

# Program Abstracts 18<sup>th</sup> Annual



## RAINY-LAKE OF THE WOODS WATERSHED 2021 FORUM

March 10 - 11, 2021  
Virtual-Online Sessions

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# Program At A Glance

## DAY 1 – MARCH 10

DAY 1 - MARCH 10		
<b>Central Time Zone</b>		
11:45	0:15	Zoom session open for pre-logon - <u>please logon before 12</u>
12:00	0:40	<b>Traditional Protocols</b> -- Elder Priscilla Simard, Other Elders TBC <b>Welcome</b> -- Consul General Delouya, Canadian Consulate Minneapolis -- Consul Koontz, U.S. Consulate Winnipeg
<b>Session 1 - Water Governance</b>		
12:40	0:18	International Rainy-Lake of the Woods Watershed Board update <a href="#">Board Co-Chairs Col. Karl Jansen and Michael Goffin</a>
13:00	0:18	Manito Aki Inakonigaawin (MAI): Natural Resource Law <a href="#">Hailey Krolyk &amp; Mona Gordon, Grand Council Treaty #3</a>
13:20	0:18	Nibi (Water) Declaration: Next Steps and Anishinaabe Water Governance <a href="#">Lucas King, Grand Council Treaty #3</a>
13:40	0:18	State of the Basin Report 2021 Update <a href="#">Bev Clark, LOWWSF; Lucas King, Grand Council Treaty #3 (Co-editors)</a>
14:00	0:18	The Shoal Lake 40 Water Regulation Project <a href="#">Chief Vernon Redsky, Shoal Lake #40</a>
14:20	0:18	Q&A with Water Governance presenters <a href="#">ALL</a>
14:40	0:20	<b>Break</b>
<b>Session 2 - Aquatic Invasive Species</b>		
15:00	0:38	Plenary Keynote: Impacts of invasive spiny water fleas and zebra mussels on first-year growth of walleye and yellow perch in Minnesota's large lakes <a href="#">Gretchen Hansen, Tyler Ahrenstorff, Bethany Bethke, Josh Dumke, Jodie Hirsch, Katya Kovalenko, Jamie LeDuc, Ryan Maki, Heidi Rantala, Tyler Wagner</a>
15:40	0:18	Do Spiny Water Flea Push Walleye, Sauger, and Yellow Perch Out of the Pelagic Zone? <a href="#">Bethany Bethke, Gretchen Hansen, Heidi Rantala, Tyler Ahrenstorff, Holly Wellard-Kelly, Katya Kovalenko, Josh Dumke, Ryan Maki, Jodie Hirsch, Valerie Brady, Jaime LeDuc</a>
16:00	0:18	Slow the Spread Campaign for Invasive Spiny Water Fleas <a href="#">Donn Branstrator, Valerie Brady, Holly Wellard Kelly, Josh Dumke, Robert Hell, and Kari Hansen</a>
16:20	0:18	Risk Assessment Tool for Aquatic Invasive Species to the Rainy-Lake of the Woods Basin <a href="#">Amanda Bell (USGS, IJC-IMA Project)</a>
16:40	0:18	Q&A with AIS presenters <a href="#">ALL</a>
17:00	<b>DAY 1 END</b>	

## DAY 2 – MARCH 11

<b>Central Time Zone</b>		
<b>8:15</b>	<b>0:15</b>	<b>Zoom session open for pre-logon - please logon before 08:30</b>
<b>8:30</b>	<b>0:10</b>	Day 2 Welcome and Introductions
<b>Session 3 - Nutrients</b>		
<b>8:40</b>	<b>0:18</b>	Spatio-temporal trends in hydroclimatic conditions for the Rainy River-Lake of the Woods watershed: implications for nutrient export. <a href="#">Wes Greenwood</a> , <a href="#">Catherine Eimers</a> , and <a href="#">Andrew Williams</a>
<b>9:00</b>	<b>0:18</b>	Then and now: Updating the nutrient budget for the Canadian Rainy- Lake of the Woods basin <a href="#">Andrew Williams</a> and <a href="#">Catherine Eimers</a>
<b>9:20</b>	<b>0:18</b>	Multi-year simulations, Under ICE dynamics and Climate Change Scenarios: outcomes from observations and the application of a coupled watershed-lake model of Lake of the Woods <a href="#">Reza Valipour</a> , <a href="#">Phil Fong</a> , <a href="#">Rajesh Shrestha</a> , <a href="#">Jun Zhao</a> and <a href="#">Craig McCrimmon</a>
<b>9:40</b>	<b>0:05</b>	Minnesota Lake of the Woods Phosphorus TMDL Update <a href="#">Cary Hernandez</a>
<b>9:47</b>	<b>0:21</b>	Q&A - With Nutrient session presenters <a href="#">ALL</a>
<b>10:10</b>	<b>0:20</b>	<b>Break</b>
<b>Session 4 - ECCC Policy: Proposed Objectives and Scenarios to reduce harmful algae in Lake of the Woods</b>		
<b>10:30</b>	<b>0:48</b>	ECCC Presentation and Town Hall Discussion: Proposed ecosystem objectives and phosphorus reduction scenarios to manage algae blooms in Lake of the Woods <a href="#">Daniel Rokitnickiwojcik</a> , <a href="#">ECCC</a>
<b>Session 5 - Regulation</b>		
<b>11:20</b>	<b>0:18</b>	Water regulation, wild rice, and the ongoing production of settler colonialism on Rainy Lake <a href="#">Johann Strube</a>
<b>11:40</b>	<b>0:18</b>	Data for decision-making: The Lake Winnipeg Community-Based Monitoring Network <a href="#">Chelsea Lobson</a>
<b>12:00</b>	<b>0:10</b>	Lake of the Woods fisheries management council's walleye sportfishing exercise <a href="#">Steve Bobrowicz</a> , <a href="#">MNR</a>
<b>12:12</b>	<b>0:16</b>	Q&A - With Regulation session presenters <a href="#">ALL</a>
<b>12:30</b>	<b>0:45</b>	<b>Virtual Lunch Break</b>
<b>Session 6 - Monitoring</b>		
<b>13:15</b>	<b>0:18</b>	Advanced Remote Sensing Methods for Automated Lake Water Quality Mapping <a href="#">Leif G. Olmanson</a> & <a href="#">David H. Porter</a>
<b>13:35</b>	<b>0:18</b>	Little Fork River Sediment – decoding sources with sediment fingerprinting to help guide management <a href="#">Anna Baker</a> and <a href="#">Faith Fitzpatrick</a>
<b>13:55</b>	<b>0:18</b>	Collaborative Fisheries Stock Monitoring Program (CSMP) in Manitoba <a href="#">Brian G. Kotak</a> , <a href="#">William Galbraith</a> and <a href="#">Brian R. Parker</a>
<b>14:15</b>	<b>0:18</b>	Cyanotoxins in fish at Voyageurs National Park <a href="#">Seth McWhorter</a>
<b>14:35</b>	<b>0:18</b>	Q&A - with Monitoring presenters <a href="#">ALL</a>
<b>14:55</b>	<b>0:05</b>	<b>Closing Remarks - Forum Ends 3:00 pm Central Time</b>

