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More Than Just a Pretty Shoreline

By Ted Gostomski, Network Science Writer

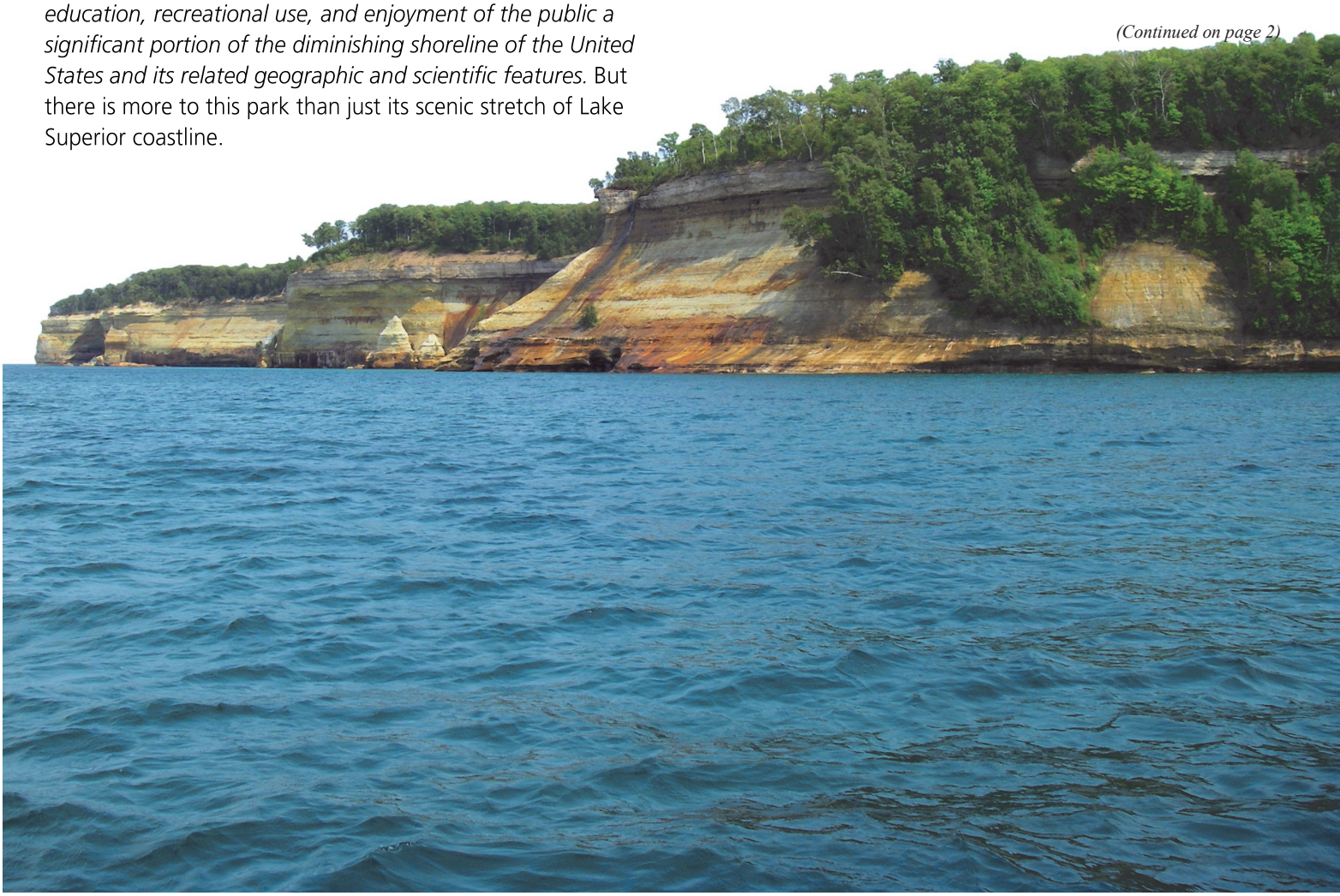
The shoreline is certainly beautiful. Water oozing out of the sandstone and conglomerate bedrock leaves mineral stains—streaks of red, black, orange, and brown—down the cliff faces, creating the namesake "picture rocks." Waterfalls spill over high bluffs and run down angled rock into Lake Superior. Further north and east, bright, sheer, gray-green cliffs plunge into the lake, their various faces joined at sharp angles. And then there are the Grand Sable Dunes.

