

# Northern Research Day 2019



**Presented by the Circumpolar Students Association**





## GREETINGS FROM CIRCUMPOLAR STUDENTS ASSOCIATION

The **2019 Northern Research Day** organizing committee would like to extend a warm welcome to this year's conference attendees. This year marks our 23<sup>rd</sup> consecutive conference for students in all disciplines whose work focuses on the North. The goal of Northern Research Day is to provide a friendly environment for students to exchange ideas and provide a stress-free forum to practice presenting Northern research. Most of all, our mission is to bring together students from across a diverse range of disciplines and backgrounds to converse and connect with a new network of peers. We hope to stimulate discussion that will help us work together to tackle complex issues in the North.

We would also like to thank UAlberta North for their generous support to help us bring our keynote speaker, Aaju Peter, from Iqaluit, NU!

## ABOUT UALBERTA NORTH

UAlberta North is an office dedicated to building relationships with northern partners, making research connections, supporting opportunities for students, and helping to amplify northern voices, especially Indigenous voices. Students will know us through the Northern Scientific Training Program Awards and U of A Northern Research Awards, which our office administers, along with community reporting awards, travel grants and relevant scholarships -- about \$200,000 per year -- as well as the Engage North summer program.

## REMOTE CONNECTION

We are pleased to announce that this year we are including a webinar connection to facilitate participation for remote students. If you are unable to attend in person, please join us on Skype [via this link](#), or you can call in at 1-833-682-2537. Conference ID: 65436588

## ACKNOWLEDGEMENT

We wish to acknowledge that the land on which we gather is Treaty 6 Territory. This land, and the lands discussed at this conference, are traditional meeting grounds and home for First Nations, Metis, Inuit, and many other First Peoples of Canada and other circumpolar countries. We acknowledge the benefits conferred to us, aim to make this benefits mutual, and aspire to conduct our research in an inclusive manner that empowers First Nations, Metis, Inuit, and all First Peoples of Canada and other circumpolar countries.

## CONFERENCE SCHEDULE

9:30AM	<b>Opening Remarks</b>
9:45AM	<b>McKenzie Kuhn</b> - Methane emissions from lakes across a climate gradient in the NWT.
10:00AM	<b>Stenette van den Berg</b> - A Greenlandic Continuing Cultural Landscape: an exploration of the symbiotic relationship between humans, dogs and the landscape in Greenland
10:15AM	<b>Samantha Blais</b> - Struggling to Survive: Health Impacts of Hydroelectric Development on Five Northern Indigenous Communities, 1960-2017
10:30AM	<b>Coffee Break</b>
11:00AM	<b>Kimberly Fairman</b> - Communities of Practice
11:15AM	<b>Kaitlin Young</b> - UANorth Story Maps
11:30AM	<b>Sarah Shakil</b> - Collapsing Permafrost as a Source of Total Mercury and Methylmercury to Downstream Ecosystems
11:45PM	<b>Poster Session and Lunch</b>
12:45PM	Setup keynote
1:00PM	<b>Keynote Presentation</b>
2:00PM	<b>Michael Peers</b> - The influence of abiotic and biotic factors on vertebrate scavenging communities
2:15PM	<b>Erin MacDonald</b> - Biodegradation and composition of DOC from thaw slump headwalls on the Peel Plateau, NT
2:30PM	<b>Morag McPherson</b> - Summer habitat use by fluvial Arctic Grayling ( <i>Thymallus arcticus</i> ) across life stages in pristine northern mountain streams
2:45PM	<b>Coffee Break</b>
3:00PM	<b>April Robin Martinig</b> - Descended from dreamers: effects of immigration for red squirrels in the Kluane region
3:15PM	<b>Patrick Williams</b> - Geochemical characterization of glacial meltwater runoff from the Greenland Ice Sheet to the ocean.
3:30PM	<b>Sydney Stenekes</b> - Decolonizing Freshwater and Fish Monitoring: Opportunities for Social Learning in the Dehcho Region
3:45PM	<b>Makenzie MacKay</b> - A Community-Based Approach to Improving Energy Systems in Tuktoyaktuk and Inuvik, NT
4:00PM	<b>Closing Remarks</b>

