COMPENDIUM OF RESEARCH
IN THE NORTHWEST TERRITORIES

This publication is a collaboration between the Aurora Research Institute, the Government of the Northwest Territories Department of Environment and Natural Resources, the Prince of Wales Northern Heritage Centre, and the Department of Fisheries and Oceans. Thank you to all who submitted a summary of research or photographs, and helped make this publication possible.

Editors: Kristi Benson, Jolie Gareis, Niccole Hammer, Angela Storr

ISSN: 1205-3910

Published in Inuvik through the Aurora Research Institute

Fisheries and Oceans Canada Pêches et Océans Canada

Northwest Territories Environment and Natural Resources

Northwest Territories Education, Culture and Employment

Foreword

Welcome to the 2019 Compendium of Research in the Northwest Territories. It is with great pleasure that I present this annual publication. For over 30 years, the Aurora Research Institute, in collaboration with the Prince of Wales Northern Heritage Centre, the Department of Environment and Natural Resources, and the Department of Fisheries and Oceans, has compiled plain language summaries of all research licensed in the Northwest Territories.

Despite a slight decrease in licenced research projects from a year ago, ARI finished 2019 with the second-highest number of licenced research projects on record, with 217 licenced through ARI for research across the NWT. When reading through this year's compendium, I would like to draw your attention to some continuing interesting trends in research in the NWT. First, there is a notable increase in the number of climate-change research licenses, including local, national, and international research projects. Also of interest, several research projects focus on preserving the rich cultural landscape of the NWT.

In addition to the compendium summaries, please refer to ARI's NWT Research Database for more information about past and present research initiatives in the Northwest Territories. The NWT Research Database is publically-available, map-based, continuously updated with new records, and designed to make information about NWT research more accessible to the people and stakeholders of our territory. As you look through this Compendium, I encourage you to contact the researchers if there is a project of interest to you. The summaries in this publication are only a brief outline of the rich findings and scientific advancements that have been made over the past year.

Joel McAlister
Vice President, Research
Aurora Research Institute

Table of Contents

2019 Licenced Research Projects

Introduction

This compendium offers a summary of research licences/permits that were issued in the Northwest Territories during 2019. The information contained in this book is a product of collaboration between the Aurora Research Institute (ARI), the Prince of Wales Northern Heritage Centre (PWNHC), the Department of Environment and Natural Resources (ENR) and the Department of Fisheries and Oceans (DFO). The Compendium series began in 1984.

Licensing in the NWT

Under territorial legislation, all research in the NWT requires a licence/permit from one of four agencies, depending on the type of research being conducted:

- *Prince of Wales Northern Heritage Centre* - Archaeology;
- *Department of Environment and Natural Resources, Government of the Northwest Territories* - Wildlife;
- *Department of Fisheries and Oceans* - Fisheries; or
- *Aurora Research Institute* - all other research in the NWT.

Through the licensing process, researchers are informed of appropriate organizations, communities, and other licensing/permitting agencies that should be contacted prior to conducting studies. Licensing ensures research activities are communicated to interested parties and provides opportunities for the exchange of information.

The Compendium provides a summary of all licences/permits issued in the NWT by all four licensing/permitting bodies. As each research project is represented by a short abstract, the reader is encouraged to contact the researcher for additional information and results.

How to Use This Document

This compendium has four main sections. Each of these sections reflects a specific licensing agency and type of licence/permit issued. Within each section, research descriptions have been grouped by subject and listed alphabetically by the principal researcher's last name. Refer to the Table of Contents for the specific page on which each section and/or subject begins. An index is included at the end of the compendium listing all researchers in each section.

1. File Number

The file numbers shown in each of the Aurora Research Institute's subject areas refer to the file number issued to a particular researcher. It allows cross referencing with research material that may be available on file or in the ARI library. The reference numbers of the other three agencies refer directly to the permit numbers given to each researcher. When requesting information from any of these agencies on the specific research outlined in the compendium, please refer to the reference number in your correspondence.

2. Regional Abbreviations

Throughout the compendium, reference is given to the specific land claim region(s) in which the research took place. The regions are shown on the following page. Some of the land claim regions are still under negotiation and the boundaries shown are only approximations. The abbreviations shown for each region are as follows:

DC	Dehcho	**SS**	South Slave
NS	North Slave	**SA**	Sahtú Settlement Area
IN	Inuvialuit Settlement Region	**GW**	Gwich'in Settlement Area

3. Glossary

A glossary of terms has been added to the Compendium. The intent of the glossary is to allow the reader to better appreciate the research descriptions.

Available for Free Download

This compendium is available and can be downloaded from the Aurora Research Institute's website (nwtresearch.com). Copies can also be requested by contacting the Aurora Research Institute.

Send Us Your Comments

Whether you are a researcher or an interested member of the public, the Aurora Research Institute welcomes your comments and suggestions concerning this publication. Contact us by mail, email, or telephone (see address on page viii).

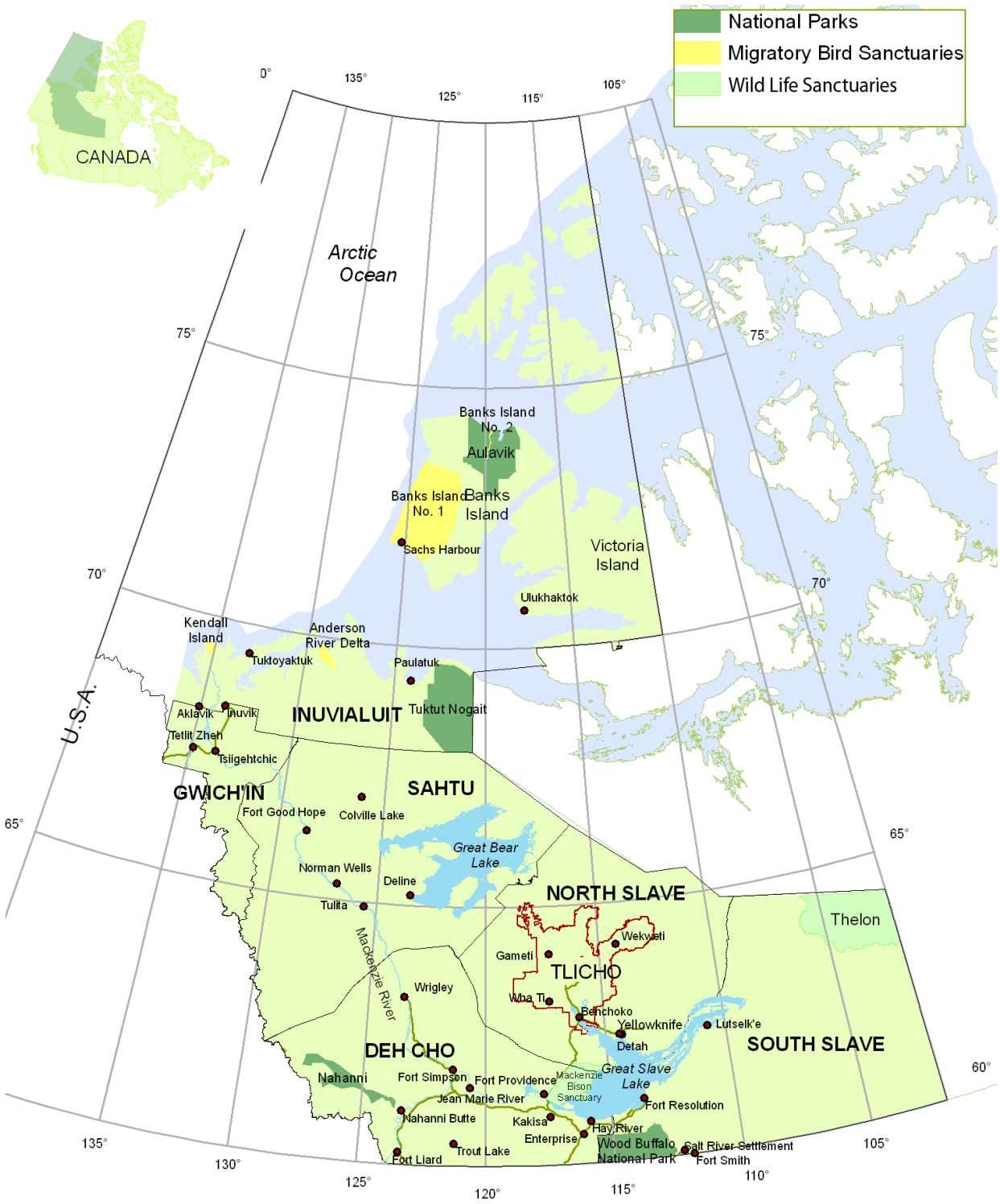

Figure 1. *Land claim regions in the Northwest Territories*

Aurora Research Institute

The Aurora Research Institute's mandate is to improve the quality of life for NWT residents by applying scientific, technological and Indigenous knowledge to solve northern problems and advance social and economic goals.

ARI is responsible for:

- licencing and coordinating research in accordance with the NWT Scientists Act: this covers all disciplines including the physical, social, and biological sciences, and traditional knowledge;
- promoting communication between researchers and the people of the communities in which they work;
- promoting public awareness of the importance of science, technology and Indigenous knowledge;
- fostering a scientific community within the NWT which recognizes and uses the traditional knowledge of northern Indigenous people;
- making scientific and Indigenous knowledge available to the people of the NWT;
- supporting or conducting research and technological developments which contribute to the social, cultural and economic prosperity of the people of the NWT.

For more information, contact ARI at:

Aurora Research Institute
PO Box 1450
Inuvik, NT, X0E 0T0
Tel: (867) 777-3298
Fax: (867) 777-4264
E-mail: licence@nwtresearch.com
Website: nwtresearch.com

Department of Environment & Natural Resources

The Government of the Northwest Territories' Department of Environment and Natural Resources (ENR) has a mandate to promote sustainable development through the management and protection of the quality, diversity and abundance of natural resources and the integrity of the environment.

With respect to permitting for research and monitoring, ENR is responsible for issuing Wildlife Research Permits under the Wildlife Act (Section 84) for all studies on wildlife or wildlife habitat in the Northwest Territories. Wildlife includes all vertebrates and invertibrates, except fish and marine mammals.

For more information, contact ENR at:

Wildlife Division
Environment and Natural Resources
Government of the Northwest Territories
PO Box 1320
Yellowknife, NT, X1A 2L9
Fax: (867) 873-0293
Website: enr.gov.nt.ca

Northwest Territories Environment and Natural Resources

Department of Fisheries and Oceans

The Department of Fisheries and Oceans Canada (DFO) is responsible for developing and implementing policies and programs in support of Canada's scientific, ecological, social and economic interests in oceans and fresh waters. Some Fisheries management responsibilities have been delegated or transferred to other federal agencies (e.g. Parks Canada), provinces/territories and co-management groups under Land Claim agreements.

DFO Fisheries Management is responsible for issuing Commercial, Domestic, Licence to Fish for Scientific Purposes (LFSP), Exploratory, Public Display and Educational licences in the NWT. Subject to Land Claim agreements, a Commercial licence is required to sell or barter fish.

All individuals fishing for scientific purposes or participating in the acts described below are required to obtain a Licence to Fish for Scientific Purposes (LFSP):

- activities involving fishing, catching or attempting to catch fish;
- activities where the potential exists for the incidental capture of fish;
- sampling or possessing fish caught in a subsistence fishery.

For further information about licensing, contact DFO at:

Licensing Officer
Central & Arctic Region
Government of Canada
Fisheries and Oceans Canada
PO Box 358
Iqaluit, NU, X0A 0H0
Tel: (867) 979-8005
Fax: (867) 979-8039
Email: XCNA-NT-NUpermit@dfo-mpo.gc.ca
Website: dfo-mpo.gc.ca

Fisheries and Oceans Canada | Pêches et Océans Canada

Prince of Wales Northern Heritage Centre

The Prince of Wales Northern Heritage Centre (PWNHC), a division of the Department of Education, Culture and Employment, Government of the Northwest Territories, is responsible for managing and protecting the archaeological resources of the NWT. Representing a continuous human occupation stretching back over 7000 years, archaeological sites are fragile and non-renewable and are protected from disturbance by legislation, regulation and policy in the NWT. There are currently about 6000 archaeological sites recorded in the NWT, though this number represents only a fraction of the existing sites as large areas remain unexplored for archaeological resources. A large part of the work done at the PWNHC involves reviewing land use and development permit applications. On average, 30 permits are reviewed per year, with recommendations being proffered to nine land management authorities.

With respect to permitting for research and monitoring, PWNHC is responsible for issuing NWT Archaeology Research Permits.

For more information, contact the Prince of Wales Northern Heritage Centre at:

NWT Cultural Places Program
Prince of Wales Northern Heritage Centre
4750 48th Street
PO Box 1320
Yellowknife, NT, X1A 2L9
Phone: (867) 873-7688
Fax: (867) 873-0205
Email: archaeology@gov.nt.ca
Website: pwnhc.ca

Northwest Territories Education, Culture and Employment

Biology

Beveridge, Meghan
Government of the Northwest Territories
Yellowknife, NT
meghan_beveridge@gov.nt.ca

File No: 12 402 935
Region: SS

Licence No: 16622
Location: Fort Resolution, Fort Smith, Slave River at the border (60.01653 N, 111.88949 W), Salt River at the Wood Buffalo National Park day use area (59.81764 N, 111.96607 W) and/or at mouth of Salt River (60.09588 N, 112.24995 W), and Slave River at Big Eddy (61.26723 N, 113.41655 W).

Alberta-Northwest Territories transboundary fish monitoring program: Slave River

The governments of the NWT and Alberta are monitoring the fish in the Slave River. To do this they are working with community members in Fort Smith and Fort Resolution, and researchers from Wilfrid Laurier University and the University of Saskatchewan. The goal of this project is to track fish health and check for contaminant levels in the fishes' bodies over time. This information could provide an early warning of change in the Slave River. The researchers caught lake whitefish, walleye, burbot, northern pike, and trout-perch in the Slave River near Fort Smith from 15 to 18 September, and near Fort Resolution from 19 to 22 September. Larger fish were caught using gillnets and small fish were caught using seine nets. Samples and measurements of length, weight, and organ sizes were taken from each fish to see how healthy they were and to measure for contaminants. Samples are currently being analyzed at the University of Saskatchewan. The next steps are to sample burbot over the winter, and white suckers in spring 2020.

Gray, Derek
Wilfrid Laurier University
Waterloo, ON
dgray@wlu.ca

File No: 12 402 917
Region: GW

Licence No: 16442
Location: Twenty small lakes in the Gwich'in Settlement Area along the Dempster Highway between Inuvik and Tsiigehtchic.

How will fish communities in Gwich'in and Inuvialuit lakes respond to climate change?

Twenty lakes located along the Dempster Highway and the Inuvik-Tuktoyaktuk Highway were sampled in 2019. Nets were used to catch fish in each lake. The fish were identified and measured, then released back into the lake. Water quality data were also collected at each lake, including water temperature, water clarity, and oxygen levels, among other measurements. All data were used together to determine how fish may respond to permafrost thaw and highway development in the future. The researchers put

together a plain-language report about their research results and sent it to all of the communities near the studied lakes.

Hovel, Rachel
University of Maine
Farmington, ME, United States
rachel.hovel@maine.edu

File No: 12 404 1008
Region: GW

Licence No: 16599
Location: Peel River at 8-Mile (67.33715° N, 134.87108° W), Peel River near the Mackenzie confluence (67.66305° N, 134.62444° W), Peel Channel near Aklavik (68.217853° N, 134.999797° W), Arctic Red and Mackenzie confluence (67.440688° N, 133.749088° W), and 19 other sites in the Gwich'in Settlement Area.

Community-based monitoring of whitefish in the lower Mackenzie River watershed

The Lower Mackenzie Whitefish Project is a community-based monitoring program focused on whitefish that are harvested in the Gwich'in Settlement Area, including the communities of Fort McPherson, Tsiigehtchic, and Aklavik. It began in 2017 as a partnership between scientists, community monitors, and Gwich'in renewable resources organizations. The Whitefish Project measures how many fish there are, when they migrate, their growth, their movement, how healthy they are, and the contaminants in the fish. The research team took measurements and samples from July to October 2019 at two fish camps on the Peel River, at one location in the Mackenzie Delta near Aklavik, and at one camp at the mouth of the Arctic Red River. Harvesters counted the number of fish they captured during the fishing season to help the researchers understand fish population sizes. They also took samples from some of the fish that they caught. To sample each fish, harvesters measured its length and weight and took samples of the fin, scales, and otoliths (a bone in the ear). Small tissue samples were taken from some fish to check for contaminants. The project team also collected more than 50 water samples from throughout the Mackenzie Delta and along the Peel and Arctic Red Rivers in cooperation with local guides and other research groups. The water samples will help the research team understand how natural and toxic chemicals move through the river systems and how they affect the fish. Samples from the 2019 field season are currently being processed and analyzed.

Insley, Stephen
Wildlife Conservation Society Canada
Whitehorse, YT
sinsley@wcs.org

File No: 12 402 894
Region: IN

Licence No: 16450
Location: South portion of Darnley Bay adjacent to the Hamlet of Paulatuk, and the eastern Amundsen Gulf adjacent to the Hamlet of Ulukhaktok.

Seal diet and condition in the ISR

The goal of this project is to monitor ringed seals (Pusa hispida) and bearded seals (Erignathus barbatus) in Darnley Bay, Sachs Harbour, and Ulukhaktok in the Inuvialuit Settlement Region. Community members who hunt seals take samples from them, which are analyzed by scientists to determine what the seals are eating and how healthy they are. Samples that were taken from seals in Sachs Harbour and Paulatuk in

2018 were shipped to North-South Consultants in Winnipeg for testing. Due to several factors, including poor hunting conditions, there were no winter samples collected from Ulukhaktok in 2018. The lab has finished analyzing the 2018 samples to see what the seals were eating, but the samples from seals harvested in 2019 and 2020 have not been analyzed yet. To ensure that the project is in the interest of the communities, the research team worked with the Paulatuk Hunters and Trappers Committee (HTC), the Sachs Harbour HTC, and the Ulukhaktok HTC by telephone and email, and in person in July and September. In addition, the researchers met with representatives from each HTC and the Inuvialuit Game Council, and made presentations of the most recent project results at the September 2019 Inuvialuit Game Council meeting in Whitehorse.

Jenkins, Emily
University of Saskatchewan
Saskatoon, SK
emily.jenkins@usask.ca

File No: 12 402 923
Region: IN

Licence No: 16453
Location: Hendrickson Island (69°30' 0" N, 133°35'10" W) and East Whitefish (69°22'45" N, 133°37'10" W).

Beluga health and food borne parasites in the Inuvialuit Settlement Region

The goal of this project is to test samples from beluga hunted in the Inuvialuit Settlement Region in order to learn about their health, and to see if there are any food-borne parasites in the beluga that might be risky for the people who eat them. Members of the research team include staff from Fisheries and Oceans Canada, community whale monitors, hunters, and pathologists. Each July, they collect blood from the hearts of beluga that were harvested at Hendrickson Island and East Whitefish, as well as samples of the meat, tongue, diaphragm, heart, brain, lung, and other body parts. Samples are shipped to Fisheries and Oceans Canada in Winnipeg, and then to the Zoonotic Parasite Research Unit in Saskatoon, for testing. Between 2015 and 2018, the parasite Toxoplasma was only found in one blood sample and one tissue sample (from two different beluga) of the 81 animals tested. The parasite Trichinella was not found in any belugas. Samples from the 15 beluga that were harvested in 2019 have not been tested yet. This project will help the community wildlife managers make better decisions about wildlife management and food safety. The research team provides reports to the Fisheries Joint Management Committee, the Inuvialuit Game Council, the Inuvik and Tuktoyaktuk Hunters and Trappers Committees, and Fisheries and Oceans Canada. They also work closely with the territorial and federal governments to make sure that people understand how healthy their foods are.

Levasseur, Annie
Environment and Natural Resources, Government of the Northwest Territories
Yellowknife, NT
annie_levasseur@gov.nt.ca

File No: 12 402 920
Region: SS

Licence No: 16478
Location: Slave River, Hay River, and the Slave River Delta.

Benthic macroinvertebrate monitoring (Slave and Hay Rivers)

'Benthic macroinvertebrates' are the insects and other small animals that live at the bottom of waterbodies. When a river system is healthy, its benthic macroinvertebrates are also healthy, so changes in the health of macroinvertebrate communities can be an early warning sign of changes or stress in the

river. In the summer of 2019, the research team collected benthic macroinvertebrates in the Slave and Hay Rivers near the NWT-Alberta border. These samples will be used to determine what a normal, healthy community of benthic macroinvertebrates looks like, so changes in the community can be tracked over time. The researchers collected between 30 to 35 'kick' samples at six different locations in each river. Kick samples are taken by disturbing (or kicking up) the sediment in the river and then taking samples of it. The benthic macroinvertebrates that were found in the kick samples were sent to a laboratory to be identified and counted. Early results show that, at each location, there are many benthic macroinvertebrates of many different types. The types of benthic macroinvertebrates seem to differ among locations depending on the type of bottom substrate (gravel, cobble, or silt) and how fast the river is flowing. The 2019 sampling program was the third year of this four-year-long project.

Lougheed, Stephen
Queen's University
Kingston, ON
steve.lougheed@queensu.ca

File No: 12 402 922 **Licence No:** 16448
Region: IN **Location:** Ulukhaktok and Tuktoyaktuk.

BEARWATCH: Monitoring impacts of arctic climate change using polar bears, genomics, and traditional ecological knowledge

No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Steiner, Nadja
Institute of Ocean Sciences, Fisheries and Oceans Canada
Sidney, BC
nadja.steiner@dfo-mpo.gc.ca

File No: 12 402 936 **Licence No:** 16626
Region: IN **Location:** Ulukhaktok and Sachs Harbour.

Estimating aquatic species physiological limits through a forage fish monitoring and observation program in the Inuvialuit Settlement Region (ISR)

The goal of this project is to monitor 'forage fish' in the Inuvialuit Settlement Region. Forage fish are small fish that are eaten by other fish, birds, and marine mammals. Another goal is to determine whether this project could be expanded and if the various monitoring programs taking place in the same area might be able to work together more closely. Working together with other coastal monitoring programs is urgently needed due to rapid climate change. The work that was done in 2019 was a pilot trial of the Inuvialuit Forage Fish Monitoring and Observation program, and it benefitted greatly from the inclusion of an Elder director and a local program coordinator. It also benefitted from the participation of trained field research technicians. The Elder director ensured that cultural values and ethics were maintained, and the program coordinator ensured that the team worked together effectively and safely. The coordinator kept in touch with the field technicians when they were out on the water or ice collecting data. Both the Elder and coordinator spread the word about the project to the community, and ensured the safety of the field guardians.

Contaminants

Blowes, David
University of Waterloo
Waterloo, ON
blowes@uwaterloo.ca

File No: 12 402 843
Region: NS

Licence No: 16447
Location: Giant Mine (62°29'59" N, 114°21'31" W), approximately 5 km north of Yellowknife.

TERRE-NET: Controls on the release of contaminants from gold tailings at the Giant Mine, Yellowknife, NT

Researchers from the University of Waterloo received funding through a Natural Sciences and Engineering Research Council grant to conduct field research at Giant Mine starting in June 2017. The purpose of this project is to study two pollutants, arsenic and antimony, in the tailings ponds at Giant Mine. Specifically, the research team is investigating why the pollutants are released into the water in the tailings ponds and how they move through the water. This information will be used to understand how proposed clean-up methods (such as remediation technologies and engineered covers) will affect pollution levels and arsenic movement. The research team spent 24 days at Giant Mine between June and October, 2019. The researchers performed three main tasks while they were in the field. First, they collected groundwater samples to understand the extent of contamination. Second, they pumped water out of the tailings ponds to see how fast they refill. This helped the researchers understand how fast water moves through the mine tailings. And third, they took samples from porous rocks. The oxygen and carbon dioxide stored in the porous rocks show how fast and for how long contaminants will be released into the water. The research team will return to Giant Mine in June 2020 to download data from data-logging equipment, replace the batteries in the equipment, and collect more samples.

Chételat, John
Environment and Climate Change Canada
Ottawa, ON
john.chetelat@canada.ca

File No: 12 402 886
Region: NS

Licence No: 16429
Location: Yellowknife Bay and Great Slave Lake.

