PROGRAMME DU 30e SYMPOSIUM ANNUEL DU GRIL
PROGRAM OF THE 30TH ANNUAL GRIL SYMPOSIUM

27 mai - 9 juin | May 27 - June 9

GRIL
Groupe de recherche interuniversitaire en limnologie
La science pour l'avenir des écosystèmes d'eau douce

ADRESSE ADMINISTRATIVE DU GRIL

Groupe de recherche interuniversitaire en limnologie (GRIL)
Département de sciences biologiques
Université de Montréal
Campus MIL
C.P. 6128, Succ. Centre-ville
Montréal (Québec) H3C 3J7

Beatrix Beisner
Directrice
Courriel : beisner.beatrix@uqam.ca

Jean-François Lapierre
Directeur adjoint
Courriel : jean-francois.lapierre.1@umontreal.ca

Marie-Andrée Fallu
Coordonnatrice générale et Agente de liaison GRIL
Cellulaire : (819) 699-2353
Courriel : marie-andree.fallu@uqtr.ca

Frédérique Bélanger-Lépine
Coordonnatrice adjointe
Cellulaire : (450) 271-8416
Courriel : frederique.belanger-lepine@umontreal.ca

Site Internet : **www.GRIL-limnologie.ca**
Twitter : **https://twitter.com/gril_limnologie** (**@GRIL-Limnologie**)
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Crédit photographique de la page couverture :
Another beautiful day of fieldwork - Anaïs Oliva (Université de Sherbrooke)
Upper Little Slocan Lake - Juillet 2019

Symposium annuel du GRIL
GRIL Annual Symposium

30e SYMPOSIUM ANNUEL — *30th ANNUAL MEETING*

Programme - *Program*

27 mai au 9 juin 2021 — *May 27th to June 9th 2021*

En ligne :

Gather Town & Zoom

Université de Montréal
Université du Québec à Montréal
Université du Québec à Trois-Rivières
Université McGill
Université Concordia
INRS-ETE
Université de Sherbrooke
Université du Québec à Chicoutimi
Université Laval
Université du Québec en Outaouais

GRIL | Groupe de recherche interuniversitaire en limnologie
La science pour l'avenir des écosystèmes d'eau douce

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Comité organisateur / *Organizing Committee*

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Jérémy de Bonville, Université de Montréal
Mathilde Salamon, Université du Québec à Montréal
Cécilia Teillet, Université du Québec à Trois-Rivières
Geneviève D'Avignon, Université McGill
Rebecca Garner, Université Concordia
Thomas Pacoureau, INRS-ETE

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Frédérique Bélanger-Lépine, Coordonnatrice adjointe
Pierre-Olivier Benoit, Coordonnateur scientifique (jusqu'au 30 avril 2021)

Nous remercions la précieuse collaboration de dernière minute de :
Marie-Ève Monchamp, postdoctorante McGill-GRIL
Audréanne Loiselle, étudiante à l'Université de Montréal
Joëlle Lafond, étudiante à l'Université de Montréal
Et du **RIVE** pour l'emprunt de **Chantal Fournier**, professionnelle (UQTR)

De la goutte d'eau au fleuve
Comprendre, anticiper, réhabiliter
Centre de recherche sur les interactions bassins versants - écosystèmes aquatiques (RIVE)

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Université Laval
Dermot Antoniades
Raoul-Marie Couture
Claude Lavoie
Monique Poulin

Université du Québec en Outaouais
Katrine Turgeon

En bleu/in blue : nouveaux/new 2019-2020
En vert/in green : nouveaux/new 2020-2021

Membres chercheurs collaborateurs au Québec / *Collaborating researcher members in Québec*

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Marie-Hélène Laprise

Centre d'expertise en analyse environnementale du Québec, Ministère de l'Environnement et de la Lutte contre les changements climatiques
Mélanie Desrosiers
Vani Mohit

Environnement et Changement climatique Canada
Christiane Hudon
Zofia Taranu

Jardin botanique et Université de Montréal
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Ministère des Forêts, de la Faune et des Parcs
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Monique Poulin

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Richard Carignan
Timothée Poisot
Jacques Brisson
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Catherine Girard

Université du Québec à Montréal
Hélène Glémet

Université du Québec en Abitibi-Témiscamingue
Guillaume Grosbois

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Rowan Barrett
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Cary Institute of Ecosystem Studies
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John Chételat

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University of Western Australia
Anas Ghadouani

Uppsala University
Lars Tranvik

En vert/in green : nouveaux/new 2020-2021

HORAIRE / *SCHEDULE*

Jeudi 27 mai au Mercredi 9 juin / *Thursday, May 27th* until Wednesday, June 9th

En tout temps sur la plateforme Gather Town : présentations courtes de 180 secondes disponibles en ligne / *Anytime in the Gather Town platform: short 180-second presentations available online*

Jeudi 3 juin / *Thursday, June 3rd*

15:00-17:00 **Happy hour virtuel! / *Virtual Happy hour!***

15:00 **Les participants et participantes des présentations courtes répondront à vos questions sur la plateforme Gather Town! / *The participants of the short presentations will answer your questions on the Gather Town platform!***

16:00 **Animation par le Comité étudiant / *Animation by the student committee***

17:00 **Fin du Happy hour virtuel! / *End of the virtual Happy hour!***

Mardi 8 juin / *Tuesday, June 8th*

8:30 **Mot de bienvenue / *Word of welcome***
Beatrix Beisner, Directrice du GRIL / *Director of the GRIL*

8:45 **Conférencier invité / Guest speaker:**
Daniel Hering, Université de Duisbourg et Essen (Allemagne)
Relationships of multiple stressors and biological responses in freshwaters: Impact, scales and mechanisms

9:45 **Mini pause / *Mini break***

9:50 **Nouveaux membres du GRIL / *New GRIL members*** (modératrice : Beatrix Beisner)

Vincent Fugère (UQTR)
Biodiversité des eaux douces en milieu agricole: une perspective éco-évolutive

Catherine Girard (UQAC)
Connectivité microbienne accrue dans l'Arctique en réchauffement

Michelle Garneau (UQAM)
Présenté par Antonin Prijac (Laure Gandois, Michelle Garneau, Laurent Jeanneau, Pierre Taillardat)
Dissolved organic matter as an indicator of processes at the interface between terrestrial and aquatic ecosystems in a boreal peatland

Raoul-Marie Couture (Université Laval)
Présenté par Wessam Neweshy (Marie Demers, Dolors Planas, Elisabeth Tellier, Raoul-Marie Couture)
Geochemical mechanisms controlling internal phosphorus loading in a lanthanum-remediated eutrophic lake

10:40 **Pause / *Break***

11:00 **Présentations orales / *Oral presentations*** (modératrice : Irene Gregory-Eaves)

Laboratoire Riccardi : Geneviève D'Avignon, Suncica Avlijas, Victoria Chicatun, Christophe Benjamin, Noémie Sheppard, Jessamine Trueman, Heather Reid, Alex Crew, Anthony Ricciardi
Des espèces envahissantes aux microplastiques : comprendre comment les écosystèmes aquatiques réagissent à la pollution chimique et biologique / *From invasive species to microplastics: Understanding how aquatic ecosystems respond to chemical and biological pollution*

Laboratoire Beisner : Gillian Martin, Vincent Fugère, Beatrix Beisner
Multi-taxonomic diversity varies across the Canadian landscape

Laboratoire Binning : Joëlle Guitard, Emmanuelle Chrétien, Jérémy De Bonville, Daniel Boisclair, Sandra A. Binning
L'augmentation de la charge parasitaire est associée à des taux métaboliques et une réponse de fuite réduits chez le poisson hôte, *Lepomis gibbosus*

Laboratoire Laurion : Thomas Pacoureau, Isabelle Laurion, Milla Rautio
Influence of DOM quality and nutrients on microbial metabolism in ponds of the Canadian Arctic

Mot de l'équipe de coordination du GRIL / *Word from the GRIL coordination team* :
Marie-Andrée Fallu et **Frédérique Bélanger-Lépine**

Présentation du nouveau Comité étudiant du GRIL / *Presentation of the new Student Committee*

12:00 **Première photo de groupe sur Zoom / *First group photo on Zoom***

12:05 **Dîner / *Lunch***

13:30 **Présentations orales / *Oral presentations*** (modérateur : Jean-François Lapierre)

Laboratoire Rautio : Pénélope Blackburn-Desbiens, Guillaume Grosbois, Michael Power, Milla Rautio
Hydrological connectivity and zooplankton biodiversity in freshwater lakes on southern Victoria Island, Nunavut, Arctic Canada

Laboratoire Boisclair : Emmanuelle Chrétien, Daniel Boisclair, Steve Cooke, Shaun Killen
Effets de l'environnement social et de la présence de refuge sur le métabolisme des poissons

Laboratoire Bertolo : Fan Qin, Maxime Leclerc, Marc Amyot, Andrea Bertolo
Grazer-mediated methylmercury and inorganic mercury regeneration in freshwater

Laboratoire Prairie : Jihyeon Kim, Yves Prairie, Sara Mercier-Blais, Yudhistir Reddy, Gabriel Bastien Beaudet
Combining physical modeling with empirical data for more robust limnological prediction and interpretation

14:20 **Pause / *Break***

14:30 **Rendez-vous sur Gather Town pour visiter les présentations en 180 secondes et poser vos questions aux présentateurs et présentatrices! / *Head over the Gather Town to view the 180-second presentations and ask questions to participants!***

16:00 **Fin de la journée / *End of the day***

Mercredi 9 juin / *Wednesday, June 9th*

8:30 **Mot de bienvenue / *Word of welcome***
Beatrix Beisner, Directrice du GRIL / *Director of the GRIL*

8:45 **Conférencière invitée / Guest speaker:**
Bailey McMeans, Université de Toronto (Canada)
Tracing temporally dynamic energy flows: combining biotracers to understand the individual to ecosystem level responses to seasonal variation

9:45 **Mini pause / *Mini break***

9:50 **Présentations orales / *Oral presentations*** (modératrice : Pascale Biron)

Laboratoire del Giorgio : Candice Aulard, Sofia Balinia, Pedro Barbosa, Pascal Bodmer, Mathilde Couturier, Gabriel Duran, Paul del Giorgio, Sabrina Gignac Brassard, Michaela Melo, Alice Parkes, Mariana Peifer, Bianca Rodriguez-Cardona, Felipe Rust, Amir Shahabibi, Masumi Stadler, Caroline Fink-Mercier
Overview of current research projects of the CarBBAS group at the UQAM

Laboratoire Pellerin : Audréanne Loiselle, Stéphanie Pellerin, Raphaël Proulx, Marie Larocque
Résilience des milieux humides de bord de lac aux changements de niveau d'eau

Laboratoire Guillemette : Jim Félix-Faure, Roxanne Giguère-Tremblay, Mathieu Michaud, Roxane St-Pierre, Steven Tessier, François Guillemette
Impacts des pratiques agricoles sur la production à la base du réseau trophique aquatique et les flux de carbone dans la plaine d'inondation du Lac Saint-Pierre

Laboratoire Walsh : Vera E. Onana, Susanne A. Kraemer, Rebecca E. Garner, Beatrix E. Beisner, David A. Walsh
Deciphering bacterial diversity patterns in temperate lakes at a continental scale

10:40 **Pause / *Break***

11:00 **Présentations orales / *Oral presentations*** (modérateur : Marco A. Rodríguez)

Laboratoire Gregory-Eaves : Paul MacKeigan, Beatrix Beisner, Zofia Taranu, Frances Pick, Irene Gregory-Eaves
Modelling cyanobacteria distribution across hundreds of temperate and subarctic lakes

Laboratoire Rosabal : Julien Labrie, Karen Lagueux, Mike Palmer, John Chételat, Marc Amyot, Maikel Rosabal
Gestion intracellulaire d'éléments traces métalliques (Ag, As, Cd, Ce, La, Sb) chez *Hyalella azteca* récoltées dans la région de Yellowknife

Laboratoire Comte : Charis Wong, Christophe Langevin, Jerome Comte, Martial Leroy, Emily Hallett, Marie-Ange Moisan, Laura Malbezin, Nicholas Kiulia
Écologie des communautés microbiennes dans les écosystèmes aquatiques en transition

Laboratoire Proulx : Jérôme Barbeau
Réponse d'évitement aux sons anthropiques par les poissons d'eau douce

Laboratoire Shapiro : Naíla Barbosa da Costa, Vincent Fugère, Marie-Pier Hébert, Gregor Fussmann, Andrew Gonzalez, Jesse Shapiro
Glyphosate pollution increases antimicrobial resistance gene frequencies in aquatic mesocosms

12:00	**Deuxième photo de groupe sur Zoom / *Second group photo on Zoom***
12:05	**Dîner / *Lunch***
13:30	**Présentations orales / *Oral presentations*** (modérateur : Jérôme Comte)
	Laboratoire Turgeon : Brenden Chabot *How and where exotic species change the Canadian Great Lakes wetlands biodiversity*
	Laboratoire Lazar : Karine Villeneuve Présentation du laboratoire d'écologie microbienne Lazar
	Laboratoire Chokmani : Claudie Ratté-Fortin, Karem Chokmani, Isabelle Laurion *A regional model to estimate conditional probability density of phytoplankton bloom occurrence*
	Remise des prix du GRIL et mot de la fin! / GRIL awards and closing remarks!
14:30	**Fin du 30e Symposium du GRIL / *End of the 30th Annual GRIL Symposium***

LISTE DES PRÉSENTATIONS COURTES DE 180 SECONDES / *LIST OF SHORT 180-SECOND PRESENTATIONS*

1 - Shahin Badesab, Vincent Fugère, Corentin Flionis, Andrea Bertolo
Impact of land use on zooplankton resting stages banks in a large river floodplain

2 - Pedro Barbosa, Felipe Rust, Pascal Bodmer, Paul del Giorgio
The influence of pelagic metabolism on CO2 dynamics in 3 young boreal cascade-reservoirs (La Romaine complex, Québec)

3 - Alexandre Baud, John Smol, Pierre Francus, Irene Gregory-Eaves
Eastern-Canadian spatio temporal analysis of lake sediment geochemical change: recent declines in heavy metals observed across several ecozones

4 - Christophe Benjamin, Jaclyn Hill, Anthony Ricciardi
*Optimal sampling protocols for capturing tench (*Tinca tinca*) in St. Lawrence River wetlands*

5 - Henry Beral
Impacts des espèces végétales sur la performance de biorétentions en climat froid

6 - Pascal Bodmer, Pedro M. Barbosa, Felipe Rust, Paul A. del Giorgio
Spatial dependence of gas transfer velocity in reservoirs: implications for diffusive flux estimates

7 - Giancarlo Cesarello, Isabelle Lavoie, Beatrix Beisner, Sonja Behmel
An innovative approach to assess future scenarios of ecological integrity of lakes based on a watershed wide analysis of multiple factors in the context of climate change

8 - Maya Chahine, Rebecca Garner, David Walsh
Exploring Fungal Diversity in Canadian Lakes

9 - Tania Couture, Pascale Biron
To what extent can the Morphological Quality Index (MQI) be used as a reliable predictor for fish biotic integrity in agricultural streams?

10 - Mathilde Couturier, Yves T. Prairie, Andrew M. Paterson, Erik JS Emilson, Paul del Giorgio
Long term trends in pCO2 in lakes following rebrowning trends in south-central Ontario from 1980 to 2017

11 - Bruno Cremella, Beatrix Beisner, Sylvia Bonilla, Yannick Huot
Characterization of water column niches and ecozone dominance of lake phytoplankton through the subtropical – tundra gradient in North America

12 - Michaela de Melo, Paul del Giorgio
Unraveling the metabolic balance of boreal rivers

13 - Emmanuel Dubois, Marie Larocque, Sylvain Gagné
Simulation of long-term regional-scale groundwater recharge in cold and humid climates – impacts of climate change from the past to the future

14 - Jérémy Dupont, Virginie Ricard-Henderson, Myriam Fontaine, Carolanne Penny, Maikel Rosabal
Évaluation de la contamination d'éléments traces métalliques dans des écosystèmes lacustres de Sudbury (ON) et Rouyn-Noranda (QC) à l'aide d'une espèce sentinelle (perchaude)

15 - Gabriel Duran
Aquatic-Terrestrial Carbon Fluxes and Carbon Budget of a Boreal Lake in Quebec

16 - Kyleisha Foote, April Mansfield, James Grant, Pascale Biron
Synthesizing our salmonid abundance and habitat knowledge: A global database

17 – Jean-Christophe Gagnon, Louis Astorg, Alison Derry, Cassandre Lazar
Réponse des communautés microbiennes face au syndrome de salinisation des eaux douces

18 - Rebecca Garner, Susanne Kraemer, Vera Onana, Irene Gregory-Eaves, David Walsh
A first view of protist diversity across hundreds of freshwater lakes spanning a temperate to subarctic gradient

19 - Benjamin Groult
Processus écologiques influençant la distribution des bactéries, archées et eucaryotes dans les aquifères

20 - James Harris, Marie Larocque, Sylvain Gagné, Simon Lavoie Lavallée
Simulation of a Canadian Shield lake hydrosystem and its vulnerability to climate change

21 - Robert Hechler, Melania Cristescu
Using environmental RNA (eRNA) to investigate the transcriptomic response of heat stressed Daphnia pulex

22 - Egor Katkov, Gregor Fussmann
Applying Green Science to Mesocosm Research

23 - Henriikka Kivilä, Jean-Simon Boulianne, Milla Rautio
High primary production in late-season ice of a boreal lake

24 - Maude Lachapelle, Zofia Taranu, Irene Gregory-Eaves
Effect of contaminants across contemporary and historical aquatic food webs structures; how environmental gradients act upon bioaccumulation and biomagnification pathways

25 - Joëlle Lafond, Bernard Angers
Détermination sexuelle chez les hybrides : un nouveau rôle pour les spermatozoïdes?

26 - Christophe Langevin, Jérôme Comte, Vani Mohit
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Biofilms algaux et microplastiques : accumulation et transfert dans les réseaux alimentaires fluviaux

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Exploring potential carbon sinks in Quebec: is the carbon balance negative during the growing season for the Isle-Verte salt marsh (Saint Lawrence estuary)?

