



Annual Report 2019 to 2020

Contents

Our changing lakes	3
Director's Message	4
Government and NGO partners	6
Academic institutions	7
Scientific objectives	8
Research highlights	9
Integration across research themes	10
LakePulse Survey completed in 2019	12
Education and training	14
LakePulse database and portal	16
Watershed and landscape analysis	18
Communications and outreach	20
Management and governance	24
Financial Summary 2019 to 2020	26
Appendices	



Our changing lakes

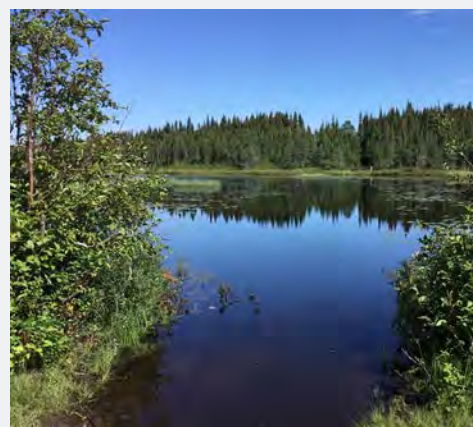
In today's context of rapid environmental changes, lakes can be impacted by multiple stressors such as pollution, land-use changes, and climate change.

The NSERC Canadian Lake Pulse Network is assessing the state of lakes across Canada while developing new approaches for lake monitoring.

To assess lake health, we carry out multidisciplinary activities:

- The LakePulse Survey sampled over 660 lakes across Canada for over 100 variables at each lake.
- Our researchers are completing Canada's first national assessment of lake health.
- The LakePulse Portal will deliver interactive maps on the health of Canadian lakes.

To understand the different problems impacting lake health across Canada, we describe how lakes have changed over time as well as predict how they will respond to key stressors in the future. This requires an understanding of the cause and effect relationships between environmental components and human activities.



By sharing information on our LakePulse Portal, our aim will be to help decision makers, municipalities, stakeholders and others to better manage lake resources. We are collaborating at local, regional, and national levels and conducting regional comparisons across Canada.

LakePulse is an academic-government partnership hosted at the Université de Sherbrooke in Quebec. We receive funding for five years (2016-2021) through the Strategic Partnership Network program, an initiative of the Natural Sciences and Engineering Research Council of Canada. LakePulse brings together experts from 13 universities across Canada with 12 governmental and NGO partners and supporting organizations.

By increasing the scientific capacity on lake health, LakePulse helps us to better respond to challenges and knowledge gaps across Canada.



Director's message

In its 4th year, the NSERC Canadian Lake Pulse Network has made excellent progress in its research program and completed the LakePulse Survey across Canada. Our growing database is a major achievement allowing the Network's projects to collaborate on our national assessment of lake health and the LakePulse Portal.

Team spirit and shared goals

Many participants contributed to making LakePulse's 4th year a success, especially our students, postdocs and research assistants whose team spirit enlivens our Network! Their perseverance and camaraderie benefited our field campaign, and their readiness to collaborate helps us meet our research goals. Our Network's success is rooted in hard work and a collaborative culture. This report highlights the impressive efforts that allowed LakePulse to meet most of its goals from April 2019 to May 2020.

Our ambitious lake survey... we did it!

The completion of the 3-year LakePulse Survey reflects the dedication of our participants and many people at the Université de Sherbrooke who support LakePulse. We sampled more than 660 lakes across southern Canada - from Newfoundland to British Columbia to the Yukon - for over 100 variables at each lake. LakePulse students, postdocs, research professionals, and trainees spent months working collaboratively across Canada to collect samples for all the Network projects.

The final season of the LakePulse Survey involved big challenges: 5 field teams sampled 219 lakes in many remote areas; an immense amount of equipment; fine-tuning protocols for standardized sampling; training over 30 participants; and fast shipping of valuable field samples. Our trainees share memories of this achievement, and now they collectively benefit from an unprecedented dataset for their research projects!

Excelling in fieldwork, in the lab, and in communication

In October 2019, we held our 4th Annual Meeting. We had over 50 participants including researchers, trainees and partners. The 3-day meeting highlighted



research progress and collaboration as well as key Network deliverables, such as the LakePulse database and portal hosted at the Université de Sherbrooke. The trainees

deserved the spotlight as they presented impressive research progress. On the final day, working groups collaborated on projects and coordinated work on the database. Projects were encouraged to continue planning deliverables for our Portal, and the trainees advanced their creative ideas with enthusiasm.

A bold vision for collaborative science

While already showing exciting results, our researchers and trainees are also analyzing data from the 2019 field season to complete our 3-year, cross-country dataset.

In LakePulse, we emphasize the advantages of multidisciplinary research and sharing knowledge, and our collaborations have been very active. Our Scientific Committee continues to track the projects and provide advice on Network research.

We have achieved our goals for our first 4 years: the successful LakePulse Survey; creating a unique database to foster collaboration and integration activities; presenting research results; and preparing the Network's web Portal to present results to the public and policymakers. We are confident that LakePulse achievements are progressing as planned and are rapidly increasing.

I thank everyone who is helping LakePulse to excel in research, training and communication.

Yannick Huot
Director, NSERC Canadian Lake Pulse Network





Our research program has three main purposes:

1. Improving our understanding of lake characteristics and functioning on large scales and their response to human impacts.

Each lake is different, but we can identify general responses to stressors that vary regionally and with lake characteristics. LakePulse aims to understand this variability and to predict lake responses.

2. Developing knowledge, monitoring tools, and technologies that can support evidence-based policy making and sustainable lake management, particularly in the context of human impacts on lakes such as pollutants, climate change, and land-use changes.

LakePulse is examining new models and methods that could be used to improve our ability to diagnose and monitor lakes.

3. Sharing lake data and information as broadly as possible.

LakePulse is developing an integrated web Portal for lake health data to address Canada's environmental challenges and to support evidence-based decision making at local, regional and national levels. Our web Portal aims to ensure that lake and water quality observations as well as scientific results from LakePulse projects are presented in a user-friendly, accurate, engaging and accessible manner.

Government and NGO partners

Our partners include federal, provincial and territorial government agencies and departments who contribute their regional expertise and monitoring datasets to our research program to achieve a pan-Canadian lake health assessment.



Our partners across Canada support our research program and lake sampling.

Our partners are listed in Appendix A.

Our partner collaborators are listed in Appendix B.

Our partners are supporting many Network activities, such as co-supervising students, participating in the lake sampling campaigns, and providing additional resources to sample more lakes or variables.

Local knowledge has been essential for planning lake access and identifying lake characteristics. Many partners provided key regional

information for the LakePulse Survey. Our partners also provided advice on selecting lakes. Some partners contributed their personnel for the LakePulse Survey.

Overall, our partners are on track for providing their expected contributions, and some will exceed them.

Appendix C lists our partners' contributions.

Academic institutions

LakePulse brings together 17 researchers from 13 universities in an exciting partnership with environmental managers and governments from across Canada.



Experts from various fields are working together to assess lake health

Appendix D lists the 17 investigators in the Network and their affiliations.

LakePulse is a scientific initiative on environmental issues affecting lakes. A collaborative approach is needed to tackle the complexity of assessing and predicting lake health.

LakePulse brings together expertise on diverse topics to assess and forecast the health status of Canadian lakes.

The Network's scientific breadth is one of its key strengths. Our researchers carry out research

in limnology, remote sensing, ecology and other related sciences.

The wide range of questions that LakePulse tackles would not be possible without a diverse and complementary group. See Appendix E for a list of the Network projects.

Our experts lead multiple research projects and supervise graduate students and postdocs (Appendix F lists the trainees).

Scientific objectives

1. To assess the health status of Canadian lakes, identify their key stressors (including emerging ones), and understand how these stressors have altered and are altering lake biogeochemical functioning.
2. To forecast probable future changes in the health status of Canadian lakes using climate and land-use scenarios.
3. To develop new observational approaches, such as genomics and remote sensing, to provide managers with new stewardship tools to understand lakes and to provide policymakers with new knowledge to inform decision-making.

Our research program is comprised of highly interconnected projects working together and sharing samples and data. Activities that require Network-wide participation have strengthened our communications and collaborations.

The LakePulse participants who are the most actively involved in Network activities (e.g., fieldwork, shared database, annual meetings, project reporting, trainee cosupervision) also tend to benefit the most from opportunities such as collaborations, integration/upscaling studies, and multidisciplinary co-supervision of trainees. Many researchers and trainees are exceeding expectations because of their enthusiastic involvement in the LakePulse community.

The milestones and deliverables of individual Network projects are tracked using an online reporting system. All projects are reviewed at 6-month intervals by the Scientific Committee (see Appendix G for a list of the members).

Issues that are identified are brought to the attention of the Board of Directors (see Appendix H for a list of the members).

The overall coordination of the Network is managed at the Université de Sherbrooke by the Administrative Centre and Specialists team.

See Appendix I for a list of achievements by our researchers, postdocs and students.

See Appendix J for an overview of our Network milestones from year 1 through to year 5

Research highlights

LakePulse researchers and trainees are benefiting from the Network's multidisciplinary research community and database, which allows them to tackle ambitious issues affecting lakes, such as the extent of antibiotic resistance bacteria or emerging contaminants across Canada. Tens of thousands of samples from our lake sampling survey were sent to the Network's labs. Then, the processed data were sent back to our shared, centralized database.

Before producing publications, many students and researchers are integrating data from the three-year field campaign (2017, 2018 and 2019) to provide a pan-Canadian understanding of the different processes they are studying. However, work on a general framework to present limnological data has started. Postdoc Nicolas Fortin St-Gelais and collaborators submitted a paper examining trophic status, a very common metric of water quality and lake alteration, and its limits to reflect alterations of aquatic ecosystem services.

Postdoc Susanne Kraemer and collaborators saw results so compelling in the data from the first field campaign that they pursued publication rapidly and submitted a paper on the impact of altering land use on lake bacterial communities. In their conclusion, they write: "... we used an extensive dataset of lake bacterial communities to model the impact of anthropogenic activity across vast areas of Eastern Canada. Human impact, and specifically... urban and agricultural development within watersheds, appeared to have a pronounced effect on lake communities and showed that when high-intensity human activities alter more than about 50% of a watershed, fragmentation of bacterial communities is observed which may ultimately lead to the decline of the ecosystem services provided by them."

In addition, LakePulse trainees participated in five other papers that range from questions about water conservation in Canada to the toxicity of the herbicide atrazine to phytoplankton. Several LakePulse trainees and researchers participated in a publication entitled, "Horizon scan of conservation issues for inland waters in Canada" where it was mentioned that, "The landscape of nation-wide ecological data collection and curation is changing through the collaborative efforts among academic research networks, government scientists, and nongovernmental organization (NGO) partners. Large research networks focused on inland waters are paving the way to a new scale of ecological inference... Current examples that provide a model for scaling up include the **Natural Sciences and Engineering Research Council of Canada (NSERC) Canadian Lake Pulse Network in Canada (Huot et al. 2019)** and the National Lakes Assessment Program in the USA. Programs such as these will be instrumental in ensuring that Canada meets its commitments under the 2030 Agenda and the implementation of the associated UN Sustainable Development Goals."

Integration across research themes

LakePulse goes beyond individual projects and supports Network-wide integration.

Integration postdocs

Postdocs focus on integration projects in years 4 and 5 (and the no-cost year). Many projects are also planning integration activities (e.g., spatial analyses, upscaling of indicators, links to landscape characteristics).



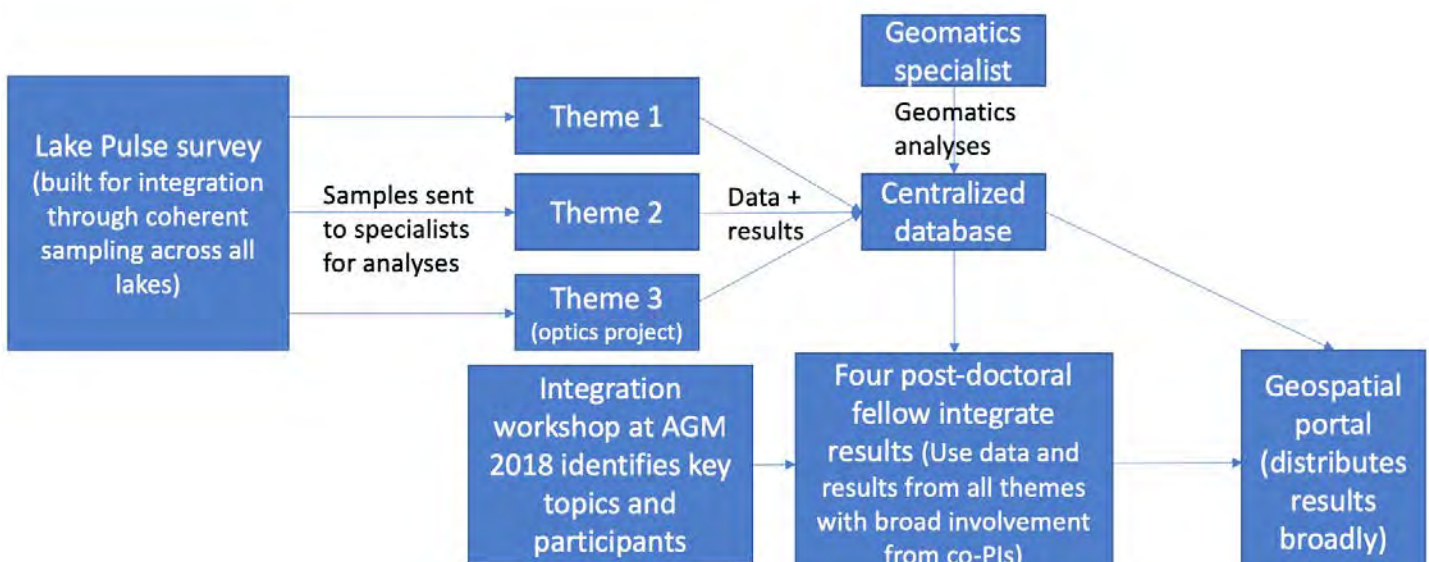
Working group

A working group on integration will be composed of co-PIs and the integration postdocs. LakePulse encourages the involvement of LakePulse participants in the integration studies to develop and strengthen collaborations.