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# Oral Presentation Abstracts

## Session 1 – Water Governance

### International Rainy-Lake of the Woods Watershed Board update

Board Co-Chairs: [Col. K. Jansen\\*](#) and [M. Goffin](#)

International Rainy-Lake of the Woods Watershed Board

#### Abstract

The presentation reviews the mandate of the International Rainy- Lake of the Woods Watershed Board in relation to the International Joint Commission and provides updates on the Board's activities from March 2020 – to March 2021. In addition to describing the role of the Water Levels Committee, the communication efforts of the Engagement Committee and the ongoing support provided by the International Watershed Coordinator in linking international, regional and local efforts in the basin highlights are related to aquatic ecosystem health, water levels forecasts and new adaptive management work. Current International Watershed Initiative projects such as the Objectives and Alerts Project, the Aquatic Invasive Species Coarse Scale Risk Assessment Project and the 2021 State of the Basin Report are also discussed.

#### Brief Bio

Colonel Karl Jansen is the Commander and District Engineer, U.S. Army Corps of Engineers – St. Paul District. He serves as the U.S. Co-chair for the International Rainy-Lake of the Woods Watershed Board, the International Lake of the Woods Control Board, and the International Red River Board.

#### Location of Study

The Board's geographic mandate includes the entire Rainy-Lake of the Woods Watershed.



## **Manito Aki Inakonigaawin (MAI): Natural Resource Law**

Hailey Krolyk & Mona Gordon

Grand Council Treaty #3

### **Abstract**

Manito Aki Inakonigaawin (MAI) is the natural resource law in Treaty #3 territory. MAI is a sacred law that has been a part of the Anishinaabe since time immemorial. It is written within and throughout nature and extends to the center of the earth to encompass all of Mother Earth's beings and inhabitants. MAI extends throughout the sky and embraces the entire universe. In 1993, Bell Canada came to Grand Council Treaty #3 and affected communities requesting permission to run a fibre optics telecommunications line throughout the territory. In order to ensure this process was done with the most respect for the past, present and future generations, Elders within Treaty #3 held multiple meetings and through ceremonial processes created the MAI written law. These developments began the harmonization of Canadian law with Indigenous law in the area. MAI now governs all developments within the territory and protects inherent and treaty rights of the Nation. MAI work continues throughout the territory as the Nation remains advocating for the sacred law to operationalize.

### **Brief Bio**

Hailey Krolyk is the Outreach Coordinator at Grand Council Treaty #3. She studied at Trent University, focusing on International Political Economy and Business Administration, where she learned essential community development tools and studied a diverse range of economic development practices globally. From there, she transferred to the University of Manitoba and continued to study Political Economy. She now continues to utilize her skills working with the natural resource law, Manito Aki Inakonigaawin (MAI) in Treaty #3. Hailey focuses on creating educational resources, community outreach and supporting the laws development.

Mona Gordon will be co-presenting. Mona is from Lac Seul First Nation and is an active member of the Grand Council Treaty #3 Women's Council. She works directly with Nibi and Manito Aki Inakonigaawin, and has contributed greatly to the development and advocacy of both within Treaty #3.

### **Location of Study**

Treaty #3 Territory

## **Nibi (Water) Declaration: Next Steps and Anishinaabe Water Governance**

[Lucas King](#)

Grand Council Treaty 3

### **Abstract**

Guided through the foundation and spirit of the Treaty #3 Nibi Declaration, Grand Council Treaty #3 continues to exercise the rights, jurisdiction, and responsibilities to water through a model of watershed management planning. This model stands on four pillars: Ceremony, Governance, Community Outreach and Education, and Community Based Monitoring. The importance of each of these pillars are in fulfillment of the rights and responsibilities as outlined in the Treaty and Anishinaabe Inakonigaawin. With continuing resource development in the Treaty #3 Territory, the protection of water through this watershed model becomes more important in order to recognize our relationship to Nibi and its connection to us all. This presentation will update on each of the four pillars of the Draft Treaty #3 watershed model, including community-based water monitoring, development of a Treaty #3 Nibi Portal, Nibi Curriculum, and interactive resource development map and Geospatial Database. Just as Nibi connects us all throughout the watershed, each pillar of this model is connected and moves towards the continued exercise of inherent and Treaty rights in Treaty #3 Territory.