Legacy arsenic pollution in Yellowknife Bay sediments: An assessment of its long-term fate under a changing climate

A two-year study is being conducted from 2018 to 2020 to investigate the stability of arsenic contamination in Yellowknife Bay sediments. Specifically, the researchers are looking at arsenic that came from local gold mining. The research team studied how arsenic is released from the sediments into the overlying water in Yellowknife Bay, and how environmental conditions affect how fast the arsenic is released into the water. Both field and laboratory experiments were used to measure how fast arsenic is released ('diffused') from contaminated sediments into the water. The researchers found that more

arsenic is diffused from sediment with higher arsenic concentrations, especially when oxygen has been removed from sediment. The research team is also studying what form the arsenic in Yellowknife Bay sediments is in, which will help them understand how arsenic moves between the water and sediments over the long-term. They are also looking at how long-term environmental change from climate warming (such as a decrease in oxygen in the sediment due to more plants and animals living there) could impact the levels of arsenic in the water of Yellowknife Bay. This information will help those who manage Yellowknife Bay, which is an important body of water for residents of Ndilǫ, Dettah, and Yellowknife.

Doig, Lorne
University of Saskatchewan
Saskatoon, SK
lorne.doig@usask.ca

File No: 12 402 932
Region: SS

Licence No: 16586
Location: Slave River Delta and Fort Resolution region.

Nutrient and contaminant status in the wetlands of the Slave River Delta

Across the broad expanse of the Slave River Delta, some wetlands are refilled with river water while others are refilled largely by snowmelt and rain. For any wetland, the source of water may change in the future due to what are called 'cumulative effects'. Cumulative effects are all of the changes from development and climate change considered together, instead of one-by-one. Communities along the Slave River are concerned about the cumulative effects of climate change and historical, current, and planned upstream activities on the river. One major community concern is reduced seasonal flooding of delta wetlands by the main river. Different parts of the Slave River ecosystem have been studied over time to assess the health of this system, but the cumulative effects of development and climate change on levels of nutrients and contaminants in Slave River Delta wetlands are unknown. The purpose of this study is to learn about how changes in the water source may affect nutrient and contaminant levels in the wetlands, including levels of trace elements in the water and trace metals in the plants and animals. The research team is collecting water, sediment, algae, invertebrates, and small-bodied fish in order to study these topics. Although samples collected in fall 2019 are still being analyzed, the initial results show that nutrient levels and water quality differ among wetlands depending upon the water source. Information about how water source affects the mercury content of wetland plants and animals will soon be available.

Evans, Marlene
Environment and Climate Change Canada
Saskatoon, SK
marlene.evans@canada.ca

File No: 12 402 681
Region: SS

Licence No: 16605
Location: Sites in Great Slave Lake, including the East Arm near Łutselk'e (62°25.114' N, 110°50.059' W), the West Basin near Fort Resolution (61°04.926' N, 113°55.713' W), and the West Basin near Hay River (60°59.053' N, 115°46.442' W).

Spatial and long-term trends in persistent organic contaminants and metals in fish from the Northwest Territories

The goal of this study was to measure how concentrations of persistent organic contaminants, mercury, and other metals in lake trout and burbot change over time. To do this, the researchers examined lake

trout and burbot that were caught at three locations in Great Slave Lake. In fall 2019, the researchers examined lake trout from both the domestic fishery at Łutselk'e in the East Arm of Great Slave Lake, and the commercial fishery operating out of Hay River in the West Basin of Great Slave Lake. Burbot from the domestic fishery at Fort Resolution in the West Basin were also examined. The researchers also continued to measure mercury concentrations in burbot from Łutselk'e, and northern pike from Fort Resolution. The average mercury concentrations in fish continue to remain very low, although they are showing a slow increasing trend for reasons that are not well understood. The researchers began to compile a data base of mercury concentrations in fish in lakes and rivers along the Mackenzie River to update previously collected data. The researchers also examined mercury levels in fish from Stark Lake in partnership with a community researcher from Łutselk'e, and finished analyzing fish from Buffalo Lake that were provided by the Kátł'odeeche First Nation. The research team planned to meet with community organizations during the winter of 2020, but these meetings were cancelled due to the COVID-19 pandemic.

Irving, Elaine
Golder Associates Ltd.
Vancouver, BC
Elaine_Irving@golder.com

File No: 12 402 934
Region: NS

Licence No: 16615
Location: Great Slave Lake at Jackfish Bay (62°22'50.71" N, 114°24'34.66" W), (62°22'32.91" N, 114°24'44.14" W), (62°22'36.24" N, 114°24'47.51" W), and Kam Bay (63°23'6.15" N, 114°23'20.09" W).

Con Mine 2019 supplemental benthic invertebrate sampling study

In September 2019, the project team took samples of sediment-dwelling insects, worms, and molluscs ('benthic invertebrates') at two main study locations. One study location was in Jackfish Bay, which has been exposed to mine effluent, and the other study location was in Kam Bay, which is studied as a comparison site because it is in an undisturbed area that has not been exposed to mine effluent. Two areas in Jackfish Bay and one area in Kam Bay were sampled to see if treated effluent is affecting the benthic invertebrates in Jackfish Bay. The researchers took samples of the sediment, and the benthic invertebrates in the sample were identified and counted. This allowed the researchers to compare the sediment-dwelling insects, worms, and molluscs between the different areas. Sediment and water quality samples were also collected from each area, and the researchers measured water temperature, dissolved oxygen, pH, and conductivity. In the lab, the researchers made detailed measurements of the metal content of both the water and sediment. Technical reports will be available by request from Con Mine, and community presentations will be provided if requested.

Jamieson, Rob
Dalhousie Univerity
Halifax, NS
jamiesrc@dal.ca

File No: 12 402 933
Region: DC, NS, SS

Licence No: 16610
Location: Fort Providence, Behchokǫ̀, and Hay River.

Fate of heavy metals in lagoon and wetland wastewater treatment systems and quantification of relative impacts to downstream aquatic systems

The objective of this project is to study the fate of heavy metals in community wastewater lagoons and wetlands. The researchers first reviewed previous records of heavy metal concentrations in lagoons and wetland systems in the NWT. They then developed a list of possible study sites to take water samples from. They were looking for study sites with historical data, engineered lagoons, and well-defined wetland treatment systems that were close to Yellowknife for ease of travel. Possible study sites were presented to a group of project partners, and with their feedback three sites were selected in Fort Providence, Hay River, and Yellowknife. In late August, the project team from Dalhousie University travelled to all three communities and met with key municipal staff who were involved with wastewater system management. In Fort Providence and Hay River, the project team also took preliminary water samples of raw wastewater, lagoon effluent, wetland effluent, and wetland sediments. Samples of water and sediments from areas not affected by sewage treatment were also collected. Samples were analyzed for a suite of heavy metals as well as other standard water quality measurements.

Low, George
Dehcho AAROM (Aboriginal Aquatic Resources and Ocean Management)
Hay River, NT
Geobarbgeo@hotmail.com

File No: 12 402 857
Region: DC

Licence No: 16617
Location: Jean Marie River and Sanguez Lake (61°15'26.1" N, 120°29'49.8" W).

Sanguez Lake fish down study
The objective of this multi-year project is to assess whether intensive fishing can act to lower mercury levels in large, predatory fishes like northern pike (jackfish) and walleye. Previous research has shown that large northern pike and walleye in Sanguez Lake have levels of mercury that exceed the Health Canada guidelines. In previous years of this study, northern pike were removed from Sanguez Lake. In 2019, a crew of five people spent ten days fishing at Sanguez Lake using mesh gillnets with three different sizes of hole (3.5, 4.5, and 5.5 inches). A total of 148 fish were caught; 13 cisco, 20 lake whitefish, 105 northern pike, and ten yellow walleye. The fish were sampled and a small piece of each fish was sent to the University of Waterloo for mercury analysis.

Palmer, Mike
Carleton University
Ottawa, ON
michael.palmer@carleton.ca

File No: 12 402 921
Region: NS

Licence No: 16463
Location: Lower Martin Lake, Long Lake, Handle Lake, and an additional lake along the Ingraham Trail.

A multidisciplinary investigation of recovery in Yellowknife area lakes from 50 years of arsenic pollution: What are the factors inhibiting recovery and the biological consequences?
Climate change is altering when, and how much, water moves across northern landscapes. In turn, water movements influence the movement and fate of pollutants, such as arsenic, in areas that have been impacted by pollution from mines. The goal of this study is to understand how lakes that have been polluted by arsenic recover over time. To do this, the researchers took measurements of arsenic in a lake and its surrounding watershed. Both the lake and watershed were impacted by mine pollution for more than 60 years, although the mine closed over 20 years ago. The researchers found that the total amount

of arsenic in the lake decreased during the study, suggesting that the lake was gradually recovering. Most arsenic moved into the lake through its inlet, and out of the lake through its outlet; however, the researchers found higher concentrations of arsenic at the outlet. This indicated that arsenic from the watershed and bottom sediments were sources of arsenic to the lake. This was supported by the high concentrations of arsenic that the researchers measured in snowmelt and rainfall runoff from the catchment. The researchers also looked at 11 years of data, and found that higher rates of streamflow flushed arsenic through the lake more quickly, while lower rates of streamflow increased the amount of arsenic that could diffuse into the lake from the bottom sediments. These results show that the recovery of arsenic-impacted lakes is controlled by how climate interacts with the amount and movement of water.

Stern, Gary
University of Manitoba
Winnipeg, MB
gary.stern@umanitoba.ca

File No: 12 402 869
Region: SA

Licence No: 16560
Location: Mackenzie River close to the town of Fort Good Hope, and as far away as Rampart Rapids.

Temporal trend studies of trace metals and halogenated organic contaminants (HOCs), including new and emerging persistent compounds, in Mackenzie River burbot, Fort Good Hope, NWT

In partnership with the Fort Good Hope Renewable Resources Council, the researchers are collecting burbot (loche) from the Rampart Rapids of the Mackenzie River to measure various kinds of contaminants. Contaminants are substances that are present in the environment at concentrations that exceed natural background levels, and that have the potential to impact animal and human health. The contaminants analyzed in this study fall into two groups: metals, such as mercury, or organic pollutants, such as pesticides and other industrial compounds that travel from the south, where they are released, to the north through the atmosphere or by river. The main reason the researchers are measuring contaminants in burbot is to see whether the burbot are safe for community members to eat. To date, the concentrations of mercury have been low in these burbot, and are below the Health Canada guidelines. Contaminant samples in burbot from the Rampart Rapids have been collected since the mid-1980s. With any long-term project, such as this one, it is important to continue to monitor wildlife to look for changes in contaminant concentrations over time. In 2018, a total of 20 burbot were collected and shipped to the University of Manitoba, where they are currently being analyzed for contaminants. The results will be shared with the Renewable Resource Council and community members when they are available.

Engineering

Bonnaventure, Philip
University of Lethbridge
Lethbridge, AB
philip.bonnaventure@uleth.ca

File Number: 12 404 1007
Region: NS
Licence No: 16598
Location: Whatì

Whati permafrost vulnerability mapping

In August 2019, the research team traveled to Whati to complete their field work. They set up a 'climate sensor network' over the study area, which included seven basic microclimate stations and three full weather stations. These stations measure and record wind, precipitation (rainfall or snowfall), and temperature, along with other aspects of the weather. The field team also drilled 150 permafrost pits over the course of the field season. In each pit, they measured the temperature of the ground at the bottom of the pit, as well as at several depths between the ground surface and the bottom. They also recorded vegetation type, tree canopy cover, and soil characteristics. One member of the field team was a local from Whati who was trained in both the station setup and permafrost pit-drilling methods. This training is the first step towards transferring the ownership and maintenance of the climate sensor network to the community (the transfer will not be complete for at least one more year). The field team contacted project partners in the community and in Yellowknife, and they also presented their preliminary field results to the community council of Whati. The presentation was well-received and the field season can be considered a success.

Dares, Matthew
Aurora Research Institute
Inuvik, NT
matthew.dares@auroracollege.nt.ca

File Number: 12 406 071
Region: NS
Licence No: 16465
Location: CN Hill (63°24'15.5'' N, 116°10'44.8'' W)

Wind energy monitoring at Snare Hill

The goal of this research project is to see whether wind power can be used to generate electricity for the city of Yellowknife. In 2019, the wind energy monitoring team from the Aurora Research Institute continued to record the wind speed and direction at Snare Hill using the previously-installed wind monitoring equipment.

Dares, Matthew
Aurora Research Institute
Inuvik, NT
matthew.dares@auroracollege.nt.ca

File Number: 12 406 071
Region: GW, IN

Licence No: 16466
Location: Inuvik

Creating heat from waste: Biomass pellets from landfill destined cardboard
The goal of this research project is to see whether cardboard that would normally end up in the dump can instead be transformed into 'biomass pellets' that can be burned in special stoves to generate heat. A specialized cardboard shredder and 'pellet mill' were purchased in 2018 and installed in September 2019, after some electrical upgrades were made to the building that houses the equipment. The project team completed three successful pellet production runs in October, but the pellet mill cannot be run in the winter in the building it is currently housed in. Any more pellet production runs will need to wait until temperatures warm up in the spring. The project team therefore decided to extend this project into 2020, so they could complete all of their research goals before they hand over the pellet mill to their industry partner in the summer of 2020.

Dares, Matthew
Aurora Research Institute
Inuvik, NT
matthew.dares@auroracollege.nt.ca

File Number: 12 406 071
Region: SA

Licence No: 16467
Location: A site in Norman Wells at (65°17'15.5'' N, 126°53'51.5'' W).

Wind monitoring in Norman Wells, NT
The goal of this research project is to monitor wind conditions in Norman Wells to see if it is windy enough to install a windmill that will generate electricity. A meteorological tower was successfully installed at the site in Norman Wells in April 2019. The tower is now reporting weather data every day through a cellular link. The research team is monitoring the data to ensure that the tower is operating correctly and producing reliable wind information. The research team had to work very hard during the summer of 2019 to maintain the tower, because the summer heat softened the ground at the site and caused the tower to shift. As the temperatures grew colder in the fall and winter, the ground hardened and the tower showed little movement at the start of 2020.

Ensom, Timothy
Wilfrid Laurier University
Waterloo, ON
enso5730@mylaurier.ca

File Number: 12 406 063
Region: IN

Licence No: 16471
Location: A number of sites, including (68°44'22.26" N, 133°27'49.91" W), (68°53'27.99" N, 133°32'20.01" W), (69°18'34.09" N, 132°59'42.35" W), (69.07887°N, 133.10733°W), (68.49004°N, 133.76615°W), (68.43968°N, 133.76543°W), (68.63218°N, 133.651822°W), (69.16785°N, 133.03723°W), (69.34394°N, 133.03831°W), (68.62570°N, 133.63201°W), (68.31620°N, 133.51630°W), (68.86829°N, 133.54014°W), and (69.35963°N, 133.04144°W).

Winter flow regime and icing dynamics of tundra streams near the Inuvik to Tuktoyaktuk Highway

The goal of this multi-year research project is to study how tundra streams along the Inuvik-Tuktoyaktuk Highway change during the winter. In 2019, the research team visited small streams along the Inuvik-Tuktoyaktuk Highway in January, April, May, July, and August. During these visits they 1) collected samples of snow, water, and ice, 2) measured snow depth and density across the streams, 3) measured the water flow in the streams, 4) took photographs of the streams, and 5) saved ground and water temperatures that had been recorded by devices that were installed beneath the streams. In May, they took a helicopter flight from Inuvik to Tuktoyaktuk to observe many of the streams and see how the highway is affecting them. A drone was also used to photograph two streams from the air, which will help the team understand the size of overflow icings and where they occur along the streams. Finally, the research team took water level measurements in several streams to see how highway bridges affect water flow. In January, flowing water was observed near the bridge at Diamond Point Creek. This water flowed onto the ice surface of the lake west of Bridge A3, the most northern bridge along the highway. Large amounts of overflow ice were observed at both the second bridge north of Inuvik (Bridge 8) and the fifth bridge north of Inuvik that crosses Hans Creek. Stream temperature measurements suggest that water may flow all winter in some streams, and that the highway bridges may affect stream temperatures beneath them and at nearby downstream sites. In the future, the research team will likely record the timing of winter stream flow events and changes in water quality that occur among seasons.

Marsh, Philip
Wilfrid Laurier University
Waterloo, ON
pmarsh@wlu.ca

File No: 12 406 059
Region: IN, GW

Licence No: 16501
Location: Trail Valley Creek (68°44.734 N, 133°30.003 W), Havikpak Creek (68°19.196 N, 133°31.193 W), and at streams along both the Dempster and Inuvik-Tuktoyaktuk Highways.

Hydrology of high latitude watersheds

The climate in the Inuvik region is changing rapidly, and will continue to change over the coming decades. One of the most dramatic changes in the Inuvik area since the late 1950s is that the number of winter days with a temperature below -40°C has gradually decreased, and over the last few years there have been very few days with such low temperatures. In the summer, on the other hand, the number of days with a temperature over +20°C has increased dramatically. In addition, the amount of rain in the summer and snow in the winter has also changed gradually over time. There is lower snowfall, less snow on the ground, and fewer days with snow on the ground now. There are also more shrubs growing on the tundra north of Inuvik, the permafrost is thawing, and water levels in lakes and rivers are changing. Everyone is wondering – how will the snow, lakes, and rivers change over the coming decades? What will they be like 50 years from now, when children born this year are adults? To help answer these questions, the research team is studying the snow, lakes, and rivers at Trail Valley Creek, which is located north of Inuvik. The team uses many types of equipment, such as drones to map the snow and vegetation and instruments to measure snow, soil moisture, icings in stream channels, and summer runoff. The goal of this research project is to predict how water will change in the future.

Morison, Stephen
SRM Consulting Ltd.
Nanaimo, BC

smorison@srmconsult.com
File Number: 12 406 072
Region: DC, SA
Licence No: 16548
Location: Along the Howards Pass Access Road corridor.

Howards Pass Access Road (HPAR) proposed 2019 baseline programs
No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Quinton, William
Wilfrid Laurier University
Waterloo, ON
wquinton@wlu.ca

File Number: 12 406 068
Region: DC
Licence No: 16518
Location: Within a 2 km radius of the Scotty Creek Research Station.

Impacts of permafrost thaw on hydrology and water resources
Permafrost is thawing throughout the Dehcho, and as a result, forested peat plateaus are gradually shrinking while treeless and permafrost-free wetlands are expanding. The land in this region is also extremely sensitive to other disturbances, such as fire, resource exploration, and development. For example, permafrost thaws more rapidly under seismic lines and networks, and therefore seismic lines can create short-cuts that divert natural drainage routes. In 2019, the research team used a wide range of methods (field studies, laboratory studies, air and satellite images, and mathematical models) to study how the permafrost thaws at Scotty Creek and make predictions about how the land will change as a result. They found a large amount of talik, which is ground that sits on top of permafrost and remains unfrozen all year. They also found that a large volume of water moves through these talik layers year-round, even during the winter. The growth of taliks is changing the balance between how much water is stored on the land and how much drains from the land into rivers. This research, which is conducted in collaboration with communities, is helping both the communities and scientists understand how the permafrost is thawing, how talik ground develops, how land-cover is changing, and how to predict changes into the future.

Health

Chan, Laurie
University of Ottawa
Ottawa, ON
laurie.chan@uottawa.ca

File Number: 12 408 102
Licence No: 16497
Region: NS
Location: Yellowknife, Ndilǫ, and Dettah.

Health effects monitoring program
The Health Effects Monitoring Program successfully completed two years of sample collection in Yellowknife, Ndilo, and Dettah in the summer 2018. Samples of urine and toenail clippings, along with other samples, were collected from participants to check for worrisome levels of arsenic, lead, and cadmium that can cause health issues. The research team collected samples from 2037 individuals (506 children and 1531 adults) between the ages of three and 79 during two sampling waves: the first wave was in the fall of 2017, and the second was in the spring of 2018. The information that was gleaned from the samples was sent to all participants in personal letters that were mailed in May 2019. Individuals who had higher, potentially unsafe levels of these metals were asked to contact the team for a follow-up appointment with a nurse practitioner who was hired specifically for this study. At these appointments, the individuals will answer some questions and provide additional samples of urine, toenail clippings, and/or blood in order to confirm the initial results. The individuals will also be given tips on how to lower their exposure to these metals in hopes they can avoid any health issues. General study results were shared with the communities at public meetings in May and June 2019, and additional results will be shared in the spring of 2020.

Cueva, Katie
University of Alaska Anchorage
Anchorage, AK, USA
kcueva@alaska.edu

File Number: 12 408 225
Licence No: 16511
Region: NS
Location: Yellowknife

Interviewing community health workers/representatives and key stakeholders in Northwest Territories
The goal of this project was to determine the best ways to support health workers in NWT communities. The researcher conducted this project with the Institute for Circumpolar Health Research, Aurora College, the Government of the NWT, and the NWT Health and Social Services Authority. The researcher interviewed 62 people in April 2019, including Community Health Representatives (CHRs), their supervisors, and other relevent and knowledgeable people. The researcher learned that supervisors and CHRs sometimes had very different ideas of what the CHR role included, what CHRs should be doing for their jobs, and how CHRs could best support their communities. For CHRs to be successful, it was important that supervisors respected and supported them, for example by helping CHRs work together, providing more mentorship and shadowing opportunities, and offering refresher training programs. To

improve the relationship between CHRs and their supervisors, CHRs could get support to better define their role, and have that role clearly explained to their supervisors. In addition, those CHRs who are active and well-connected to their community could be supported so they can identify and develop ways to help their community be healthy.

Goodman, Karen
University of Alberta
Edmonton, AB
karen.goodman@ualberta.ca

File Number: 12 408 149
Region: GW, IN

Licence No: 16436
Location: Aklavik, Tuktoyaktuk, Fort McPherson, Inuvik, and Sachs Harbour.

Addressing community concerns about health risks from *H. pylori* infection

The CANHelp Working Group conducts research in communities in the Yukon and the Beaufort Delta Region of the NWT to address concerns about H. pylori (Hp) infection. The project team finished most of their research before 2019, but one major achievement in 2019 was the creation of a website to share project results. The website is organized to present information for each community that participated in the project. Project planning committees in each community are currently reviewing their community's website; they will provide feedback and suggestions to make the website even better. The project team also continued to study the genomics (the gene patterns) of Hp bacteria that had been collected and frozen in previous years. They contributed some of these Hp samples to two international collaborations that are led by top Hp genomics experts. In January, they received a grant to study the genes in all of the Hp samples, and in September, they completed an analysis of the rate at which project participants have been reinfected with Hp. Also, in November, a graduate student began community reporting for a project titled 'Social Inequity, Gender, and H. pylori Infection'. Throughout the year, the project team carried out knowledge exchange activities and consulted community planning committees about their research plans, results, and reports. The team also published several journal articles.

Kuziemsky, Craig
University of Ottawa
Ottawa, ON
kuziemsky@telfer.uottawa.ca

File Number: 12 408 227
Region: IN, NS, SS

Licence No: 16547
Location: Hay River, Inuvik, and Yellowknife.

Improving colorectal cancer screening in northern Canada using participatory simulation modelling

No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Logie, Carmen
University of Toronto
Toronto, ON
carmen.logie@utoronto.ca

File Number: 12 408 199
Region: DC, GW, IN, NS, SA, SS

Licence No: 16445
Location: Secondary schools in Aklavik, Whatì, Fort McPherson, Ndilǫ, Łutselk'e, Fort Liard, Fort Simpson,

Yellowknife, Ulukhaktok, Fort Resolution, Behchokǫ̀, Inuvik, Tuktoyaktuk, Hay River, K'atl'odeeche First Nation, Fort Smith, and Norman Wells.

Visual and performance art for HIV prevention with Indigenous youth in the Northwest Territories

FOXY and SMASH are interactive HIV prevention programs that address sexual health, HIV, sexually transmitted infections (STIs), sexuality, and healthy relationships. Each program consists of seven workshops, each lasting one to two hours, that are conducted over the course of one or two days. Professional facilitators work with trained peer facilitators to lead the workshops for groups of eight to 15 participants. The goal of this study was to assess whether the workshops are effective. Participants completed a baseline survey right before the workshop, and another survey right after the workshop. The surveys included questions about the participants and how much they knew about STIs and mental health. Out of 529 workshop participants, 442 completed both the pre- and post-workshop surveys. On average, the participants that completed the surveys were 13.8 years old, and just over half of them had previously attended a FOXY or SMASH workshop. The research team used many statistical tests to see if the workshops are effective. According to their calculations, the workshops do seem to increase the participants' knowledge of STIs, their self-perceived risk of contracting HIV or an STI, and their perceptions of female empowerment. They also seem to increase the likelihood that participants will have safer sex and use condoms. Therefore, the FOXY and SMASH programs effectively increase sexual health among NWT youth.