Such geological drama is what made Pictured Rocks the National Park System's first national lakeshore, created by Congress in 1966 to *preserve for the benefit, inspiration, education, recreational use, and enjoyment of the public a significant portion of the diminishing shoreline of the United States and its related geographic and scientific features.* But there is more to this park than just its scenic stretch of Lake Superior coastline.

Moving inland from the shoreline by just half-a-mile in many places, or as many as 4 miles through the Beaver Basin Wilderness, an invisible line separates the park's Shoreline Zone from the Inland Buffer Zone. Pictured Rocks is the only NPS area with a legislated buffer zone, an area extending the length of the park that is intended *to stabilize and protect the existing character and uses of the lands, waters, and other properties*, including hunting and logging.

"No [NPS] lands are commercially logged," says Bruce Leutscher, the lakeshore's Chief of Science and Resource

(Continued on page 2)



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(Continued from page 1)

Stewardship. "Timber harvest takes place on private or state lands within our boundary, but our oversight of logging activity is limited." Still, park managers review the state's proposed forest management prescriptions and work with them if a timber sale will affect traffic flow, aesthetics, watershed, or species habitat close to the park boundary.

Leutscher says, "There is usually some IBZ topic that comes out every week, but it's not always about logging. Many times it's a right-of-way issue for maintaining a road used by park visitors, cooperative monitoring of resources, or boundary issues."

When it comes to natural resources, plant and animal populations in the park are influenced by the larger populations beyond park borders—what happens outside the park does not stay there. One of the biggest issues facing Leutscher's staff is the spread of non-native species, specifically non-native pathogens. White-nose Syndrome, the fungal disease killing bats all across the country during their winter hibernation, is one of those pathogens.

Bats found in Pictured Rocks during the summer months migrate to hibernation sites outside the park for the winter. Fewer seem to be returning each summer.

"Our populations of northern long-eared and little brown bats are declining significantly," says the lakeshore's wildlife biologist, Cindy Heyd.

Another insidious threat is beech bark disease (BBD), which is killing American beech, a dominant tree in the northern hardwood forest. BBD has an infection rate of approximately 99% and a 92% mortality rate. The loss of beech trees will impact many species of plants and wildlife. (See pages 4 and 5 for more detailed information.)

It's important to have the right tools in addressing resource issues, and this is where network staff lend a hand. "ArcGIS products such as aerial imagery and the vegetation map have been quite useful when designing wildlife surveys," says Leutscher. Network scientists have also helped to develop a American beech restoration program. Researchers will collect seeds and twig cuttings from healthy trees in the park and use them in a grafting program to grow disease-resistant trees that can be planted in the future. This program is scheduled to begin in the summer of 2017.

More recently, park managers have been wrestling with increased visitation. Between 1973 and 2016, an average of 454,164 people visited Pictured Rocks every year. In 2015, visitation jumped by almost 200,000 people (37%) from the year before, topping 700,000 visitors. There was a smaller increase in 2016, but the last two years saw the highest visitation on record. The sudden popularity raises concerns over how to minimize the environmental impact of so many more people using the park. To address this, the park has begun developing a Visitor Use Management Plan focused on the western third of the park from Sand Point to Chapel Beach. This is the next challenge for a newly discovered gem in the National Park System. ●

Welcome, Alex!