### **Brief Bio**

Lucas King is Director of the Territorial Planning Unit of Grand Council Treaty #3

### **Location of Study**

Treaty #3 Territory

## **State of the Basin Report 2021 – Outline and Progress Report**

Bev Clark<sup>1</sup> and Lucas King<sup>2</sup>, Co-Editors

<sup>1</sup>Lake of the Woods Water Sustainability Foundation;

<sup>2</sup>Territorial Planning Unit, Grand Council Treaty #3

### **Abstract**

A preview of the recently started update to the Rainy-Lake of the Woods State of the Basin Report (SOBR 2021) will be presented, including the outline, data gaps and workplan. The SOBR 2021 is being research and produced in a partnership of the Lake of the Woods Water Sustainability Foundation, Grand Council Treaty #3, the International Multi-Agency Arrangement and the IJC Rainy-Lake of the Woods Watershed Board. The completed SOBR will be launched at the 2020 Forum.

### **Brief Bio**

Bev Clark is a consultant working with the Lake of the Woods Water Sustainability Foundation. Bev has been involved in Lake of the Woods monitoring and research since the 1980s, and was involved extensively on both previous SOBRs.

Lucas King is the Director of the Territorial Planning Unit, Grand Council of Treaty #3

### **Location of Study**

Entire Rainy/Lake of the Woods Watershed

## **The Shoal Lake 40 Water Regulation Project**

[Chief Vernon Redsky](#)

Shoal Lake #40

### **Abstract**

Chief Redsky's presentation will focus on the ongoing work Shoal Lake #40 is doing to ensure the regulation of water in Treaty #3 respects Anishinaabe laws and jurisdiction.

### **Brief Bio**

### **Location of Study**

Shoal Lake

## Session 2 – Aquatic Invasive Species

### Plenary Keynote: Impacts of invasive spiny water fleas and zebra mussels on first-year growth of walleye and yellow perch in Minnesota's large lakes

Gretchen Hansen<sup>1</sup>, Tyler Ahrenstorff, Bethany Bethke, Josh Dumke, Jodie Hirsch, Katya Kovalenko, Jamie LeDuc, Ryan Maki, Heidi Rantala, Tyler Wagner

<sup>1</sup>Gretchen Hansen, University of Minnesota, [ghansen@umn.edu](mailto:ghansen@umn.edu)

#### Abstract

Invasive species represent a threat to aquatic ecosystems globally; however, impacts can be variable, making generalizations difficult. Documented impacts of invasive zebra mussels (*Dreissena polymorpha*) and spiny water fleas (*Bythotrephes cederstroemi*; hereafter *Bythotrephes*) on native fishes are variable across locations and time periods. Here, we present the results of a comparative study of first-year growth of walleye (*Sander vitreus*) and yellow perch (*Perca flavescens*) in nine large walleye lakes in Minnesota. We use a hierarchical Bayesian analysis of a 35-year dataset to evaluate the effects of these aquatic invasive species on the early life growth of walleye and yellow perch. Walleye grew more slowly throughout their first year of life, and were on average 12 or 14% smaller at the end of their first summer following invasion by *Bythotrephes* or zebra mussels, respectively. Yellow perch growth was less affected by invasion. Yellow perch on average grew more slowly in their first year of life following invasion by zebra mussels, although this effect was not statistically distinguishable from zero. Early life growth of both walleye and yellow perch was less tightly coupled to degree days in invaded systems, as demonstrated by increased variance surrounding the degree day-length relationship. Smaller first-year size is related to walleye survival and recruitment to later life stages and has important implications for lake food webs and fisheries management, although again the relationship between first year growth and survival to later life stages varies among lakes. We present these results in the context of whole-lake food web responses to invasion and discuss the implications for fisheries management on large walleye lakes threatened by aquatic invasive species.

#### Brief Bio

Dr. Gretchen Hansen is an assistant professor of Fisheries Ecology at the University of Minnesota. Her work focuses on the impacts of large-scale drivers of change in lakes, including climate change, invasive species, and land-use. Dr. Hansen has a Master's degree from Michigan State University and a Ph.D. from the University of Wisconsin-Madison. She worked as a research scientist for the Wisconsin and Minnesota Departments of Natural Resources prior to joining the U of MN faculty in 2018.

#### Location of Study

Large Lakes of Minnesota (Rainy, Lake of the Woods, Kabetogama, Vermilion, Mille Lacs, Red, Winnibigoshish, Leech, Cass)

## **Do Spiny Water Flea Push Walleye, Sauger, and Yellow Perch Out of the Pelagic Zone?**

[Bethany Bethke](#), [Gretchen Hansen](#), [Heidi Rantala](#), [Tyler Ahrenstorff](#), [Holly Wellard-Kelly](#), [Katya Kovalenko](#), [Josh Dumke](#), [Ryan Maki](#), [Jodie Hirsch](#), [Valerie Brady](#), [Jaime LeDuc](#)

Bethany Bethke, Minnesota Department of Natural Resources, 5351 North Shore Dr, Duluth, MN 55804, 218-302-3271, [bethany.bethke@state.mn.us](mailto:bethany.bethke@state.mn.us).