Logie, Carmen
University of Toronto
Toronto, ON
carmen.logie@utoronto.ca

File Number: 12 408 199 **Licence No:** 16477
Region: DC, GW, IN, NS, SA, SS **Location:** Blachford Lake

Understanding syndemics and HIV/STI vulnerability among northern Indigenous youth in Northwest Territories

The goal of this project was to see whether FOXY and SMASH retreats benefit northern Indigenous youth participants. The research team asked participants what they learned during the retreats and found that there were three main benefits. The first benefit was self-confidence. Participants discussed gaining leadership skills, growing as a person, making social connections, developing resilience, and improvements to their emotional and mental health. They also discussed how leadership was empowering, including empowerment for self expression, to affect change, to build capacity, and to develop teamwork skills. The second benefit was improved sexual health that left the participants in a better position to make decisions about themselves and their bodies. Specifically, participants discussed improved sexual health knowledge, increased use of sexual health resources, learning about healthy relationships, and transforming inequitable gender norms. The final benefit that emerged was from land-based learning and traditional Indigenous teaching and practices. Specifically, youth discussed the benefits of drumming, connecting with ancestors, healing practices, cultural connectedness, connections with the land, and connections to school, home, and community. Another benefit that the research team did not anticipate was physical health. Participants discussed learning about healthy eating, exercise, physical strength, and general improvements in physical health.

Sharma, Sangita
University of Alberta

Edmonton, AB
gita.sharma@ualberta.ca

File Number: 12 408 1412
Licence No: 16488
Region: GW, IN, NS
Location: Inuvik and Yellowknife.

50+ and Elders health survey in the Northwest Territories
In January 2019, team members from the Indigenous and Global Health Research Group travelled to the NWT to meet with the Aurora Research Institute, physicians at the Inuvik Hospital, and members of Hotìì ts'eeda (the Hotìì ts'eeda group is the NWT SPOR support unit, which works towards research-based improvements to the health care system that meet local needs). The team presented information about some of their recent NWT research projects, including the '50+ and Elders Health Survey' project. They later travelled to Fort Good Hope, Inuvik, and Yellowknife from 27 October to 30 November to do work on both the '50+ and Elders Health Survey' and the 'Maternal and Infant Health' projects. During this trip, the team members met with people in Inuvik who were interested in their work to share some early results of their research.

Sharma, Sangita
Indigenous and Global Health Research Group
Edmonton, AB
gita.sharma@ualberta.ca

File Number: 12 408 1412
Licence No: 16596
Region: GW, IN, NS, SA
Location: Inuvik, Fort Good Hope, and Yellowknife.

Improving Indigenous maternal and infant health in northern Canada
Between 27 October and 30 November eight team members from the Indigenous and Global Health Research Group travelled to Fort Good Hope, Inuvik, and Yellowknife to collect data for the Maternal and Infant Health project. First, the team members interviewed people whose work was related to maternal health. These interviews included questions about maternal healthcare in the NWT, what parts of maternal healthcare are good and bad, and short- and long-term solutions to problems with maternal healthcare. Second, the team members interviewed Indigenous women who were pregnant or had recently given birth. These interviews asked about their experiences with pregnancy, birth, and the time right after birth, along with other related questions. Four northern residents worked with the team to find interviewees and conduct the interviews. In total, 27 healthcare staff interviews and 161 maternal interviews were completed. The team also met with over 115 people from more than 50 partner organizations, including Indigenous government organizations, the Government of the NWT, the Department of Health and Social Services, and Hotìì ts'eeda. In 2020, the team will analyze the data they collected in 2019, write papers, and return to the NWT to present their findings.

Spiegel, Jerry
University of British Columbia
Vancouver, BC
jerry.spiegel@ubc.ca

File Number: 12 408 224
Licence No: 16487
Region: DC, GW, IN, NS, SA, SS
Location: Yellowknife

Engaging with mining impacts on Indigenous community health: Allegiance challenges in public health research and practice

This research project is not complete, so this summary is a snapshot of the project progress so far and a description of what project activities were completed in 2019. The researcher conducted a group interview of three non-Indigenous GNWT employees in 2019, rather than interviewing the employees one at a time. This was done at the request of the primary interviewee. The interview was transcribed, and the transcript has been analyzed and compared with other interviews that were conducted with people from outside the NWT. Since the results of this study are still being written up there are no findings to report at this time. The researcher is continuing to work on the remaining parts of the study, including a review of federal, provincial, and territorial government literature about the impact of mining on Indigenous communities. This research project should be completed in 2021.

Straus, Sharon
Unity Health Toronto, St. Michael's Hospital
Toronto, ON
sharon.straus@utoronto.ca

File Number: 12 408 226 **Licence No:** 16538
Region: NS **Location:** Yellowknife

A content analysis of organizations and programs that implement approaches to address appropriate prescribing and use

No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Thiessen, Kellie
University of Manitoba
Winnipeg, MB
kellie.thiessen@umanitoba.ca

File Number: 12 408 228 **Licence No:** 16606
Region: NS, SS **Location:** Yellowknife, Fort Smith, and Hay River.

Welcoming the Sacred Spirit (Child): Connecting Indigenous and Western 'ways of knowing' to inform future policy partnerships to optimize maternal child health service delivery initiatives in remote Carcajou River south

The research team contacted relevant and knowledgeable people in the communities of Hay River, Fort Smith, and Yellowknife, and met with them for a two-day advisory group meeting in Yellowknife in September 2019. The advisory group discussed many issues about maternal and child services in their communities, along with many successes. The advisory group discussed the benefits of this study for their communities and the NWT healthcare system, developed an interview guide, and identified potential participants from their communities. The interview guide has been approved by the advisory group, and interviewer training will occur at the end of October 2019. Potential participants will be contacted in November, and the interviews will start shortly thereafter. The next advisory group meeting will be in February or March 2020, when the results of the interviews will be discussed by the group.

Veugelers, Paulus
University of Alberta
Edmonton, AB
paul.veugelers@ualberta.ca

File Number: 12 408 220
Region: NS, SA

Licence No: 16456
Location: Chief T'Selehye School in Fort Good Hope and Chief Jimmy Bruneau School in Behchokǫ̀.

APPLE schools evaluation
No research was conducted under this licence in 2019.

Physical Sciences

Abiven, Samuel
University of Zurich
Zurich, Switzerland
samuel.abiven@geo.uzh.ch

File No: 12 404 990
Region: GW, DC, SS

Licence No: 16550
Location: Yellowknife, Fort Smith, and Hay River.

Where on Earth is fire-derived carbon stored?
In this project the researchers are studying fire-derived carbon, like the charcoal that is produced during forest fires, in the soils of the Canadian boreal forest in the NWT and Alberta. The researchers want to know how old the fire-derived carbon is and where it came from. Carbon is an element that is needed by all life on earth, and it cycles between the earth and atmosphere in what is known as the carbon cycle. The cycling of fire-derived carbon is not well understood, however, and this limits our understanding of the carbon cycle in the Canadian boreal forest. This is an important gap because the boreal forest is prone to wildfires and is very strongly affected by global climate change. In summer 2019, the researchers conducted field work in Wood Buffalo National Park, around Fort Smith, and near Inuvik. They took samples from the upper 60 cm of the forest soil at several locations in order to understand how the soil and landscape control the storage of fire-derived carbon and its release to the air. Currently, they are still analyzing the samples they took and finding out how old the fire-derived carbon is. In 2021 they will continue taking samples in the same regions, and will also collect samples for a different experiment as well.

Asselin, Hugo
Université du Quebec en Abitibi-Témiscamingue
Rouyn-Noranda, QC
hugo.asselin@uqat.ca

File No: 12 404 962
Region: NS

Licence No: 16472
Location: Behchokǫ̀ , Gamètì, Wekweètì, and Whatì.

Impacts of climate change on wildfire risk in boreal forests in the Northwest Territories
No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Audet, Pascal
University of Ottawa
Ottawa, ON
paudet.uottawa@gmail.com

File No: 12 404 815
Region: DC

Licence No: 16435
Location: Fort Liard and Wrigley.

Yukon-Northwest Territories seismic network: Characterizing earthquakes and earth structures

Seven earthquake recording stations were installed in the summer of 2013. At each station there is a very sensitive machine called a seismometer, which measures the motion of the ground from earthquakes – even those earthquakes that are very soft or very far away. Each seismometer was buried in a hole that was dug by hand, and the information about any earthquakes that are detected by the seismometers is sent by satellite through a small station that is powered by solar panels, batteries, or an electrical outlet. The data that are collected are used to monitor earthquake activity and to produce images of the deep interior of the Earth. Using these maps and images, the researchers are finding that the boundary between the mountains and the flat sedimentary basin at depths of 50 to 100 km is more variable than they had thought. They are learning more about how the mountains were made by the movement of the Earth's crust over many millions of years. If you think of the mountains as icebergs, they float over the weaker, hotter rocks below – just like icebergs floating on water. This movement is what causes earthquakes. The researchers are developing a way to assess how much of a risk there is that any particular area might have an earthquake. In 2019, the research team serviced all stations in the network, and removed the station in Fort Liard due to water damage. This means that the network is now down to six active stations. The research team is producing a lot of academic papers and publications from the information they have gathered.

Audet, Pascal
University of Ottawa
Ottawa, ON
paudet.uottawa@gmail.com

File No: 12 404 815
Region: IN

Licence No: 16498
Location: Bar Harbour (74.258 N, 123.901 W), Victoria Island (72.901 N, 115.973 W), Nelson Head (71.39 N, 122.959 W), Ulukhaktok (70.763 N, 117.806 W), and Muskox (73.602 N, 117.453 W).

Teleseismic investigations of the crust and mantle structure beneath Banks Island, NWT

The goal of this project is to produce images of the deep geological structure under Banks Island to understand its origin. There are two theories – one is that Banks Island was made from long-ago volcanoes under the ocean. If this is true, there may be oil and gas deposits in the area. The other theory is that Banks Island is a part of the Canadian Shield, like all of mainland Nunavut and the eastern half of the NWT. If this is true, there may be diamond deposits and a potential to build diamond mines. To figure out which theory is true, the researchers used very sensitive machines called 'seismometers' to record any ground movements produced by distant earthquakes. The seismometers are buried in the ground, powered by solar panels or batteries, and have a small station attached to them where data are recorded and stored. Earthquakes move through different types of ground in different ways and at different speeds, which allows the researchers to get a better idea of what type of ground is found deep under Banks Island. The seismometers located at Bar Harbour, Nelson Head, Ulukhaktok, and Johnson Point were serviced in 2019. While they were in the field, the researchers collected the data and carried out some site maintenance. The researchers analyzed the information they collected and the results were presented at research conferences. The team will return to the area next year to collect more data from the stations.

Babin, Marcel
Université Laval
Québec, QC
marcel.babin@takuvik.ulaval.ca

File No: 12 404 983
Region: IN, GW

Licence No: 16517
Location: Mackenzie and Shallow Bays in the West Channel of the Mackenzie Delta, and Kugmallit and Kittigazuit Bays in the East Channel. Also, a coastal station near the Natural Resources Canada monitoring station by the Tuktoyaktuk shoreline.

Nunataryuk WP4: Satellite tracking of the organic matter in the Mackenzie Delta, impact of climate change on permafrost thaw

The researchers conducted a number of scientific activities in 2019 in partnership with community members from Inuvik, Aklavik, and Tuktoyaktuk. First, the researchers led several field expeditions in two coastal areas in the Mackenzie Delta region. One coastal area was the Shallow Bay-Mackenzie Bay area, and the other was the Kugmallit Bay-Kittigazuit Bay area. The expeditions were conducted during four distinct 'hydrodynamic periods' of the Mackenzie River; the pre-freshet period in April, the freshet period in June, the post-freshet period in July and August, and the pre-freeze period in September. The team took a number of physical, chemical, optical, and biological measurements from helicopters, snowmobiles, and small boats in the areas where the water changes from river water to ocean water. The samples that were collected were either analyzed in the laboratory at the Aurora Research Institute in Inuvik, or were shipped to several laboratories in the USA, Europe, and Canada. Most of the samples have now been analyzed by local, national, and international team members, and a research article co-authored by several team members and local partners will soon be submitted to an international scientific journal. The paper combines satellite data and new measurements of reservoirs of organic matter across the Mackenzie Delta region. The ultimate goal of the project is to better understand permafrost thaw under climate change.

Baltzer, Jennifer
Wilfrid Laurier University
Waterloo, ON
jbaltzer@wlu.ca

File No: 12 404 855
Region: SA

Licence No: 16581
Location: Within 80 km of Norman Wells and the Husky Lease site.

Northern water futures baseline environmental monitoring

The overall objective of this project is to understand how climate change and resource development in the Sahtú region will affect the local landscape, vegetation, water, and 'aquatic ecosystems' (all of the plants and animals that are present in the water). Specifically, the researchers are studying terrain instability due to permafrost thaw, and are particularly interested in a few topics including the terrain instability around communities and culturally-important areas, vegetation changes due to climate warming and wildfires (especially in important wildlife habitat areas), changes in the groundwater and surface water quantity and quality in response to climate warming and development, and how aquatic invertebrates (insects and small animals) are responding to landscape changes. In 2019 and 2020, the research team worked with local partners (this work was virtual in 2020 due to COVID). They set up new research plots to study vegetation and take samples, studied lichen and plant biomass in a lake after forest fires in the area, took groundwater samples to study the effects of permafrost thaw, held on-the-land camps, shared knowledge in online forums and through presentations, and wrote four academic papers.

Baltzer, Jennifer
Wilfrid Laurier University
Waterloo, ON
jbaltzer@wlu.ca

File No: 12 404 855
Region: DC

Licence No: 16593
Location: Fort Providence, and fire sites along Highway 3 and around Kakisa.

Impacts of wildfire and forest management on permafrost conditions and post-fire regeneration
The goal of this multi-year project is to study how taiga forests in the southern and central NWT recover after a severe wildfire so that decision-makers will have the information that they need. This project began after the severe wildfires in 2014. In 2015, the researchers took measurements in the fresh 2014 fire scars. From 2016 to 2019, a team of nine students and postdocs took samples from sites that had been burned at various times in the past to help them understand how fast the forest recovers. Each year they visited the research sites, took a variety of measurements, and took samples to study the permafrost and peat. They also set up some new research sites. The researchers are also working with the Government of the Northwest Territories to study how the forest recovers after forest harvesting, or logging. To do this, they started monitoring proposed forest management areas in the southern NWT. These sites will be monitored during and after forest harvesting to see how logging impacts the land and how the forest grows back. The research team also engaged with communities in the Dehcho and Sahtú regions to share knowledge and support on-the-land events, two of which allowed youth to participate in science activities. The researchers also made some presentations, wrote papers, and attended meetings.

Bilak, Grayson
Carleton University
Edmonton, AB
gbilak@ualberta.ca

File No: 12 404 937
Region: NS

Licence No: 16585
Location: Exeter Lake (64.47'33'' N, 110.51'22'' W)

The Exeter Lake esker: Nature and origin of North America's longest esker
No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Boike, Julia
Alfred Wegener Institute
Potsdam, Germany
julia.boike@awi.de

File No: 12 404 974
Region: IN

Licence No: 16489
Location: Sites at Trail Valley Creek (68.745483°N, 133.499070°W) and Havikpak Creek (68.333624°N, 133.500439°W).

MOSES rapid permafrost thaw
Between 31 July and 7 August, researchers visited sites along the Inuvik-Tuktoyaktuk Highway. At a research site at Trail Valley Creek, approximately 80 ‘iButtons’ were collected and replaced with new iButtons. These are small temperature loggers that were placed just below the ground surface, at about 2 cm depth, to monitor differences in surface temperature in areas with different vegetation, soil

moisture, and snow properties. The data from these sensors has not yet been analyzed, but should show how differences in vegetation, soil moisture, and snow affect the ground temperature and permafrost. At five sites along the highway, data from GPS monitoring stations was also collected. Each GPS monitor is tracking the height of its antenna above the ground surface. This information will tell the research team about changes in surface height, subsidence (whether the ground is sinking), and snow depth. Unfortunately, due to a hardware problem, data was only collected for about a week during the last year of operation. The stations were updated and repaired, and will continue to collect data for the next year.

Bourgeau-Chavez, Laura
Michigan Technological University
Ann Arbor, MI, United States
lchavez@mtu.ecu

File No: 12 404 885
Region: DC, NS, SS

Licence No: 16565
Location: Peatland areas surrounding Great Slave Lake.

Understanding the interactions between wildfire disturbance, landscape hydrology and post-fire recovery in boreal-taiga ecosystems

The goal of this project is to see whether a changing climate will help or hinder boreal-taiga ecosystems as they regrow after wildfires. The research team will meet this goal by looking at both land and water after the wildfires that took place in the southern regions of the NWT between 2014 and 2016. In August 2019, two field teams visited eight areas that were burnt in the 2014 and 2015 fires to measure post-fire regrowth after four and five years, and to take measurements of soil moisture in both burned and unburned sites. The soil moisture measurements will be used to calibrate satellite images that measure soil moisture remotely, without doing field work. The researchers also measured the diameters of trees and shrubs in unburned areas, because both trees and shrubs can affect the interpretation of air photos and satellite radar systems. Therefore, trees and shrubs must be accounted for when using satellite radar systems to measure soil moisture. At both burned and unburned sites the researchers measured soil moisture, soil temperature, the depth to frozen ground, and the depth of peat. All field measurements will be used to predict the effects of a changing fire regime.

Burgess, David
Natural Resources Canada
Ottawa, ON
David.Burgess@canada.ca

File No: 12 404 707
Region: IN

Licence No: 16504
Location: Melville South Ice Cap (75 27.68 N, 114 59.701 W)

Glacier mass balance of the Melville South Ice Cap

Since the mid-2000s, ice caps in the Canadian Arctic have been melting rapidly and playing an important role in rising sea levels. The Melville Ice Cap is one of five glaciers that are regularly measured by the Geological Survey of Canada in order to understand the rate of climate change in the Arctic, and the rate at which ice caps in this region are adding to global sea level change. In the spring of 2018 and spring of 2019, the researchers took measurements of the Melville Ice Cap to see how much it had changed between 2017 and 2018. They found that, although the 2017-2018 accumulation of winter snow was slightly lower than the long term average, the ice cap was actually thicker, mostly due to low rates of snow melt during the cool summer in 2018. The researchers measured 30 cm of accumulated snow over the

Melville Ice Cap from June to August 2018; this was the sixth time the ice cap had grown since measurements began in 1962. Average net thickening across the Melville Ice Cap resulted in a mass gain in 2017-2018, but despite this, the average rate of thinning of the Melville Ice Cap since 2005 remains about five times higher than the rate before 2005. Since it is likely that it will get even warmer in the future, glaciers in this region will lose even more mass after 2100.

Burn, Chris
Carleton University
Ottawa, ON
christopher.burn@carleton.ca

File No: 12 404 235
Region: IN

Licence No: 16535
Location: Garry Island, Illisarvik, Inuvik at Dempster Highway km 256, and Paulatuk.

Permafrost and climate change, western Arctic Canada

In 2019 the research team made two visits to the western Arctic to do field work. The first was in late May, and the second was in July and August. In May the team visited the Illisarvik drained lake basin and Garry Island. Most of their work in July and August took place on Garry Island. On Garry Island, the researchers monitored ground temperatures and installed a number of new thermometers to record the temperatures at different places in a set of ice wedge polygons. They also retrieved a number of data loggers that have been monitoring the temperature at the top of ice wedges, and drilled ten shallow holes across a valley to find the quantity of ground ice in the upper metre of the ground. All of these measurements will be used to estimate how quickly the permafrost is warming and to determine the consequences of warming in the western Arctic. The researchers reported this work to the Inuvialuit Monitoring Workshop at the Inuvialuit Cultural Resource Centre on 8 January 2020.

Busby, Robert
Incorporated Institutions for Seismology (IRIS)
Washington, DC, United States
busby@iris.edu

File No: 12 404 947
Region: IN, GW

Licence No: 16421
Location: Six locations at (71.99220 N, 125.26172 W), (69.34763 N, 124.07056 W), (68.31 N, 133.53 W), (67.61063 N, 135.78635 W), (67.44098 N, 133.74194 W), and (67.26110 N, 135.10445 W).

EarthScope transportable array

The goal of the EarthScope project is to study earthquakes and volcanoes in North America to understand how the continent was created over millions of years, and to understand how it continues to change today. To do this, the researchers are maintaining a network of special earthquake sensors across North America. Six of these stations are located in the NWT. Sometimes the researchers need to visit these sensors to do maintenance on them, but in 2019, the researchers did not need to visit any of the NWT stations. Now that the EarthScope network has operated for two whole years, the researchers have some preliminary results. These results and the project data are publicly available and can be found by searching online. The researchers are also working to have the stations incorporated into the permanent earthquake monitoring networks in Alaska and Canada so the stations can continue to measure earthquakes. Any stations that are not incorporated will be removed in 2020.

Chamberland, Joseph
C-CORE
Ottawa, ON
joseph.chamberland@c-core.ca

File No: 12 404 888
Region: NS, SS

Licence No: 16473
Location: North along the Slave River from Fort Smith, and south along the Slave River and Delta out of Fort Resolution. Great Slave Lake out of Fort Resolution. Great Slave Lake going south out of Yellowknife.

Remote sensing water indicator monitoring for the Mackenzie and Slave Rivers, and Great Slave Lake
During the spring and summer of 2018, community members and leaders from Fort Smith, Fort Resolution, and Yellowknife collected water samples on three occasions. The samples collected out of Fort Smith and Fort Resolution were used by the research team to help them understand the level of suspended sediments and the water temperature in the Slave River and Delta. The Yellowknife team collected similar samples to help the researchers study Great Slave Lake. Unfortunately, due to cloudy weather at the time of sampling, fewer Great Slave Lake samples were taken than were needed, so this work was pushed back to 2019. The samples from the other locations were analyzed by Taiga Labs in Yellowknife. The water temperature and suspended sediment results will be sent in a report to the Government of the Northwest Territories Department of Environment and Natural Resources, and can also be accessed by the local communities for free online. The researchers talked about where the data will be stored and who will be allowed to see it during the Water Strategy Workshop in Dettah in November. In their presentation, the researchers showed raw satellite images and explained how they use them. Their main message was that community members can often make more sense of raw data, as their knowledge of the land and their Traditional Knowledge allow them to understand the data in a very localized context – which is something that the researchers can't do.

Chasmer, Laura
University of Lethbridge
Lethbridge, AB
laura.chasmer@uleth.ca

File No: 12 404 1010
Region: DC, NS, SS

Licence No: 16602
Location: Fort Liard, Fort Providence, Fort Simpson, Jean Marie River, Behchokǫ̀, Yellowknife, Enterprise, Fort Resolution, Hay River, Kakisa, along HIghway 3 and Highway 1, and within the Scotty Creek and Baker Creek basins.

Transitioning of permafrost to wetland and implications for biomass gains and losses
No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Cobbett, Rose
Memorial University
St John's, NL
cobbettrosie@gmail.com

File No: 12 404 999

Licence No: 16574

Region: DC

Location: South of Haywire Lakes, Flat River area, and Glacier Lake area.

Paleozoic rift history of western Laurentia as recorded in Yukon-NWT-Alaska
No research was conducted under this licence in 2019.

Côté, Michelle
Geological Survey of Canada
Sidney, BC
michelle.cote@canada.ca

File No: 12 404 866
Region: IN

Licence No: 16583
Location: The Kugmallit Pock Mark Field, located approximately 35 km northwest of Tuktoyaktuk (69°45' N, 133°21.5' W).

Marine geohazard and environmental studies in the southern Beaufort Sea
No research was conducted under this licence in 2019.

Culp, Joseph
Wilfrid Laurier University
Waterloo, ON
jculp@wlu.ca

File No: 12 404 996
Region: IN, GW

Licence No: 16570
Location: At numerous sites from km 0.3 to km 143 along the Inuvik-Tuktoyaktuk Highway, and at seven sites along the upper Dempster Highway between (68°17'10.11" N, 133°15'0.68" W) and (67°45'13.34" N, 133°51'38.04" W).

Development of a biological monitoring program to detect change in stream health along the Dempster–Inuvik–Tuktoyaktuk corridor
The goal of this project is to study how the Dempster-Inuvik-Tuktoyaktuk road development is affecting stream ecosystem health. To do this, the research team is monitoring a number of streams along this road corridor. In 2019, the team conducted research along the Inuvik-Tuktoyaktuk Highway and upper Dempster Highway on two separate occasions. They used a standard set of measurements called the 'Canadian Aquatic Biomonitoring Network (CABIN) Protocol' in a total of 12 streams between Tsiigehtchic and Tuktoyaktuk. Sites were selected and sampled with the help of the Imaryuk Monitors along the Inuvik-Tuktoyaktuk Highway, and with the help of an environmental monitor from the Gwichya Gwich'in Renewable Resource Council along the upper Dempster Highway. At each site, the researchers took water samples to study the water quality, small insects, and animals that live in the water. They also installed special instruments called data loggers at each site; these instruments measure water level, temperature, and conductivity, as well as some other measurements. In late September, all of the data loggers and other tools were removed from the streams. This project will produce important information about the impacts of road development in the Gwich'in Settlement Area and Inuvialuit Settlement Region that can be used by resource boards to develop management plans that will protect rivers and streams.