We are thrilled to welcome Alex Egan to the Great Lakes Network as our inland lakes aquatic ecologist at Isle Royale National Park. Alex is not new to the NPS or to Isle Royale. He worked on the island as a seasonal biological technician for 15 years, becoming an accomplished ecologist with an impressive knowledge of songbirds, loons, and aquatic insects. He earned a Ph.D. from the University of Minnesota studying the larval midges that inhabit splash pools along the island's Lake Superior shoreline. Most recently, Alex was a Natural Resource Specialist with the Minnesota Department of Natural Resources. ●

NPS PHOTO

2017 Field Schedule

Amphibian monitoring is going strong now, with many of the technical glitches smoothing out. That continues this year along with the newest contaminants monitoring using larval dragonflies to measure mercury in the aquatic environment. The landscape dynamics guys will embark on virtual tours of Isle Royale and Grand Portage this year, while the vegetation monitoring crew will travel to Pictured Rocks to resample plots established in 2009. ●

	AMPH	BATS	BC-dragonflies	DIAT	LB	VEG	WQ
Apostle Islands (APIS)	April–June	June–mid-Aug	May–Aug		June		
Grand Portage (GRPO)	April–June	June–mid-Aug	May–Aug		June		May-Oct (contam. only[3])
Indiana Dunes (INDU)	March–May	June–mid-Aug	May–Aug	May	June		May, Jul, Sept, Nov[3]
Isle Royale (ISRO)	April–June	June–mid-Aug	May–Aug		June		May–Sept[4]
Mississippi River (MISS)	March–May	June–Aug	May–Aug		June		
Pictured Rocks (PIRO)	April–June	June–mid-Aug[2]	May–Aug		June	May–Aug	June–Sept
St. Croix (SACN)	April–June[1]	June–mid-Aug	May–Aug	Sept	June		Apr–Nov
Sleeping Bear Dunes (SLBE)	April–June	June–mid-Aug	May–Aug		June		June–Sept
Voyageurs (VOYA)	April–June[1]	June–mid-Aug	May–Aug		June		June–Sept[3,5]

AMPH – *Amphibians.* Park staff and volunteers will collect data recordings. [1]Monitoring is being conducted using a U.S. Geological Survey protocol.

BATS – Collection of data recordings will be accomplished by park and network staff. [2]Monitoring being conducted under a park protocol.

BC – *Bioaccumulative Contaminants (dragonflies).* Samples will be collected by Randy Lehr and Northland College students (APIS, GRPO, ISRO, SACN), Joy Marburger and others (INDU, SLBE), Allie Holdhusen and volunteers (MISS), volunteers (PIRO), and Jaime LeDuc and others (VOYA).

DIAT – *Diatoms.* Collected during water quality sampling at INDU and SACN.

LB – *Landbirds.* Surveys are conducted by park staff and others.

VEG – *Vegetation.* Conducted by a team of up to three student cooperators led by Suzy Sanders and Jessica Kirschbaum.

WQ – *Water Quality.* Conducted by Josh Dickey (INDU), Alex Egan (ISRO), Leah Kainulainen (PIRO), Rick Damstra (SACN), Chris Otto (SLBE), and Jaime LeDuc (VOYA). 3–Includes sampling for surface water contaminants. 4–Includes sampling for freshwater midges from a subset of lakes. 5–Includes sampling for mercury in water from a subset of lakes.

In Memoriam

Parker Matzinger, Bat Biologist: 1994–2017

Parker came to work for us in 2015 as the coordinator of our new bat monitoring program. He returned in 2016, after graduating from Northland College, and he added event planning (for a bat monitoring workshop here in Ashland) and outreach education (Wisconsin Science Fest) to his accomplishments. When he left the office in January, he was headed to Panama and a three-month internship with the Smithsonian Tropical Research Institute. He was also set to begin graduate studies focused on bats, and we looked forward to having him back in our office and parks. Parker had been in Panama only a couple of weeks when he suddenly collapsed one morning and could not be revived. His death is attributed to natural causes. Parker was doing what he loved when he died. That is some comfort, but we miss our colleague and friend. ●

BOB GROSS

A Forest Community Under Attack

Beech bark disease is significantly changing eastern deciduous and mixed northern hardwood forest communities in the northeastern and Midwestern U.S. Beech bark disease (BBD) arrived in North America in 1890 when European beech was brought to Nova Scotia. It has since moved south and west, infecting American beech trees at a rate of approximately 99% and killing 92% of those it infects. It was first discovered at Pictured Rocks in 2001.

