UNIVERSITY OF OTTAWA DECEMBER 2021

The Record

The 2021 newsletter for the Blais lab; Issue 5

Highlights for 2021

Despite the continuing pandemic and restrictions on our movement, we have much to be proud of in 2021. This year was a time when we found new ways to continue our research and adapt to new circumstances. This newsletter features some of our lab's highlights for 2021.

August 2021. The Collective Climate Accountability and Adaptation Project seen here during its field sample collection in Saskatchewan. Our objective was to study lakes across four different ecoregions to better predict impacts of long-term climate change. Our team represents a collaboration between Indigenous communities and universities across Canada.

Who we are in 2021:


Jules Blais


Linda Kimpe


David Eickmeyer


Brayden Gregory


Mija Azdajic


Sawyer Stoyanovich


Cynthia Cheney


Jennifer Keir


Jennifer Kissinger


Daniel Dagodzo


Stephanie Walsh


Adriana Raats


Bowen Xiao

Collective Climate Accountability and Adaptation Project (CCAAP)

We are working with northern communities in Saskatchewan to promote climate literacy, climate science and climate action.

Our lab is a member of the Collective Climate Accountability and Adaptation Project (CCAAP), an Indigenous-led program funded by Environment and Climate Change Canada to support programs in climate literacy, climate science, and climate action in northern Saskatchewan.

This is an exciting new initiative for our group that has allowed us to work with northern communities in ways we haven't been able to do before. Based at the Clearwater River Dënë School in Laloche Saskatchewan., and led by Dënë Cheecham-Uhrich, a community leader from Laloche, this project intends to inspire a new generation of Indigenous and non-Indigenous climate leaders, improve our collective understanding of climate change, and to help mobilize climate action.

We are working with communities to combine our methods of studying the past using sediment archives with a better knowledge of environmental change based on traditional ecological knowledge. Both traditional ecological knowledge and paleolimnology are interpretations of past events, so this project hopes to combine these different approaches to better merge these knowledge systems. To do this, we will engage the Elders and families (and any interested community members) from the Laloche and Clearwater River communities to provide personal accounts on the changing lakes and forests either through their own personal stories or knowledge passed down into the family retrospections.

Our goal is to learn how to study environmental change by consulting with land experts and reading information preserved at the bottom of lakes.

In summer 2021, we sampled sediment and water from 15 lakes spanning 4 ecoregions in Saskatchewan. One of our goals was to identify chemical markers (e.g. chemical mixtures of lignins, sterols, n-alkanes) that may be characteristic of different ecoregions (e.g. prairie grassland, aspen parkland, boreal transition, and boreal Uplands). We hope to combine this information with what we can learn from Indigenous and community knowledge holders.

Summer 2021. The logo for the CCAAP project represents both Indigenous knowledge systems (left) and scientific knowledge systems (right). The middle (third) space merges the two.

New insights from a Jamaican bat cave

4,300 years of bat foraging and environmental change recorded in a natural archive.

We recently applied our methods of tracking historical changes in lake sediments to a bat cave in Jamaica in a study published this year in the Journal of Geophysical Research: Biogeosciences.

Bat guano was used historically as fertilizer and was also used to make saltpeter, a key ingredient in the production of gun powder. For this reason, few intact deposits still exist. The deposit in the Home Away From Home cave in Jamaica was protected by a steep drop inside the cave that required technical climbing equipment to access it.

Like sediment and ice core records, the guano core extracted from the Jamaican cave recorded the chemical signatures of human activities like nuclear testing and leaded gasoline, which, along with radiocarbon dating, helped us to correlate the history seen in the guano with other events in Earth's climate history.

Our new study looked at biochemical markers of diet called sterols, a family of sturdy chemicals made by plant and animal cells that are part of the food bats and other animals eat. Cholesterol, for example, is a well-known sterol made by animals. Plants make their own distinctive sterols. These sterol markers pass though the digestive system into excrement and can be preserved for thousands of years. We compared the relative amounts of plant and animal sterols in the guano core though the layers to learn about how the cave's bats shifted their exploitation of different food sources over thousands of years.