---

d'Entremont, Marc
LGL Limited Environmental Research Associates

Sidney, BC
mdentremont@lgl.com

File No: 12 404 972
Region: SS

Licence No: 16419
Location: The taiga plains ecoregion between Buffalo River and Little Buffalo River.

Recovery of boreal caribou habitat after forest fires
This project investigates how long it takes after a fire for caribou foraging habitat to become suitable for boreal caribou to use again. To answer this question, the researchers measured how many forage lichens were present in burned versus unburned sites in the South Slave Region of the NWT. Between 2018 and 2019, they measured lichens at 77 sites that were chosen based on how long it had been since the area had last been burned by a fire. Each site was 30 m by 30 m in size, and at each site the researchers selected seven random locations where they took lichen samples. Sampling didn't harm the lichen, because the researchers simply recorded the species or genus of the lichen and its height instead of removing it. To start, the researchers focused on the three predominant 'fruticose' lichen species, which are brushy-looking and resemble coral from a reef. These are the three species Cladina mitis, Cladina stellaris, and Cladina rangiferina. The project results indicate that there seems to be more lichen present 21 to 40 years after a fire.

Derksen, Chris
Environment and Climate Change Canada
Toronto, ON
Chris.Derksen@canada.ca

File No: 12 404 641
Region: IN

Licence No: 16495
Location: The Trail Valley Creek research camp (68.74209 N, 133.49922 W).

Investigating the relationship between snow microstructure and airborne synthetic aperature radar measurements of tundra snow to improve environmental prediction capabilities in polar regions
The goal of this research project is to develop new methods to measure snow from space using radar from spaceborne satellites. If these methods are successfully developed, the satellites could be used to document near real-time changes in snow on the ground across Canada every few days. The research team took measurements of snow (depth, water storage, density, crystal size, and layering) as part of #TVCSnow, the 2018-2019 Trail Valley Creek Snow Experiment run by Environment and Climate Change Canada. At the same time, air photos and satellite radar measurements were taken and will be compared to the measurements taken on the ground. This will help the researchers understand how snow affects radar measurements in a tundra environment. The snow measurements were recorded 50 km north of Inuvik, in and around the Trail Valley Creek research station, at three different times; in November 2018, January 2019, and March 2019. These measurements and comparisons will be made available to the public through the Government of Canada's Open Data Portal.

DesRosiers, Patrick
Simon Fraser University
Burnaby, BC
patrick_desrosiers@sfu.ca

File No: 12 404 1002

Licence No: 16579

Region: NS

Location: A site located at (64°39'45.6" N, 112°20'14.9" W).

Terrain mapping and surficial material sampling - East Credit Lake

The purpose of this research project is to study glacial melt water in order to improve diamond exploration techniques in the NWT. When glaciers melt, the water that runs off of them can contain hints about the location of diamond deposits. The hints are minerals, called 'kimberlite/diamond indicator minerals', that are deposited in the soil as the glacial meltwater is absorbed. Checking the soil for these mineral deposits can help scientists guess where diamond mines should be excavated. Specifically, the research team collected samples that they will use to get a better understanding of how the melt water affects the concentration of kimberlite/diamond indicator minerals in the soil. The team will travel on foot to collect samples using hand tools; the samples will be analyzed later. They will also make observations about the sampling locations and the surrounding landscape. The results of this research will be useful for diamond exploration projects in the NWT.

DeWolfe, Michelle
Mount Royal University
Calgary, AB
mdewolfe@mtroyal.ca

File No: 12 404 992

Licence No: 16561

Region: SS

Location: Sunset Lake, approximately 100 km ENE of Yellowknife.

Detailed study of the rhyolite dome and surrounding volcanic rocks at Sunset Lake, Slave craton, Northwest Territories

From early June to early July 2019, the research team conducted geological research in the Sunset Lake area of the NWT. The objective of this research project was to study the geological history of the area, including major events that occurred in the past such as volcanoes erupting or mountains being created. The team did this by examining volcanic rocks. The research team included graduate and undergraduate students, a professor, and geologists from the Northwest Territories Geological Survey. They went to the area by float plane, camped at the south end of Sunset Lake, and used a Zodiac boat to cross the lake to places where they hiked, collected hand-sized rock samples, and made observations of the rocks and ground. They used these observations to create a geological map of the area. The results of this project were presented at the Yellowknife Geoscience Forum in November 2019, and will be publicly available through the Northwest Territories Geological Survey online database by the end of 2019.

Dibike, Yonas
Environment and Climate Change Canada
Victoria, BC
yonas.dibike@canada.ca

File No: 12 404 987

Licence No: 16539

Region: IN

Location: Noell Lake (68°31'37" N, 133°30'48" W)

A program to evaluate changing northern lake ice regimes

The main goal of this research project is to measure the thickness and 'composition' of lake ice over a number of years. The composition of lake ice is what it is made of. The information that is collected during this research project will be used to check whether the scientists' understanding of Noell Lake and its

winter ice cover are correct, and to examine how climate change is affecting both the lake ice and the conditions within the lake itself (under the ice). On 25 April 2019, members of the research team travelled by snowmobile from Inuvik to Noell Lake. A handheld GPS (Global Positioning System) unit was used to locate 30 specific sampling locations on the ice-covered surface of Noell Lake. These locations formed a north-south and an east-west transect over the lake surface. At each location, a tape measure was used to measure the depth of the snow on top of the ice. An ice auger was then used to drill a hole into the ice cover to see whether any white ice was present. After that, the ice auger was used to drill all the way through the ice cover, and the research team measured the total thickness of the ice and the hydrostatic water level (this is the water level inside the ice hole – in other words, the height from the top of the water to the top of the ice cover). Pictures were taken of the ice, the snow cover, and the research team as they took measurements.

Doré, Guy
Université Laval
Quebec, QC
guy.dore@gci.ulaval.ca

File No: 12 404 1006
Region: IN, GW

Licence No: 16597
Location: Tuktoyaktuk, Fort McPherson, along the Dempster Highway at (67.177 N, 135.756 W) and (67.182 N, 135.730 W), and the Inuvik-Tuktoyaktuk Highway at (69.372 N, 133.043 W) and (69.015 N, 133.282 W).

Self-stabilization of thaw slumps

In September 2019, the research team visited 'retrogressive thaw slump' sites along the Dempster Highway and Inuvik-Tuktoyaktuk Highway. These types of slumps happen when the permafrost is exposed and thaws, leading to more slumping, which in turn exposes more permafrost. The researchers wanted to investigate how and why the slumps sometimes stabilize, which stops this cycle and prevents any further thawing of the permafrost. A better understanding of what makes the slumps stabilize could be used to prevent damage to infrastructure, such as buildings and roads, that are at risk from thawing permafrost. To study this, the researchers drilled holes with hand-held equipment, dug small pits with shovels, and collected soil samples from the slumps and the surrounding terrain. While they were at the sites, the researchers also measured thaw depths in and around the slumps with a probe that they inserted into the ground. The soil samples were shipped to the Université Laval in Quebec, where they are currently being tested in a lab. The results of these tests will help the researchers figure out how the various layers of soil act to stabilize the slumps. Overall, this work did not disturb the land and no instruments were left behind. However, research collaborators did install instruments in the ground that measure ground temperatures; this data will be used to assess the development and stabilization of slumps. Preliminary data from these instruments show that a protective layer of frozen soil has generally formed over very old thaw slumps, while the debris from recent thaw slumps, which are in the early stages of self-stabilization, are still thawed at depth.

Doré, Guy
Université Laval
Québec, QC
guy.dore@gci.ulaval.ca

File No: 12 404 1006

Licence No: 16624

Region: IN

Location: The Inuvik-Tuktoyaktuk Highway right-of-way at (69.0118 N, 133.3024 W).

Mechanical and thermal design of embankments built on permafrost

The goal of this project was to measure the 'response' of the Inuvik-Tuktoyaktuk Highway to a loaded dump truck being driven over it at different times during the summer. The responses that were measured using a special instrument included shifts in the highway surface, or shaking as the dump truck drove over the highway. In September 2019, the researchers chose the location where the instrument would be installed and responses would be measured. The location was chosen because it is flat, the embankment is relatively thin, and it is close to another test site where there is a weather station. Half of the embankment at the location was excavated, and an instrument was installed that measures the pressure and road movement that is caused by the passage of vehicles. The embankment was then reconstructed, and the researchers tested the instrument to make sure it would work properly in the summer of 2020. To do this, a loaded dump truck drove past the test location to make sure that the highway responses were accurately recorded. Everything worked well, so measurements of the highway response will be collected during 2020.

Drolet, Andrée
Pine Point Mining Limited
Montreal, QC
adrolet@osiskomining.com

File No: 12 404 1012

Licence No: 16621

Region: SS

Location: Enterprise, Fort Resolution, and Fort Smith.

Pine Point project

On 2 October 2019, researchers from Golder Associates Ltd. completed water quality and fish surveys. The goals of this work were to check water flows and see if, and how, diversion ditches and pits were connected. The 2019 water sampling program was completed by a water quality specialist, who worked from 15 to 21 October. The specialist took samples and installed a meteorological station. In addition to water and fish research, Golder completed vegetation and soil surveys in mid-September 2019. The goals of these surveys were to help the research team understand the vegatation and soil in the area, and to identify any gaps in understanding that need further study.

Drouin, Hugo
Canada Centre for Remote Sensing
Ottawa, ON
hugo.drouin@canada.ca

File No: 12 404 1015

Licence No: 16629

Region: IN, GW, NS

Location: Inuvik and Yellowknife.

Radar satellite observations of lake ice breakup and freeze-up

Canada's RADARSAT Constellation Mission is a three-spacecraft fleet of Earth observation satellites that were launched in June 2019. The goal of this project is to evaluate whether the satellites can be used to monitor the breakup and freeze-up of lakes. Two out of the three study areas for this research project are located in the NWT; one is a set of lakes near Inuvik, and the other is a set of lakes near Yellowknife. The research team took several kinds of satellite images and developed a method to identify ice and water in the images. The researchers then validated their method of identifying ice and water using oblique aerial

photographs that were taken from a fixed wing aircraft. At each study area, the aerial photography work was contracted out to local organisations. So far, four aerial surveys for this project were completed in October 2019; three at the Inuvik study site, and one at the Yellowknife study site. More aerial surveys were scheduled for both study sites in late October and November 2019. The aerial surveys were timed so that they took place during good weather conditions and at the same time that the RADARSAT-2 satellites were passing overhead. The results are not yet published because the project is not complete yet, but the method that was developed will be used to easily monitor breakup and freeze-up in the future.

Eitel, Jan
University of Idaho
McCall, ID, United States
jeitel@uidaho.edu

File No: 12 404 931
Region: IN, GW

Licence No: 16446
Location: Sites between Fort McPherson and the NWT/Yukon border, including (67°16.586' N, 135°3.812' W), (67°14.511' N, 135°16.858' W), (67°13.149' N, 135°30.478' W), (67°10.760' N, 135°42.330' W), and along the Inuvik-Tuktoyaktuk Highway, including (68°30.010 'N, 133°47.576' W), (68°31.885' N, 133°51.044' W), (68°33.156' N, 133°52.608' W), and (68° 34.838' N, 133° 53.965' W).

Forest ecotone experiment
No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Fedorowski, Jerzy
Institute of Geology, Adam Mickiewicz University of Poznan
Poznan, Poland
jerzy@amu.edu.pl

File No: 12 404 962
Region: DC

Licence No: 16430
Location: Sites in the Mississippian/Pennsylvanian strata in the Liard Basin, including (61°07.23 N, 123°29.13 W), (60°33’50 N, 123°48’20 W), (60°52’30 N, 124°03’40 W), (60°59’03 N, 123°57’30 W), (61°06’38 N, 123°45’54 W), (61°11’00 N, 123°37’38 W), (60°36’05 N, 123°45’00 W), and (61°07’23 N, 123°29’13 W).

Global and regional environmental signals of the Mississippian/Pennsylvanian strata in the Liard basin northwest Canada
In 2019, the research team did not complete any field work in the Liard Range to Nahanni Butte region of the NWT. Instead, the group prepared, studied, and described the large number of solitary fossil corals they had collected during the summer of 2018. These fossil corals were collected from limestone in the Middle Mississippian (330 to 346 million years ago) Flett Formation at Jackfish Gap, 33 km west of Nahanni Butte. A scientific paper about the solitary corals from the Flett Formation is almost ready to be published. The paper reports important information about the age of the fossils and what the world was like when the corals were alive. In addition, the team wrote a paper about two new fossil corals from the Mattson

Formation, which is located on top of the Flett Formation and is mostly made up of sandstone. The two new fossil corals are types that grow in colonies. This paper about the Mattson corals has been submitted to a scientific journal for publication, and is important because the researchers used the corals to figure out that the previously undated upper part of the Mattson Formation dates to the Bashkirian age (315 to 323 million years ago).

Fischer, Beth
Northwest Territories Geological Survey
Yellowknife, NT
beth_fischer@gov.nt.ca

File No: 12 404 968
Region: SA

Licence No: 16479
Location: In an area that spans from 63°30' N to 63°45' N, and 129°30' W to 130°0' W.

Stratigraphic studies, Mackenzie Mountains
No research was conducted under this licence in 2019.

French, Nancy
Michigan Tech Research Institute
Ann Arbor, MI, United States
nhfrench@mtu.edu

File No: 12 404 1011
Region: SS

Licence No: 16611
Location: Enterprise, Fort Resolution, Fort Smith, and Hay River.

Wetland status, change, and seasonal inundation dynamics for assessing the vulnerability of waterfowl habitat within the ABoVE study domain
The goal of this project is to map out wetlands, how they flood seasonally, and how they are changing, to see if the waterfowl that use the wetlands might be at risk from any changes. Field crews surveyed wetlands in the Fort Resolution and Fort Smith areas from 14 to 19 August 2019. The crews were in the field at the same time that satellite images and air photos were being taken of the region, so they were able to compare information collected on the ground with the pictures taken from the air. The crews visited a total of 51 wetland sites and recorded information about them. In particular, the researchers were looking for wetlands that were accessible by road and that included all the different types of wetlands that waterfowl use. The researchers also measured wetland inundation at some of the field sites to help develop ways to detect wetland flooding using satellite imagery. Field crews met with Indigenous representatives in Fort Resolution and Fort Smith in order to provide an overview of the project and show examples of land cover maps. They also discussed current and possible future research sites. First Nations representatives provided insights about the land, climate, and water systems in the surrounding areas that helped inform the project. The researchers will follow up in order to continue building working relationships between the groups.

Froese, Duane
University of Alberta
Edmonton, AB
duane@ualberta.ca

File No: 12404744
Region: SA, DC

Licence No: 16420
Location: Hare Indian River Channel at (66 1.8' N, 125 28.2' W) and (66 7.8' N, 126 7.6' W), the crests of the northern Franklin Mountains (65 20' 24'' N, 126 36' 00'' W), the crest of the easternmost ridges of the Canyon Ranges (64 57' 36'' N, 127 33' 36'' W), and the banks of the Mackenzie River between Wrigley and the mouth of the Mountain River (65 40' 48'' N, 128 51' 36'' W).

Deglaciation of the NW Laurentide Ice Sheet and opening of the Mackenzie Valley
No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Fujii, Kazumichi
Forestry and Forest Products Research Institute
Tsukuba, Japan
fkazumichi@affrc.go.jp

File No: 12 404 944
Region: GW

Licence No: 16481
Location: Dempster Highway at (68°03' N, 133°30' W).

Reconstructing history of hummocky soil formation in drunken forest
The goal of this research project was to figure out the environmental factors that cause the development of 'drunken forests' and hummocky soils. A drunken forest is an area where the trees are all leaning at different angles. To study this, the researchers looked at how tree rings grow differently after a tree starts to lean. They took tree ring samples and recorded soil hummock properties in 50 tree-mound combinations. The researchers found that, after they start to lean, black spruce trees deposit lignin, a natural tissue that strengthens the trees, on the downside slope in what is known as 'reaction wood'. Trees grow reaction wood to try and straighten up after they start to lean or are bent over. Most of the reaction wood in mature trees can be found between 0 and 30 cm from the ground. Also, there is less reaction wood in trees growing in soil with deeper permafrost. Only the trees at the edge of the mounds grow reaction wood, and in those trees there is more reaction wood in soils containing lots of clay than in soils containing lots of sand. Due to all of these differences in how reaction wood grows, tree rings that are taken from black spruce between ground level (0 cm) and 30 cm above ground record the movement of soil mounds containing a lot of clay and with a shallow permafrost layer. The tree rings can therefore be used to reconstruct how the soil hummock grew.

Gammon, Paul
Geological Survey of Canada, Natural Resources Canada
Ottawa, ON
paul.gammon@canada.ca

File No: 12 404 1014
Region: IN, GW

Licence No: 16628
Location: Inuvik-Tuktoyaktuk Highway, in an area bounded at the SW corner at (68.36917 N, 133.77724 W), the SE corner at (68.36917 N, 133.70042 W), the NE corner at (69.39293 N, 133.43883 W), and the NW corner at (69.48868 N, 133.94179 W).

ITH metal chemistry

During 2019, the first year of this project, the research team started consultations, permitting, and licensing in order to conduct more extensive field work in subsequent years. All were successful and the team received good advice, information, and feedback from many stakeholders in Inuvik. The team was able to conduct a small field program in late October 2019. This field program had two goals; first, to see what equipment is needed to collect water and soil samples when the ground is actively freezing, and second, to collect information about metals in the Inuvik-Tuktoyaktuk Highway corridor to compare to other monitoring surveys. The research team dug five wells in a gravel quarry and took 15 water samples and 12 soil samples. The sampling demonstrated that the team's newly designed and built groundwater sampling equipment works well when the ground is freezing. The researchers also found that measurements made during their field program agree with the results of previous monitoring surveys. Further laboratory analysis of the samples is on-going and is not yet complete. Overall, the results so far suggest that the samples taken in October 2019 have slightly higher metal concentrations than those taken during other monitoring surveys. The goal for 2020 is to start to collect more detailed data that is required for this research project.

Giff, Garfield
Aurora Research Institute, Aurora College
Inuvik, NT
Garfield.Giff@auroracollege.nt.ca

File No: 12 404 965
Region: IN

Licence No: 16424
Location: Reindeer Station, the East Channel of the Mackenzie River, and Inuvik.

Online digital hazard maps of landslides along the Caribou Hills
No research was conducted under this licence in 2019.

Gray, Derek
Wilfrid Laurier University
Waterloo, ON
dgray@wlu.ca

File No: 12 404 956
Region: GW

Licence No: 16441
Location: Within 2 km upstream and downstream of the Fort McPherson ferry landings on the Peel River (67.34° N, 134.87° W), and upstream and downstream of the Tsiigehtchic ferry landings on the Mackenzie and Arctic Red Rivers (67.46° N, 133.76° W).

Impact of ferry landings on water quality and traditional fish harvesting in the Mackenzie and Peel Rivers
The researchers measured water quality at the Mackenzie River ferry crossing at Tsiigehtchic, and at the Peel River ferry crossing near Fort McPherson. Measurements were taken both upstream and downstream of the ferry crossings, and then compared to see if the ferry landings caused any change to the water quality. The researchers found that water quality did not differ between the upstream and downstream locations, and therefore, no effects of the ferry landings were detected during their short study period. The researchers wrote a report about their findings, and shared it with both communities.

Gray, Derek
Wilfrid Laurier University
Waterloo, ON
dgray@wlu.ca

File No: 12 404 938
Region: NS

Licence No: 16568
Location: Frame Lake in Yellowknife (62.454° N, 114.390° W).

A monitoring program for Frame Lake

The goal of this project is to see whether the water quality in Frame Lake is good enough to support the reintroduction of fish. The researchers set up probes to measure dissolved oxygen and temperature at a central monitoring point in the lake. The probes were supported by a buoy that was anchored to the lake bottom with a cinder block. The probes were set up on 25 July and the research team visited them every two weeks to download data and make sure that the probes were still working. In August 2019 the researchers collected bugs from the shallow areas along the shoreline of the lake, as well as water samples that they brought back to the laboratory for analysis. Early results show that there is enough dissolved oxygen in July and August for fish to be able to live in the water. However, it is likely that oxygen levels will fall too low during the ice-covered winter season to support fish. The researchers will continue to monitor conditions throughout the coming year, to see if oxygen levels remain high enough to support fish over the winter.

Grogan, Paul
Queen's University
Kingston, ON
groganp@queensu.ca

File No: 12 404 687
Region: NS

Licence No: 16493
Location: Within a radius of approximately 10 km from the Daring Lake Terrestrial Ecosystem Research Station (64°52' N, 111°35' W).

Capitalizing on long-term experimental manipulations to understand and predict Arctic terrestrial ecosystem responses to climate warming

The Arctic is critical to maintaining a stable global climate, in part because of the enormous amounts of carbon that are stored in tundra soils. Carbon is an element that all life on earth needs, and it cycles between the soil, living organisms, and the atmosphere in what is known as the 'carbon cycle'. Recent increases in Arctic air temperatures have changed the extent of permafrost, or frozen ground, and have also changed where some types of vegetation are found. As the climate continues to warm in the Arctic, how carbon cycles in the tundra will also change. This may potentially cause a significant increase in the amount of carbon dioxide in the atmosphere, which in turn may cause more warming. One of the main goals of this research project is to better understand how carbon is released from plants and the ground during the growing season as the temperature in the region increases. To do this, the researchers are comparing plots of ground that were warmed with a greenhouse to 'control' plots of ground that were left uncovered. The researchers installed instruments that measured the amount of carbon dioxide gas in both the greenhouse and control plots. They will return in 2020 to take a measurement of the amount of carbon dioxide released over a full growing season. The results of this study will help to predict how rising temperatures due to climate change will affect the release of carbon from tundra vegetation and soil.

Gruber, Stephan
Carleton University
Ottawa, ON
stephan.gruber@carleton.ca

File No: 12 404 878
Region: NS

Licence No: 16480
Location: Yellowknife, in the Lac de Gras region, along Highway 3, the Ingraham Trail, and the Tibbitt-to-Contwoyto winter road.

Quantifying permafrost thaw

The goal of this project was to develop and test a new method to measure how permafrost is thawing. The method that was developed to track the heaving (lifting) and subsidence (lowering) of the ground as permafrost thaws is now used by the Northwest Territories Geological Survey. It is an improvement on other methods because it better describes the ice loss that occurs as the ground warms and permafrost thaws. In 2019, team members collaborated with the Northwest Territories Geological Survey to do field work around Yellowknife. In the Lac de Gras area, the research team found buried ice that was preserved during the last glaciation. This ancient ice helped the researchers understand how much the landscape could change as temperatures continue to warm in the future. Over the five years of this research project, the many observations that the team made in the Lac de Gras area have improved their ability to predict permafrost change. Their research has been used by Environment and Climate Change Canada to predict climate change, and by the European Centre for Medium-Range Weather Forecasts to predict global weather and climate change. This research project has also improved predictions of how permafrost varies between different parts of the landscape such as wet valleys, dry hilltops, and peatlands. These findings have been published in scientific journals and were reported at the Yellowknife Geoscience Forum.

Gurney, Kirsty
Environment and Climate Change Canada
Saskatoon, SK
kirsty.gurney@canada.ca

File No: 12 404 939
Region: SA

Licence No: 16455
Location: Ts'ude niline Tu'eyeta Candidate Protected Area at (66°10'21.22" N, 129°52'33.50" W) and (66°14'07.62" N, 129°25'30.45" W).

Understanding changes in aquatic ecosystem health and water quality in the Fort Good Hope – ramparts area

What is happening in Ts'ude niline Tuyeta? The lakes and ponds of the Sahtú help keep water clean and support hunting and other cultural activities, but disturbances such as forest fires might affect them. To better understand how forest fires in Ts'ude niline Tuyeta might change lakes and ponds, samples of water and the bugs living in the water were collected from lakes in areas that were burned less than ten years ago, as well as from lakes in areas where there have been no burns in more than 50 years. Levels of heavy metals were too low to be detected in any of the samples. In smaller ponds, surface water had more 'dissolved organic carbon', which is created when plants and animals break down. Ponds in areas with no recent burns also had more dissolved organic carbon. Where there were recent burns, the nutrient (nitrogen and phosphorus) levels in the water had changed. Lakes and ponds in areas with more recent

fires had less nutrients than lakes and ponds in areas where fires had happened a long time ago. Overall, the types of bugs were similar in both pond types, but it seems that the levels of methyl mercury found in the bugs varies depending on their species, and may be different in recently burned areas. Lakes and ponds in Ts'ude niline Tuyeta provide essential resources for people and wildlife, and since increases in forest fires could affect these waterbodies, continued monitoring is very important.