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Biodiversité dans les bassins de rétention d'eau pluviale urbains : étude de la diversité et de la composition des communautés avec une approche multi-taxonomique

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Potentiel d'utilisation de larves de *Chaoborus* en tant qu'espèce sentinelle pour les éléments de terres rares des lacs de deux régions minières canadiennes (Sudbury, Ontario; Rouyn-Noranda, Québec)

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Nutrient dynamics in La Romaine river and reservoir complex

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Investigating local adaptation to calcium concentration as a refuge to invasive predator impact in native gastropods within a dynamic river ecosystem

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Dissolved organic carbon across Canadian lakes: Concentration and Optical properties

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RÉSUMÉS DES CONFÉRENCES / *CONFERENCE ABSTRACT*
Mardi 8 juin – *Tuesday, June 8th*

Mardi 8:45 – *Tuesday 8:45 AM*

Conférencier invité / *Guest speaker*

Daniel Hering[1]

[1]University of Duisburg-Essen, Department of Aquatic Ecology, D-45117 Essen

Email: Daniel.hering@uni-due.de

Relationships of multiple stressors and biological responses in freshwaters: Impact, scales and mechanisms

European freshwater ecosystems are commonly exposed to multiple stressors, with diffuse pollution and hydromorphological degradation being most frequent. The interaction of stressors in affecting lake and river biota is poorly understood, and it is currently not possible to predict under which circumstances stressors will interact.

A concept on the mechanisms of how multiple stressors affect freshwater biota will be presented.

We analysed original data from European lakes and rivers covering 180 mesocosm experiments, basinand cross-basin studies in which two stressors and a biological response variable were investigated. The biological response to paired stressors was analysed by generalised linear regression to partial out the effects of the individual stressors and their interaction term. The total explanatory power (R2) of our models decreased with scale for both lakes and rivers, but the partial R2 of interaction (relative to the total R2, for cases with significant interaction term) did not differ between scales. This observation underlines that the interaction strength between stressors stays similar, irrespective of confounding factors related to scale. In lakes, the effects of eutrophication usually exceeded those of the second stressor (e.g. warming), while a heterogeneous pattern was observed for rivers with the effects of eutrophication depending on the specific stressor combination and biological response. This result vindicates the prioritisation of eutrophication in lake restoration, while highlighting that for rivers more individual management choices are required. The suitability of management measures applicable to multiply stressed waterbodies is discussed and several restoration examples of European water bodies will be presented.

Mardi 9h50 - *Tuesday 9:50 AM*

Nouveau membre GRIL / New GRIL member

Vincent Fugère[1]

[1]Université du Québec à Trois-Rivières, Québec, Canada

Biodiversité des eaux douces en milieu agricole: une perspective éco-évolutive

Je profiterai de cette présentation de nouveau membre pour faire un survol de mes orientations de recherche. Mes travaux portent généralement sur les effets de l'expansion et de l'intensification agricoles sur la biodiversité des eaux douces, une problématique que j'aborde en combinant des expériences en milieu naturel ou semi-naturel, de la synthèse de données et de l'échantillonnage de cours d'eau le long de gradients d'utilisation du territoire. Je présenterai des études qui s'intéressent aux réponses à l'échelle de la communauté (tri d'espèces et changements dans plusieurs dimensions ou "facettes" de la biodiversité), puis d'autres études qui s'intéressent plutôt à l'évolution contemporaine et à la variation intraspécifique induite par la pollution agricole. Je conclurai en parlant brièvement de nouveaux projets initiés depuis mon entrée en poste à l'UQTR en 2020, soit des projets qui portent, sans surprise, sur le Lac Saint-Pierre!

Mardi 10h02 - *Tuesday 10:02 AM*

Nouveau membre GRIL / New GRIL member

Catherine Girard[1, 2, 3]

[1]UQAC

[2]GRIL

[3]CEN

Connectivité microbienne accrue dans l'Arctique en réchauffement

Le réchauffement rapide de l'Arctique a des conséquences sur l'ensemble des écosystèmes nordiques, incluant la fonte des habitats gelés de la cryosphère (glaciers, pergélisol, glace de mer et de lac, neige), dont le volume total est estimé à plus de 33 millions de kilomètres d'eau gelée. La dégradation de la cryosphère a des conséquences à l'échelle planétaire bien documentées (comme l'augmentation du niveau de la mer), mais elle a aussi des conséquences locales moins étudiées : en effet, la fonte des glaces alimente un réseau hydrologique de plus en plus connecté, et pourrait donc transformer les écosystèmes d'eau douce en aval et les organismes qui s'y trouvent. Par ailleurs, la fonte permet la libération des microorganismes qui s'y trouvent : en effet, les environnements gelés regorgent d'une diversité surprenante de microorganismes adaptés à leurs habitats extrêmes, qui pourraient transformer les milieux récepteurs des eaux de fonte en aval. Dans cette conférence, je présenterai le nouveau laboratoire sur l'écologie microbienne de la cryosphère de l'UQAC, à l'aide d'un cas de figure venant de deux lacs de l'extrême Arctique. Je présenterai les conditions structurant les communautés microbiennes articques, en suivant plus particulièrement un genre de bactérie psychrophiles, pour démontrer l'importance de mieux comprendre les microorganismes de la cryosphère et les effets locaux des changements climatiques.

Mardi 10h14 - *Tuesday 10:14 AM*

Nouveau membre GRIL / New GRIL member

Michelle Garneau

Présenté par Antonin Prijac[1, 2, 3],
Laure Gandois[4], Michelle Garneau[1, 2, 5], Laurent Jeanneau[6], Pierre Taillardat[7]
[1]GRIL, UQAM, [2]GÉOTOP, UQAM, [3]Institut des Sciences de l'Environnement, UQAM,
[4]Laboratoire Écologie Fonctionnelle et Environnement, Université de Toulouse, CNRS, Toulouse, France,
[5]Département de Géographie, UQAM,
[6]UMR 6118 Géosciences Rennes, Univ. de Rennes 1–CNRS, Rennes, France,
[7]National University of Singapore

Dissolved organic matter as an indicator of processes at the interface between terrestrial and aquatic ecosystems in a boreal peatland

DOM (dissolved organic matter) in pools play an important role in the peatland carbon (C) cycle by representing a potential source of C to the atmosphere. Pools are typical microforms of boreal peatlands but remain poorly documented, especially in terms of the origin, composition and degradability of their DOM.

The objective of the research realized in a boreal peatland within the Romaine River watershed (Minganie, Quebec) is to: 1) describe the spatial-temporal variability of DOM in the peatland interstitial water (IW) and pools and 2) document processes that explain this variability. A combination of isotopic, optical, elemental and molecular analyses and DOM incubations were performed on samples taken from both environments during two growing seasons.

The results show higher concentrations of dissolved organic carbon (DOC) in IW than in pools, as well as a seasonal increase in these concentrations more important in IW (*2.5) compared to pools (*1.7). Elemental, molecular and optical markers show a distinct composition of DOM in both environments. Although plant-derived DOM is dominant in both environments, higher molecular weight compounds are analyzed in IW. On the other hand, a contribution of microbial DOM and a greater degradation of lignin phenols are identified in pools. Despite these differences in composition, a similar degradability of DOM is measured for both environments.

This study highlights the dynamics of peatland DOM. DOM is mainly produced in IW, linked with vegetation, and is partly transferred to pools, where it undergoes more microbial transformations compared to IW.

Mardi 10h26 - *Tuesday 10:29 AM*

Nouveau membre GRIL / New GRIL member

Raoul-Marie Couture

Présenté par Wessam Neweshy[1],
Marie Demers[1], Dolors Planas[2], Elisabeth Tellier[3], Raoul-Marie Couture[1, 4]
[1]Chaire de recherche Sentinelle Nord en géochimique des milieux aquatiques, Département de chimie, Université Laval, Québec, Canada
[2]Université du Québec à Montréal et Groupe de recherche interuniversitaire en limnologie
[3]Action de Conservation du Bassin Versant du Lac Bromont
[4]Takuvik Joint International Laboratory ULaval-CNRS

Geochemical mechanisms controlling internal phosphorus loading in a lanthanum-remediated eutrophic lake

Sustained eutrophication of aquatic environment by remobilization of legacy P stored in the sediment is a worldwide issue. In that context, abatement measures via bottom water treatment or sediment remediation have been shown to successfully complement catchment management approaches [1]. Here, we present a case study of the eutrophied Lac Bromont, which underwent remediation treatment using lanthanummodified bentonite (LMB). We investigated the effectiveness of LMB in decreasing soluble reactive phosphorus (SRP) availability in sediments and in reducing dissolved fluxes of P across the sediment-water interface. Sediment cores were retrieved before and after LMB treatment, to measure P speciation using sequential extractions. Porewater P, Fe, dissolved organic matter (DOC), and La profiles were obtained after treatment at three sites. Results indicate that SRP extracted from the sediments decreased at all sites, while total P bound to redox-sensitive Fe oxides increased. Results show that P mobility is coupled to La or Fe depending on the site. Modeling confirms that a LaPO4(S) mineral phases are likely forming (i.e., rhabdophane and/or monazite [2], but suggests that La3+ binding by DOC hinder its precipitation [3]. Finally, 31P NMR reveals that 30-50% of total solid-phase P is in an organic form, susceptible to be released via microbial degradation.

[1] Jilbert, T., et al., Hydrobiologia, 2020. 847(21): p. 4343-4357.
[2] Dithmer, L., et al., Environmental Science & Technology, 2015. 49(7): p. 4559-4566.
[3] Marsac, R., et al., Geology, 2021. 567: p. 120099.

Mardi 11h00 - *Tuesday 11:00 AM*

Laboratoire Riccardi / *Riccardi Laboratory*

Des espèces envahissantes aux microplastiques : comprendre comment les écosystèmes aquatiques réagissent à la pollution chimique et biologique

Geneviève D'Avignon[1], Suncica Avlijas[1], Victoria Chicatun[1], Alex Crew[1], Jessamine Trueman[1], Heather Reid[1], Christophe Benjamin[1] and Anthony Ricciardi[2]

[1] Département de Biologie, Université McGill

[2] Redpath Museum & Bieler School of Environment, McGill Univeristy

Le laboratoire Ricciardi explore l'impact des espèces envahissantes, des changements climatiques et de la pollution microplastique sur les communautés aquatiques du fleuve Saint-Laurent. Notre principal objectif de recherche est de développer une compréhension prédictive des invasions. Nos études mené le long du gradient physico-chimique naturel du fleuve démontrent que la chimie de l'eau limite la distribution et l'impact des animaux Ponto-Caspiens envahissants dont la moule zébrée, la moule quagga et le gobie à tache noire. Nous appliquons maintenant une nouvelle approche expérimentale (les réponses fonctionnelles comparatives) pour prédire comment les changements climatiques affecteront le risque d'invasion par les poissons et écrevisses envahissants. Nous surveillons également l'expansion récente de la population de tanche, un poisson eurasien,dans la rivière et menons des expériences en mésocosme afin d'évaluer ces effets concurrentiels sur les espèces en péril comme les chevaliers.

En 2013, nous avons découvert des microbilles de polyéthylène réparties sur une section de 320 km du lit du fleuve Saint-Laurent à des concentrations locales allant jusqu'à 100 à 1 000 par litre. Cette découverte a inspiré une législation fédérale visant à interdire les microbilles des produits de soins personnels. Nous étudions les sources, la distribution et le sort des microplastiques dans la rivière et ses réseaux trophiques.

En résumé, notre laboratoire cherche à améliorer l'évaluation des risques liés aux facteurs de stress anthropiques, afin que les gestionnaires puissent prioriser plus efficacement les menaces émergentes.

From invasive species to microplastics: Understanding how aquatic ecosystems respond to chemical and biological pollution

The Ricciardi Lab explores how aquatic communities are affected by invasive species, climate change and microplastic pollution, using the St. Lawrence River as an outdoor laboratory. A major research objective is to develop a predictive understanding of invasions. Surveys and experiments across a natural conductivity gradient in the river showed that water chemistry limits the distribution and impact of invasive Ponto-Caspian animals, including the zebra mussel, quagga mussel, and round goby. We are now applying a novel experimental approach (comparative functional responses) to predict how climate change will affect the invasion success and impact of fishes and crayfishes in the Great Lakes-St. Lawrence River system. We are also monitoring the recent population expansion of a Eurasian fish (Tench) in the river and conducting mesocosm experiments to test its competitive impacts on species-at-risk such as redhorse.

In 2013, we discovered polyethylene microbeads distributed across a 320-km section of the Saint Lawrence River bed in local concentrations as high as 100s to 1000s per liter. This discovery inspired federal legislation to ban microbeads from personal care products. We are investigating the source, fate and distribution of microplastics in the river, and our results have indicated that invasive mussels play a major role in capturing and transferring microplastics through food webs.

Ultimately, our lab seeks to enhance risk assessments of anthropogenic stressors, so that managers can more effectively prioritize emerging threats in freshwater ecosystems.

Mardi 11h12 - *Tuesday 11:12 AM*

Laboratoire Beisner / *Beisner Laboratory*

Multi-taxonomic diversity varies across the Canadian landscape

Gillian Martin[1], Vincent Fugère[2], Beatrix Beisner[1]
[1]UQÀM
[2]UQTR

Canadian lakes are facing a period of unprecedented change. In order to better predict how human impact will affect lake ecosystems, it is vital to understand whether all trophic groups present within a lake will respond similarity to perturbation. We hypothesize that Canadian lakes that support high diversity, support high diversity across all four taxonomic groups studied (bacteria, phytoplankton, crustacean zooplankton, and fish). Using a measure of multi-taxonomic diversity we analysed variation in multi-trophic diversity within 560 Canadian lakes in response to variation in environment, spatial structure, and degree of human impact. We found that while bacteria, phytoplankton, and crustacean zooplankton community diversity were strongly correlated, fish community diversity was not correlated with the diversity within any of the other taxonomic groups. Variables primarily associated with light and water temperature were most important for supporting high multi-taxonomic diversity within a lake, while urbanization had a strong negative effect. In addition, lakes that supported high alpha diversity across all taxonomic groups were frequently not significant contributors to local beta diversity, suggesting that lakes with low alpha diversity make unique contributions to Canadian freshwater biodiversity.

Mardi 11h24 - *Tuesday 11:24 AM*

Laboratoire Binning / *Binning Laboratory*

L'augmentation de la charge parasitaire est associée à des taux métaboliques et une réponse de fuite réduits chez le poisson hôte, *Lepomis gibbosus*

Joëlle Guitard[1], Emmanuelle Chrétien[1], Jérémy De Bonville[1], Daniel Boisclair[1], Sandra A. Binning[1]
[1]Département de sciences biologiques, Université de Montréal

Les animaux sauvages sont soumis à des infections par les parasites qui peuvent compromettre leurs performances physiologiques et/ou comportementales. Pourtant, la mesure dans laquelle la charge parasitaire est liée à la variation intra-individuelle des traits de performance au sein des populations sauvages reste relativement inexplorée. Nous avons utilisé le crapet-soleil (*Lepomis gibbosus*) et ses endoparasites comme système modèle pour explorer les effets de l'intensité de l'infection sur les performances métaboliques et de fuite de ces individus. Les traits métaboliques (taux métaboliques standard et maximum, capacité aérobique) et la réponse de fuite ont été mesurés chez ces poissons à travers un gradient d'infection par des endoparasite visible (trématodes causant la maladie du points noir) et non-visible (cestodes et trématodes internes quantifiés post-mortem). Nous avons constaté que des charges d'infection plus élevées sont liées à des taux métaboliques standard et maximal inférieurs chez les poissons et ce à travers un gradient d'infection par les endoparasites non-visible, mais pas à travers un gradient visible par la maladie du point noir. La charge d'infection par les endoparasites non-visibles était également liée à une diminution de la réactivité à une attaque aérienne simulée. Nos résultats suggèrent que l'infection par des parasites qui ne sont pas immédiatement apparent pour les chercheurs peuvent conclure en une variation intra-spécifique pour les performances physiologiques et comportementales des populations sauvages. Nous sommes d'avis qu'il importe d'aborder et de tenir compte des infections naturelles dans les études liées à la performance et à l'écologie des populations à l'état sauvage.

Mardi 11h36 - *Tuesday 11:36 AM*

Laboratoire Laurion / *Laurion Laboratory*

Influence of DOM quality and nutrients on microbial metabolism in ponds of the Canadian Arctic

Thomas Pacoureau[1], Isabelle Laurion[1], Milla Rautio[2]
[1]Centre Eau Terre Environnement, INRS
[2]Département des sciences fondamentales, UQAC

Ponds forming on ice-rich permafrost play a key role in the biogeochemistry of Arctic regions. As permafrost thaws and erodes, carbon is transferred to freshwaters in the form of dissolved organic matter (DOM), where it is processed by aquatic microbes. However, the rate and efficiency at which microbes process this DOM may vary between ponds due to local conditions (e.g. temperature, mixing regime, light, oxygen and nutrients) and the nature of DOM (influenced by thermokarstic erosion, autochthonous production, seasonal inputs and historical degradation). A series of ponds were sampled between 2016 and 2019 in a glacier valley of Bylot Island (Nunavut, Canada) in the continuous permafrost region. In 2018, different aspects of bacterial metabolism were considered: bacterial respiration rate (measured as oxygen consumption over 24 hours and converted to CO2 using respiratory quotients from parallel incubations), biomass production rate (estimated with tritiated leucine, 2h assays), and carbon use efficiency (CUE), an estimation of the quantity of bacterial biomass produced per unit of organic carbon substrate incorporated calculated from the first two parameters. Results are currently being processed. We aim to determine which DOM properties are mainly regulating CUE in the studied ponds, which represent the gradient of conditions on polygonal landscapes facing climate warming and permafrost thawing.

Mardi 13h30 - *Tuesday 1:30 PM*

Laboratoire Rautio / *Rautio Laboratory*

Hydrological connectivity and zooplankton biodiversity in freshwater lakes on southern Victoria Island, Nunavut, Arctic Canada

Pénélope Blackburn-Desbiens[1], Guillaume Grosbois[2], Michael Power[3], Milla Rautio[1]
[1]Sciences fondamentales, UQAC
[2]Département de Biologie, UQAT
[3]Biology, University of Waterloo

Significant warming conditions have been reported in the Arctic for the past few decades. This vast territory contains numerous lakes and with increased warming and consequent changes in hydrological connectivity, the ecology of many of these water bodies will be impacted. We sampled 35 lakes for zooplankton abundance, community structure and production in Cambridge Bay, Nunavut (690 07'00.71N; 105003'34.85''W) during the summers of 2018 and 2019. Based on satellite imagery, we further estimated changes in hydrological connectivity (appearance/disappearance of water bodies, changes in surface area and connectivity) from 1989 to 2019. The water bodies ranged from hydrologically isolated lakes and headwater lakes to highly inter-connected lakes receiving water from 1 to 765 upstream lakes. We observed no changes in the water body number in the last 30 years. A total of 82 zooplankton species were found (60 rotifers, 10 copepods and 12 cladocerans). Zooplankton community structure was different between isolated and connected lakes but also among connected lakes so that the lakes closer to each other were more similar than the lakes with a greater distance between them. Isolated water bodies had more than 18 unique species and connected lakes had the highest zooplankton abundance. Further, isolated water bodies were hotspots for zooplankton productivity. Our study provides important baseline information for Arctic zooplankton communities that have an essential role in Arctic freshwater landscapes.