We found a spike in plant sterols relative to animal sterols about 1,000 years ago during the Medieval Warm Period (900-1,300 CE), a time when cores of lakebed sediments in Central America suggest the climate in the Americas was unusually dry. Similar spikes occurred 3,000 years ago, at a time known as the Minoan warm period (1350 BCE). Our results suggested that fruit diets were favoured during dry periods.

Through their dietary habits, bats provide pollination, insect suppression and seed dispersal for ecosystems. This research provides a first glimpse at the different strategies used by bats over the past four millennia, and also shows how human activity has affected their foraging behaviour and their ability to nourish themselves.

See AGU press release for more:

https://news.agu.org/press-release/poop-core-records-4300-years-of-bat-diet-and-environment

Entrance to the Home Away From Home cave in Jamaica. (Photo: Chris Grooms)

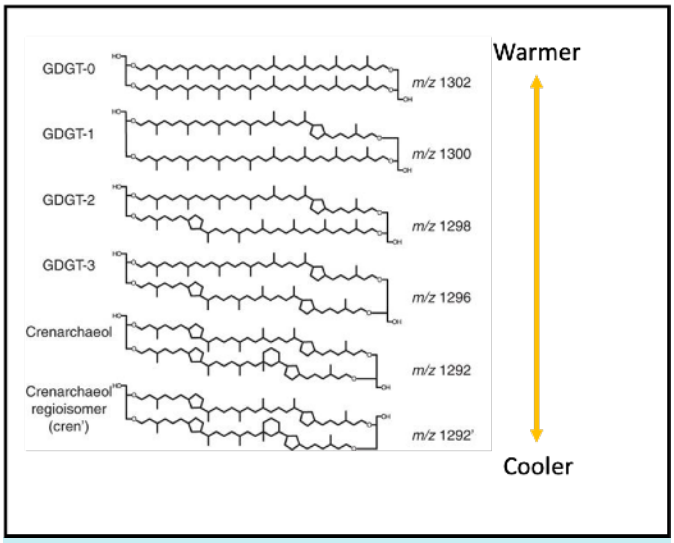
A new collaboration in France

We are working with colleagues at Sorbonne Université in Paris to develop new methods for paleoclimate research.

Arctic coastlines are experiencing some of the most rapid climate warming on Earth, with significant future climate change predicted. Arctic coastlines in particular are an important habitat for diverse plants, lichens, and wildlife, including seabirds, and terrestrial and marine mammals. These extreme environments are under high water stress because the High Arctic is a dry polar desert with limited precipitation. One of the consequences of climate warming is that prolonged summers due to warming conditions is causing the disappearance of coastal ponds and wetlands, with widespread consequences for Arctic coastal ecosystems, including wildlife.

A focus for the conservation of Arctic coastal ecosystems is to place the recent changes in Arctic coastal ecosystems in the context of long-term climate variability. Our lab has begun a collaboration with Prof. Arnaud Huguet at Sorbonne Université in Paris to answer questions about long-term climate variability in coastal Arctic environments. Both our groups have focused our research on the study of climate variability using lake sediment cores and peat cores as archives for reconstructing long-term environmental change. We have applied to the France Canada Research Fund (FCRF) to formalize this collaboration and support exchanges between our laboratories.

Recent advances in paleolimnology are focused on a new group of temperature-sensitive biomarkers with a promising ability to infer past temperatures from lake sediments and other natural archives. These chemical indicators include the glycerol dialkyl glycerol tetraethers (GDGTs), temperature-sensitive microbial membrane lipids. Our goal is to develop new tools to study climate warming in the Canadian High Arctic and elsewhere. Jules will be spending a part of his sabbatical along with other Blais lab members in Paris working with the Huguet team to further develop these methods and apply them to sites across Canada.



Glycerol dialkyl glycerol tetraethers (GDGTs) are microbial membrane lipids that may allow us to track past temperature changes based on chemical records in natural archives like lake sediments or peat cores.

Studying radioisotopes in Nunavik

Our collaborators with Canadian Nuclear Laboratories traveled to Kuujjuaq to determine how radioisotopes may find their way into northern food webs.

