



# The Current

Issue 22, Fall/Winter 2022



## The Future of Lakes As Told By Their Past

By Ted Gostomski, Network Science Writer

The value of long-term monitoring lies in its regularity. It's like watching a child grow from an infant through the school years and into adulthood. You remember and have some sort of record of each important moment during that time, and you know your child well. But all that learning is a long, drawn-out process. The same goes for diatom monitoring.

"We needed 15 to 16 years of sampling to get three data points for each of 27 lakes," says David VanderMeulen, the Great Lakes Network's lead aquatic ecologist.

He's talking about sampling for diatoms, a type of algae that is collected after it has died and its "fossil" has fallen to the bottom of the lake. To achieve a complete picture of the diatom community over time, you have to wait for years of "fossils" and sediments to layer over one another on the bottom of each lake. Then you collect these diatoms by taking a sediment core from the bottom of the lake. In the case of diatoms collected and analyzed in this latest study, the sediments in the cores dated back more than 150 years.

All that waiting and collecting has yielded some interesting results. David and his partners found that the diatom communities in all 27 lakes are changing in the same direction, regardless of the size of the lake, water temperature, or any other physical or chemical characteristic.

They found this through principal components analysis, or PCA. PCA shows the trajectory of change, but it cannot show what is causing the



**Sediment cores** are separated into thin layers that are then analyzed for diatoms. NPS PHOTO/J. ELIAS

change. Water quality data helps to identify the cause.

"We found significant shifts in diatom communities and increased productivity in most of our lakes," writes David in the latest resource brief. "As predicted, greater diatom community change occurred in deep, stratified lakes with

*continued on page 11*

## It's back!

Turn to page 3 to learn more about this exciting revival!



## GIS Intern Alejandra Rios

Ask Alejandra Rios “what is your career goal?” and she’ll tell you, “I ask myself that every day.”

But more than just ask herself, Alejandra works hard at exploring possibilities and putting her various skills and experiences to use in her search for a career. One of those possibilities was working as the network’s GIS intern this summer. She had never worked a desk job before coming here from her home in Washington, D.C., but she accepted the position to see if she would like it as a career.

Alejandra applied and was selected through the NPS GIS Internship Program, a partnership between the NPS and Southern Utah University through the Colorado Plateau Cooperative Ecosystem Studies Unit. She was one of 40 interns in the fourth cohort to come through the partnership. Prior to the internship, Alejandra was an Endangered Species Observer on dredging ships for Coastwise Consulting in Athens, Georgia. She has also done bird surveys, worked as an educator, and conducted sea turtle nesting research and box turtle tracking. It was the use of telemetry and GPS in box turtle tracking that brought her to GIS.

Alejandra’s main job was to assist the landscape dynamics monitoring program in analyzing and validating disturbances (logging, wind-throw, beaver flooding) identified in and around the St. Croix National Scenic Riverway by the automated LandTrendr system (Landsat-based detection of trends in disturbance and recovery). It’s a tedious but necessary part of ensuring that areas identified as disturbance are real and correctly identified.

“I think what I learned is that I like GIS,” she says. “The other part is I never would have considered working for the federal government, and now that is something I would be interested in.”

Thanks for all your work this summer, Ále! We hope to see you back here. •



**Alejandra Rios** returned to the origins of global positioning systems when she spent a day in the Apostle Islands making sure network staff knew where the zebra mussel samplers were located. NPS PHOTO.



## Return of the Western Great Lakes Research Conference!

When you meet with long-time park staff in the Great Lakes region, there is one thing you can be sure you are going to hear: “We really valued the ‘Western Great Lakes Research Conference.’ Please bring it back.” We are answering that call. Staff from the network office, network parks, the Great Lakes Research and Education Center, the Great Lakes-Northern Forest CESU, and Northland College have begun planning to make it happen, so **mark your calendars for March 21st–23rd, 2023!** The Great Lakes Science for Parks Conference will be held at Northland College in Ashland, Wisconsin!

Our theme this year will be: “Protecting, restoring, and reconnecting for the next generation: Addressing emerging issues in Great Lakes parks.” We will explore this theme through 15-minute presentations, five-minute lightning talks, posters, roundtables, and hallway conversations over coffee.