Mardi 13h42 - *Tuesday 1:42 PM*

Laboratoire Boisclair / *Boisclair Laboratory*

Effets de l'environnement social et de la présence de refuge sur le métabolisme des poissons

Emmanuelle Chrétien[1], Daniel Boisclair[1], Steve Cooke[2], Shaun Killen[3]
[1]Université de Montréal
[2]Carleton University
[3]University of Glasgow

La sélection des habitats est liée à la performance des organismes. D'une part, les limites physiologiques d'un organisme peuvent dicter leur sélection d'habitats. D'autre part, les conditions physiques et les interactions biotiques dans les habitats peuvent avoir des conséquences physiologiques. En outre, l'environnement social peut moduler les liens entre la sélection des habitats et la physiologie des organismes. L'objectif de cette étude était de quantifier et de comparer les effets de l'environnement social et de la présence de refuges sur le métabolisme des ménés communs *Phoxinus phoxinus*. Notre design expérimental consistait en une expérience sociale de 3 semaines précédée et suivie par des expériences de respirométrie. Durant l'expérience sociale, les poissons étaient gardés en densités de 4 ou 8 poissons dans des aquariums qui contenaient un refuge (plante aquatique) ou non. La répétition des expériences de respirométrie permettait de mesurer le changement des taux métaboliques dus à l'expérience sociale. En présence de refuge, les taux métaboliques étaient moins élevés avant et après l'expérience sociale. Nous avons également observé une augmentation des taux métaboliques après l'expérience sociale, surtout chez les poissons gardés en densité faible, mais pas d'effet de la présence de refuge dans les aquariums. Nos résultats démontrent que la taille des groupes peut influencer les dépenses énergétiques des individus, ce qui souligne l'importance de comprendre le rôle des dynamiques sociales sur les variations dans les traits métaboliques.

Mardi 13h54 - *Tuesday 1:54 PM*

Laboratoire Bertolo / *Bertolo Laboratory*

Grazer-mediated methylmercury and inorganic mercury regeneration in freshwater

Fan Qin[1], Maxime Leclerc[2], Marc Amyot[2], Andrea Bertolo[1]
[1]Département des sciences de l'environnement, Université du Québec à Trois-Rivières
[2]Département de sciences biologiques, Université de Montréal

Whereas it is well established that zooplankton can transfer various pollutants such as Hg from primary producer to higher trophic levels, we have poor knowledge about the effects of inefficient feeding (i.e. sloppy feeding) and/or assimilation (i.e. excretion/egestion) on the efficiency of this trophic transfer. Here, we tested experimentally the impact of zooplankton grazing efficiency on metal concentrations in freshwater. We focused on inorganic Hg and methylmercury (MeHg) concentrations in water by using isotopically labeled algae with stable Hg isotopes (200HgCl2, Me198HgCl) in a controlled experiment. We also explored the potential effects of grazing on other elements by analyzing main ions and rare earth elements. To highlight the role of feeding behavior, we compared a filter-feeder (*Daphnia*) to a grasper-feeder zooplankton taxon (calanoid copepods), with the latter being expected to cause more sloppy feeding than the former. Whereas the concentration of dissolved MeHg was not affected by grazers, our results show that both zooplankton taxa significantly influenced the concentrations of the particulate phase of both inorganic Hg and MeHg. In contrast, only *Daphnia* significantly increased the concentration of dissolved inorganic Hg. We also observed short-term (i.e. 30 min) effects of both zooplankton taxa on SO42-, Fe, Zn, and REE concentrations, whereas, for Cu and Ce (a REE), zooplankton effects were found during the complete duration of the experiment. Our study demonstrated the recycling of Hg between primary producer and consumer and highlighted a new source of inorganic Hg and MeHg in the water column for trophic transfer in freshwater ecosystems.

Mardi 14h06 - *Tuesday 2:06 PM*

Laboratoire Prairie / *Prairie Laboratory*

Combining physical modeling with empirical data for more robust limnological prediction and interpretation

Jihyeon Kim[1], Yves Prairie[1], Sara Mercier-Blais[1], Yudhistir Reddy[1], Gabriel Bastien Beaudet[1]
[1]Department of Biological Sciences, UQAM

The acquisition of biogeochemical and biological data from aquatic systems is nearly always limited either in space (few sites or few systems), in time (short temporal coverage) or both. While spatial or temporal interpolation techniques can be applied to such data, their underlying assumptions (linear or otherwise) often overly simplifies the underlying patterns by ignoring the physical constraints on the processes. In this presentation, we introduce multiple examples to illustrate how physical modeling can be coupled with empirical data with fill the gaps of fragmentary fieldwork. First, we bridge multi-lake snapshot sampling program and long-term high-frequency samplings by using a Pan-Canadian carbon data. Second, to globally assess how climate modulates CH4 emissions in reservoirs, we coupled a biogeochemical model with an existing physical framework to predict future water-column profiles of temperature and biogenic gases (CO2, CH4, and O2) across different climate zones. Third, CH4 often accumulates in the hypolimnion of lakes over the summer months. Here, we combined a physical model with a CH4 oxidation model to quantify the fraction of the accumulated CH4 that gets either oxidized or emitted to the atmosphere during the fall turnover. Lastly, we use a physical modeling approach to improve water temperature profile predictions which in turn can be used to estimate, in combination with basic meteorological data, open-water evaporation from lake surfaces. Overall, we expect this approach to improve our use of the limited data and provide more robust prediction and interpretation of biogenic gas processing and water footprint in inland aquatic systems.

Mercredi 8h45 - *Wednesday 8:45 AM*

Conférencière invitée - ***Guest speaker***

Bailey McMeans[1]

[1]University of Toronto Mississauga, Department of Biology, 3359 Mississauga Rd, Mississauga, ON :5L 1C6
Email: bailey.mcmeans@utoronto.ca

Tracing temporally dynamic energy flows: combining biotracers to understand the individual to ecosystem level responses to seasonal variation

Aquatic ecosystems are inherently dynamic. The physical environment and biological landscape vary drastically from year to year and with the changing seasons. Polar and temperate lakes, for example, experience dramatic declines in temperature and light from open water to ice-covered winter periods. This inherent variation means aquatic organisms likely employ a diversity of physiological coping strategies, while obtaining energy from a variety of temporally dynamic sources. As a result, biotic interactions within aquatic communities and food webs likely change through time, with important implications for biodiversity maintenance and whole ecosystem functioning. However, tracing energy flows through time is logistically challenging, and food webs are still largely perceived as static in nature. This is problematic because sustaining aquatic ecosystems in a rapidly changing world demands knowledge of how complex ecological systems respond to natural and anthropogenic variation through time. Current and emerging biotracers provide a powerful approach to studying dynamic ecological processes through both space and time. I will present findings from several research projects that demonstrate the application of biotracers in seasonally ice-covered aquatic environments. Importantly, because each biotracer has its own assumptions and limitations, combining evidence from multiple biotracers allows for multiple, repeated lines of evidence into the dynamic ecological processes that underpin aquatic ecosystem functioning in a variable world.

Mercredi 9h50 - *Wednesday 9:50 AM*

Laboratoire del Giorgio / *del Giorgio Laboratory*

Overview of current research projects of the CarBBAS group at the UQAM

Candice Aulard[1], Sofia Balinia[2], Pedro Barbosa[1], Pascal Bodmer[1], Mathilde Couturier[1], Gabriel Duran[1], Paul del Giorgio[1], Sabrina Gignac Brassard[1], Michaela Melo[1], Alice Parkes[1], Mariana Peifer[1], Bianca Rodriguez-Cardona[1], Felipe Rust[1], Amir Shahabibi[1], Masumi Stadler[1], Caroline Fink-Mercier[1]
[1]UQAM
[2]Universidad de Buenos Aires

The CarBBAS group at the UQAM carries out research at the interface between aquatic biogeochemistry, ecosystem science and microbial ecology. Over the past years the group has carried out extensive comparative studies across the boreal biome of Québec and beyond, exploring large scale patterns in aquatic greenhouse gas dynamics, C burial, transport and processing, as well as of microbial biogeography and function. Current projects include linking regional water dynamics to biogeochemical patterns in lakes and rivers in watersheds across Québec and Ontario, determining the contribution of beaver habitats to the landscape C balance in Abitibi, quantifying the patterns of C and material export of rivers to the Eastern James Bay, and determining long term patterns of acidification recovery, browning and potential links to CO2dynamics in lakes across Eastern Canada. Our participation in the Lake Pulse allowed us to greatly expand the geographic scope of our work, with pan-Canadian studies of lake C burial, ecosystem metabolism and patterns in dissolved organic matter. Collaborations allow us to carry out comparative studies in shallow lakes and reservoirs in Argentina. Our group has also developed an interest in reconstructing the movement of water, microbes and materials within single boreal watersheds, and has focused its efforts in La Romaine River located on the Côte Nord. This watershed is also the site for the largest hydroelectric development in North America, and our group has been working since 2015 to determine the C footprint of the 4 major hydroelectric reservoirs that were constructed there.

Mercredi 10h02 - *Wednesday 10:02 AM*

Laboratoire Pellerin / *Pellerin Laboratory*

Résilience des milieux humides de bord de lac aux changements de niveau d'eau

Audréanne Loiselle[1], Stéphanie Pellerin[1], Raphaël Proulx[2], Marie Larocque[3]
[1]Sciences biologiques, Université de Montréal
[2]Sciences de l'environnement, Université du Québec à Trois-Rivières
[3]Sciences de la terre et de l'atmosphère, Université du Québec à Montréal

Loin d'être de simples écotones entre les milieux terrestres et aquatiques, les milieux humides lacustres sont des écosystèmes diversifiés, soutenant une vaste gamme de fonctions et services écologiques. Leur classification est fortement influencée par les caractéristiques hydrogéomorphologiques du paysage, les rendant particulièrement vulnérables aux changements climatiques et d'utilisation du territoire. Dans le sud du Québec, une hausse de la température et des précipitation annuelles sont attendues. Couplée à l'intensification des activités agricoles et de coupe forestière, ces changements pourraient avoir d'importants impacts sur l'hydrologie des lacs. Une variation du niveau d'eau pourrait affecter non seulement la typologie des milieux humides lacustres, mais aussi leur superficie totale, entraînant d'importantes modification des fonctions et services écologiques rendus par ces écosystèmes. Bien que de tels impacts aient été étudiés sur les Grands Lacs et sur des lacs fluviaux (lac Saint-Pierre, lac Saint-Louis), aucune étude ne s'est intéressée aux systèmes de plus petite taille.

L'objectif principal du projet présenté est donc d'identifier les principaux prédicteurs hydrogéomorphologiques de la typologie des milieux humides lacustres afin d'estimer les impacts potentiels de variations du niveau d'eau causées par les changements climatiques et d'utilisation du territoire. Pour se faire, des données sur la végétation et 12 prédicteurs hydrogéomorphologiques ont été compilées afin de caractériser trois types de milieux humides lacustres. Un modèle *random forest* a ensuite été développé afin de simuler les impacts de différents scénarios de changement du niveau d'eau sur la typologie et la superficie des milieux humides lacustres. Les résultats de ces analyses seront présentés.

Mercredi 10h14 - *Wednesday 10:14 AM*

Laboratoire Guillemette / *Guillemette Laboratory*

Impacts des pratiques agricoles sur la production à la base du réseau trophique aquatique et les flux de carbone dans la plaine d'inondation du Lac Saint-Pierre

Jim Félix-Faure[1], Roxanne Giguère-Tremblay[1], Mathieu Michaud[1], Roxane St-Pierre[1], Steven Tessier[1], François Guillemette[1]

[1]Centre de Recherche sur les Interactions Bassins Versants – Écosystèmes aquatiques (RIVE), UQTR

Dans le contexte de la zone d'inondation de récurrence 0-2 ans du Lac Saint-Pierre, réserve de la biosphère de l'UNESCO, notre laboratoire développe plusieurs projets de recherche afin d'étudier l'impact des pratiques agricoles et des projets de restauration sur la productivité aquatique en plaine inondable. Collectivement, ces projets visent à: i) étudier l'impact des différentes pratiques agricoles et projets de restauration sur la biodiversité des microorganismes pouvant altérer certaines fonctions écologiques clés de la plaine d'inondation (ex. recyclage de nutriments, méthanotrophie); ii) étudier la capacité des producteurs à la base du réseau trophique aquatique à soutenir les organismes supérieurs (ex. invertébrés, larves de poisson) à l'aide d'une approche isotopique; iii) quantifier les flux et les sources de carbone soutenant l'activité microbienne et la production de gaz à effet de serre autant durant l'inondation que pendant la saison de végétation; iv) de quantifier la séquestration de carbone du sol dans les zones inondables de récurrence 0-2 ans et l'émission nette de méthane le long d'un gradient d'utilisation des terres. Ces projets s'inscrivent dans la mission du Pôle d'expertise du Lac Saint-Pierre (UQTR/McGill/Laval) visant à proposer une stratégie d'intervention dans la zone littorale favorisant la mise en place d'une agriculture durable, adaptée et respectueuse de l'écosystème du lac Saint-Pierre et soutenant la restauration de milieux prioritaires.

Mercredi 10h26 - *Wednesday 10:26 AM*

Laboratoire Walsh / *Walsh Laboratory*

Deciphering bacterial diversity patterns in temperate lakes at a continental scale

Vera E. Onana[1], Susanne A. Kraemer[1], Rebecca E. Garner[1], Beatrix E. Beisner[2], David A. Walsh[1]
[1]Biology Department, Concordia University
[2]Department of Biological Sciences, Université du Québec à Montréal

The mapping of diversity patterns and species distributions is crucial for understanding the ecological and evolutionary processes shaping contemporary biodiversity. Microorganisms are critical components of ecosystems, yet their biodiversity patterns and the processes that give rise to them are not as well described as for macroorganisms, particularly at large spatial scale. In this study, we investigated bacterial diversity and distributions across Canadian lakes at the continental scale. We generated a 16S rRNA amplicon dataset encompassing 615 lakes situated in twelve ecozones. The lake dataset also captured variations in watershed land use types and intensities (e.g. agriculture and urbanization). We identified a broad-scale west to east gradient in taxonomic richness and phylogenetic diversity. The longitude associated with the Rocky Mountains appeared to be a divide between lower diversity western lakes and higher diversity eastern lakes. In addition, a latitudinal decrease in diversity was apparent, while temperature, pH and lake colour were the environmental variables most correlated to diversity shifts. Human land use within lake watersheds had little observable effect on diversity. Assessment of community composition showed that the nutrient-rich lakes of the Prairies, where agricultural intensity is high, harboured exceptionally distinct bacterial communities compared to lakes in other Canadian regions. In total, these results are beginning to shed light on the complexity of lake bacterial communities across Canada. Further work will investigate how dispersal and environmental conditions, including human land use, influence bacterial taxonomic and functional trait distribution using metagenomic approaches.

Mercredi 11h00 - *Wednesday 11:00 AM*

Laboratoire Gregory-Eaves / *Gregory-Eaves Laboratory*

Modelling cyanobacteria distribution across hundreds of temperate and subarctic lakes

Paul MacKeigan[1], Beatrix Beisner[2], Zofia Taranu[3], Frances Pick[4], Irene Gregory-Eaves[1]
[1]Department of Biology, McGill University
[2]Department of Biological Sciences, University of Québec at Montréal
[3]Environment and Climate Change Canada
[4]Department of Biology, University of Ottawa

Predictive cyanobacteria models are broadly applied tools for lake management. Although the conditions favoring cyanobacteria dominance are well established, blooms are becoming more frequent yet dynamic in many places around the world. Canada is home to a rich abundance and diversity of lakes, but until recently there was no systematic national sampling program or complementary analyses to identify cyanobacterial occurrences and drivers. To address this gap, we developed a unique dataset within the Canadian Lake Pulse Network - a collaborative initiative investigating the structure and functioning of Canadian lakes - to improve our understanding of cyanobacterial biomass distribution and to identify the multiple factors that promote their dominance. Using this ~650-lake dataset, we applied a dual-modelling approach consisting of random forests (RF) to identify the most influential variables and generalized linear models (GLM) to quantify the relative importance of over two dozen physical-chemical, land-use, climate, and zooplankton drivers. The highest biomasses of cyanobacteria were recorded in the Prairies and Boreal plains ecozones, where *Aphanizomenon* and *Microcystis* dominated. Our most parsimonious models identified total phosphorus, total nitrogen, zooplankton biomass and percent agriculture in the watershed as the top predictors, as well as ecozone as a significant random variable. Overall, our preliminary results show that cyanobacteria dominance is highly variable across our vast network of Canadian lakes and that predictors also vary among regions.