Webinar series

Trainees have participated in several webinar series, and this will increase to a monthly webinar series for LakePulse participants to highlight results emerging from our projects.



LakePulse was designed with key aspects to encourage the integration of research results:

1) Collaborative Network-wide activities benefit all the research projects.

Smaller, individual projects would not be able to carry out these large-scale activities: LakePulse Survey, centralized database and portal, extensive geospatial analyses, climate change scenarios.

2) Synthesis studies and upscaling

LakePulse has two research themes specifically focused on integrating the outcomes of the individual projects in syntheses that crosscut through the Network.

- **Theme 3** focuses on spatial modelling techniques and remote sensing.
- **Theme 4** uses the results from the other themes to integrate knowledge; examine the vulnerability of ecosystem services to change; and extend results into the future

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An introductory paper was published to provide details of the Network's large-scale sampling strategy and an overview of the broad scientific program:

Huot et al. 2019 "The NSERC Canadian Lake Pulse Network: A national assessment of lake health providing science for water management in a changing climate", Science of the Total Environment.

Ambitious, integrative and collaborative

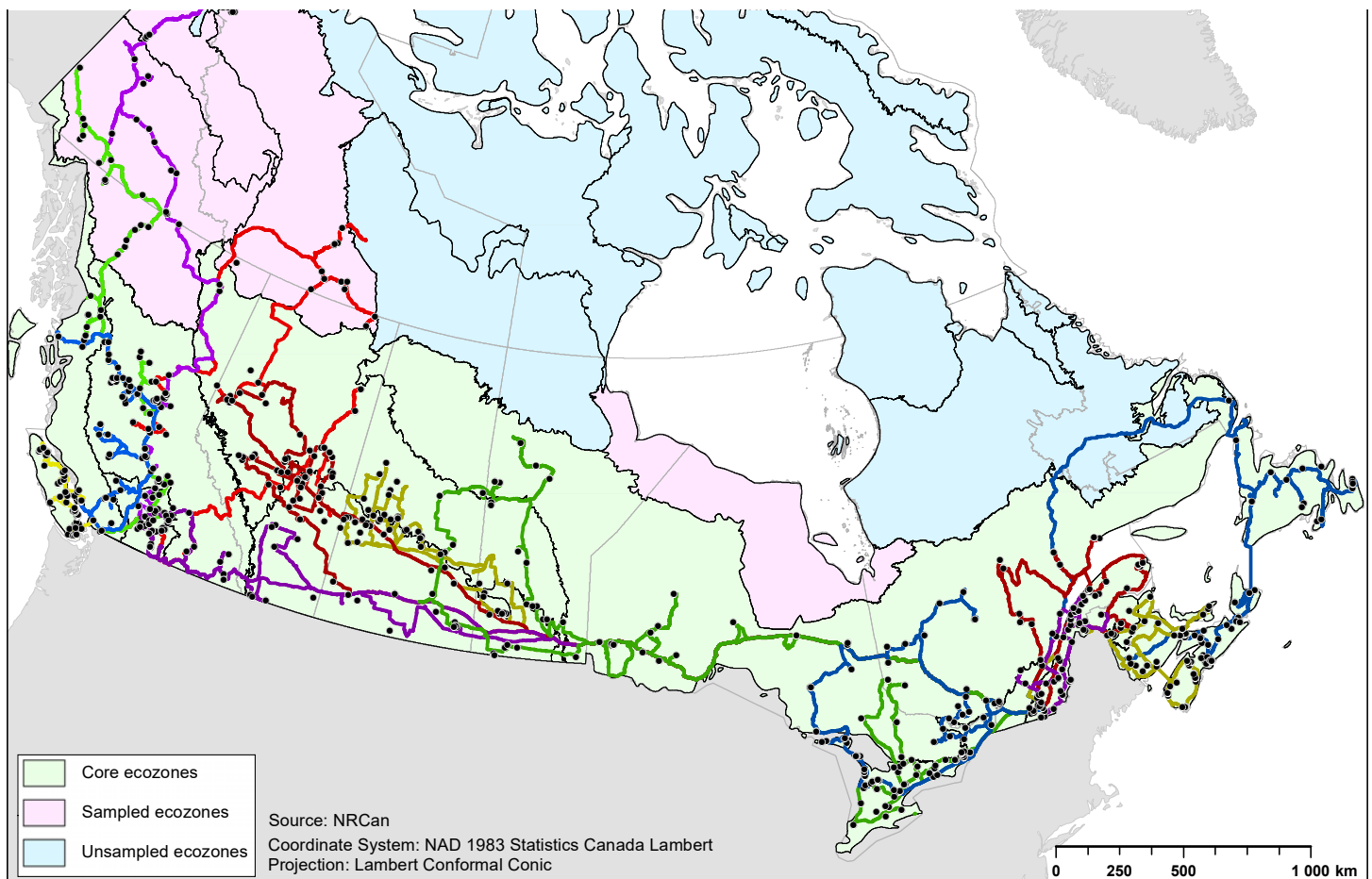
- The research projects send their quality-checked data to the centralized database in a coordinated manner to avoid delays in the synthesis studies.
- Several projects are collaborating with Amina Pollard (our international advisor from the EPA NLA) to integrate datasets from LakePulse and the NLA.
- A meeting with the NLA and LakePulse is planned in Year 5.



LakePulse Survey completed in 2019

For the past three summers, our field teams have traveled from Newfoundland to British Columbia to the Yukon with logistical support from our partners, municipalities, Indigenous communities, and local citizens. LakePulse sampled lakes for a large suite of variables to address knowledge gaps identified by freshwater experts, NGOs, and our federal, provincial, and territorial partners, ranging from baseline analyses for water quality monitoring to cyanobacterial toxins to emerging contaminants (e.g., pharmaceuticals, personal care products).

For our cross-country assessment of lake health, we sampled over 660 lakes: large and small, pristine and polluted. We trained many more students than originally planned as field team participants. The 2019 field season was by far the most challenging due to logistical aspects and the remoteness of the sites. Thanks to the valuable experience gained over the first two years by the LakePulse Network, the 2019 field season was a resounding success that highlighted the problem-solving skills, determination and autonomy of the field teams. Congratulations to the Green, Purple, Blue, Red and Yellow Teams!



The LakePulse trainees travelled across Canada with mobile labs to sample lakes. Intense collaboration was required to carry out this multidisciplinary survey of lakes to collect data for all the Network projects.

Trainees shipped tens of thousands of field samples to the Université de Sherbrooke for distribution to various analytical labs. Many logistical and technical challenges were tackled by the field teams.

Before each field season, a training workshop was held at the Université de Sherbrooke for the sampling teams to practice the standardized protocols.

The **LakePulse Field Manual** is a comprehensive set of protocols for over 100 variables. It is an important Network deliverable, which will be disseminated via online, open access servers.

LakePulse was welcomed by 27 Indigenous communities to sample 65 lakes on many reserves and traditional territories. Some communities helped us with logistics and access to the lakes, others provided lodging for our teams on their lands, and some sent participants to sample with the field teams for a day or several days.

For the selection of lakes, we worked with Indigenous communities in a similar way to our approach with government partners. In addition, if a lake was randomly selected on their lands, they were offered the possibility of choosing an alternate lake for which information was more important to them. In addition to providing our results on the Water Portal, we will provide data that are relevant for the stewardship of their lakes.

The extensive LakePulse Survey provides an unprecedented opportunity to assess and compare lake health in 13 ecozones across Canada.

By addressing large spatial scales, the impact of stressors on lake functioning and biogeochemistry is examined in various regions.



Education and training

The LakePulse trainees are essential and full participants in Network activities. Communication and collaboration are integral to our functioning throughout the year, and the LakePulse trainees are provided with abundant networking activities.

Field training workshop - June 17, 18 and 19, 2019 - Over 30 participants participated in a 3-day workshop before departing for the final field season. Before the workshop, each field team coordinated many planning and preparation activities for the lakes and travel routes that they were assigned. Many trainees have developed exceptional skills for organizing fieldwork and leadership.

Trainee-led workshop - October 22, 2019 - A total of 28 trainees participated in a full-day workshop organized and led by trainees. They also met the Scientific Committee and Board of Directors during the morning and afternoon breaks as well as a group supper. A special session focused on data management, timelines and quality control (QC). An online platform based on ClickUp was set up to coordinate data dependencies within the Network, data processing priorities, how data are shared, and easy access to data. Another session focused on how to present lake science to the public and policymakers. The trainees proposed how their project results could be presented on the LakePulse Portal. LakePulse trainees discuss and plan their Portal deliverables while also advancing their research; they are working with our Portal team to build the collective Portal. The trainee representatives led an outreach activity to provide feedback to a lakeside community facing unprecedented changes in water quality. The Field Coordinator led a discussion on the field season.

Fourth Annual Network Meeting - October 23, 24 and 25, 2019 - The trainees delivered 25 presentations and 10 posters. On the last day of the meeting, working groups chaired by trainees met to focus on collaborative research.

Data derby organized by trainees and webinars - Trainees received external funding from GRIL (Interuniversity research group in limnology) to carry out data derbies. This activity has been delayed due to COVID-19. LakePulse trainees have organized and participated in several webinar series.

Presentations and conferences - Trainees have been very active presenting their work to many different groups - from lake associations to global scientific audiences - and have given talks from the Northwest Territories to Puerto Rico. See Appendix I.

Scholarships - We are proud that our trainees are being awarded various scholarships, including faculty awards and prestigious national honours. See Appendix I.

Participation in project reports - May 2020 - This year, many trainees participated in updating the project reports in Google Docs, which were reviewed by the Scientific Committee. The involvement of the trainees in completing the project reports teaches them how the projects are evaluated and tracked. It also encourages communication and accountability for the Network-wide activities.




LakePulse database and portal: an integrated system for sharing lake and watershed data

Database - Our database forms the backbone of the online LakePulse Portal for sharing and mapping information on lake and watershed health for the public, policymakers, and our partners. The database has advanced rapidly and it is a key milestone in the development of our collective Portal. The LakePulse database is populated with data from our researchers' labs and historical monitoring datasets from our partners. The database supports national and continental-scale analyses of lake health indicators. The integration of various datasets has expanded opportunities for analysis and comparison.

2017 NEW TASK

FINAL QC	29 TASKS	ASSIGNEE	DUE DATE	PRIORITY
■ BACI&BACL - Data not usable	project specific (p-qc-nd)	JW		
■ ANIO	basic (b-qc-nd)	Y		
■ CATI	basic (b-qc-nd)	Y		
■ Basic info - id, LatLong, ecozone, province, size, human impact index, etc	basic (b-qc-nd)	MF		
■ Kestrel - air temp, relative humidity, atm. pressure, wind speed	basic (b-qc-nd)	MF		
■ LULC - Land use/land cover (7 main classes)	basic (b-qc-nd)	MF		
■ DOC - Dissolved Organic Carbon data	basic (b-qc-nd)	JK		
■ Secchi	basic (b-qc-nd)	GP		
■ CH4 A&B - bubbling Shallow and Deep Site	advanced (a-qc-nd) project specific (p-qc-nd)	JK		
■ SWAB - Influenza/coliform swab	advanced (a-qc-nd) project specific (p-qc-nd)	JW		
■ RBR - Pressure	basic (b-qc-nd)	MF		
■ RBR - Sea Pressure	basic (b-qc-nd)	MF		
■ RBR - Conductivity	basic (b-qc-nd)	MF		
■ RBR - Salinity	basic (b-qc-nd)	MF		
■ RBR - Specific conductance	basic (b-qc-nd)	MF		
■ RBR - Sound velocity	basic (b-qc-nd)	MF		
■ RBR - pH	basic (b-qc-nd)	MF		



By rapidly populating our database with quality-checked data, Network participants are advancing with their research results, publications, and deliverables for the LakePulse Portal.