## KEYNOTE PRESENTATION



### **Aaju Peter: Lawyer and Inuit Activist**

Aaju Peter is a proactive member and defender of the Inuit community. As an indigenous rights activist and lawyer, she has traveled to many countries to represent Inuit life, and plays a major part in consolidating northern indigenous peoples' affairs. Complimentary to these responsibilities, she is also a recognized translator, traditional singer and sealskin fashion designer. She is recognized for her involvement through awards such as the Order of Canada, one of the highest Canadian honours awarded to individuals for their extraordinary initiatives/contributions to society. She also makes an appearance in the 2016 documentary film, *Angry Inuk*, where she discusses the catastrophic effects of the seal ban on Inuit economy and life, a topic she has been passionate about since the end of the 20<sup>th</sup> century.



## ORAL PRESENTATIONS

### Methane emissions from lakes across a climate gradient in the NWT


*McKenzie Kuhn, PhD Candidate, Department of Renewable Resources*

Lakes in northern regions are particularly important sources of greenhouse gases and have been identified large sources of methane, which is 30 times more powerful than carbon dioxide. The burning of fossil fuels by humans has significantly increased the amount greenhouse gases in the atmosphere, which has lent to a rise in global temperatures. As a result, higher temperatures are also affecting natural sources of greenhouse gases such as wetlands and lakes. However, there remains an extremely high uncertainty with exactly how much methane is being produced from northern lakes and how emissions will change with increasing temperatures. Most of the uncertainty stems from biased sampling of lakes in only a handful of places, for example in Alaska and parts of Siberia. Since methane emissions from lakes are mainly controlled by lake characteristics, including lake size and surrounding vegetation, there may be significant differences in emissions from lakes in different regions. Currently, these regional differences are currently not account for. More studies on methane emissions in under-represented regions is of vital importance towards a better understanding of how much methane is produced from northern lakes, and how this will further increase global temperatures. Lakes in the Northwest Territories represent an important gap in our knowledge of methane emissions. This region is twice the size of Alberta and has regional characteristics that set it apart from previous studies. However, methane emissions from lakes in this area have never been measured. Currently, we can only assume what the emissions are based on other studies. The goal of my research to fill this important gap in our knowledge by measuring emissions from lakes throughout the Northwest Territories. The results of this research will help predict how much methane will be emitted in the future as temperatures continue to increase.

### A Greenlandic Continuing Cultural Landscape: an exploration of the symbiotic relationship between humans, dogs and the landscape in Greenland

*Stenette van den Berg, PhD Candidate, Department of Anthropology*

The aim of this research was to determine whether Greenlandic sled dogs, through their relationships with humans, actively contribute to the creation of a Greenlandic Cultural Landscape. It may be argued that the presence of Greenlandic dogs has played a deciding role in human survival in Greenland for millennia. The Thule people, the ancestors to all modern Inuit, were the first to harness them to sleds. This act changed the way in which people had, up to that point, engaged with their surrounding landscape, making it possible to access large parts of the landscape with greater speed than ever before. What is more, an intimate, mutually dependent human-animal relationship placed humans and their dogs as equals: each one's survival depended on the other. Today, largely due to globalisation, this relationship has been forced to adapt. In West Greenland, at least, people are no longer dependent on dogs for survival and consequently dog numbers in certain places in the region is diminishing. This has been exacerbated by the ever-increasing use of snowmobiles, considered to be the modern equivalent of the dogsled. Despite these challenges, having dogs is still of vital importance to those who do, and the research shows that, whereas they were previously depended on for physical survival, they are today depended on for a specific type of cultural survival, themselves becoming porters of culture. It may therefore be argued that the intimate human-nature-animal relationship that exists in Greenland today, creates and constantly recreates a living, continuing cultural landscape.