Mercredi 11h12 - *Wednesday 11:12 AM*

Laboratoire Rosabal / *Rosabal Laboratory*

Gestion intracellulaire d'éléments traces métalliques (Ag, As, Cd, Ce, La, Sb) chez *Hyalella azteca* récoltées dans la région de Yellowknife

Julien Labrie[1], Karen Lagueux[1], Mike Palmer[2], John Chételat[3], Marc Amyot[4], Maikel Rosabal[1]
[1]Département des sciences biologiques, Université du Québec à Montréal (UQAM)
[2]Department of Geography and Environmental Studies, Carleton University
[3]Environment and Climate Change Canada National Wildlife Research Centre, Carleton University campus
[4]Département de sciences biologiques, Université de Montréal

Plusieurs décennies d'activités minières dans la région de Yellowknife ont libéré une quantité considérable d'éléments traces métalliques (ETM), en particulier l'arsenic et l'antimoine, dans les systèmes aquatiques environnants. Ces métaux peuvent être par la suite bioaccumulés par les organismes aquatiques et ainsi provoquer des effets néfastes. Afin de déterminer le devenir intracellulaire de plusieurs ETM (Ag, As, Cd, Ce, La, Sb), le fractionnement subcellulaire s'avère un outil intéressant pour évaluer le potentiel toxique de ces contaminants. Afin d'évaluer la distribution subcellulaire, des mesures de ces ETM ont été effectuées sur des fractions subcellulaires isolées des amphipodes *Hyalella azteca* échantillonnés dans la région de Yellowknife. Pour ce faire, un protocole a été adapté aux amphipodes en évaluant plusieurs stratégies d'homogénéisation et vitesses de centrifugation à l'aide de tests enzymatiques spécifiques à des fractions. Nos résultats démontrent un rôle prédominant de la fraction « granules + exosquelette » dans la séquestration de métaux où le pourcentage du métal total trouvé dans cette fraction (Ag : 27 ± 6%; As : 22 ± 9%; Ce: 75 ± 12%; Sb: 31 ± 8%; La: 66 ± 17%) est généralement supérieur à celui des autres fractions subcellulaires. Dans le cas du Cd, le pourcentage représenté par la fraction des protéines thermorésistantes est le plus dominant (30 ± 31%). De plus, l'accumulation de métaux dans la fraction mitochondriale occupe une deuxième place en importance pour l'Ag (12 ± 6%), le Ce (10 ± 7%), le La (13 ± 7%) et le Sb (14 ± 11%). Ces données permettront d'élargir nos connaissances sur le devenir de ces contaminants chez des organismes aquatiques.

Laboratoire Comte / *Comte Laboratory*

Aperçue des projets en cours au laboratoire Comte sur l'Écologie des communautés microbiennes dans les écosystèmes aquatiques en transition

Christophe Langevin[1], Charis Wong[1], Martial Leroy[1], Emily Hallett[1], Marie-Ange Moisan[1], Laura Malbezin[1], Nicholas Kiulia[1], Jerome Comte[1]
[1]INRS-ÉTÉ

L'objectif principal du programme de recherche du professeur Comte est d'identifier les mécanismes de réponses des communautés microbiennes aux perturbations environnementales et d'évaluer leurs implications dans la structure, la fonction et les services des écosystèmes aquatiques. Plusieurs projets touchent directement les intérêts de la population comme la caractérisation de la qualité chimique et biologique de l'eau potable au sein des communautés nordiques ou l'utilisation du séquençage comme outil de suivi ministériel de la qualité des eaux des lacs ou l'utilisation des aquifères comme source naturelle de refroidissement pour les bâtiments urbains.

Dans l'Arctique, le dégel du pergélisol est une des conséquences du réchauffement climatique. Plusieurs projets étudient l'impact de ce phénomène, notamment : comment le microbiome des lacs arctiques, leurs propriétés émergentes et fonctionnement clefs sont affectés par l'augmentation de la matière organique dissoute en provenance du paysage terrestre environnant, l'importance de la connectivité terrestre-aquatique sur l'émission de GES dans les étangs de dégel le long d'un gradient latitudinal de dégradation du permafrost et, l'implication du brunissement sur la qualité de l'eau potable.

D'autres études caractérisent la variation temporelle et spatiale du phytoplancton dans les lacs méridionaux; les effets des pesticides sur la composition taxonomique et fonctionnelle des biofilms en rivière; et l'implication d'un système d'eau souterraine comme pompe thermique sur la géochimie et les communautés microbiennes dans l'aquifère.

Ces études permettront de mieux comprendre comment les microorganismes réagissent aux perturbations environnementales et pourront être utilisées pour éclairer les décisions et développer des stratégies assurant une gestion durable des écosystèmes.

Overview of current projects of Comte group on the Ecology of microbial communities in aquatic ecosystems in transition

The main objective of Professor Comte's research program is to identify the response mechanisms of microbial communities to environmental disturbances and to assess their implications for the structure, function, and services of aquatic ecosystems. Several projects directly address population concerns such as the characterization of the chemical and biological quality of drinking water in northern communities or the use of sequencing as a new tool in ministerial monitoring of lake water quality or the use of aquifers as a natural source of cooling for urban buildings.

In the Artic, permafrost thawing is one of the manifestations of a warming climate. There are currently several projects investigating the impact of this phenomenon including how the Arctic Lake microbiome, their emergent properties and important functioning are being affected by the increase in dissolved organic matter from the surrounding terrestrial landscape, the importance of the terrestrial-aquatic connectivity on greenhouse gas emission in thaw ponds along a latitudinal gradient of permafrost degradation and, the implication of browning on the drinking water quality.

Other studies include the characterization of the temporal and spatial variation in phytoplankton in meridional lakes; the effects of pesticides on the taxonomic and functional composition of river biofilm microorganisms; and implication of groundwater heat pump system on the groundwater geochemistry and microbial communities in the aquifer.

All these studies will provide insights into how microorganisms respond to environmental disturbance and can further be utilised to inform decisions and develop strategies ensuring sustainable management of the aquatic ecosystem.

Mercredi 11h36 - *Wednesday 11:36 AM*

Laboratoire Proulx / *Proulx Laboratory*

Réponse d'évitement aux sons anthropiques par les poissons d'eau douce

Jérôme Barbeau[1]

[1]Département des sciences de l'environnement, Université du Québec à Trois-Rivières

Les activités anthropiques ont modifié les paysages acoustiques naturels en y ajoutant des sources sonores. Jusqu'à maintenant, les connaissances au niveau de l'impact des sons anthropiques sur les organismes aquatiques demeurent fragmentaires. Pourtant, le son demeure un facteur important pour les poissons dont le système auditif est bien développé. L'étude avait pour objectif d'évaluer le comportement d'évitement des poissons d'eau douce à un son anthropique dans un système naturel et à l'échelle d'une communauté. Les étapes préalables étaient d'acquérir une bonne compréhension des adaptations auditives qui déterminent la sensibilité auditive des poissons et, par conséquent, leur réponse aux sons ainsi que du paysage acoustique auxquels les poissons sont soumis. 109 seuils auditifs de poisson ont été obtenus à partir d'audiogrammes publiés. 41 séquences sonores ambiantes et 98 séquences sonores anthropiques ont été enregistrées dans différents écosystèmes d'eau douce. Finalement, une expérience d'évitement a été menée avec des engins de capture sur les poissons en générant localement un son anthropique sur un lac d'eau douce. Les taux de capture et la taille des captures ont été comparés par famille entre les traitements sonores ambiants et anthropiques. Nos résultats révèlent que les sons anthropiques interfèrent avec l'audition des poissons et engendrent systématiquement un effet d'évitement chez les familles de poisson ayant une adaptation auditive. La tendance observée suggère que la réponse comportementale serait reliée à l'affiliation phylogénétique des poissons.

Mercredi 11h48 - *Wednesday 11:48 AM*

Laboratoire Shapiro / *Shapiro Laboratory*

Glyphosate pollution increases antimicrobial resistance gene frequencies in aquatic mesocosms

Naíla Barbosa da Costa[1], Vincent Fugère[2], Marie-Pier Hébert[3], Gregor Fussmann[3], Andrew Gonzalez[3], Jesse Shapiro[1, 3]
[1]UdeM
[2]UQTR
[3]McGill

Glyphosate is the active ingredient of Roundup, one of the most commonly used herbicides worldwide. Freshwater resources close to agricultural fields are often contaminated by traces of glyphosate which may affect microbial communities by selecting glyphosate-resistant species. We hypothesized that selection for glyphosate resistance could also indirectly select for antimicrobial resistance. Such cross-resistance could occur if the same genes (*e.g.* encoding efflux-pumps) confer resistance to both glyphosate and antimicrobials. To test this hypothesis, 1000L freshwater mesocosms at the Large Experimental Array of Ponds were treated with different concentrations of glyphosate in two nutrient backgrounds, and water samples were filtered at 11 timepoints for DNA extraction and shotgun metagenomic sequencing. Genomes were reconstructed and annotated for the presence of known antimicrobial resistance genes (ARGs) and resistance mutations in the enzyme targeted by glyphosate (EPSPS). We found that high doses of glyphosate resulted in increased frequencies of ARGs, and about half of the genomes identified with ARGs had a glyphosate-sensitive EPSPS, suggesting that they may use cross-resistance mechanisms to persist in the presence of the herbicide. Together, these results show how glyphosate contamination of freshwaters can have the undesirable consequence of selecting for antimicrobial resistance.

Mercredi 13h30 - *Wednesday 1:30 PM*

Laboratoire Turgeon / *Turgeon Laboratory*

How and where exotic species change the Canadian Great Lakes wetlands biodiversity

Brenden Chabot[1]

[1]Biology, Université du Québec à Outaouais

Coastal wetlands play crucial ecological, economic and social roles that stem from their rich biodiversity. They provide essential habitat for a large variety of species, mitigate climate change and offer coastal protection and water purification. However, the Great Lakes (GL) wetlands are being degraded at an alarming rate due to anthropogenic stressors, climate change and invasive species. Exotic and invasive plant species are particularly problematic, and are suggested to be responsible for many ecosystem changes in the GL. An up-to-date analysis of the current distribution of wetland species[KT1] is now of critical need. Working with the Great Lakes Protection Initiative (GLPI), this study examines the current biodiversity and distribution of plant species along the Canadian GL wetlands' hydrosere. We used an impressive dataset collected by Environment and Climate Change Canada during the summer of 2018-2019. This dataset includes 26 sites and more than 8500 quadrats across five GL. We adopted a multiscale approach to perform alpha-, beta-, and gamma-diversity analysis of this dataset. We showed that the northern lakes (Superior and Huron) are richer, more diverse and less invaded by exotic species than the southern lakes. The southern lakes (Erie and Ontario) are strongly human-impacted by showing a lower richness, a high cover in exotics and a more homogenous plant community. We also showed that the emergent marsh vegetation community is the most impacted along the hydrosere. This study offers an opportunity to develop a conceptual framework to assist wetland managers in their conservation and restoration efforts.

Mercredi 13h42 - *Wednesday 1:42 PM*

Laboratoire Lazar / *Lazar Laboratory*

Présentation du laboratoire d'écologie microbienne Lazar

Karine Villeneuve[1]
[1]Biologie, UQAM

Les aquifères sont des réservoirs d'eau souterraine et la majorité de l'eau douce liquide mondiale est contenue dans ces systèmes. L'eau souterraine provient de l'écoulement de l'eau des zones de recharge en surface à travers les interstices des particules de roches et de sol. Bien que peu propices à l'établissement de la vie, ces habitats souterrains renferment une grande diversité de microorganismes appartenant à chacun des trois grands domaines du vivant. Les organismes qui ont su s'adapter à ce milieu, y jouent un rôle fondamental et sont impliqués dans les cycles biogéochimiques s'y déroulant. Cependant, la nature souterraine de ces habitats en a longtemps limité l'étude et l'on commence à peine à entrevoir l'étendue de la diversité d'espèces et de métabolismes qui s'y trouve. Les recherches menées dans le laboratoire de la docteure Cassandre Lazar se concentrent sur ces milieux et visent à identifier les facteurs influençant les microorganismes présents dans ces écosystèmes. Cette présentation résume des travaux de recherches récents s'intéressant, entres autres, aux fluctuations temporelles des communautés microbiennes, aux phénomènes écologiques expliquant la distribution biogéographique des microorganismes, et finalement, à l'effet de la profondeur sur la diversité des procaryotes sessiles et planctoniques.

Présentation du laboratoire d'écologie microbienne Lazar

Aquifers are underground body of rocks or sediments that hold water which infiltrated from the surface through porous spaces and fracture in the ground. The water collected underground in those systems is the largest source of available fresh water on Earth. While the dark and energetically challenging conditions of the intraterrestrial ecosystems may seem unfitted for life, those hidden habitats are actually home to a diverse community of microorganisms originating from all three domains of life. These organisms play a crucial role in these environments and are drivers of many biogeochemical cycles. However, past studies focused on these environments are limited considering the below-ground location of the habitats. Therefor we've only had a glimpse of the full diversity of microorganisms and metabolisms thriving underneath our feet. The research carried out in the laboratory of doctor Cassandre Lazar focuses on these ecosystems in order to understand drivers of microbial diversity in aquifers. This presentation will summarize some on-going research examining different factors, such as time, ecological processes involved in biogeographic distribution and the effect of depth on sessile and planktonic microorganism.

Mercredi 13h54 - *Wednesday 1:54 PM*

Laboratoire Chokmani / *Chokmani Laboratory*

A regional model to estimate conditional probability density of phytoplankton bloom occurrence

Claudie Ratté-Fortin[1], Karem Chokmani[1], Isabelle Laurion[1]
[1]INRS

Despite significant socioeconomic and environmental costs related to phytoplankton blooms, particularly when they are dominated by cyanobacteria, stakeholders are rather from a culture of reaction than one of prevention. Monitoring and modeling tools are focal points to consider in developing rigorous and comprehensive procedures for bloom management. However, the several climatic, physiographic and morphologic drivers involved in bloom phenology can create complex spatiotemporal patterns in biomass and composition, making monitoring and forecasting difficult. This complexity also limits the capacity of process-based algorithms in modelling the phenomenon with an adequate accuracy.

We present a novel model to estimate conditional density of natural events based on environmental covariates. We applied the model to estimate the conditional density of phytoplankton bloom frequency based on physiography and climate descriptors of the lake watersheds. The goal was to provide a tool to project future scenarios of bloom phenology in response to climate change and anthropogenic developments, and to test the efficiency of mitigating approaches.

Simulations conducted for different climatic and physiographic scenarios on the watershed of Lake Brome showed an increase in bloom frequency by 65 % over the horizon 2080-2100. The model also allowed to evaluate *a posteriori* scenarios of environmental disturbances, such as agriculture or settlement land use increase on the watershed, and their effects on bloom phenology. Results clearly indicate how physiographic and climatic disturbances affect bloom frequency. For example, results suggest that lakes that have already reached a high level of eutrophication might respond the least to rising pressures from land-cover changes.

RÉSUMÉS DES PRÉSENTATIONS COURTES DE 180 SECONDES / *SHORT 180-SECOND PRESENTATIONS ABSTRACTS*

1 - *Impact of land use on zooplankton resting stages banks in a large river floodplain*

Shahin Badesab[1], Vincent Fugère[1], Corentin Flionis[1], Andrea Bertolo [1]
[1]UQTR

Floodplains, despite their transient dynamics, are key habitats for zooplankton and could harbor significant amounts of their resting stages. Here, we analysed the impact of land use on these propagule banks. To reach this objective, we compared different types of agricultural agroecosystems to natural environments (forest & grassland) at four different locations in the Lake Saint-Pierre floodplain. At each site, we characterized the zooplankton egg bank (size and composition) through an experimental approach (hatching in controlled environment). We hypothesize that there will be lower abundance and species diversity of zooplankton that will hatch from propagule banks from agricultural soils as opposed to natural habitats. We expect that these negative effects of agriculture should be weaker at sites with ameliorated than conventional agricultural practices. Our preliminary results show that all the different zooplankton groups recorded were affected by the land use gradient. The total zooplankton abundance showed a decreasing trend with the land use gradient with forest harboring significantly more zooplankton than the other treatments (except for new grasslands). Significant impact of land use treatments was also observed on the community composition and abundance of zooplankton groups, with natural environments and grasslands being represented by more diverse groups and higher abundances than that of agricultural soils.

2 - *The influence of pelagic metabolism on CO2 dynamics in 3 young boreal cascade-reservoirs (La Romaine complex, Québec)*

Pedro Barbosa[1], Felipe Rust[1], Pascal Bodmer[1], Paul del Giorgio[1]
[1]UQAM

Reservoirs have been considered net sources of biogenic gases to the atmosphere, part of this carbon excess being associated to the decomposition of terrestrial OM from surrounding soils and vegetation. The balance between ecosystem primary production and ecosystem respiration, together with inputs of soil derived CO2 and carbon burial will define if a reservoir is a net source or a net sink of carbon. Ecosystem metabolism is known to play a key-role in CO2 dynamics and emissions in a variety of aquatic environments, including reservoirs, but the magnitude of this contribution has seldomly been addressed, especially in higher latitudes. Here we propose to use oxygen isotopes and concentrations to measure gross primary production (GPP), respiration (R) and the resulting net ecosystem production (NEP) in a series of young cascade-reservoirs in Northern Quebec and estimate how much of the observed CO2 emissions can be attributed to metabolism. We further compared the metabolic rates from the reservoirs with those from the main river, its tributaries, and surrounding lakes. There was a high degree of variability in metabolic rates both within and between reservoirs, and in time. Most measured sites, however, had net heterotrophic metabolism, and ambient CO2 concentrations were negatively related to the magnitude of NEP, suggesting an influence of aquatic metabolism on CO2 fluxes. NEP explained between 25 and 90% of the observed CO2 emissions, the latter occurring during autumn turnover. These results highlight the important role played by aquatic metabolism on the carbon balance of Northern reservoirs.

3 - ***Eastern-Canadian spatio temporal analysis of lake sediment geochemical change: recent declines in heavy metals observed across several ecozones***

Alexandre Baud[1], John Smol[2], Pierre Francus[3], Irene Gregory-Eaves[1]
[1]McGill University, [2]Queen's University, [3]INRS

Since the inception of the Industrial Revolution, the chemical cycling of numerous elements has been fundamentally altered. Continuous sediment cores from 37 Eastern Canadian lakes belonging to 4 different ecozones were analyzed to quantify their trajectories of geochemical change since ~1880 AD. Cores were dated with 210Pb and analyzed using high-resolution CT and micro X-ray fluorescence (ITRAX) instruments. We also calibrated the ITRAX data with independent ICP-MS and AES and found strong coherence. Using Principal Component Analysis, we identified that elements commonly associated with erosion (strontium and titanium), lake productivity (Rayleigh Incoherence:Coherence), local pollution (nickel and zinc) and atmospherically-transported pollution (lead) were key variables structuring the within and among-lake variations since 1880 AD. Calcium was identified as an additional variable, particularly for lakes in the Mixedwood Plains (MWP), which may be linked to catchment activities including the application as a fertilizer. Lakes of the MWP generally displayed greater overall change than lakes set in other ecozones, but little directional changes. However, lakes from the three other ecozones (Boreal Shield, Atlantic Highlands and Atlantic Maritimes) showed a general direction towards an increase in atmospherically deposited metals around 1960 AD, with many of these lakes displaying a “departure and return” type of trajectory. These results show that controls of atmospheric pollutants in North America appear to have been effective across a large area of the continent.