The LakePulse database was developed at our host institution, the Université de Sherbrooke. It is a major achievement that has required the careful coordination of data management in the Network.

Portal - The LakePulse Portal is a major deliverable that will present the collective work of the Network. It is coordinated by the Administrative Centre and Specialists team; it is hosted at the Université de Sherbrooke. At the Network's annual meetings in 2018 and 2019, special sessions were held for researchers and trainees to discuss how their results could be presented in an online, interactive format for the public and policymakers.

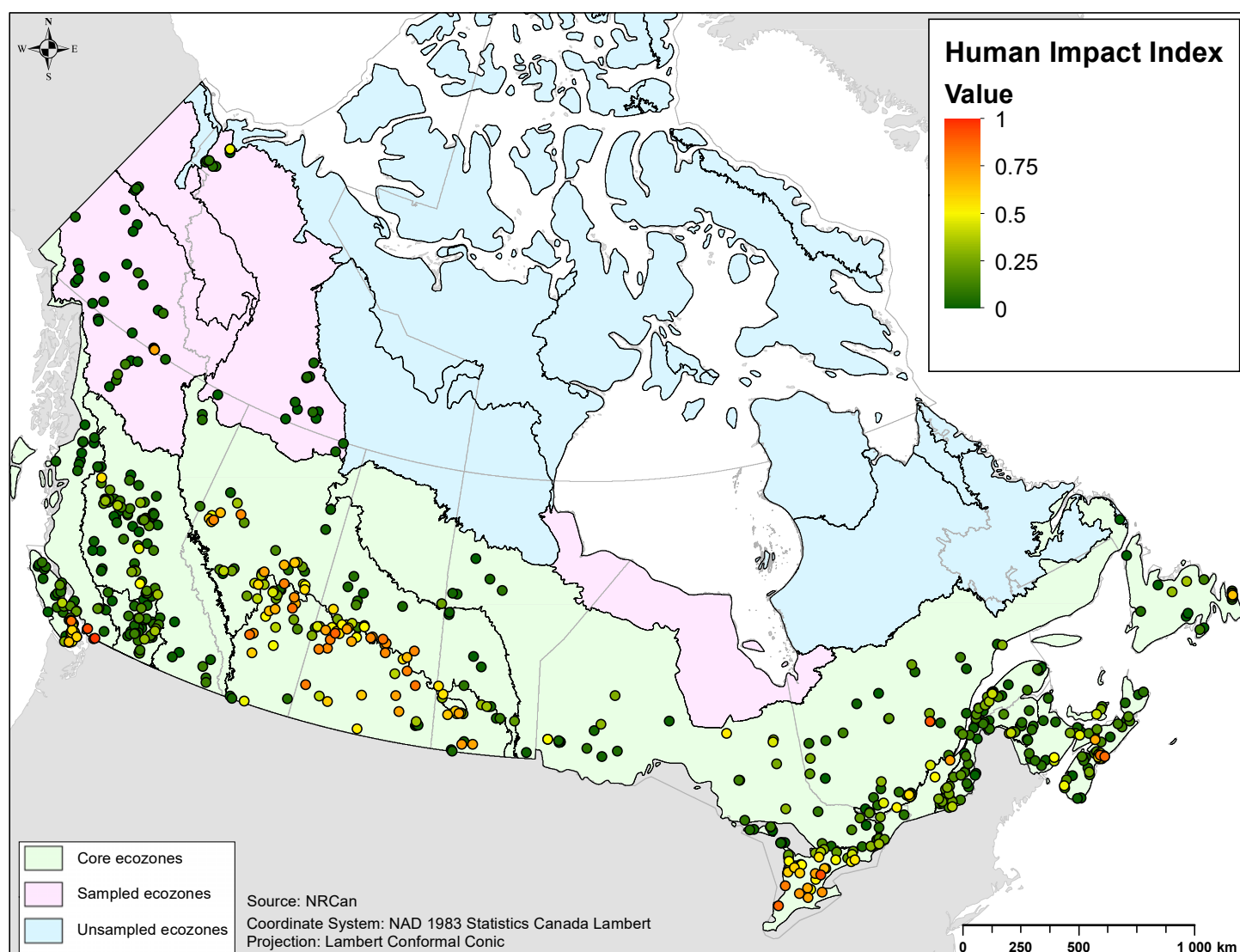
Almost all of the Network projects have been very cooperative and enthusiastic in planning their contributions for the Portal. A couple of projects have been slower to describe their potential deliverables for the Portal or to provide a timeline, and this has been addressed by the Scientific Committee to encourage participation.

The completion of key aspects of the database has allowed us to work on a "beta" version of the Portal to support our outreach efforts and to foster feedback within and outside the Network.

By sharing results from the research projects, the Portal aims to contribute to freshwater protection and aquatic ecosystem health. The Portal will present useful information to inform decision-making and facilitate the sharing and use of water information in Canada. By improving the availability of lake health information, the LakePulse Portal aims to enhance Canada's capacity to address environmental challenges affecting lakes, adapt to climate change, and enable sustainable lake management.

Watershed and landscape analysis

We have delineated 80,231 lake watersheds across Southern Canada, which we have characterized by land use and a human impact index. This work is carried out at our host institution, the Université de Sherbrooke



Human impact for the sampled lakes - The index ranges from 0 (for the least impacted watersheds) to 1 (for the most impacted watersheds). In the map above, each point represents a lake sampled by LakePulse that is coloured according to the human impact in its watershed.

LakePulse's human impact index is a measure that reflects the potential impact on lake health of agriculture, urbanization, forestry and industrial activities in lake watersheds. This index was designed to support the lake selection process for the LakePulse Survey.

LakePulse Watershed Analysis

This dataset is a key tool to examine links between water quality indicators and watershed characteristics and is used extensively by LakePulse researchers.

Regional comparisons

How does the health of watersheds and lakes vary across Canada ?



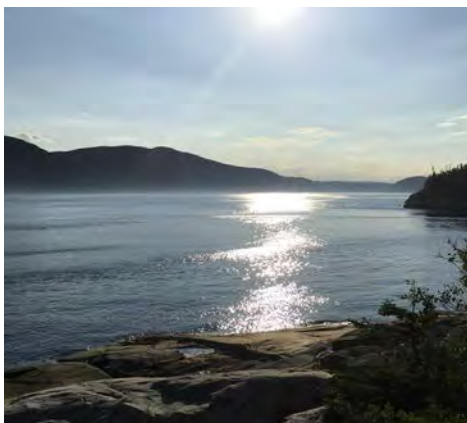
Links to lake health

How are observations of lakes and water quality linked to watershed characteristics?



A national perspective

What are the overall trends and how will they be affected by climate change, land-use alterations, and pollution?



Lake health forecasts

How will lake health be impacted by changes in watersheds?



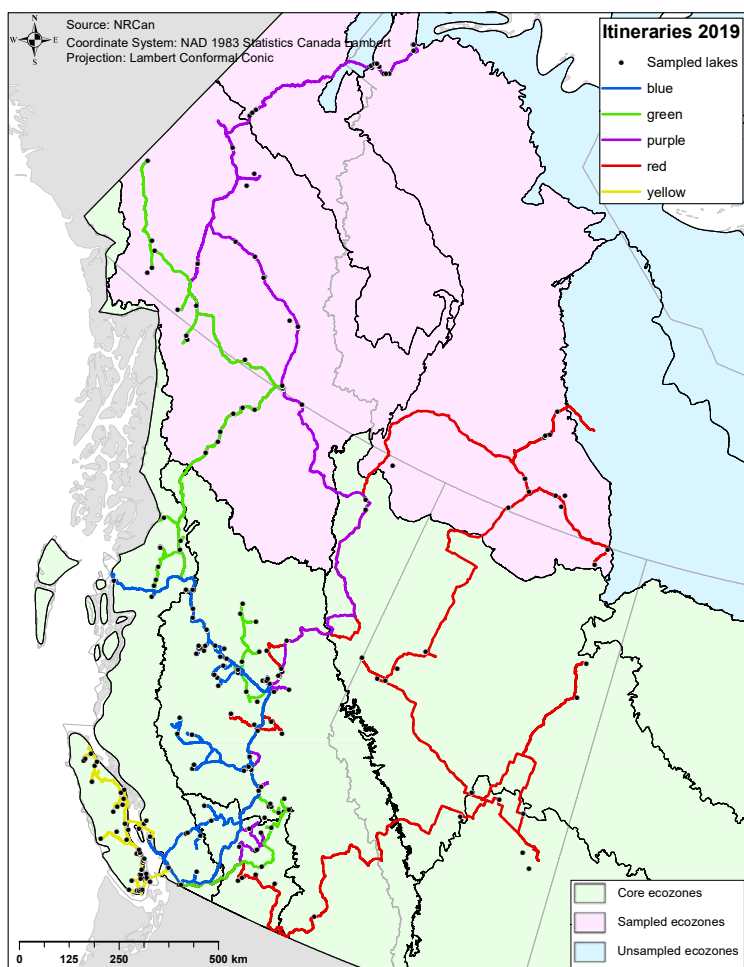
Communications and outreach

Over the past year, our communications strategy focused on three major aspects. First, we continued to raise awareness of LakePulse, especially for lakeside communities, our partners across Canada, NGOs, and the public. Our bilingual website (www.LakePulse.ca), social media (Twitter and Facebook), YouTube, and our blog were central to this effort, especially when working with partners and lakeside communities to coordinate our lake sampling campaign. These platforms helped us to explain how the LakePulse Survey is supporting many research projects on lake health, and how the results will be shared on the LakePulse Portal for the public, policymakers and our partners.

Supporting the LakePulse Survey

The figure at left shows the itineraries of the field teams in 2019. During the field season, interactive maps and photos were updated online to show where the field teams were sampling lakes.

Communicating and sharing our activities and outputs with diverse groups is an integral aspect of LakePulse. The Administrative Centre has also advanced broader communication with the public, our partners, lake associations, NGOs, and Indigenous groups. Many of our planned deliverables, such as the interactive maps on our Portal, are intended for a broad range of end-users. Many lake associations, lakeside communities, and NGOs, have contacted LakePulse to request information about lake health from the LakePulse Survey.



Coordinating development of the LakePulse Portal, Université de Sherbrooke

Secondly, we focused on developing the Portal, which is an interactive, geospatial platform for disseminating information on lakes. The Portal is a key deliverable that will present the collective results from LakePulse researchers to a wide audience.

Our Administrative Centre and Specialists team have been in communication with LakePulse researchers and trainees to coordinate the development of the database, geomatics information, and project deliverables for the LakePulse Portal.

At the Université de Sherbrooke, the LakePulse geospatial database was designed, developed and populated, which is the backbone of the Portal. In addition, the Portal interface has been designed to present geospatial information on lakes and watersheds. We are now working on a beta version of the Portal.

- The Administrative Centre and Specialists team work with each individual project to coordinate their contributions to the Portal. Each project has identified trainees who are the main liaisons for developing the deliverables for the Portal.
- At the trainee workshops in 2018 and 2019, the trainees participated in activities to develop the deliverables from their projects. The trainees presented their ideas for the Portal to the Network's database and geomatics specialists. The trainees have been enthusiastic and creative in their proposals for sharing their findings.
- In the project reports for 2018 and 2019, each project was asked to describe potential deliverables that would be relevant to the public and policymakers.
- At each Annual Meeting, an update on the Portal is presented to encourage participation. In 2018, a special session was held on development of the Portal.
- The LakePulse website is gradually being transitioned to the Portal interface as the deliverables from each of the projects are developed.



