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GREAT LAKES INVENTORY AND MONITORING NETWORK

Integration, Excellence, and Communication

By Ted Gostomski, Network Science Writer

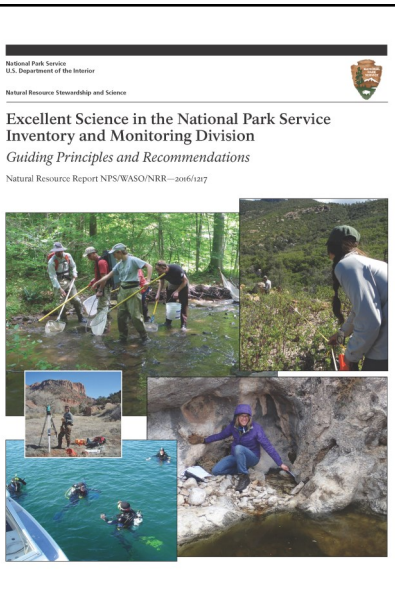
A few years after the Inventory and Monitoring (I&M) Program turned 10 years old and transitioned from a program to a division (IMD) of the Natural Resource Science and Stewardship Directorate (NRSS), division leaders conducted a survey of all IMD employees to learn what was working and how we can we improve our support of park management. Four thematic focus areas emerged from the responses that were received: Excellence in Science, Science Communication, Inventories, and Accountability and Achievability.

A committee was formed around each theme to look deeper into the issues and come up with recommendations for improvement. This past May, two working groups of the Excellence in Science committee published their recommendations for integrating science and park management and for strengthening the scientific integrity of the IMD.

"Scientists need to fully understand the management questions and context to which the science will be applied," state the authors of the *Integrating Science and Park Management*[1] report. To this end, "parks should openly express how well the [I&M monitoring] science does or does not meet their needs and routinely update [network staff] on their changing information needs." It is not always possible to modify I&M's long-term monitoring protocols to address "hot button" management questions, but the authors suggest implementing "effectiveness monitoring" to make better use of the monitoring data in some situations. Effectiveness monitoring is a process of analyzing monitoring data in a way that incorporates park management actions as treatment effects.

The authors also recommend that parks and networks work together to match I&M science with park information needs and decision support. They suggest "alternative approaches to exchanging science information, moving away from relying on formal technical reports to make more and better use of targeted resource briefs, interactive media, and personal engagement."

The second report— *Excellent Science in the National Park Service: Guiding Principles and Recommendations*[2]—arose in part from a realization made in the past few years that the external scientific community may not see I&M monitoring data as scientifically rigorous, if they see it at all. According to the authors, I&M networks publish 300–500 data summary and technical reports each year, making them available to resource managers through the NPS Natural Resource Publication Series. But this report series has two problems: first, the reports in the series are seen as "gray literature" by the science community



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Integration, Excellence, and Communication

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because, though they are peer reviewed, such reviews do not take place under the strict anonymous peer review standards of science journals. Second, the NPS report series is not widely available through standard science literature searches, and consequently, NPS science lacks visibility compared to that of other natural resource agencies, such as the U.S. Forest Service, Geological Survey, and Fish and Wildlife Service.

Thus, the Stellar Science work group made 25 recommendations aimed at ensuring the scientific credibility, reliability, and integrity of I&M science. Among other things, they recommend increasing our contributions to peer-reviewed scientific literature and building strong collaborative relationships both within and outside the NPS. They also recommend subjecting the IMD's monitoring programs to a critical review from the scientific community at large. In other words, university scientists and others should be given the chance to review and evaluate what I&M scientists are doing and to make recommendations for how we can improve the effectiveness and visibility of our work.

A third report, released by the Science Communication committee—the *Inventory and Monitoring Division Communication Strategy and Resource Guide*[3]—is intended to complement the larger-scale NRSS Science Communication Framework and to serve as a starting place for I&M networks looking to create their own communication plans. It "melds the strategic with the practical" by setting objectives that reflect division-wide direction and goals, and by providing tools and resources that can be used to achieve those goals. Individual networks can use this resource guide to develop "local implementation plans, which allow networks to meet both their specific needs and support the larger division goals." The Communication Strategy is organized around four objectives, each based on a target audience: resource managers; the larger scientific community; division, directorate, and NPS leadership; and the general public. For each audience, the authors lay out key messages, strategies, tactics, and expected outcomes, and they provide references, links to tools and templates, and suggestions for evaluating whether or not the communication has achieved what was intended.