In the summer of 2021 environmental research by our lab and CNL Chalk River Laboratories, continued with the goal to better understand the behaviour and transportation of naturally occurring and artificially generated radionuclides in northern environments. The research is motivated by the increase of uranium mining as well as the potential for deployment of small modular reactors (SMRs).

We were part of a group of researchers who travelled to Kuujjuaq, a Nunavik community in northern Quebec, to collect soil, tundra plant species and water samples to study how soil type and water chemistry can impact the uptake and accumulation of low-level radioactive contaminants in various plant species. Local Inuit guide, Allen Gordon, provided knowledge of the land its traditional uses.

A second trip to Lac Granet, QC, focused on the uptake of naturally occurring radionuclides, specifically polonium-210 and lead-210, in various freshwater aquatic organisms and how water chemistry and land cover may impact their ultimate fate. Stephanie was able to test an optimized, rapid determination method for polonium-210 analysis using these samples. Similar samples were collected around decommissioned uranium mines in the Bancroft, ON region to gain an understanding of how mining operations may impact the presence of polonium-210 and lead-210 in surrounding environments.

Summer 2021: Stephanie Walsh collecting stream water on the shore of the Koksoak River, Kuujjuuaq, QC

Summer 2021: Stephanie Walsh sampling the freshwater foodweb of Lac Granet, QC

David W. Schindler (1940 – 2021)

David W. Schindler, one of limnology's most prominent and recognizable champions, passed away on March 4, 2021. During his long and prolific career spanning 6 decades, Dave is perhaps best remembered for his whole-lake experimental approaches to address questions related to eutrophication, climate change, and chemical pollutants. To those who knew him, he was also a passionate advocate for the environment, a remarkable intellect, an avid reader, a fierce debater, a hearty outdoorsman, and (perhaps surprisingly to some) a patient mentor. Importantly, he was an outstanding role model, not only for his prowess in conducting ground-breaking science, but also by demonstrating the importance of communicating scientific findings to policy makers and the public-at-large.

His early collaborative research on the importance of phosphorus on algal blooms brought international attention to the nascent ELA in the early 1970s. At the time, harmful algal blooms were increasing in number and frequency worldwide, and their causes were fiercely debated. One of Dave's approaches to inform the eutrophication debate was to divide a narrow section of ELA's Lake 226 with a curtain and fertilize one side with carbon and nitrogen, and the other side with carbon, nitrogen, and phosphorus. Only the side fertilized with phosphorus developed a massive algal bloom, providing clear experimental evidence of the role of phosphorus in the eutrophication of lakes. The photo became one of the most famous images in environmental sciences, broadcast internationally and reproduced in numerous textbooks, magazines, and newspapers (see inset photo). This research ultimately led to regulations to limit phosphorus as well as new technologies to remove phosphorus in water treatment, a move that improved water quality worldwide. The success of phosphorus abatement in controlling algal blooms has since become a testament to Dave's early intuitions, not just to the science of limnology, but to the improvement of water quality and to the quality of life for millions of people. In the process, Dave helped transform the science of limnology from an obscure academic discipline to a mainstream science with direct applications to public policy, human health, and ecosystem management.

The photo that went around the world: The eutrophication experiments led by David W. Schindler at the Experimental Lakes Area in northwestern Ontario changed how we manage algal blooms in lakes.
Photo: D.W. Schindler

More reading on David W. Schindler:

https://thetyee.ca/News/2021/03/09/David-Schindler-Scientific-Giant-Fresh-Water-Defender/

OUR GRADUATES ARE MOVING ON TO NEW POSITIONS!

Jonathan Séguin and Sawyer Stoyanoovich have both accepted positions as environmental consultants with Bruce Kilgour and Associates and will be moving back to Ottawa. We are excited for their new opportunity and we look forward to seeing them around town.

Cynthia Cheney has accepted a position as an environmental consultant.

Mija Azdajic, has accepted a postdoctoral position following her thesis defense (in January 2022) at Health Canada working with our long time colleague Paul White.

A taste of research in 2021...