[Home](#) [Research](#) [Data](#) [Videos](#) [Blog](#) [Facebook](#) [Twitter](#) [YouTube](#) [Français](#)



Research projects: tracking progress and accountability

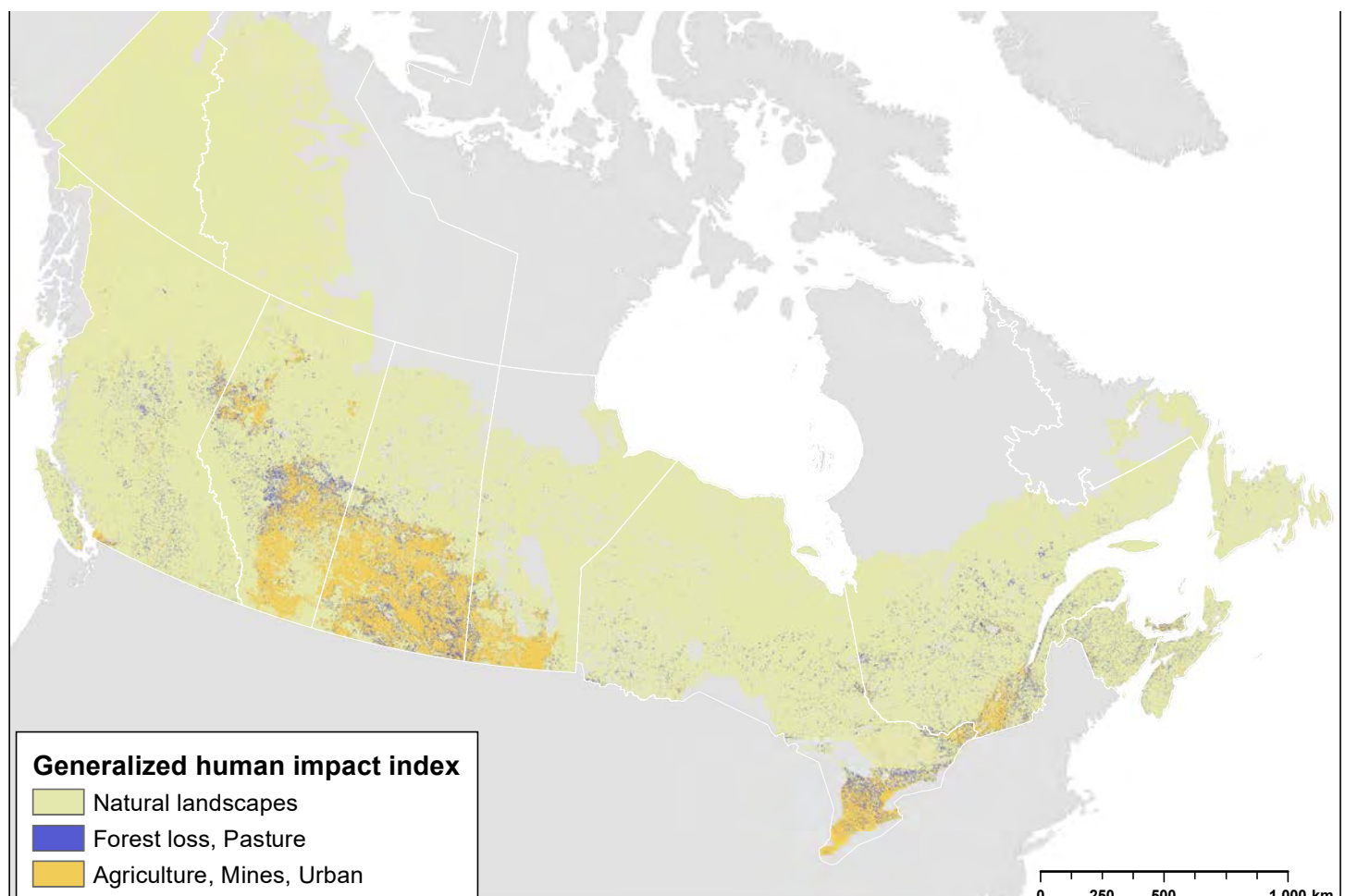
Thirdly, the Scientific Committee and Administrative Centre have carefully tracked the projects and trainee recruitment. The LakePulse Network has a short timeline for its ambitious program, and the active cooperation of the participants is essential. The Network's governance structure and effective communication have helped to ensure that the projects are accountable and on track.

LakePulse benefits from having many enthusiastic "team players" who help to build and strengthen the LakePulse community and work towards its collective achievements. Most of the project leaders have done an excellent job in regularly updating their project reports. Collaborative efforts within the Network are recognized and encouraged because they have been critical in the Network's success in being productive and cohesive.



Geomatics support for Network research projects

To support the Network projects, the geomatics specialist at the Université de Sherbrooke carries out extensive analyses that are shared with all the researchers and trainees. In 2019, the geomatics specialist focused on supporting both the lake sampling campaign and the research projects. For the LakePulse Survey, over 260 lakes (plus back-up lakes) were selected according to the Network's sampling strategy. In addition, itineraries were planned with the Field Coordinator for the 5 field teams. Throughout the year, the geomatics specialist works closely with the director, researchers and trainees to carry out various analyses that are needed for the research projects. Effective communication and cooperation in LakePulse have resulted in highly productive and efficient work that benefits the entire Network.



Management and governance

The structure and decision-making of the Network includes the Administrative Centre, Scientific Committee and Board of Directors. Decisions regarding budgets are made according to yearly budgets that are approved by the Board.

Both the Board of Directors and Scientific Committee include representatives from our partners who have played a key role in orienting some of the decisions. The Board of Directors and Scientific Committee meet regularly twice a year and ad hoc meetings are also called.

A recurring decision-making step is the evaluation of project reports. Individual projects are tracked using an online reporting system. Projects are reviewed at six-month intervals by the Scientific Committee. Problems identified by the Scientific Committee are brought to the attention of the Board of Directors.

In a similar fashion, all changes to the originally planned trainees are reviewed by the Scientific Committee and Board of Directors to make sure that they improve the Network's ability to meet its objectives.

Annual face-to-face meetings

In 2019, the face-to-face meetings for the Board of Directors and the Scientific Committee were held the day before the 3-day Annual Meeting. This allowed them to meet the trainees who were attending the trainee workshop and to participate in a Networking supper with the trainees. It also allowed them to attend the Annual Network Meeting.



Board of Directors

Rick Butts (Chair, retired Director General, Agriculture and Agri-Food Canada)

Voting members

Vincent Aimez (VP Partnerships and Know. Transfer, UdeS)
Nicole Armstrong (Director, Manitoba Sustainable Development)
Beatrix Beisner (Professor, Université de Québec à Montréal)
Kevin Cash (DG, Environment and Climate Change Canada)
John Downing (Director of Minnesota Sea Grant, Chair of SC)
Yannick Huot (Network Director, Université de Sherbrooke)
Ralph Pentland (Forum for Leadership on Water, President of Ralbet Enterprises Inc.)
Verena Tunnicliffe (Professor, University of Victoria)

Non-voting members

Ainsley McFarlane (Manager, NSERC)
Catherine Brown (Network Manager, Université de Sherbrooke)

Scientific Committee

John Downing (Chair, University of Minnesota)

Voting members

Stéphanie Brazeau (Public Health Agency of Canada)
Paul del Giorgio (UQAM, Theme 1 leader)
Irene Gregory-Eaves (McGill, Theme 1 leader)
Marie-Josée Fortin (UofT, Theme 3 leader)
Daniel Hering (Universität Duisburg-Essen)
Yannick Huot (UdeS, Theme 4 leader)
Andrew Lang (Memorial University, Theme 2 leader)
Amina Pollard (US EPA)
James Rusak (MOECC)
 Non-voting members
Catherine Brown (UdeS)

Administrative Centre

Yannick Huot (Network Director)
Catherine Brown (Network Manager)

Student Committee

Lisa Lahens (Université de Sherbrooke)
Cindy Paquette (Univ. de Québec à Montréal)

Theme 1

Paul del Giorgio and Irene Gregory-Eaves
 (Theme 1 leaders)

Yves Prairie (UQAM, Project 1.1 and 1.3 leader)
Paul del Giorgio (UQAM, Project 1.2 leader)
Helen Baulch (USask, Project 1.4 leader)
Hubert Cabana (UdeS, Project 2 leader)
John Smol (Queen's U., Project 3 leader)
Dave Walsh (Concordia, Project 4 leader)

Theme 3

Marie-Josée Fortin (Theme 3 leader)

Simon Bélanger (UQAC, Project 7 leader)
Jeff Cardille (McGill, Project 7.2 leader)
Marie-Josée Fortin (UofT, Project 8.1 leader)

Theme 2

Andrew Lang (Theme 2 leader)

Andrew Lang (U. Memorial, Project 5 leader)
Dave Walsh (Concordia University, Project 6.2 leader)
Irene Gregory-Eaves (McGill University, Project 6.3 leader)

Theme 4

Yannick Huot (Theme 4 leader)

Roxane Maranger (UdeM, Project 9 leader)
Yves Prairie (UQAM, Project 10.2 leader)
Yannick Huot (Université de Sherbrooke, Project 10.3 leader)

Financial Summary 2019-2020

Explanation of the funds transfers to other universities

The budget below only considers the funds at the Université de Sherbrooke. The funds that are transferred to other universities are used for paying bills; they are transferred on a “need only basis”. When researchers must advance funds to pay for expenses, they will often keep the transferred funds for later use. All of the transferred funds are Network funds that were allotted to researchers to carry out their projects; once they are transferred to the other universities, we consider them used. An exception to this is when we send funds to pay HQP at the beginning of the year. If an HQP leaves before their planned end date, this may leave some unused funds. There is only one case when this happened (a postdoc found an academic position), and the HQP is being replaced. A full accounting including transfers will soon be provided to NSERC; this section provides an explanation of the expenses and projected expenditures.

The budget projections assume a “return to normal” for meetings and travel activities in the fall of 2020 with respect to the COVID-19 pandemic. If this does not happen, some activities will be pushed back to 2021, but the overall budget will remain similar.

Budget tables

The attached tables show the two current sources of funds: 1) funds coming from NSERC and 2) funds coming from the Université de Sherbrooke. They show past expenses (first column), expected funds for the last year (second column). The third column is the sum of the first two and shows the funds available at the beginning of Yr 5. The following two columns show the planned expenses in Yr 5 and the no-cost, supplementary Yr 6, respectively. The last column shows the remaining funds at the end of the project.

Funds from NSERC for the LakePulse Network

NSERC funds						
	Remaining funds end of Yr 4	Yr 5 to be released by NSERC	Funds available for Yrs 5 and 6 activities	Projected expenses Yr5	Projected expenses Yr6	Remaining after Yr6
Network Administration (total)	\$62,755.97	\$128,855.00	\$191,610.97	\$121,043.86	\$75,521.93	-\$4,954.82
Travel and conferences	\$98,233.30	\$53,754.00	\$151,987.30	\$30,000.00	\$30,000.00	\$91,987.30
Manager salary	-\$35,477.33	\$75,101.00	\$39,623.67	\$91,043.86	\$45,521.93	-\$96,942.12
International Strategy (total)	\$100,232.43	\$92,490.00	\$192,722.43	\$50,090.00	\$50,090.00	\$95,542.43
Travel and conferences	\$100,232.43	\$95,490.00	\$195,722.43	\$50,090.00	\$50,090.00	\$95,542.43
Common Network Resources (total)	-\$175,394.36	\$464,311.00	\$288,916.64	\$429,813.83	\$192,479.86	-\$285,210.65
Equipment and materials	-\$125,183.67	\$342,450.00	\$217,266.33	\$213,311.00	\$41,650.00	-\$37,694.67
Travel and conferences	\$56,568.60	\$0.00	\$56,568.60	\$0.00	\$0.00	\$56,568.60
Salaries professionals	-\$54,932.68	\$121,861.00	\$66,928.32	\$216,502.83	\$150,829.86	-\$300,404.37
Publications	-\$3,680.21	\$0.00	-\$3,680.21	\$0.00	\$0.00	-\$3,680.21
Theme 1 (total)	\$27,336.71	\$197,054.00	\$224,390.71	\$185,822.00	\$15,000.00	\$23,568.71
Salaries professionals	\$54,554.11	\$114,886.00	\$169,440.11	\$118,886.00	\$0.00	\$50,554.11
Equipment and materials	\$1,496.23	\$0.00	\$1,496.23	\$0.00	\$0.00	\$1,496.23
Student and postdoc salaries	-\$26,213.63	\$75,918.00	\$49,704.37	\$60,686.00	\$15,000.00	-\$25,981.63
Publications	-\$2,500.00	\$6,250.00	\$3,750.00	\$6,250.00	\$0.00	-\$2,500.00
Theme 2 (total)	\$47,170.58	\$79,020.00	\$126,190.58	\$75,873.00	\$0.00	\$50,317.58
Equipment and materials	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Student and postdoc salaries	\$45,920.58	\$74,020.00	\$119,940.58	\$72,123.00	\$0.00	\$47,817.58
Publications	\$1,250.00	\$5,000.00	\$6,250.00	\$3,750.00	\$0.00	\$2,500.00
Theme 3 (total)	\$44,671.79	\$63,234.00	\$107,905.79	\$56,241.00	\$0.00	\$51,664.79
Equipment and materials	\$2,414.69	\$0.00	\$2,414.69	\$0.00	\$0.00	\$2,414.69
Student and postdoc salaries	\$38,507.10	\$60,734.00	\$99,241.10	\$51,241.00	\$0.00	\$48,000.10
Publications	\$3,750.00	\$2,500.00	\$6,250.00	\$5,000.00	\$0.00	\$1,250.00
Theme 4 (total)	\$83,356.18	\$100,035.00	\$183,391.18	\$51,403.00	\$35,367.00	\$96,621.18
Equipment and materials	\$2,500.00	\$0.00	\$2,500.00	\$0.00	\$0.00	\$2,500.00
Student and postdoc salaries	\$79,606.18	\$93,785.00	\$173,391.18	\$47,653.00	\$35,367.00	\$90,371.18
Publications	\$1,250.00	\$6,250.00	\$7,500.00	\$3,750.00	\$0.00	\$3,750.00
Totals	\$238,295.70	\$1,124,999.00	\$1,363,294.70	\$970,286.69	\$368,458.79	\$24,549.22