## Struggling to Survive: Health Impacts of Hydroelectric Development on Five Northern Indigenous Communities, 1960-2017

*Samantha Blais, PhD Candidate, Department of History and Classics*

Hydroelectric development in Canada's North is widely recognized as having caused irreversible ecological change and environmental damage with negative impacts for northern Indigenous peoples. Despite this recognition, we know very little about how this development and ecological change impacts the overall health of Indigenous communities. While Canadian scholars have examined the environmental impacts of hydroelectric development on a variety of communities, Indigenous and otherwise, their overall health has often been overlooked. As the World Health Organization notes, the physical and mental health of a person or group is largely determined by their social, environmental, and political circumstances. The unique problems Indigenous people face during and following hydroelectric development include, but are not limited to, food insecurity, exposure to chemical and heavy metal contamination in food, poor housing, and forced relocation from flooding. In northern Manitoba, there have been allegations of racism and sexual abuse of Indigenous women by Manitoba Hydro employees. My research addresses this gap in the scholarly literature and will lead to a better understanding of how the individual Indigenous groups have been impacted by hydroelectric development. It will also help them in their battles for recognition and compensation for their losses, adding a comprehensive academic angle to the process of addressing the historical and current injustices caused by hydroelectric development.

### Communities of Practice


*Kimberly Fairman, MSc Candidate, School of Public Health*

Introduction: Health care in Canada's North faces considerable challenges in the delivery of services. Despite per capita expenditures that are among the highest in the world, health outcomes continue to lag behind the rest of Canada, and health inequities continue to persist. While improving the health of northerners requires addressing underlying social determinants, transforming the health care system holds promise in the short and medium term. A key component of system transformation includes process for patient engagement Methods: A community of practice model was used to guide the formation of community based patient groups in the Northwest Territories, Canada Results: Community of practice groups were developed in the areas of indigenous values, life transitions, mental wellness, and chronic conditions. Conclusion: The presentation will highlight the approach for community engagement, emerging themes, and key activities within community of practice groups.

### The influence of abiotic and biotic factors on vertebrate scavenging communities

*Michael Peers, PhD Candidate, Department of Biological Sciences*

Carrion is a valuable resource for numerous vertebrate species across the globe, and the consumption of carrion can have widespread consequences on the structure and stability of food webs. However, the ecology of scavenger communities remains understudied, especially in regards to how biotic and abiotic factors influence scavenging dynamics. Here, we examined whether habitat, season, and other environmental variables influence the efficiency and composition of the scavenger community in the boreal forest of southwest Yukon. For common scavenger species, we further examined whether scavenging rates were dependent on carcass or prey availability on the landscape. Our results indicate that biotic and abiotic factors can have significant impact on scavenging communities, however, the important drivers of scavenging rates depend on the species examined. Studies that fail to incorporate these factors could result in the over or underrepresentation of vertebrate scavengers in food web dynamics.



## Biodegradation and composition of DOC from thaw slump headwalls on the Peel Plateau, NT

*Erin MacDonald, MSc Candidate, Department of Biological Sciences*

Increasing temperatures from climate change are enhancing permafrost thaw, which allows previously stored organic carbon (OC) to become available for release. Biodegradation (decomposition by microbes) of this OC is codependent on the composition of the carbon substrate and the local microbial community, but these factors are not well characterized among different permafrost deposits in northwestern Canada. Retrogressive thaw slumps are highly abundant in this region, particularly on the Peel Plateau, and expose distinct stratigraphic permafrost deposits in the headwall. In the summer of 2018, I collected samples from the headwall of three active thaw slumps which represent Pleistocene (ca. 3-7 m), Holocene (ca. 2 m) and active layer (ca. 0.3 m) deposits. Adjacent to each slump, stream inoculum samples were collected from the upstream, un-impacted site and from rill water draining the slump. The soil/permafrost samples received a 10% v/v addition of inocula source, were placed into experiment bottles and then were set in a dark incubator for 28 days. Preliminary results show that Holocene samples had increased oxygen consumption (indicative of OC biodegradation) relative to active layer and Pleistocene samples. Due to the varying biodegradability between stratigraphic layers, it is critical for studies to include a range of permafrost deposits, especially when comparing between regions across the circumpolar Arctic. These results will allow for more accurate predictions of how much OC may be released from thaw slump headwalls and how quickly it will biodegrade, which has important implications for carbon cycling in a warming climate.