August 2021: Saskatchewan field crew processing sediment cores. From left, David Eickmeyer, Dënë Cheecham-Uhrich, Henriikka Kivilae, Liam Cheecham

Summer 2021. Stephanie Walsh, David Rowan and Allen Gordon at the site of an ancient tent ring on the shore of Wolf Lake, Kuujjuuaq, QC.

August 2021: Collecting a sediment core in Saskatchewan with Boreal forest in background.

Summer 2021. Muskox herd browsing on the shore of Wolf Lake, Kuujjuaq, QC

FINDING NEW WAYS TO BE CREATIVE DURING A PANDEMIC

Braden and his fiancée Holleh have been preparing for their upcoming wedding, but with so many couples delaying their wedding because of pandemic restrictions, demand has skyrocketed, and prices on everything from venues to cakes and flowers are exorbitant. To reduce costs, they started looking for alternatives and found some clever solutions. One of their ideas was to make all their flowers by hand using crepe paper. For the past few months, they spent evenings covered in hot glue strings and pan pastels as they slowly accumulated a stockpile of paper flowers for the big celebration.

Left: A small bouquet decorating Braden and Holleh's front hall. Right: The flower stockpile so far. Almost halfway there!

CONGRATULATIONS TO EVERYONE WHO DEFENDED THEIR THESES IN 2021!

Cynthia Cheney (PhD)

Jonathan Séguin (MSc)

Sawyer Stoyanovich (PhD)

Publications in 2021:

Duda MP, Hargan KE, Michelutti N, Blais JM, Grooms C, Gilchrist HG, Malory ML, Robertson GJ, Smol JP. 2021. Reconstructing long-term changes in avian populations using lake sediments: Opening a window onto the past. Frontiers in Ecology and Evolution 9: Article 698175 https://doi.org/10.3389/fevo.2021.698175

Black TA, White MS, Blais JM, Hollebone B, Orihel DM, Palace VP, Rodriguez-Gil JL, Hanson ML. 2021. Surface oil is the primary driver of macroinvertebrate impacts following spills of diluted bitumen in freshwater. Environmental Pollution 290: 117929. https://doi.org/10.1016/j.envpol.2021.117929

Aždajić M, Yumvihoze E, Blais JM, Poulain AJ. 2021. The effect of legacy gold mining on methylmercury cycling and microbial community structure in northern freshwater lakes. Environmental Science: Processes & Impacts https://doi.org/10.1039/d1em00129a

Stoyanovich SS, Rodríguez-Gil JR, Hanson M, Hollebone BP, Orihel DM, Palace V, Faragher R, Mirnaghi FS, Shah K, Yang Z, Blais JM. 2021. Simulating bitumen spills in Boreal Lake limnocorrals – Part 2: Factors affecting the physical characteristics and submergence of diluted bitumen. Science of the Total Environment 790: 148580. https://doi.org/10.1016/j.scitotenv.2021.148580

Rodriguez-Gil JL, Stoyanovich S, Hanson ML, Hollebone B, Palace V, Orihel DM, Black T, Cederwell J, Mason J, Patterson S, Timlick L, Séguin J, Blais JM. 2021. Simulating diluted bitumen spills in boreal lake limnocorrals - Part 1: Experimental design and responses of hydrocarbons, metals, and water quality parameters. Science of the Total Environment 790: 148537. https://doi.org/10.1016/j.scitotenv.2021.148537

Thienpont JR, Yang Z, Hall RI, Wolfe BB, Hollebone BP, Blais JM. 2021. Tracking petrogenic hydrocarbons in lakes of the Peace-Athabasca Delta, Alberta, Canada using petroleum biomarkers. Environmental Pollution 286: 117286 https://doi.org/10.1016/j.envpol.2021.117286

Clyde N, Hargan KE, Forbes MR, Iverson SA, Blais JM, Smol JP, Bump JK, Gilchrist, H.G. 2021. Seaduck engineers in the Arctic Archipelago: Nesting eiders deliver marine nutrients and transform the chemistry of island soils, plants, and ponds. Oecologia https://doi.org/10.1007/s00442-021-04889-9

Salat A, Williams K, Chiu S, Eickmeyer D, Kimpe LE, Blais JM, Crump D. 2021. Extracts from dated lake sediment cores in the Athabasca Oil Sands Region alter EROD activity and gene expression in avian hepatocytes. Environmental Toxicology & Chemistry 40: 1883-1893. https://doi.org/10.1002/etc.5040