Hajnsek, Irena
German Aerospace Center DLR
Wessling, Germany
irena.hajnsek@dlr.de

File No: 12 404 958
Region: IN, GW, DC, NS

Licence No: 16425
Location: Yellowknife Airport (62°27'57" N, 114°25'06" W), Baker Creek (62°35'00" N, 114°25'60" W), Scotty Creek (61°17'60" N, 121°17'60" W), Smith Creek (63°09'60" N, 123°19'60" W), Havikpak Creek (68°19'60" N, 133°30'00" W), Trail Valley Creek (68°41'06" N, 133°42'01" W), Siksik Creek (68°45'00" N, 133°30'00" W), Mackenzie vegetation transect (68°33'34" N, 133°30'10" W), Gordon Lake and the surrounding area (63°05'55" N, 113°12'00" W), and Inuvik and the surrounding area (68°17'59" N, 134°11'57" W).

PermASAR - Airborne SAR campaign on permafrost soils and boreal forests in the Canadian north-west
Airborne SAR uses radar waves sent out from a plane, which bounce off the surface of the earth and back to the plane. The returning radar waves are recorded and used to create very detailed maps or three-dimensional computer models of the surface of the earth. The goal of this project was to use airborne SAR equipment on a plane that came from Germany to map out several areas in the NWT and Yukon. The researchers were in the NWT from 28 February until 17 April 2019. They started their work in Yellowknife, where they took their first measurement flight over the Yellowknife airport to calibrate their instruments. The researchers then flew over Baker Creek to help with a satellite mapping project, followed by two flights over Gordon Lake area on 14 and 15 March to monitor the ice-road and take measurements of the lake ice. In mid-March the whole team traveled to Inuvik to fly over and map out sites in the Mackenzie River, Havikpak Creek, Siksik Creek, and Trail Valley Creek areas. One measurement flight was also made over Herschel Island in the Yukon. Back in Yellowknife, the researchers flew over Baker Creek and Scotty Creek on 28 March, before moving the aircraft to La Ronge in Saskatchewan. The PermASAR 2019 campaign ended with two more calibration flights over Yellowknife in April, before the plane and its instruments returned to Germany on 17 April.

Hendricks, Stefan
Alfred Wegener Institute
Bremerhaven, Germany
stefan.hendricks@awi.de

File No: 12 404 986
Region: IN, GW

Licence No: 16530
Location: Flights that originated from Inuvik.

Ice Bird 2019

This research project had three main goals; to measure the thickness of Arctic sea ice, to map the roughness of the ice surface, and to measure the depth of the snow layer on top of the ice. These measurements were taken using special instruments that were either mounted on a plane, or dragged by a plane at a height that was close to the ground. The project team also looked at how snow cover depth varied as sea ice thickness varied across the Arctic Ocean, and how the relationship between sea ice thickness and snow depth has changed over time. Each sea ice survey flight was between one and six hours in length, and each took place in two legs over the same flight track but at two different altitudes. During the first leg (the outward flight), measurements were taken while the plane flew very slowly at a low altitude. During the second leg (the return flight), the plane flew at a higher altitude (1600 feet) to measure a wider swath of the sea ice. All of the instruments worked well and the project team recorded a very large set of measurements from the eastern Beaufort Sea and the Amundsen Gulf, including sea ice thickness, the depth of snow on sea ice, and sea ice surface roughness. Although the sea ice surveys were the main focus, the research team also flew over permafrost regions near Inuvik to measure the depth of snow cover on land.

Hille, Erika
Aurora Research Institute
Inuvik, NT
erika.hille@auroracollege.nt.ca

File No: 12 404 953
Region: IN

Licence No: 16525
Location: Five locations at (69°27'16.95" N, 133°0'27.45" W), (69°26'22.19" N, 132°55'18.82" W), (69°25'15.65" N, 132°52'56.75" W), (69°24'31.26" N, 133°7'58.58" W), and (69°33'43.17" N, 132°58'49.52" W).

Beaufort Sea coastal restoration – Exploring the potential for using indigenous plant species to revegetate coastline affected by permafrost thaw slumping

Thaw slumps happen when permafrost is exposed to the air. The exposed permafrost thaws, which causes more slumping, which in turn exposes more permafrost. The goals of this project are to study how thaw slumps on the Beaufort Sea coastline start and progress, how they affect the land and sea, and to see whether the slumps can be remediated (or healed) using plants or by adding soil. The research team used air photos and satellite images to figure out how quickly thaw slumps appear and expand in the Kugmallit Bay region. In July of both 2018 and 2019, they focused on three thaw slumps that are located on the west, south, and east sides of Kugmallit Bay. The researchers took more detailed pictures of these thaw slumps using a drone. They then took water samples from each of the thaw slumps, as well as from nearby unaffected terrain without any slumps. Water samples were also taken from the near-shore zone within the sediment plume that was leaving each of the thaw slumps, as well as from outside of the sediment plume. The researchers will use these samples to see how the thaw slumps affect near-shore fish habitat. Finally, at each slump, the research team put three thermometers in the slump and covered one of them with a square of sod to see if the sod will help the permafrost refreeze. If successful, this method could be used to remediate terrain that has been impacted by thaw slumping.

Hille, Erika
Aurora Research Institute
Inuvik, NT
erika.hille@auroracollege.nt.ca

File No: 12404953

Licence No: 16532

Region: IN, GW

Location: Fifteen sites located along the Dempster Highway from the NWT/Yukon border to Inuvik, and along the Inuvik-Tuktoyaktuk Highway.

Investigating the water quality of runoff from different terrain types

The goals of this project are to see how the seasons, climate, and terrain affect the water quality in streams, and to study how these factors might make the stream more or less sensitive to permafrost thaw. The researchers collected water samples from a number of streams located along the Dempster Highway and the Inuvik-Tuktoyaktuk Highway. When possible, they also measured stream discharge, or the volume of water moving downstream per unit of time. Discharge measurements will allow the researchers to understand how the water quality in the streams might change due to changes in the environment or weather. They took water samples and stream discharge measurements twice a week during the spring snowmelt period, and once a month during the summer and fall periods. They will repeat this sampling program in 2020, when they will also map out the streams and nearby terrain using detailed images taken by satellites and drones. The catchment for each stream will then be classified based on the local climate and terrain, including the vegetation, bedrock, landscape, glacial history, and permafrost conditions.

Hille, Erika
Aurora Research Institute
Inuvik, NT
Andrew.Gordon@auroracollege.nt.ca

File No: 12 404 953
Region: IN

Licence No: 16588
Location: Noell Lake catchment (68°31'36.58" N, 133°34'13.03" W).

Impacts of natural and anthropogenic disturbances on the aquatic health of tundra lakes in the upland region northeast of Inuvik, NT

The purpose of this research project is to examine the effects of permafrost thaw slumping and fire on the water quality of small tundra lakes in the upland region east of Inuvik. This project started in 2009, when the Aurora Research Institute collaborated with Environment and Climate Change Canada to investigate how permafrost thaw slumping affects small tundra lakes in the Noell Lake watershed. In 2012, there was a tundra fire in the Noell Lake watershed, which prompted the researchers to expand their study to include small tundra lakes that had been impacted by the fire. In August 2019, water samples were collected from several of these small tundra lakes. Three of the lakes had been impacted by permafrost thaw slumping, three had been impacted by fire, and three were pristine. These samples will extend the long-term data set for these lakes, although the results still need to be analyzed and compiled.

Hilton, Robert
Durham University
Durham, United Kingdom
hilton.rg@gmail.com

File No: 12404717
Region: GW

Licence No: 16562
Location: Middle Channel of the Mackenzie Delta, Mackenzie River at Tsiigehtchic, Arctic Red River at Tsiigehtchic, and Peel River at Fort McPherson.

Erosion of old organic carbon in the Mackenzie River basin

Carbon is an element that all life on earth needs. Each year, carbon dissolves from the soil into the Mackenzie River. The carbon that is dissolved in the river water can be 'dated' to see how old it is using radiocarbon dating methods, and its age can tell us more about where the carbon may have come from. For example, old carbon is found in deep soils, and when the ground thaws, this old carbon can be washed into river networks. The research team visited Inuvik in the Mackenzie Delta region in June 2019, in order to sample the rivers at high flow after ice break up. This was the third year in a row that the team has tracked carbon in the water and sediment. River water and sediments were collected from the Middle Channel of the Mackenzie River in the Mackenzie Delta, the Mackenzie River at Tsiigehtchic, and the Arctic Red and Peel Rivers. The trip was a success because of the support and help of the staff at the Aurora Research Institute and other residents from the region. In June 2018, the team found very old carbon dissolved in the river water at all of the sites they sampled. In 2019, the carbon in the river water was young again, just like it was in June 2017. The changes could be linked to the temperature during the winter months, as the 2018-2019 winter was much warmer than the average. More work will be done to try and figure this out. The team is writing scientific papers and will update Aurora College and the communities as they make progress.

Holmes, Robert Max
Woods Hole Research Center
Falmouth, MA, United States
rmholmes@whrc.org

File No: 12 404 713
Region: GW

Licence No: 16438
Location: Mackenzie River near the Tsiigehtchic ferry crossing (67°27'21'' N, 133°45'11'' W).

The Arctic Great Rivers Observatory III

This project studies the six largest rivers that flow into the Arctic Ocean. The rivers that are studied in North America are the Mackenzie and the Yukon, and the rivers that are studied in Russia are the Ob', Yenisey, Lena, and Kolyma. The research team is measuring the concentration of naturally occurring chemicals, such as carbon, nitrogen, and phosphorus, in these rivers. Their aim is to measure the amount of these chemicals that are flowing into the Arctic Ocean now, so they can better understand how climate change will affect Arctic rivers in the future. This project has run since 2003. The current phase of the project is funded for three years, with 2019 being the third year. Samples are collected from the Mackenzie River (and the other five rivers) every second month. The researchers are currently analyzing the water samples in the lab, and the results are posted on a public website when they are available. The Mackenzie River samples are collected by staff from the Aurora Research Institute, in collaboration with the Gwichya Gwich'in Renewable Resources Council in Tsiigehtchic. During the summer, samples are taken from a motor boat just upstream of the Tsiigehtchic ferry crossing. During the winter, an ice auger is used to drill a hole in the ice so that a water sample can be taken from the same location in the middle of the river. During each sampling trip, they take approximately eight litres of water from the Mackenzie. The water sample is taken back to the lab in Inuvik, where it is processed.

Hood, Alexandra
De Beers Canada Inc.
Yellowknife, NT
Alexandra.Hood@debeersgroup.com

File No: 12 404 808
Region: NS

Licence No: 16418
Location: Snap Lake Mine

De Beers Canada Snap Lake Mine environmental monitoring
The goals of this project are to fulfill the requirements of the Snap Lake Mine's Land Use Permit, Water License, Environmental Agreement, and Fisheries Authorization, and to meet De Beers' corporate commitments on the environment. The Snap Lake Mine is currently in 'Care and Maintenance', which means the mine is no longer active and all the work done on-site is directed at closing the mine down following the requirements in the various licenses and permits. In 2019, no wildlife research was conducted, although incidental observations of wildlife were made around the mine. The research that was completed in 2019 focused on aquatic monitoring and site monitoring. The research team took samples and studied the water quality, plankton, and sediments in the water. They also took measurements of air quality. The results of analyses that will check the samples for contaminants will be available by May 2020. In June, Elders from the four Aboriginal Signatories of the Snap Lake Environmental Agreement visited the mine site. The researchers also presented project updates to four communities and at a board meeting.

Hopkinson, Chris
University of Lethbridge
Lethbridge, AB
c.hopkinson@uleth.ca

File No: 12404975
Region: IN, GW, SA, DC, NS, SS

Licence No: 16491
Location: Forested areas of the NWT.

Airborne laser mapping
The goals of this project are to understand and predict forest growth and loss over the Taiga Plains and Shield, and then to apply the same research methods to the entire northern Boreal region in order to better understand continental patterns of greening and browning. The research team used a special instrument, a laser, on a plane to map out research sites in great detail. Airborne data collection targeted plots that are widely distributed across the forested areas of the NWT. All aerial data collection was conducted at speeds of 140 knots and at an altitude greater than 1000 m above ground level. The research team also used satellite images to do their work. There are several graduate students who are working on this project, and who will publish papers in academic journals about their research. The research team went to various meetings, attended community consultation sessions, and gave presentations about their work. The researchers are optimistic that the airborne and satellite biomass inventory research will continue in 2021. They hope to once again engage community support for their field work.

Huot, Yannick
Université de Sherbrooke
Sherbrooke, QC
Yannick.Huot@USherbrooke.ca

File No: 12 404 1000
Region: GW, DC, NS, SS

Licence No: 16577
Location: Team 1 worked on lakes near Fort McPherson, Tsiigehtchic, and Inuvik, while Team 2 worked on lakes near Enterprise, Hay River, Fort Smith, Fort Providence, and Behchokǫ̀.

NSERC Canadian Lake Pulse Network: More than 660 Canadian lakes sampled over three summers
The goals of this project are to study how the health of lakes has already changed, and to predict how lakes will respond to changes in the future. To assess lake health, the research team worked with many

scientists and students. Over the last three years, they took samples from 664 lakes that were selected to represent the millions of lakes across Canada. Over the next couple of years, they will put all of their research results online at the LakePulse Web Portal, along with water stewardship tools and interactive maps that display information about the health of Canadian lakes. The website will also show regional threats to lake health. By 2022, this research project will culminate in the first national assessment of lake health. During the summer of 2019, two teams sampled 22 lakes in the NWT. They used a boat to sample the deepest spot in each lake, where they collected about 50 L of water, took samples of sediment from the lake bottom, and took some measurements of the lake. No dangerous products were released in the lakes, and all precautions were taken to avoid contaminating the lakes with any invasive species. The researchers also set up a mobile lab where they filtered the lake water samples and prepared them for shipping.

Jerrett, Rhodri
The University of Manchester
Manchester, United Kingdom
rhodri.jerrett@manchester.ac.uk

File No: 12 404 1005
Region: SA

Licence No: 16595
Location: In Tulít'a, and approximately 20 km from Tulít'a at (64°52'41.988'' N, 125°14'44.0016'' W).

Reconstructing latitudinal terrestrial temperature gradients at the Cretaceous-Paleogene boundary: Testing the 'equable earth' hypothesis

During the late Cretaceous and early Palaeogene (66 million years ago), 75% of all species on Earth suddenly went extinct. The goal of this project is to learn about changes in the air temperature before, during, and after this extinction, so we can better understand extinctions in general. The researchers visited a site near Police Island from 4 to 9 August 2019 to study a thick layer of coal 12 m below the surface of the earth. Coal is peat that has been compressed after it was buried. The researchers think that the peat recorded changes in air temperature during this extinction event. They spent the first two days in the field looking for the coal, which they found. On 6 August they met with community members in the Tulít'a Hotel boardroom to explain the science they were trying to do. For the next two days, they removed the sediment covering the coal and collected some samples. They returned to the UK with these samples, which have been freeze-dried and ground into a powder. The researchers are now waiting to analyze the samples. They will finish their laboratory work in February 2020, and can provide further updates after that time. Due to the success of the 2019 field season, they will not be doing any more field work in 2020.

Kabanov, Pavel
Natural Resources Canada
Calgary, AB
pavel.kabanov@canada.ca

File No: 12 404 988
Region: SA

Licence No: 16545
Location: Prohibition Creek, Norman Range, 3 km upstream and downstream of a reference station located at (65°11'15.95" N, 126°13'15.48" W), and Francis Creek 500 m upstream and downstream of a reference station located at (65°14'30.65" N, 126°23'26.90" W).

Devonian reference section, source rocks and paleomagnetic study

The 2019 field work for this project was a joint effort between the Geological Survey of Canada and the DEEP research group from the University of Liverpool in the United Kingdom. The goals of this project were to study, take samples of, and record information about a special layer of bedrock from the Middle-Late Devonian at Prohibition Creek southeast of Norman Wells. This layer of bedrock is about 376 to 388 million years old. The rock layers that were studied formed in a basin, and contain fossils from many different organisms. These rock layers are interesting for two reasons. First, they are a high-quality oil and gas prospect, which means that the rock layers might contain oil and gas that could be developed. Second, they are a valuable and well-preserved 'sedimentary archive' of a time when the earth was much warmer than it is now, when there was no ice on earth. These rocks have started to attract the attention of the international scientific community that studies the earth's surface conditions and the global warming events that have happened in the deep geological past. As of November 2020, samples from Prohibition Creek were being processed in labs for further research, and the researchers were also publishing academic papers about their work.

Kershaw, Geoffrey
Wilfred Laurier University
Waterloo, ON
kers7130@mylaurier.ca

File No: 12 404 116
Region: SA

Licence No: 16428
Location: Study sites were accessed from the North Canol Heritage Trail and Mactung mine road between Dale Valley (63°15'58.18" N, 130°5'6.37" W) and Caribou Pass (63°34'21.70" N, 129°12'4.19" W).

A mass-energy analysis of permafrost and vegetation change across a Mackenzie Mountain treeline ecotone: 1944 to 2017

The goal of this project is to study how permafrost and vegetation have changed in a mountain basin at the Mackenzie Mountain treeline. In April and May, the researchers surveyed the snow and measured thaw depths at five locations in the study basin. Multiple drone flights were used over a stretch of time to collect images of the basin and record changes in the snow pack as it melted. At regular intervals during the spring melt, the researchers measured the water leaving the basin through the main channel. At the end of the spring melt, the sensors that the researchers had installed in the basin were checked and the water level information was downloaded from them. Also, water samples were taken from multiple locations in the basin before, during, and after the spring melt. In July, the researchers installed a series of sensors to record the depth of the water table, soil moisture, and temperature throughout the year. They also used ground penetrating radar to map the deeper ground conditions along the same transects that they used in the spring to survey the snow. They collected soil and water samples to analyze later in the laboratory. Finally, the researchers downloaded data from a weather station in the basin, which logs atmospheric conditions year-round, and used a drone to take pictures of and map the surface water in the basin during low-flow fall conditions.

Kiss, Frank
Natural Resources Canada
Ottawa, ON
frank.kiss@canada.ca

File No: 12 404 526

Licence No: 16512

Region: DC, NS

Location: Sites in the Lac Levis area, including (63°05'07" N, 119°41'55" W), (63°05'07" N, 118°00'00" W), (62°45'30" N, 118°00'00" W), (62°45'30" N, 117°00'00" W), (62°00'00" N, 117°00'00" W), (62°00'00" N, 118°30'00" W), (62°08'25" N, 118°34'45" W), (62°12'04" N, 118°46'55" W), (62°26'15" N, 118°45'56" W), and (62°35'28" N, 119°38'03" W).

Lac Levis aeromagnetic survey

The goal of this project was to map out the earth's magnetic field in the Lac Levis area using special instruments attached to a twin-engine plane. Magnetic mapping like what was used in this project can show the general location of certain minerals in the earth's surface, such as iron-bearing minerals. It can also show us the composition of the bedrock, even if it's hidden under soil and lakes. However, due to budgetary restrictions, this project was not adequately funded and therefore no work was completed.

Knox, Bernadette
Northwest Territories Geological Survey
Yellowknife, NT
bernadette_knox@gov.nt.ca

File No: 12 404 917
Region: NS

Licence No: 16544
Location: Newbigging Lake (64°25'4.899" N, 112°14'51.209" W), Desteffany Lake (64°37'11.04" N, 111°58'54.528" W), and Point Lake (65°12'5.942" N, 112°58'27.222" W).

North central Slave craton bedrock mapping

This project is an on-going study of the relationships between volcanic rock, which forms when lava from a volcano hardens, and the older 'plutonic rock' that surrounds them. Plutonic rock forms when magma under the earth cools in place. In 2019, the research team mapped the bedrock in the Newbigging and Point Lake areas. The research team continued to learn more about the nature of the ancient volcanic rocks in the area, such as their absolute age, chemical compositon, metal content, style of deposition, and type of deformation (in other words, how they were bent under pressure). They also learned about the pressures and temperatures these rocks experienced in the past. This information will be used to gain an undertanding of the deep history of the Slave craton, and to predict where metals might be mined in the NWT. On-going laboratory work will add more information to the observations that were made during the summer of 2019. The researchers will publish maps and reports through the Northwest Territories Geological Survey and make presentations at the Yellowknife Geoscience Forum.

Korosi, Jennifer
York University
Toronto, ON
jkorosi@yorku.ca

File No: 12 404 929
Region: DC

Licence No: 16439
Location: In the vicinity of the Scotty Creek Research Station at (61°17'53.47" N, 121°17'5.38" W), approximately 50 km south of Fort Simpson.

Long-term aquatic ecosystem change at the southern limit of permafrost

Temperature, light, and oxygen are important determinants of how well a lake ecosystem functions. They influence lake food webs and how productive the lake is. They also affect the level of mercury in the water, and how much mercury is taken up by plants and fish. The goals of this project are to study seasonal changes in temperature, light, and oxygen in order to understand how lakes change as permafrost thaws over time, and to study how permafrost thaw will affect lake ecology and mercury levels in the future. In early June 2019, the researchers put data loggers in Goose Lake and First Lake at the Scotty Creek field research station. These data loggers are special instruments that take continuous measurements of water temperature, sunlight penetration into the lake, and oxygen concentrations at the bottom of the lake. The data loggers recorded these measurements all summer, and were removed from the lakes in September 2019. In the summer of 2018, the researchers collected sediment cores from 25 lakes in the area around Scotty Creek that are being used to document how lake ecosystems have changed over the last several hundred years. The researchers are particularly interested in how lake colour and mercury levels have changed. The researchers are currently running tests to see how old the layers in the sediment cores are. They anticipate that they will have preliminary results available to share with the community by December 2020.

Korosi, Jennifer
York University
Toronto, ON
jkorosi@yorku.ca

File No: 12 404 929
Region: IN

Licence No: 16516
Location: Small lakes around Noell Lake (68°31'37.16" N, 133°34'5.39" W), Parson's Lake (68°58'28.40" N, 133°37'58.58" W), and just outside Tuktoyaktuk (69°26'35.00" N, 132°59'55.00" W).

Climate change impacts on lake ecosystems of the western Canadian Arctic

This project had two main goals. The first was to understand how permafrost thaw slumping affects the zooplankton living in lakes (zooplankton are the tiny animals that live in the water). This part of the project built on earlier field research that showed that if lakes had been heavily impacted by thaw slumping, then a group of large-bodied zooplankton called Daphnia wouldn't be found in the lakes. The researchers collected sediment cores from 24 small lakes clustered around Noell Lake and Parson's Lake. These sediment cores are being analyzed to see if they contain Daphnia fossils. The results from this part of the project will be available by December 2020. The second goal of this project was to conduct a pilot study to determine if abandoned military sites (the DEW Line sites) in and around Tuktoyaktuk had contaminated lakes with PCBs. The researchers collected sediment cores from small lakes close to three former DEW Line sites, including a site in Tuktoyaktuk, a coastal site east of Tukotyaktuk, and a site south of Tuktoyaktuk. The researchers analyzed the sediment cores to determine their age, and they will also check the cores for PCB contamination. They plan to have preliminary results available to share with the community in spring 2020, to coincide with planned field work activities in Inuvik and Tuktoyaktuk that April. At that time, they will welcome the opportunity to discuss with the community whether there is any need or interest in expanding the pilot study, and if so, what an expanded project would look like.

Lafleur, Peter
Trent University
Peterborough, ON
plafleur@trentu.ca

File No: 12 404 982
Region: NS

Licence No: 16492
Location: Within a 2 km radius of the Daring Lake Tundra Ecosystem Research Station (64°52' N, 111°34' W).

Future of tundra-atmosphere climate interactions

The goals of this project are to understand how tundra environments interact with the atmosphere, and to predict how changing tundra vegetation and permafrost will affect the climate in the future. Tundra ecosystems exchange energy, water, and carbon gases with the atmosphere. As the climate warms, tundra vegetation changes, which alters the rates at which energy, water, and carbon gases are exchanged with the atmosphere. In turn, this affects the rate and extent of climate warming. The research team has established four semi-permanent sites near Daring Lake where they set up special instruments each May and take them down in October. The instruments monitor how energy, water, and carbon gases move between the tundra and the atmosphere. While they are at the sites, the research team also measures snow depth and collects data from the previous winter. In 2019, the research team included two students who visited the four research sites in order to maintain the equipment, collect and archive data, and make vegetation and ground thaw observations at regular intervals. The students left the field in mid-August, and a research technician arrived at the end of August to winterize the research sites and make final observations. The 2019 field season was a busy one; the principal researchers, technicians, and students spent a total of 111 days at the Daring Lake Tundra Ecosystem Research Station. The students also participated in the Daring Lake Tundra Science and Culture Camp at the end of July.

