



Emerging Concern Among “Every Day Chemicals”

You may have heard the saying “all drains lead to the lake,” but it can be hard to remember that includes what is sent down sinks, toilets, and washing machines. Many things we do in the course of a day can contribute to the contamination of surface waters (lake and streams) in ways we cannot see. Some of these “every day chemicals” are known as contaminants of emerging concern.

In 2013, the Great Lakes Network joined six other Inventory and Monitoring Networks and the U.S. Environmental Protection Agency (USEPA) in a study analyzing samples from park surface waters for wastewater indicators, pharmaceuticals, personal care products, and pesticides. From 2013 through 2015 we collected surface water samples from four parks—Apostle Islands National Lakeshore, Indiana Dunes National Lakeshore, Isle Royale National Park, and Mississippi National River and Recreation Area. Samples from Isle Royale were not analyzed for wastewater indicators.

Estrogen, medications, DEET, and more

More chemicals and higher concentrations were detected at the two urban parks (Mississippi River and Indiana Dunes) than at the two more remote parks (Apostle Islands and Isle Royale).

Fourteen wastewater indicators were detected across the three parks analyzed, including two forms of estrogen (*Table 1*), both of which were detected in the same sample at concentrations >100 ng/L. Concentrations of >5 ng/L are known to affect the reproduction of at least one species of minnow.

At Indiana Dunes and Mississippi River, pain relievers, anticonvulsants, antidepressants, and diuretics were the most frequently detected pharmaceuticals (*Table 2*).

Gabapentin, an anticonvulsant, had the highest concentration of all detected pharmaceuticals.

Bisphenol A, an industrial chemical used primarily to make polycarbonate plastic and epoxy resins, and *organophosphate flame retardants* were commonly detected wastewater indicators at all three sampled parks.



A technician collects a water sample from a stream at Indiana Dunes National Lakeshore. NPS photo.

Table 1. Detection frequency and maximum concentration of detected wastewater indicators analyzed in a subset of samples in 2013 and 2014. ng/L = nanograms per liter, or parts per trillion.

Park	Chemical	Chemical Class	Detection Frequency (%)	Maximum Concentration (ng/L)
<i>Apostle Islands National Lakeshore (2014)</i>				
	Bisphenol A	Plastic component	12	56.2
	Tri(dichloroisopropyl) phosphate	Plasticizer/flame retardant	12	50.9
	Triclosan	Antimicrobial	12	74.9
<i>Indiana Dunes National Lakeshore (2014)</i>				
	Acetophenone	Fragrance	40	67.7
	Bisphenol A	Plastic component	40	350
	Caffeine	Stimulant	20	215
	Camphor	Fragrance	20	89.6
	Equilenin	Estrogen	20	187
	Estrone	Estrogen	20	121
	Methylsalicylate	Fragrance	20	53.4
	Triphenyl phosphate	Plasticizer/flame retardant	20	82
<i>Mississippi National River and Recreation Area (2013)</i>				
	Bisphenol A	Plastic component	50	232
	Caffeine	Stimulant	50	43.3
	Galaxolide	Synthetic fragrance	33	115
	Metolachlor	Herbicide	17	867
	Tributyl phosphate	Plasticizer/flame retardant	33	68.6
	Triethyl citrate	Plasticizer	17	146

Simazine had the highest observed concentration among herbicides (>1000 ng/L) in two samples, both from Indiana Dunes. Those two, along with concentrations of *metolachlor*, another herbicide, at Mississippi River, were similar to concentrations reported for other major urban rivers in the United States. None of the samples exceeded the Maximum Contaminant Levels for herbicides in drinking water set by the USEPA.

With the exception of a few chemicals, detected concentrations were generally far below screening values or benchmarks at which human health can be affected. The exceptions were metformin, atrazine, and simazine, which each had concentrations approaching available human-health benchmarks in at least one sample, and *hydrochlorothiazide* (a diuretic medication), which exceeded a human health-based screening value in seven samples.

Management Implications

Data from this study will help us to establish a baseline for chemicals of concern in Midwestern national parks and highlight the need to better understand where these chemicals come from, how they get into our surface waters, and what effects they can have on aquatic systems in national parks.

In the meantime, the work continues. We collected samples from inland lakes at Pictured Rocks and Sleeping Bear Dunes national lakeshores in 2016, and we hope to collect samples in 2017 from Voyageurs National Park and Grand Portage National Monument. ●

Table 2. Detection frequency and maximum concentration of pharmaceuticals, personal care products, and pesticides detected in at least 30% of samples collected at each national park. ng/L = nanograms per liter, or parts per trillion.

Park	Chemical	Chemical Class	Detection Frequency (%)	Maximum Concentration (ng/L)
<i>Apostle Islands National Lakeshore (2014)</i>				
	Gabapentin	Medication (anticonvulsant)	30	13.7
<i>Isle Royale National Park (2015)</i>				
	Atrazine	Herbicide	38	14.6
	N,N-diethyl-3-methylbenzamide (DEET)	Insecticide	92	119
<i>Indiana Dunes National Lakeshore (2014-2015)</i>				
	2,4-Dichlorophenoxyacetic acid	Herbicide	58	179
	Acetochlor oxanilic acid	Herbicide by-product	68	105
	N,N-diethyl-3-methylbenzamide (DEET)	Insecticide	92	122
	Gabapentin	Medication (anticonvulsant)	58	2790
	Imazethapyr	Herbicide	42	492
	Metformin	Medication (antidiabetic)	32	903
	Metolachlor sulfonic acid	Herbicide by-product	100	1550
	Simazine	Herbicide	34	3140
	Triclopyr	Herbicide	39	581
<i>Mississippi National River and Recreation Area (2013-2014)</i>				
	2,4-Dichlorophenoxyacetic acid	Herbicide	100	172
	Acetochlor	Herbicide	50	265
	Acetochlor oxanilic acid	Herbicide by-product	95	896
	Atenolol	Medication (blood pressure)	35	30.5
	Atrazine	Herbicide	100	302
	Atrazine de-ethyl	Herbicide by-product	30	56.8
	Bentazon	Herbicide	30	12.6
	Caffeine	Stimulant	55	43.3
	N,N-diethyl-3-methylbenzamide (DEET)	Insecticide	60	251
	Desmethylvenlafaxine	Medication (antidepressant)	65	74.7
	Dimethenamid	Herbicide	45	119
	Dimethenamid ethanesulfonic acid	Herbicide by-product	35	107
	Gabapentin	Medication (anticonvulsant)	100	1080
	Gemfibrozil	Medication (cholesterol mgmt)	35	27.5
	Hydrochlorothiazide	Medication (diuretic)	55	67.8
	Hydroxybupropion	Medication (antidepressant metabolite)	40	42.6
	Imazethapyr	Herbicide	70	198
	Lamotrigine	Medication (anticonvulsant)	65	85.2
	Metformin	Medication (antidiabetic)	100	150
	Metolachlor	Herbicide	65	867
	Metolachlor sulfonic acid	Herbicide by-product	100	555
	Ranitidine	Medication (antacid)	42	33.1
	Sulfamethoxazole	Medication (antibiotic)	55	77.7
	Tramadol	Medication (opioid, pain reliever)	30	28.2