Gallant LR, Fenton MB, Grooms C, Bogdanowicz W, Stewart RS, Clare EL, Smol JP; Blais JM. 2021. A 4,300-year history of dietary changes in a bat roost determined from a tropical guano deposit.Journal of Geophysical Research – Biogeosciences126, e2020JG006026 https://doi.org/10.1029/2020JG006026

Perrett M, Sivarajah B, Cheney C, Korosi J Kimpe LE, Blais JM, Smol JP. 2021. Impacts on

aquatic biota from salinization and metal(loid) contamination by gold mine tailings in sub-Arctic lakes. Environmental Pollution 278 ; 116815. https://doi.org/10.1016/j.envpol.2021.116815

Persaud AA, Cheney CL, Sivarajah B, Blais JM, Smol JP, Korosi JB. 2021. Regional changes in Cladocera (Branchiopoda, Crustacea) assemblages in subarctic (Yellowknife, Northwest Territories, Canada) lakes impacted by historic gold mining activities. Hydrobiologia, https://doi.org/10.1007/s10750-021-04534-9

Salat APJ, Eickmeyer DC, Kimpe LE, Hall RI, Wolfe BB, Mundy LJ, Trudeau VL, Blais JM. 2021. Integrated analyses of petroleum biomarkers and polycyclic aromatic compounds in lake sediment cores from an oil sands region. Environmental Pollution 270: 116060 https://doi.org/10.1016/j.envpol.2020.116060

Cheng W, Kimpe LE, Mallory ML, Smol JP, Blais JM. 2021. An ~1,100-year sediment record of Arctic seabird occupation. Geology v. 49: 510-514. https://doi.org/10.1130/G48215.1

Conference presentations in 2021:

Keir JLA, Kirkham T, Aranda-Rodriguez, R, White PA, Blais JM. Soap and water is the most effective skin PAH decontamination method for firefighters, but it doesn't reduce the internal dose. Platform presentation at the Environmental Mutagenesis & Genomics Society Annual Meeting (virtual), September 22-25, 2021

Keir JLA, Kirkham T, Aranda-Rodriguez, R, White PA, Blais JM. Study of dermal cleaning procedures to reduce firefighters' exposures to combustion-derived PAHs. Poster presentation at the Environmental Mutagenesis & Genomics Society Annual Meeting (virtual), September 22-25, 2021.

Keir JL, Kirkham TL, Aranda-Rodriuez R, White PA, Blais JM. Effectiveness of reducing firefighters' exposure to PAHs and genotoxins by implementing dermal cleaning interventions. Laurentian and Prairie Northern Annual General Meeting and Conference; Virtual location. June 14-18, 2021.

Cheney CL, Eccles KM, Kimpe LE, Lehnherr I, Blais JM. Tracing the legacy of mercury deposition to lake sediments near historic sub-Arctic gold mines. Ontario-Quebec Paleolimnology Symposium (PALS). Virtual location. May 2-4, 2021.

Gregory BRB, Kissinger J, Kimpe LE, Eickmeyer DC, Kurek J, Smol JP, Blais JM. Do commercial mink farms contribute Hg to aquatic ecosystems in SW Nova Scotia? Presented to the 13th Annual Québec/Ontario Pleolimnology Symposium, online, May 4-5, 2021.

Duda MP, Letournel B, Robertsoon GJ, Lim JE, Kimpe LE, Michelutti N, Blais JM, Smol JP. Tracking ~5,800 years of natural seabird dynamics and the impacts of European settlement on St. Pierre and Miquelon, Atlantic Canada. Presented to the 13th Annual Québec/Ontario Paleolimnology Symposium, online, May 4-5, 2021.

Blais JM. Coupler les analyses d'isotopes stables et de nouveaux biomarqueurs organiques dans

les archives sédimentaires pour étudier les changements environnementaux. Présentation invitée pour le Congrès des étudiant.e.s du Géotop 2021, à l'Université du Québec à Montréal, le 17 mars, 2021.