The Inventory and Monitoring Division is growing and changing to meet the demands of contemporary park management. Those demands include doing more than just collecting and reporting on data or talking only to other scientists about our work. This is important not just for the future viability of the IMD, but also the future integrity of our parks' natural resources. ●

1. Bennetts, R.E., N. Chambers, J. Comiskey, K. James, J. Lawler, K. Legg, E. Matthews, L. Mazzu, R. Ohms, C. Schreier, and J.J. Taylor. 2016. Integrating science and park management: A framework for partnership. Natural Resources Report NPS/NRSS/NRR—2016/1230. National Park Service, Fort Collins, Colorado.

2. Perkins, D.W., M. Bozek, M. MacCluskie, T. Philippi, A. Ray, **W. Route**, and D. Thoma. 2016. Excellent science in the National Park Service Inventory and Monitoring Division: Guiding principles and recommendations. Natural Resource Report NPS/WASO/NRR—2016/1217. National Park Service, Fort Collins, Colorado.

3. Mims, A.L., M.D. DeBacker, A. Wondrak Biel, **T. Gostomski**, M. Nortrup, and M. Beer. 2016. Inventory and Monitoring Division communication strategy and resource guide. Natural Resource Report NPS/IMD/NRR—2016/1208. National Park Service, Fort Collins, Colorado.

"Next Generation Stewards" Play a Major Role in 2016

Both in the field and in the office, college students and recent graduates played a major role in accomplishing our field work this year. Along the way, they gained practical experience that will serve them well as they move ahead in their careers. Thanks to all of you. Job well done!


1

Erin Blow (1)
A 2012 Northland College graduate, Erin Blow spent a summer at Voyageurs National Park with the vegetation monitoring crew. Erin's duties focused on identifying and quantifying the herbaceous species in each plot and documenting any browse.

Joe Fitzgerald (2)
As our contaminants monitoring program shifts its focus from using eagles and fish as biosentinels to using dragonfly larvae, a crew of Northland College students led by Joe Fitzgerald worked with Dr. Randy Lehr to collect those larvae from four network parks this summer.


2 NPS photo/Colleen Flanagan Pritz

Joel Gebhard (3)
Joel started his senior year at the University of Wisconsin in Stevens Point after finishing up a summer with the vegetation monitoring crew in Voyageurs National Park. Joel was responsible for measuring tree diameters, taking coarse woody material measurements, making forest floor assessments for earthworm presence, collecting tree cores, and determining canopy characteristics.

Asher Maliepaard (4)
Asher is a 2016 graduate of Northland College whose work on the vegetation crew included recording tree diameters, taking coarse woody material measurements, assessing earthworm impacts to soil, collecting tree cores, and determining canopy characteristics. In addition to being a botanist, he was well-regarded as a handyman who knew just what to do if there were problems with the boat.


3

Parker Matzinger (5)
Parker graduated from Northland College in May and immediately came to work for the network office, coordinating the bat monitoring program. In addition to helping parks set up equipment, he was their point-of-contact for questions and the one to receive the data. Parker also helped to organize a bat monitoring workshop in August that was attended by park biologists as well as the U.S. Forest Service.

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Next Generation Stewards refers to an element in the National Park Service *Call To Action* (C2A)—an initiative launched in 2011 to "chart a path toward our second century vision by ... committing to concrete actions that advance the mission of the Service." In the *C2A*, the Next Generation Stewards action item aims to "create a new generation of citizen scientists and future stewards of our parks." The Great Lakes Network has worked toward that goal by engaging local high school students in independent research and, this year, by working with our local college to give current students and recent graduates a number of opportunities to be a big part of our work force. We are proud of these partnerships and what the students have accomplished. www.nps.gov/calltoaction/index.html


5 Alec Malenfant


4

2016 Field Season Summary

Amphibians

Thanks to all of you at the parks who contributed to another successful year of monitoring amphibians. Data is starting to roll in, and because there was very little equipment failure compared to last year, we are receiving a lot of sound files. No song meters were flooded out or stolen this year, but we still see occasional vandalism.