Lantz, Trevor
University of Victoria
Victoria, BC
tlantz@uvic.ca

File No: 12 404 758
Region: IN, GW

Licence No: 16520
Location: Eighteen existing core sites with instrumentation at (68.315 N, 133.428 W), (68.648 N, 133.626 W), (69.366 N, 133.035 W), (67.234 N, 135.387 W), (68.764 N, 133.549 W), (69.362 N, 133.036 W), (69.063 N, 132.286 W), (69.634 N, 127.896 W), 68.924 N, 134.321 W), (68.452 N, 133.431 W), (69.352 N, 133.049 W), (69.218 N, 129.508 W), (72.012 N, 125.207 W), (72.012 N, 125.214 W), (72.025 N, 125.273 W), (72.024 N, 125.277 W), (71.982 N, 125.543 W), and (71.987 N, 125.254 W). New sites that were added in 2019 include (68.833 N, 136.985W), (68.810 N, 137.517 W), (69.068 N, 138.395 W), (69.155 N, 135.867 W), (69.209 N, 135.689 W), and (69.239 N, 135.512 W).

Drivers and constraints of ecological change in the western Arctic

Climate change is changing northern vegetation and permafrost in important ways. These changes are concerning because they influence the regional and global climate, making it harder for animals to stay alive, damaging water quality, and threatening buildings and roads. The goals of this research program are to understand how fast things are changing, to figure out what is causing the changes, and to see what the changes will mean in the future. The researchers are using air and satellite photos combined with field

studies to map the changes that are occurring both locally and across the continent in order to predict what the future may bring. In 2019 the research team went to the outer Mackenzie Delta to see how a large storm surge that happened in 1999 has affected the soil, vegetation, and birds in the area. They took measurements and samples from 50 research plots and also walked transects. Their results show that the 1999 storm surge is still affecting the birds and plants in the area 20 years later. The researchers also went to the Tuktoyaktuk coast to study plant growth in the region. The research team surveyed the soil and vegetation conditions at 36 sites, and found that topography, wetness, and land cover all influence how well plants grow. The research team is also monitoring and taking long-term measurements of the vegetation, permafrost, and soil at other research sites.

Liu, William
De Beers Canada Inc.
Calgary, AB
william.liu@debeersgroup.com

File No: 12 404 981
Region: SS

Licence No: 16460
Location: Kirk Lake, Hoarfrost and Fletcher watersheds, and at eight sites along a transect that runs 20 km to the SW from the edge of the Gahcho Kue Project footprint.

De Beers - Gahcho Kué environmental monitoring program

In 2019 De Beers continued to monitor the environment at the Gahcho Kue mine site, as they are required to do under the mine's Environmental Monitoring and Management Plans. They are monitoring the effects of the mine on the water, lake and river sediments, air quality, soil, vegetation, fish, wildlife, and ground water systems in the area around the mine. They are also monitoring the chemicals found in the ground, as well as the effects of the mine on the health of the tiny animals and plants that live in the water and at the bottom of the lakes and creeks. In 2019, the research team took measurements of the snow pack, the flow rates in downstream channels, and the water level in the lakes. They measured the snow berms along the winter road, surveyed the wildlife at the mine site every week, and measured the air quality and dust deposition. Water quality within the mine boundary and in downstream lakes and channels was measured, and an aquatic effects monitoring program that tracks arctic grayling was conducted. The team also worked with six Indigenous groups and Ni Hadi Xa to conduct an annual fish tasting. Indigenous employees and contractors were hired to assist with survey work when possible. Traditional Knowledge monitoring was also conducted by Ni Hadi Xa in the family culture region surrounding the mine.

Low, Mike
Deh Cho First Nation
Hay River, NT
jmichaellow@gmail.com

File No: 12 404 549
Region: DC

Licence No: 16633
Location: In the Fort Simpson, Jean Marie River, Sambaa K'e, and Wrigley areas, Deep Lake (61.21258' N, 120.91894' W), Trout Lake (60.45031' N, 121.32453' W), Fish Lake (63.16567' N, 122.69569 ' W), Cli Lake (61.96936' N, 123.31' W), and McGill Lake (61.30639' N, 121.01611' W).

Further examination of the bio-magnification of mercury within fish species and watersheds of the Deh Cho and their varying levels among lakes

In summer 2019, a joint university-community team worked at Fish Lake, and a student-youth team worked at Kakisa Lake, to study and take samples of all of the 'biotic' (living) and 'abiotic' (non-living) parts that make up an ecosystem. These included the water, plants, animals, and fish, as well as the non-living things that have an influence on the ecosystem. Traditional Knowledge and input from harvesters were key in selecting the research locations and activities. In addition to the food web and water sampling that took place at Fish and Kakisa Lakes, the research team collected water and sediment samples from all of the lakes in the study area in August and September 2019. The lakes that were sampled were Kakisa, Tathlina, Gargan, McGill, Deep, Ekali, Sanguez, Willow, Big Island, Mustard, Fish, Greasy, and Trout. This was the second year that this set of lakes was sampled. The chemistry, genetic material, and mercury contained in the samples will be analyzed and measured. The researchers are studying what causes different types of mercury to be present at different levels in the lakes, such as the lake type, how the lakes are filled and emptied, and whether or not there are beavers at a particular lake. The combination of water, insect, and fish sampling, along with observations of the plants and terrain near the lakes, has shown how beaver dams, wetlands, and other aspects of the natural environment can lead to elevated mercury concentrations in fish. In addition, research has shown that fish from the sample lakes are very high in healthy omega-3 fatty acids. This information will be important to members of the community.

Macdonald, Francis
University of California at Santa Barbara
Santa Barbara, CA, United States
francism@ucsb.edu

File No: 12 404 994
Region: NS

Licence No: 16564
Location: East Arm of Great Slave Lake and along the Yellowknife Highway.

Did the formation of the Great Unconformity trigger oxygenation and the Cambrian explosion?

The goal of this research project is to figure out when the North American crust eroded, and how much of the crust has been eroded over time. One hypothesis is that the large glaciers that covered North America about 700 million years ago deeply eroded the crust. Another hypothesis is that tectonic uplift lifted the crust and created topography, which sped up erosion and consumed carbon dioxide; in turn, the decrease in carbon dioxide cooled temperatures and contributed to glaciation. To distinguish between these two hypotheses, a better understanding of the long-term erosion history of North America is needed. In 2019, the research team took samples that were dated and used to determine how much tectonic uplift took place in the past. The samples were analyzed, and the results suggest that the northwestern part of Canada was lifted about 720 million years ago. This finding is consistent with the second hypothesis, but it is still possible that glacial erosion played a role.

Machtans, Hilary
Golder Associates Ltd.
Whitehorse, YT
Hilary_Machtans@golder.com

File No: 12 404 799
Region: NS

Licence No: 16557
Location: Baker Creek (62°29'14.00" N, 114°21'44.30" W), Yellowknife Bay (62°29'11.20" N, 114°21'35.79" W), Yellowknife River at (62°31'28.34" N, 114°18'53.68" W)

and (62°33'29.20" N, 114°13'16.90" W), and Horseshoe Island Bay (62°23'04.36" N, 114°16'30.00" W).

Giant Mine Yellowknife Bay environmental monitoring
No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Mamet, Steven
University of Saskatchewan
Saskatoon, SK
steven.mamet@usask.ca

File No: 12 404 868
Region: SA

Licence No: 16524
Location: Several long-term monitoring sites along the Canol Heritage Trail within the Mackenzie and Selwyn Mountains, from (63.24616 N, 130.02978 W) to (63.47521 N, 129.36182 W).

Long-term ecological and geomorphological investigations in the alpine tundra of the Mackenzie Mountains, NWT
The goals of this project were to study permafrost thaw, and see how far the treeline may move, as the climate continues to change in the area of the western Mackenzie Mountains and eastern Selwyn Mountains. Annual air temperatures at five weather stations have warmed by 0.2°C per decade since 1990; at these same stations air temperatures in the winter have warmed by 0.4°C per decade. Permafrost temperatures are also being tracked at the weather stations. The summer permafrost temperatures are now about 0.3°C warmer than they were 20 years ago, and the winter permafrost temperatures are now about 0.8°C warmer. The warming temperatures have thawed the top layers of the permafrost at a rate of six to 18 cm per decade. As temperatures rise and permafrost thaws, Arctic landscapes will change, sometimes abruptly, and the plants and animals currently living there may not be able to adapt. The movement of the treeline was the other major focus of this research project. Warmer temperatures could mean that, in future, trees can grow further north or at locations that are further upslope in mountainous areas. From 2016 to 2019, the researcher planted tree seeds in some areas to see if they would grow. In 2019, the researcher found that south-facing alpine slopes may be ideal environments for new trees to grow. However, there are three reasons why the treeline may not move as quickly as expected. First, the existing trees along the Canol Trail do not produce enough good seeds for the trees to take over new areas. Second, seeds that fall on the ground in shrubby areas are quickly eaten by small mammals. And third, other plants prevent young tree seedlings from growing into adult trees.

Martel, Edith
Northwest Territories Geological Survey
Yellowknife, NT
edith_martel@gov.nt.ca

File No: 12 404 582
Region: SS

Licence No: 16459
Location: Nonacho Lake

Nonacho bedrock mapping project
The Northwest Territories Geological Survey is studying the 'South Rae craton' in the Nonacho Lake area. A craton is the stable part in the middle of a continent where there are no mountains or volcanoes. Mountains and volcanoes are created by tectonic forces, such as those that occur along the edges of

tectonic plates. The research team used a special test to measure the age of the bedrock layers in the craton, studied how the layers of the bedrock were formed, and checked the bedrock for metals. The bottom layers of the South Rae craton contain rocks that formed from magma (molten rock that flows under the surface of the earth) and that are around 2.3 to 2.6 billion years old. This is similar to the ages of other rocks in the surrounding area. The rocks that sit on top of these lower layers were formed from sediments deposited in a long-ago sea. This is new information because scientists used to think that the sediments were from freshwater lakes and rivers, but the research team suspects that the sediments were actually from a sea environment because there are certain wave patterns preserved in the rocks. The layers of rocks formed from sediment are more than 1.9 billion years old. The research team also found three 'shear zones' where the bedrock cracked and sheared due to strong tectonic forces, and new and interesting minerals formed. They suspect there may be even more shear zones in the area. Using the shear zones, the evidence they gathered from recording the rock layers, and their observations of how the rocks have changed over time, the research team has a much better idea of how the geology of the area has changed over billions of years.

McLennan, Donald
Polar Knowledge Canada
Cambridge Bay, NU
donald.mclennan@polar.gc.ca

File No: 12 404 995
Region: NS

Licence No: 16566
Location: Daring Lake Tundra Ecosystem Research Station (64°52´ N, 111°35´ W).

Classification, mapping, monitoring, quantification, and inventory of key ecosystem properties of terrestrial ecosystems in the NWT mainland, adjacent to Victoria Island

Plants, animals, and natural systems are changing across the circumpolar Arctic, and will continue to change in the future, due to global warming. Because the whole circumpolar north is changing, scientists want to be able to accurately compare how things are changing across many different regions. This project is creating a standardized method to map, study, and track Arctic ecosystems, and is similar to programs in BC and the Yukon. The project will help scientists measure change and use local study results to understand changes on a regional scale. To support this work, the research team is sampling, describing, classifying, mapping, and monitoring the plants and animals around the Canadian High Arctic Research Station in Cambridge Bay, Nunavut, including the adjacent regions of the NWT. They are also using computerized mapping programs, satellite imagery, air photos, and other maps to catalogue the different ecosystems in the study area, and are checking these computer maps with the field samples they took. The maps will be used for long term monitoring in the area, and will also be used to see if it is possible to use local measurements (measurements made in a relatively small area) to understand regional conditions (the conditions over a larger area). In some types of ecosystem, the researchers collected soil samples that will be analyzed to determine nutrient concentrations. Finally, vegetation from the lakes and land were sampled and sent to the University of Guelph to be identified using DNA analysis.

McWilliams, Kathryn
University of Saskatchewan
Saskatoon, SK
kathryn.mcwilliams@usask.ca

File No: 12 404 935

Licence No: 16468

Region: GW

Location: A site on the north end of Inuvik (68°24’52’’ N, 133°46’11’’ W).

Inuvik SuperDARN radar facility

Just as high and low pressure systems drive weather in the earth’s atmosphere, high and low voltages drive weather in space. The voltage patterns near the earth’s surface project out into space along the earth's magnetic field lines. The Inuvik SuperDARN radar is part of a worldwide network of over 35 radars that monitor space weather conditions in the upper atmosphere. The Inuvik SuperDARN radar measures voltage patterns several hundred kilometers above the ground by taking a scan every minute, 24 hours a day, 365 days a year. The only exceptions to continuous scanning in 2019 were a few intermittent power outages. The scans from the Inuvik radar were shared with researchers from around the world. There was a site visit planned for 2019, but it was delayed due to problems that had to be fixed at another site. The SuperDARN Canada engineers are planning a maintenance visit to Inuvik in 2020 in order to perform regular inspections and maintenance, as well as to install new radar electronics. This upgrade will improve remote operations and create a more flexible system for radar experiments. There have been no significant changes to the project, and the Inuvik SuperDARN radar will continue to operate in 2020.

Miller, Charles
Jet Propulsion Laboratory
Pasadena, CA, United States
charles.e.miller@jpl.nasa.gov

File No: 12 404 923
Region: IN, GW, SA, DC, NS, SS

Licence No: 16592
Location: Daring Lake Tundra Ecosystem Research Station, Inuvik, Fort Providence, Fort Simpson, Scotty Creek Research Station, and Fort Liard.

NASA ABoVE airborne campaign 2019

From July to September 2019, the ABoVE airborne campaign flew over four million square kilometers of Alaska and northwestern Canada, including the entire Northwest Territories. During these flights, special instruments on board the plane took pictures of the plants and trees covering the landscape, and recorded detailed maps of surface topography that were used to study the permafrost. Some areas that were flown over in 2019 include the Great Bear Lake/Tsá Tué UNESCO Biosphere Reserve, sites between Great Bear Lake and Great Slave Lake that are studied by Indigenous and Northern Affairs Canada, and vegetation monitoring sites near Hay River. At the same time that images were captured by the plane, on-the-ground measurements were taken in Fort Smith, Daring Lake, Fort Liard, Scotty Creek, Inuvik, and Trail Valley Creek. These measurements allow the researchers to link local site-based studies with plane and satellite measurements that cover much larger tracts of land. The ABoVE team also visited Délı̨nę, Inuvik, and Tuktoyaktuk to meet local residents and learn more about how to include Indigenous Knowledge in their research activities.

Miller, Matthew
Northwest Territories Power Corporation
Hay River, NT
mmiller@ntpc.com

File No: 12 404 923
Region: SS

Licence No: 16509
Location: Taltson Hydroelectric Facility

Taltson Hydroelectric Facility aquatic monitoring

The goals of this research project were to monitor changes in fish and their habitat in both the near shore and main channel of the Taltson River from Nonacho Lake to the Taltson Twin Gorges Generating Station. The purpose of this research project is to better understand the effects of flow regulation on fish and their habitat. The research team took aerial photographs and sampled the vegetation, fish, and water. They also monitored fish and fish habitat. They checked to see whether mercury contamination is a danger to humans or wildlife, and found that only older, larger fish have dangerous levels of mercury. Over time, the level of mercury in fish has gone up in some areas and down in others. They also studied vegetation and fish in areas outside of Taltson River, so they could compare the conditions in the river to nearby areas that are unaffected by flow regulation. The research team caught at least eight fish species, with northern pike being caught most often. Finally, the research team also monitored erosion on Nonacho Lake and Trudel Creek in the summer of 2019. Based on their monitoring, it looks like the hydroelectric project is not significantly changing erosion rates at Nonacho Lake, but is significantly affecting erosion rates in Trudel Creek. Therefore, the Taltson Hydroelectric Facility must continue to monitor erosion rates at Trudel Creek, but monitoring is no longer required at Nonacho Lake. Overall, there is a medium risk to the aquatic environment due to the Taltson Hydroelectric Facility.

Miller, Matthew
Northwest Territories Power Corporation
Hay River, NT
mmiller@ntpc.com

File No: 12 404 923
Region: SS

Licence No: 16619
Location: Fort Smith, Hay River, the Lower Taltson River (60.41572° N, 111.41403° W), Nonacho Lake (61.72563° N, 109.78008° W), and Rutledge Lake (61.63403° N, 110.79366° W).

Taltson Twin Gorges Hydro Generating Facility aquatic effects monitoring program (AEMP) 2019

No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Mochnacz, Neil
Fisheries and Oceans Canada
Winnipeg, MB
neil.mochnacz@dfo-mpo.gc.ca

File No: 12 404 1004
Region: GW

Licence No: 16591
Location: Rat River (67°48.192' N, 136°17.993' W)

Defining the biothermal envelope of Dolly Varden in the Canadian western Arctic to inform conservation planning

The goals of this field program were to improve our understanding of how water temperature might influence where Dolly Varden are found in a stream, and how long they stay in the stream. A total of 88 temperature loggers were placed in Fish Creek and tributaries of Fish Creek in 2018 and 2019. These loggers measured the water temperature and stored the data for the project team to retrieve later. The temperature data will be used by the research team to predict the water temperature in all of the streams that flow into Fish Creek, as well as in Fish Creek itself. The research team will then be able to understand the range of temperatures that different life stages of Dolly Varden (such as juveniles or spawning adults) prefer or need to live in. In the second phase of this project, the researchers will predict the amount of

stream habitat that has the correct temperature conditions, and is therefore currently available for different life stages of Dolly Varden. They will then predict how climate change may affect the quality and amount of habitat for each life stage. If streams warm as predicted, there may be fewer streams with suitable temperatures for Dolly Varden to live in. The results from this study will be used to identify conservation actions that can be included in future management plans.

Osawa, Akira
Kyoto University
Ohtsu, Japan
aosawa@kais.kyoto-u.ac.jp

File No: 12 404 876
Region: SS

Licence No: 16483
Location: Along Highway 5, between Wood Buffalo National Park west of Fort Smith and Angus Tower (but excluding the settlement near Salt River). Also, a forested area in a 6 km radius around Rainbow Lakes in Wood Buffalo National Park and south of Fort Smith.

Structure, carbon dynamics, and silvichronology of boreal forests

The overall goal of this research project is to see how the 'carbon dynamics' of the boreal forest in northwestern Canada have been affected by climate change over the last century. Carbon is an element that all life on earth needs, and the term 'carbon dynamics' refers to how carbon moves through the soil, plants, and air. Because the principal investigator of this research project passed away in May 2019, only part of the field work that was planned was completed. Three people visited Fort Smith and the Wood Buffalo National Park for three specific reasons. First, they set up a study plot about half the size of a school gym in a stand of black spruce. They measured the trees and collected tree-ring samples to see how tree growth may have been affected by the climate in the past. Second, they tracked how the trees in a dense stand of jack pine changed after natural disturbances such as fire. To do this, they recorded the location and size of each tree in the stand. The research team found that trees that are taller than five meters are evenly distributed, but that tall trees are more likely to be found in sparser areas. Third, they measured the width and length of stems and branches to see if these measurements are helpful in evaluating how the climate affects the growth of black spruce trees. Their results indicate that they are.

Pacholski, Laura
Dominion Diamond Ekati ULC
Calgary, AB
laura.pacholski@ddcorp.ca

File No: 12 404 949
Region: DC

Licence No: 16508
Location: Ekati Diamond Mine Site

Ekati engineering and environmental monitoring programs

The goal of this research project is to see if the Ekati Diamond Mine is having an effect on the surrounding aquatic (water) environment or air quality. Another goal of this project is to study the areas where mine development may occur in the future to see what the conditions are like before the development occurs. There are many different components to this project that were designed to detect potential changes in surface water, air, vegetation, wildlife, wildlife habitat, soil, water quality, aquatic sediment quality, and aquatic life (the plants and animals that live in the water) that may be related to mine activity. The researchers also worked in Lac du Sauvage, in lakes and streams near the Sable and Misery developments,

and at the outlet of Lac de Gras, in order to gather information about the current conditions in these areas. They also monitored the effects of the mine at Pike Creek in the community of Łutselk'e. In order to gather the information they needed, the researchers looked at lakes and streams, weather, water quality, sediment quality, the tiny plants and animals that live in the water and along the bottom of lakes and streams, fish and fish health, and made observations of wildlife and their behaviour. The results of their work will be made available to the public through Dominion Diamond Mines ULC.

Palucis, Marisa
Dartmouth College
Hanover, NH, United States
marisa.c.palucis@dartmouth.edu

File No: 12 404 985
Region: GW

Licence No: 16522
Location: An alluvial fan near Bug Hunter Creek in the Aklavik Range.

Understanding how alluvial fans form in periglacial environments

When a scientist wants to understand the planet Mars, sometimes the best way to do this is to find areas on earth that resemble what conditions are like on Mars - at least in some ways. This project uses a watershed located below Black Mountain in the Aklavik range for just this purpose. This location is an ideal example of what things are like on Mars because the watershed and its adjoining 'fan' (a deposit of sediment and mud) are the same size and shape as Martian watersheds and fans, and they likely formed under the same climate. This research project had three goals. First, to assess how the site has changed since it was first mapped in the early 1980s. Second, to see how permafrost thaw and the melting of ground ice affect how sediment moves across the fan. And third, to map features on the fan that might also be seen in Martian fans. The team spent about 21 days studying the Black Mountain fan. They also watched and recorded when melting snow in mid-August brought new sediment down the fan in a river channel. The team recorded water flow speeds and the size and number of grains of sediment that were being transported down this river channel. The information they collected will be used to predict how fans form and change on Mars, including during times of snowmelt.

Panayi, Damian
Golder Associates Ltd.
Yellowknife, NT
dpanayi@golder.com

File No: 12 404 779
Region: SS

Licence No: 16555
Location: Approximately 5 km NE of the Gahcho Kué Mine.

Kennady North diamond project

The goal of this project was to monitor water quality and quantity at the Kennady North Diamond Project to prepare for future regulatory approvals and environmental impact assessments. The project team recorded water quality immediately downstream of the Gahcho Kué Mine during winter ice-covered conditions in April, and again during summer open-water conditions in September. At each sampling location in the lakes they took measurements of the entire water column (in other words, measurements that spanned from the surface of the lake down to the lake bed). They also measured water depth, surface elevation, and water pressure in both winter and summer. During the winter, they recorded the thickness of the ice cover. The research team found that the water quality in the lakes downstream from the mine

was similar to the water quality in other small lakes that were not affected by the mine. In early April, the research team installed dataloggers under the ice to monitor as much of the spring freshet period as possible. These dataloggers measured how fast the water was flowing, and how deep the water was, throughout the period when the ice cover was melting and breaking up. This information was used by the researchers to calculate the amount of water that was passing through the lakes during the freshet. The data collected during this project will be useful during future environmental assessments of the Kennady North Project. The researchers recommend that the mine continues this research project in future, in order to have a good understanding of water conditions over a range of wet and dry years.

Paulen, Roger
Geological Survey of Canada
Ottawa, ON
roger.paulen@canada.ca

File No: 12 404 934
Region: DC, NS, SS

Licence No: 16482
Location: Between (60°0' N, 114°0' W) and (62°00' N, 122°00' W).

Southern Mackenzie surficial mapping

In August 2019, the Geological Survey of Canada conducted field work south of the Mackenzie River to map out the rock formations in the area and take samples from a type of deposit called 'till'. A till deposit is a mix of boulders, smaller rocks, and fine sediment that was left behind by glaciers. The research team needed to do this field work in 2019 because the water levels in the streams flowing from northern Alberta and the Cameron Hills during the summer of 2018 were too high. This prevented the field crews from completing their sampling survey in July and August of 2018. In 2019, they collected 20 stream sediment samples from across the study area. In addition, five glacial till sediment samples were collected along the banks of the Buffalo River downstream from the Highway 5 bridge crossing. The research team travelled to their sampling sites either by helicopter or by hiking upstream from the road crossings of the Hay and Buffalo Rivers. This was the final year of this research project.

Pisaric, Michael
Brock University
St. Catharines, ON
mpisaric@brocku.ca

File No: 12 404 640
Region: DC, NS, SS

Licence No: 16609
Location: Fort Providence, Behchokǫ̀, Wekweètì, Whatì, Yellowknife, and Kakisa.

Using the past to inform the future: A paleoecological perspective of the impacts of drought and fire on lakes, permafrost and forests

No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Porter, Trevor
University of Toronto
Mississauga, ON
trevor.porter@utoronto.ca

File No: 12 404 865

Licence No: 16559

Region: GW **Location:** A site located at (68.16° N, 133.76° W).

