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GREAT LAKES INVENTORY AND MONITORING NETWORK

Up On the Border

By Ted Gostomski, Network Science Writer

When I first visited International Falls in the winter of 1998, I had no idea where I was. A colleague and I arrived after dark, and the meeting we were there to attend regarding the park's general management plan was held in the hotel, so I did not go outside until dinner time the next night. A few months later, I returned for a boat tour the planners had arranged for those who were interested in seeing first-hand some of the challenges the GMP would address. What I remember most about the meeting, and especially that boat tour, is how Voyageurs National Park seemed to be a wild frontier. There were dozens of access points and no reservation system; we heard stories of people fighting over campsites. I wondered how park managers could know who, where, or how anyone was visiting the park?

It is worth remembering that Voyageurs is relatively young (added to the National Park System in 1971), so to some extent, we are witnessing its growing pains. But the park is also part of the border separating the United States and Canada, so the waterways and the land that surrounds them have a long history of use by people from two countries. That history made the creation of the park a very contentious issue, and park staff acknowledge that and manage resource use accordingly.

One of those uses is power generation. The four large lakes in Voyageurs (Kabetogama, Namakan, Sand Point, and Rainy; a fifth lake—Crane—is mostly outside the park boundary) flow north and west toward the Rainy River. Water levels are controlled by a hydroelectric dam at the outlet of Rainy Lake and by regulatory dams on Namakan Lake's two outlets. These privately owned dams have been in place since the early 1900s, providing power to the towns of International Falls, Minnesota, and Fort Frances, Ontario.

"Since the park was established, much of the resource management focus has been on the effects of artificial lake management," says Mary Graves, the park's chief of resource management, "and this will continue to be a major focus for

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Up On the Border

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a few years as the International Joint Commission moves toward completing studies to evaluate the effects of Rule Curves established in 2000." Those Rule Curves regulate how and when water is drawn down. The 2000 Rule Curves reflect an attempt to bring the timing of those fluctuations closer to the natural cycles.

Necessarily, a border park also works cooperatively on many projects. "There are challenges inherent in working within a watershed and lake system that extends far beyond park boundaries (and into another country)," says Graves. "We work with the Ontario Ministry of Natural Resources on fisheries projects, and we're currently working with OMNR, Environment Canada, and others on projects associated with the International Joint Commission's Plan of Study for evaluating the 2000 Rule Curves in our shared waterways."

Moose at Voyageurs were captured and fitted with GPS collars during a study of how climate change is affecting the animals. GPS collars allowed investigators to locate where the moose were bedding. *NPS photo/Steve Windels*

Other challenges include the effects of climate change, especially on moose; contaminants ("there is a growing concern about the potential impacts of proposed sulfide mining in northern Minnesota and in northwestern Ontario"); and the invasion of non-native species. Park staff are studying how moose use forests and beaver-created wetlands to counteract temperature and weather extremes. Part of this study involves placing GPS collars on moose so that their bedding sites can be located. It is thought that moose moderate their internal temperature through contact with the ground while bedding, and the amount of heat that can be dissipated depends on many factors, possibly including the thickness of the duff layer and soil-moisture conditions[1].

One part of the long-term water quality monitoring conducted by Network staff is the year-round measurement of temperature in Little Trout Lake. A line of sensors extends from the surface of the lake to the bottom, collecting water temperature data every hour, year-round. From this, we can determine how long the lake is ice-covered and how the water temperature profile changes throughout the year. Extreme changes in the temperature profile can have serious consequences for the ability of some fish to survive because of warmer temperatures, but also because temperature affects the amount of oxygen the water can hold (see pages 4 and 5). So far, though, the data coming from Little Trout Lake suggest that the lake is staying cool enough for the survival of lake trout and cisco.

The work going on at Voyageurs belies its initial "wild frontier" impression. Mary Graves acknowledges that the park has not had the ability to monitor visitor use. But, she says, "we are implementing a reservation and fee program for overnight camping this year. This is a positive change and will help us understand how many visitors are coming to the park, where they are going, and what impacts to resources might result."

Sixteen years after I first encountered Voyageurs National Park, a form of order is coming to this seemingly wild frontier. ●

[1]Bryce Olson, David Morris, and Steve Windels. 2012. Investigations of the effects of climate change on moose in Voyageurs National Park. Unpublished FY12 Assistance Request Summary Report to the Great Lakes Research and Education Center.

