UNIVERSITY OF OTTAWA DECEMBER 2017

The Record

The 2017 newsletter for the Blais lab; Issue 1

Highlights of 2017

Archeological sites in Nunavut, collaborations in China, bats in Central America, lake expansion into bison habitat, field work in Canada's oil sands region, Yellowknife gold mines, firefighter health, and a pilot study at the IISD-Experimental Lakes Area.

July 2017. Lauren Gallant and David Eickmeyer retrieving a sediment core in 'Savelle Pond' at PaJs-13, a Thule site on Somerset Island in Nunavut, Arctic Canada (see p. 5). Remnants of 'whale bone houses' are visible in the background. Photo: Jules Blais

FIELD SITES

IISD Experimental Lakes Area; Alberta oilsands; Tibetan Plateau; Canada's north

RESEARCH VIGNETTES

Gold mines; Firefighter health; Oil spills in lakes; Arctic pre-history

MISCELLANEOUS

Navigating an air weapons range; Introducing FACETS; Movember/Wovember

Studying oil spills

New pilot study in Northwestern Ontario

Arsenic in the Northwest Territories

Examining Giant Mine's historical impacts

Combining lake studies with archeology

Lake sediments reveal the history of Arctic people

Who we are in 2017:


Jules Blais, Professor


Linda Kimpe, Lab Manager


David Eickmeyer, Lab Analyst


Josh Thienpont, Postdoctoral Fellow


Katherine Hargan, Postdoctoral Fellow


Jose Rodriguez-Gil, Postdoctoral Fellow


Philippe Thomas, PhD Candidate


Lauren Gallant, PhD Candidate


Mija Azdajic, PhD Candidate


Cynthia Cheney, PhD Candidate


Jonathan Seguin, PhD Candidate


Sawyer Stoyanovich, PhD Candidate


Madison Bell, PhD Candidate

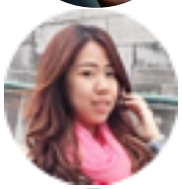

Jennifer Keir, MSc Candidate


Brian Moeun, MSc Candidate


Michelle-Claire Roy, MSc candidate


Kirsten Smythe, MSc Candidate


Alexandre Salat, MSc Candidate


Claudia Tanamal, MSc Candidate


Leah Cundall, MSc Candidate

Studying how arsenic and mercury affect ecosystems near Yellowknife gold mines

Our studies have revealed how and when lakes were affected by contaminants, which can lead to more sustainable mining practices.

Yellowknife is home to half the population of the Northwest Territories in Canada, and owes much of its economic expansion to gold mines. In particular, Giant Mine, located just 7 km from downtown Yellowknife, produced over 7 million ounces of gold during its operation that spanned from 1948 to 2004.

However the economic boom from this Klondike gold rush had a dirty secret. Toxic arsenic trioxide dust was being released from the mine's roaster stack, with the worst contamination occurring in the first decade of the mine's operation. Over 20,000 tonnes of arsenic trioxide dust was released directly to the air from the stack between 1948 and 1958. In subsequent years, the mine's operators collected and moved the toxic dust underground, leaving a legacy that must be maintained until a solution for this contamination can be found. Despite a $1 billion remediation effort, there is widespread public concern over this contamination.

Our lab is currently engaged in a Strategic Partnership grant from the Natural Sciences and Engineering Research Council of Canada to study the effects of that legacy arsenic in lakes

September 2017: David Eickmeyer extruding a sediment core in the field. Photo: Claudia Tanamal

near Yellowknife. As part of this research program, Adam Houben, a PhD candidate in our lab, drew attention to high arsenic in Yellowknife lakes in a 2016 study that showed high arsenic in lakes within a 15 km radius of the mine. Another study from our lab in the same year revealed that high arsenic releases to Pocket Lake near Giant Mine resulted in dramatic changes to the lake's ecosystem. A novel aspect of our study was that we used dated lake sediment cores to show the timing and magnitude of these changes, enabling us to show that contamination from the the mine was responsible. In the process, we are developing the field of Paleoecotoxicology, the use of natural archives to track historical ecological effects of past contamination events.