The amphibian monitoring protocol and standard operating procedures are in the final stages of development before going out for review. Gary Casper, our contractor for the amphibian monitoring program, is drafting a report synthesizing the monitoring data collected thus far. We expect to publish his report by the end of 2017. We have also begun developing a key to salamander larvae and egg masses to help us identify salamander species while deploying the recorders each spring.

Though this recorder at Indiana Dunes appears to have been flooded, it was in fact vandalized. This was the second consecutive year that someone moved the recorder at this site from the top of its post and reattached it below the water line.

Call recognition files have now been developed for 11 of 14 species. The other three—mink frog, pickerel frog, and Fowler's toad—are proving problematic. But of these, only the mink frog is known to occur in the network parks.

We are looking into eDNA as both an alternative to song meters and a way to detect non-calling amphibians such as salamanders. Mark Hart visited three of the parks this year (APIS, INDU, SLBE) to collect and filter water samples from several of the wetlands being monitored. These will be used to develop DNA markers and test for amphibian presence. In addition to identifying non-calling amphibians, having eDNA for frogs and toads should provide a good way to test the accuracy and reliability of the acoustical data. Our eDNA work is supported by funds from the Great Lakes Restoration Initiative.

Bats

We moved into our second year of acoustic bat monitoring to provide a solid foundation for assessing trends in park and regional bat populations as the effects of white-nose syndrome (WNS), an exotic fungal disease that has killed thousands of bats, progresses through the upper Midwest. We successfully added MISS, SACN, and INDU to the program this year, making bat monitoring an active program in all nine network parks. The result was a more than two-fold increase in sampling from 2015 that spanned over 1,800 nights at more than 200 sites in eight of the nine parks. (PIRO has initiated their own bat monitoring under a different protocol.) All of this knowledge will improve how our parks are able to manage for bats in the future as well as maintain federal compliance for bat exclusion from buildings now.

We provided hands-on training to park technicians at the start of the year, visited multiple parks throughout the sampling season, and brought together park biologists and regional bat experts for a workshop in September to evaluate this season and discuss future monitoring. We also refined and finalized our protocol and primary standard operating procedures, and provided easy online access to resources. Our work also resulted in two presentations about the monitoring program, one at a public forum in Ashland, Wisconsin, and the other at the 46th North American Bat Symposium in San Antonio, Texas.

Bat detector station at Sleeping Bear Dunes.

Acronym Decoder

APIS Apostle Islands National Lakeshore (Wisconsin)

GLKN Great Lakes Inventory and Monitoring Network

A preliminary analysis of our 2015 data confirms the presence of all the species expected to be present in the network parks. We are working with a new contractor to analyze 2015 and 2016 data, and to create an institutionalized central pathway for data management, data quality, and archival of data. We submitted another grant to receive WNS funding to continue our monitoring program through 2017 and should hear the results this November.

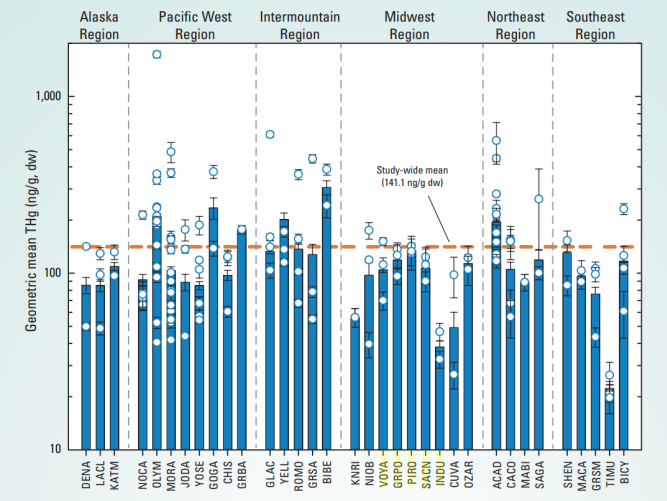
Contaminants—Mercury and Dragonflies

We are transitioning away from monitoring a large suite of contaminants in bald eagles and fish to monitoring just mercury (Hg) using larval dragonflies. Our protocols for monitoring contaminants in bald eagles and fish do not go away, but they will be used on a less frequent basis and only as funds are available. Monitoring mercury in larval dragonflies is much more feasible on an annual basis and for the long-term because they are easily sampled and laboratory analysis is less expensive. More importantly, mercury is the most pervasive contaminant in the upper Midwest, so monitoring its occurrence in biota is important for park managers and the public.