2014 Field Schedule

Amphibian monitoring is expanding into the other Network parks, the vegetation monitoring team returns to GRPO to revisit plots established there in 2007, and the field component of monitoring contaminants in eagles returns.

Here's a summary of where we'll be and when. Contact the people named below or your park resource management staff if you would like to join us in the field for a day. ●

	AMPH	CONTAM	LB	VEG	WQ
Apostle Islands (APIS)	April–June	(BE) June	June		June–Sept
Grand Portage (GRPO)		(DF) June	June	May–Aug	
Indiana Dunes (INDU)	March–May	(DF, F) June	June		May, Jul, Sept, Nov
Isle Royale (ISRO)	April–June		June		May–Sept
Mississippi River (MISS)	March–May	(BE) May	June		July, Aug
Pictured Rocks (PIRO)	April–June	(DF) June	June		June–Sept
St. Croix (SACN)	April–June‡	(BE) May–June	June		Apr–Nov
Sleeping Bear Dunes (SLBE)	April–June	(DF) June	June		June–Sept
Voyageurs (VOYA)	April–June‡	(DF) June	June		June–Sept

AMPH – *Amphibians.* Collection of data recordings will be accomplished by park staff and volunteers. ‡ Monitoring is being conducted using a U.S. Geological Survey protocol.

CONTAM – *Contaminants.* Bald eagle (BE) sampling conducted by Bill Route and others. Dragonfly (DF) and fish (F) collections gathered by

LB – *Landbirds.* Conducted by park staff and volunteers.

VEG – *Vegetation.* Team of three biological technicians led by Suzy Sanders and Jessica Grochowski.

WQ – *Water Quality.* David VanderMeulen (APIS), Josh Dickey (INDU), Rick Damstra (ISRO) and one biological technician, Leah Kainulainen (PIRO), Michelle Prosser (SACN), Chris Otto (SLBE), Jaime LeDuc (VOYA).

Staff Insider

Jaime LeDuc, Biological Science Technician

Jaime began working as a seasonal biological technician at Voyageurs National Park in 2008. Working through SCEP (Student Career Experience Program), she was hired as a permanent aquatic bio tech there in 2012—a position that is shared between VOYA and the Network office. She has a B.S. in Aquatic Biology from Bemidji State University and an M.S. in Biological Sciences from Michigan Technological University, where she studied the interactions between fish and the spiny waterflea. In addition to water quality monitoring, she assists with amphibian monitoring, fish studies, and aquatic invasive species projects. When not working, Jaime is still on the water, either riding a surfboard, wakeboard, or snowboard. ●

Is it hot in here?

Lake trout (*Salvelinus namaycush*) are an important sport fish, and cisco (*Coregonus artedii*; also known as tu
are ecological indicators due to their need for relatively cold, well-oxygenated water. Climate change projec
increased water temperatures and lower levels of dissolved oxygen. If these changes occur, it will reduce the
decline or disappear altogether, especially in more southern portions of their range, including southern Can

Little Trout Lake in Voyageurs National Park is a deep, cold lake that historically hosted lake trout and cisco populat
captured has declined; only one trout was captured in 2009 and none were caught in 2012. It is thought that clima
than usual. Catches of cisco were variable, with no discernable trend in population observed.

To gain insights into how lakes stratify (organize into different temperature layers) and how the layers mix, and hov
consists of probes (*see bottom-right photo*) attached at 1 meter (3.2 feet) intervals to a line that extends vertically fr
record the water temperature every hour, all year round—even under the ice. Once the array is installed, huge amo
the fish in Little Trout Lake, we paired the continuous temperature data gathered by the arrays with the oxygen dat
dissolved oxygen requirements for trout and cisco.