A 2,000 year record of climate change from white spruce tree-rings

The goal of this research project was to use tree rings to study what the climate in the Mackenzie Delta was like in the past. White spruce tree rings are sensitive to summer temperatures; both the size and the density of the tree ring change in predictable ways as summer temperatures get hotter. This means that tree ring measurements can be used to make a record of how summer temperatures have changed in the past, which can be compared to recent temperature changes that have resulted from climate change. In 2019, the research team went to sites in the uplands south of Inuvik and collected 'cores' from living trees, and 'disks' from dead trees that were resting on the land or buried in lakes. Scanned images of the tree rings were used to measure their width and density. The data confirmed that some of the trees that were sampled were alive over 900 years ago. The data also confirmed that summer temperatures in the Mackenzie Delta have increased by about two degrees Celsius over the last century, and that this amount of warming is highly unusual over the last 900 years.

Pratt, Brian
University of Saskatchewan
Saskatoon, SK
brian.pratt@usask.ca

File No: 12 404 911 **Licence No:** 16556
Region: SA **Location:** Dodo Canyon (64°56'14.9'' N, 127°15'57.6'' W), an unnamed cliff (64°58'34.0'' N, 127°36'22.9'' W), Bearpaw Creek (65°03'25" N, 127°45'17.2" W), and Carcajou Falls (64°40'15.9'' N, 127°09'25.6'' W).

Cambrian stratigraphy and paleontology

No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Pumpanen, Jukka
University of Eastern Finland
Kuopio, Finland
jukka.pumpanen@uef.fi

File No: 12 404 887 **Licence No:** 16540
Region: GW **Location:** Between Inuvik and Tsiigehtchic.

Permafrost carbon fluxes

No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Reid, Kirsten
Memorial University of Newfoundland and Labrador
St. John's, NL
kirsten.reid@mun.ca

File No: 12404960 **Licence No:** 16452
Region: IN, GW **Location:** Along the Dempster and Inuvik-Tuktoyaktuk Highways, from Dawson City in the Yukon to Tuktoyaktuk.

Do diversity gradients and wildfires interact to facilitate tree range expansion across a broad latitudinal scale?

The goal of this research project is to understand how landscape disturbances like fires affect different types of tree stands. The researchers revisited monitoring sites they had set up in 2018 in order to record measurements and download data from loggers and cameras that had been continuously running. They studied nutrients and decomposition in the soil, counted the number of tree seedlings that had started to grow, recorded the plants and animals that were present at the site, and took soil samples. The researchers also added two new research sites. One site had experienced a 'regular' stand-replacing fire in 2005, but had not burned for 90 years prior to that, so all the trees that burned were mature and producing seeds. The other site had experienced two fires in quick succession (1990 and 2005), so the trees were not old enough to produce viable seeds the second time it burned. Finally, the researchers tested how well seeds from different locations grew in various soil conditions. Black spruce seeds were collected from Inuvik, which is a high-latitude site, Dawson City, which is a mid-latitude site, and Whitehorse, which is low-latitude site. All three types of seeds were then planted in both tundra and forested locations in the high-, mid-, and low-latitude sites. The researchers will check on the seeds in 2020 and 2021 to see how well they grow.

Risk, Dave
St. Francis Xavier University
Antigonish, NS
drisk@stfx.ca

File No: 12 404 1003
Region: IN, GW

Licence No: 16590
Location: Inuvik, Tuktoyaktuk, Fort McPherson, and Tsiigehtshic.

Using novel technology to survey methane emissions in the Mackenzie Delta

During this study the researchers sampled the air along roadways and river channels in the summer of 2019. They used a portable gas analyzer mounted on a truck or boat that was equipped with a GPS to measure the amount of methane in the air. They also went to hotspots of methane production in the outer Mackenzie Delta between Shallow Bay and East Channel that they had previously identified using aerial surveys. The researchers wanted to see if these methane hotspots were persistent over multiple years. If there was methane present at the hotspots in 2019, the researchers wanted to see whether it was produced in the active layer of the permafrost that thaws in the summer, or in a deeper layer of the permafrost and then released to the surface through 'discontinuities', or breaks in the permafrost. Some of these methane hotspots have persisted since 2013 and the researchers were able to sample them again during the summer of 2019. The researchers also surveyed and sampled additional sites in the fall, when they were visible and easy to sample due to delayed ice formation. The researchers should have a good understanding of where the methane is coming from in the permafrost, and how methane hotspots persist, early in 2020.

Robinson, Cindy
Barr Engineering and Environmental Science Canada Ltd.
Calgary, AB
crobinson@barr.com

File No: 12 404 998
Region: SS

Licence No: 16573
Location: A site located at (60°53'16" N, 114°25'12" W).

Reclamation research and closure plan for Pine Point

The goal of this research project is to understand how zinc (and other metals) move within the tailings, water, and soil in and around the Tailings Impoundment Area at the former Pine Point Mine. This information is needed to update the mine's Closure and Reclamation Plan, which will be submitted to the Mackenzie Valley Land and Water Board by 31 December 2020. The first phase of this two-and-a-half-year research program began in 2018. In 2019, the research team collected samples and measurements to learn more about the soil, bedrock, water quality, and how water moves between the atmosphere and earth. They also mapped out what covered the ground surface around the mine site (for example, plants or stones) and any risks to humans or the environment. They started two field trials to see what is needed to help seeds sprout and grow successfully on the tailings cover. The researchers are also figuring out ways to treat the water over the long term; for example, they are testing options to use wetlands to treat water that has been polluted by metals. Community members, mostly from Fort Resolution, were involved in the field programs and provided feedback on the Closure and Reclamation Plan. The researchers will continue to conduct research and engage with the community through 2020, and new information and community input will be incorporated in the final closure plan.

Rogers, Marty
Transport Canada
Ottawa, ON
marty.rogers@tc.gc.ca

File No: 12 404 993
Region: IN, GW

Licence No: 16563
Location: In the area of the Inuvik-Tuktoyaktuk Highway, the Tarium Niryutait Marine Protected Area, and the Dempster Highway from Inuvik to the Yukon border.

Remotely piloted aircraft based research

Fisheries and Oceans Canada and Transport Canada worked together for two weeks in July 2019 on a mission in Inuvik that was titled the 'Remotely Piloted Aircraft Beyond Visual Line of Sight Mission'. Usually, remotely piloted aircraft are flown within sight of the pilot, who remains on the ground. In some cases, however, the pilot is allowed to fly the aircraft out of sight. In this mission, an aircraft was used to monitor the impacts of human activities along the Inuvik-Tuktoyaktuk Highway. The aircraft took photos and measured the elevation of the ground surface along the highway. The aircraft was also used to take photographs and monitor beluga whales in the Beaufort Sea and Tarium Niryutait Marine Protected Area.

Schaefer, Kevin
National Snow and Ice Data Center
Boulder, CO, United States
kevin.schaefer@nsidc.org

File No: 12 404 1009
Region: NS

Licence No: 16601
Location: Yellowknife to Kakisa.

ABoVE permafrost dynamics observatory

No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Schutt, Derek
Colorado State University
Fort Collins, CO, United States

derek.schutt@colostate.edu

File No: 12 404 896
Region: SA

Licence No: 16427
Location: Transect between Haines Alaska and Great Bear Lake.

The Mackenzie Mountains Earthscope project
No work was conducted under this licence in 2019.

Sendrowski, Alicia
Colorado State University
Fort Collins, CO, United States
Alicia.Sendrowski@colostate.edu

File No: 12 404 989
Region: IN, GW

Licence No: 16546
Location: Along the Peel River close to Fort McPherson (67°26'4.34" N, 134°53'53.81" W) and along the Mackenzie River near Tsiigehtchic (67°27'22.08" N, 133°45'25.10" W). Potential field sites within 30 kilometers of Inuvik and Aklavik.

Large wood transport in the Mackenzie River basin
No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Smith, Sharon
Geological Survey of Canada
Ottawa, ON
sharon.smith@canada.ca

File No: 12 404 657
Region: IN, GW, SA, DC

Licence No: 16534
Location: Trout Lake, Jean Marie River, Fort Simpson, Wrigley, Tulít'a, Norman Wells, Fort Good Hope, Inuvik, Tuktoyaktuk, and locations surrounding these communities.

Permafrost monitoring and collection of baseline terrain information in the Mackenzie Valley corridor, NWT
The research team visited permafrost monitoring sites throughout the Mackenzie Valley corridor in the Inuvialuit, Gwich'in, Sahtú, and Dehcho regions in June, July, and September of 2019. At each site they measured ground temperatures and the depth of the permafrost active layer (the top layer of permafrost that thaws each summer). An Inuvik resident provided guiding services and boat transportation in the Inuvialuit and Gwich'in regions, and the Tuktoyaktuk community-based monitoring program coordinator helped with field work on Tuktoyaktuk Island. The observations and measurements that the researchers made in 2019 were added to the record of measurements that have been taken over the last 25 or more years. This long-term record helps the researchers understand how permafrost conditions are changing over time, which is particularly useful for land management decisions. The researchers found that the permafrost is continuing to get warmer. In the northern part of the Mackenzie Valley, the ground temperature is increasing by up to 0.1°C per year. In the southern part, ground temperature has increased by up to 0.03°C per year at sites between Norman Wells and Fort Good Hope, and by less than 0.02°C per

year at sites south of Norman Wells. The active layer of the permafrost, which thaws every summer, has generally been getting thicker over the last decade. The research team will continue to work on the measurements and observations that they took in order to better understand how climate change is impacting the permafrost.

Smol, John
Queen's University
Kingston, ON
smolj@queensu.ca

File No: 12 404 547
Region: NS

Licence No: 16537
Location: Lakes around Yellowknife.

Biological responses to multiple environmental stressors in lakes around Yellowknife, NT

The research team had a very productive lake sampling program in 2019. They collected water and sediment samples from 17 lakes around Yellowknife over a period of two weeks (24 July to 7 August). They are measuring the nutrient and metal concentrations in the water samples, and are also looking at some other aspects of the water chemistry. In addition, they are studying the tiny shrimp-like animals that live in the sediments at the bottom of the lake. The researchers hope that having a better understanding of how the tiny shrimp change over time will help them understand how the environment is changing. They are also looking for water fleas in the sediment, to see whether their remains can be used to measure any natural toxins that were present in the water long ago. Unfortunately, due to COVID-related interruptions, this project has been put on hold temporarily, but will continue as soon as the research team is allowed back into their laboratory. The 2019 field season also gave the research team several opportunities to connect with local stakeholders, and to strengthen research partnerships with scientists at Aurora College and the Northwest Territories Geological Survey.

Sonnentag, Oliver
Université de Montréal
Montréal, QC
oliver.sonnentag@gmail.com

File No: 12 404 806
Region: DC

Licence No: 16431
Location: Scotty Creek (61°18’ N, 121°18’ W)

Influence of changing active-layer thickness on permafrost peatland trace gas exchanges and carbon balance

Carbon is an important greenhouse gas, but it also exists as an element in the water, land, and all living things. The goal of this project is to understand how thawing permafrost influences carbon, water, and the temperature of the land and atmosphere. In order to study this, the research team has been measuring the amount of carbon and water that move between the earth and the atmosphere at Scotty Creek since 2013. In 2019, the research team continued their work at the Scotty Creek Research Station near Fort Simpson. They visited the site to do basic maintenance, such as calibrating their instruments, downloading data, and doing any basic repairs that were needed.

Sonnentag, Oliver
Université de Montréal
Montréal, QC
oliver.sonnentag@gmail.com

File No: 12 404 806
Region: IN, GW

Licence No: 16433
Location: Trail Valley Creek (68°44'13" N, 133°29'15" W) and Havikpak Creek (68°19'13" N, 133°30'48" W).

Quantifying carbon fluxes and budgets of boreal forest-tundra landscapes under the influence of rapidly changing permafrost regimes

There is general agreement that permafrost landscapes are vulnerable to climate change, but scientists do not understand how changes to the permafrost will affect the nature of boreal forests and the tundra. To learn more and predict how the boreal forest and tundra may be affected by permafrost thaw, the research team has placed a special instrument at research sites in Trail Valley Creek and Havikpak Creek. This instrument continuously measures wind speed and the concentrations of various gases in the air. At Trail Valley Creek, the research team also measured the wind speed and gas concentrations in the air right above the ground using a special 'chamber', which is a container that sits directly on the ground and catches the gases that are released from the soil. These chamber measurements will help the research team better understand how gas concentrations change over small distances on the tundra landscape.

Sonnentag, Oliver
Université de Montréal
Montréal, QC
oliver.sonnentag@umontreal.ca

File No: 12 404 806
Region: DC

Licence No: 16434
Location: Smith Creek (63°09'28" N, 123°14'59" W)

The frontline of permafrost thaw: A transect of eddy covariance towers across the southern Taiga Plains to better understand changing regional carbon and water budgets

The goal of this project is to record how carbon gas moves between the earth and the atmosphere. To do this, the research team has set up special instruments that continuously measure wind speed and the concentrations of various gases in the air. In addition to these measurements, the research team is recording other weather and climate information. The instruments at Smith Creek are set up in a way that is more-or-less identical to the way that the same instruments are set up in a few other locations across the NWT. One other location is Scotty Creek, which is in a boreal peat landscape with sporadic permafrost near Fort Simpson. Another location is Havikpak Creek, which is in a forest-tundra transition zone with continuous permafrost near Inuvik. Another location is Trail Valley Creek, which is on the tundra with continuous permafrost near Inuvik. The research team works on data that is collected by the instruments at all of these locations.

Tank, Suzanne
University of Alberta
Edmonton, AB
suzanne.tank@ualberta.ca

File No: 12 404 785
Region: IN, GW

Licence No: 16575
Location: Big Fish River, Beaver House Creek, Willow River, Rat River, Stony Creek, Vittrekwa River, Road River, Trail Creek, Rengling River, Caribou Creek, and two other sites at (67.253 N, 135.271 W) and (67.181 N, 135.727 W).

The effect of permafrost slumping on carbon delivery from land to water

The goal of this research project is to investigate the effects of permafrost thaw slumps on streams on the Peel Plateau. In 2019, the research team measured the water quality and chemistry of stream outflows across the Peel Plateau, ranging from Big Fish River in the north to Vittrekwa River in the south. The team also collected samples from stream outflows on the east side of the Mackenzie Delta, in order to compare them to the Peel Plateau stream outflow sites. Finally, the team took measurements of water levels at the mouth of Stony Creek near Fort McPherson, and revisited a past slump site near the Dempster Highway west of the Peel River. Overall, the goal of the research team is to measure the transport of carbon and other substances through stream networks, and to understand how the carbon is transformed within the streams. So far, the team's results show that the soil carbon that was previously frozen in slumps can be transformed and decomposed into carbon dioxide, but if the carbon is attached to particles, it decomposes much more slowly. This information improves our understanding of how thawing permafrost affects aquatic ecosystems. The research team presented their work during the Aurora Research Institute Summer Speaker Series, and also at a community meeting that was arranged by the Tetlit Gwich'in Renewable Resource Council.

Terlaky, Viktor
Northwest Territories Geological Survey
Yellowknife, NT
viktor_terlaky@gov.nt.ca

File No: 12 404 1001
Region: SA

Licence No: 16578
Location: Imperial River (65°06.93969' N, 127°51.38753' W), Mountain River (65°14.36160' N, 128°35.67600' W), Gayna Gorge (65°17.46501' N, 129°21.45433' W), Carcajou River south (64°44.70683' N, 126°46.81683' W), and Powell Creek (65°16.62000' N, 128°46.44000' W).

Shale basin evolution in central NWT (2019)

The goal of this project was for the research team to visit, and take geological samples at, various sites in the central NWT. The sites that were visited in 2019 included Carcajou River south, Imperial River, Mountain River, Powell Creek, and Gayna Gorge. The research team visited two outcrops of the Imperial Formation at Carcajou River south that had not been described previously. The team found that the rocks they sampled at Carcajou River south were formed in a shallow water environment. During their visits to all sites, the researchers made observations of the site, took samples that were later measured using specialized instruments in a laboratory, and made notes about areas that would be suitable for further studies during future field seasons.

Turner, Elizabeth
Laurentian Unviersity
Sudbury, ON
eturner@laurentian.ca

File No: 12 404 813
Region: SA

Licence No: 16454
Location: Gayna River in the Mackenzie Mountains (64°57' N, 130°42' W).

Neoproterozoic stratigraphy, Mackenzie Mountains

No research was conducted under this licence in 2019.

Turner, Elizabeth
Laurentian University
Sudbury, ON
eturner@laurentian.ca

File No: 12 404 812
Region: DC

Licence No: 16549
Location: Camp 1 was located at (63°28'19" N, 126°58" W), 184 km WNW of Wrigley and 11 km WSW of Hayhook Lake. Camp 2 was located at (63°14'35" N, 126°58'55" W), 178 km W of Wrigley and 30 km SSW of Hayhook Lake. Camp 3 was located at (62°23'50" N, 126°23'45" W), 172 km WSW of Wrigley, 273 km WNW of Fort Simpson, and 36 km SSW of Coates Lake.

Neoproterozoic stratigraphy, Mackenzie Mountains II

The goal of this project was to decipher the history of the earth's surface between about 780 and 825 million years ago at three sites in the Mackenzie Mountains. The first site was near Hayhook Lake, and the other two sites were in the Thundercloud Range south of Coates Lake. At each site the research team stayed in a small camp that was accessed by helicopter, but each day the research team traveled by foot to reach their work site. They climbed the slope above their camp, took measurements of rock dimensions, and collected geological information about the rocks. Each day they worked at a progressively higher position on the slope, until they had measured the full span of the rock unit and described it in great detail. They collected a small sample of the rock every 1 to 1.5 m so they could study it and conduct tests on it later in the laboratory. When the researchers finished their work at a site, they took down their camp and left no trace behind.

Ullmann, Tobias
Julius-Maximilians-Universität Würzburg
Würzburg, Germany
tobias.ullmann@uni-wuerzburg.de

File No: 12 404 957
Region: IN, GW

Licence No: 16423
Location: Richards Island, and the Dempster Highway between Inuvik and the Yukon/NWT border.

Remote sensing and geophysics of tundra landscapes

The goal of this project is to study seasonal changes in the land surface at a few sites in the NWT and the Yukon. The researchers want to see if satellite images can be used to detect and measure either freeze-thaw cycles or the seasonal growth of vegetation. In August 2018 and August and September 2019, the research team visited sites along the Invuik-Tuktoyaktuk Highway, on the north side of Richards Island, and in the Richardson Mountains between Rock River Campground and James Creek. They used a steel rod to measure the 'active layer' thickness at intervals along 200 m-long transects (the active layer is the upper-most layer of the permafrost that thaws every summer). The researchers took photographs of the vegetation both from the ground and using a small drone, and also measured the electric resistivity of the soil. All of the measurements they took were non-invasive, so no vegetation was harvested and no ground was disturbed during their work. Finally, the researchers installed small dataloggers at each site that take a measurement of soil moisture and temperature every hour. The information that the research team

collected on the ground will be compared to images that were taken by satellites. The team is planning to revisit the sites in August and early September 2020.

---

van der Sanden, Josephus
Canada Centre for Mapping and Earth Observation, Natural Resources Canada
Ottawa, ON
joost.vandersanden@canada.ca

File No: 12 404 709
Region: IN, GW, NS

Licence No: 16485
Location: Near Yellowknife and Inuvik.

Lake and river ice fieldwork in support of PermASAR data analysis

The goal of this project was to measure lake and river ice to see if radar images can be used to determine how thick the ice is, without having to travel to the site and take measurements of it in the field. Freshwater ice is an important part of the water, climate, biological, cultural, and economic systems in Canada's northern landscape. As such, information about freshwater ice is of interest to many people. Radar images of a series of Canadian sites, including the Mackenzie River Delta near Inuvik and the Tibbitt-to-Contwoyto Winter Road near Yellowknife, were taken by plane. Members of one research team carried out field work in the Mackenzie River Delta, at a site on the Middle Channel of the Mackenzie River near the ice road to Aklavik, and around Noell Lake. Another research team worked in the area near the Tibbet-to-Contwoyto Winter Road, around Gordon Lake and Waite Lake. The teams measured the thickness of snow and ice, and made observations of how the snow and ice were layered, using an auger and corer. They also dug snow pits to see what the snow was like under its surface. Around Gordon and Waite Lakes, they also took measurements of ice thickness using a ground penetrating radar.

Varner, Ruth
University of New Hampshire
Durham, NH, United States
ruth.varner@unh.edu

File No: 12 404 997
Region: DC

Licence No: 16572
Location: Scotty Creek Research Station (61°18'27.61" N, 121°17'54.49" W) and Smith Creek near Wrigley (63°9'16.63" N, 123°15'6.66" W).

From archaea to the atmosphere: Integrating microbial, isotopic and landscape-scale observations to quantify methane emissions from global high-latitude ecosystems

The goal of this project is to improve estimates of how much methane is coming from thawing permafrost in peatland landscapes. The researchers are using air and satellite photos combined with field measurements and samples to do this. They are also studying the tiny life-forms that live in the permafrost. For part of this project, the researchers worked at Smith Creek near Wrigley. In July 2019, the field team stayed in Wrigley and conducted daily field work at Smith Creek. The team collected peat soil cores, soil water samples, and measurements of methane gas emission at 30 plots across bogs, fens, and permafrost plateaus. They observed and recorded the vegetation at each of the 30 plots as well, and took photos of the vegetation using an unmanned aerial vehicle. They will continue to process the samples for the next two years. The research team is doing similar work at other sites in the northern hemisphere, and will eventually combine all of the information they have collected in order to better understand and predict methane emissions over a large scale.

Walmsley, Caroline
Peter Kiewit Sons ULC
Oakville, ON
caroline.walmsley@kiewit.com

File No: 12 404 1016
Region: NS

Licence No: 16635
Location: Behchokǫ̀, Wekweètì, Whatì, and Yellowknife.

Tłı̨chǫ all-season road
No research was conducted under this licence in 2019.

Wells, David
Diavik Diamond Mine (2012) Inc.
Yellowknife, NT
David.Wells@riotinto.com

File No: 12 404 809
Region: NS

Licence No: 16422
Location: Lac de Gras (64"30' N, 110"30' W).

Diavik aquatics effects monitoring program
In 2019, Diavik Diamond Mines continued its aquatic effects monitoring program that was designed to measure the effects of the mine on the water, sediment, and aquatic life in Lac de Gras. To do this, the research team measured dust deposition at 14 locations, and took snow samples at 25 locations, in late winter in order to check for dustfall and snow water chemistry. To study the chemistry of the water in Lac de Gras, they took samples at 38 stations in late winter (April) and 39 stations in late summer (August). These stations were spread throughout the lake, its outflow to the Coppermine River, and its inflow from Lac du Sauvage. Field measurements of the water temperature, acidity, and other properties were also taken at a number of depths at the lake stations. Finally, the research team collected plankton samples at 37 lake stations during late summer. Plankton are the tiny plants and animals that live in the water, and that are used as food by other animals. The amount and types of plankton can change if there is pollution present in the water. The 2019 Annual Report will provide a detailed analysis of any mine effects on Lac de Gras, and will be available on the Wek'èezhii Land and Water Board public registry after 31 March 2020.

Wolfe, Brent
Wilfrid Laurier University
Waterloo, ON
bwolfe@wlu.ca

File No: 12 404 599
Region: NS

Licence No: 16437
Location: Along Highway 3 west of Yellowknife, and along an 80 km transect NW of Yellowknife.

SAMMS: Sub-Arctic metal mobility study
The goal of this research project is to analyze lake sediment cores in order to track pollution that was released from the former gold mines near Yellowknife. Measurements of the concentrations of two metals, arsenic and antimony, in lake sediment cores show that these metals were dispersed by wind as far as 80 km to the northwest of Yellowknife, and as far as 40 km to the northeast of Yellowknife. In the time since the mines closed, concentrations of these metals in the bottom sediments of lakes located 50

to 80 km to the northwest, and 20 to 40 km to the northeast, have largely returned to background levels. The concentrations of arsenic and antimony found at the sediment surface of lakes located from 10 to 40 km to the northwest remain high, however, and suggest that these metals are still being added to the lakes from their catchments over 60 years after the metals were emitted from the mine.

Wolfe, Stephen
Natural Resources Canada
Ottawa, ON
stephen.wolfe@canada.ca

File No: 12 404 549
Region: NS

Licence No: 16462
Location: Ingraham Trail and the Tibbitt-to-Contwoyto Winter Road.