BBD is a "disease complex" because of its two-part infection process. The disease begins with the beech scale insect feeding on tree sap. Later, nymphs and adults secrete a white, wool-like wax that is evident on affected trees. Death of the tree occurs because the burrowing of insects into the wood provides an entry way for subsequent infection by one of two species of fungi.

This disease complex is similar to Dutch elm disease, which decimated more than 75% of the elms in North American between 1930 and 1989, and chestnut blight, which wiped out most mature American chestnut trees between 1904 and 1940. The difference between then and now is that Dutch elm disease and chestnut blight eliminated those trees from their native ranges; in this case, beech trees will still survive, but they will do so as young thickets of "highly defective" individuals, most of which will die young. Some modeling studies have shown that it will take 300 years for beech forests to return to their pre-BBD health and composition.

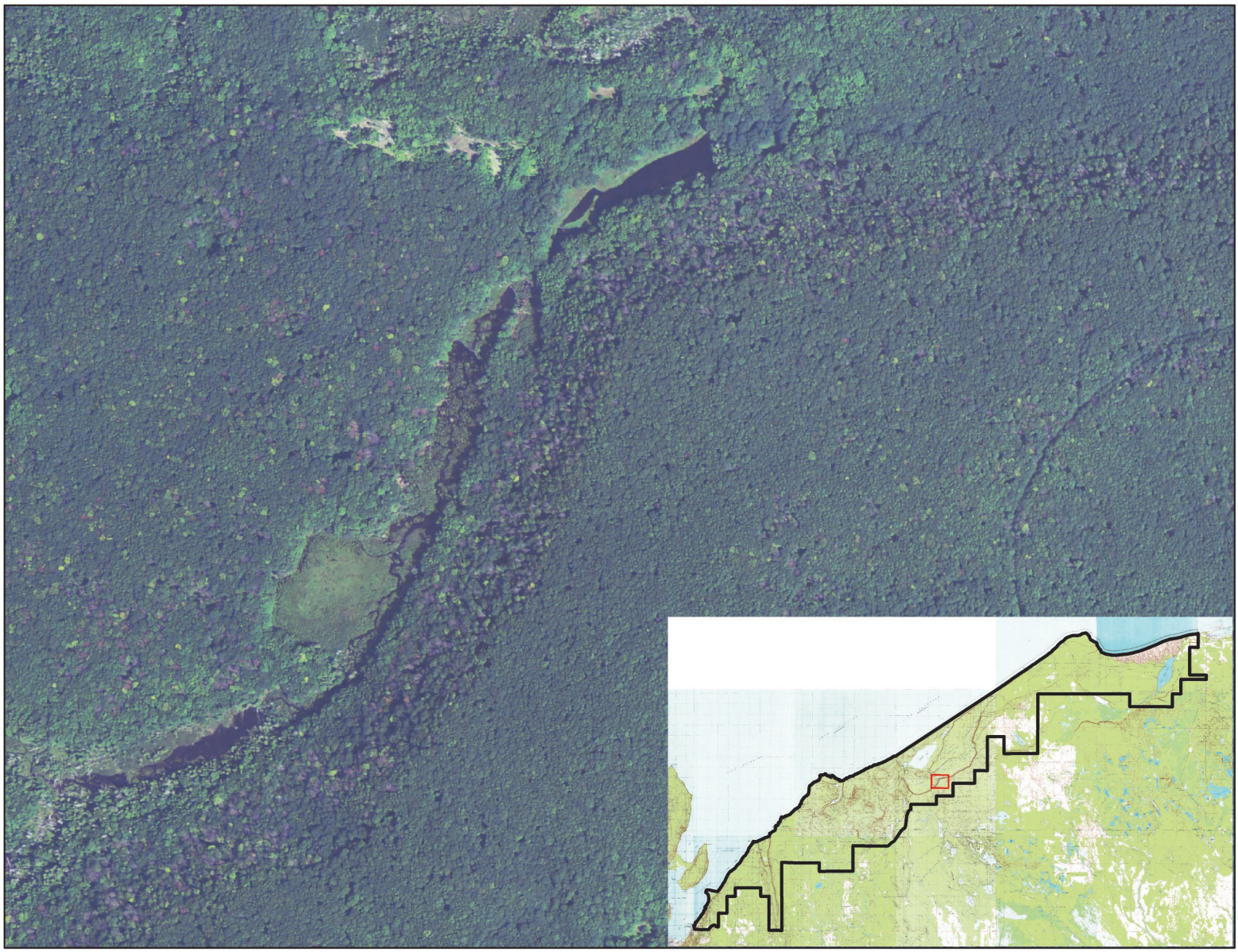
Loss of American beech trees creates problems throughout the forest community food web. Forest-dwelling hawks such as the northern goshawk and red-shouldered hawk favor large beech trees for nesting because the leafy canopy provides ideal protection to eggs and young from sun and rain and the temperature extremes they bring. But one of the first signs of tree death is the loss of leaves, leaving nests exposed and creating large openings in the forest canopy.