Funds from the Université de Sherbrooke for the LakePulse Network

Université de Sherbrooke complementary funds						
	Current funds	Yr 5 to be released by UdeS	Funds available for Yrs 5 and 6 activities	Projected expenses Yr5	Projected expenses Yr6	Remaining after Yr6
Equipment and materials	\$6,008.64	\$0.00	\$6,008.64	\$6,008.64	\$0.00	\$0.00
Salaries professionals	\$44,997.55	\$0.00	\$44,997.55	\$44,997.55	\$0.00	\$0.00
Travel and conferences	\$194.22	\$2,800.00	\$2,994.22	\$2,994.22	\$0.00	\$0.00
Student and postdoc salaries	\$17,465.22	\$12,500.00	\$29,965.22	\$14,983.00	\$14,982.22	\$0.00
Totals	\$68,665.63	\$15,300.00	\$83,965.63	\$68,983.41	\$14,982.22	\$0.00

Appendix A: Partners and supporting organizations

Partner	Starting date – current status
Environment and Climate Change Canada	Founding Partner – current partner
Environment and Natural Resources (Government of Northwest Territories)	Founding Partner – current partner
Environmental Monitoring and Science Division (Government of Alberta)	Founding Partner – current partner
Environmental Protection Division (Ministry of Environment – Province of British Columbia)	Founding Partner – current partner
Ministère du Développement Durable, de l'Environnement et de la Lutte contre les Changements (Québec)	Founding Partner – current partner
Ontario Ministry of the Environment and Climate Change	Founding Partner – current partner
Ouranos Consortium	Founding Partner – current partner
Public Health Agency of Canada	Founding Partner – current partner
Department of Municipal Affairs and Environment (Government of Newfoundland and Labrador)	Founding partner changed status to “supporting organization”
New Brunswick Department of Environment and Local Government	Partner added in Year 1 – current partner
Yukon	Partner added in Year 1 – current partner
IISD-Experimental Lakes Area	Partner added in Year 3 – current partner

Appendix B: List of Partner Collaborators

Name	Affiliation	Position	Role
Caren Binding	Environment and Climate Change Canada	Scientist	Partner Scientist, SC Member
Stéphanie Brazeau	Public Health Agency of Canada	Scientist	Partner Scientist
Don Fox	State of the Environment (NB)	Scientist	Partner Scientist
Antoinette Ludwig	Public Health Agency of Canada	Scientist	Partner Scientist
Nicholas Ogden	Public Health Agency of Canada	Scientist	Partner Scientist
Louis Roy	Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques	Scientist	Partner Scientist
James Rusak	Ontario Ministry of Environment and Climate Change	Scientist	Partner Scientist, SC Member
Mike Sokal	Environmental Protection Division (B.C. Ministry of Environment)	Environmental Impact Assessment Biologist	Partner Scientist
Gila Somers	Northwest Territories Department of Environment and Natural Resources	Watershed Management Advisor	Partner Scientist
Ron Zurawell	Alberta's Environmental Monitoring and Science Division	Scientist	Partner Scientist

Appendix C: Partner contributions

With the current pandemic situation, communications with our partners have been slowed, and we have not received the estimates of the contribution amounts from several of the partners. When this is the case, the Administrative Centre has provided estimates in grey in the table below. We also note that the annual report is usually completed in April, such that 2 months of the year are missing. We include here contributions that occurred in May and June 2019 (but were not part of the midterm report).

Partner	Received contribution (Year 4)	Comments
Environment and Climate Change Canada	-Estimate yet to be received but expected to have exceeded planned contribution. -Kevin Cash sits on the BOD. -Arthur Zastepa has welcomed an HQP in his lab for several weeks and supported running cyanotoxin samples.	Caren Binding attends Annual Network Meetings. She is involved at all levels of science, including student co-supervision and is supervising a student internship. -Provided optical instrument, hyperpro and HS2 for the field campaign.
Environment and Natural Resources (Government of Northwest Territories)	-Estimate yet to be received but expected to be in line with planned. -Gila Somers sits on the conflict of interest committee.	This partner has been very helpful during the organization of the field campaign and logistics for the last field campaign.
Environmental Monitoring and Science Division (Government of Alberta)	- \$12 500, which is about half of the contribution expected.	Ron Zurawell and his team have been essential in the selection of lakes in Alberta with lots of interaction. He has spent many days working with the Specialists team on lake selection. This partner has always contributed when required, but we did not have a need for more contributions this year.
Environmental Protection Division (Ministry of Environment - Province of British Columbia)	-Estimate yet to be received but expected to be in line with planned.	Mike Sokal has been closely involved working with the Specialists team on lake selection and helped with orienting the LakePulse Survey in BC. He has been particularly supportive of the field teams.

Appendix C: Partner contributions (continued)

Ministère du Développement Durable, de l'Environnement et de la Lutte contre les Changements (Québec)	-Estimate yet to be received but expected to be in line with planned.	Louis Roy and his team have participated in the Network and interacted numerous times with Project 9.
Ontario Ministry of the Environment and Climate Change	\$5500	Jim Rusak is very active in the Network and sits on the SC. He is also strongly involved in a student PhD thesis and co-supervises a MSc student in the Network.
Ouranos Consortium	-Estimate yet to be received but expected to be in line or exceeding the planned amounts.	Robert Siron participates actively in the Annual Network Meetings and Project 9. Many meetings with the climate modeling groups have occurred in the past year. Ouranos contributed in cash more than expected as they provide a MITACS postdoc scholarship contribution instead of a doctoral scholarship. Ouranos regularly hosts a postdoc in their offices.
Public Health Agency of Canada	-Estimate yet to be received but expected to exceed the planned amounts.	Stéphanie Brazeau supervises a MSc student in the Network. Nick Ogden supervises a PhD student in the Network Both participated in the Annual Network Meetings. The PHAC has also added a cash contribution to their initial in-kind contribution to support the scholarships of the students.
IISD – ELA	- 0\$	Partner is collaborating specifically with one project and contributing when required, but this project has been focused on data processing and thus there has not been much required interaction in the past year. The planned contributions will likely occur in Year 5 and the no-cost year as this project advances.

Appendix D: List of Co-PIs

Name	Affiliation	Position
Dermot Antoniades	Université Laval	Professor
Beatrix Beisner	Université du Québec à Montréal	Professor
Helen Baulch	University of Saskatchewan	Professor
Simon Bélanger	Université du Québec à Rimouski	Professor
Hubert Cabana	Université de Sherbrooke	Professor
Jeffrey Cardille	McGill University	Professor
Paul del Giorgio	Université du Québec à Montréal	Professor
Marie-Josée Fortin	University of Toronto	Professor
Irene Gregory-Eaves	McGill University	Professor
Yannick Huot	Université de Sherbrooke	Professor
Andrew Lang	Memorial University	Professor
Isabelle Laurion	INRS-ETE	Professor
Roxane Maranger	Université du Montréal	Professor
Yves Prairie	Université du Québec à Montréal	Professor
John Smol	Queens University	Professor
Rolf Vinebrooke	University of Alberta	Professor
David Walsh	Concordia University	Professor

Appendix E: Status of the LakePulse Project Reports

Theme# (Theme leader)	Project# (Project leader) <i>Title</i>	Evaluation by Scientific Committee (SC) on June 4th, 2020
1 (Gregory-Eaves and del Giorgio)	1.1 (Prairie) <i>Carbon gas fluxes, concentration and isotopic signature in Canadian lakes</i>	On track; the SC recommends to the Board to approve the continuation of the project
1 (Gregory-Eaves and del Giorgio)	1.2 (del Giorgio) <i>Biogeochemical drivers of carbon sinks, greenhouse gas fluxes, and nutrient regeneration – Patterns in lake metabolism and organic C dynamics</i>	On track; the SC recommends to the Board to approve the continuation of the project
1 (Gregory-Eaves and del Giorgio)	1.3 (Prairie) <i>In-lake carbon modelling in Canadian lakes</i>	On track; the SC recommends to the Board to approve the continuation of the project
1 (Gregory-Eaves and del Giorgio)	1.4 (Baulch) <i>Sediment phosphorus characterization across Canadian lakes</i>	*Tabled by the SC; the SC requested more information from the project leader
1 (Gregory-Eaves and del Giorgio)	2 (Cabana) <i>Fate and behaviour of contaminants of emerging concern in Canadian lakes</i>	*Tabled by the SC; the SC requested more information from the project leader
1 (Gregory-Eaves and del Giorgio)	3 (Smol) <i>Changes in Canadian lakes over the Anthropocene; which lakes are susceptible to different stressors</i>	On track; the SC recommends to the Board to approve the continuation of the project
1 (Gregory-Eaves and del Giorgio)	4 (Walsh) <i>Linking genetic and microscopic approaches to reconstruct historical conditions of lake ecosystems</i>	On track; the SC recommends to the Board to approve the continuation of the project
2 (Lang)	5 (Lang) <i>Microbial contamination in Canadian lakes – risks for human and animal health</i>	On track; the SC recommends to the Board to approve the continuation of the project
2 (Lang)	6.2 (Walsh) <i>Assessment of anthropogenic influences on the structure and function of plankton communities across the lakes of Canada</i>	On track; the SC recommends to the Board to approve the continuation of the project
2 (Lang)	6.3 (Gregory-Eaves) <i>Cyanobacteria distribution and dynamics</i>	On track; the SC recommends to the Board to approve the continuation of the project
3 (Fortin)	7 (Bélanger) <i>Remote sensing as direct observation of lakes water quality and information on land use</i>	On track; the SC recommends to the Board to approve the continuation of the project
3 (Fortin)	7.2 (Cardille) <i>Harnessing all available imagery to predict CDOM/DOC in Pulse Lakes</i>	On track; the SC recommends to the Board to approve the continuation of the project

Appendix E: Status of the LakePulse Project Reports (continued)

3 (Fortin)	8.1 (Fortin) <i>Spatial modelling as a tool to integrate results</i>	On track; the SC recommends to the Board to approve the continuation of the project
4 (Huot)	9 (Maranger) <i>What biophysical features package aquatic ecoservice bundles and how do these bundles change across Canada?</i>	*Tabled by the SC; the SC requested more information from the project leader
4 (Prairie)	10.2 <i>Integration and forecasting project</i>	Project start date pending budget review.
4 (Huot)	10.3 (Huot) <i>Forecasting future states of lakes</i>	Project start date pending on budget review.
Network project	Network project (Huot) <i>Development of the integrated LakePulse Web Portal</i>	On track

* At the Scientific Committee (SC) meeting on June 4th, 2020, the SC reviewed the project reports submitted by the project leaders. Three of the projects were found to have issues that the SC decided should be resolved before the projects were recommended to the Board for continuation. These issues were all resolved before the Board meeting on June 15th, 2020; the SC was thus able to recommend to the Board to approve continuation of all the Network's projects.

- **Project 1.4:** The SC sent their feedback to the project leader: *Delays in the processing of certain samples could cause some delays for other projects and trainees in the Network.* The issue was resolved: 1) The SC developed a plan with the project leader that provided a clear path forward for the timely processing of samples; and 2) The SC voted (by email) to recommend to the Board to approve continuation of the project.
- **Project 2:** The SC sent their feedback to the project leader: *Clearer reporting would improve the section on data processing.* The issue was resolved: 1) The project scientists and trainees clearly explained that data processing was on track; and 2) The SC voted (by email) to recommend to the Board to approve continuation of the project.
- **Project 9:** The SC sent their feedback to the project leader: *The SC requested that the project leader complete Section 1 of the project report before the SC recommends to the Board to approve the continuation of the project. Section 1 of the project report addresses the project's contributions to the LakePulse Portal, including an approximate timeline for deliverables.* The issue was resolved: The project leader completed Section 1 of the project report.

An online reporting system is used to track the projects, HQP, milestones, deliverables and metrics. These project reports are reviewed at 6-month intervals by the SC.

Appendix F: Highly Qualified Personnel

Type of HQP	Theme 1		Theme 2		Theme 3		Theme 4		Common Network activities	
	Total number	Number completely supported by RN grant ¹	Total number	Number completely supported by RN grant ¹	Total number	Number completely supported by RN grant ¹	Total number	Number completely supported by RN grant ¹	Total number (field campaign participants ² + full-time HQP ³)	Number completely supported by RN grant ¹
Undergrad.									19 + 0	19 + 0
M.Sc.	1	1			1	1	1	1	7 + 1	7 + 1
Ph.D.	9⁵	7	6	6	3⁵	2			3 + 0	3 + 0
PDF	3⁵	1	1	1	2	2	1⁴	1		
Research associates	3	3							2 + 4	2 + 4
Totals	16	12	7	7	6	5	2	2	31 + 5	31 + 5

1. Apart from the research professionals and undergraduate students who receive 100% of funding from LakePulse, all graduate students and postdocs are supported 75% by LakePulse funds and 25% by a LakePulse researcher's funds (or scholarships obtained by the trainee, see below). LakePulse offers funds for materials, conference participation, and internships for all the graduate students and postdocs. We therefore consider the students and postdocs who receive 75% of their funding from LakePulse as fully supported by LakePulse (i.e. they are HQP who are fully dedicated to working on LakePulse activities).
2. Represents HQP who participated in the field campaign only.
3. Represents HQP who are full-time HQP.
4. PDF supported though NSERC funds, Ouranos (partner) contributions and MITACS scholarships.
5. Four HQP were not planned within the original proposal and are funded externally.