The value of using dragonfly larvae for monitoring Hg was documented by our collaborators from the University of Wisconsin-La Crosse. Using data they collected at four parks in the network, they concluded that concentrations of Hg in larval dragonflies are highly correlated with levels in fish. Their publication provides the scientific basis for our continued monitoring. This study was commissioned by the network, with major funding provided by the Great Lakes Restoration Initiative.

In parallel with the above study, we began using dragonflies to monitor mercury at SACN in 2012 under a citizen science partnership between the NPS Air Resource Division, the University of Maine, and the U.S. Geological Survey, with students from Northland College in Ashland, Wisconsin, doing the collecting. This program has grown to include all parks in the network and over 50 other national park units across the nation. Each park has three sites (lakes or sections of stream) where 15 larval dragonflies are collected each year. Each individual dragonfly is identified to species or genus and sent to a laboratory where the concentration of total mercury (THg) is measured in parts per billion (ppb). The added benefit to this program is that we can compare parks across regions and across the nation (*see graph*). As of 2014, the data suggests that parks in the Midwest are at or below the national average for total mercury in dragonfly larvae.

We are building upon this citizen science partnership and developing a more rigorous sampling protocol under our water quality program. Citizen science partners may continue to be part of this new protocol, but we must ensure the data are collected and handled properly to maintain a high degree of scientific credibility. We expect to have the new protocol ready for implementation by summer of 2018.



Average total mercury load (nanograms/gram; also referred to as parts per billion, or ppb) in dragonfly larvae collected from lakes in 34 parks across the United States. Great Lakes Network parks are highlighted in yellow. The orange dashed line indicates the national average total mercury load. *Graph from Eagles-Smith et al., Dragonfly Mercury Project fact sheet (http://pubs.usgs.gov/fs/2016/3005/fs20163005.pdf).*

Landbirds

Monitoring was completed at all points in all nine parks this year. This was the fifth year of monitoring for Pictured Rocks and the second year at Mississippi River.

Notable Observations

ISRO: Uncommon birds recorded during the surveys this year included a Tennessee warbler on the Lake Richie–Greenstone

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2016 Field Season Summary

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route and Cape May warblers on the Feldtmann Lake and Passage Island routes.

GRPO: A northern goshawk was heard calling, and a quick check revealed a nesting female on or just outside the park boundary. Also, two American bitterns were heard calling at two different points. Though not the first record for the park, it is the first time this uncommon species has been heard during the surveys.

PIRO: Though not a songbird and not seen in the park during the survey period, a crested caracara appeared near the western edge of Pictured Rocks National Lakeshore in early July. The caracara is common in Central America, with the northern edge of its range being in southeastern Texas. Photos posted on eBird.org show the caracara was still in the Munising area as of 28 September.

Work is progressing on an online bird monitoring database for the Great Lakes Network as part of the Midwest Avian Data Center. A data entry portal is in place, and we are now setting up login rights for each of the parks so that data entry can begin.

A Crested Caracara (*Caracara cheriway*) visited the south shore of Lake Superior near Pictured Rocks National Lakeshore in July. *NPS photo/C. Heyd.*

Land Cover/Land Use

Sleeping Bear Dunes National Lakeshore

Early in the 2016 field season, Al Kirschbaum and Northland College student Lewis Weichmann traveled to Sleeping Bear Dunes to validate areas of blowdown Lewis had delineated the previous winter using aerial photography and satellite imagery. After two long days in the field, Lewis presented the results to park natural resource staff. The field validation results showed that the work Lewis performed in the lab proved to be correct nearly 90% of the time. This is an incredibly high rate, especially given the small size of some of the blowdown areas in the park.

Pictured Rocks National Lakeshore

We recently received LiDAR elevation data products for PIRO and SLBE. These data provide accurate, high-resolution topography of the ground surface, revealing details of glacial features such as eskers, moraines, sand dunes, and outwash flats. We have also used the data to model PIRO's network of streams and to derive forest canopy metrics. Though we found these data provide a detailed stream network, there is a considerable number of stream courses delineated that are not apparent on the landscape, so some discretion is needed in using these data. The canopy modeling revealed highly accurate canopy surface heights. For example, we found a grove of sugar maples >30 m (98 ft) tall. However, understory canopy metrics were somewhat unreliable, and we expect to do some further analysis to tease out these finer details in forest structure.