This conference is an opportunity for researchers and park managers to come together and share ideas, new findings, and new opportunities. It will be an opportunity for learning, reconnecting with colleagues, expanding your network of

collaborators, and coordinating or brainstorming new management and/or research efforts. Your participation and the participation of your cooperators/collaborators are what made this valuable in the past and what will make it valuable in the future.

So, think about putting together a presentation or poster, and encourage your colleagues to do so as well. Or, just come to listen, chat with your colleagues, and think about how you might develop or expand a project to benefit natural or cultural resources management and science on NPS lands.

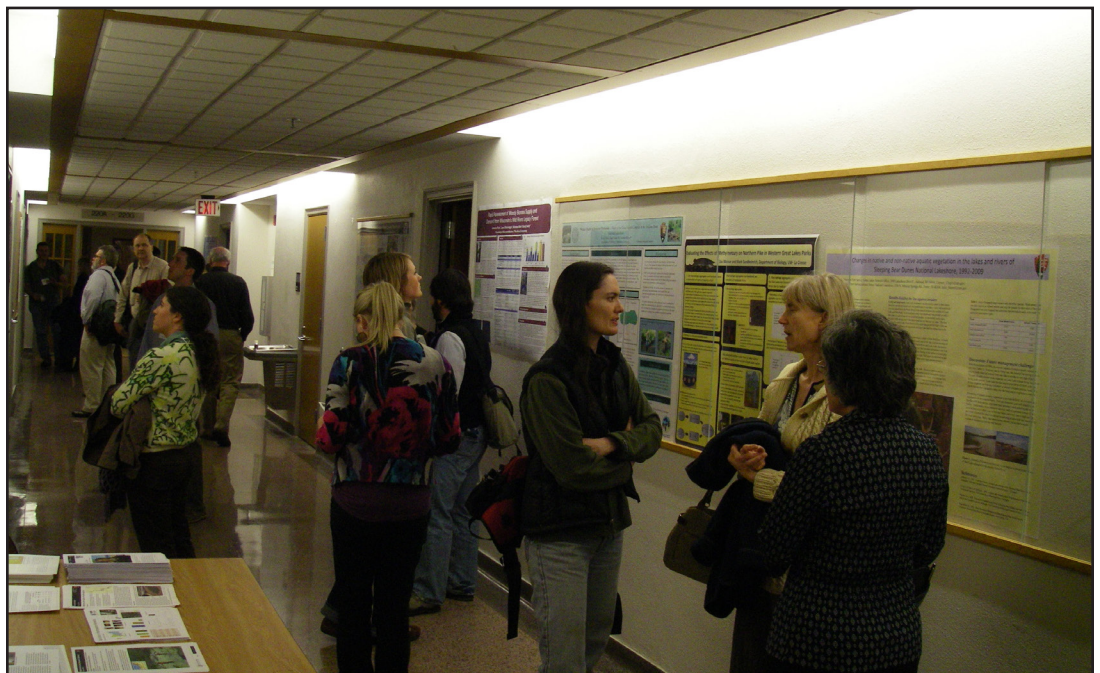
Watch for future announcements or email [glkn@nps.gov](mailto:glkn@nps.gov) to be sure you are on the mailing list. See you in March!

Great Lakes Science for Parks Conference  
March 21–23, 2023  
Northland College, Ashland, Wisconsin



2010 research conference attendees browse poster presentations and talk science.

NPS PHOTO.



## 2022 Field Season Summary

### Amphibians

Another year and another 200,000 files and four terabytes of data from the seven network parks participating in amphibian monitoring. We are in the midst of wrapping up the analysis of 2021 data and will begin the analysis of 2022 soundfiles. We do this in partnership with our contractor Gary Casper.

Each fall, after you ship us the acoustic files, we download them onto hard disks, sift them, sort them, perform QA/QC checks, create graphs, and select the files that we ship to Gary and his team for analysis. They then run software that detects the individual calls of individual species in each file. At the same time, they pull a subset of the files and listen to each file, marking the presence or absence of each species. We owe the success of this protocol in large part to the park staff who go out each year and retrieve cards and change batteries. We couldn't do it without you!