Appendix G: Scientific Committee Members

Name	Affiliation	Position	Representation on SC
Stéphanie Brazeau	Public Health Agency of Canada	Scientist	Federal Partners
Paul del Giorgio	Université du Québec à Montréal	Professor	Theme 1 Co-leader
John Downing (Chair of the Scientific Committee)	University of Minnesota Duluth	Professor / Director of Minnesota Sea Grant Program	External / Independent
Marie-Josée Fortin	University of Toronto	Professor	Theme 3 Leader
Irene Gregory-Eaves	McGill University	Professor	Theme 1 Co-Leader
Daniel Hering	Universität Duisburg-Essen	Professor / Dean of the Faculty of Biology	External International Advisor / Independent
Yannick Huot	Université de Sherbrooke	Professor	Network Director
Andrew Lang	Memorial University of Newfoundland	Professor	Theme 2 Leader
Amina Pollard	U.S. Environmental Protection Agency	Scientist	External International Advisor / Collaborator
James Rusak	Ontario Ministry of the Environment and Climate Change	Scientist	Provincial Partner
Non-voting member			
Catherine Brown	Université de Sherbrooke	Manager	Network Manager

Appendix H: Board of Directors

Name	Affiliation	Position	Representation on BOD
Vincent Aimez	Université de Sherbrooke	Vice-President Partnerships and Knowledge Transfer	Host university
Nicole Armstrong	Water Science and Watershed Management Branch Department of Sustainable Development Government of Manitoba	Director	Provincial Partner
Beatrix Beisner	Université du Québec à Montréal	Professor	Network co-PI
Richard Butts (Chair of the Board)	Cross Sectoral Strategic Direction /Agriculture Agri-Food Canada	Director General (retired)	External/Independent
Kevin Cash	Water Science and Technology/Science and Technology Branch Environment and Climate Change Canada	Director General	Federal Partner
John Downing	University of Minnesota Duluth	Professor / Director of Minnesota Sea Grant Program	Chair of the Scientific Committee
Yannick Huot	Université de Sherbrooke	Professor	Network Director
Ralph Pentland	Forum for Leadership on Water; President of Ralbet Enterprises Inc.	Director of Water Planning and Management, Canadian Department of the Environment (1978 to 1991)	External/Independent
Verena Tunnicliffe	University of Victoria	Professor	External/Independent
Non-voting members			
Catherine Brown	Université de Sherbrooke	Network Manager	
Ainsley McFarlane	NSERC	NSERC Manager	

Appendix I: Metrics

In this section, the **LakePulse HQP names are in bold font** while the LakePulse co-PIs and collaborators are underlined.

GRANTS DIRECTLY LINKED TO LAKEPULSE

Applied for

1. Gueguen (lead), Segura (coPI), Bellenger (coPI). FRQ-NT Team project 2020-2023. Establishing Lake Memphrémagog water quality baseline prior to the Coventry (Newport, Vt) landfill expansion. (Total requested: \$226,183)

Obtained

1. Bélanger, S., Y. Huot et al, WaterSat Imaging Spectrometer Experiment (WISE) for optically shallow inland and coastal waters assessment - The WISE-Man project. Funding: 400K\$ from the Canadian Space Agency - Flights and Fieldwork for the Advancement of Science and Technology (FAST 2017). The funding will help to train HQP in the field of hyperspectral remote sensing of optically complex waters. **Yanqun Pan** will receive money from this project to complete his PhD salary. (Obtained in July 2018)
2. FisHab: Funding from GRIL (FRQNT) and DFO (Canada) to support PhD2 (**Vincent Fugère**) salary complement and technical help to gather fish data (Annick St-Pierre)
3. Gregory-Eaves (lead), Antoniades (coPI), del Giorgio (coPI), Francus (coPI) and Smol (collaborator). FRQNT Team grant (total award = \$162,000 over 3 years). Announced in May 2018. **Alex Baud** is PhD1 on this project. Paul del Giorgio and Irene Gregory-Eaves have recruited **Candace Aulard** as PhD2 on this grant and a third PhD student, Hamid Ghanbari, will be starting as soon as his VISA is approved. Hamid will be co-supervised by Dermot Antoniades and Irene Gregory-Eaves.
4. Gueguen (lead), Hausladen (coPI), Cabana (coPI), Bellenger (coPI). NSERC Research Tools and Instruments Grants, 2020. Urgent replacement of a sensitive and matrix tolerant ICP-MS for metal(loid) speciation. (Total obtained: \$149,768)
5. Lang applied for and received an internal research grant at Memorial University (\$10,000) for a project building on LakePulse Network research and connections ("Over-Winter Survival of influenza A Viruses in Natural Environments"; collaboration with Network collaborator Ramey, USGS).
6. **Paquette, C.** (PhD11): Funding from the GRIL (FRQNT) *projets conjoints* program
7. Walsh D., B. Beisner, I. Gregory-Eaves, and Y. Huot (co-applicants) Compute Canada Resources for Research Groups: Computational Support for the Lake Pulse Network: microbial metagenomics of Canadian Lakes

Appendix I: Metrics (continued)

REFEREED JOURNAL ARTICLES DIRECTLY SUPPORTED BY LAKEPULSE

Published

1. Huot Y., **Brown C.A.**, **Potvin G.**, Antoniades D., Baulch H.M., Beisner B.E., Bélanger S., Brazeau, Cabana H., Cardille J.A., del Giorgio P., Gregory-Eaves I., Fortin M-J., Lang A.S., Laurion I., Maranger R., Prairie Y.T., Rusak J.A., Segura P.A., Siron R., Smol J.P., Vinebrooke R.D., Walsh D.A. The NSERC Canadian Lake Pulse Network: A national assessment of lake health providing science for water management in a changing climate. *Science of the Total Environment*, Volume 695, 10 December 2019, <https://doi.org/10.1016/j.scitotenv.2019.133668>

Submitted

1. **Fortin St-Gelais**, Lapierre, Siron and Maranger. Is trophic status a meaningful metric to assess the delivery of multiple aquatic ecosystem services? Accepted pending revisions April 2020, *Bioscience*
2. **Kraemer, S.**, Barbosa da Costa, N., Shapiro, B.J., **Fradette M.**, Huot Y., Walsh, D., Land use structures lake bacterial communities across Eastern Canada. *The ISME Journal: Multidisciplinary Journal of Microbial Ecology*, Under revision 2020

REFEREED JOURNAL ARTICLES INDIRECTLY SUPPORTED BY LAKEPULSE

Accepted/In Press/Published

1. **Beaulieu, M.**, H. Cabana, Y. Huot (2019) Adverse effects of atrazine, DCMU and metolachlor on phytoplankton cultures and communities at environmentally relevant concentrations using Fast Repetition Rate Fluorescence. *Science of the Total Environment*, 712:136239. **M. Beaulieu** was a research professional at different times during her PhD and participated in field campaigns to collect supplementary data for her PhD.
2. **Griffiths, K.**, Winegardner, A.K., Beisner, B.E., Gregory-Eaves, I., 2019. Cladoceran assemblage changes across the Eastern United States as recorded in the sediments from the 2007 National Lakes Assessment, USA. *Ecol. Indic.* 96, 368–382. Article develops an innovative trait matrix for subfossil zooplankton and informs the work of **C. Paquette** (PhD student in Theme 2). Although LakePulse data were not used in the manuscript, the LakePulse sampling program is mentioned, and this dataset may eventually be merged with the eastern LakePulse dataset that **C. Paquette** is developing.
3. Pérez Jvostov F., Sutherland W.J., Barrett R. D.H., **Brown C.A.**, Cardille J. A., Cooke S.J., Cristescu Melania E., Fussmann G.F., **Griffiths K.**, Hendry A.P., Nyboer E.A., Reid A.J., Ricciardi A., **Fortin St-Gelais N.**, Sunday J.M., Winegardner A.K., Gregory-Eaves I. 2020, Horizon scan of conservation issues for inland waters in Canada, *Canadian Journal of Fisheries and Aquatic Sciences*. 77:869-881. Three LakePulse HQP and two co-PIs participated in the preparation of this paper.

Appendix I: Metrics (continued)

4. Ramey AM, Reeves AB, Drexler JZ, Ackerman JT, De La Cruz S, Lang A, Leyson C, Link P, Prosser DJ, Robertson GJ, **Wight J**, Youk S, Spackman E, Pantin-Jackwood M, Poulson RL, Stallknecht DE. Influenza A viruses remain infectious for more than seven months in northern wetlands of North America. Proc Roy Soc B, Submitted 4 May 2020 (manuscript ID RSPB-2020-0959)
5. **Simmatis, B., Baud, A., Gregory-Eaves, I., Francus, P., and Smol, J.P.** (2020) Using subfossil Simuliidae to track past river flow into an industrially-contaminated lake. J. Paleolimnology, <https://doi.org/10.1007/s10933-020-00130-4>

Submitted/Under review

1. **Beaulieu, M.** et al. (2020) Predicting atrazine concentrations in lakes across the contiguous United States: The importance of land use, hydrology and lake physico-chemistry. Submitted to Limnology and Oceanography. Under review

OTHER NON-REFEREED CONTRIBUTIONS DIRECTLY SUPPORTED BY LAKEPULSE

Policy brief

1. **NSERC Canadian Lake Pulse Network**, Mémoire sur l'impact des pesticides dans les milieux aquatiques du Québec préparé pour la Consultation générale sur les impacts des pesticides sur la santé publique et l'environnement, July 2019

Articles

1. **Potvin G, Oliva A, Brazeau S, Huot Y, Ogden N.** Télédétection et qualité de l'eau des lacs canadiens. Bulletin AQT: Edition spéciale sur l'eau, May 2019

Technical report

1. "Portrait global de l'état de nos lacs Laurentiens" as part of EcoLac training, **St-Gelais** and **Maranger** experimented on how to integrate stakeholder; data came from the RSVL and CRE Laurentides, and product shared with them. June 2019

Appendix I: Metrics (continued)

POSTERS

International

1. **Deutsch, E.**, Fortin, M.-J., Cardille, J., Baulch, H., Rusak, J., **Koll-Egyed, T.**, **Donelle, L.** May 2020. Modeling lake health in unsampled Canadian lakes. IALE NA 2020 Meeting [<https://2020toronto-ialena.ipostersessions.com/default.aspx?s=C0-89-F0-52-7D-88-57-EB-56-D8-F7-BA-DF-C2-32-CD>]
2. **Fugère, V.**, Huot, Y., Walsh, D., Beisner, BE. 2019. Effects of lake size and watershed land use on multitrophic lake communities in Eastern Canada. Annual meeting of the *Global Lake Ecological Observatory Network (GLEON)*, Huntsville, ON.
3. **Goubet S.**, Laurion I., Chokmani K. Development of optical tools to quantify algal biomass and identify dominant taxa. 9th US Symposium on Harmful Algae, 11-17 November, 2017, Baltimore, USA
4. **Kim, J** et al. 2019. Annual meeting of the *Global Lake Ecological Observatory Network (GLEON)*, Huntsville, ON.
5. **Koll-Egyed, T** and Cardille JA. Scaling Field Samples of Lake Water Quality Characteristics to Regional and National Scales. International Association of Landscape Ecology-North America Meeting, May 2020. Presentation of electronic poster at this international conference that was moved to virtual format due to COVID.
6. **Oliva A.**, Huot Y., Ogden N. Spatially based environmental determinants related to infectious disease pathogen indicators in Canadian lakes. LakePulse AGM, November 2019, Longueuil, Canada; and 21st All Hands' Meeting of the *Global Lake Ecological Observatory Network (GLEON)*, November 2019, Huntsville (ON), Canada

Regional

1. **Baud A.**, **Griffiths K.**, **MacKeigan P.**, **Paquette C.**, Smol JP., Antoniades D., Francus P., Beisner B. and Gregory-Eaves I. "A changing Canada – the paleo-perspective from the Lake Pulse Network (lakepulse.ca)" GRIL annual meeting, 22-24 March 2018, St-Hippolyte, QC
2. **Cremella Palmerini BN.**, Y Huot., BE Beisner., S Bonilla. Environmental and geographical distance structuring effects on phytoplankton community from the taxonomical and functional perspectives in Eastern Canada. GRIL Symposium, March 2019. Orford, QC.
3. **Deutsch, E.** et al. Lake Health Composite Measures in Lake Pulse and Beyond. LakePulse 2019 AGM Presentation.
4. **Fugère, V.**, Huot, Y., Walsh, D., Beisner, BE. 2019. Effects of lake size and watershed land use on multitrophic lake communities in Eastern Canada. Annual meeting of the *Quebec Center for Biodiversity Science*, Montréal, QC.
5. **Garner R.**, Gregory-Eaves I., Walsh D. Comparative paleogenetics of modern and preindustrial Canadian lake ecosystems, GRIL annual meeting, 22-24 March 2018, St-Hippolyte, QC

