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Remember the Natural Resource Challenge!

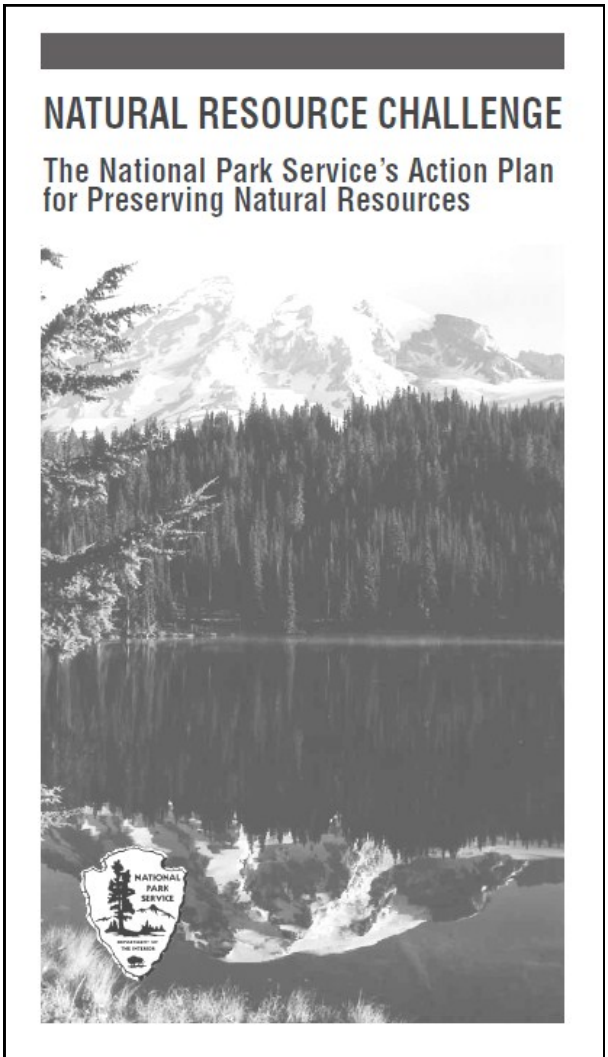
By Ted Gostomski, Network Science Writer

It may not have the same panache as "Remember the Alamo!" or "Remember the *Maine*!", but 16 years after it came into being, the Natural Resource Challenge has some of the same historical heft among those who remember the exciting promise that it held for the future of resource management. I remember it as a glimmering ray of hope that I might yet find a permanent job with the NPS. I was a biological technician on Isle Royale when I first heard about a new "natural resources initiative" that was going to professionalize natural resource positions and possibly create some openings. That hope materialized 12 years later when I joined the Great Lakes I&M Network, which, as part of the Inventory and Monitoring Program, was created by the Natural Resource Challenge.

The history behind the Natural Resource Challenge is beyond the scope of this article. What's important to us as an Inventory and Monitoring Network is to recognize that the NRC is where we come from. Though the Challenge included many strategies to improve natural resource management in parks, the need for inventories and long-term monitoring is expressed throughout the document. Goal #2 for the Challenge became the I&M Division's statement of purpose: *management of national parks is improved through a greater reliance on scientific knowledge* (see the I&M slogan on the back cover of this newsletter).

The NRC identified three challenges it would address in the coming years: (1) Protect native species and their habitats, (2) Provide leadership for a healthy environment, and (3) Connect parks to protected areas and parks to people. The foundation of the I&M program rests on the strategies for Challenge #3.

The focus began with water. *The National Park Service needs to establish a water quality monitoring system comparable to our air monitoring network*. As a result, every I&M Network (even the three desert Networks) has a water quality monitoring program with a base set of parameters that are monitored. Challenge #3 also identified the benefits of "a consistent set of basic data on natural resources" (inventories) by which we can begin to "understand the processes that maintain and preserve the national parks." But the



Released in 1999, the Natural Resource Challenge laid out the NPS plan to "revitalize and expand our natural resource programs, strengthen partnerships with the scientific community, and share knowledge with educational institutions and the public."
www.nature.nps.gov/challenge/assets/actionplan/NatRes2.pdf

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Remember the Natural Resource Challenge!

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benefits would not be extended only to park managers. "The expanding body of knowledge," the Challenge says, "must be...widely disseminated to the public." Thus, we have produced species checklists using the NPSpecies database, and we have an expressed commitment to good communications to both internal and external audiences.