Lake trout and cisco have differing temperature and dissolved oxygen requirements. Explored together, the tempera
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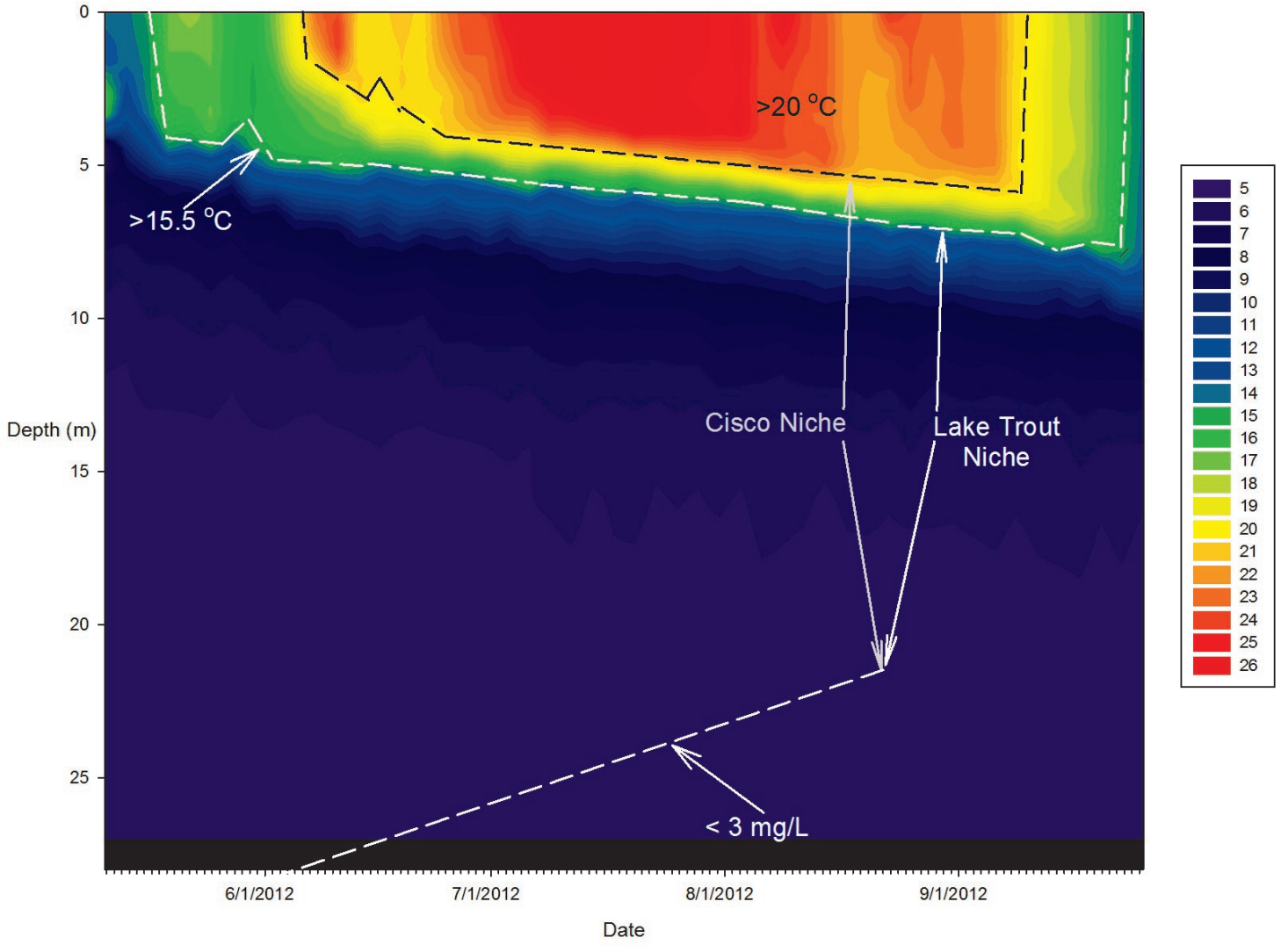


The oxythermal niche of cisco and lake trout in Little Trout Lake in 2012.

llibee) are an important baitfish and sport species. Both are native to some lakes in Voyageurs National Park and tions indicate warmer average temperatures, which could have an effect on water quality, primarily through e amount of habitat available for lake trout and cisco, and consequently, local populations of these fishes could ada and the northern United States.