Network remote sensing specialist, Al Kirschbaum, investigates canopy height and structure at Pictured Rocks.

Vegetation

We completed our second consecutive year monitoring forests at Voyageurs, focusing on the interior lake chain, the Kettle Falls region, the area south of Namakan Lake, and western Rainy Lake. We sampled 34 permanent monitoring plots, bringing the

total number of plots at the park to 54.

One highlight this season was finding early saxifrage (*Micranthes virginiensis*) in a plot on Dryweed Island. This species is a specialist, its habitat limited to moist cracks on sunny, rocky outcrops. We located approximately 30 individuals, but did not perform an exhaustive search. Because this population represents a county record (Koochiching), we sent a specimen to the University of Minnesota Bell Museum Herbarium for documentation and archival. We hope to present preliminary results of our monitoring at the International Rainy-Lake of the Woods Watershed Forum in March 2017. We will revisit all 54 plots in 2025.

Early saxifrage, shown next to the tip of a pen, was found at Voyageurs, the first record of the species in Koochiching County.

We also took a "sabbatical" from our normal routine and spent three weeks monitoring rare plants on Isle Royale's barrier islands with Dr. Sarah Johnson of Northland College. We visited 28 permanent monitoring plots established by Dr. Emmet Judziewicz in 1993 and 1994 (and revisited by him in 1998 and 2003). The rare plants we sought included knotted pearlwort (*Sagina nodosa*), three-toothed saxifrage (*Saxifraga tricuspidata*), black crowberry (*Empetrum nigrum*), fir clubmoss (*Huperzia selago*), and encrusted saxifrage (*Saxifraga paniculata*). Many of these species have circumboreal distributions—in addition to Isle Royale and the Canadian Arctic, they are found in the British Isles, along the coast of Greenland, within the fjords of Norway, and in the Caucasus Mountains in Asia.

We found the populations of most species to be stable or increasing, possibly due in part to Lake Superior's higher water levels in recent years. Prior to our work, there was only one known population of lingonberry (*Vaccinium vitis-idaea*) in Michigan, which was just above the boulders on the south side of Passage Island. When we visited the island this year, Dr. Johnson found a second population not far from the lighthouse.

Water Quality—Inland Lakes

Network and park staff worked together to complete three rounds of routine water quality sampling on 31 lakes in 2016. It was a very challenging year due to technical issues with equipment at nearly every park. We overcame these challenges by using backup equipment, shipping equipment from park to park, and by having extremely capable water quality staff at the parks that were able to use several different pieces of complicated monitoring equipment. Nevertheless, we officially dubbed this as the year of "Twenty Fixteen."

We maintained vertical arrays of temperature loggers that are collecting data year-round from Lake Richie (ISRO), Grand Sable Lake (PIRO), Lake Manitou (SLBE), and Little Trout Lake (VOYA). VOYA staff also maintain an array at Mukooda Lake. New arrays were deployed in Bass, Beaver, and Shoepack lakes at SLBE, PIRO, and VOYA, respectively. Data from these arrays are providing important information about each lake's thermal structure, as it is related to weather and climate, suitability for fish habitat, and timing of important events such as ice formation and melting. The arrays also document when each lake's water column is mixing (cool water rising to the top, warmer water sinking to the bottom). Mixing events are a natural occurrence in spring and fall (*see graph on next page*), but if they occur in the summer, they increase the chances of a harmful algal bloom (HAB) forming. Summer mixing occurs when strong winds blow over the lake surface, bringing cool water and sometimes even sediment up from the lake bottom. Because both the cool water and the sediment are rich in nutrients such as phosphorous and nitrogen, conditions become ideal for HAB formation. Also, the longer it takes for ice to form on a lake in the late fall and early winter, the greater the chances of lakes mixing a second time, again increasing the likelihood of a