4 - ***Optimal sampling protocols for capturing tench (Tinca tinca) in St. Lawrence River wetlands***

Christophe Benjamin[1], Jaclyn Hill[2], Anthony Ricciardi[1]
[1]McGill University, [2]Institut Maurice-Lamontagne, MPO

Effective management of invasive species requires efficient sampling protocols, otherwise invasive species may be detected too late to prevent establishment or their abundance may be underestimated. The tench, an Eurasian cyprinid fish introduced to Quebec in the 1980s, has been notoriously difficult to capture, despite their increasing occurrence in the by-catch of commercial fisheries. Our study aimed to determine the best conditions and scientific gear type for capturing tench in wetlands, by comparing four techniques commonly used by fish biologists: gillnets, fyke nets, electrofishing and seining. At two sites in the Sorel Archipelago, where a tench population is well established, we sampled day and night over 12 days in the summer 2020, and recorded environmental conditions during each sampling event. Data were modeled using a Poisson GLM and ecologically relevant predictors. Time of day had no effect on tench captures except when using gillnets, in which a positively correlation with day sampling was marginally significant ($P=0.08$). The fyke nets model was highly significant ($P<0.0001$) with fish species richness in the nets as a predictor, whereas electrofishing and seining had nonsignificant results owing to low captures. The correlation between tench captures and fish species richness in fyke nets suggests tench occurrence was greatest in micro-habitats favored by other species. The gillnet data raise questions concerning tench daily activity regimes, as the species is widely assumed to be most active at night. A comparison of labor expenditures for the different gears will be used to evaluate their respective operational efficiency.

5 - Impacts des espèces végétales sur la performance de biorétentions en climat froid

Henry Beral[1, 2, 3]
[1]Institut de recherche en biologie végétale (IRBV)
[2]Département de sciences biologiques
[3]Université de Montréal (UdeM)

Les villes et leurs surfaces imperméables sont en perpétuelle augmentation, augmentant avec elles les volumes d'eaux pluviales à gérer. Lors de son ruissellement dans l'environnement urbain l'eau se charge en contaminants divers, qui lorsque rejetée sans traitement, contamine le milieu naturel. Les biorétentions sont capables d'améliorer les bilans, les flux, et la qualité des eaux urbaines grâce à des processus mécaniques, chimiques et biologiques opérant dans ce filtre planté à flux vertical. Cette phytotechnologie qui fait l'objet de ma thèse tend à se démocratiser, bien que son efficacité reste encore mal connue dans les climats froids alors qu'il pourrait impacter les processus impliqués dans son efficacité.

Les objectifs de ma thèse sont de comparer l'efficacité (qualité et bilan hydrique) de biorétentions dans des régions climatiques froides, plantées par différentes espèces couramment utilisées en Amérique du Nord.

Pour répondre aux objectifs, l'efficacité de 6 biorétentions réelles à Trois-Rivières doublée d'une expérience en mésocosmes a été suivie et comparée en fonction de l'espèce. L'état phytosanitaire a été suivi pour déceler tout signe de bioaccumulation ou carence. Chaque mésocosmes a été planté avec un spécimen de l'une des quatre espèces suivantes *Juncus effusus*, *Cornus sericea*, *Iris versicolor*, *Sesleria autumnalis* ou non planté, tandis qu'elles sont en polyculture à Trois-Rivières dans 60cm de substrat commercial pour biorétention (Savaria Inc.). Les mésocosmes ont été alimentés avec une eau de ruissellement semi-synthétique reproduisant la composition moyenne retrouvée dans l'eau de ruissellement. Le volume et la fréquence d'irrigation utilisés se rapprocher des conditions hydrologiques moyennes à Trois-Rivières.

6 - *Spatial dependence of gas transfer velocity in reservoirs: implications for diffusive flux estimates*

Pascal Bodmer[1], Pedro M. Barbosa[1], Felipe Rust[1], Paul A. del Giorgio[1]
[1]Groupe de Recherche Interuniversitaire en Limnologie, Département des Sciences Biologiques, Université du Québec à Montréal, Canada

Reservoirs may be significant sources of greenhouse gases (GHG) such as CO2 and CH4, but the magnitude of these emissions remains uncertain. One key requirement of diffusive flux estimates is combining robust CO2 and CH4 gas concentration gradients at the water-air interface with realistic gas transfer velocities (k600). There exist many models for estimating k600, primarily based on wind. However, these models do not perform well in large reservoirs with complex shapes. This study aimed to improve current k600 estimation approaches for such reservoirs. We focus on the La Romaine complex, composed of 3 consecutive reservoirs along the La Romaine River in Northeastern Québec. In these reservoirs, we performed 594 flux measurements using floating chambers in 11 field campaigns over four years and calculated the k600 from these fluxes. We also measured wind, morphometry, and other complementary variables. We found that besides wind, the location within the reservoir based on depth and distance to shore strongly modulates k600 and that this effect was reservoir-dependent. Hence, we created a k600 model based on these three variables and modeled k600 to detailed grids on each of the reservoirs. We had previously modeled the CO2, and CH4 surface water gas concentrations for each of these grid cells, which, combined with the modeled k600 layer, yielded a detailed spatially and temporally resolved cartography of diffusive fluxes for both gases in the reservoirs. The improved k600 estimation approach is transferable to other reservoirs worldwide and will help narrow the uncertainties of reservoir GHG fluxes.

7 - *An innovative approach to assess future scenarios of ecological integrity of lakes based on a watershed wide analysis of multiple factors in the context of climate change*

Giancarlo Cesarello[1], Isabelle Lavoie[1], Beatrix Beisner[2], Sonja Behmel[1]
[1]INRS-ÉTÉ
[2]Département des sciences biologiques, UQAM

Provision of clean water creates economic and social development opportunities, although negatively affecting the ecological integrity of the watershed ecosystems that provides the water resource, potentially leading in ecological and socio-economical resource losses due, for example, to the development of harmful algae blooms. Current water governance has responded mostly with restoration, end-of-pipe, and quick fixes interventions, neglecting the ecosystem resilient capacity, especially in the context of climate change. Moreover, stakeholders, and decision makers, have not been made fully aware of the complexity of the watershed's ecosystems.

This project aims at developing a systemic approach, allowing stakeholders to understand the socio-ecological complexity of their local reality to support decision-making and to develop adaptive watershed management scenarios in a context of climate change. The methodology comprises 1) Development of a Causal Loop Diagram to show the complexity of socio-ecological system; 2) Co-constructing of the CLD with stakeholders through a participative approach and 3) Test the CLD based on a case-study, e.g., lake Saint-Charles's watershed, Canada. The objectives of the CLD are to help stakeholders to 1) better understand and explore the complexity of the socio-ecological processes regulating the ecological integrity of the lake, 2) realize their stakes 3) foster their consensual collaboration to identify mitigating measures for the overall benefit of the watershed.

For this conference, we present preliminary results of the CLD based on the "systems thinking" method and on the participative water resource management approach, capturing the social-ecological system complexity of the project's case study (Lake St-Charles, Quebec, Canada).

8 - *Exploring Fungal Diversity in Canadian Lakes*

Maya Chahine[1], Rebecca Garner[1], David Walsh[1]
[1]Biology, Concordia University

Fungi play critical roles in aquatic ecosystems as decomposers of organic matter and parasites of phytoplankton. Despite their ubiquity and functional importance, fungi are an often overlooked component of lake biomes. As part of the first standardized national lake assessment by the Canadian Lake Pulse Network, a startling abundance and richness of fungi in the surface waters of 382 lakes was revealed through 18S rRNA gene amplicon sequencing. Fungal communities were dominated by chytrids, notorious phytoplankton parasites. However, both aquatic and terrestrial lineages as well as a large proportion of dark matter fungi were detected. Following the observation that the phylogenetic variation between assemblages did not appear to conform to any clear spatial nor ecological patterns, we investigated the processes of fungal community assembly in this set of lakes. Stochastic processes (drift and dispersal) played a prevailing role in community assembly, yet deterministic forces (environmental selection) were an important secondary driver of fungal diversity. Our hypothesis that deterministic community assembly is linked to higher fractions of indwelling aquatic taxa was not supported by the evidence. This study provides an unprecedented view of lacustrine fungal diversity at the landscape scale and opens new questions on the forces shaping community structure.

9 - *To what extent can the Morphological Quality Index (MQI) be used as a reliable predictor for fish biotic integrity in agricultural streams?*

Tania Couture[1]
[1]Concordia University

With the increasing pressure of anthropogenic stressors the impact of watershed modification on our natural waterways has become a prominent cause of aquatic habitat degradation and biodiversity loss. Habitat degradation has become one of the leading threats to aquatic biodiversity and as a result, freshwater ecosystems are among the most vulnerable environments with extinction rates greater than those in other terrestrial and marine settings. The project for my master's research at Concordia University will be analyzing the hydrogeomorphology of streams in agricultural settings in connection with fish habitat quality and the biotic integrity of fish communities. Specifically, agricultural streams in the Monteregie area will be studied where the Morphological Quality Index (MQI) and the fish Index for Biotic Integrity (IBI) will be measured. The hypothesis is that the MQI will provide a holistic characterization of agricultural streams for both habitat and biological communities which could be adapted in the Quebec context to identify problematic reaches and prioritize areas for conservation or restoration.

10 - *Long term trends in pCO2 in lakes following rebrowning trends in south-central Ontario from 1980 to 2017*

Mathilde Couturier[1, 2], Yves T. Prairie[1, 2], Andrew M. Paterson[3], Erik JS Emilson[4], Paul del Giorgio[1, 2]
[1]GRIL
[2]UQAM
[3]DESC, Ministery of the Environment, Conservation and Parks
[4]NRC, Great Lakes Forestry centre

Over the last 30 years, lake browning has increased in many northern lakes. In Central and Eastern Ontario these browning trends have been linked to the decline in bulk deposition of SO4 and the recovery from the impacts of the acid deposition. As a result, many acid-sensitive lakes that were heavily impacted have seen increases in pH and changes in their chemical composition. As DOC levels are now approaching past baselines in most of these lakes, the extent to which these long-term changes have affected the C balance of lake, and CO2 dynamics, is unclear. We have studied the temporal trends in pCO2 in 15 lakes over 40 years, following the browning trend and the abatement of SO4 deposition in lakes in two distinct regions of Ontario. Whereas from 1980 to 2000 there were no significant trends in pCO2 over time in any of the lakes, a significant increase was observed during the second time period. The trajectory of lake response is not uniform across watersheds. Whereas the re-browning trend appears to be linked to the increase in pCO2 in lakes in the Dorset region, chemical changes in soil CO2 and sulfate deposition in watersheds are the drivers of the changes in the lakes in the Turkey watersheds. All these lakes have undergone a decline in pH over the past decade, following 2 decades of slow pH recovery. This downward shift may be linked to the observed increases in lake pCO2 that may be related to rebrowning and regional processes.

11 - *Characterization of water column niches and ecozone dominance of lake phytoplankton through the subtropical – tundra gradient in North America*

Bruno Cremella[1], Beatrix Beisner[2], Sylvia Bonilla[3], Yannick Huot[1]
[1]Département de géomatique appliquée, Université de Sherbrooke, Québec
[2]Département des sciences biologiques, Université du Québec à Montréal
[3]Limnology Division, University of the Republic, Montevideo, Uruguay

Phytoplankton taxa occupy different niches that are reflected by higher biomasses within specific intervals of several environmental gradients. Measuring the water column conditions that favour different taxa, as well as their distribution across ecozones provides a tool to monitor and forecast how changes in water use, land use and climate will alter community composition and geographical distribution. In this study, we aim to characterize the realized niches of the most abundant phytoplankton genera across a wide range of ecozones. Phytoplankton taxa from 640 lakes sampled in the 2017-2019 LakePulse survey and 1159 lakes in the 2012 US-EPA National Lakes Assessment were updated to the latest accepted taxa name from Algaebase. Biomass for each genus was estimated as the sum of all corresponding species' biovolumes. Genera with the highest median percentage of total biomass for each ecozone were then compared. The environmental matrix was constructed using 7 water column variables listed as main factors by Reynolds et al. (2002): mixing depth (Zmix), temperature (T) percentage of subsurface light (as a proxy of epilimnetic mean irradiance), TP, TN, and pH (as proxies of [P], [N], and [C], respectively). Biomass-weighted niche centroids and their 1st and 3rd quartiles were estimated for each genus across the environmental gradients. A map of the most abundant genera by ecozone was built, and their differences were evidenced by their position in niche space. These results showcase the geographical diversity of the phytoplankton communities across North America.

12 - *Unraveling the metabolic balance of boreal rivers*

Michaela de Melo[1], Paul del Giorgio[1]
[1]UQAM

While boreal rivers are recognized to be active sites of biogeochemical transformation and emissions throughout the aquatic continuum, estimates of in-situ organic matter production via photosynthesis (gross primary production - GPP) and consumption via ecosystem respiration (ER) are still scarce from northern rivers, which limit our understanding on the relative role of internally and externally derived CO2 in supporting river emissions. Here we present preliminary results of a large-scale study of ecosystem metabolism across a wide range of boreal rivers. We deployed optical dissolved oxygen and temperature loggers at 12 large and medium rivers draining the James Bay region of northern Quebec, over a 4 month-period (June-October 2019), and then modelled GPP and ER using the streamMetabolizer R package. A special effort was employed to install these probes at the same location as the pre-established hydrometric stations and thus generate coupled estimates of discharge and metabolic rates. Our preliminary results show much lower GPP than ER daily rates for all rivers, confirming that riverine metabolism is consistently net heterotrophic and a net source of CO2 fuelling river supersaturation. These metabolic data will be combined with ambient gas fluxes to determine the balance between external and internal sources sustaining CO2 emissions in these rivers, and the role of GPP in modulating these fluxes. This study stands out as an unprecedented opportunity to unravel the seasonal dynamics and landscape drivers of metabolism and CO2 flux in boreal rivers.

13 - *Simulation of long-term regional-scale groundwater recharge in cold and humid climates – impacts of climate change from the past to the future*

Emmanuel Dubois[1], Marie Larocque[1], Sylvain Gagné[1]
[1]Département des sciences de la Terre et de l'atmosphère, UQAM

Long-term climatic condition changes indirectly propagate to aquifers through groundwater recharge (GWR), thus making GWR estimates strategic to develop long-term water policies and land management. This work aims to 1) simulate the evolution of the regional GWR since the middle of the 20th century (1961-2017) and for the future conditions (2100 horizon), and 2) identify precipitation and temperature changes leading to significant changes of GWR. Transient spatially-distributed GWR is simulated using a water budget model for southern Quebec, between the St. Lawrence River and the Canada-USA border, and between the Quebec-Ontario border and Quebec City (36 000 km²). Especially developed for cold and humid climates, the model is automatically calibrated on river flow and baseflow for the 1961-2017 period. Winter GWR increased significantly due to warmer temperature and more precipitation (significant positive trends for the 1961-2017 period) increasing the availability of liquid water during winter. Climate scenarios from global climate models (RCP4.5 and RCP8.5) indicate warming temperatures and wetter conditions for the second half of the 21st century in comparison to the 1981-2010 reference period. Simulations of future GWR show that annual precipitation increase > 150 mm/yr or winter precipitation increase > 25 mm lead to significantly higher future GWR, and inversely for significant lower future GWR. These significant GWR changes are produced only when temperature change exceeds +2°C. Temperature change larger than +4.5°C limits GWR increase to +30 mm/yr. The methodology is expected to be applicable to other hydrological variables.

14 - Évaluation de la contamination d'éléments traces métalliques dans des écosystèmes lacustres de Sudbury (ON) et Rouyn-Noranda (QC) à l'aide d'une espèce sentinelle (perchaude)

Jérémy Dupont[1], Virginie Ricard-Henderson[2], Myriam Fontaine[1], Carolanne Penny[1], Maikel Rosabal[2]
[1]Institut des sciences de l'environnement, UQAM
[2]Département des Sciences Biologiques, UQAM

Les lacs situés près des villes canadiennes de Sudbury (Ontario) et de Rouyn-Noranda (Québec) ont reçu des émissions d'éléments traces métalliques (ETM) provenant des activités minières de manière chronique. Malgré des mesures prises pour limiter la circulation de ces contaminants, l'ensemble de lacs localisés dans ces régions présente une contamination en métaux variés et à des concentrations variables, comprenant notamment le nickel (Ni), le cadmium (Cd) et l'arsenic (As). En plus des métaux déjà répertoriés, des études sur les ETM d'intérêt émergeant tel que les éléments de terres rares (ex. gadolinium (Gd), lanthane (La), Cérium (Ce)) s'avèrent pertinentes. Pour évaluer la contamination de tous ces ETM, les perchaudes (*Perca flavescens*) sont proposées comme espèce sentinelle. En effet, celles-ci présentent l'intérêt de pouvoir tolérer les conditions qui prévalent dans les lacs les plus acides et les plus contaminés en métaux. Les concentrations d'ETM au sein des échantillons hépatiques de perchaudes récoltés dans quatre lacs localisés dans les deux régions sont mesurées par ICP-QQQ. Les données recueillies dans le cadre de ces travaux montrent une grande hétérogénéité spatiale au niveau de la bioaccumulation des éléments traces métalliques à l'étude. D'ailleurs, nous constatons d'importants gradients de bioaccumulation (ratio [ETM] maximale / [ETM] minimale) pour les métaux étudiés, mais les ratios les plus importants sont associés aux éléments de terre rares (La : 22 ; Ce : 23). Les données obtenues représentent un point de départ pertinent pour étudier la gestion intracellulaire de ces contaminants et identifier de potentiels marqueurs d'effets toxiques associés à la bioaccumulation d'ETM.

15 - *Aquatic-Terrestrial Carbon Fluxes and Carbon Budget of a Boreal Lake in Quebec*

Gabriel Duran[1], Paul del Giorgio[1]
[1]Biological Sciences: UQAM

Waterbodies are major hotspots for carbon (C) transformation and can play an immense role in C fluxes across an entire watershed. Knowledge on the biogeochemical cycling of C explores how C moves through terrestrial and aquatic systems, but seldom examine the lateral movement through the landscape. In creating C budgets of ecosystems, these values are often derived and estimated, posing uncertainties in the global C budget. For instance, the redistribution of organic matter has important implications on biogeochemical cycling of essential biological solutes, like NH4, NO3, CO2, CH4, and terrestrial carbon sequestration. Therefore, in these attempts, a mass-balance approach should be utilized to determine the movement of C to better constrain C fluxes in a landscape. This will include deriving CO2 and CH4 fluxes from the subsurface flow, stream, and lake of a watershed. The goal for our research is to paint a more holistic picture of what is happening at the intersection of aquatic and terrestrial systems and how they impact the net production of carbon emissions to the atmosphere. More broadly, we want to understand the interface and lateral transport of carbon from terrestrial ecosystems into aquatic ecosystems on a boreal lake in Québec.