### **Abstract**

Large percids, including Walleye *Sander vitreus*, Sauger *Sander canadensis*, and Yellow Perch *Perca flavescens* can be flexible in their use of littoral (e.g., benthic invertebrates, nearshore prey fish) and pelagic (e.g., zooplankton, offshore prey fish) zones depending on system and fish community dynamics. However invasive species such as spiny waterflea *Bythotrephes cederstroemii* may so dramatically alter the pelagic production available for percid use that fish may be forced to take advantage of more littoral resources. We sought to quantify the contribution of pelagic resources to age-0 and adult large percid diets sampled from Lake of the Woods, Rainy Lake, Kabetogama Lake, and Lake Vermilion using carbon and nitrogen stable isotope analysis of fish and invertebrate tissue. We sampled these lakes in summer and fall 2018; all lakes were invaded by spiny water flea. Using Bayesian mixing models, we calculated the proportion of fish diets that were derived from littoral versus pelagic prey sources and estimated diet overlap of fish species within lakes. Despite spiny water flea invasion, the resource contribution to these fish was from mostly pelagic sources and within lakes, percid resource use was very similar. Unfortunately, we do not have similar data from these systems on pelagic resource contributions prior to spiny waterflea invasion. However, it would be interesting to repeat the study in the future to determine how variable pelagic resource contribution is year to year and also how it may change with other community changes, such as zebra mussel *Dreissena polymorpha* infestation.

### **Brief Bio**

Bethany Bethke is a graduate of the Fisheries and Wildlife programs at South Dakota and North Carolina State Universities. She has worked for the MN DNR since 2012 and her research includes work on fisheries food webs and how they are changing with climate and invasive species.

### **Location of Study**

Rainy, Lake of the Woods, Kabetogama, Vermilion

## **Slow the Spread Campaign for Invasive Spiny Water Fleas**

Donn Branstrator, [Valerie Brady\\*](#), Holly Wellard Kelly, Josh Dumke, Robert Hell, and Kari Hansen

Donn Branstrator, University of Minnesota Duluth, Department of Biology, 1035 Kirby Drive, Duluth MN, 55812, ph. 218-726-8134, [dbranstr@d.umn.edu](mailto:dbranstr@d.umn.edu)

Valery Brady, University of Minnesota Duluth, Natural Resources Research Institute, 5013 Miller Trunk Highway, Duluth, MN 55811, [vbrady@d.umn.edu](mailto:vbrady@d.umn.edu)

### **Abstract**

The invasive spiny water flea, a predacious zooplankton, is present and often abundant in Lake Superior and many inland lakes in the Lake of the Woods and Rainy Lake region. Preventing the spread of spiny water flea to uninfested lakes is an important management priority because they can reduce the abundance of native zooplankton, reduce the food for planktivorous and young fish, and thus alter food webs. Humans are the primary spread vectors for spiny water flea through movement of infested water and fouled equipment between lakes. We tested the susceptibility of commonly-used fishing gear to fouling by spiny water flea by simulating the use of gear (fishing lines, downrigger cables, bait buckets, livewells, and anchor ropes) on Island Lake Reservoir and Lake Mille Lacs in Minnesota. We found that surface and downrigger lines became readily fouled by spiny water fleas when the fleas were present in the water, even at low ambient densities. Lesser amounts of fouling occurred with livewells and downrigger cables. Fouling rarely occurred with bait buckets and anchor ropes. We highlight the research and our upcoming slow-the-spread campaign including a cloth printed with instructions for wiping off spiny water fleas, and PSA's created for TV and YouTube.

### **Brief Bio**

Donn Branstrator is a Professor of Biology at the University of Minnesota Duluth with a focus on limnology and freshwater zooplankton. He directs the Water Resources Science Graduate program; and he maintains a research program on the ecology of spiny water flea. His research with the Minnesota Aquatic Invasive Species Research Center focuses on the impacts and colonization history of spiny water flea in Lake Mille Lacs and Lake Kabetogama, as well as an evaluation of the risk of dispersal of spiny water flea by boating equipment. He teaches courses in general ecology, lake ecology, and ethics in science, and he co-directs the Water Resources Science Graduate Program at the University of Minnesota.

Valerie Brady (Presenting for Don) is a Senior Research Program Manager at the University of Minnesota Duluth's Natural Resources Research Institute. She works on using aquatic invertebrates and fish to indicate the condition of aquatic ecosystems, as well as investigating effects of AIS on aquatic ecosystems. Her research with the Minnesota Aquatic Invasive Species Research Center focuses on an evaluation of the risk of dispersal of spiny water flea by angling equipment. Among other projects, she coordinates the Great Lakes Coastal Wetland Monitoring Program for USEPA GLNPO and teaches Wetlands Ecology.

### **Location of Study**

Island Lake Reservoir (Duluth) and Lake Mille Lacs (Garrison) in Minnesota

## **Risk Assessment Tool for Aquatic Invasive Species to the Rainy-Lake of the Woods Basin**

[Amanda Bell](#)

US Geological Survey Upper Midwest Water Science Center

### **Abstract**

The Rainy-Lake of the Woods Basin covers 70,000 square kilometers in mid-central North America and is contained within the provinces of Ontario and Manitoba in Canada and the State of Minnesota in the United States. This unique watershed contains beautiful natural wilderness areas, National Parks and thousands of lakes that bring outdoor enthusiasts from around the world for hunting, fishing, backpacking and relaxation. However, visitors can inadvertently bring along hitchhiking exotic invasive species that upset the functioning of natural systems by displacing native organisms, introducing diseases, and modifying predator/prey relationships. The International Joint Commission and the US Geological Survey are building an interactive Risk Assessment Tool for the Rainy-Lake of the Woods Basin that can be used to evaluate known exotic invasive species. This interactive database is built off the Great Lakes Aquatic Nonindigenous Species Information System (GLANSIS) risk assessment model and focuses on five categories for evaluation: arrival risk, vulnerability assessment, ecological impact, socioeconomic impact and beneficial impact. A report for each of the species summarizes the risk scores and can be used to target those that pose the greatest risk to the basin. The database currently contains over 1,500 species, and risk assessments are being completed for each species.