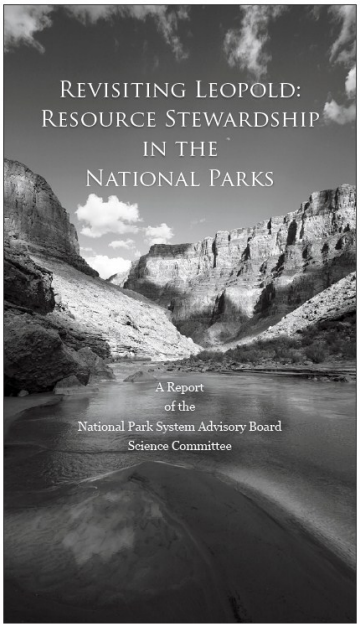
Challenge #3 also established the need for long-term monitoring that will tell us how the condition of natural resources changes over time. It called for planning that defines the park's role in a regional context. This is why the vital signs we chose to monitor are primarily those that are relevant to all nine parks in our Network. Even the concept of a "network of parks broadly representative of regional systems" is defined in the Challenge.

Accomplishing all of this was encapsulated in the Strategic Approaches to address Challenge #3:

> *The National Park Service will create networks of parks linked by geography and shared natural resource characteristics to facilitate collaboration, information sharing, and economies of scale in natural resource management.*
>
> *The National Park Service and collaborators in the networks will accomplish natural resource inventory needs and monitor park vital signs.*
>
> *We will develop integrated, standardized databases...as well as enhanced web pages and data analysis and retrieval tools to increase usability of natural resource information.*
>
> *The resource planning process will be improved to provide the foundation for establishing monitoring programs and as a vehicle for incorporating the results of scientific study into park management.*

The Inventory and Monitoring Program wasn't the only beneficiary of these strategies. Also outlined in Challenge #3 was the establishment of Research Learning Centers, a "private-public learning center...in each network to facilitate the use of parks as libraries of knowledge and support visiting researchers." Ours—the Great Lakes Research and Education Center—is located at Indiana Dunes.

Sixteen years later, is the Natural Resource Challenge still relevant? Have we accomplished its goals? If you read the NRC now, it does seem that the vision it expressed has become reality for most parks and programs. It could be said that the transition of the Inventory and Monitoring Program to a full-fledged Division in the National Park Service and the embarkation of the Great Lakes Network on our tenth field season in 2016 are measurable accomplishments of the Natural Resource Challenge. Of course, we still have work to do, and the challenges we face have not diminished.



The 2012 Revisiting Leopold report is the next iteration of improving natural resource management in the national parks. www.nps.gov/calltoaction/PDF/LeopoldReport_2012.pdf

In 2012, the National Park System Advisory Board's Science Committee published its "Revisiting Leopold" report. Reflecting on and building from the 1963 "Leopold Report"—or "Wildlife Management in the National Parks," as it was officially titled—the 2012 document makes recommendations for resource management in light of "accelerating climate change, a growing and more diverse population of Americans, and extraordinary advances in science." Within its minimal 23 pages are recommendations for "life cycle stewardship" and managing for resiliency and connectivity. There is also an implicit affirmation of the NRC goals in the recommendations for "decision making based on *best available sound science*" (emphasis in original) and "an expanded role for monitoring" as an "essential component of managing for change." These also reflect the ongoing need for the Inventory and Monitoring Division. It seems that the promise made by the NRC more than 15 years ago has become a promise kept. ●

So This is What a Botanist Does!

What are you going to do once you leave college? Where do you see yourself in five years? What career path do you think you're going to follow? These are the constant questions that plague a college student. I hear them from parents, from professors, from friends, from co-workers, and even from random people on the street. Sometimes the most honest answer is to throw my hands up in the air, yell "I have absolutely no idea!", and break down in tears. Mostly, however, I go for a slightly more reasoned answer: "I want to be a botanist, and I expect I'll be taking a lot of seasonal jobs for the next few years."

But to tell the truth, I didn't know exactly what being a botanist involved, and my answers were somewhat vague when anyone questioned me further (cue the "I don't know!" and tears again). All that changed when I was hired as a Biological Science Technician for the Great Lakes Inventory and Monitoring Network and hit the road for Voyageurs National Park. What I knew when I left was that I would be doing a lot of identification and measurements of trees as part of a program to monitor and track changes in vegetation, but I soon learned that there was quite a bit more to it.

One of the first things I learned was that knowing how to juggle is a useful skill for a botanist. I was overwhelmed by the number of tools I had to carry: diameter-tape, calipers, pen, clipboard, witness tree tags and nails, compass, hand-lens, hammer, rebar, flags, and where did I put the camera again? Perhaps the second thing I learned is that there is a lot to remember: take three pictures at each transect end point, coarse woody material decay classes, where do I take the diameter on this forked tree and does it count as one or two trees, did I count that tree already, and where the heck am I in the plot right now? (Oh yeah, I have a compass. Somewhere…) Thirdly, it is very hot to be a botanist—as in head-to-toe layers of clothing in the constant battle against mosquitoes and other marauding insects.