Media related to this story

CBC Print: Lake near Giant Mine will never recover from contamination, new research shows.

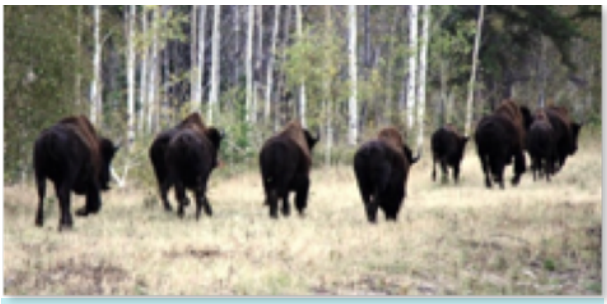
Lake expansion displaces a threatened species in the Mackenzie Bison Sanctuary

Josh Thienpont and Jennifer Korosi showed that recent climate change has caused extensive lake expansion and landscape flooding in the southern Northwest Territories, affecting the core habitat of the Mackenzie wood bison herd.

Wood bison are listed as "threatened" under Canada's Species At Risk Act. The Mackenzie Bison Sanctuary in the NWT plays a key role in efforts to conserve and increase wood bison populations in the Northwest Territories. Unfortunately, bison surveys show this herd has been shrinking since the 1980s, and our research in 2017 identified a possible cause.

Our study published in Nature Communications looked at changes in critical bison habitat in two ways (1) satellite images covering a 10,000 km2 section of the region between 1986 and 2011; and (2) a lake sediment core spanning over two hundred years of lake deposits.

The satellite image survey revealed that the total lake surface area in the region nearly doubled over that period. Chemical analysis in the lake sediment record also captured the lake expansion event, and further showed that the flooding of the landscape over the past two decades was unprecedented in over 200 years.



February 2017: A bison herd in the Mackenzie Bison Sanctuary. Photo: Linda Kimpe

This lake expansion is disproportionately affecting essential bison habitat by flooding the bison's preferred habitat, the grassy meadows that tend to grow in previously dry plains. Surveys done at the same time indicate that as the lakes expanded, the bison herd abandoned the former core of its range within the protected area of the sanctuary.

"The results of our study, both from the satellite imagery and lake sediments, point to recent climate change as being the primary driver of lake area expansion in this region," said Joshua Thienpont, a senior author of the study and postdoctoral fellow in the Blais lab at the University of Ottawa. Thienpont noted that there are various mechanisms by which lakes can expand or shrink due to climate change across the vast northern landscape, which are currently being studied. *

Media related to this story:

CBC Print: Climate change doubles size of lakes in N.W.T. bison sanctuary, reducing habitat.

*with excerpts from a University of Ottawa press release posted on February 23, 2017

Paleo-archeology of the Thule, ancestors of the Inuit

Our studies using lake sediment cores are permitting us to look back into the lives of Arctic whalers who lived a thousand years ago.

Our July 2017 expedition to Resolute Bay brought our field crew to a number of Thule archeological sites on Bathurst Island, Somerset Island, and Cornwallis Island.

The Thule were a whaling society, ancestors of the modern-day Inuit, who survived the Arctic environment by their resourcefulness. They used umiaks, large open skin boats rowed by seven to eight people, and harpoons attached to lines. With these tools, the Thule hunted bowhead whales that could reach over 60 feet in length. Our team was struck and amazed by how the Thule people lived, and how they earned their living.

July 2017: Remnants of Thule whale bone houses at the Deblicquy Site on Bathurst Island. Photo: Linda Kimpe

July 2017: Jules Blais and Lauren Gallant flanking an intact Thule house at Brooman Point on Bathurst Island. Photo: Linda Kimpe

Without the benefit of any wood from trees in this Arctic desert, they framed their houses with whale bone and covered them with skins, or buried them in the ground. The entrance to their houses was typically trenched in the ground to insulate from the cold.

Our research involved collecting and analyzing lake sediment cores adjacent to these Thule camps and settlements. When the whalers brought whales and other hunted animals back to their families, the nutrients from these animals fertilized the local environment and left chemical and biological tracers that washed into nearby ponds, becoming fossilized in the layers of pond sediments. Lauren Gallant will be carefully examining the sediment layers in these ponds in 2017-2018, and applying radiocarbon dates to the sediment layers to reveal details of Thule occupation in these locations.