BBD also affects the production of beech nuts, an important food source for many in the northern hardwoods forest. One study found a 37% reduction in beech nut production after the arrival of BBD. Beech nuts are the primary autumn food source for bears before going into their dens, and some studies have shown a relationship between beech nut abundance and successful reproduction for bears and the American marten. Smaller mammals and birds, such as chipmunks, red squirrels, ruffed grouse, and blue jays—all of which are prey for the goshawk and red-shouldered hawk—also rely on beech nuts.

The rapid pace of BBD across forests in the national lakeshore makes it unlikely the disease will be stopped. So park managers and network scientists have devised a plan for restoring beech to the forest community by using local, healthy stock. Beginning this summer, scientists from Michigan Technological University will collect seed and twig cuttings from healthy trees at Pictured Rocks and Sleeping Bear Dunes (BBD was discovered at Sleeping Bear Dunes in 2008). The cuttings will be used for grafting then growing disease-resistant beech trees that can be planted at both parks. Hopefully, this restoration will help the forests at Pictured Rocks (and Sleeping Bear Dunes) to recover from BBD and return balance to the forest community in something less than 300 years. ●

Top right: Seen from the air, the southern edge of the Beaver Basin Wilderness (2012) reveals a dark brown, S-shaped line of dead beech trees. Purple-brown dots north and east of the ridgeline are also dead beech trees. Inset map shows this ridge's location in the park. NATIONAL AGRICULTURE IMAGERY PROGRAM, datagateway.nrcs.usda.gov

Bottom: Beech nuts are an important food source for many in the northern hardwood forest (*near right*). Beech bark disease becomes visible when a waxy coating is produced on the bark by the invading scale insects (*center)*. As the disease kills the tree and the leafy crown is lost, eggs and young in the nests of forest-dwelling birds like red-shouldered hawks are vulnerable to sun, heat, and rain (*far right*).



OHIO DEPARTMENT OF NATURAL RESOURCES

NPS PHOTOS

Things We're Learning

From: Elliott, S.M., and **D.D. VanderMeulen**. 2016. A regional assessment of chemicals of concern in surface waters of four Midwestern United States national parks. Science of the Total Environment. DOI: www.sciencedirect.com/science/article/pii/S0048969716325682.