But the most important thing I've learned this summer is more profound and complex than that. I have learned that even when I'm covered in sweat, being dogged by swarms of mosquitoes, overtired, completely drenched by rain, or any combination of these, I still find that I can't think of another job that I would prefer to be doing. I learned that even if it does become repetitive or overwhelming after hours of measuring trees, I still love that I'm gaining a more intimate knowledge of the plants here than I ever would have otherwise. I love that I am able to see parts of the park that I never would have seen. I have learned a little about what my future as a botanist might look like and helped out with a project that will have a long-term impact. And I have learned to have confidence in that answer, "I want to be a botanist." ●

Tana Route is an up-and-coming botanist and an accomplished writer. This was her first season with the Network vegetation monitoring crew.

Staff Insider

Rick Damstra, Aquatic Ecologist

Rick Damstra is a Network veteran, having honed his water sampling, backcountry, and boating skills on Isle Royale's inland lakes for five seasons before moving to his current position as the large rivers aquatic ecologist. Rick is primarily tasked with implementing the large rivers water quality monitoring protocol at SACN, but he also assists with other aspects of water quality monitoring and data analysis. Born and raised in Michigan, Rick now lives in Ashland with his wife, daughter, and two bird dogs. He enjoys all manner of outdoor activities, especially fishing, and has recently taken up running, and will soon begin training for his first half marathon. ●

2015 Field Season Summary

Amphibians

Amphibians are now being monitored at all nine Network parks, as new sites were established at Isle Royale and Grand Portage this year.

The data is coming in, and this appears to be the best year yet in terms of song meter operation, with fewer errors and data dropouts, and no units flooded! MISS and INDU continue to be problematic because the din of background noise—vehicles, planes, barges, and trains—confounds the use of automated detection software. We are searching for locations with less background noise so we can obtain cleaner sound files that have more detectable frog calls.

One significant highlight is the discovery of cricket frogs (*Acris blanchardi*) at MISS. These very small frogs are on Minnesota's threatened species list. Calling individuals were recorded at a site next to constructed industrial detention ponds at a cement plant. We intend to visit this site next spring to try and find some of the frogs and more specifically identify their breeding habitat.

Cricket frogs are an endangered species in Minnesota. Calling individuals were recorded this summer at one of our monitoring sites along the Mississippi River. *Minnesota DNR photo, http://bit.ly/1jRxgHR*

Bioaccumulative Contaminants—Bald Eagles

This was our 10th field season monitoring bald eagle productivity at APIS, MISS, and SACN. We and state partners conduct aerial surveys to locate active nests and to assess the growth and health of the eagle populations. The number of active bald eagle territories has steadily increased in most of our study areas since 2006 (*figure 1*). The increase has been most dramatic at MISS where we documented 55 active territories this year. The number of active territories has also continued to expand at both the Apostle Islands and the lower St. Croix Riverway. Only along the upper St. Croix have we seen a leveling off of active territories. Eagles may be reaching a threshold in this section where the river is a small, shallow, cold-water stream, and consequently, there is less food for eagles.

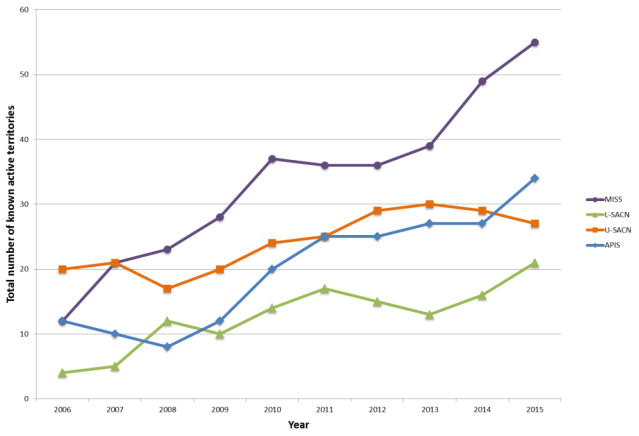


Figure 1. Number of active bald eagle territories at the Mississippi National River and Recreation Area (MISS), the upper (U-SACN) and lower (L-SACN) St Croix National Scenic Riverway, and Apostle Islands National Lakeshore (APIS). Data from the Great Lakes Network and the Wisconsin DNR.

We are currently working with the University of Minnesota and their Raptor Center to analyze patterns and trends of lead contamination in bald eagle nestlings. Nestlings incorporate lead into their feathers as they grow so that feathers integrate lead from many sources, a sort of averaging. We have found that the levels of lead in nestling feathers has steadily declined since 2006, matching a declining trend in the amount of lead found in ambient air. By contrast, the amount of lead in a nestling's blood results from a recent exposure—contaminants found in their food pulse through the blood following a meal. Consequently, patterns of lead in eaglet blood are more erratic and do not increase with nestling age.