Building bridges to China to study how waterbird populations have changed on the Tibetan Plateau

We are collaborating with partners in China to study how birds on the Tibetan Plateau occupied lakes over thousands of years, based on lake sediment records.

The Tibetan Plateau in northern China is a montane grassland region bordered by the Himalayan, Kunlun, and Qilian mountain ranges. It stands as the world's largest and highest plateau region, harbouring nomadic populations who raise livestock due to the terrain's unsuitability to crops and other forms of agriculture. It is an extreme environment at high altitude, whose severe climate and scant resources have tested the limits of its occupants for thousands of years. The region has recently attracted much scientific interest due to the effects of climate change, where warming is four times faster than the average in China, and Tibetan glaciers are retreating faster than in any other part of the world.

At 3,194 meters above sea level on the Tibetan Plateau sits Qinghai Lake, the largest closed basin lake in China. Located in Qinghai Province at the crossroads of major bird migration routes, it harbours large populations of water birds that congregate in certain areas, attracting large numbers of tourists every year.

Our lab is embarking on a project to use lake sediment cores to track waterbird population dynamics in Qinghai Lake over thousands of years, using techniques we have developed in pilot studies in Arctic Canada and the Laurentian Great Lakes. Dr. Jinping Liu is a Professor at Qinghai Normal University in Xining who spent a year in our lab learning methods to study the history of bird migrations using lake sediment cores. She is now leading a project to study how bird populations fluctuated over past millennia in Qinghai Lake in response to past changes in climate and human occupation. The project will also involve our former postdoctoral fellow Dr. Wenhan Cheng, who is now Assistant Professor at the University of Science and Technology of China in Hefei. Our team located suitable sites for our study in 2017, and we plan to return in 2019.

April 2017: Qinghai Lake on the Tibetan Plateau in China (top), and a colony of cormorants on the same lake. Photos: Linda Kimpe

A landmark study to show how firefighters are exposed to harmful combustion products while on the job

Jennifer Keir's 2017 study on firefighters' occupational exposure to combustion products brought international attention to the issue of firefighter health.

June 2017: Jennifer Keir participating in a firefighter training event. Photo: Jennifer Keir

Firefighters have a dangerous job. They enter burning buildings to save people who may be caught in flames, and they administer life-saving first aid to fire victims. The rewards for these acts of heroism are few, and the risks to a firefighter's personal health are considerable. It has long been known that firefighters experience higher rates of cancer and other maladies than the general population, and occupational exposure to combustion products and other chemicals in fire smoke is suspected to be the cause. What wasn't known previously is how much exposure firefighters experience while on the job, and what is the primary route of exposure to these chemicals.

Jennifer Keir's research is to better understand the chemical exposures that firefighters experience while on the job. In October 2017, we published a study where we collected urine and skin wipe samples from the firefighters at the start of their shift as well as after a fire to measure whether firefighters were exposed to toxicants including polycyclic aromatic hydrocarbons (PAHs), which can cause DNA mutations and cancer. Results clearly showed that firefighters had on average three to five times the amount of metabolites, or by-products of PAHs, in their urine after a fire compared to before the fire. Some individuals had more than 70 times their pre-exposure doses. The mutagenic potency of the urine, which reveals the potential for genetic mutations that may lead to cancer, was also on average four times higher after a fire than before the fire, with some individuals having more than 70 times the mutagenic potency than pre-fire levels. An unexpected finding was that the most likely route of exposure to these chemicals was through the skin, rather than by inhalation. These results suggested that skin decontamination can reduce these exposures, which Jennifer plans to investigate further in 2018.

Media related to this story:

Ottawa Citizen: Groundbreaking research shows Ottawa firefighters absorb harmful chemicals through skin

Studying the impacts of the Athabasca oil fields in Alberta

We are studying how contaminants are affecting the Athabasca and Peace rivers in northern Alberta. We are using our methods to track where contaminants come from, and how populations from the smallest microbes to fish and river otters have responded to contamination.