### **Brief Bio**

### **Location of Study**

Rainy-Lake of the Woods Watershed



## **Session 3 – Nutrients**

### **Spatio-temporal trends in hydroclimatic conditions for the Rainy River-Lake of the Woods watershed: implications for nutrient export**

[Wes Greenwood](#), [Catherine Eimers](#), and [Andrew Williams](#)

Trent University, School of the Environment, 1600 West Bank Dr., Peterborough, ON K9L 0G2

#### **Abstract**

Nutrient export from tributaries draining the Rainy River-Lake of the Woods (RR-LOW) basin is one of the largest contributors of phosphorus to Lake of the Woods (LOW). Recent work has shown that rivers and streams draining the Agassiz clay-mantled, agricultural portion of the LOW basin are very flashy and prone to sediment export relative to those on the Canadian Shield; as such, these basins are hot spots for nutrient export. Furthermore, the vast majority of runoff and sediment losses from these basins occurs during spring snowmelt and large storm events, which are hot moments for nutrient export. Little work has been done to understand how the magnitude and frequency of these episodic nutrient export events may be changing in response to long-term changes in climatic drivers. Here we present long-term trends in precipitation and temperature for the RR-LOW basin, explore relationships between climate drivers and streamflow, and discuss implications for nutrient export from tributaries to LOW. This information may be used to inform future monitoring design and evaluate potential sensitivity to climate change.

#### **Brief Bio**

Wes Greenwood is a surface water specialist based out of Edmonton, AB. He led the field monitoring campaign for the Trent U. watershed loading project in 2018-19, and is currently assisting with the program's data analysis and reporting.

#### **Location of Study**

Tributaries of the Rainy River and Lake of the Woods in the Canadian portion of the Rainy-Lake of the Woods basin.

## **Then and now: Updating the nutrient budget for the Canadian Rainy- Lake of the Woods basin**

[Andrew Williams and Catherine Eimers](#)

Trent University - School of the Environment, 1600 West Bank Dr., Peterborough, ON K9L 0G2,  
[andwilliams@trentu.ca](mailto:andwilliams@trentu.ca)

### **Abstract**

Phosphorus delivery remains a major issue within the Lake of the Woods (LOW) watershed, and quantifying basin-wide nutrient loading is important for guiding decision-making at both the resource management and policy level. In 2011, a whole lake nutrient budget – the first of its kind for the Canadian portion of the watershed – was developed to characterize total phosphorus (TP) loading from the province of Ontario into LOW, thereby providing a first look at nutrient loading from this under-studied region. Here, we build on this work and present an up-to-date watershed P budget using data collected over two full hydrologic years (2018-2020) and identify key problem areas (“hot spots”) along with time periods of particularly high nutrient export (“hot moments”) within the Canadian portion of the watershed that should be targeted for management action. To more accurately assess nutrient loadings, ten tributaries and five bulk deposition stations were monitored year-round, with a high frequency, event-targeted sampling regime. Stations were selected to straddle the Boreal shield and Agassiz regions and to encompass both disturbed and predominantly natural landcovers. Results of two years of intensive monitoring will be presented and compared with the 2011 nutrient budget to identify differences over time. These results may be used to inform a made-in-Canada approach for controlling nutrient loss, and identify options for managing watersheds in a targeted, cost effective manner.

### **Brief Bio**

Andy Williams is an MSc. candidate at Trent University in Peterborough ON, and the field lead for the Trent nutrient loading study. He has been monitoring tributaries within the Canadian LOW basin for the last 2 years, and contributing to the analysis of findings.

### **Location of Study**

Rainy River tributaries: Sturgeon River, Everett Creek, La Vallee River, Pickerel River, Atikokan River, Trout River, and Seine River. Lake of the Woods local (direct lake inflow) tributaries: Little Grassy River, McGinnis Creek, and Berry Creek.

## **Multi-year simulations, UnderICE dynamics and Climate Change Scenarios: outcomes from observations and the application of a coupled watershed-lake model of Lake of the Woods**

[Reza Valipour](#), [Phil Fong](#), [Rajesh Shrestha](#), [Jun Zhao](#) and [Craig McCrimmon](#)

Water Science and Technology, Environment and Climate Change Canada

### **Abstract**

The Lake of the Woods three-dimensional hydrodynamic-ecosystem process-based model at a 250m horizontal resolution was previously validated for summer and early fall periods. Here, we present the historical multi-year results and future climate projections in the lake with a particular focus on the Big Traverse Bay. The model is calibrated with lake-wide observed meteorological data of 2016-2018. After presenting initial validation during the winter regimes, we present model runs with future climate projections for 2079-2100 (CanESM2 and CRCM5-NEMO climate models under RCP 8.5 emissions) and with lake-wide CanSWAT watershed model riverine outputs, and outflows at Kenora and Norman dams. The lake model was initialized, calibrated and validated using the collected field observations from two year-round mooring deployments, lake-wide water quality measurements, Satellite Images, and different functional groups of total chlorophyll-a.

### **Brief Bio**

### **Location of Study**

Lake of the Woods (lakewide)

## Minnesota Lake of the Woods Phosphorus TMDL Update

Cary Hernandez

Minnesota Pollution Control Agency

### Abstract

The Minnesota Pollution Control Agency's draft Lake of the Woods Nutrient TMDL study will be on public notice from February 22, 2021 through March 24, 2021. The TMDL study is available on the [MPCA's website](#) or can be found by searching online for "Lake of the Woods TMDL".

Submit comments to or request information from Cary Hernandez at email [cary.hernandez@state.mn.us](mailto:cary.hernandez@state.mn.us) (telephone 218-846-8124, 800-657-3864), or regular mail at Cary Hernandez, MPCA, 714 Lake Ave. Ste. 220, Detroit Lakes MN, 56501 by 4:30 p.m. CST on March 24, 2021.