16 - *Synthesizing our salmonid abundance and habitat knowledge: A global database*

Kyleisha Foote[1], April Mansfield[2], James Grant[2], Pascale Biron[1]
[1]Geography, Planning & Environment, Concordia University
[2]Biology, Concordia University

Many salmonid species are listed as threatened or endangered, despite over a hundred years and billions of dollars spent on habitat conservation. Restoration efforts could focus on the 'best streams', but little is known about the range of salmonid production across the world, or what hydrogeomorphological context characterizes these streams. Many studies show habitat preferences for certain species and age class in specific regions, but comprehensive compilations on the global range of salmonid abundance have not been completed for several decades.

To identify the best salmonid streams, we first have to synthesize the data on salmonid abundance across the world. We will create a database of published studies that have recorded salmonid biomass in streams. The species, and means, variance and distribution of biomass will be explored. Additional data will be recorded, including sampling methods, size of stream, spatial extent and time of study, and stream characteristics including temperature, nutrients, stream style, and physical habitat variables.

We will use the database to identify regions or species that lack data on salmonid measures, regions that could act as 'role-models' for restoration, and temporal changes in salmonid abundances, as well as creating models of salmonid abundance and environmental variables. Preliminary analysis from a pilot study of the database shows that biomass follows a lognormal distribution where most streams have low to medium biomass and a few have high biomass. Interestingly, we identified multiple instances where biomass surpasses previously hypothesized limits of in stream salmonid biomass.

17 - Réponse des communautés microbiennes face au syndrome de salinisation des eaux douces

Jean-Christophe Gagnon[1, 2], Louis Astorg[1, 2], Alison Derry[1, 2], Cassandre Lazar[1, 2]
[1]UQAM
[2]GRIL

Chaque année, des millions de tonnes de chlorure de sodium (NaCl) sont déversées sur les routes en Amérique, pouvant s'introduire dans les cours d'eau avoisinants lors des fontes printanières, et ainsi contribuer au syndrome de salinisation des eaux douces. Nous cherchions à comprendre l'effet du NaCl sur les communautés microbiennes lacustres. À l'aide de mésocosmes constituant un gradient de salinité variant de 0.01 à 2.74 ppt NaCl (0.27 – 1161.3 mg/L-1 Cl-) et du séquençage de l'ARNr 16S, et de réaction en chaîne polymérase digitale (dPCR), l'effet engendré sur la diversité et l'abondance absolue à court terme (3 semaines) et long terme (6 semaines) a pu être évalué, au printemps 2018. Une relation positive entre les valeurs de Cl- et l'abondance absolue bactérienne (R2=0.63, p=0.009), était présente à court terme. Cette relation était absente à long terme, malgré une croissance accrue. Une différenciation significative (p=0.0004) des communautés bactériennes dès 420 mg/L-1 Cl-, a été observé à court terme. Ces niveaux sont inférieurs aux recommandations américaines d'exposition aigüe au Cl-. Une différentiation drastique significative (p=0.0032) a également été observée dès 708 mg/L-1 Cl- après six semaines. Nos résultats laissent toutefois présager la possibilité d'un retour partiel des communautés bactériennes « normales ». La diminution de la prédation est en cause dans l'augmentation de l'abondance microbienne. Les niveaux de salinités sont toutefois en cause dans la variation de composition. La transition de dominance des Betaprotéobactéries et Actinobactéries vers les Bactéroidia et Alphaprotéobactériese est très similaire à la transition naturelle observée dans les estuaires.

18 - *A first view of protist diversity across hundreds of freshwater lakes spanning a temperate to subarctic gradient*

Rebecca Garner[1], Susanne Kraemer[1], Vera Onana[1], Irene Gregory-Eaves[2], David Walsh[1]
[1]Department of Biology, Concordia University
[2]Department of Biology, McGill University

Unicellular eukaryotes, known as protists, occupy key functional roles in aquatic ecosystems as primary producers, nutrient cyclers, and symbionts. While a comprehensive view of protist diversity in the global ocean is emerging, a similar perspective of protist diversity in lakes has been challenged by the vast heterogeneity of environmental conditions in these systems. As part of the Canadian Lake Pulse Network national lake assessment, we surveyed the diversity of protists inhabiting lake epilimnia on an unprecedented scale by sequencing the taxonomically informative 18S rRNA gene. Based on samples from 366 freshwater lakes spread across the Canadian landscape, we identified strong relationships between water chemistry (nutrients and major cations) and protist community turnover. Watershed soil pH and agricultural crop coverage were the next strongest predictors of protist diversity. We also identified hotspots of exceptional community composition typified by taxonomic impoverishment and associated with high nutrient and ion conditions that coincided with large proportions of watershed cropland cover. These patterns raise new questions surrounding the impact of anthropogenic stress on protist assemblages. Our work puts the protist diversity of Canadian lakes on the map and advances our understanding of the environmental selection pressures in eukaryotic microbiomes in critical inland waters.

19 - Processus écologiques influençant la distribution des bactéries, archées et eucaryotes dans les aquifères

Benjamin Groult[1]
[1]Biologie, UQAM

Les aquifères sont peuplés de microorganismes provenant des trois grands domaines du vivant, les bactéries, les archées et les eucaryotes. Leurs conditions de vie tout comme leurs besoins sont extrêmement variables. Et l'on suppose que les mécanismes écologiques les impactant seront tout aussi différents. Quels sont ces mécanismes et quels sont leurs impacts sur l'assemblage des communautés de microorganismes?

20 - Simulation of a Canadian Shield lake hydrosystem and its vulnerability to climate change

James Harris[1], Marie Larocque[1], Sylvain Gagné[1], Simon Lavoie Lavallée[1]
[1]Département des sciences de la Terre et de l'atmosphère, Université du Québec à Montréal

This research project is part of the pluridisciplinary study of the resilience of the Lake Papineau hydrosystem and the biodiversity of its wetlands. Lake Papineau is situated in the Kenauk Nature private reserve located halfway between Ottawa and Montreal. This reserve covers 260 km2 of forest and includes numerous lakes, of which Lake Papineau is the largest. In partnership with Kenauk Nature, Nature Conservancy of Canada and the Ouranos consortium, this project aims to simulate the dominant processes of the Lake Papineau hydrosystem and evaluate the impact of future anthropic pressures and climate change. A model of the study domain (880 km2) was developed using MODFLOW in order to simulate groundwater flow within the fractured bedrock of the Canadian Shield. The model is first calibrated in steady state utilising water table depth measurements available across the investigative zone. It was then recalibrated in transient state with datasets specific to the project: hydrometric (5 streamflow stations), piezometric (6 piezometers), and recharge (simulated using the surface-water balance model, HydroBudget) that were either available for the entirety of the 1964-2020 period or reconstituted using different methods such as artificial neural networks. The factors exerting the greatest influence on the water budget of Lake Papineau are identified through the implementation of the MODFLOW LAK module. The calibrated hydrodynamic model allows for an evaluation of the influence of climate changes on the hydrology of Lake Papineau according to twelve scenarios, provided by Ouranos, of temperature and precipitation anticipated at the 2100 horizon.

21 - *Using environmental RNA (eRNA) to investigate the transcriptomic response of heat stressed Daphnia pulex*

Robert Hechler[1], Melania Cristescu[1]
[1]Biology, McGill University

Following advancements in next-generation sequencing, molecular methods such as environmental DNA (eDNA) metabarcoding have emerged to complement traditional biodiversity surveys. By sampling for the presence of an organism's DNA in environmental samples, eDNA metabarcoding allows researchers to determine the presence/absence of species without the need for organism isolation or visual identification. However, eDNA analysis is limited to identifying the presence/absence of species. Alternatively, environmental RNA (eRNA), referring specifically to RNA released by organisms into the environment, could allow for functional insights into the physiological state of organisms. As RNA is linked to gene expression, eRNA markers might be useful to estimate gene expression profiles of organisms within a community. Such assays could provide functional information on the physiological status of organisms, overcoming the presence/absence limitation of eDNA analyses.

As proof of concept, we reared *Daphnia pulex* in 7L of artificial lake water at both 20°C and 28°C. We filtered 1L of tank water per sample, from which eRNA was subsequently extracted. Additionally, RNA was extracted from tissue samples as a positive control. Following RNA sequencing, we plan to conduct differential expression analyses using reads resulting from both eRNA and tissue based libraries, to identify genes and functional pathways that are differentially expressed under heat stress. This experiment aims to demonstrate proof of concept that eRNA based gene expression profiling could be useful to monitor the functional status of organisms in a non-invasive manner.

22 - *Applying Green Science to Mesocosm Research*

Egor Katkov[1], Gregor Fussmann[1]
[1]Biology, McGill University

In Fall 2020, a group of ambitious undergraduate students found microplastics in the sediments of Lac Hertel, McGill's nearest and dearest limnological playground, located in the Gault Nature Reserve of Mont-Sainte-Hilaire. Many of these plastics resembled the material that we use to conduct mesocosm experiments in the lake. Indeed, over the years, we discovered several times that some of the mesocosms, which are made of a flexible ~1 mm-thick polyethylene material, had developed large holes by the end of an experiment, causing us to discard data. We had tried several techniques to address this problem: double bagging, buying expensive netting to surround the mesocosm platform and even reducing the length of our experiments. However, last summer we finally found what we think is the best and "greenest" solution to date. We used new and reconditioned 750 L barrels made of a rigid, ~5 mm-thick polyethylene that we cut open and hooked onto the mesocosm platform. Although the material is the same, the thickness makes these much sturdier and protects the integrity of the mesocosm. Other advantages include the ability to clean and re-use the mesocosms, a better-defined volume, a minimal chance of leakage. Disadvantages include more room required for storage, a higher up-front cost, and the necessity for cleaning. Nevertheless, we hope that other mesocosm experiments will consider this approach and that scientific inquiry in general can strive for minimal impact on the environments it hopes to understand.

23 - *High primary production in late-season ice of a boreal lake*

Henriikka Kivilä[1, 2, 3], Jean-Simon Boulianne[1], Milla Rautio[1, 2, 3]
[1]Département des sciences fondamentales, Université du Québec à Chicoutimi
[2]Groupe de recherche interuniversitaire en limnologie (GRIL)
[3]Centre d'études nordiques (CEN)

Winter and ice-covered period of lakes remain an understudied part of lakes' annual cycling, despite the fact that they may have a profound cascading effect on the following open water season. During winter 2020-2021 we conducted a study at boreal Lake Simoncouche (Saguenay, Quebec), where water samples and lake ice were sampled in late winter. A broad spectrum of variables including physical and chemical conditions as well as bacterial and primary productivity were analysed. Our aim was to assess the role of lake ice as a potential reservoir of organic carbon which could fuel the microbial loop and pelagic plankton during the melting period and ice-off. Particulate materials in the ice were more concentrated than in the water, while dissolved nutrients were mostly excluded from the ice. Relationship between ice-originating carbon and heterotrophic production was not clear in our experiment, but we observed that the late season ice contained higher concentrations of Chl-a than the underlying water column and supported considerable primary production. Our results suggest that the role of ice in boreal lakes during late winter and early spring is not only to isolate the lake from atmosphere and inhibit energy flows, but also to serve as a storage of organic carbon, as well as a microhabitat favorable for primary production.

24 - *Effect of contaminants across contemporary and historical aquatic food webs structures; how environmental gradients act upon bioaccumulation and biomagnification pathways*

Maude Lachapelle[1], Zofia Taranu[2], Irene Gregory-Eaves[1]
[1]Department of Biology, McGill University
[2]ACRD, Environment and Climate change Canada

Multiple, anthropogenic stressors footprint on lake ecosystems is well recognized, but there appears to be substantial heterogeneity across sites in terms of the cumulative impact of such stress on aquatic food webs. The response of species to stressors may differ across lakes if adaptation to one stressor (e.g., contaminants) results in an increased susceptibility to others. Changes in community composition and network interactions in response to eutrophication and/or climate change may affect contaminant accumulation pathways and their degree of impact. The objective of my PhD project will be to quantify the effect of contaminants, as well as the relative impact of changing nutrient concentrations and climate across both contemporary and historical aquatic food webs (phytoplankton to zooplanktivorous fish). This project will aim at examining how environmental gradients act upon bioaccumulation and biomagnification pathways via their effect on biodiversity and food web structures. This will be explored by 1) conducting a large-scale synthesis of contemporary datasets to test hypotheses between eutrophication gradients and contaminant bioaccumulation in aquatic food webs, 2) carrying out a field study along contamination and eutrophication gradients to tease apart the additional effect of climate warming, 3) evaluating long-term dynamics with paleolimnology. eDNA sequencing and contaminant analyses through time will allow us to reconstruct changes in potential contamination pathways across aquatic networks and detect critical transitions using multivariate regime shift models. As the effects of eutrophication on aquatic ecosystems increase globally, there is a high interest in examining variations in contamination pathways and how they change through time.

25 - Détermination sexuelle chez les hybrides : un nouveau rôle pour les spermatozoïdes?

Joëlle Lafond[1], Bernard Angers[1]

[1]Département des Sciences Biologiques, Université de Montréal

Il existe plusieurs cas avérés de reproductions atypiques chez les vertébrés aquatiques. Chez les poissons *Chrosomus eos-neogaeus*, des ménés abondants dans nos lacs et rivières, on retrouve ainsi des femelles hybrides produisant une progéniture clonale ou triploïde suite à la fécondation des œufs par un mâle d'une espèce proche. Dans la grande majorité des cas, la progéniture sera femelle. Alors, que se passe-t-il avec les spermatozoïdes portant le déterminisme mâle (Y)? Afin de répondre à cette question, une analyse génomique est en cours afin d'identifier des séquences liées au déterminisme du sexe et déterminer le sort des spermatozoïdes portant le déterminisme mâle suite à la fécondation. Les résultats de ce projet permettront de mieux comprendre la stratégie de ces poissons ne produisant naturellement qu'un seul sexe.

26 - La génomique au profit du suivi environnemental

Christophe Langevin[1], Jérôme Comte[1], Vani Mohit[2]

[1]Centre Eau Terre Environnement, Institut national de la recherche scientifique (INRS)

[2]Centre d'expertise en analyse environnementale du Québec (CEAEQ), Ministère de l'environnement et de la lutte contre les changements climatiques (MELCC)

Les changements climatiques et les activités anthropogéniques menacent de plus en plus la santé des écosystèmes d'eau douce, incluant les lacs au Québec. Ces écosystèmes lacustres recèlent une riche biodiversité naturelle et ils assurent aussi de nombreux services à la population dont l'apport en eau potable. Il est donc primordial de caractériser et suivre la structure et le fonctionnement des lacs afin de comprendre et anticiper leurs réponses face à des perturbations. En particulier, les efflorescences de cyanobactéries et algues toxigéniques sont de grandes préoccupations environnementales et sanitaires au Québec. Le MELCC a mis en place plusieurs programmes de suivi environnemental des plans d'eau au Québec dont le programme des lacs témoins. Ces programmes utilisent essentiellement la microscopie comme technique de caractérisation de la diversité taxonomique des microorganismes. La microscopie est une approche fiable mais qui est dispendieuse et chronophage. Ce projet de recherche en collaboration avec le MELCC vise à valoriser l'approche génomique pour caractériser la variation temporelle et spatiale de la diversité du phytoplancton et des cyanobactéries, au sein du réseau de surveillance des lacs; et identifier les variables environnementales qui influencent la structure de cette biodiversité. La diversité du phytoplancton, dont les cyanobactéries, sera déterminée à la fois par les outils de séquençage et par la microscopie afin d'évaluer le potentiel de l'utilisation du séquençage pour les projets de suivi environnemental du MELCC. Cela permettra de contrer les lacunes de la microscopie et de complémenter la méthode de suivi ministériel.

27 - *Mixotrophy vs. specialist trophic strategies in a stratified water column: a spatial mechanistic modeling approach*

Philippe Le Noac'h[1], Sebastian Diehl[2], Beatrix Beisner[1]
[1]Université du Québec à Montréal (UQAM)
[2]Umea University

Mixotrophy is being increasingly recognized as an important plankton process, but we are still far from a mechanistic understanding of its functional role in community assembly. Along the opposing vertical gradients of light and nutrients usually present in stratified lakes with deep chlorophyll maxima, mixotrophy provides a generalist trophic strategy; an alternative to pure autotrophic or heterotrophic specialist strategies in the water column. Given the difficulty of measuring mixotrophy rates in the field, modeling allow us to test hypotheses pertaining to its role in the nanophytoplankton community and along typical environmental gradients. We developed a model to simulate the dynamics of three competitors (pure autotroph, mixotroph and pure heterotroph) and bacterial prey populations over the vertical dimension of a stratified lake water column. We examined the effect of resource competition on the vertical distribution of the competitors and bacteria over opposing gradients of light and nutrients. The relative biomass of each competitor in the community was assessed, as well as the characteristics of their spatial niches over a range of resource inputs and hydrological conditions. Preliminary results indicate that the spatial niche of the mixotrophic competitor tends to be larger than those of the specialist strategists, and that the prevalence of mixotrophy is maximized under conditions of low levels of nutrient availability.

28 - Il était une fois le lac Ledoux

Riwan Leroux[1], Pierre Magnan[1], Marc Pepino[1], Andrea Bertolo[1]
[1]Sciences de l'environnement, Université du Québec à Trois-Rivières

Whereas it is well accepted that predation plays a key role in shaping both size structure and species composition in lacustrine zooplankton communities, most studies focus on differences among lakes, neglecting within-lake variations. We seek to investigate how small-scale variations in predation risks can modulate the structure and composition of zooplankton communities within the same lake. We compared the size spectra of zooplankton using imagery sampling from a small boreal lake (lac Ledoux, réserve Mastigouche, Canada). The brook charr, a cold-stenothermic species, is the only fish present in this system. Lake Ledoux can be distinguished into a well-mixed shallow basin, inaccessible to the brook charr during summer because of a thermal barrier and a deeper one in which fish can predate on zooplankton. Zooplankton data were transformed into normalized biovolume size spectra (NBSS) to compare productivity and trophic efficiency of the two basins. Our results showed a three times higher productivity of zooplankton in the shallow fishless basin compared to the deeper basin. Furthermore, following the drop of water temperature in late summer, we observed a clear zooplankton community shift with a concomitant drop of NBSS slopes. Shallow areas, inaccessible to cold-stenothermic fish species, could lead to strong within-lake variations in zooplankton community structure and composition, with consequences for the trophic structure of the whole lake. Whenever strong habitat contrasts occur in a lake, it should be considered in sampling protocols to avoid wrong interpretation of trophic dynamics.