Appendix I: Metrics (continued)

6. **Lahens L** et al. Preliminary study of the occurrence of trace organic contaminants in Canadian lakes. 32^e congrès de l'Est du Canada. Association canadienne sur la qualité des eaux. 4 May 2018, Sherbrooke, QC.
7. **Lahens L** et al. Preliminary study of the occurrence of trace organic contaminants in Canadian lakes. 22^e Colloque annuel du SETAC Chapitre Saint-Laurent. 14 – 15 June 2018, Québec, QC.
8. **Lahens L** et al. Study of the occurrence of trace organic contaminants in Eastern Canadian lakes. 21st Annual Chemistry and Biochemistry Graduate Research Conference, November 9, 2018. Montreal, QC
9. **Lahens L**, Barry K, **Dion Fortier A**, Cabana H, Segura P A. Study of the occurrence of trace organic contaminants in Eastern Canadian lakes. 23^e Colloque du Chapitre Saint Laurent, June 2019. Sherbrooke, QC, Canada.
10. **Lahens L**, Barry K, **Dion Fortier A**, Cabana H, Segura P A. Study of the occurrence of trace organic contaminants in Eastern Canadian lakes. 102nd Canadian Chemistry Conference and Exhibition, June 2019. Quebec City, QC, Canada.
11. **MacKeigan P**, Beisner B, Taranu Z, **Garner R**, Pick F, Walsh D, Gregory-Eaves J. Cyanobacteria Distribution and Dynamics Across a Wide Range of Canadian Lakes. LakePulse AGM November 2019, Quebec.
12. **Oliva A**, Huot Y, Ogden N. Assessing microbial contamination and waterborne diseases in lakes using Earth Observation Indicators. LakePulse AGM, November 2018, Longueuil, Canada
13. **Oliva A**, Huot Y, Ogden N. Évaluation des risques de contaminations microbiennes des lacs canadiens à l'aide d'indicateurs d'observation de la Terre. AQT/RHQ Colloque, May 2019, Bishop's University, Sherbrooke.
14. **Paquette, C**, I Gregory-Eaves and BE Beisner. 2019. Biogéographie du zooplancton dans l'est du Canada: influence de l'espace, des activités humaines et de la taille des lacs. Présentation d'une affiche au 87^e Congrès de l'Acfas, Gatineau, QC.
15. **Potvin G**, Huot Y, Bélanger S, Binding C (2019) Développement d'algorithmes bio-optiques pour le suivi de paramètres de la qualité de l'eau des lacs canadiens. Colloque AQT/RHQ, Sherbrooke, Québec.
16. **Potvin G**, Huot Y, Belanger S, Binding C, Utilisation de la télédétection pour mesurer les paramètres de la qualité de l'eau des lacs canadiens. GRIL Symposium, March 2019. Orford, QC.
17. **Reddy, Y** et al. 2020. In-lake carbon modelling in Canadian lakes. Online GRIL 2020 Symposium
18. **Shahabinia A**, Bogard MJ, del Giorgio PA, Patterns and Regulation of Ecosystem Metabolism in Lakes across Canada. GRIL Symposium, March 2019. Orford, QC.

Appendix I: Metrics (continued)

PRESENTATIONS

International

1. **Fortin St-Gelais N**, Goyette JO, Siron R, Lapierre JF, Maranger R. A novel approach to quantify the multiple dimensions of water quality and aquatic ecosystem services, ASLO summer meeting, Victoria, BC. 10 – 15 June 2018.
2. **Fortin St-Gelais N**, Lapierre JF, Siron R, Maranger R. Identifying thresholds for the effect of land use and climate change on aquatic ecosystem services. Association of the Sciences of Limnology and Oceanography (ASLO), Planet Water, February 2019, San Juan, Puerto Rico.
3. Gregory-Eaves I, **Baud A**, **Garner R**, **Griffiths K**, **Jeziorski A**, **MacKeigan P**, **Paquette C**, **Simmatís B**, Amyot M, Antoniadés D, Francus P, Beisner B, Huot Y, Poulain A, Walsh D and Smol JP. "Landscape Paleolimnological Insights from the Canadian Lake Pulse Network (lakepulse.ca)", International Paleolimnology Association 2018 meeting, 18 – 21 June 2018, Stockholm, Sweden
4. **Griffiths K**, Smol JP, Antoniades D, **Jeziorski A**, Gregory-Eaves I. "Inferring past environments across the Lake Pulse Network: Tracking diatom changes across four Canadian ecozones", International Paleolimnology Association 2018, June 18 – 21, 2018, Stockholm, Sweden
5. **Kraemer, S.**, Barbosa da Costa, N., Shapiro, B.J., Walsh, D., Land use structures lake bacterial communities across Eastern Canada SAME meeting September 2019, Germany
6. **Kraemer SA**, Barbosa da Costa N, Shapiro BJ, Walsh D. Land use structures lake bacterial communities across Eastern Canada, ASLO summer meeting, Victoria, BC, 10 – 15 June, 2018.
7. **Kraemer, S.**, Barbosa da Costa, N., Shapiro, B.J., Walsh, D., Land use structures lake bacterial communities across Eastern Canada GRIL General Meeting, March 2018
8. **MacKeigan P**, Beisner B, Taranu Z, Pick F, Sauvé S and Gregory-Eaves I. Cyanobacteria Distribution and Dynamics from the Canadian Lake Pulse Network (lakepulse.ca), Interdisciplinary freshwater harmful algal blooms workshop, Toronto, 16 – 20 April 2018.
9. Maranger R, **Fortin St-Gelais N**, Lapierre J-F, Poisot T, Dubé P, Franssen J, Talbot J. Making ecosystem science matter: stakeholder-engaged research through co-design and integrated social-ecological synthesis, PECS II, 7 – 10 November, 2017 Oaxaca, Mexico
10. Maranger R, **Fortin St-Gelais N**, Clarke E, Franssen J, Lapierre JF, Messer P, Poisot T, Slade S, Talbot J. Bridging social-innovation and ecosystem science for effective stakeholder-engaged research. Association of the Sciences of Limnology and Oceanography (ASLO), Planet Water, February 2019, San Juan, Puerto Rico.
11. **Paquette C**, Gregory-Eaves I and Beisner B. Zooplankton subfossil assemblage shifts since preindustrial times across Canadian ecozones and in relation to human activities. Association of the Sciences of Limnology and Oceanography (ASLO), Planet Water, February 2019, San Juan, Puerto Rico.

Appendix I: Metrics (continued)

12. **Paquette, C.**, I Gregory-Eaves and BE Beisner. 2019. Subfossil zooplankton Biogeography in Eastern Canada: Influence of space, human activities and depth. *Présentation au Symposium of the North American Lake Management Society (NALMS)*, Burlington, VT, USA.
13. Prairie YT. Pimping your profile: Estimating basin-scale vertical diffusivities from single temperature profiles in seasonally stratified lakes. ASLO meeting, June 2018, Victoria, Canada
14. **Shahabinia, A.**; Bogard, M.; del Giorgio, P. Patterns and regulation of ecosystem metabolism in lakes across Canada, Association of the Sciences of Limnology and Oceanography (ASLO), Planet Water, February 2019, San Juan, Puerto Rico.
15. **Simmatis B.**, Amyot M, Antoniades D., Francus P, Beisner B., Huot Y., Poulain A, Walsh D., Smol JP., "Applying a midge-based model to reconstruct hypolimnetic oxygen in two productive Canadian lakes that support cold-water fisheries", 14th International Paleolimnology Symposium. 18- 21 June 2018. Stockholm, Sweden.
16. **Xiong Y.**, Zhang X, Huot Y. (2018) Variations of the volume scattering functions measure in North Pacific Ocean and eastern Canadian lakes, Ocean Optics, October 2018, Dubrovnik, Croatia.

National

1. **Jeziorski A.**, **Griffiths K.**, **Simmatis B.**, Gregory-Eaves I., Antoniades D., Smol JP. Paleolimnological data from the Canadian LakePulse Network 2017 field campaign (Eastern Canada). Society of Canadian Limnologists 2019 Annual Meeting. London, ON
2. **Kim, J** and Prairie, Y. Pan-Canadian picture of lake contributions to the global GHGs emissions: preliminary results from the first Lake Pulse campaign in Eastern Canada. Society of Canadian Limnologists (SCL) meeting. 3-6 January 2019, London, ON
3. **MacKeigan P.**, **Garner R.**, Walsh D., Beisner B., Pick F., Gregory-Eaves I. Comparative Analyses of Cyanobacteria Assemblages Using Microscopy and Metabarcoding from 82 Canadian Lakes. 3rd Interdisciplinary Freshwater Harmful Algal Blooms (IFHAB) workshop. April 24 - 26, 2019 in Toronto, ON
4. **Simmatis B.**, Gregory-Eaves I., Antoniades D., **Jeziorski A.**, Smol JP. Examining cumulative effects on Chironomidae (Diptera) in a shallow lake using paleolimnological techniques. 3rd Interdisciplinary Freshwater Harmful Algal Blooms (IFHAB) workshop. April 24 - 26, 2019 in Toronto, ON

Regional

1. **Cremella, B.**, Beisner, B., Bonilla, S., Huot, Y. March 2020. Biogeography of lake phytoplankton in North America. Midi-Aquatic seminars (UQAM).
2. **de Toledo M.**, and Baulch HM. Phosphorus Concentration and Nutrient Availability in Canadian Lakes: The Role of Regional Geology, Geography, Land

Appendix I: Metrics (continued)

- Use, and Lake Characteristics. School of Environment and Sustainability Symposium, 23 March 2018. Saskatoon, SK
3. **Fortin St-Gelais N**, Goyette JO, Lapierre JF, Maranger R. What does water quality mean to you?, GRIL Symposium, March 22-24, 2018, Orford, QC.
 4. **Fortin St Gelais N**, Lapierre JF, Siron R, Maranger R. Cadre d'évaluation de la vulnérabilité des services écosystémiques aux changements globaux comme outil socio-écologique quantitatif. ACFAS Outaouais, QC Mai 2019.
 5. **Fugère, V.**, Beisner, **BE**. Temperature-size relationships in hundreds of species of plankton across North American lakes. *Montreal Eco-Evolutionary Symposium*, McGill University.
 6. **Garner R**, Gregory-Eaves, I and Walsh, D. eDNA reconstructions of preindustrial and contemporary micro-eukaryotic diversity from Canadian lake sediments. Quebec Center for Biodiversity Science Annual Symposium. 10-12 December 2018. Montreal, QC
 7. **Garner R, et al.** DNA reconstructions of preindustrial and contemporary micro-eukaryotic diversity from Canadian lake sediments. GRIL Symposium 2019, March 2019. Orford, QC.
 8. **Goubet S**, Laurion I, Chokmani K. Hyperspectral imagery for the detection of algal blooms on lakes. Groupe de recherche interuniversitaire en limnologie (GRIL) Symposium, 22-24 March, 2018, St-Hippolyte, QC
 9. Huot Y. The NSERC Canadian Lake Pulse Network. GRIL Symposium, 22-24 March, 2018, Orford, QC
 10. **Griffiths K, et al.** Tracking diatom assemblage changes since pre-industrial times across four Canadian ecozones within the LakePulse network. GRIL Symposium, March 2019. Orford, QC.
 11. **Jeziorski A**, **Griffiths K**, **Simmtis B**, Gregory-Eaves I, Antoniades D, Smol JP. The 2017 Canadian Lake Pulse Network field campaign - preliminary paleolimnological results. Ontario-Québec Paleolimnology Symposium. 2018. Toronto, ON
 12. **Kim, J et al.** 2020. Carbon gas fluxes in Canadian lakes. Online GRIL 2020 Symposium
 13. **Kraemer, S.**, Barbosa da Costa, N., Shapiro, B.J., Walsh, D., Land use structures lake bacterial communities across Eastern Canada GRIL General Meeting March 2018
 14. **Laboratoire Prairie** - Understanding the drivers and patterns of carbonic greenhouse gas cycling in lakes and reservoirs from in-lake processes to worldwide predictions. GRIL Symposium, 22-24 March, 2018, Orford, QC
 15. **Paquette C**, I Gregory-Eaves, **BE Beisner**. Biogéographie du zooplancton dans l'est du Canada : influence du type d'écozone, des activités humaines et de la prédation. GRIL Symposium 2019, March 2019. Orford, QC.
 16. **Rusak JA**, New (and improved) tools for researching algae in lakes. 2017 Muskoka Stewardship Conference: 50 Shades of Green. 12 May 2017. Port Carling, ON.
 17. **Simmtis B**, Gregory-Eaves I, Antoniades D, **Jeziorski A**, Smol JP, Examining cumulative environmental effects in a shallow lake using midge assemblages

Appendix I: Metrics (continued)