### Bats

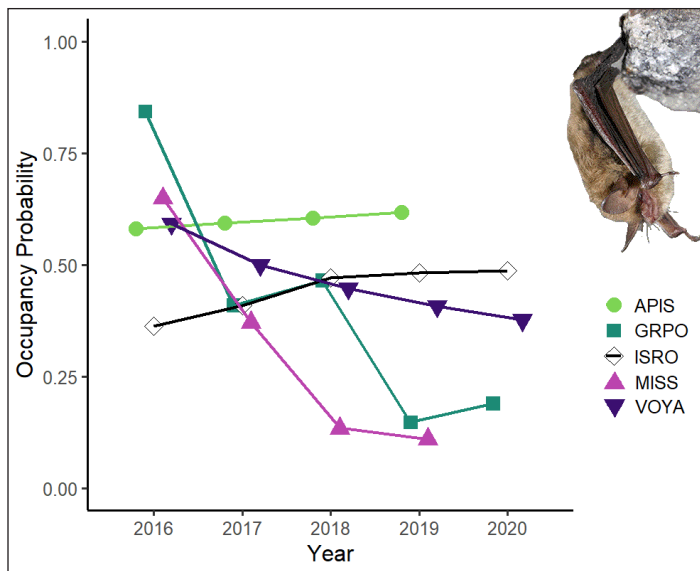
Seven GLKN parks participated in the bat acoustic monitoring program this year. As of 2022, all parks have completed at least six years of bat monitoring.

New for this field season, we created a digital data collection form to use on tablets as an alternative to paper datasheets. The new digital form was successfully used by all parks and will greatly reduce the time required for data entry by network staff. The bat monitoring program will see additional changes next year because 2022 was the last field season of data collection funded by GLKN. **Any future data collection will be park-funded.**

We are collaborating with the NABat Midwest Bat Hub (<https://midwestbathub.nres.illinois.edu/>) to create statistical models of bat occupancy at our parks. *Occupancy* measures the probability that a species is using an area, while taking into account

the fact that we cannot always perfectly detect the species. For example, our microphones may miss a species that is actually present, resulting in a false negative. Our occupancy analysis focuses on species most affected by the fungal disease white-nose syndrome, one of which is the federally threatened northern long-eared bat (*Myotis septentrionalis*). We found that northern long-eared bat occupancy declined by an average of 31% between 2016 and 2020. However, some parks had relatively stable occupancy (*see graph*).

Although northern long-eared bats are severely impacted by white-nose syndrome, the good news is that they are still present on the landscape. However, in late November, the U.S. Fish and Wildlife Service published a final rule to reclassify the northern long-eared bat as endangered under the Endangered Species Act.



**Estimated occupancy probability**, by year, for the northern long-eared bat at five parks, 2016–2020. Occupancy probability estimates are derived from park-specific dynamic occupancy models. Other parks had insufficient data from this species to run models. USFWS PHOTO (NORTHERN LONG-EARED BAT).

### Contaminants—Dragonfly Larvae and Fish

In partnership with Northland College, park staff, and volunteers, dragonfly larvae were collected from all nine network parks in 2022. Samples were

sent to a USGS lab in Oregon, where they will be analyzed for mercury.

In May 2022, our Dragonfly Mercury Project (DMP) partners used GLKN's "Monitoring Mercury in Dragonfly Larvae and Fish" protocol as a template to draft and publish a nation-wide protocol titled "Protocol Implementation Plan for Dragonfly Larvae Sampling and Mercury Analysis." GLKN, along with other I&M networks, NPS regions, and the DMP staff successfully competed for funding for a project proposal titled, "A Nationwide Assessment of Per- and Polyfluoroalkyl substances (PFAS) on National Park Service Lands" through the USGS/NPS Water Quality Partnership Program. Field sampling for this project will occur in 2023.

### Contaminants—Bald Eagles

Bald eagle nest occupancy and productivity surveys occurred this spring at MISS, but not at APIS or SACN due to limited partner resources.

Former network program manager Bill Route, in collaboration with our partners, continues to analyze bald eagle data collected from 2006 through 2015 and publish the findings. Most recently, he and others published a paper showing how the onset of nesting is timed to ice-out on northern lakes and rivers, and how morphological measurements (most notably, the size of an eagle's footpad) can be used to distinguish between male and female. See "New Reports and Publications" on page 10 for a link to the paper. We are working on a final paper on lead stable isotopes in nestling red blood cells.

Last, as part of a larger Great Lakes Restoration Initiative project to examine PFAS in bald eagle nestlings along the south shore of Lake Superior, we hope to sample nestlings at APIS in 2023. This work will be led by the U.S. Fish and Wildlife Service in cooperation with the Michigan and Wisconsin Departments of Natural Resources. GLKN will provide some logistical support.