The oil sands region in northern Alberta has seen intense development over the past decade. Although the oil sands industry provides significant economic benefits, the development of this resource has not been without controversy. In particular, members of the Mikisew Cree and Athabasca Chipewyan First Nations are worried about the impact of oil sands activities on their traditional lifestyles and treaty rights. Moreover, there have been a number of concerns raised by scientists and Indigenous communities about the impact of the oil sands industry on human and ecosystem health.

May 2017: Industrial development along the Athabasca River. Photo: Alexandre Salat

The oil sands are naturally occurring mixtures of crude bitumen (thick, heavy crude oil), sand, clay, ultrafine mineral solids and water. Bitumen contains polycyclic aromatic hydrocarbons (PAHs), alkylated PAHs and dibenzothiophenes; collectively known as polycyclic aromatic compounds (PACs). These PACs are of considerable interest for human and wildlife health due to their potential to have toxic, carcinogenic, mutagenic and endocrine disrupting effects. Evidence is emerging that these PACs are increasing in the atmosphere, water, soil, sediments, plants, wildlife and fish in the AOSR as a result of oil sands activity.

As is the case for many other environmental pollutants, the effects and underlying mechanisms triggered by exposure to complex PAC mixtures have been mostly drawn from studies using single compounds in cell cultures or laboratory animals; experiments which do not address the impact of these chemical mixtures on wildlife and human health.

To learn more about the impacts of industrial developments on wildlife populations, Phil Thomas is focusing his PhD research on impacts of oil sands industrial development on free ranging river otters in the Athabasca River. The North American river otter (*Lontra canadensis*) was chosen because, as a top consumer in the aquatic food web, it is a good indicator of ecosystem health, while being culturally- and economically-important to local land users and Indigenous communities. This work is intended to examine how river otters are exposed to contaminants from the oil sands industry, and determine whether their health is being compromised by these contaminants.

Phil Thomas with a river otter in Fort Chipewyan, Alberta. Photo: Phil Thomas

May 2017: Alexandre Salat and David Eickmeyer collecting lake sediment cores from the Athabasca oil sands region in Alberta. Photo: Alexandre Salat

His projects include determining whether some PACs bioaccumulate in river otters, whether exposure to contaminants from the oil sands region compromises the otters' endocrine system using a non-invasive sampling program, and whether otter populations have been compromised by the presence of industrial development.

Michelle-Claire Roy has been focusing her research on contaminants in the Peace Athabasca Delta, a region in northern Alberta at the confluence of these two great rivers downstream of the oil sands region and the home of First Nations communities. She is using 'metagenomics', a technique to identify microbial community abundance based on microbial DNA analysis to see if the microbes in the Delta are utilizing the petroleum hydrocarbons from the bituminous sands as a source of energy for their metabolism. She is interested to see whether microbial communities in the Peace Athabasca Delta have adapted to the presence of petroleum hydrocarbons in the same way that microbes in the oceans have adapted to the presence of petroleum seeps and occasional oil spills. She is also exploring how petroleum 'biomarkers', chemical constituents unique to bitumen and other petroleum products, can be used to trace the movement of petroleum through the aquatic ecosystem to better predict downstream impacts of the oil sands industry.

Alexandre Salat is an MSc candidate looking at historical contamination in the region using lake sediment cores as historical archives. He is looking at the PACs and petroleum biomarkers in historical sediment deposits to see how much bitumen has historically flowed through the Athabasca and Peace rivers.

Collectively, these studies are intended to determine how industrial expansion in the Peace and Athabasca river systems has increased contamination to the region and affected human and ecosystem health.

A pilot study to examine the effects of pipeline spills at the IISD Experimental Lakes Area

Our group is embarking on an unprecedented study to examine the effects of pipeline spills on lakes.

Pipelines are considered to be vital to the future of Canada's oil sands industry. However, efforts to build pipelines have been hampered by concerns about the potential environmental impacts of a spill. A 2015 report commissioned by the Royal Society of Canada identified major shortcomings in our understanding of how a pipeline spill would affect Canada's freshwater environments. Some of this report's recommendations included more research to better understand the environmental impact of spilled crude oil on water, and to develop a program of controlled field research to better understand spill behaviour and effects on aquatic life at the population, community, and ecosystem levels.