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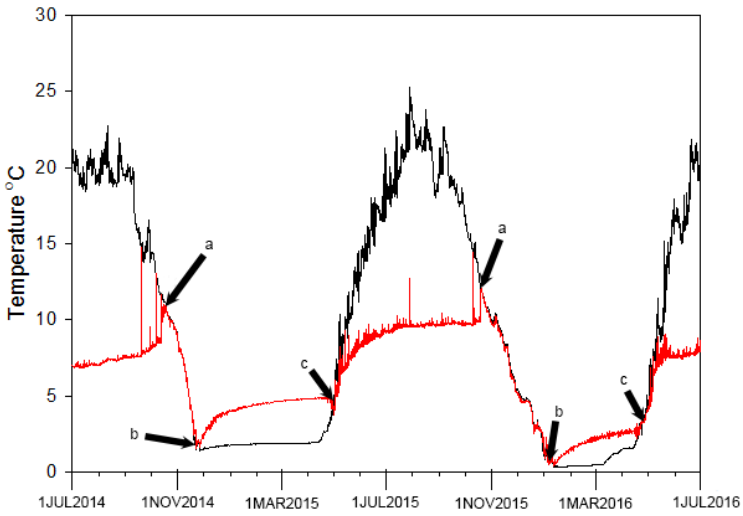
HAB forming. Water temperature data for these lakes are now available online at https://irma.nps.gov/aqwebportal/.

Apostle Islands National Lakeshore

When a 328-foot-long section of the sand berm separating Outer Island lagoon from Lake Superior was washed away during a storm in September 2014, the lagoon became a bay. Despite this new connection to Lake Superior, we continued our annual monitoring at the lagoon in 2015. Not surprisingly, analyses of those data showed that water in the lagoon was chemically the same as water in Lake Superior. Thus, the lagoon no longer represents an "inland lake" in any way, and we have suspended our monitoring at that site. However, our partners at the St. Croix Watershed Research Station (SCWRS) analyzed lagoon sediment collected prior to the breach and found what appears to be a previously unknown diatom species, the description and naming of which are underway. It remains to be seen whether this new species will persist in the lagoon's more Lake Superior-like conditions.



Thermal array data for Grand Sable Lake (PIRO) from July 2014 to July 2016, showing water temperature near the lake's surface (black line, 2 m/6.5 ft depth) and bottom (red line, 18 m/59 ft depth), and associated events such as timing of fall turnover (a), ice-on (b), and ice-off (c).

Network staff provided field support for a number of aquatic monitoring projects at APIS, including benthic mapping, monitoring water quality of Lake Superior at two sites near Sand Island, and collection of larval dragonflies for mercury analysis. We also provided laboratory and office space to researchers from the University of Wisconsin-Milwaukee.

Indiana Dunes National Lakeshore

Josh Dickey, with assistance from other park staff, conducted all three rounds of sampling at Middle Lagoon in 2016 and collected surface water samples from 19 stream, river, and ditch sites in April and November for our surface water contaminants monitoring.

Isle Royale National Park

Like castles made of sand, Mark Romanski's tenure as the network's Inland Lake Aquatic Ecologist was brief. Fortunately, he left us to return to Isle Royale as the Chief of Resource Management, and under his tutelage, network biological technicians Maria DeLaundreau and Matthew Pierle successfully completed all three rounds of monitoring at all nine lakes. Maria and Matt also maintained and downloaded data from the temperature logger array in Lake Richie.

Isle Royale's water quality monitoring team: Maria DeLaundreau, Matthew Pierle, and Mark Romanski.

Pictured Rocks National Lakeshore

Leah Kainulainen, with assistance from park and network staff and volunteers, completed all scheduled routine monitoring at six inland lakes. She downloaded data from the temperature logger array in Grand Sable Lake in May and August, and she deployed a new temperature array in Beaver Lake in August.

Leah continued piloting our Wadeable Streams protocol on Miners River through deployment of a multiprobe and collection of macroinvertebrates, and she assisted USGS staff with the installation of a streamflow gage on the river. Real-time information for river stage (height) can be found at http://waterdata.usgs.gov/mi/nwis/uv/?site_no=04044755&PARAmeter_cd=00065,00060. Streamflow and water temperature and chemistry information will be online in 2017.