- (Diptera: Nematocera) via paleolimnological techniques. Ontario-Québec Paleolimnology Symposium. 2018. Toronto, ON
18. Soued C, **Kim J**, Reis P, Extent and regulation of CH₄ oxidation in lakes and reservoirs: from landscape to microbes. GRIL Symposium 2019, March 2019. Orford, QC.
 19. **Wight J**, Lang AS, Tahlan K. 2018. Detection and characterization of antibiotic resistant coliforms: What's found in the lakes and ponds around us. Memorial University Biology Graduate Student Symposium, St. John's, NL
 20. **Wight J**, Tahlan K, Lang AS. Antibiotic resistant coliforms: What's found in the lakes and ponds around us. Memorial University BioMedicine Conference 2018, 5-6 July 2018. St. John's, Canada
 21. **Wight, JT**, **Varin M**, Lang AS. 2019. Culturing bacteria during field work: a rugged, highly reliable, and cost-effective method for determining real-time fecal coliform loads in surface waters. Memorial University Biology Graduate Student Symposium, St. John's, Canada

INVITED PRESENTATIONS

National

1. Gregory-Eaves I was an invitee and presenter at the Canada Sustainable Development Goals Solution Network, 7-8 May 2018. Waterloo, Canada
2. Huot Y. The NSERC Canadian Lake Pulse Network. Canadian Conference for fisheries research, 5-8 January 2017. Montreal, Canada (*Plenary*)
3. Huot Y. (2018). Water Indicators via an Open Environmental Web Portal. Thematic Consultation on Open Data and Sustainable Development Goals at Statistics Canada, Ottawa, Canada

Regional

1. **Garner R.**, Gregory-Eaves I., Walsh D. Lake sediment metagenomes as time capsules for preimpact microbiomes. UQAM Midi Aquatique (November 2019)
2. Gregory-Eaves, I. Ecosystems and Global Change group at Cambridge University on May 12 2020 (invited talk via zoom).
3. Gregory-Eaves I, **Griffiths K**, **Paquette C**, **Jeziorski A**, **Baud A**, **Simmatis B**, **Taranu Z**, **Antoniades D**, **Beisner B**, **Hamilton P**, **Legendre P**, and **Smol JP**. 2019. Inférer les changements environnementaux et écologiques du passé à travers le réseau LakePulse. ACFAS, Gatineau, Canada
4. Huot Y. (2018). The NSERC Canadian Lake Pulse Network. 32e Congrès de l'Est du Canada sur la Qualité de l'eau, Sherbrooke, Canada (*Plenary*)
5. Huot Y. (2018). Le Réseau Canadien sur l'état des lacs du Canada. Association des biologistes du Québec, Victoriaville, Canada
6. **Kim J**, **Oliva A**, **Shahabinia A**, **Couture C**. The NSERC Canadian Lake Pulse Network. July 2019. Aurora College, Fort Smith, Canada

Appendix I: Metrics (continued)

8. **Oliva A, Huot Y, Ogden N.** Assessment of microbial contamination related to waterborne diseases in Canadian lakes using Earth observation indicators. UQAM Midi-Aquatique Seminar, September 2019, Montréal, Canada
9. **Oliva A, Cremella B, Tapics T, Potvin G, Juric J, Beaudet J, Huot Y.** Huot Lab: Peering at lakes from space, mapping their health, understanding their dynamics, and bringing them into your living room. UQAM Midi-Aquatique Webinar, March 2020.
10. **Wight J, Tahlan K, Lang AS.** Antibiotic resistant coliforms: What's found in the lakes and ponds around us. Memorial University BioMedicine Conference 2018, St. John's, Canada

SPECIAL SESSIONS AT MEETINGS

International

1. **Fortin St-Gelais N** and **Maranger R** co-chaired a special session at the 2019 ASLO, Planet Water meeting, San Juan Puerto Rico, February, 2019. The session is titled: "Socio-ecological research for actionable sustainable solutions: examples, perspectives and challenges"
2. **Gregory-Eaves I, Griffiths K** and Jenny J co-chaired a special session at the 2018 joint meeting of the International Paleolimnology Association and the International Association of Limnogeology (IPA-IAL) 18-21 June 2018, Stockholm University, Sweden. The session was titled: "Landscape paleolimnology: a powerful approach for examining pressing environmental problems facing lakes at regional and global scales"

WORKSHOPS AT MEETINGS

Regional

1. Astorg L, Guernon S, **Paquette C.** Everything you don't know about plankton. ÉcoLac-GRIL Student Autumn Workshop, November 2017
2. **MacKeigan P** gave a workshop on Paleolimnological Methods at the annual GRIL/Ecolac student meeting, Fall 2018
3. **Oliva A** organized a GIS/remote sensing workshop. ÉcoLac-GRIL Student Autumn Workshop, Fall 2018
4. **Walsh D, McMahon T.** DNA-based approaches in paleolimnology: what new questions can we address, GRIL symposium, 22-24 March 2018, Orford, QC

Appendix I: Metrics (continued)

SCHOLARSHIPS OBTAINED

1. **C. Aulard (PhD, not originally planned in the Network, funded externally)**
 - GRIL cosupervision award for Candice Aulard
2. **A. Baud**
 - NSERC CREATE EcoLac Scholarship
 - FQRNT PhD scholarship
3. **M. Beaulieu (PDF, not originally planned in the Network, funded externally)**
 - FQRNT PDF fellowship
4. **M. de Toledo**
 - NSERC CREATE in Water Security Scholarship
5. **N. Fortin St-Gelais**
 - MITACS PDF scholarship supported by Ouranos
 - FQRNT Postdoctoral scholarship
6. **R. Garner**
 - NSERC CREATE EcoLac Scholarship
 - NSERC MSc Scholarship
 - Bios2 Scholarship for Computational Biology Training
7. **L. Lahens**
 - FRQNT PhD Scholarship (2020)
 - Scholarship for excellence, Gene H. Kruger, La Fondation de l'Université de Sherbrooke (2018)
8. **P. MacKeigan**
 - McGill Trottier Scholarship
 - FRQNT MSc Scholarship
 - NSERC CREATE EcoLac Scholarship
9. **M.-E. Monchamp (PDF, not originally planned in the Network, funded externally)**
 - GRIL-McGill/Liber Ero fellowship in 2019
10. **V. Onana**
 - NSERC CREATE EcoLac Scholarship
11. **C. Paquette**
 - UQAM Faculty of Science Scholarship
12. **J. Wight**
 - Dr. Cater W. and Martha Andrews Memorial Graduate Scholarship in Biology
 - Memorial University School of Graduate Studies Baseline Funding

Non-competitive (awarded to supervisor for trainee)

13. B. Cremella, GRIL (FRQNT) partial scholarship
14. C. Paquette, GRIL (FRQNT) partial scholarship program

Appendix I: Metrics (continued)

HQP AWARDS AND HONOURS

1. V. Fugère

- Early Career Researcher Award, British Ecological Society (Aquatic Group)
- FRQNT 'Rising star' award (Relève étoile Louis-Berlinguet)

2. L. Lahens

- Award of Excellence (Master's level). Saint-Laurent Chapter of the Society for Risk Analysis and the Society of Environmental Toxicology and Chemistry, 2018.
- Travel award. Saint-Laurent Chapter of the Society for Risk Analysis and the Society of Environmental Toxicology and Chemistry, 2018.
- Best poster award. Chemistry and Biochemistry Graduate Research Conference, 2018

3. G. Potvin

- Selected as one of 20 international students to receive full scholarship and board for the 2018 IOCCG Summer lecture series.
- NSERC "Science Action" video competition in 2018, Selected by the public among the top 25 videos, over 1300 views on NSERC YouTube channel.

4. J. Wight

- Best MSc presentation award, 2019 Memorial University Biology Graduate Student Symposium.
- Best MSc presentation award, 2018 Memorial University Biology Graduate Student Symposium.

Appendix J: LakePulse Milestones Yr1 - Yr5

*Progress on the milestones from year 1 to year 5 in the proposal. **Green** cells are milestones that are on track or were achieved on or near the expected date. **Yellow** cells are milestones that will be or were achieved behind schedule but with no expected impact on the Network. **Red** cells are milestones that are behind schedule with either potential or certain impacts on the Network.*

Milestone	Dates planned	Progress
Advertise, interview and hire the Network Manager	2016-08-28	Catherine Brown was hired on Nov. 1, 2016, but is on track with all responsibilities.
Advertise and hold first AGM	2016-09-23	First AGM was held on Nov. 21 and 22, 2017
BOD meeting	2016-09-23	Oct. 31, 2016 (videoconference) Dec. 12, 2016 (face-to-face) Jan. 17, 2017 (videoconference)
Recruit Network RPs to work on database and prepare first field campaign	2016-10-20	Three RPs were hired between Jan. and Feb. 2017
Recruit students involved in first field campaign	2017-05-12	Some students were not recruited and replaced with interns and professionals.
Basic database is running and ready to receive data	2017-02-28	We have a database in place to receive data; it is currently being filled with Yr1 data. This was about a year late, with little or no consequences on the Network progress.
Geomatics analysis for lake sampling in 2017: delineate watersheds; create an index of human impacts; determine lake sizes; accessibility; etc.	2017-09-30	An initial analysis was completed in April 2017. This analysis was done rapidly to allow lake selection; it will be refined with new techniques and data as they become available.
Train sampling teams for first field campaign	2017-06-16	Carried out in the first week of July 2017. This was logistically a better approach.
Yr2 large sampling effort	2017-08-31	Accomplished as planned.
Processing samples from the Yr2 sampling effort	2018-01-01	Mostly completed after some delays.

Appendix J: LakePulse Milestones Yr1 - Yr5 (continued)

Geomatics analysis for Yr3 and Yr4 lakes available in database	2018-09-17	Completed after some delays.
Yr2 data products are available in the Network	2018-06-29	Expected to be reached for most samples, except taxonomy (see above).
IOCCG training class	2018-06-29	We did not hold this class as the organizers preferred to keep the class in its original location. One of our students, Geneviève Potvin, was selected to participate.
Yr2 annual and board member meeting	2017-10-27	The meeting was held a few weeks later to help with attendance.
Training sampling teams Yr2	2018-06-23	Completed one week later
Yr3 sampling effort	2018-08-31	Successful campaign
Yr3 annual and board member meetings joint with GLEON	2018-10-26	Annual meeting was completed but the SC and Board decided not to join it with the GLEON meeting because of logistical issues. Students were offered the possibility of attending the GLEON conference.
Yr3 data products are available to the Network	2019-06-28	Samples have mostly been processed; most required samples are at a preprocessed level. Quality control in ongoing.
Publications from first cohort of students are published	2020-02-01	Although quite a few publications are being prepared, only a few publications have been submitted. This does not reflect a problem with the Network but mostly the decisions made by many projects to wait until all data from the three sampling years are available to submit publications with greater impact.
Participation in first international conferences by students	2019-03-29	Students have started participating in conferences. It is now impossible to travel with Covid-19, but conferences are starting to be held virtually.
Training sampling teams Yr4	2019-06-19	Completed

Appendix J: LakePulse Milestones Yr1 - Yr5 (continued)

Yr4 sampling effort	2019-08-31	Completed successfully.
Processing samples from the Yr4 sampling effort	2020-01-31	This is currently ongoing. Most of the basic data are at a preprocessed level and QC is ongoing.
Yr4 annual and board member meetings	2019-10-30	Completed
Interactive web platform is developed and deployed	2021-06-30	This has started. We expect that we will use the no-cost year, if approved, to continue to work on it; delivery will be delayed to have a more polished and tested portal, including the integration of results.
Yr4 data products are available in the Network	2020-06-28	Upcoming.
Deliverables for mapping provided to database	2021-03-17	Upcoming, but likely on time.
Workshop with EPA National Lake Assessment group	2020-10-27	We have not yet made specific plans and are waiting to see how the situation with the pandemic evolves. This may be moved online.
Yr5 annual and board member meetings	2020-10-30	Upcoming. We are waiting to see how the pandemic evolves for planning. It will likely be moved online. We are starting a monthly webinar series that will accustom participants to an online meeting format.
Interactive website completed for internal commenting	2021-04-17	Upcoming, but expected to take longer to fully prepare.
Partners workshop	2021-05-03	We will likely delay it by about 6 months into the no-cost year to have a more polished and tested portal, including the integration of results.
Website on the health of Canadian lakes announced and online	2021-05-17	Will be delayed by 6 months to a year.

Sampling Daine Lake on the MOST Miserable Day of the Year BY THE BLUE TEAM

(with some apologies to fans of
"Stopping by Woods on a Snowy Evening"
by Robert Frost)

Whose lakes are these? I do not know.
I will have to sample though;
Geneviève won't stop here -
"A day off please?" - but she shouts "No!"

Our mighty truck must find it queer
To stop without lake access near
Between the lake and our gear
- blueberries, forests, swamps - and
The MOST miserable weather of the year.

On days like these we'd like to wake
To loon calls on a "purple lake".
But mosquitoes whine and we weep
For how our rock-hard muscles ache.

This lake is lovely, dark and deep!
But at day's end a Therm-a-Rest seems cheap,
And the freezer beeps, I cannot sleep,
And the freezer beeps, I cannot sleep.