ions. However, recent fish surveys by the Minnesota DNR and Voyageurs staff found the number of lake trout te may have something to do with this decline because many of the preceding years were warmer and drier

v these factors relate to fish habitat, we installed a temperature array in Little Trout Lake in 2011. The array rom the surface of the lake down to the bottom (about 28 m, or 91 ft) where it is anchored in place. The probes unts of data can be collected with little additional effort. To explore how much thermal habitat is available to ta we collect during summer water quality monitoring and compared them to the known temperature and

ature and dissolved oxygen requirements are called the "oxythermal niche," which is the layer of water between e upper temperature and lower dissolved oxygen boundaries where these fish can survive. Cisco have a atively broad oxythermal niche for a coldwater fish and can tolerate temperatures as high as 20.0 °C (68 °F). ke trout have a much narrower niche, with an upper temperature tolerance of 15.5°C (60 °F). Both species pically require dissolved oxygen levels to be at least 3 mg/L. We can see the oxythermal niche of both species in tle Trout Lake by plotting summer 2012 temperature and dissolved oxygen collected at the deepest part of the ke (*see graph*). Cisco had about 19 m (62 ft) of vertical habitat available to them; lake trout had about 17 m (56 . From the data we have collected, it appears that water temperature and dissolved oxygen alone are not niting cisco or lake trout habitat in the summer, but this research is ongoing.

is information will help managers plan and set priorities for fisheries management now and in the future. Park aff have also extended this work by placing a temperature array in Mukooda Lake and plan on deploying several hers in lakes that support coldwater fish species. ●

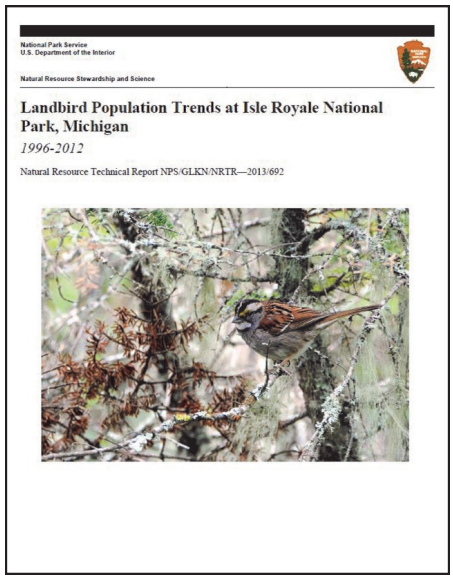
The temperature array is retrieved from the lake for regular maintenance.

One data logger along the Little Trout Lake temperature array.

Things We're Learning

From *Landbird population trends at Isle Royale National Park, Michigan: 1996–2012* by A.T. Egan and T.J. Gostomski. 2013. Natural Resource Technical Report NPS/GLKN/NRTR—2013/692. National Park Service, Fort Collins, CO.

Standardized landbird monitoring has been conducted on Isle Royale since 1996. It was incorporated into the Network landbird monitoring protocol in 2010. Data are collected annually during the month of June by conducting counts at 130 points distributed along eight transects (hiking trails).



An annual average of 1,457 individuals representing 89 landbird species was recorded during the 17-year period. Using least squares regression, 47 species (52%) revealed increasing trends, of which twelve were significant ($p<0.05$), while 24 species (27%) had decreasing trends, nine of which were significant. Of the declining species, only the common raven and chipping sparrow were detected during surveys in all years. Some species that were common and abundant (e.g., ovenbird and white-throated sparrow) had considerable annual fluctuations, but a weak, uncertain trend. A high number of warblers was observed during point counts, both in terms of the diversity of species and in some of the most abundant numbers of individuals occurring annually (e.g., black-throated green warbler, Nashville warbler, and ovenbird). Finches and flycatchers, while having a high number of represented species, were comprised of fewer individuals. The Simpson Index of Diversity for most transects was 0.94 –0.95 with a low standard deviation (0.01 on six of the eight routes). The Simpson Index ranges from 0 to 1, with 1 representing the highest diversity.

Use caution when viewing trends for species such as the bay-breasted warbler, Cape May warbler, evening grosbeak, and Tennessee warbler. Though present on the island, they are not abundant, and few individuals are heard during June surveys.

The decline in chipping sparrows is curious given that there seems to be an increase in the number of forest gaps on Isle Royale in recent years. These forest gaps, and habitat across Isle Royale generally, should favor chipping sparrows as well as American redstarts, which are also declining significantly. American redstart declines in recent decades are likely due to reduced habitat quality, both on breeding and wintering grounds.