Sleeping Bear Dunes National Lakeshore

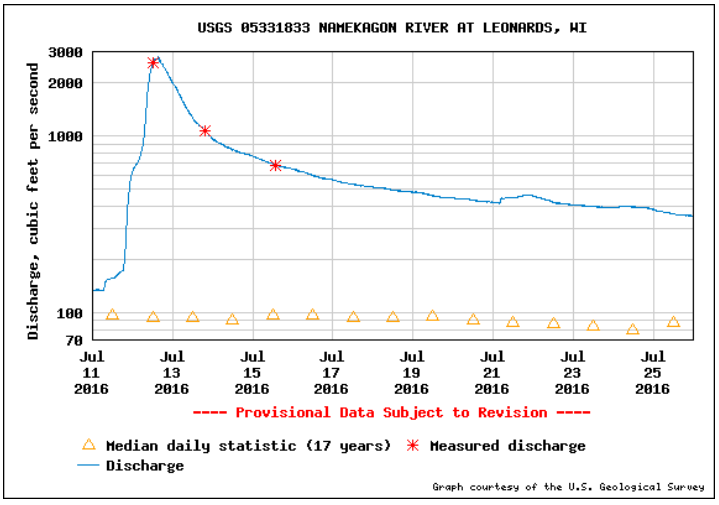
Chris Otto, with assistance from park staff, completed all scheduled routine monitoring at six index lakes. Chris deployed a new temperature array in Bass Lake in July. Chris is managing many aquatics projects at SLBE, including overseeing a state-of-the-art lab for monitoring beach bacteria.

Voyageurs National Park

Jaime LeDuc completed all inland lake sampling in what turned out to be one of her most field-intensive summers. We added Mukooda Lake to our monitoring routine, bringing the number of lakes sampled in the park to nine. Jaime was fortunate to have the assistance of a very capable biological technician in James Smith, as well as other park staff and volunteers. Jaime downloaded data from the vertical temperature logger array in Little Trout and Mukooda lakes in May, July, and September, and she deployed an additional array in Shoepack Lake in June. She also collected water samples from five inland lakes to be assessed for mercury levels, as part of an ongoing collaboration between the network, VOYA, and USGS to conduct long-term monitoring of mercury in the park's inland lake waters.

Water Quality—Large Rivers

Sampling on the St. Croix and Namekagon rivers was completed more or less on schedule, with one exception: the site at Phipps Landing on the Namekagon had to be delayed for a week in July due to the previously mentioned equipment problems combined with a 1,000-year flood event. Beginning in the evening on 11 July and extending into the early morning hours of the next day, 8–10 inches of rain fell on the upper reaches of the watershed, causing a nearly 5-foot rise in water level on the Namekagon River. During the flood, discharge on the river peaked nearly 30 TIMES higher than the daily median value (*see graph*). This flood was catastrophic, causing loss of life and extensive damage to roads and other infrastructure. It is unknown at this time if the flood affected water quality.



Discharge (in cubic feet per second) of the Namekagon River, 11–25 July 2016. During this flood event, stream discharge reached levels approaching 30 times the median daily value. *Graph from USGS gaging station, available online at http://waterdata.usgs.gov/nwis/uv?05331833.*

Water Quality—Diatoms

When diatoms (a type of algae) die, their silica-based cell walls (called *frustules*) are preserved in lake-bottom sediments. When collected, the frustules can be identified very precisely to the species level. While they are alive, diatoms have specific habitat requirements to survive, so the assemblage of diatoms present in a lake or river give an indication of environmental quality in that water body.

Every three to five years we collect the top 2 cm (0.7 in) of sediment from the bottoms of lakes and rivers. These sites are typically the same places where we conduct our routine water quality monitoring. We collect surface sediments because the

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frustules there represent the most recent diatom assemblage in a water body, which helps us to understand the changes in water quality over the same period of time.

Surface sediment cores were collected from nine lakes at ISRO in August. Our cooperators at the SCWRS will analyze them this winter. Additionally, we worked with our SCWRS partners to collect a long sediment core (approx. 1 m, or 3.2 ft) from Brown Lake at VOYA. Long cores reflect hundreds of years of sedimentation, and by identifying the diatom remains in each layer, we can estimate water quality conditions that pre-date Euro-American settlement.