Two virtual public information meetings will be held via Webex on March 4 from 1-3 p.m. and 6-8 p.m. Information meeting attendees will need to register to obtain a link to the meeting(s). Follow the links below to register for the meetings:

- **1-3 p.m. (CT) meeting**  
If using a desktop or laptop computer - Click [here](#) to register/join the meeting
- **6-8 p.m. (CT) meeting**  
If using a desktop or laptop computer - Click [here](#) to register/join the meeting

You can also visit the Lake of the Woods [TMDL web page](#) for more information and other options for joining a meeting. The TMDL web page and also be found by searching online for "Lake of the Woods TMDL."

### Brief Bio

**Cary Hernandez** is a watershed project manager working out of the MPCA's Detroit Lakes Office. Cary works with watersheds throughout the Red River Valley and the Lake of the Woods/Rainy River Basin. Cary has been with the MPCA for the past 30 years.

### Location of Study

Lake of the Woods (lakewide)

## **Session 4 – Environment & Climate Change Canada**

### **ECCC Policy: Proposed Objectives and Scenarios to reduce harmful algae in Lake of the Woods**

[Daniel Rokitnickiwojcik](#)

Environment and Climate Change Canada, Harmful Pollutants Section, Regional Director General's Office, Ontario Region - Strategic Policy Branch

#### **Abstract**

Presentation and Town Hall Discussion: This presentation will provide an overview of Environment and Climate Change Canada's recent work to develop proposed Lake Ecosystem Objectives and phosphorus reduction scenarios to reduce harmful algal blooms in Lake of the Woods. This session is part of a broader process to engage Indigenous Peoples, the public and other partners on this work and on appropriate measures and tools to reduce phosphorus, such as the potential establishment of Canadian phosphorus reduction targets based on Environment and Climate Change Canada's and partners' science for Lake of the Woods.

#### **Brief Bio**

Daniel Rokitnickiwojcik is Program Coordinator , Harmful Pollutants Section, Regional Director General's Office, Ontario Region - Strategic Policy Branch, Environment and Climate Change Canada.

#### **Location of Study**

Canadian portion of the Lake of the Woods watershed

## Session 5 – Regulation

### Water regulation, wild rice, and the ongoing production of settler colonialism on Rainy Lake

[Johann Strube](#)

PhD Candidate, The Pennsylvania State University

#### Abstract

Since 1909, hydro dams on Rainy Lake have damaged wild rice (*Zizania palustris*, Manoomin) beds which sustained Anishinaabe Nations for centuries. Through water regulation, Settlers have transformed the waterscape to serve their needs (e.g. logging, hydro power, tourism) at the expense of Indigenous Nations who have found it increasingly difficult to maintain ancestral relationships with the non-human environment—a core tenet of Indigenous sovereignty.

This colonialist relationship continues today despite recent efforts to integrate Indigenous Nations in water regulation. On the one hand, wild rice remains essential to Anishinaabe identity and social reproduction—the ability of a community to sustain its social relations across generations. On the other hand, dams still impede the natural flow of water through the watershed and often harm the plant at critical times of its life cycle.

In consequence, maintaining water levels that damage wild rice reproduces settler colonial violence. Restoring wild rice and Indigenous sovereignty over the watershed ecology constitutes tangible decolonization. Building on interviews with members from Couchiching First Nation and Nigigoonsiminikaaning First Nation and members of the International Rainy-Lake of the Woods Watershed Board, as well as a review of historical evidence, this presentation examines how historic and contemporary water regulation at Rainy Lake are implicated in the ongoing production of Settler colonialism.

#### Brief Bio

Johann Strube is a rural sociologist with a focus on food, agriculture, and environmental justice.

He holds a master's degree in landscape planning and landscape architecture from the University of Natural Resources and Life Sciences, Vienna (Austria). Originally from Germany, Johann conducted 18 months of fieldwork in Manitoba, Northwestern Ontario, and Minnesota for his dissertation on the impacts of water level governance on wild rice and Indigenous Nations on Rainy Lake.

#### Location of Study

Rainy Lake

## **Data for decision-making: The Lake Winnipeg Community-Based Monitoring Network**

[Chelsea Lobson](#)

Lake Winnipeg Foundation

### **Abstract**

Lake Winnipeg, the world's tenth largest lake, has experienced an increase in potentially harmful algae blooms due to an increase in phosphorus loading to the lake. However, without robust monitoring data, we are unable to target resources to phosphorus hotspots, areas contributing greater amounts of phosphorus. The Lake Winnipeg Community-Based Monitoring Network (LWCBMN) mobilizes a citizen scientists and conservation partners to collect samples frequently during the spring melt and after heavy rainfall events when phosphorus is washed off the land and into our waterways. Piloted in 2016, LWCBMN samples at over 160 sites across southern Manitoba, breaking down larger watersheds into smaller sub-watersheds to more precisely identify phosphorus hotspots. Volunteers and partners follow scientifically vetted sampling protocols that compliment provincial and federal water-quality data. Therefore, LWCBMN data can be integrated into decision-making processes and can guide the development of evidence-based policies and practices to reduce the amount of phosphorus entering Lake Winnipeg and other lakes in the watershed. In 2019, LWCBMN expanded into the Winnipeg River system, partnering with Ontario Power Generation, Manitoba Hydro and citizen scientists in the region to collect frequent and responsive phosphorus data and identify phosphorus hotspots in the Winnipeg River System.