### Landbirds

Songbird surveys were completed in all nine parks this season through the continued dedication of park staff, contractors, and volunteers. And with COVID travel restrictions lifted, network staff got out to help with surveys at Voyageurs and Isle Royale. Due to massive flooding of the Rainy Lake Basin at Voyageurs, only transects accessible by road could be completed.

The season's most remarkable sighting was made by Dave and Sara Fehringer at Rainbow Cove on Isle Royale.

"While at Rainbow Cove, when we were stuck there for the weekend due to the weather, we happened to catch a glimpse of this [Scissor-tailed Flycatcher] flying up to one of the big aspens along the beach. I took a ton of pics hoping the gusty wind would move him enough to force his tail open, but his balance was too good!"

Scissor-tailed Flycatchers nest in the south-central United States and into northeastern Mexico. The Cornell Laboratory of Ornithology notes that, "during both spring and fall migration ..., Scissor-tailed Flycatchers tend to wander widely and can show up pretty much anywhere throughout North America" ([www.allaboutbirds.org/guide/Scissor-tailed\\_Flycatcher/maps-range](http://www.allaboutbirds.org/guide/Scissor-tailed_Flycatcher/maps-range)).



Scissor-tailed Flycatcher at Rainbow Cove on Isle Royale. PHOTO BY D. FEHRINGER.



Staff at Isle Royale established and surveyed a new route across the area burned in 2021 by the Horne Fire on the northeast end of the island. This is a park-specific area of interest for monitoring post-burn effects. This transect will not be added to the network's formal landbird monitoring program, but they are using our protocol methods and data are being stored in the network's landbirds monitoring database.

We learned in October that we were selected to receive funding for a study of the *“effects of landscape-scale fragmentation on forest and grassland breeding bird communities in central North America.”* The proposal was developed by Ryan Burner, a research biologist with the U.S. Geological Survey, in cooperation with all three I&M networks in the Midwest Region (Great Lakes, Heartland, and Northern Great Plains). Thus, the study will encompass 37 NPS units in 15 states. Using monitoring data from the three networks and from the North American Breeding Bird Survey, we will attempt to:

1. Quantify the amounts and fragmentation levels of forest and grassland habitats at several scales around Midwest national parks,
2. Quantify responses of habitat specialist bird species and other species of concern to local- and landscape-scale habitat, and
3. Develop a threat index for each park and make predictions for each park and species under future scenarios of “stable,” “habitat decrease,” and “habitat increase.”

Work begins early in 2023, and the first of a suite of products (GIS spatial data, webinar, training workshops, resource brief, species heat maps, and publications) will be available beginning in September 2023.

## Landscape Dynamics

During the summer of 2022, we hired a seasonal employee (Alejandra Rios; see her profile in this issue) to validate landscape disturbances in and around the St. Croix Riverway (SACN) for the

period of 1990–2021. The SACN analysis area includes the Namekagon and St. Croix River corridors and five sub-watersheds that feed into those rivers, representing a range of land cover types and land uses.

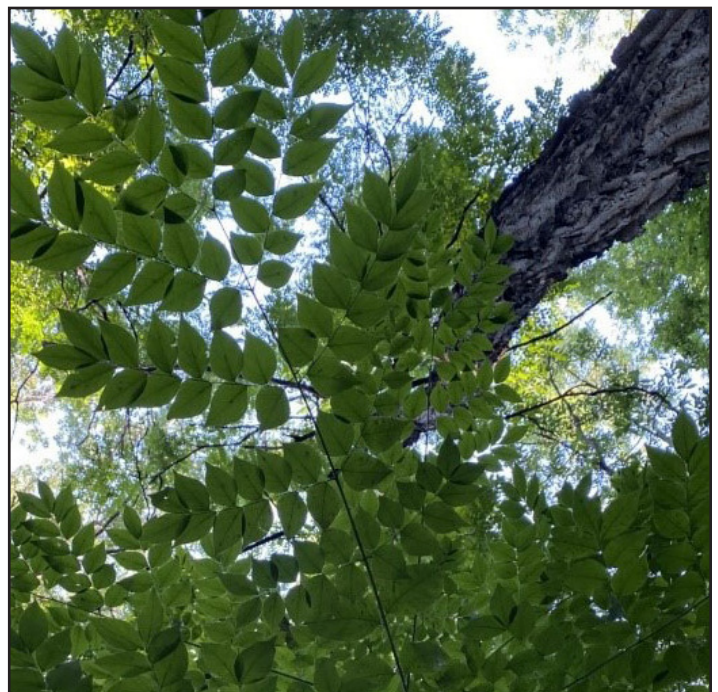
During her time here, Alejandra validated nearly 40,000 polygons! We were also able to go into the field to check some polygons that were questionable.