29 - Effets des pesticides sur les communautés microbiennes des biofilms périphytiques : suivi par une approche multi-descripteur en conditions contrôlées et en milieu naturel

Laura Malbezin[1], Mariem Fadhlaoui[1], Soizic Morin[2], Jérôme Comte[1], Isabelle Lavoie[1]

[1]Centre Eau Terre Environnement, Institut national de la recherche scientifique, Québec (Canada)

[2]Unité de recherches « Écosystèmes Aquatiques et changement globaux », Institut national de recherche pour l'agriculture, l'alimentation et l'environnement, Cestas (France)

Les pratiques agricoles entraînent une contamination des eaux en herbicides. Parmi eux, l'atrazine et le S-métolachlore sont fréquemment mesurés dans les rivières de la province. Leur présence pourrait perturber le fonctionnement de la composante biologique de ces milieux, comme par exemple le biofilm périphytique. Ce consortium d'organismes à la base de la chaine alimentaire constitue une ressource importante en acides gras (AGs), molécules nutritionnelles clés pour les organismes le consommant. Les AGs représentent ainsi un proxy intéressant de la qualité nutritive des biofilms. Mon projet de doctorat consiste donc à déterminer l'impact de l'atrazine et du S-métolachlore, seuls et en mélange, sur les organismes du biofilm (aspects taxonomiques et fonctionnels) et les répercussions sur la qualité nutritive vis-à-vis d'un consommateur primaire. La modélisation de courbes dose-réponse a été utilisée afin de déterminer la toxicité des deux herbicides en utilisant les AGs comme variable réponse. Une expérience subséquente d'exposition de biofilm en canaux artificiels permettra de déterminer si les modifications des AGs est liée à (1) une altération directe du métabolisme des acides gras et/ou (2) un changement de composition de taxons riches en certains acides gras polyinsaturés (diatomées) pour des taxons moins riches en ceux-ci (bactéries). Une expérience de transfert trophique permettra de déterminer l'impact des modifications des profils en AGs du biofilm sur un consommateur. Finalement, une étude de terrain s'intéressera aux effets d'un mélange de pesticides en rivières agricoles sur du biofilm en suivant encore une fois plusieurs descripteurs biologiques.

30 - Les communautés microbiennes endolithiques, sessiles et planctoniques de la subsurface terrestre

Julia Meyer[1], Robert Lehmann[2], Kai-Uwe Totsche[2], Marie Larocque[3], Cassandre Lazar[1]
[1]Département des sciences biologiques, Université du Québec à Montréal (Canada)
[2]Hydrogeologie, Institut des Géosciences, Université d'Iéna (Allemagne)
[3]Département des sciences de la Terre et de l'atmosphère, Université du Québec à Montréal (Canada)

La subsurface terrestre est un des habitats les moins explorés sur Terre. À cause de la difficulté d'accéder aux roches et aux sédiments sous le sol, la plupart des recherches microbiennes conduites dans cet habitat se sont intéressées aux communautés planctoniques présentes dans l'eau de l'aquifère. Par conséquent, les communautés endolithiques et sessiles qui vivent sur/dans les sédiments ont reçu relativement peu d'intérêt. Cette recherche a pour but (1) d'étudier ces communautés peu connues afin de comprendre l'effet de différents facteurs abiotiques sur leur diversité, leur abondance et leur composition; et (2) d'étudier les différences de composition entre les communautés planctoniques présentes dans l'eau *versus* les communautés endolithiques et sessiles présentes dans les roches de l'aquifère. Grâce à des opérations de forage, nous avons été en mesure de récupérer des échantillons de la subsurface jusqu'à plusieurs centaines de mètres de profondeur. Afin d'analyser la composition et la diversité, nous avons extrait l'ADN microbien des communautés et séquencé les gènes d'ARN 16S et 18S (Illumina MiSeq). Les résultats ont montré que la profondeur et le pH influencent la diversité et l'abondance de ces communautés. De plus, les communautés microbiennes planctoniques étaient significativement différentes des communautés endolithiques et sessiles de l'aquifère. Ces résultats suggèrent que ces facteurs abiotiques sont des filtres d'habitat efficaces sur les communautés endolithiques et sessiles de la subsurface terrestre. Ils montrent également l'importance d'échantillonner à la fois les roches et l'eau lorsque l'on étudie l'ensemble des communautés de l'aquifère.

31 - *A deep dive into zooplankton diversity in Canadian lakes: How effective are metagenomes in detecting metazoans?*

Marie-Eve Monchamp[1], David Walsh[2], Rebecca Garner[2], Susanne Kraemer[2], Beatrix Beisner[3], Melania Cristescu[1], Irene Gregory-Eaves[1]
[1]Biology Department, McGill University
[2]Biology Department, Concordia University
[3]Département des Sciences Biologiques, UQAM

Shotgun metagenomics has a high potential for developing holistic perspectives of lake ecosystems, extending from prokaryotic diversity to entire food webs. Here, we investigated the capacity of lake water column metagenomes for detecting zooplankton diversity in 20 northern temperate lakes, and we are currently expanding our analyses to surface sediments. We used a BLAST-based approach combined with taxonomic assignment at the family level based on the last common ancestor algorithm using i) the full set of metagenome reads and ii) a subset of reads originating from 18S rRNA genes. Zooplankton diversity and density (rotifers and crustaceans) was also assessed to the family level using traditional microscopy-based approaches. The coherence between morphological and metagenomic surveys was verified using RV coefficients (analogous to R2 for multivariate datasets). Preliminary results showed a stronger representation of visually-identified zooplankton using the whole metagenome approach compared to dataset composed of 18S rRNA genes. Our study demonstrated the efficiency of eDNA-based metagenomic approaches in detecting a key group of macro-eukaryotes in aquatic environments. Our results suggest a potential expansion to detecting other meio- and macro-fauna in metagenomes, with high relevance for biodiversity monitoring, conservation, and ecology.

32 - Biofilms algaux et microplastiques : accumulation et transfert dans les réseaux alimentaires fluviaux

Linsey Mouatcho[1], Isabelle Lavoie[1], Marc Amyot[2]
[1]Centre Eau Terre Environnement, Institut national de la recherche scientifique, Québec (Canada)
[2]Université de Montréal, Montréal (Canada)

Les microplastiques (MP) et les microfibres (MF) sont omniprésents dans l'environnement aquatique. Cependant, peu d'études portent sur leur présence en milieux fluviaux or, ils constituent leur voie d'entrée majeure vers les océans. Aussi, rares sont les études qui ont évalué la présence des MP/MF dans les biofilms algaux et suivi leurs effets. Pourtant, ces producteurs primaires peuvent potentiellement transférer les MP/MF (et les contaminants adsorbés) aux organismes des maillons trophiques supérieurs. Ainsi, l'objectif de ce projet de recherche est d'évaluer l'accumulation des MP/MF dans les biofilms algaux et leur transfert trophique. Il sera question de (1) détecter, quantifier et caractériser les MP/MF dans les biofilms algaux d'écosystèmes fluviaux et d'évaluer leurs effets sur ces derniers ; (2) évaluer l'effet de l'ingestion de ce périphyton par un consommateur primaire. Ce projet repose sur une étude terrain où les MP/MF présents dans les biofilms algaux et invertébrés benthiques seront quantifiés et caractérisés. Des expériences en laboratoire seront également menées en cultivant des biofilms d'origine naturelle dans des microcosmes et en les exposant à des MP/MF. Après exposition, une portion des biofilms servira au suivi de la toxicité des MP/MF envers les organismes microbiens. Une autre portion servira de nourriture à des consommateurs primaires afin de déterminer les effets d'une source de nourriture contaminée. Une approche multi-descripteur permettra d'évaluer les effets des MP/MF sur les organismes étudiés incluant des marqueurs précoces tels que l'activité antioxydante ainsi que des indicateurs plus globaux tels que la structure/composition des communautés microbiennes et la mortalité/croissance des consommateurs.

33 - ***Exploring potential carbon sinks in Quebec: is the carbon balance negative during the growing season for the Isle-Verte salt marsh (Saint Lawrence estuary)?***

Carolanne Penny[1, 2, 3], Michelle Garneau[1, 2, 4], Pierre Taillardat[1, 5, 6]
[1]GRIL (UQAM)
[2]GEOTOP (UQAM)
[3]ISE (UQAM)
[4]Département de géographie (UQAM)
[5]GÉOTOP, UQAM
[6]National University of Singapore

When compared to terrestrial and other wetlands systems, salt marshes are amongst the most efficient carbon sinks at local scale. Most previous studies have focused on estimates of soil organic carbon (SOC) stocks and nowadays very few have presented net ecosystem carbon balance for those ecosystems The main objective of this project is to quantify the net ecosystem carbon balance of a salt marsh located in the Isle-Verte region, Saint Lawrence esturary. Secondary objectives are to: 1) determine the influence of the vegetation and the tidal inundation on the magnitude of carbon accumulation in each zone of the marsh and 2) estimate the temporal variability of the carbon fluxes over two growing seasons (May-September). Data are being collected monthly in the main vegetation zones of the marsh (*Zostera marina, Spartina alterniflora, Spartina patens, Spartina pectinata*). In each zone, collars (3-4 replicats) are installed to measure CO2 and CH4 fluxes using the static chamber method and a portable gas analyser (Picarro). Data are coupled with water table depth and soil temperatures at 5, 10, 20 and 40 cm. Water and gas samples are collected from a tidal creek to estimate DIC and DOC export. Finally, cores are retrieved to estimate the long-term carbon accumulation rates and compare with the contemporaneous values. As coastal wetlands are globally being threatened by sea level rise and land-use change, accurately quantifying all aspects of C gains and losses is critical for developing policies emphasizing the protection and predicting the future of blue carbon sinks.

34 - Biodiversité dans les bassins de rétention d'eau pluviale urbains : étude de la diversité et de la composition des communautés avec une approche multi-taxonomique

Matisse Petit-Prost[1], Isabelle Lavoie[1], Monique Poulin[2]
[1]INRS-ÉTÉ
[2]Université Laval - Département de Phytologie

Les bassins de rétention d'eau pluviale (BREP) font partie intégrante des plans d'aménagements urbains. En plus de représenter une infrastructure clé dans la gestion de la quantité et la qualité des eaux ruisselantes en ville, les BREP peuvent fournir des services écosystémiques essentiels. Cette étude vise à (1) étudier la diversité des plantes, des insectes, des amphibiens et des oiseaux et (2) à déterminer les facteurs contribuant à la composition et à la diversité des communautés dans les BREP.

Cette étude inclut 54 BREP catégorisés comme : engazonnés, humides, humides avec un chenal, et en eau permanente. Un inventaire spécifique selon les communautés de végétation présentes dans les bassins a été réalisé pour identifier les espèces végétales et d'insectes. Des enregistreurs de son ont été disposés dans les bassins pour identifier le chant des oiseaux et des amphibiens. Les amphibiens ont également pu être identifiés par l'extraction d'ADN ciblé de six espèces avec l'utilisation de *quantitative Polymerase Chain Reaction* (qPCR). La contribution de variables environnementales à la biodiversité et aux structures des assemblages a été évaluée (distance au BREP le plus proche, présence/distance aux zones forestières et aux corridors naturels, utilisation des terres).

Des résultats préliminaires montrent que les BREP humides et avec un chenal sont les infrastructures étant le plus favorable à la diversité des plantes et des insectes tandis que les BREP en eau permanente favorisent la diversité des amphibiens. Ces résultats multi-taxonomiques permettront à terme d'identifier les meilleures conditions pour avoir une meilleure biodiversité dans les BREP.

35 - *Microplastic trophic transfer in an aquatic food chain of Southern Quebec*

Hélène Pfister[1], Genevieve D'Avignon[1], Anthony Ricciardi[2]
[1]Département de Biologie, Université McGill
[2]Musée Redpath & Bieler School of Environment, Université McGill

Microplastics are ubiquitous in inland waterways – floating in the water and accumulating in bottom sediments. Important freshwater invertebrates, like Trichopteran, interact with floating particles through trophic activities and create protective cases from available deposited materials including microplastics. Specialised caddisfly behaviour allows them to interact with multiple sources of microplastics contaminating freshwaters. Caddisflies are also substantial components of the diet of a wide range of taxa, becoming a potential vector of plastic transmission to higher trophic levels. We designed a series of experiments to explore the potential for caddisflies to incorporate microplastics to their case and whether they can transfer these plastics trophically.

Limnephilus sp. were exposed to mixtures of MP arrays and natural building material for 48h to either 0% or 50% plastic materials. Caddisflies were found to select microplastics to build their cases but the inclusion of microplastics impaired case stability and ballast.

Four caddisflies with natural cases and four with microplastic-incorporated cases were offered to brown bullheads (*Ameiurus nebulosus*) to evaluate the preferential feeding towards natural or artificial prey items. *A. nebulosus* consumed natural and synthetic cased caddisflies but had a stronger bias towards synthetic food items suggesting that MP incorporation in case matrices renders caddisflies more vulnerable to predation. As the coupling of both effects threatens the survival of the case-building caddisfly and the numerous aquatic species it sustains, this study emerges as of great importance in the comprehension of current and future impacts of microplastic pollution on freshwater food webs.

36 - *Boreal exoreic lake in winter: spatial and temporal story of GHG accumulation and transportation under ice*

Vilmantas Prėskienis[1], Henriikka Kivilä[1], Milla Rautio[1]
[1]Département des sciences fondamentales, UQAC

Winter remains the least studied season for the processes happening in aquatic systems, especially in boreal and Arctic regions. Vast boreal areas of the Canadian Shield feature numerous exoreic lake systems (natural lake chains connected by rivers). Despite high connectivity of these systems, lakes are often still studied as closed basins, disregarding the effect of water movements under ice. In this study, carried out during winter 2020-2021, we measured concentrations of CO2 and methane, together with a set of additional limnological characteristics (including chl-a, DOC, CDOM, water temperature and dissolved oxygen) as part of a project following an under-ice lake ecosystem, in order to better understand spatial and temporal distribution of these green-house gases during winter.

Our data show that CO2 accumulated under ice during winter, while methane concentrations decreased substantially in the first part of winter and then remained low. This can be attributed to active methanotrophy found in other boreal lakes, despite low oxygen concentrations. Furthermore, lake basin closer to the inlet showed higher concentrations of both gases; especially so for CH4 in the shallow part (<2m) of the lake. Lower CO2 concentrations in basins closer to the outlet likely indicate an efficient transportation of this gas by currents that remained active under ice. Lake ice was not found as an important gas accumulator. Such efficient gas evasion from boreal lakes through their outlets continuing all along winter requires further attention, as the importance often given to the ice-out period may be overestimated.

37 - Potentiel d'utilisation de larves de *Chaoborus* en tant qu'espèce sentinelle pour les éléments de terres rares des lacs de deux régions minières canadiennes (Sudbury, Ontario; Rouyn-Noranda, Québec)

Virginie Ricard-Henderson[1, 2], Maikel Rosabal Rodriguez [1, 2], Jérémy Dupont[1, 2], Dominic E. Ponton[1, 3], Marc Amyot[1, 3]
[1]Sciences biologiques
[2]UQAM
[3]Université de Montréal

L'utilisation d'espèces sentinelles s'avère un excellent moyen d'obtenir des renseignements sur le niveau de contamination des contaminants émergents notamment les éléments de terres rares, (ETR) pour lesquels nos connaissances sur leur comportement environnemental demeurent limitées. Dans les lacs, les larves de *Chaoborus* se sont déjà avérées être d'excellentes candidates pour refléter le niveau de contamination de plusieurs éléments traces métalliques, incluant le cadmium, le nickel et le sélénium. Cependant, son potentiel pour suivre la contamination des ETR demeure méconnu. Cette étude porte sur l'évaluation du potentiel des larves de *Chaoborus* comme sentinelle pour nous renseigner sur les niveaux de contamination en ETR dans les lacs des régions minières de Rouyn-Noranda (Québec) et Sudbury (Ontario). À cette fin, des échantillons d'eau et de larves de *Chaoborus* ont été récoltés dans neuf lacs et les concentrations d'ETR ont été déterminées par ICP-QQQ afin d'explorer les liens entre les concentrations des ETR retrouvées dans les deux matrices à l'étude. Nos résultats démontrent des gradients de concentrations d'ETR (ratio [ETR] maximale/ [ETR] minimale) important dans l'eau (La : 47 ; Ce : 59; ΣETR : 55) et dans les larves (La : 23 ; Ce : 22; ΣETR : 5,4), reflétant l'hétérogénéité spatiale des résultats pour l'ensemble des lacs étudiés. De plus, des corrélations significatives entre les concentrations d'ETR dans l'eau et celles mesurées dans les larves ont été observées (ΣETR, R2 = 0.79, *p = 0.02*), ce qui mets en évidence l'utilité de cet organisme en tant que sentinelle de contamination en ETR.

38 - *Nutrient dynamics in La Romaine river and reservoir complex*

Bianca Rodríguez-Cardona[1], Pascal Bodmer[1], Felipe Rust[1], Masumi Stradler[1], Paul del Giorgio[1]
[1]UQAM

Reservoirs can alter the transport and export of nutrients and organic matter from rivers to estuaries. In the La Romaine River, a series of four hydroelectric dams have been progressively built between 2015 and 2019 where we have been able to monitor the river through this progression and aging process. Here, we present longitudinal patterns in concentrations of total nitrogen (TN), total phosphorous (TP), dissolved organic carbon (DOC), and stoichiometric ratios (C:N:P) within the La Romaine River and reservoirs. We found that the reservoirs can be both sources and sinks of N, but concentrations below the dams remained on average roughly similar to those in the upstream river. TP concentrations, in contrast, consistently increased longitudinally and were grater below the dams than upstream, suggesting that the reservoirs are net sources of P. DOC concentrations were relatively constant across the river and the reservoir continuum. Stoichiometric ratios varied longitudinally where N:P decreased from above the reservoirs to the estuary, C:N were relatively constant, and C:P declined through the reservoirs and downstream river into the estuary; these stoichiometric shifts were mostly driven by changes in P concentrations. Our data suggest that in these young boreal reservoirs can be sources of nutrients, with P playing a major role in biogeochemical processes. Continuous monitoring is needed to determine how and if these signals will vary with age of reservoirs.