## Summer habitat use by fluvial Arctic Grayling (*Thymallus Arcticus*) across life stages in pristine northern mountain streams

*Morag McPherson, MSc Candidate, Department of Renewable Resources*

Northern aquatic ecosystems face increasing pressures from climate change and natural resource development, creating conservation concerns for species in these understudied regions. The Arctic Grayling (*Thymallus arcticus*) is a widely distributed but sensitive freshwater fish that is a good indicator of stream health. The objectives of this study were to characterize Arctic Grayling distribution among mountain streams in the Northwest Territories, and to determine habitat characteristics and ecological factors that influence habitat use. Four sub-basins were sampled within the Little Nahanni River watershed, with Arctic Grayling detected in 31% of sites (n=183). Four distinct life stages of Arctic Grayling were determined based on biological, distributional and statistical results: young-of-year, juvenile, sub-adult and adult. Logistic regression and redundancy analysis (RDA) were used to explore relationships between stream habitat variables (n=19) and life stages. Multivariate regression tree (MRT) analysis was used to identify environmental thresholds and habitat-based life stage segregation. Results showed adult and sub-adult Arctic Grayling used habitats with higher mean elevation (>1200 m) and lower mean temperature (7°C) than young-of-year and juveniles (<1050 m and >10°C). Arctic Grayling habitat relationships differed with life stage, notably a change from warmer, run dominated habitat of juveniles to colder, wider, boulder dominated habitat of sub-adult. The results show important ontogenetic shifts, and the dynamic nature and diversity of Arctic Grayling habitat use. Consideration of stream habitat complexes at a broader watershed-scale, and an understanding of life history type and life stage-specific habitat requirements are needed for effective management and monitoring of Arctic Grayling.



## Descended from dreamers: effects of immigration for red squirrels in the Kluane region

*April Robin Martinig, PhD Candidate, Department of Biological Sciences*


A central assumption of hypotheses for the evolution of animal dispersal is that dispersal incurs a cost, which is later compensated for through increased fitness. However, the empirical data needed to test this assumption are logistically challenging to collect. Using 30 years of demographic and genetic data from a population of North American red squirrels (*Tamiasciurus hudsonicus*) in southwestern Yukon, Canada we asked whether lifetime breeding success and longevity differed between residents and immigrants and their offspring. Immigrant females had lower lifetime breeding success and longevity than residents, while immigrant males had both higher lifetime breeding success and longevity, which was further supported by females producing more offspring sired by immigrant males. Daughters and sons born to immigrant females and sons born to immigrant males suffered lower lifetime breeding success relative to offspring born to residents. Our results suggest that dispersal benefits are sex-dependent and generally realized within, rather than across, generations. This is in contrast to theoretical models that predict compensation is necessary for the maintenance of dispersal and is suggestive of immigrants of both sexes dispersing for reasons that differ from why residents may stay. While immigrant females may be making the best of a bad lot, immigrant males appear to be able to compensate, while offspring of immigrants that settle locally remain at a disadvantage. To our knowledge, this is the first empirical demonstration of an intergenerational effect of immigration, making an important conceptual advance in our understanding of the drivers of dispersal.

## Geochemical characterization of glacial meltwater runoff from the Greenland Ice Sheet to the ocean

*Patrick Williams, MSc Candidate, Department of Earth and Atmospheric Science*

Primary production in marine arctic waters follows a seasonal cycle, slowing in early summer as high-latitude microbial communities become limited by nitrate and iron. However, the influx of nutrients entrained in glacial meltwater coincides with large summer phytoplankton blooms in the Labrador Sea, and melting marine-terminating glaciers have been linked to increased primary productivity around Greenland. While the effects of glacially derived nutrients on downstream marine communities remains a subject of debate, characterizing meltwater and establishing the hydrological controls on nutrient export is the first step in answering larger ecological questions. Nutrient concentrations in meltwaters are dependent on seasonal supraglacial, subglacial, and marginal drainage development and release. Here we report measurements of trace metals, dissolved organic carbon, and a suite of other ancillary hydrochemical properties across supraglacial, subglacial, terrestrial, and marginal environments on Sarqardliup Sermia Glacier – a large marine-terminating glacier draining the western Greenland Ice Sheet. To better elucidate differences between these glacial sub-environments, we employed several multivariate statistical techniques. Using hierarchical cluster and non-metric multi-dimensional scaling analyses we show that different glacial environments are geochemically distinct. In particular, meltwater sampled from marginal lakes and streams is distinct from samples taken from terrestrial, subglacial, and supraglacial environments. This characterization and differentiation of sources of glacial runoff, and their mechanisms of release to the ocean, will be useful in further studies assessing meltwater impacts on downstream ecosystems.