We have found some nestlings to have lead concentrations in their blood that are higher than what the Centers for Disease

Control and Prevention deems healthy for humans (*figure 2*). Other researchers have documented that most lead poisonings in adult eagles are the result of having ingested lead fragments from ammunition lodged in the discarded remains of animals killed by hunters. In the upper Midwest this is almost entirely from lead fragments in remains of white-tailed deer during and immediately after the late fall hunting season. However, we sample nestlings in spring when the remains from hunter-killed deer are already consumed, so our theory is that many of the nestling exposure events are caused by ingesting fishing tackle attached to fish the adults bring to the nest. Indeed, we occasionally find fishing tackle, including lead sinkers, in the nests we visit.

We conclude that lead concentrations in the aquatic environment in these parks is generally declining in concert with levels in ambient air, and that such declines have been due to regulations on many industrial sources. However, there are sporadic exposures that could potentially cause problems in developing nestlings, and the timing of these exposures implicates lead fishing tackle. We are analyzing these data more closely and hope to explore the use of lead stable isotopes to shed light on the source of lead in the nestling eagle diet.

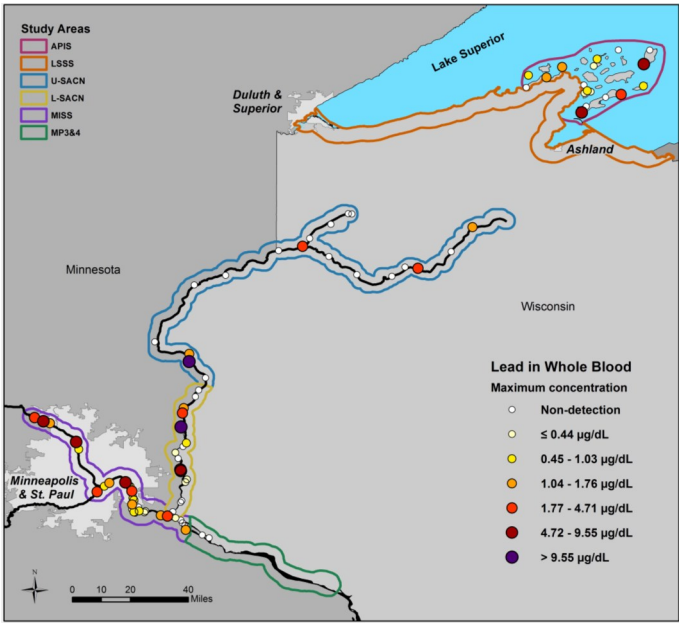


Figure 2. Maximum concentrations of lead found in the whole blood of nestling bald eagles from Apostle Islands National Lakeshore (APIS), Wisconsin's portion of the Lake Superior shoreline (LSSS), the upper (U-SACN) and lower (L-SACN) St Croix National Scenic Riverway, the Mississippi National River and Recreation Area (MISS), and Pools 3 and 4 of the Mississippi River. Concentrations measured in micrograms of chemical per deciliter of blood (µg/dL).

Landbirds

Monitoring was completed at all nine parks this year, including a new and improved program conducted entirely by park staff at MISS. Thanks to Allie Holdhusen for coordinating the surveys at the park, and to Sharon Stiteler, Oliver Liu, Neil Smarjesse, Kadie Gullickson, and Christine Steinwand for completing the surveys. Special thanks to Dan Dressler for allowing some of his interpretive staff the time to do the surveys.

Thanks also to the following individuals for their help in completing all the surveys this summer: Alex Egan, Mike Mossman, and Sumner Matteson at APIS; Debbie Peterson at GRPO; Ralph Grundel at INDU; Dave and Sara Fehringer, Alex Egan, Rhoda Boettcher, and Rolf and Candy Peterson at ISRO; Brian Johnson and Skye Haas at PIRO; Matt Berg, Robin Maercklein, Michelle Prosser, Hank Carlson, Monica Blaser, Aimee Van Tatenhove, and Kathy Kafura at SACN; Kathy Kaczynski and Alice Van Zoeren at SLBE; and Tom Gable and Jaime LeDuc at VOYA (with coordination by Lisa Maass).

The landbird monitoring program's first technical report will be published later this fall. It provides detailed analyses of bird trends for parks with >5 yrs of monitoring data—APIS, GRPO, INDU, ISRO, SACN, SLBE, and VOYA. Overall, two species increased strongly across Network parks (American Robin and Red-winged Blackbird), while only three species showed strong declining trends across parks (American Crow, Chestnut-sided Warbler, and Evening Grosbeak). Also, birds with a substantial proportion of fruit in their summer diet showed a general decline across parks, while wetland species and bark foragers showed generally increasing trends. Park-specific trends are also discussed.