Jaime LeDuc and Adam Heathcote (St. Croix Watershed Research Station) discuss the plan for collecting a long sediment core from Brown Lake at VOYA. *NPS photo/D. VanderMeulen.*

Water Quality—Surface Water Contaminants

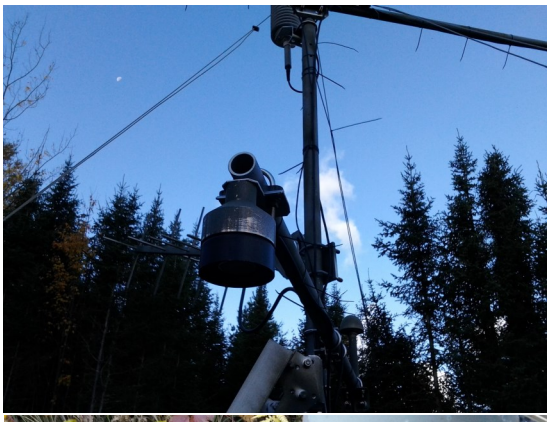
Surface water samples were collected from all 12 lakes at PIRO and SLBE during three rounds of monitoring, and from 19 river, stream, and ditch sites at INDU in April and November. This monitoring is part of a NPS/Environmental Protection Agency Emerging Contaminants Program designed to assess the presence of pesticides, pharmaceuticals, personal care products, and waste water indicators, collectively known as contaminants of emerging concern (CECs). Results from our analyses of samples collected from 2013 through 2017 will be assessed using a tool called ToxEval, which searches the EPA's ToxCast database to find which of the CECs we have detected have potentially harmful biological effects. ToxEval was developed by the USGS Wisconsin Water Science Center.

Weather and Climate

We are continuing our affiliation with the Climate Analyzer (CA) web portal as the means of synthesizing and distributing climate data appropriate to each park (www.climateanalyzer.org/glkn/map_html). We are always seeking feedback from park staff if there are other stations/ sources of climate data that you would like to see in Climate Analyzer.

CA is primarily a tool for looking at historical weather data, but the developer has also created Dashboards for getting real time (latest station readings) weather information. To-date, we have developed CA Dashboards for three parks (APIS, PIRO, and VOYA). We will certainly work with any additional park that wants a Dashboard for current conditions.

We maintain RAWS (Remote Access Weather Station) in three of the parks to augment other weather data sources. One of the unique features of these stations is the snow depth sensors, which have provided valuable data, but have also been more temperamental than the standard weather sensor suite. We are evaluating potential changes to improve the snow depth sensors. ●



A snow depth sensor functions like sonar, projecting an ultrasonic beam that bounces back from the snow surface and registers snow depth as the difference between the snow surface and the calibrated distance to the cement blocks at ground level. *NPS photos.*

New Reports and Publications

Hobbs, W.O., **B.M. Lafrancois**, R. Stottlemyer, D. Toczydlowski, D.R. Engstrom, M.B. Edlund, J.E. Almendinger, K.E. Strock, **D. VanderMeulen**, **J.E. Elias**, and J.E. Saros. 2016. Nitrogen deposition to lakes in national parks of the western Great Lakes region: Isotopic signatures, watershed retention, and algal shifts. Global Biogeochemical Cycles 30. Available online at 10.1002/2015GB005228.

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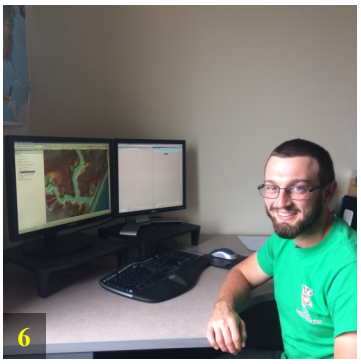
Next Generation Stewards

(Continued from page 3)

Michael Sinclair (6)
After graduating from Northland College last spring, Michael was looking to gain experience with the National Park Service in using geographic information systems (GIS). He found it with the network's remote sensing specialist who gave him a project analyzing 2015 high-resolution elevation data for Ashland County (Wisconsin) and delineating culverts. His work is a crucial part of the hydrologic modeling process used to auto-generate stream networks and watershed boundaries. These products will be extremely useful for partner agencies such as fish passage modeling by the Fish and Wildlife Service and culvert replacement by Ashland County.


6

Lewis Weichmann (7)
Currently a senior at Northland College, Lewis was hired to delineate areas of blown down trees at Sleeping Bear Dunes resulting from a 2015 storm. He then traveled to SLBE with the network's remote sensing specialist to perform ground validation of randomly selected areas and presented his findings to SLBE's natural resource managers. ●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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

Improving park management through greater reliance on scientific knowledge

The Current is published twice a year for Great Lakes Network park staff, our partners, and others interested in resource management at Great Lakes region national parks.

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