We will work on the data summary report during the winter, with final publication in 2023.

## Vegetation

The team spent the summer of 2022 resampling the 33 permanent monitoring sites at MISS, and we added an additional 17 sites, bringing the total to 50.

Since the majority of sites are accessed by canoe or motorboat, we faced some challenges later in the sampling season, after river levels dropped. Nonetheless, we collected extensive data on floodplains and hope to use this to assess



**The Kentucky coffee tree** is a species seen at no other network park besides MISS. Its leaves are distinct because they are bipinnate (i.e., twice divided). The trunk visible in the top right of the photo is a separate individual, showing its unique, deeply-fissured bark. NPS PHOTO.

recruitment, particularly of silver maple and cottonwood. We also have a number of upland sites that we hope to use in assessing changes in certain invasive species (e.g., buckthorn), as well as gauge regeneration of desired species (i.e., oaks and maples).

Sampling vegetation at MISS is fun because of the number of species that we don't see in any other network park. These include Kentucky coffee tree, honey locust, black maple, butternut, and, yes, common hemp.

Completion of sampling at MISS marks the completion of our second round of sampling in all parks. The third round begins in 2023 at Indiana Dunes.

### Water Quality—Diatoms and Midges

Diatom monitoring—accomplished through collection of long sediment cores and surface sediments—has taken place almost annually since 2005. In 2022, network and park staff sampled diatoms at APIS, INDU, and SACN.

In collaboration with our partners at the St. Croix Watershed Research Station (SCWRS), 2022 was a milestone year for publishing diatom-focused papers. Our first paper focused on analysis of long sediment cores mostly collected in the mid-2000s, where diatom community changes (dating back to pre-European American settlement times) were used in conjunction with lake and watershed physical characteristics to predict lake sensitivity to climate change. Our second paper focused on finer-scale diatom community change over the past 15 years and how that change related to water quality parameters measures by network and park staff through our Inland Lakes Water Quality Monitoring. *Agate* magazine published a nice article about this work, which you can find at [www.agatemag.com/2022/09/ecosystems-changing-rapidly-in-many-remote-northern-lakes/](http://www.agatemag.com/2022/09/ecosystems-changing-rapidly-in-many-remote-northern-lakes/).

Finally, SCWRS staff continue to catalog nearly 150 of the most common diatom species found throughout the Great Lakes Network parks

by ensuring that their presence is recorded in an online diatom taxonomic resource (<https://diatoms.org/projects/great-lakes-inventory-and-monitoring-network-glkn>).

Field work on chironomid midges of ISRO's inland lakes continued in 2022. Samples were collected, subsampled, slide mounted, and identified to species for a biotic inventory to compare with water quality data. Work also continued on organizing and identifying specimens from SACN for a study of the chironomid community from the Gordon Dam to the confluence with the Mississippi River.

### Water Quality—Inland Lakes

All of the usual water quality data were collected from five parks. James Smith, a new permanent bio tech for VOYA water quality, was hired to fill the position vacated by Jaime LeDuc. James is duty stationed in International Falls and began work in June.

Our aquatic ecologist at ISRO, Alex Egan, helped the park with zebra mussel veliger and native mussel projects in an effort to eradicate zebra mussels from park docks and monitor native mussel populations in Lake Superior. This included tow net and Hester-Dendy sampling. He also assisted with harmful algal bloom monitoring on the ISRO



**James Smith** (standing) and Christian Dahlquist-Olesen measure water level at Ryan Lake, Voyageurs NP. NPS PHOTO.





**Just another day at the office!** SACN bio tech, Jay Johnson, on the way to a water quality sampling site on the lower reaches of the St. Croix River. NPS PHOTO/R. DAMSTRA.

lakes where water quality monitoring occurs. Blooms have been problematic on Lake Richie in past years, fouling drinking water and preventing swimming at park campgrounds. Blooms are now observed on many lakes each year.