Midwest Region I&M Networks (Great Lakes, Heartland, and Northern Great Plains) are partners in an agreement with Rocky Mountain Bird Observatory and Point Blue (a non-profit organization in California—formerly Point Reyes Bird Observatory) to tailor an existing online bird monitoring database (Midwest Avian Data Center) for bulk upload of Network monitoring data and direct online data entry by park staff and others in the future.

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2015 Field Season Summary

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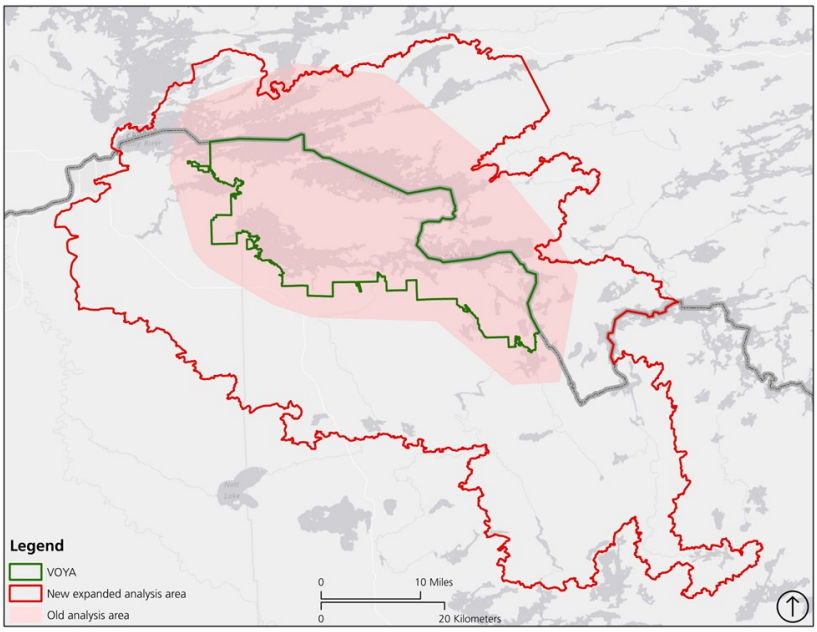
Land Cover/Land Use

Having completed an initial analysis for each of the nine Network parks, we returned this year Voyageurs—the first park in the rotation—to analyze data from years 2008 to 2013. For this cycle, we greatly increased the land area to be monitored outside the park, using watershed boundaries to define the extent of the analysis area. We are now monitoring eight watersheds flowing into or through the park, plus additional watersheds in Canada that flow into the park, bringing the total monitored land area from 140,000 ha (345,948 acres) in 2010 to 419,000 ha (1,035,372 acres) this year. This will allow us to do more meaningful analysis on a watershed basis, which is much more important to a park where water comprises 36% of the area within its boundaries.



Widening the view. In 2010, our analysis area (shown in pink) focused on 345,948 acres of land within and outside of the park boundaries. This year, we expanded our analysis area almost three-fold (marked by red border) to more than one million acres in eight watersheds that flow into or through the park.

Being able to monitor outside the park boundary is one of the most beneficial parts of this monitoring program because it allows park managers to have a better understanding of where stressors on park resources may be coming from. As a pilot project, we are also going back further in time than when we started monitoring. For example, at VOYA our analysis has encompassed years 2002–present. Starting this winter, we are analyzing disturbances prior to 2002, with a goal of analyzing back to 1995, giving us a 20 year (1995–present) dataset. If we are able to complete this analysis we will likely apply it to future parks as well. Stay tuned.

We had successful collections of LiDAR elevation data flown last spring around PIRO and SLBE, and expect to see those data come in around Christmas this year. We also set up a cooperative agreement with Bayfield County to collect LiDAR at APIS either this fall or coming spring.

Vegetation

The vegetation monitoring crew worked at Voyageurs this summer, but our one-park-per-year monitoring plan was upset by glitches in hiring seasonal staff. We would normally have a crew of four seasonals for a park as large as VOYA, but due to conditions beyond our control, we were only able to hire one person. Thus, we could only complete sampling at 20 of the park's 50 monitoring plots and we have to return to Voyageurs in 2016 to collect data at the remaining 30 plots.

We focused our sampling in three areas of the park: east Rainy Lake, Sand Point Lake, and Johnson Lake, with a few additional plots around the Whispering Pines area. While we did not encounter any state-listed threatened or endangered species, we also did not locate any invasive species. Non-native species located in plots were limited to crown vetch, red clover, curly dock, and both Kentucky bluegrass and Canada bluegrass—all species that do not generally become invasive.