39 - ***Investigating local adaptation to calcium concentration as a refuge to invasive predator impact in native gastropods within a dynamic river ecosystem***

Mathilde Salamon[1], Louis Astorg[1], Antoine Paccard[2], Rowan Barrett[3], Alison Derry[1]

[1]Département de Biologie, Université du Québec à Montréal

[2]Centre de génomique de McGill

[3]Department of Biology, Redpath Museum, McGill University

Adaptation and dispersal are key adaptive strategies for species persistence facing rapid environmental disturbance. Biological invasions have caused loss of freshwater biodiversity worldwide from predation pressure on native species. However, the interplay between adaptation and dispersal in explaining the resilience of impacted populations is poorly understood. This study focuses on the native freshwater gastropod *Amnicola limosa* in the Saint Lawrence River (Québec, Canada), distributed along spatial gradients in invasion impact from an invasive predatory fish (*Neogobius melanostomus*) and calcium concentrations limiting the distribution of the invader. Our objective was to investigate the potential for genetic adaptation to low calcium habitats as refuges for *A. limosa* from round goby predation. Twelve *A. limosa*, populations were sampled from the Upper Saint Lawrence River (n= 6 with round goby present/high calcium, n= 6 with round goby absent/low calcium) and sequenced with pooled whole genome sequencing. This data was complimented with a laboratory reciprocal transplant of wild F0 *A. limosa* individuals to measure survival and fecundity in factorially-crossed treatments of water calcium concentration (low/high) and round goby cue (present/absent). Preliminary genomic results indicate that gene flow in *A. limosa* is not limited between the two habitat types. In the transplant experiment, we found higher fecundity in invaded populations, consistent with selection for increased fecundity, but no detrimental effect of the low calcium treatment on survival or effect of goby cues on both traits. Our study has important implications for understanding the mechanisms of adaptation of native species along environmental gradients that mitigate invasion impact.

40 - ***Dissolved organic carbon across Canadian lakes: Concentration and Optical properties***

Amir Reza Shahabinia[1], Jean-Francois Lapierre[2], Mathilde Couturier[1], Paul del Giorgio[1]

[1]Groupe de Recherche Interuniversitaire en Limnologie (GRIL), Département des Sciences Biologiques, Université du Québec à Montréal (UQAM), Succ. Centre-Ville, Case postale 8888 Montréal, Québec H3C 3P8, Canada

[2] Faculté des arts et des sciences - Département de sciences biologiques, Université de Montréal, Montréal, Québec, Canada

Dissolved organic carbon (DOC) is a key component of the biogeochemical functioning of lakes. Although we know much about the dynamics of DOC concentration and composition at the local and watershed scales, less is known about the variation of DOC at macroscales (i.e., continental) and how different in-lake and ecoregional properties at a continental scale interact to shape its concentration and composition. Here we present the initial results of the large-scale comparative study based on fluorescence spectroscopy to explore DOC optical properties from 680 lakes, part of the NSERC-funded Canadian LakePulse network, distributed within thirteen major ecozones across Canada, spanning a wide range of topographic, watershed, climate features and anthropogenic influence. Five fluorescence components were identified using parallel factor analysis (PARAFAC) and the intensity and relative abundance of these components were analyzed in relation to lake chemistry, catchment, and climate characteristics. There was a large degree of variability within and across ecoregions in lake DOC concentration, suggesting shifting geographic or climatic drivers of how much DOC is loaded and processed within lakes. Our preliminary results also indicate that ecoregions are clearly segregated into clusters on the basis of their respective PARAFAC components, confirming systematic differences in composition of DOC. Ecoregions with high human influence (e.g., the Prairies) in particular tend to have distinct DOC composition patterns.

41 - ***Large-Scale Geospatial Analysis of Beaver Ponds in a Watershed of Boreal Québec***

Facundo Smufer[1], Paul del Giorgio[1]

[1]Département des sciences biologiques, Université du Québec à Montréal

In the boreal biome of North America, aquatic habitats generated by beaver activity are an important component of the landscape. Over the last century the beaver population has been increasing exponentially, and consequently the extent of beaver habitat through the landscape is expected to increase. Although beaver ponds are considered as hotspots of carbon dioxide (CO2) and methane (CH4) production, the carbon (C) emissions associated to beaver habitat have rarely been incorporated into estimates of inland water C budgets. This is hampered by the lack of robust estimates of the extent and size distribution of these habitats within the landscape. Recent improvements of platforms for large-scale geospatial analysis such as Google Earth Engine and high resolution satellite images vastly improve our ability to identify and map different types of waterbodies. The goal of this study was to produce an accurate cartography of the extent, size distribution and morphology of beaver ponds within a selected watershed of boreal Québec, Canada. In order to approach this, we carried out a large-scale geospatial analysis using forestry maps produced by the Québec Ministry of Natural Resources and Wildlife, and high-resolution PlanetScope imagery. Our results show that within the study area (13,105 Km2), there are 10,850 beaver ponds that comprise 79.11 km2, representing 9% of the total aquatic area. The data set produced by this study is a key step in incorporating beaver ponds into estimates of inland water C budgets, as well as for developing hydrological, biogeochemical and other ecological assessments of these habitats.

42 - ***The relevance of terrestrial and aquatic history in microbial community assembly along a boreal terrestrial-aquatic continuum***

Masumi Stadler[1], Paul A. del Giorgio[1]

[1]Département des sciences biologiques, Université du Québec à Montréal

Inland waters form complex hydrological networks acting as a bridge of abiotic and biotic matter between the terrestrial milieu and ultimately the oceans. While microbial taxa traverse through diverse habitats along the network, microbial communities are modified and re-assembled, forming complex patterns of ecological successions. Seldom, however, is the potential effect of upstream assembly on the downstream community composition considered within aquatic networks. Here, we reconstructed the microbial succession along a true land-freshwater-estuary continuum within La Romaine river watershed in Eastern Québec for three years. We captured hydrological seasonality by sampling in spring and summer, and differentiated the total from the reactive community by sequencing both 16S rRNA genes and transcripts. By examining how DNA-/RNA-based assemblages diverge and converge along the continuum, we were able to capture temporal shifts in the relative importance of assembly processes, with mass effects dominant in spring, while species selection became stronger in summer. Spatially, the point of strongest selection within the network differed between seasons, indicating towards a shifting window in selection hotspots that moves depending on the hydrological conditions. Furthermore, the unreactive fraction was composed of a diverse pool of origins along the whole aquatic network, while a large proportion of the reactive community could be traced back to soils and soilwaters. Notably, taxa within the reactive fraction were recruited along the entire rank-abundance curve. Overall, our findings highlight the importance of considering upstream history, hydrological seasonality and the reactive microbial fraction to fully understand microbial community assembly on a watershed scale.

43 - *Emergence of anticipatory governance in the Lake St. Charles' social-ecological system after a period of social conflicts*

Louis Tanguay[1], Beatrix Beisner[1], René Audet[2], Isabelle Lavoie[3]
[1]Département des sciences biologiques, UQAM
[2]Département de stratégie, responsabilité sociale et environnementale, UQAM
[3]Centre Eau Terre Environnement, INRS

Conflicts over resources can lead to many negative consequences hampering relationships between the stakeholders of any social-ecological system, but it can also give rise to new opportunities. The actors involved in governing, managing and using the Lake St. Charles watershed and its resources have faced many challenges because of cyanobacteria blooms in the lake that have led to social conflicts. As part of the LimnoScenES research project, we engaged in a participatory process with diverse local stakeholders, through a series of interviews and workshops. The goal was to bring the actors involved together to build a common vision for the lake and to work on potential solutions for the social-ecological issues that led to the earlier conflicts. In this presentation, I will show how this participatory process allowed us to observe fundamental changes in the mindset of some stakeholders that remained following the disputes over the watershed's management. I will discuss how some signs of anticipatory governance were thus detected, and I will also describe how stakeholders elaborated basic guidelines for engaging in a new governance regime based on the concepts of anticipation and foresight.

44 - Modélisation multispécifique de la distribution des communautés de poissons de lac

Cécilia Teillet[1], Marco A. Rodríguez[1], Andrea Bertolo[1]
[1]Centre de Recherche sur les interactions Bassins Versants – Écosystèmes Aquatiques, Université du Québec à Trois-Rivières

L'écologique se concentre souvent sur la compréhension des réponses des espèces aux filtres environnementaux et des interactions inter-spécifiques pour expliquer leur occurrence, co-occurrence et distribution spatiale. Les approches de modélisation hiérarchique abordent la compréhension des réponses des espèces aux filtres environnementaux au niveau communautaire en prenant simultanément en compte les réponses de plusieurs espèces aux variations environnementales et l'influence des traits des espèces sur ces réponses. Notre étude visait à comprendre comment la présence de 22 espèces de poissons est influencée par les variations environnementales dans 44 lacs du parc national de la Mauricie. Nous avons utilisé un modèle multispécifique de distribution des espèces (JSDM) pour déterminer comment l'occurrence des espèces répond aux variations environnementales, ainsi que l'influence de la phylogénie et des traits fonctionnels sur ces réponses. Le JSDM a également été utilisé pour examiner les modèles de co-occurrence d'espèces. Pour beaucoup d'espèces, la probabilité d'occurrence diminue avec l'augmentation des concentrations en carbone organique dissous, et augmente avec la connectivité des lacs et la superficie. Les modèles de cooccurrence étaient pour la plupart neutres, suggérant que la prédation et la compétition ne jouent qu'un rôle indirect dans la structuration de ces communautés. La connectivité des lacs ainsi que les concentrations en nutriments semblent être des facteurs clés de la probabilité d'occurrence pour de nombreuses espèces, soulignant l'importance probable de l'isolement, de la production littorale et des refuges en tant que moteurs de la diversité des poissons dans ces lacs.

45 - ADN environnemental et metabarcoding, des outils prometteurs pour évaluer les réponses des communautés d'invertébrés à l'introduction de truites invasives dans les lacs de montagnes

Daphné Trépanier-Leroux[1], Melania Cristescu[2], Dylan Fraser[3], Alison Derry[1]
[1]Département des Sciences Biologiques, UQAM
[2]Department of Biology, McGill
[3]Department of Biology, Concordia

Dans les Rocheuses canadiennes, l'omble de fontaine, *Salvelinus fontinalis*, est une des espèces introduites les plus invasives. L'introduction de ce poisson s'est faite dans des lacs sans égard aux conséquences sur les écosystèmes. Les études faites à ce jour n'ont pris en compte que l'effet sur les communautés de zooplancton et très peu se sont attardés aux communautés de macro-invertébrés, malgré leur importance dans la diète des ombles de fontaine. Mon projet a pour but d'évaluer l'effet de l'omble de fontaine sur les communautés de proies et prend place dans 14 lacs de la région de Banff, CB, Canada. Je combine des méthodes traditionnelles d'énumération et des méthodes moléculaires de metabarcoding et d'ADN environnemental (eDNA). La combinaison de ces méthodes permettra d'évaluer l'effet de ce poisson invasif plus en détail et de détecter avec une plus grande sensibilité les espèces d'invertébrés aquatiques. Cela devrait se traduire par une meilleure détection des communautés de proies par rapport aux méthodes traditionnelles puisque les techniques moléculaires permettront de détecter des espèces rares grâce à leur plus grande précision. Je pourrai ainsi avoir une idée plus précise de l'effet de l'omble de fontaine sur les macro-invertébrés et le zooplancton incluant la richesse et l'abondance de ces communautés. C'est la première fois que ces méthodes moléculaires sont utilisées pour mesurer l'impact d'une espèce plutôt que pour sa détection. Ce sera aussi une des premières études prenant en compte des données de communautés de l'omble de fontaine plutôt que seulement sa présence ou son absence.

eDNA metabarcoding for an expanded understanding of how aquatic zooplankton and macroinvertebrates community assemblages respond to exotic trout introduction in mountain lakes

In the Canadian Rockies, brook trout, *Salvelinus fontinalis*, is one of the most introduced and invasive fish species. The introduction of these fish in lakes was done will little regards to the consequences on the ecosystems. As of today, studies have only looked at the impact on the zooplankton communities and very few have looked at macroinvertebrate's communities. The objective of my project is to evaluate the effect of brook trout on the invertebrate prey communities of 14 mountain lakes in the region of Banff, BC, Canada. I combined traditional enumeration methods with molecular methods, environmental DNA (eDNA) and metabarcoding. The combination of these methods will enable the evaluation of the effect of this invasive fish with more depth. This should translate by a better detection of the prey communities compared to traditional methods. I will be able to have a more precise idea of the effect of brook trout on the macroinvertebrates and zooplankton communities, including the richness and abundance of these communities. It will be the first time these molecular techniques will be used to measure the effect of a species rather than for its detection. It will also be one of the first time brook trout population data will be used rather than just its presence and absence. This could potentially give more insight in how the brook trout population affect the invertebrate communities in these lakes. Therefore, giving a better understanding of how the introduction of an exotic trout affects the native invertebrate communities.

46 - Approche multi-descripteurs pour le suivi des effets interactifs d'un biocide et de la lumière sur les biofilms de rivières

Romain Vrba[1, 2], Nicolas Creusot[1], Mélissa Eon[1], Agnès Feurtet-Mazel[3], Gwilherm Jan[1], Nicolas Mazella[1], Aurélie Moreira[1], Dolors Planas[4], Isabelle Lavoie[2], Soizic Morin[1]

[1]Inrae, UR EABX

[2]INRS-ÉTÉ

[3]Université de Bordeaux, CNRS, UMR EPOC

[4]UQAM, GRIL

En zone urbanisée, la généralisation de la lumière artificielle de nuit impacte négativement les biofilms périphytiques entraînant des perturbations photosynthétiques qui peuvent se traduire par des modifications dans leur métabolisme. De plus, avec le contexte épidémique actuel, l'utilisation des biocides a connu une forte augmentation. Parmi eux, le chlorure de benzyldiméthyldodecylammonium (BAC 12), un biocide utilisé dans plus de la moitié des produits virucides conseillés par l'US EPA contre le SARS-CoV 2 soulève des questions. Ce composé est connu pour être toxique pour les organismes aquatiques et certaines études avancent qu'une exposition lumineuse artificielle pourrait accroitre son impact envers les biofilms. Ces derniers étant la base de la chaine trophique aquatique et ayant un potentiel de réponse rapide face à des perturbations, l'objectif de cette étude est donc d'étudier les effets individuels et conjugués du BAC 12 et de l'illumination nocturne sur les biofilms aquatiques urbains. Dans un premier temps, le long d'une cinétique de 10 jours nous regarderons les effets d'une exposition à ces stress sur leurs profils lipidiques qui nous informerons sur les possibles répercussions directes (synthèse des lipides) et indirectes (changements de composition dans les communautés) en lien avec leur qualité nutritive. Dans un second temps, nous évaluerons l'impact d'une telle co-exposition sur une chaîne alimentaire simplifiée (i.e. exposition de brouteurs à du biofilm pré-exposé) afin de révéler un possible transfert. Dans l'ensemble ces travaux pourraient permettre d'identifier des biomarqueurs d'altération(s) spécifique(s) candidats pour la surveillance de l'impact de ces stress sur les communautés microbiennes aquatiques.

47 - Variabilité spatiale et temporelle des caractéristiques microbiologiques et géochimiques d'un aquifère résultant de l'exploitation d'un système de pompes à chaleur géothermique

Charis Wong[1], Geneviève Bordeleau[1], Jasmin Raymond[1], Christine Rivard[2], Jérôme Comte[1]
[1]INRS-ETE
[2]GSC

Substantial amount of heat is released into the atmosphere as a result of conventional building cooling technologies. This leads to the formation of urban heat islands in populated areas, which contribute towards climate change. This project investigates the potential of utilising groundwater heat pump systems (GWHPs) as a form of energy efficient cooling technology in the major Canadian cities.

With this technology, groundwater is extracted from an abstraction well for cooling purposes at the buildings, before being reinjected back into the aquifer through an injection well. This operation interrupts the natural aquifer processes by inducing the mixing of shallow oxic and deeper anoxic iron-rich groundwater at the abstraction well, causing precipitation of iron oxyhydroxides mediated by iron oxidising bacteria, and the development of a thermal plume in the aquifer near the injection well. However, their impacts on the aquifer ecosystem remain to be understood.

The aim of this study is to determine how GWHPs influences aquifer geochemistry and microbial communities. We hypothesize that: 1) The geochemical and microbiological responses (both compositionally and functionally) to the GWHP operation will vary spatially due to local processes; 2) Different geochemical and microbiological responses are likely to be observed at different periods throughout the operation (e.g. heat injection and recovery). A field pilot test to simulate the GWHPs has been conducted in summer 2020; preliminary results confirmed spatial and temporal variation in aquifer geochemistry and microbial metabolic functioning. Further analyses of microbial community composition and laboratory experiments will be conducted for this project.

The spatial-temporal variability of an aquifer's microbiological-geochemical characteristics as resulted from the operation of a groundwater heat pump system

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48 - *Spatiotemporal analysis of environmental change across Canadian lakes*

David Zilkey[1], Alexandre Baud[1], Pierre Francus[2], Dermot Antoniades[3], Irene Gregory-Eaves[1]

[1]Université McGill

[2]Institut national de la recherche scientifique

[3]Université Laval

Lakes across Canada are affected by natural and anthropogenic factors, but the presence and strength of different drivers are not spatially consistent. At present, there is a fragmented understanding of environmental change across the Canadian landscape. Lake sediments offer a window into the past, but most paleolimnological studies generate only local to regional perspectives. With the NSERC Canadian LakePulse Network, we have an opportunity to develop a more complete portrait through the analysis of 116 sediment cores from across the Canadian landscape. Research on cores obtained from Eastern Canadian lakes to investigate spatiotemporal geochemical change is nearing completion; sediments were dated using lead-210 and elemental change was analyzed with a micro X-ray fluorescence (ITRAX) instrument. Our team is now building on this foundation to extend the geochemical analysis to lakes from Central and Western Canada and integrate the results from Eastern Canada. Hotspots of geochemical change across the Canadian landscape will be detected in order to predict regions where augmented future geochemical changes may be expected.

Université de Montréal

UQÀM
Université du Québec à Montréal

UQTR
Université du Québec à Trois-Rivières

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