## Decolonizing Freshwater and Fish Monitoring: Opportunities for Social Learning in the Dehcho Region

*Sydney Stenekes, MSc Candidate, Resource Economics and Environmental Sociology*

With the aim of decolonizing monitoring in Canada's sub-arctic region, along with the growing uncertainty regarding the health of freshwater systems for future generations, community-based environmental monitoring (CBEM) programs are increasingly emphasizing Traditional Knowledge in their design and implementation. Kátł'odeeche First Nation (KFN) have occupied their traditional territory in Northwest Territories' Dehcho region since time immemorial. Hay River, and Great Slave Lake are culturally, socially and economically significant bodies of water to the First Nation and continue to be monitored by the community through the traditional practise of fish harvesting. This research in collaboration with KFN uses interviews to document how Indigenous elders, fish harvesters and youth assess the health of the water and fish in their traditional territory in order to identify various Traditional Knowledge indicators of aquatic ecosystem change. In addition, this study seeks to investigate social learning in the context of community-based freshwater and fish monitoring at various institutional levels. Specifically, a thematic analysis of interviews is conducted to understand what knowledge related to freshwater and fish in KFN's traditional territory is shared at local, regional, territorial, and federal levels, and to uncover the social learning processes, including the mechanisms by which knowledge is shared. The analysis also distinguishes between knowledge that is disseminated versus received by KFN. Overall, this research contributes to emerging literature that documents Traditional Knowledge indicators in relation to freshwater systems, and presents a northern case study that analyzes CBEM from an Indigenous perspective and through the lens of social learning.

## A Community-Based Approach to Improving Energy Systems in Tuktoyaktuk and Inuvik, NT

*Makenzie MacKay, MSc Candidate, Resource Economics & Environmental Sociology*

Canada's Northwest Territories sees some of the highest heating and electricity costs among all Arctic Nations. Most communities in the NWT, especially those that live in more Northern and remote locations, rely on fossil fuels imported from the South. Associated shipping costs are high and the far transportation distance creates risk that the supply chain will be disrupted, leaving the community without energy.

My Masters research works in collaboration with the Inuvialuit peoples that live in Inuvik and Tuktoyaktuk, NT. These communities are two of the Northernmost settlements on Canada's mainland. I have utilized the principles of Community-Based Participatory Research at every stage of the project. A critical part of this methodological approach is building relationships with locals in order to ensure a meaningful research partnership that benefits the community. Together we have decided to explore the research question, How can local energy sources be developed in a way that improves reliability and reduces costs while operating within the unique socio-economic conditions of the Northwest Territories?

Through semi-structured interviews with 20 Elders, community members, and energy stakeholders, we seek to answer the question of how to best meet the energy needs of the region. A qualitative "thematic analysis" of interview transcripts is underway to identify the priorities, concerns, and aspirations discussed by interviewees. Findings from this study will inform policy recommendations, directed at the Government of Northwest Territories, that aim to improve energy systems and provide real benefits to people that live in the Inuvik and Tuktoyaktuk.