Many of our upland sites showed the continued impacts of a lack of fire in the ecosystem. Numerous plots supported standing dead jack pine and extensive downed jack pine, with few or no living individuals remaining. In their stead is extensive balsam fir and red maple. We located black ash— a species threatened by the emerald ash borer—in 13 of the 20 sampled plots. Our data will help understand overstory dynamics once this insect reaches the park.

Tree cores were collected this summer as part of a planned five-year project with Northland College to assess the impact of lake proximity and latitude on tree growth. This is expected to help us predict how climate change may affect tree growth.

Just like the Postal Service, the vegetation monitoring crew goes out rain or shine!

Water Quality—Large Rivers

This was Rick Damstra's first full year as GLKN's Large River Aquatic Ecologist, and he accomplished all of this year's sampling with critical field help from Michelle Prosser (SACN), Jill Medland (SACN), and Mark Romanski.

For the first time in years, the April sampling round was not delayed due to dangerous high water and ice conditions, despite a few inches of snow being on the ground for the first day of fieldwork.

We continue to make annual sampling visits to all six sites on the St. Croix and Namekagon rivers that were randomly-selected for monitoring when the protocol was implemented in 2007. Since 2013, we have also collected samples from four other non-randomly selected sites located in the upper Riverway. Data from the random sites allow us to make park-wide inferences on long-term trends in water quality, while monitoring at the non-random sites will provide site-specific information that is of great interest to the park and regional water quality professionals.

Water Quality—Inland Lakes

As in previous years, we conducted three rounds of sampling on 31 lakes and maintained temperature logger arrays that are collecting data year-round in Lake Richie (ISRO), Grand Sable Lake (PIRO), Lake Manitou (SLBE), and Little Trout and Mukooda lakes (VOYA). Data from these arrays are providing important information on lake thermal structure as it is related to weather and climate, suitability for fish habitat, and resuspension of lake sediments in the summer (which can cause increased nutrient levels and algal blooms). Network staff received significant and much appreciated help from Shania Leask and Hayley Bahr (APIS); Danielle Kiesow, Stephanie Wong, and Seth DePasqual (ISRO); Brenda Moraska Lafrancois (MWRO); Ben Thierry (PIRO); Rebecca Phillips (VOYA); and other park staff and volunteers.

Apostle Islands National Lakeshore

By the end of the 2014 monitoring season we had strong evidence that water levels and chemistry in the Outer Island Lagoon (our only water quality sampling site at APIS) were being driven by the higher-than-average water level of Lake Superior, which was causing lake water to backflow through the sand berm and into the lagoon. Before our first visit to the lagoon in 2015 we discovered via Google Earth satellite imagery that a 100 meter section of the sand berm had completely washed away. Using satellite imagery we were able to determine that the breach occurred sometime between 9 September (date of last monitoring visit) and 18 September (first date of cloud-free imagery) 2014. Water quality within the lagoon is now essentially the same as Lake Superior, with high pH and conductivity, and much lower dissolved organic carbon. Now that the lagoon is directly connected to Lake Superior, we also expect to see major changes in other environmental conditions such as methylmercury levels. Outer Lagoon is historically a very hot spot for methylmercury, but since the breach we expect much of it to be flushed out of the system.

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2015 Field Season Summary

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This summer, as an add-on to already-planned monitoring at APIS, a group of Northland College students collected dragonfly larvae at Outer Lagoon. Chemical analysis of the larvae can provide us with a measure of mercury in the aquatic system. Continued monitoring using dragonfly larvae should reveal a marked drop in mercury concentrations over the next few years.

Indiana Dunes National Lakeshore

In addition to completing all three sampling rounds at Middle Lagoon, Josh Dickey also collected surface water samples from 19 stream, river, and ditch sites for the surface water contaminants project (see below).

Isle Royale National Park

Mark Romanski attributes his successful first field season as GLKN's new Inland Lake Aquatic Ecologist to the exceptional assistance provided by biological science technician, Anna Quist, and all the lessons learned from numerous mistakes made during his previous 19 field seasons on Isle Royale. With assistance from Rick Damstra, Mark and Anna also serviced the vertical array of temperature loggers on Lake Richie in June. Mark and Anna revisited the site in late August to download the summer's data and prep the array for winter. Mark and Anna also collected surface water samples from our nine index lakes to be analyzed for surface water contaminants (see below).