A successful application to NSERC's Strategic Partnership program in 2016 led to our first pilot study in 2017 at the IISD Experimental Lakes Area to see how diluted bitumen, the oil pumped through pipelines, affects freshwater environments. Our University of Ottawa lab partnered with the University of Manitoba, Queen's University, Environment and Climate Change Canada, and Fisheries and Oceans Canada, among others. Our study in 2017 was intended to provide preliminary information on the behaviour of diluted bitumen on an outdoor water environment. Studies focused on the oil's physical and chemical properties as it weathered, its effects on phytoplankton, zooplankton, and benthos, and the bioaccumulation of its chemical constituents in fish.

This pilot study is our first installment of a much larger study planned for 2018 that will examine the effects of diluted bitumen spills on freshwater ecosystems using large 10-meter diameter limnocorrals. Our goal is to provide information that will be useful for regulators and managers to mitigate the effects of diluted bitumen spills on freshwater ecosystems.

June 2017: We added diluted bitumen to microcosms filled with lake water and sediment in a pilot study to simulate an oil spill in an outdoor lake environment. Photo: Jules Blais

A bat colony's long history in Central America

A Jamaican cave yielded a bat guano deposit extending back over 4,000 years, revealing a bat colony's long history.

With over 1,300 species, bats are a diverse group that occupy many ecological niches across the globe. Some feed on plants, like the nectar and fruit eating varieties, whereas their carnivorous counterparts include both insect eating and the more nefarious blood-drinking varieties.

In tropical environments like Jamaica, bats nest all year, sometimes choosing caves as their refuge. These caves are home to thousands of bats that flutter in the dark above large mounds of reeking bat guano. As unappealing as this environment may seem to the casual observer, we have been excited to discover a rich history recorded in these bat guano deposits. Lauren Gallant has been analyzing core samples of bat guano in Jamaica that reveal details about the bats and how these bats have been affected by humans. In particular, chemical analysis in guano core samples have so far chronicled the arrival of agriculture to Jamaica in the seventeenth century, and in more recent times, the rise and fall of leaded gasoline, and the arrival of synthetic nitrogen fertilizers and fungicides, revealing details about how bats are exposed to pollutants, how they derive their nutrition, and how their feeding strategies have changed over thousands of years.

We determined that this bat guano deposit in a Jamaican cave provided a continuous 4,000 year record of the dietary history of this bat colony: Photo: Chris Grooms

May 2017: Lauren Gallant went to the Lamanai Outpost Lodge in Belize to study how sterols in bat guano can reveal details about a bat's diet.

Lauren is now embarking on a more detailed study that will explore sterols in bat guano to see what these chemicals can tell us about bat diets over the last four thousand years. In May 2017, Lauren joined a group of biologists in Belize and collected guano samples from bats that eat a range of different diets, from the fruit and nectar eating varieties, to the insect eaters and blood drinking varieties.

Tracking petroleum hydrocarbons in Cold Lake, Alberta

Kirsten Smythe and Josh Thienpont sampled lakes in northeastern Alberta related to the impacts of *in situ* oil sands extraction.

Cold Lake in Alberta, located east of Edmonton near the Saskatchewan border, is home to a large bitumen deposit that significantly contributes to Alberta's oil production. The oil-sand-water mixture known as bitumen is buried about 500 meters below ground at the Cold Lake deposit, and is too dense to flow to the surface without modification. For this reason, steam is injected into the ground to extract the bitumen. The high-pressure steam reduces oil viscosity and enhances oil fluidity, allowing the bitumen to flow to the surface where it is collected for further processing. Occasionally, the bitumen flow to the surface does not happen in a controlled manner, and inadvertent flows contaminate nearby soils and lakes.