## POSTER PRESENTATIONS

### Mercury cycling in boreal peatland catchments


*Lauren Thompson, MSc Candidate, Department of Renewable Resources*

Vast mercury stores in permafrost soils are expected to be released due to permafrost thaw arising from climate change and human disturbance. However, the degree to which inorganic mercury will be transformed via microbial methylation to organic, toxic, and bioaccumulative methylmercury in northern environments is unclear. This study will focus on boreal peatland catchments in the Northwest Territories and northern Alberta where anoxic, acidic, and dissolved organic matter rich conditions facilitate the production of methylmercury. Patterns of mercury cycling in response to permafrost thaw and increasingly favorable methylation conditions will be derived from sampling on a climate transect from continuous permafrost to permafrost free. I hypothesize that discontinuous permafrost peatlands currently undergoing rapid thaw will have the highest concentrations due to mercury release from permafrost thaw and changing hydrological conditions that facilitate methylation. I will take samples from each permafrost zone in late summer of 2019 along a gradient from peatland to lake to stream in order to inform on methylmercury production and inorganic mercury release in peatlands and the subsequent path of mercury through the freshwater aquatic environment. In addition, I will observe seasonal fluctuations of mercury by intensively sampling two discontinuous permafrost peatland catchments from May-October of 2019 and 2020. This study will produce an inventory of inorganic mercury and methylmercury concentrations throughout boreal Western Canada in addition to understanding how climate change may impact mercury cycling patterns in the study region.

### Assessing habitat enhancements to improve the restoration and development of northern boreal lakes

*Sebastian Theis, PhD Candidate, Department of Renewable Resources*

Offsetting has been used on a large scale in Canada to compensate for the loss of ecosystem productivity and overall biomass. Especially already implemented and further planned compensation lakes in the oil sands region have received an increased attention and popularity. However, evaluations of projects and regular monitoring programs beyond mandatory requirements are rarely conducted, making it difficult to determine if offsetting can truly compensate for lost habitat and ecosystem function. In terms of deployed and implemented methods, habitat enhancement has proven itself to be the most successful and often viable option to increase habitat quality and effectiveness in aquatic ecosystems. However the major focus of habitat enhancement projects in the last decades has been largely centered on streams and rivers. Little attention has been set on lentic systems to evaluate potential positive effects of habitat enhancement for those ecosystems. To fill this gap of knowledge we are conducting habitat enhancement measures on northern boreal lakes by introducing Large Woody Debris and conducting capture and recapture studies. Results of our ongoing research allow us to gain invaluable insights in the potential; habitat enhancement could have for ongoing and future compensation lake projects in the northern boreal region of Alberta and which fish species it directly or indirectly benefits.



## Breaking and Reinforcing Socio-cultural Barriers with SciComm

*Megan Paranich, MSc Candidate, Department of Anthropology*

Successful science communication is vital to the application of Arctic science to policy and practice. Solidified as of 2015, it is colloquially referred to as “SciComm,” usually through the hashtag #SciComm on social media websites, such as Twitter. This movement arose from multiple motivations that can be generally summarized as an imperative within the academic science community to make their knowledge more accessible to the public. There are multiple conceptual stages upon which this takes place, but there is little unity and definition from the academic science community itself. This project demarcates the informal social roles of SciComm and identifies core barriers to engagement with a given audience. This project also uses a local case study as a positive example for other science communication hopefuls to follow. The case study demonstrates how science communicators must engage in capacity building that develops multiple epistemologies, or even ontologies, within themselves in order to straddle the socio-cultural boundaries that keeps knowledge generated by science in the realm of the esoteric. I argue that barriers that science communication seeks to deconstruct are self-initiated, and that the scientific community must fundamentally change the nature of its self-identity in order to consider the themselves successful within #SciComm.

## Spatial & Interannual Variability of DOM characteristics in Boreal Plain Lakes

*Emily Pugh, PhD Candidate, Department of Biological Sciences*

The response of Boreal Plains (BP) shallow lakes to landscape characteristics is largely unknown, creating difficulty in forecasting water availability and quality. The BP is comprised of a series of shallow lakes interspersed with peatlands and forestlands. These land covers overlay thick heterogeneous surficial geology and exist within a sub-humid climate, whereby precipitation is less than or equal to potential evapotranspiration. A combination of landcovers, complex surficial geology and a sub-humid climate causes subtle changes in lesser components of the water balance to fluctuate between a positive and negative change in storage, creating dynamic hydrologic connectivity of a watershed. Hydrologic connectivity can determine the magnitude, timing and composition of water and allochthonous dissolved organic carbon (DOC) entering shallow lakes, causing potential water deficits and water quality deterioration. This creates issues for drinking water providers in terms of distribution demands, human health and cost.