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 (lakes 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.

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 nanograms per liter (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 1). 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.

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 levels 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.

Data from this study will help us to establish a baseline for chemicals of concern in Midwestern national parks. The study also highlights 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. ●

Download the **resource brief** about this project from our website: Emerging Concern Among "Every Day Chemicals."

Opposite page: Water quality technician Josh Dickey collects a water sample from a stream at Indiana Dunes National Lakeshore. NPS PHOTO.

Table 1. Pharmaceuticals, personal care products, pesticides, and wastewater indicators (excluding Isle Royale) detected in at least 30% of water samples collected from lakes and streams at each of four Great Lakes Network national parks. Substances are listed from greatest detection frequency to least for each park. Asterisk (*) after the substance name indicates detection in 50% or more samples. Substances in **bold** were detected in 100% of samples.

Chemical	Chemical Class
Apostle Islands National Lakeshore	
Gabapentin	Medication (anticonvulsant)
Bisphenol A	Plastic component
Tri(dichloroisopropyl) phosphate	Plasticizer/flame retardant
Triclosan	Antimicrobial
Indiana Dunes National Lakeshore	
Metolachlor sulfonic acid	Herbicide by-product
N,N-diethyl-3-methylbenzamide (DEET)*	Insecticide
Acetochlor oxanilic acid*	Herbicide by-product
2,4-Dichlorophenoxyacetic acid*	Herbicide
Gabapentin*	Medication (anticonvulsant)
Imazethapyr	Herbicide
Acetophenone	Fragrance
Bisphenol A	Plastic component
Triclopyr	Herbicide
Simazine	Herbicide
Metformin	Medication (antidiabetic)
Caffeine	Stimulant
Camphor	Fragrance
Equilenin	Estrogen
Estrone	Estrogen
Methylsalicylate	Fragrance
Triphenyl phosophate	Plasticizer/flame retardant
Isle Royale National Park	
N,N-diethyl-3-methylbenzamide (DEET)*	Insecticide
Atrazine	Herbicide

Chemical	Chemical Class
Mississippi National River and Recreation Area	
2,4-Dichlorophenoxyacetic acid	Herbicide
Atrazine	Herbicide
Gabapentin	Medication (anticonvulsant)
Metformin	Medication (antidiabetic)
Metolachlor sulfonic acid	Herbicide by-product
Acetochlor oxanilic acid*	Herbicide by-product
Imazethapyr*	Herbicide
Desmethylvenlafaxine*	Medication (antidepressant)
Lamotrigine*	Medication (anticonvulsant)
Metolachlor*	Herbicide
N,N-diethyl-3-methylbenzamide (DEET)*	Insecticide
Caffeine*	Stimulant
Hydrochlorothiazide*	Medication (diuretic)
Sulfamethoxazole*	Medication (antibiotic)
Acetochlor*	Herbicide
Bisphenol A*	Plastic component
Dimethenamid	Herbicide
Ranitidine	Medication (antacid)
Hydroxybupropion	Medication (antidepressant metabolite)
Atenolol	Medication (blood pressure)
Dimethenamid ethanesulfonic acid	Herbicide by-product
Gemfibrozil	Medication (cholesterol mgmt)
Galaxolide	Synethetic fragrance
Tributyl phosphate	Plasticizer/flame retardant
Atrazine de-ethyl	Herbicide by-product
Bentazon	Herbicide
Tramadol	Medication (opioid, pain reliever)
Triethyl citrate	Plasticizer

Apostle Islands National Lakeshore
Grand Portage National Monument
Indiana Dunes National Lakeshore
Isle Royale National Park
Mississippi National River and Recreation Area
Pictured Rocks National Lakeshore
Sleeping Bear Dunes National Lakeshore
St. Croix National Scenic Riverway
Voyageurs National Park

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