In 2013, over 1.5 million litres of bitumen oozed from the ground at the Primrose Lake steam injection site near Cold Lake Alberta, adjacent to an air weapons range. The leak began in early 2013 and lasted for several months, resulting in flows of bitumen to the ground surface and into the nearby lake. Remediation efforts for this spill included draining the 53-hectare lake.

Our project at Cold Lake involves collecting lake sediment cores to track the history of hydrocarbon deposition to lakes in the region. Sediment cores reveal a history of hydrocarbon composition and quantity depositing to lakes, allowing us to identify not only the extent of contamination in the environment, but also the likely sources.

"If you're ever looking for a challenge in planning field work, try getting permission to travel around an area where fighter aircraft are actively dropping munitions!" - Josh Thienpont

August 2017: Kirsten Smythe (shown here) and Josh Thienpont sampled lakes in northeastern Alberta related to the impacts of *in situ* oil sands extraction.

FACETS journal receives a special endorsement

FACETS is Canada's first and only multidisciplinary open access journal, with Jules Blais as its founding Editor-in-Chief.

Launched in 2016, FACETS journal provides researchers with a wide range of open access publishing options including research articles, perspectives, editorials, and a science applications forum intended to improve communication of science policy in Canada.

In June 2017, FACETS was named the official journal of the Academy of Science of the Royal Society of Canada (RSC), the first time the society has named an official journal in its 135 year history. The Academy of Science of the RSC is the senior national council of distinguished Canadian scientists, whose primary objective is to promote Canadian research and scholarly accomplishment and to advise governments, non-governmental organizations and Canadians on scientific matters of public interest.

FACETS was a major sponsor of the American Geophysical Union conference in New Orleans in December 2017. This conference spans all disciplines in the earth and space sciences and receives over 25,000 participants every year. Jules attended this conference to promote FACETS. Find out more about FACETS at: http://www.facetsjournal.com/

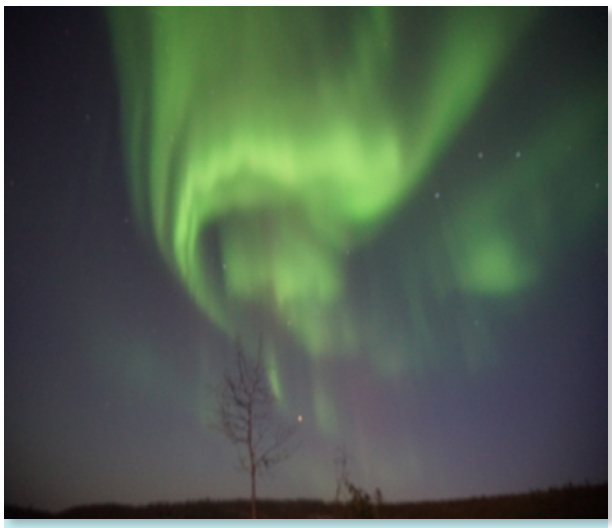
"Some of the most exciting advances are in the inter-disciplinary sciences, and the world is moving towards open access journals. FACETS aims to merge these trends." - Jules Blais

December 2017: Jules Blais attended the American Geophysical Union conference in New Orleans to promote FACETS, Canada's only multidisciplinary open access journal. Photo: Linda Kimpe

Save a bro, grow a mo!

Movember/Wovember 2017: Blais lab members proudly sporting their mustaches and raising awareness for prostate cancer!

..more photos near Yellowknife...



September 2017: Northern lights in Yellowknife. Photo: Claudua Tanamal

August 2017: Claudia Tanamal in foreground, hiking to Lower Martin Lake near Yellowknife. Photo: Mija Azdajic

September 2017: Last day of field work in Yellowknife. Photo: Mija Azdajic

August 2017: David Eickmeyer and Mija Azdajic collecting samples from the zodiac on a lake near Yellowknife. Photo: Claudia Tanamal.

..more from the Thule sites in Nunavut..

July 2017: A restored Thule house framed by whale bones near Resolute Bay on Cornwallis Island. Photo: Lauren Gallant

July 2017: Jules Blais, Linda Kimpe, and Lauren Galant sitting at the Deblicquy Thule site on Bathurst Island, with the remains of houses constructed from whale bone in the background.