Outer Island Lagoon and the Lake Superior shoreline in Fall 2014 (top) and Spring 2015. *Images from Google Earth.*

Pictured Rocks National Lakeshore

In addition to completing the three sampling rounds, Leah Kainulainen downloaded data from and serviced the vertical array of temperature probes on Grand Sable Lake and finished mapping the bottoms of Beaver and Grand Sable lakes, which completes bathymetric work at PIRO index lakes. Leah and Ben Thierry also continued piloting GLKN's Wadeable Streams protocol on Miners River by deploying a multiprobe and collecting aquatic insects.

Sleeping Bear Dunes National Lakeshore

Chris Otto, with assistance from park staff, completed all scheduled routine monitoring at six index lakes. In June, July, and September he downloaded data from and serviced the vertical array of temperature probes on Lake Manitou on North Manitou Island. During the September visit, eight temperature probes were replaced with new units.

Voyageurs National Park

Jaime LeDuc completed all sampling at the eight index lakes, downloaded data from and serviced the vertical array of temperature probes on Little Trout and Mukooda lakes in May and October, and continued to collect water samples from five inland lakes for an assessment of mercury levels. The mercury assessment project is part of an ongoing collaboration

between the Network, VOYA, and USGS to conduct long-term monitoring of mercury at inland lake waters in the park.

Surface Water Contaminants

Water samples were collected from nine inland lakes at ISRO and from Lake Superior offshore from one beach site at APIS as part of a NPS/USEPA Emerging Contaminants Program. The program is designed to assess the presence of pesticides, pharmaceuticals, personal care products, and waste water indicators, collectively known as contaminants of emerging concern (CECs). This project differs from our standard contaminants monitoring in that we are collecting water samples rather than using bald eagles, fish, or dragonfly larvae as indicators. Samples were analyzed for more than 200 chemicals, but preliminary results for the nine lakes at ISRO indicate that only DEET (insect repellent) and atrazine (a pesticide used on agricultural crops) were above their respective detection limits.

In 2013 and 2014, samples were collected from 31 sites across MISS, INDU, and APIS and analyzed for CECs. There were 44 different CECs detected at MISS, 42 at INDU, and 5 at APIS. Pesticides, mainly in the form of herbicides or associated breakdown products, were the most common type of contaminant found at MISS and INDU (detected in at least 50% of all samples). Gabapentin, a pharmaceutical used to treat epilepsy and neuropathic pain, was widespread in surface waters across all three parks—80% of samples from MISS, 58% of samples from INDU, and 29% of samples from APIS. Wastewater indicator samples were collected infrequently, but flame retardants, which are one type of wastewater indicator, were detected in samples from all water body types.

Microplastics

The NPS and Clemson University are collaborating on a study of the prevalence of microplastics in 37 ocean or Great Lakes coastal beaches across 35 parks. With assistance from our cooperators, we coordinated the collection of sand samples from one beach site each in INDU, SLBE, PIRO, ISRO, APIS, and GRPO.

Microplastics are small pieces of beads or fibers ranging from 0.00033 to 5.0 mm in size—about the size of a grain of sand. They enter water bodies either indirectly by shoreline run-off or rivers, or directly as larger plastic pieces that then break down. There is growing evidence that microplastics are ubiquitous in oceans, lakes, and rivers, and scientists are finding them in zooplankton, copepods, marine worms, and other organisms that serve as prey for larger species. These plastics can contain pollutants, but they can also absorb pollutants from the environment that could potentially impact food webs and humans.

Despite their small size, microplastics are an insidious form of pollution in the Great Lakes. They are easily ingested by all forms of aquatic life and over time can create blockages in the digestive tract. They can also contain or absorb chemical contaminants from the surrounding water. *Photo by Sherri A. Mason, State University of New York–Fredonia, and 5 Gyres. Used by permission.*

Having this information will help us to better understand the distribution of microplastics and any associated risks to humans and the environment. For more information about microplastic pollution, visit www.5gyres.org/microbeads/. Also, Lake Scientist.com summarizes presentations from the 2014 International Association of Great Lakes Research conference regarding microplastics pollution in the Great Lakes.

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2015 Field Season Summary

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Diatoms

Every three to five years we use bottom corers to collect the top 2 centimeters of sediment from areas of deposition in lakes and rivers. These sites are typically at the same locations where we conduct our routine water quality monitoring. Surface sediments contain the most recent diatom assemblage within a water body, and we use them to track and analyze the diatom species they contain and subsequently gain a better understanding of changes in water quality.

Just like the game "Operation," Rebecca Phillips needs keen concentration and a steady hand when she collects a sediment sample from the 1-2cm layer of a core taken from Brown Lake at VOYA. *Photo by Greg Jennings.*

Diatoms are a type of algae that form silica-based cell walls. When diatoms die, glass-like "fossils" fall to the bottom and are preserved in lake sediment. Many diatom species require specific water quality conditions, so the assemblage of species present in the sediments reflects environmental conditions in the lake or river. Once collected, expert algologists can identify individual diatom species using just these remains.