### **Brief Bio**

Chelsea Lobson is Lake Winnipeg Foundation's Programs Director responsible for the Lake Winnipeg Community-Based Monitoring Network. In this role, she works collaboratively with scientists, watershed partners and citizen volunteers. She has a Master's of Science from the University of Manitoba, Department of Environment and Geography

### **Location of Study**

Sampling sites along the Winnipeg River System

## **Lake of the Woods fisheries management council's walleye sportfishing exercise**

[Steve Bobrowicz](#)

Ontario Ministry of Natural Resources and Forestry

### **Abstract**

The Ontario waters of Lake of the Woods comprise the most economically valuable recreational fishery among inland lakes in Ontario, with approximately CAN\$112 million direct expenditures annually by anglers. The lake also supports a significant, though largely unquantified, First Nations commercial fishery. Monitoring by MNR's Biodiversity and Monitoring Section indicates that the walleye population in Ontario waters is experiencing high fishing mortality and low biomass of mature fish, suggesting that the current fishery is unsustainable. MNR has established a stakeholder Advisory Council to assist it in developing a management plan for the recreational walleye fishery. The plan is being developed using a structured decision making process and is following an aggressive schedule that calls for seven planning meetings between January and May 2021. Changes to the recreational fishing regulations are an expected outcome of this process; however, it is premature to anticipate what those changes might be at the current stage of planning.

### **Brief Bio**

Steve Bobrowicz is the Project manager and Regional Fisheries Specialist with Ontario Ministry of Natural Resources and Forestry.

### **Location of Study**

Sampling sites along the Winnipeg River System



# Session 6 – Monitoring

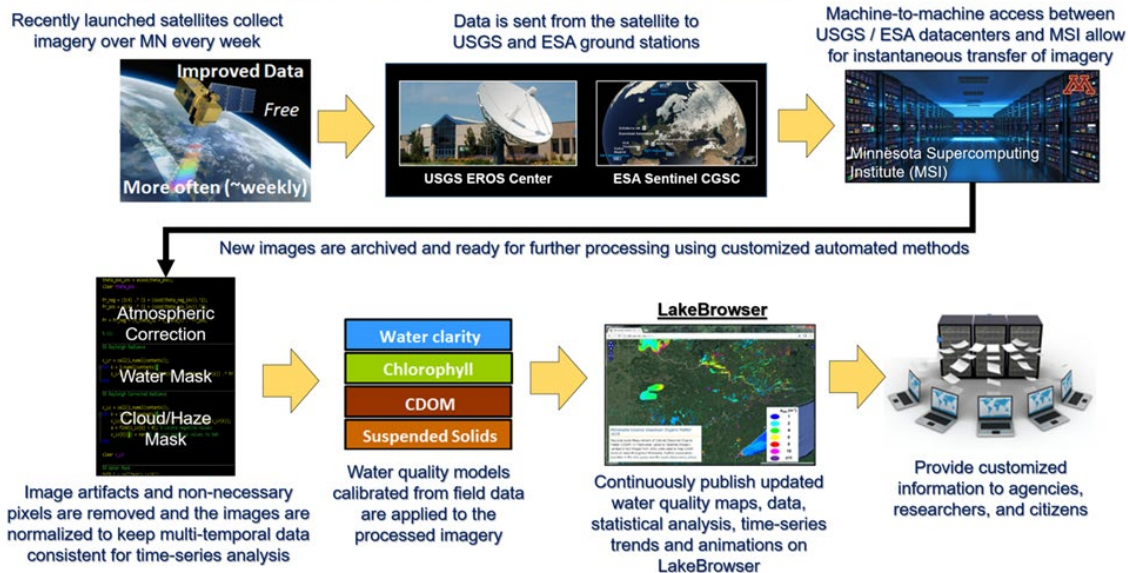
## Advanced Remote Sensing Methods for Automated Lake Water Quality Mapping

Leif G. Olmanson<sup>1</sup> and David H. Porter<sup>2</sup>

<sup>1</sup>Department of Forest Resources, University of Minnesota, [olman002@umn.edu](mailto:olman002@umn.edu)

<sup>2</sup>Minnesota Supercomputing Institute, University of Minnesota, [dhp@umn.edu](mailto:dhp@umn.edu)

### Opportunity: Near Real Time Water Quality Monitoring



### Abstract

Using satellite imagery, we have been assessing lake water quality in Minnesota, USA for over 20 years. These assessments at around five year intervals were used for spatial and temporal trends and causative factors. Recent advances in satellite technology (improved spectral, spatial, radiometric and temporal resolution) and atmospheric correction, along with cloud and supercomputing capabilities have enabled the use of satellite data for automated regional scale measurements of water resource characteristics. These new capabilities provide opportunities to improve lake and fisheries management by measuring more variables (chlorophyll, colored dissolved organic matter (CDOM) and total suspended matter, the main determinants of water clarity) more often.

To utilize these capabilities we have develop field-validated methods and implemented them in an automated water quality monitoring system on University supercomputers. This system enables near real-time monitoring of water quality variables at regional scales, which will enhance our understanding of spatial and temporal variability and responses of surface waters to environmental change. Examples from Minnesota and the Rainy -Lake of the Woods Watershed will be presented..

### Brief Bio

### Location of Study

## **Little Fork River Sediment – decoding sources with sediment fingerprinting to help guiding management**

[Anna Baker and Faith Fitzpatrick](#)

US Geological Survey

### **Abstract**

Fine sediment and the nutrients it carries are leading causes of habitat degradation in aquatic ecosystems. In order to manage the landscape to reduce erosion and prevent habitat degradation, detailed information describing the sources of sediment to aquatic systems is needed. Sediment fingerprinting, which uses chemical and physical tracers to apportion fluvial sediment to its sources in the landscape, has become a widely used, EPA-certified, tool for determination of sediment sources to aquatic ecosystems. This presentation will detail sediment fingerprinting methods and plans for their implementation in delineating sediment sources to the Little Fork River Basin.