## Wood bison migration in northern Alberta

*Lee Hecker, PhD Candidate, Department of Renewable Resources*

Migration is a unique type of animal movement behaviour where animals shift their activities between disjunct home ranges. Migration is evolutionarily stable when the cost of movement is outweighed by greater fitness gains like access to higher quality forage, higher fecundity, and/or higher survival rates. The green wave hypothesis states that at northern latitudes herbivores migrate in response to the emerging high-quality vegetation. Alternatively, the predation hypothesis states that herbivores migrate in response to an increased predation pressure. We explore these competing hypotheses by investigating the spring migration of the Ronald Lake bison herd (RLBH). In late May, the RLBH migrate out of their core range into a discrete meadow where they remain for 2-3 weeks before migrating back to their core range. The timing of the migration coincides with parturition and the emergence of green vegetation. We deployed camera traps throughout the meadow to assess habitat use by bison and predators. We found when bison occupy the meadow there is an increase in black bear activity, but a decrease in wolf activity. Using location data provided by 59 collared bison we developed Brownian bridge movement models that identified migration corridors and indicated different migratory behaviours during ingress and egress. Additionally, we compared vegetative greenness at bison locations to the rest of the RLBH's home range. This analysis revealed that bison occupied areas that had significantly higher quality vegetation during the migration period. While research is ongoing, early results suggest the RLBH's spring migration aligns with the green wave hypothesis.



## Exploring fish species richness and co-existence in boreal lakes with isotopic niches

*Karling Roberts, PhD Candidate, Department of Renewable Resources*

Environmental offsetting is the practice of compensating for environmental damage with the restoration, enhancement, or creation of habitat. This practice is used increasingly around the world, and occurs in the Alberta oil sands to offset the damage or destruction of fish habitat. Improving our understanding of the outcomes of offsetting projects and how offsets can be managed to achieve specific goals and targets is important to developing them as a reliable conservation tool. Here we examine how fish trophic niche size, overlap, and distribution differ with fish species richness in natural and compensation lakes of the oil sands region. How trophic niches respond to variation in species richness can provide evidence about the mechanisms that determine fish species richness in boreal lakes. Specifically, I test whether resource diversity, niche partitioning, or life-history trade-offs are more important for enabling co-existence among boreal lake fishes and determining species richness. Findings from this study will help with the design and management of offsets that support a desired fish community.

## Changes in lichen biomass following 10 years of warming climate in the Mackenzie Valley of north-western Canada

*Ruth Errington, PhD Candidate, Department of Renewable Resources*

Lichen-rich forest and peatland environments form critical habitat for boreal woodland caribou (*Rangifer tarandus* caribou) within the Northwest Territories (NWT). Listed as threatened under both Canadian and NWT Species at Risk Acts, the national recovery strategy identifies the level of habitat disturbance as the primary factor affecting the sustainability of a population. Currently, there is limited understanding of the effect of climate change disturbances on critical habitat attributes. This is particularly important in the Mackenzie Valley of the NWT which is predicted to be one of the regions exhibiting the greatest temperature increases in Canada and, due to the presence of large areas of ice-rich permafrost, is a region where the consequences of this warming may be most dramatically evident.

In 2007-2008, 69 permanent monitoring plots were established on peat plateaux (permafrost-containing bogs), areas of permafrost thaw within the peat plateaux (collapse scars) and low productivity upland forests. Fifteen transects were also established at the interface of peat plateau and collapse scar features. These plots and transects were re-measured in 2017-2018, following 10 years of warming climate conditions. Lichen biomass differed significantly ( $\alpha=0.05$ ) between peat plateau, upland forest, and collapse scar environments, with the greatest difference between peat plateaux and collapse scar features. Ten-year changes, in the absence of permafrost collapse, exhibited a significant, but much less dramatic effect on lichen biomass. These results indicate that climate warming causing any substantial permafrost collapse in the ice-rich, lichen-dominated peat plateau environments will affect lichen biomass and, potentially, caribou habitat quality.