaminated sites like Zug Island or specific areas of concern in the Great Lakes," he said. "But once these are disbursed all over, it's really hard to do much at that point."

Contact Keith Matheny: 313-222-5021 or kmatheny@freepress.com.