Alex became an instructor for the Department of Interior's Motorboat Operator Certification Course after attending a training at Lake Mead. He helped train 18 staff and volunteers at ISRO in June. Alex and Rick Damstra are the only MOCC instructors among the network staff.

### Water Quality—Large Rivers

Water quality sampling was completed as scheduled on the St. Croix National Scenic Riverway from April through November, 2022. After two years of field sampling were disrupted by the COVID-19 pandemic, GLKN staff returned to regular overnight travel and field work on the whole length of the riverway. Water levels were again low in 2022, which sometimes required creativity to get the boat in the water!

Invertebrates were collected at all water quality sites on the Namekagon and St. Croix Rivers using Hester-Dendy samplers. Hester-Dendy samplers are stacks of particle board plates placed in the river for six weeks to allow aquatic insects and other invertebrates to colonize the spaces in between the plates. After the samplers are collected, the captured invertebrates are sent to the University of Wisconsin-Stevens Point Aquatic Biomonitoring

Lab for identification. Although the 2022 samples will not be identified until this winter, past samples all pointed to good water quality at most sites on the St. Croix and Namekagon Rivers, as indicated by the high number of clean-water-loving species.

GLKN also began pilot work deploying temperature/conductivity sensors year-round at selected sites in the St. Croix and Namekagon Rivers. The goal of this sampling is to look for seasonal spikes in conductivity (the concentration of salt and other minerals in the water) to determine if road salt application or other land-use practices in the St Croix watershed are causing pollution. These sensors must be recovered, cleaned, and downloaded a few times a year to be effective.



**Scientists-in-Parks intern, Hallie Arno,** prepares a temperature/conductivity logger for late fall redeployment. NPS PHOTO/R. DAMSTRA.



Rick Damstra completed river sampling at SACN with help from biological technicians Jay Johnson, Annie Bahe, and Jason Dowell; SACN's aquatic ecologist Marian Shaffer; and GLKN interns Alejandra Rios and Hallie Arno. Invaluable logistical support and lab space were also provided by The Acreage at Osceola and by the Wild Rivers Conservancy.

## Weather and Climate

A reminder that both current and historical climate data for selected weather stations in or close to GLKN parks can be found on our Climate Analyzer site, [www.climateanalyzer.us/glkn/](http://www.climateanalyzer.us/glkn/). If you have questions or suggestions about the station site, please contact Mark at GLKN.

## Farewell to Rebecca Key

We bid farewell to Assistant Data Manager Rebecca Key this spring after she accepted a position with the U.S. Fish and Wildlife Service as a Data Manager for the their Inventory and Monitoring program. In her new role, she provides data management services to wildlife refuges in Arizona, New Mexico, Oklahoma, and Texas.

Rebecca joined the Great Lakes Network in 2007, splitting her time between the network programs and the Great Lakes Exotic Plant Management Team. For the I&M network, she created and maintained databases for the contaminants, vegetation, and landbirds monitoring programs; she helped set up and implement electronic data recording using tablets in the field; and she created opportunities for students from Northland College (her alma mater) to come in and gain experience working as volunteers or paid interns.

Starting in 2018, Rebecca began expanding her horizons by accepting detail assignments as Data Manager for the Mediterranean Coast Network

With relaxed post-COVID travel permitted, maintenance visits were made to all GLKN-owned weather stations. In some cases, there were some sensor replacements needed. Most of those have been addressed. At APIS and PIRO, the stations are getting some vegetation encroachment that will have to be addressed in the near future. In both cases, there is a tree or two that is blocking the line-of-sight for data transmission to the GOES satellite.

(MEDN) in California, our own network (2020), then again to MEDN in 2021.

Rebecca's skill and work ethic are missed here at the network office, but we wish her the best in her new role. Thank you, Rebecca! •



## New Reports and Publications

All of these reports can be found on the Great Lakes Network website: [www.nps.gov/im/glkn/reports-publications.htm](http://www.nps.gov/im/glkn/reports-publications.htm). Those published in peer-reviewed journals can also be found using their DOI (digital object identifier). Great Lakes Network staff are indicated in **bold blue** text.