The Little Fork River contributes disproportionately to sediment loading to the Rainy River-Lake of the Woods watershed, which are internationally managed waters impacted by excess sedimentation and eutrophication. Turbidity and fish community impairments identified by the Minnesota Pollution Control Agency (MPCA) have spurred the development of Total Maximum Daily Load Regulations for the Little Fork River. In order to meet the target of 15 mg/L total suspended solids, detailed information describing the sources of sediment to the Little Fork is needed.

A sediment sourcing study is being undertaken as a collaboration between the US Geological Survey and MPCA and will have its first field season beginning in spring of 2021. This study will use geochemical sediment fingerprinting and sediment budget techniques to track sediment from its sources in uplands and along the stream corridor to sinks within the river corridor and to sediment exported to downstream Rainy River and Lake of the Woods. Sources investigated will include upland forests (mature and recently harvested), wetlands, roadways, and cropland, as well as stream corridor sources such as streambanks, eroding valley walls, and gullies. Sediment sources also will be constrained using a complimentary line of evidence – a sediment budget based on field and geographic information system analysis. The results of this study may inform management actions for the reduction of sediment from its primary sources in the Little Fork River basin.

### **Brief Bio**

#### **Location of Study**

Little Fork River Basin

## **Collaborative Fisheries Stock Monitoring Program (CSMP) in Manitoba**

Brian G. Kotak<sup>1</sup>, William Galbraith<sup>2</sup> and Brian R. Parker<sup>3</sup>

<sup>1</sup>CSMP Coordinator, Miette Environmental Consulting Inc. P.O. Box 268, Pine Falls, MB R0E1M0, PH 204-345-4835, [miette.env@icloud.com](mailto:miette.env@icloud.com);

<sup>2</sup>Indigenous Services Canada, 200-365 Hargrave St, Winnipeg, MB R3B3A3, PH 204-590-9573, [william.galbraith@canada.ca](mailto:william.galbraith@canada.ca);

<sup>3</sup>Wildlife and Fisheries Branch, Manitoba Agriculture and Resource Development, Box 20, 200 Saulteaux Crescent, Winnipeg, MB R3J3W3, PH 204-945-7814, [brian.parker@gov.mb.ca](mailto:brian.parker@gov.mb.ca)

### **Abstract**

Stock monitoring is an important part of the management of commercial fisheries, providing the data required to understand the current state and dynamics of a fishery, determine sustainable harvest levels of target species, as well as to forecast commercial marketing and sales opportunities and inform business planning and investment decisions. It can also provide a foundation for the eco-certification of a fishery. Fisheries managers, however, often lack sufficient resources (staffing, field equipment, etc.) to undertake stock assessments on waterbodies on a consistent basis over time. On the other hand, Indigenous fishers, who have first-hand knowledge of their fishery, and often times decades or more of traditional knowledge, are ideally positioned to provide input into fishery management. Additionally, they can contribute significantly by collecting much-needed fisheries information through systematic data collection programs such as index netting. This presentation describes the Collaborative Stock Monitoring Program (CSMP) in Manitoba; a collaboration between the Government of Canada (Strategic Partnerships Initiative-funded Indigenous Inland Commercial Fisheries Initiative (IICFI), and Indigenous Services Canada), Manitoba Agriculture and Resource Development, University College of the North and eight First Nation communities. A main goal of the CSMP is to support capacity building of selected indigenous commercial fishers to acquire the necessary skills and equipment to undertake annual stock monitoring of their local fishery.

### **Brief Bio**

Brian Kotak is the CSMP Coordinator, overseeing the recruitment and training of Indigenous commercial fishers, as well as coordinating the collection of field data. He works collaboratively with provincial fisheries biologists in Manitoba through the CSMP. Brian has several decades of research, monitoring and management experience in aquatic and terrestrial ecosystems, climate change and participatory natural resource management.

William Galbraith is the Senior Resources Management Officer for Indigenous Services Canada (Manitoba) and Lead of the Federal-funded Indigenous Inland Commercial Fisheries Initiative in both Saskatchewan and Manitoba. William has over 20-years of experience working in Manitoba's freshwater commercial fisheries. Before returning to Indigenous Services Canada in 2018 he served for a decade as the Province of Manitoba's Commercial Fishing Program Manager and Manager of the Wildlife and Fisheries Branch's Sustainable Fisheries Unit.

Brian R. Parker is Head Scientist with Manitoba Agriculture and Development's Wildlife & Fisheries Branch. An ecosystem scientist, Brian has over three decades of experience in scientific research, monitoring and ecosystem management. His published works include papers on fish ecology, climate change, eutrophication, cascading trophic interactions, and aquatic ecosystem responses to management perturbations.

### **Location of Study**

Lakes and First Nation communities in central and northern Manitoba

## **Cyanotoxins in fish at Voyageurs National Park**

[Seth McWhorter](#)

PhD candidate, University of Georgia

### **Abstract**

Eutrophication leads to the occurrence of harmful cyanobacterial algal blooms at Lake Kabetogama in Voyageurs National Park that release cyanotoxins. We measured toxins accumulated in fish from Lake Kabetogama. We extracted tissues from whole young of year fish as well as the liver and muscle from adult fish. Tissue concentrations were measured using enzyme-linked immunosorbent assays and liquid chromatography tandem mass spectrometry. Most enzyme-linked immunosorbent assay toxin results were above the upper limit of detection of 5.0ppb, and all but six liquid chromatography tandem mass spectrometry microcystin-LR samples were below the lower limits of detection, which varied per sample. Five samples were Smallmouth Bass, five samples were at sites near deep areas that internally load phosphorus, and six samples were in livers. Levels of microcystin and anatoxin-a in fish were low enough as to not be of risk to humans, but wildlife could be at risk.

### **Brief Bio**

#### **Location of Study**

Kabetogama Lake in Voyageurs National Park