.. some majestic Arctic wildlife..

July 2017: A narwhal mother and calf (left) in Lancaster Sound, and a muskox on Cornwallis Island. Photos: Linda Kimpe

.. and our field crew in western China

April 2017: Our field crew taking a moment to get accustomed to the high altitude on the Tibetan Plateau. Photo: Charlotte Li

Publications in 2017:

Lefebvre C, Kimpe LE, Metcalfe C, Trudeau V, Blais JM. 2017. Bioconcentration of polycyclic musks in fathead minnows caged in a wastewater effluent plume. *Environmental Pollution*, 231: 1593-1600. https://doi.org/10.1016/j.envpol.2017.09.062

Keir JLA, Akhtar US, Matschke DMJ, Kirkham TL, Chan HM, Ayotte P, White PA, Blais JM. 2017. Elevated exposures to polycyclic aromatic hydrocarbons and other organic mutagens in Ottawa firefighters participating in emergency, on-shift fire suppression. *Environmental Science & Technology*, 51: 12745-12755 http://dx.doi.org/10.1021/acs.est.7b02850

Thienpont JR, Desjardins CM, Kimpe LE, Korosi JB, Kokelj SV, Palmer MJ, Muir DCG, Kirk JL, Smol JP, Blais JM. 2017. Comparative histories of polycyclic aromatic compound accumulation in lake sediments near petroleum operations in western Canada. *Environmental Pollution* 231: 13-21.

Korosi JB, Thienpont JR, Smol JP, Blais JM. 2017. Paleo-ecotoxicology: what can lake sediments tell us about ecosystem responses to environmental pollutants? *Environmental Science & Technology* 51: 9446-9457. DOI 10.1021/acs.est.7b02375

Cheng W, Blais JM, Xie Z, Li M, Sun L. 2017. Response of polar regions to emerging organic pollutant organophosphorus esters (OPEs) *Advances in Polar Science*. 28: 13-22. http://dx.doi.org/10.13679/j.advps.2017.1.00013

Zastepa A, Pick FR, Blais JM. 2017. Distribution and flux of microcystin congeners in lake sediments. *Lake and Reservoir Management* 33:444-451. https://doi.org/10.1080/10402381.2017.1362491

Sarma SN, Blais JM, Chan LHM. 2017. Neurotoxicity of alkylated polycyclic aromatic compounds in human neuroblastoma cells. *Journal of Toxicology and Environmental Health, Part A*: 80: 285-300. https://doi.org/10.1080/15287394.2017.1314840

Korosi JB, Thienpont JR, Smol JM, Blais JM. 2017. Paleolimnology can provide the missing long-term perspective in ecotoxicology research. *Integrated Environmental Assessment and Management* 13(5): 957-959. DOI: 10.1002/ieam.1935

Korosi JB, Thienpont JR, Pisaric MFJ, deMontigny P; Perreault JT, McDonald J, Simpson MJ, Armstrong T, Kokelj SJ, Smol JP, Blais JM. 2017. Broad scale lake expansion and flooding inundates critical wood bison habitat. *Nature Communications* 8: Article # 14510. http://www.nature.com/articles/ncomms14510

Zastepa A, Taranu ZE, Zurawell RW, Kimpe LE, Blais JM, Gregory-Eaves I, Pick FR. 2017. Reconstructing a long-term record of microcystins from the analysis of lake sediments. *Science of the Total Environment*, 579: 893-901. http://dx.doi.org/10.1016/j.scitotenv.2016.10.211

Hargan K, Coleman K, Grooms C, Blais JM, Kimpe LE, Gilchrist G, Mallory M, Smol JP. 2017. Cliff-nesting seabirds influence production and sediment chemistry of lakes situated above their colony. *Science of the Total Environment* 576: 85-98. http://dx.doi.org/10.1016/j.scitotenv.2016.10.024

Conference presentations in 2017:

Bilodeau JC, Kimpe LE, Gutierrez Villagomez JM, Trudeau VL, and Blais JM. Toxicokinetics and bioaccumulation of PACs in wood frog tadpoles exposed to Athabasca oil sands sediment. . Presented to the 44th Canadian Ecotoxicity Workshop; University of Guelph, Guelph, Ontario; October 1-4, 2017.