Common raven populations are exhibiting increasing trends at state, regional, and ecoregional scales, yet they are declining on Isle Royale (r^2=0.66, P=0.001). Ravens are often dependent upon carrion, and it is thought that wolf-killed moose are probably critical to their winter survival on the island. Raven numbers have at best a weak correlation to either wolf numbers or wolf kill rates, but the data are not directly comparable—wolf numbers and kill rates are estimated during the winter, while raven numbers are taken from summer point counts.

Bird species exhibiting significant ($p<0.05$) population changes at Isle Royale NP, 1996–2012. Each column is ordered from greatest to least average proportional change per year.

Increasing ↑	*Declining* ↓
Red-winged Blackbird	Bay-breasted Warbler
American Goldfinch	American Crow
Golden-crowned Kinglet	American Redstart
Alder Flycatcher	Least Flycatcher
Song Sparrow	Tennessee Warbler
Pileated Woodpecker	Common Raven
American Robin	Chipping Sparrow
Hermit Thrush	Evening Grosbeak
Common Yellowthroat	Cape May Warbler
Red-breasted Nuthatch	
Swamp Sparrow	
Nashville Warbler	

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Things We're Learning

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Without a more in-depth study of ravens on Isle Royale, we cannot say for sure what might be causing the island population to decline in spite of noted increases everywhere else in the region.

The remoteness of Isle Royale protects it from many negative influences (e.g., land development, fragmentation), but climate change will likely exert a greater influence on island bird populations both indirectly (via changes to wintering and migratory stopover sites) and directly in the future. The decline of ravens is potentially one example of this emerging influence. ●

See the **full report** on our website:

http://science.nature.nps.gov/im/units/glkn/monitor/landbirds.cfm

The common raven is declining on Isle Royale despite increasing population trends at state, regional, and ecoregional scales. *NPS photo.*

New Publications

Haro, R.J., S.W. Bailey, R.M. Northwick, K.R. Rolfhus, M.B. Sandheinrich, and J.G. Wiener. 2013. Burrowing dragonfly larvae as biosentinels of methylmercury in freshwater food webs. Environmental Science and Technology 47: 8148-8156.

Edlund, M.B., J. Ramstack Hobbs, and D.R. Engstrom. 2013. Biomonitoring using diatoms and paleolimnology in the western Great Lakes national parks: 2011/2012 summary. Natural Resource Technical Report NPS/GLKN/NRTR—2013/814. National Park Service, Fort Collins, Colorado.

Sanders, S., and **J. Grochowski**. 2013. Forest vegetation monitoring at Indiana Dunes National Lakeshore. Natural Resource Technical Report. NPS/GLKN/NRTR—2013/779. National Park Service. Fort Collins, Colorado.

Kirschbaum, A.A., and **U.B. Gafvert**. 2013. Landsat-based monitoring of landscape dynamics at Mississippi National River and Recreation Area: 2005–2010. Natural Resource Technical Report NPS/GLKN/NRTR—2013/745. National Park Service, Fort Collins, Colorado.

Kirschbaum, A.A., and **U.B. Gafvert**. 2013. Landsat-based monitoring of landscape dynamics at St. Croix National Scenic Riverway: 2005-2010. Natural Resource Technical Report NPS/GLKN/NRTR—2013/715. National Park Service, Fort Collins, Colorado.

Route, B., and J. Schaberl. 2013. A cursory survey of bats in Voyageurs National Park, Minnesota. Natural Resource Technical Report NPS/GLKN/NRTR—2013/701. National Park Service, Fort Collins, Colorado.

Damstra, R.A., **D. VanderMeulen**, and J. Elias. 2014. Monitoring water quality of inland lakes, Great Lakes Network, 2012: Data summary report. Natural Resource Data Series NPS/GLKN/NRDS—2014/629. National Park Service, Fort Collins, Colorado.

VanderMeulen, D. 2013. Water quality monitoring at Mississippi National River and Recreation Area: 2012 summary report. Natural Resource Data Series NPS/GLKN/NRDS—2013/577. National Park Service, Fort Collins, Colorado. ●

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Improving park management through greater reliance on scientific knowledge

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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.

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Take a look at our new and improved website!

http://science.nature.nps.gov/im/units/glkn/