Edlund, M.B., J.M. Ramstack Hobbs, A.J. Heathcote, D.R. Engstrom, J.E. Saros, K.E. Strock, W.O. Hobbs, N.A. Andresen, and **D.D. VanderMeulen**. 2022. Physical characteristics of northern forested lakes predict sensitivity to climate change. *Hydrobiologia* 849: 2705–2729. Available at: <https://doi.org/10.1007/s10750-022-04887-9>.

Flanagan Pritz C.M., C.A. Eagles-Smith, **D.D. VanderMeulen**, S.J. Nelson, and J.J. Willacker. 2022. Protocol implementation plan for dragonfly larvae sampling and mercury analysis: A contribution of the Dragonfly Mercury Project. Natural Resource Report. NPS/NRSS/ARD/NRR—2022/2386. National Park Service. Fort Collins, Colorado. Available at: <https://doi.org/10.36967/nrr-2291783>.

**Gostomski, T.** 2022. Great Lakes Network communication evaluation: 2022. Natural Resource Report NPS/GLKN/NRR—2022/2458. National Park Service, Fort Collins, Colorado. Available at: <https://doi.org/10.36967/2294045>.

**Kirschbaum, A.A.** 2022. Landsat-based monitoring of landscape dynamics at Grand Portage National Monument: 1995–2018. Natural Resource Data Series NPS/GLKN/NRDS—2022/1353. National Park Service. Fort Collins, Colorado. Available at: <https://doi.org/10.36967/nrds-2293284>.

LeDuc, J.F., R.P. Maki, **R.A. Damstra**, J.D. Glase, J.T. Myers, and M.C. Romanski. 2022. Assessment of inland lake coldwater fish habitat in Isle Royale and Voyageurs national parks

through analysis of oxygen and temperature data. Natural Resource Report NPS/VOYA/NRR—2022/2457. National Park Service, Fort Collins, Colorado. Available at: <https://doi.org/10.36967/2294181>.

Ramstack Hobbs, J.M., A.J. Heathcote, **D.D. VanderMeulen**, and M.B. Edlund. 2022. Integrating water quality monitoring and diatom community trends to determine landscape-level change in protected lakes. *Ecosphere* 13(8): e4199. Available at: <https://doi.org/10.1002/ecs2.4199>.

**Route, W.T.**, C.R. Dykstra, K.A. Williams, J. Campbell-Spickler, M.S. Martell, and **R.L. Key**. 2022. Breeding phenology and nestling morphology of bald eagles in the upper midwestern United States. *Journal of Raptor Research*. Available at: [doi: https://doi.org/10.3356/JRR-21-76](https://doi.org/10.3356/JRR-21-76).



*"The future of lakes" (continued from page 1)*

smaller watersheds. However, diatom species groups showed variable responses along the sensitivity spectrum, suggesting that a warming climate may favor certain types of diatoms over others."

In other words, climate change will influence what is able to live in a given lake. And it will influence the lakes themselves. The team also found that increased productivity (the creation of biomass), especially the build-up of carbon in the sediments, was more common in shallow lakes regardless of

their watershed size. This tells us that shallow lakes will become more productive as their average water temperature continues to warm up.

How can we use this information? The diatom record tells us what lakes were like historically. By matching those historic conditions with what we are seeing now, we may be able to predict the sensitivity of the lakes to climate change and take action to limit or slow the changes to the most vulnerable lakes. •



**Bass Lake** (Benzie County), Sleeping Bear Dunes National Lakeshore.  
NPS PHOTO/T. GOSTOMSKI.

**Data discussed here are combined from two journal articles:**

*Physical characteristics of northern forested lakes predict sensitivity to climate change* by Edlund et al., available at <https://doi.org/10.1007/s10750-022-04887-9>, and

*Integrating water quality monitoring and diatom community trends to determine landscape-level change in protected lakes* by Ramstack Hobbs et al., available at <https://doi.org/10.1002/ecs2.4199>



Apostle Islands National Lakeshore  
Grand Portage National Monument  
Indiana Dunes National Park  
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

*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.

**Editor and Web Manager**

Ted Gostomski

**Network Program Manager**

Thomas Parr

**Thanks to the following contributors**

Rick Damstra  
Alex Egan  
Katy Goodwin  
Mark Hart  
Al Kirschbaum  
Thomas Parr  
Suzanne Sanders  
David VanderMeulen