Cheney CL, Pothier M, Poulain A, Korosi J, Kimpe L, Blais JM. Assessing the toxicity of lake sediments contaminated by historic gold mining activities. Presented to the 44th Canadian Ecotoxicity Workshop; University of Guelph, Guelph, Ontario; October 1-4, 2017.

Salat APJ, Galus M, Trudeau VL, Blais JM. Paleoecotoxicology: Determining the toxicity of oil sands emissions in dated lake sediment cores. Presented to the 10th Ontario- Quebec Paleolimnology Symposium; Brock University, St. Catharines, Ontario; May 25-26, 2017.

Cheney CL, Pothier M, Morin F, Poulain A, Korosi J, Blais JM. Using lake sediment archives to assess the toxicity of sediment impacted by historic mining activities: A paleo-ecotoxicology approach. Presented to the 10th Ontario- Québec Paleolimnology Symposium; Brock University, St. Catharines, Ontario; May 25-26, 2017.

Salman N, Kimpe LE, Crann C, Blais JM, Cornett RJ. Particulate polycyclic aromatic hydrocarbons (PAH) and ^{14}C in urban and rural air in the Ottawa, Ontario region. Presented at the 14th International Conference on Accelerator Mass Spectrometry in Ottawa, ON, Aug. 14-18, 2017.

Blais JM. New developments in paleolimnology. Invited presentation at Qinghai Normal University, Xining, China, April 20, 2017.

Blais JM. New developments in paleolimnology. Invited presentation as Honorary Professor at the University of Science and Technology of China, Hefei, China. April 17, 2017

Blais JM. Using lake sediments to reconstruct legacy impacts of past mining activities. Invited presentation at Yunnan Normal University, Kunming, China. April 12, 2017

Eickmeyer D, Korosi JB, Thienpont JR, Palmer MJ, Kimpe LE, Blais JM. Are diesel emissions contributing to contaminants in remote subarctic environments along the Tibbitt to Contwoyto winter road, NWT? Presented to the Canadian Conference for Fisheries Research / Society of Canadian Limnologists Meeting in Montreal Jan. 2017.

Blais JM. New developments in using natural archives to track environmental change. Invited lecture for the Rigler Award, presented to the Canadian Conference for Fisheries Research / Society of Canadian Limnologists Meeting in Montreal Jan. 2017.

Cheney CL, Pothier M, Morin F, Poulain A, Korosi J, Blais JM. Assessing the Impact of Historic Gold Mining Activities on the Toxicity of Lake Sediments in Yellowknife, NWT. Presented to the Canadian Conference for Fisheries Research / Society of Canadian Limnologists Meeting in Montreal Jan. 2017.

Gallant LR, Grooms C, Kimpe LE, Smol JP, Bogdanowicz W, Stewart S, Blais JM. Examining the dietary changes and contaminant exposure trends in a 4,000-year-old bat guano core using lake sediment core methodologies. Presented to the Canadian Conference for Fisheries Research / Society

of Canadian Limnologists Meeting in Montreal Jan. 2017.

Roy MC, Thienpont JR, Greer CW, Kimpe LE, Blais JM. Distribution and composition of polycyclic aromatic compounds and metals in lakes of the Peace-Athabasca Delta. Presented to the Canadian Conference for Fisheries Research / Society of Canadian Limnologists Meeting in Montreal Jan. 2017.

Mouen B, Kimpe LE, Trudeau VL, Blais JM. Bioaccumulation and elimination of metals by tadpoles exposed to sediments near oil sands mining in Alberta. Presented to the Canadian Conference for Fisheries Research / Society of Canadian Limnologists Meeting in Montreal Jan. 2017.

Hargan KE, Smol JP, Kimpe LE, Blais JM. Using isotopic tracers $d^{18}O$-$d^{2}H$, to track lake evaporation across sensitive Arctic and Alpine lakes. Presented to the Canadian Conference for Fisheries Research / Society of Canadian Limnologists Meeting in Montreal Jan. 2017.