Surface sediment cores were collected from nine lakes at VOYA in August. The surface sediment cores were sent to our cooperators at the St. Croix Watershed Research Station (SCWRS) to be analyzed this winter. Next year we will collect diatom samples at ISRO and possibly at SACN.

SCWRS staff also analyzed diatoms from "long" sediment cores—one-to-three meters (three-to-nine feet) in length—from four inland lakes at VOYA that were collected in 2010 as part of a separate study on mercury in sediment. Diatom communities in these long cores can be cataloged going back 150 years or more, allowing us to model what water quality conditions were like in the past. This gives us a basic means of comparing modern-day water quality conditions with those from pre-Euro-American settlement. Preliminary results indicate there have been no significant changes in phosphorus, pH, or specific conductivity in VOYA's lakes since Euro-American settlement.

Weather and Climate

Our climate monitoring is primarily a data assimilation activity, the results of which can be found on the Climateanalyzer.org data visualization and distribution portal. We developed a draft dashboard interface for VOYA's weather data, which is ready for public viewing (www.climateanalyzer.org/voya_dash).

In the field this summer, we performed maintenance work on the nearshore RAWS (remote access weather stations) in APIS, PIRO, and SLBE. RAWS continue to supplement data from non-NPS sources to provide a better picture of climate within park units.

A working draft of our climate monitoring protocol has gone through an internal review, but completion of it is on hold as the I&M division develops a national protocol. ●

New Reports and Publications

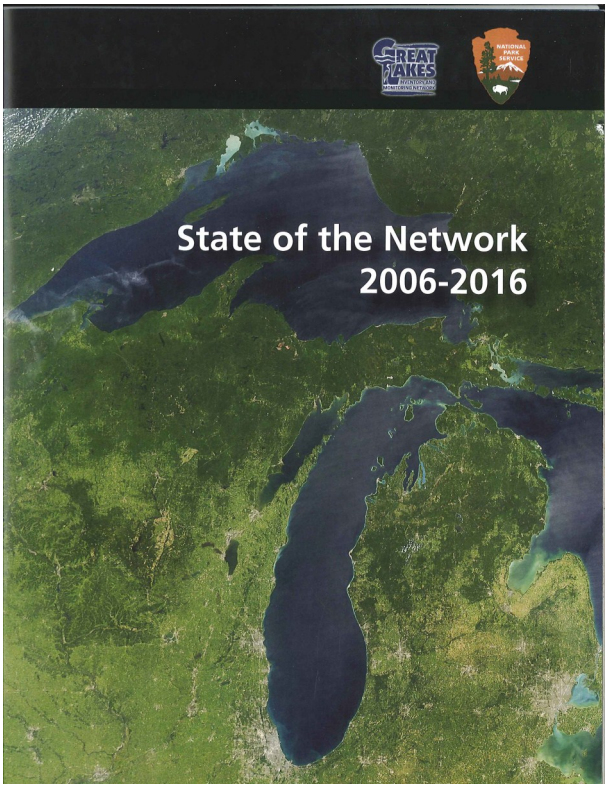
Licht, D.S., R.A. Moen, D.P. Brown, **M.C. Romanski**, and R.A. Gitzen. 2015. The Canada lynx (*Lynx canadensis*) of Isle Royale: Over-harvest, climate change, and the extirpation of an island population. Canadian Field-Naturalist 129(2): 139–151.

Route, W.T., C.R. Dykstra, P.W. Rasmussen, **R.L. Key**, M.W. Meyer, and J. Mathew. 2014. Patterns and trends in brominated flame retardants in bald eagle nestlings from the upper Midwestern United States. Journal of Environmental Science and Technology. 48(21): 12516–12524.

Sanders, S., and **J. Kirschbaum**. 2015. Forest health monitoring on the St. Croix National Scenic Riverway: Short-term change and longer-term projections. Journal of the Torrey Botanical Society 142(4): 271–282.

VanderMeulen, D. 2015. Screening for contaminants of emerging concern in surface waters of the Great Lakes Network parks: 2013–2014. Natural Resource Data Series NPS/GLKN/NRDS—2015/786. National Park Service, Fort Collins, Colorado.

Coming May 2016!



Draft image—may not resemble final product.

In addition to celebrating the National Park Service Centennial, 2016 will mark our 10th year of field work in the Great Lakes Network parks! Our *State of the Network* report will look back on the path we have traveled and what we have learned, along with highlighting long-term projects conducted by staff at each of the parks.

Smart writing, full-color photos, interesting facts—it's all here! And it will all be revealed in May 2016, both in print and online. Watch for it!

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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