North Slave permafrost study: Characterizing and predicting discontinuous permafrost for climate change adaptation

The goal of this project is to study where discontinuous permafrost exists at research sites in the northern Great Slave Lake region. This will allow planners and scientists to predict where permafrost will occur in other areas, so that communities and industry can make better decisions about new buildings and roads. Field work was conducted in the Great Slave region along Highways 3 and 4, north of Gordon Lake on the Tibbitt-to-Contwoyto Winter Road, and at Whitebeach Point, in September 2019. The researchers collected measurements of ground and air temperatures at a number of sites, including active layer temperatures from forest peatlands and bare sand sites, and ground temperatures from both undisturbed and burned sites. They also collected data from monitoring sites that were installed in 2016, in recently burned areas at Lucky Lake east of the Discovery Mine site, Boundary Creek north of Highway 3, and along the Ingraham Trail near Tibbitt Lake. The researchers will use these measurements to understand ground temperature changes and the effects of fire on permafrost conditions. The researchers also continued to monitor recent thaw slumps along the Yellowknife River, and they removed a site that monitored winter overland flow from the Tibbitt-to-Contwoyto Winter Road.

Zdanowicz, Christian
Uppsala University
Uppsala, Sweden
christian.zdanowicz@geo.uu.se

File No: 12 404 959
Region: IN, GW, SA, DC, NS, SS

Licence No: 16443
Location: At many locations on the Mackenzie River.

Identifying sources of mercury in Arctic rivers

The goal of this project was to better understand how mercury enters rivers in the Mackenzie River Basin. Mercury can be toxic to fish, marine animals, and people if it accumulates in their bodies. In the Arctic, much of the mercury in water comes from distant pollution sources, but is stored for a while in nearby soils. As the climate gets warmer, there is a risk that more of this mercury could be released from the soil into rivers and the Arctic Ocean. The research team collected water from many NWT rivers, and measured the amounts and types of mercury that were present. Based on their results, and on information about water quality that was collected by NWT communities, the team found the following four results. First, that most of the mercury in the Mackenzie River comes from soil and rocks that eroded in the western part of its basin, while a smaller amount was recently deposited in rain or snow. Second, that this mercury is associated with ancient carbon that probably comes from ancient sediments and permafrost. Third, that

the Liard, Peel, and Arctic Red Rivers carry the largest shares of mercury in the basin. Finally, the research team found that future changes in the landscape in the Mackenzie River Basin, such as permafrost thaw slumps and wildfires, will likely cause more mercury to be transported to the Arctic Ocean.

Social Sciences

Ashthorn, Heather
Arctic Borderlands Ecological Knowledge Co-op
Whitehorse, YT
arcticborderlands@gmail.com

File No: 12 410 1090
Region: IN, GW

Licence No: 16620
Location: Aklavik, Inuvik, Tuktoyaktuk, Fort McPherson, and Tsiigehtchic.

ABEKS - Community based ecological monitoring program

The Arctic Borderlands Ecological Knowledge Co-op runs a long-term monitoring project. Every year, community monitors ask knowlegeable community members questions about plants, animals, weather, and other topics. Monitors were hired in fall 2019 in partnership with Renewable Resource Councils and Hunters and Trappers Committees in Aklavik, Inuvik, Fort McPherson, and Tsiigehtchic. Senior and junior monitors gathered in Inuvik in September for training. This year, monitors were also trained to work with data that was obtained through their interviews, and to produce simple graphs for presentation to their communities. Monitors worked with their Renewable Resource Council or Hunters and Trappers Committee to select 20 local experts to be interviewed. The interviews were conducted between October and December of 2019. Monitors uploaded all of the data they collected to the online database by late December, and submitted summary reports and graphs that were included in the end-of-season community monitor report. In total, 117 interviews were completed in the NWT. The data that was collected is accessible to all participating communities, and to others with the permission of those communities. In 2019, the program improved and clarified the data access process, and several applications for data access were received.

Barzilai, Maya
Georgetown University
Washington, DC, United States
mlb290@georgetown.edu

File No: 12 404 984
Region: NS

Licence No: 16519
Location: Behchokǫ̀ and Yellowknife.

The relative effects of phonetic and phonological salience on speech sound processing

The sounds of a language are important to how people understand the meaning of spoken and written language. This includes how the sounds of spoken language that are close together contrast with each other. The goal of this research project was to study this in speakers of the Tłı̨chǫ language. The researcher worked with 14 Tłı̨chǫ speakers in Behchokǫ̀, who completed experiments on a laptop after signing informed consent forms. One participant expressed discomfort with the experimental setting after signing the consent form; any data that had been collected from this participant up until this point was omitted from all analyses. The researcher wrote a dissertation that included the data that was collected, and successfully defended it on 5 March 2020. Their dissertation will be deposited in the Georgetown

University Graduate School of Arts and Sciences before the end of 2020. The completed dissertation, as well as any journal publications that result from this research, will be uploaded to the internet when they are available.

Becker, Matilda
University of Oxford
Oxford, United Kingdom
matilda.becker@ouce.ox.ac.uk

File No: 12 410 1124
Region: NS

Licence No: 16444
Location: Yellowknife

Legislating space: Cartographic technologies, geological data, Indigenous land governance, and the Mineral Resources Act of the Northwest Territories, Canada
No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Behe, Carolina
Inuit Circumpolar Council Alaska
Anchorage, AK, United States
carolina@iccalaska.org

File No: 12 410 1100
Region: IN

Licence No: 16432
Location: Inuvik, Ulukhaktok, Tuktoyaktuk, and Paulatuk.

Collaborative research: Food sovereignty and self-governance – Inuit role in managing Arctic marine resources
In 2019, the research team brought together all of the information, Indigenous Knowledge, and legal research they had completed for this project into the first draft of a technical report. They also held workshops and meetings in Alaska, including meetings with both the Savoonga Tribal Council and the Food Sovereignty and Self-Governance Collective. The collective meeting brought together the project partners to discuss key themes that have been identified from their research so far, including information gathered through focus groups and individual interviews. The researchers developed a brief workshop report from these meetings.

Clark, Douglas
University of Saskatchewan
Saskatoon, SK
d.clark@usask.ca

File No: 12 410 607
Region: IN

Licence No: 16527
Location: Ulukhaktok and Tuktoyaktuk.

Transforming Arctic conservation through social innovation
This project will help northern communities monitor polar bear and grizzly bear activity and health. The monitoring will be community-based and use non-invasive research techniques; mostly these will be trail cameras, but DNA will also be sampled from bear poop. The researchers are working with community members and local partners in two places. One is Churchill, Manitoba, where the researchers are working with the Churchill Northern Studies Centre. The other location is Ulukhaktok, where the researchers are

working with the Inuvialuit Game Council. Some of this research project will take place during workshops, and some will take place out on the land using trail cameras. Community members who are involved in the study will decide where to place the cameras and when to put them out. They will also put the cameras out on the land, collect the photos from them, and interpret the photos with the researchers. This project will run from 2018 until 2020, and is funded by the Social Sciences and Humanities Research Council of Canada.

Collings, Peter
University of Florida
Gainesville, FL, United States
pcollings@ufl.edu

File No: 12 410 524
Licence No: 16627
Region: IN
Location: Ulukhaktok

Examining the relationship between culture, stress, and health in two Canadian Inuit communities through community based participatory research (CBPR)
No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Durnford, Kerry Lynn
Aurora College
Yellowknife, NT
kdurnford@auroracollege.nt.ca

File No: 12 410 1147
Licence No: 16612
Region: NS
Location: Yellowknife

Reflective writing: What do BSN students write about and why?
'Reflective writing' refers to writing down your thoughts, feelings, perceptions, and interactions about a specific thing that happened. It is used to help students learn, and can help students develop certain skills that are important to nursing. The goal of this project was to see what students who are taking a Bachelor's of Science degree in nursing (BSN) write about when they are using reflective writing, and why they write about it. This project began in September 2019, when the research team got consent from the BSN students at Aurora College and started to collect reflective writing assignments to study. They have asked a faculty member from the School of Health and Human Services at Aurora College to help them by collecting the consent forms and assignments. The team will not review any of the reflective writing assignments until June 2020, once all of the students' grades have been submitted.

Farnel, Sharon
University of Alberta
Edmonton, AB
sharon.farnel@ualberta.ca

File No: 12 410 1116
Licence No: 16440
Region: IN
Location: Paulatuk, Ulukhaktok, Sachs Harbour, Tuktoyaktuk, Inuvik, and Aklavik.

Metadata driven by Indigenous communities in Canada's north: An exploration

When used in a library, 'metadata' refers to information about a book or other source of information. For example, metadata might refer to the project that a report was produced for, the language the report is written in, or who funded the work that led to the report. The goals of this project were to find out what kinds of culturally-appropriate metadata are needed for digital libraries of cultural resources in northern Canada, and how to develop these metadata. This project builds on the work that was done during the Digital Library North project, which developed the Inuvialuit Digital Library. In 2019, the research team continued to work on the Inuvialuit Digital Library. While in Inuvik from 13 to 23 February, the team held informal discussions and demonstration sessions with several individuals in the heritage and culture sector, several staff from the Inuvialuit Regional Corporation, and a new staff member at the Inuvialuit Cultural Centre. During these sessions, the researchers described the Inuvialuit Digital Library and demonstrated it to visitors from communities in the Inuvialuit Settlement Region and elsewhere. The researchers also held discussions and demonstrations when they were in Inuvik between 29 May and 8 June. The researchers analyzed what they heard in the sessions and from their project partners, and wrote a thesis. The Inuvialuit Digital Library was officially launched on Inuvialuit Day on 5 June, and the project was presented at the Inuit Studies Conference in Montreal in October 2019.

Fresque-Baxter, Jennifer
Environment and Natural Resources, Government of the Northwest Territories
Yellowknife, NT
Jennifer_Fresque-Baxter@gov.nt.ca

File No: 12 410 885
Region: GW

Licence No: 16502
Location: On-the-land camps accessible from Aklavik, Inuvik, Fort McPherson, and Tsiigehtchic.

The state of Northwest Territories country food systems: Planning for long-term sustainability
No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Gartler, Susanna
University of Vienna
Vienna, Austria
susanna.gartler@univie.ac.at

File No: 12 410 1136
Region: IN, GW

Licence No: 16531
Location: Inuvik, Aklavik, Tuktoyaktuk, and Shingle Point.

Nunataryuk - Permafrost thaw and the changing Arctic coast, science for socioeconomic adaptation - Social science components
This project is part of a larger study called 'Nunataryuk - Permafrost thaw and the changing Arctic coast, science for socioeconomic adaptation'. This project is circumpolar, and assesses the impact of permafrost thaw on five Arctic communities in Canada, Greenland, Svalbard, and Russia. There are five main objectives to this project. First, the project will identify how permafrost thaw will impact subsistence harvesting and well-being in Arctic coastal communities. Second, the project will identify risks that arise from thawing permafrost. Third, the project will assess how well the adaptation strategies that are already implemented in Arctic communities have worked, and will help to co-design new strategies. Fourth, the project will raise awareness outside of the north about the challenges faced by Arctic coastal communities. Finally, the project will help Arctic communities share what they are doing to protect themselves from the effects of permafrost thaw. The goal of the project team is to bring together the

social and natural sciences, in the same way they are bringing communities from across the circumpolar north together using positive story-telling. The research team will also involve youth and Elders in a video project in order to teach people about film-making and the co-production of knowledge with scientists.

Gauthier, Maeva
University of Victoria
Victoria, BC
maeva@uvic.ca

File No: 12 410 1120
Region: IN
Licence No: 16528
Location: Tuktoyaktuk

Food security, social and environmental justice and resilience in the western Canadian Arctic, using participatory video method

This project, also called 'Nuna Tariuq Silalu film project (Land, Sea, and Air)' by the participants, is a community-based research project that provides opportunities for youth in Tuktoyaktuk to learn film-making skills so they can share stories on topics that matter to them. The research team partnered with the Tuktoyaktuk Community Corporation, the Mangilaluk School, and Avatar Media to make this project possible. Between 21 May and 21 June, the research team held community meetings and taught a two-and-a-half week film workshop to seven youth participants from Mangilaluk School. The participants chose to create two movies. 'Happening to Us' is a film about how climate change is affecting people in Tuktoyaktuk, and 'Living in Two Worlds' is a film about youth navigating life in both the modern and traditional worlds. Seventy people attended the community film screening in Tuktoyaktuk on 19 June, and more film screenings will be planned in the region and at international film festivals. Opportunities for the youth participants include presenting their film at the UN Climate Change Conference in Santiago, Chile, in December 2019. The researcher also interviewed participants to evaluate how well the project worked.

Giles, Audrey
University of Ottawa
Ottawa, ON
audrey.giles@uottawa.ca

File No: 12 410 582
Region: IN
Licence No: 16608
Location: Aklavik, Ulukhaktok, Sachs Harbour, Tuktoyaktuk, and Paulatuk.

Encouraging power boating safety for adults and children/youth in the Inuvialuit Settlement Region through research, education, and awareness

The goal of this project is to prevent boating accidents through education. The project team and a community co-researcher started the project by doing interviews in three of the five Inuvialuit communities (a community co-researcher is still needed in Uluhaktok and Sachs Harbour). The researchers asked questions to find out why people take preventable risks while they are boating. Once they understand why people take these risks, they can make a plan to teach people what safe boating practices are and why they are important. The team does not yet have any findings to report, but they are renewing their research licence and will continue the project in 2020.

Goodwin, Rebecca
Western University
London, ON

rgoodwi3@uwo.ca

File No: 12 410 1112
Region: IN

Licence No: 16567
Location: Inuvik, Tuktoyaktuk, Aklavik, and Ivvavik National Park.

Stories, objects, gender and memories: Using digital media to share Inuvialuit knowledge
No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Hall, Rebecca
Queen's University
Kingston, ON
rh116@queensu.ca

File No: 12 410 1141
Region: NS

Licence No: 16554
Location: Yellowknife, Behchokǫ̀, and Ndilǫ.

Post-extractive futures in northern Indigenous communities
No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Hansen, Nathaniel
Institute for Circumpolar Health Research & Tufts University School of Medicine
Yellowknife, NT
natefoxhansen@gmail.com

File No: 12 410 1148
Region: IN, DC, NS

Licence No: 16613
Location: Inuvik, Yellowknife, and Hay River.

Mixed-method study of physician burnout in northern Canada
No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Hodgetts, Lisa
Western University
London, ON
lisa.hodgetts@uwo.ca

File No: 12 410 849
Region: IN

Licence No: 16541
Location: Inuvik, Aklavik, Ivavvik National Park (Imniarvik), and Tuktoyaktuk.

Co-creating Inuvialuit living history through visual documentary production
The results of this project indicate that researchers should use pictures and video when they are doing culture and history research with local communities. They also need to work with people from different generations, who can teach and learn from each other, in order to respect and celebrate Indigenous ways of knowing and being. The Inuvialuit Living History Project Culture Camp at Imniarvik (Ivavvik National Park) in mid-July 2019 brought together Inuvialuit community members, archaeologists, anthropologists, and artists. Together, they created products about Inuvialuit history and culture, from art pieces to videos to a brand new Inuvialuit youth magazine. The researchers did not just make art and do research with the community; they also studied how making the art pieces helped to record Inuvialuit culture and history.

This study found that 'co-creation' (creating side-by-side) is the most effective way to change the power imbalances in research. There needs to be active, equal, and dynamic partnerships between community members and researchers in order to share power and authority. Creative methods have to be explored and experimented with as well so that everyone's goals are met. The research team has found that using new ideas – instead of bringing new people into old science-based ways of doing things – is most effective. When all of these actions are used in partnership with Indigenous communities, it helps us move closer to making archaeology and anthropology a more equal learning experience for everyone involved.

Holyoke, Paul
Saint Elizabeth Research Centre
Markham, ON
Paulholyoke@sehc.com

File No: 12 410 1144 **Licence No:** 16584
Region: NS, SS **Location:** Fort Smith and Yellowknife.

The reflection room: Moving from death-denying to death-discussing, part 2
No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Hucklebridge, Sherry
University of Massachusetts Amherst
Northampton, MA, United States
shucklebridg@umass.edu

File No: 12 410 1117 **Licence No:** 16571
Region: SA, NS **Location:** Behchokǫ̀, Yellowknife, and Délı̨nę.

The semantics of quantifiers in Tłı̨chǫ Yatii and Sahtú'otı̨nę Yati
No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Jaffe, Peter
Western University
London, ON
pjaffe@uwo.ca

File No: 12 410 1085 **Licence No:** 16461
Region: IN, GW, SA, DC, NS, SS **Location:** Yellowknife

Canadian domestic homicide prevention initiative with vulnerable populations
This project investigates three things that are related to preventing people from being murdered by their partners. The first is risk assessments, or how much risk there is to the victim and/or others connected to the victim. The second is risk management, or ways to reduce the risk presented by a perpetrator. And third is safety planning, or how people can safely leave a dangerous situation. The goal of this research project is to decrease the risk of members of particular 'vulnerable populations' being killed through domestic violence. Vulnerable populations include Indigenous peoples, immigrants and refugees, children exposed to domestic violence, and those living in rural, remote and northern areas. These vulnerable populations experience domestic violence and homicide at a higher rate than the general population, and may also face particular challenges and barriers to getting help. In 2017, the researchers asked 1,405 service providers to fill out an online national survey. They also interviewed 22 NWT service providers.

Their survey results showed that the majority of service providers do risk assessments, risk management, and safety planning frequently or regularly with families experiencing domestic violence. Since September 2019, the researchers have conducted interviews with survivors of severe domestic violence and others who were close to a victim of domestic homicide from across Canada (but there have been no interviews in the NWT yet). The goal is to learn about what worked and did not work when trying to be safe, and what might help others who are experiencing domestic violence. Overall, the information gathered during the interviews and surveys will be used to help prevent domestic homicide.

Janus, Magdalena
McMaster University
Hamilton, ON
janusm@mcmaster.ca

File No: 12 408 222 **Licence No:** 16464
Region: IN, GW, SA, DC, NS, SS **Location:** Across the NWT.

Measuring the developmental health of children in NWT

The goal of this project was to describe the 'developmental health' of kindergarten-aged children at the territorial, school board, and school levels. Developmental health refers to how well a child is progressing in terms of their physical, emotional, and intellectual health. The research team surveyed kindergarten teachers in the NWT using a survey they developed called the 'Early Development Instrument'. It is a short questionnaire that measures the children's ability to meet age-appropriate developmental expectations. The research team has analyzed the information gathered from the kindergarten teachers. They have written reports about early child development in the NWT that were delivered to the NWT government. The reports will help the NWT government make policies and practices that will improve the physical, mental, and intellectual health of children going forward.

Klein, Peter
University of British Columbia
Vancouver, BC
peter.klein@ubc.ca

File No: 12 410 1113 **Licence No:** 16449
Region: NS **Location:** Yellowknife

Turning points: A collaborative digital storytelling project in Yellowknife

In 2019, the research team made a documentary short series, 'Turning Points', about alcohol use, addiction, resilience, and healing in Yellowknife. It was produced in partnership with local Indigenous storytellers, who were involved at every stage of the production. They shared the cultural, social, geographic, and historical factors that both drew them into addiction and allowed them to map out their recovery. Many of the storytellers connected their addictions to the trauma of being forcibly removed from their families by the Canadian government and placed with other families, usually white, or into residential schools. The series debuted in February 2020 at a screening and panel event in Yellowknife. In total, eight stories aired in 2020 and 2021 on PBS NewsHour, and the short series was also broadcast by the Global Reporting Centre. There were also eight media stories and one research paper written about the short series. All photos and video that were captured during the making of 'Turning Points' were returned to each storyteller.

Lakhani, Sabrina-Ayesha
University of Queensland
Yellowknife, NT
sabrina.lakhani@uq.net.au

File No: 12 410 1152 **Licence No:** 16634
Region: NS **Location:** Yellowknife

Understanding the implications of trends in mining technologies on regional development in the context of the Northwest Territories
No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Lamontagne-Cumiford, Mathieu
Concordia University
Montreal, QC
mat.lamontagne@gmail.com

File No: 12 410 1139 **Licence No:** 16551
Region: IN, GW **Location:** Inuvik and Tuktoyaktuk.

The end of the road: An ethnographic account of tourism down the Inuvik-Tuktoyaktuk Highway
This project studies the tourism in the western Arctic region that has resulted from the newly-completed all-season highway. The new Inuvik-Tuktoyaktuk Highway connects the Hamlet of Tuktoyaktuk, a community of 900 people on the Beaufort Sea, to the public highway system of the NWT and Canada. It has led to a steady stream of road trippers, overlanders, motorcyclists, cycle-trekkers, and RVers into the region. Although it can be seen as just an extension of the already-famous Dempster Highway, the Inuvik-Tuktoyaktuk Highway has sparked the imagination of travellers and set online forums and blogs abuzz with accounts of a new arctic destination. These tourists speak of adventure, unspoiled wilderness, and rugged frontier towns, but also are aware of the explosive potential for change in communities that are now seeing several times their population visit during the short summer months. The researcher hopes to understand larger notions of arctic travel, leisure travel, and the tourists' odd interest in particular places. The researcher interviewed 20 people, held mapping exercises, and spent hundreds of hours simply being around tourists; this is known as 'participant observation'. This is part of the ethnographic method of research, where the researcher engages with a group of people and hopes to learn in a way that is recognizable to them. Participant observation also allows the researcher to speak with some authority about the activities and practices of the group, because they have experienced these activities and practices as well.

Leyenaar, Matthew
St. Lawrence College & McMaster University
Kingston, ON
leyenam@mcmaster.ca

File No: 12 410 1131 **Licence No:** 16486
Region: IN **Location:** Tuktoyaktuk

Health in the north: Phase 2 - Case study on the community health service needs of Tuktoyaktuk and mapping back to CAN/CSA-Z1630-17

The goal of this research project was to see whether paramedic services in Tuktoyaktuk would be likely to succeed. The community seemed to be accepting of establishing paramedic services in Tuktoyaktuk to help address their health service needs. The project results demonstrated that an understanding of the regulations surrounding paramedical services in the Northwest Territories are needed, because the role of paramedics can differ from one region to the next. The project results also showed that on-going communication with community members is needed so that the community can provide input on, and be fully engaged in, any paramedic program that is set up. Collaboration of any future paramedic program with existing health care providers and services in the community will help ensure that the needs of community members remain the focus.

Malla, Ashok
Douglas Mental Health University Institute, McGill University
Verdun, QC
Ashok.Malla@douglas.mcgill.ca

File No: 12 410 1069 **Licence No:** 16470
Region: IN **Location:** Ulukhaktok

ACCESS Open Minds: Youth mental health – Ulukhaktok
The goal of ACCESS Open Minds is to improve mental health services for youth aged 11 to 25 years old. The project is based at 14 sites in six provinces and the NWT. Currently, 1,658 youth are enrolled in the study. In the NWT, the ACCESS Open Minds site is located in Ulukhaktok, and the Inuvialuit Regional Corporation is overseeing it. The site in Ulukhaktok employs ACCESS Youth Workers to deliver services to youth in the community. These Youth Workers collaborate with other health professionals in the community to ensure a unified approach to youth mental health services. The Youth Workers provide sharing circles, information sessions, and cultural programs such as land-based activities and sewing to young people. A summer student travelled to Ulukhaktok and worked with ACCESS Open Minds staff to enroll five youth in the project. The Youth Workers in Ulukhaktok do not collect as much information as at other sites, although they do record demographic information to tell the story of who in Ulukhaktok is participating in the program. They have requested information from the Government of the Northwest Territories Department of Health and Social Services to see if overall mental wellbeing in the community has improved due to the project.

Mallett, Alexandra
Carleton University
Ottawa, ON
alexandra.mallett@carleton.ca

File No: 12 410 1009 **Licence No:** 16607
Region: SA, NS **Location:** Colville Lake, Tulít'a, and Yellowknife.

Governing energy system change in the Canadian Arctic: Alternative sources of innovation in communities?
The goal of this project is to speak with community members about new alternative energy sources. The researcher held a focus group session and interviews with community members in Colville Lake. A local interpreter and caterer from the community were hired to help. The researcher also held a focus group session and several interviews in Yellowknife, where a local caterer was also hired. Following that, the researcher travelled to Tulít'a. While she was there, she met with community members and interested stakeholders to provide information about the project and address any questions or concerns they had.

The researcher plans to return to Tulít'a to hold a focus group session and conduct interviews in April and May of 2020. This project remains in the early stages, and the researcher is still reviewing other relevant academic literature. Preliminary findings will be made available after the second field work trip in 2020.

Marlowe, Eileen
McMaster University
Hamilton, ON
emarlowe3825@gmail.com

File No: 12 410 1135
Region: GW, DC, NS, SS

Licence No: 16515
Location: Baker Creek (62°29'14.00" N, 114°21'44.30" W), Yellowknife Bay (62°29'11.20" N, 114°21'35.79" W), Yellowknife River at (62°31'28.34" N, 114°18'53.68" W) and (62°33'29.20" N, 114°13'16.90" W), and Horseshoe Island Bay (62°23'04.36" N, 114°16'30.00" W).

To what extent do communication approaches, communication structures, competencies, and characteristics of the communicator affect relationships between governments and Indigenous leaders?
The goal of this research project is to examine what Indigenous leaders think about government communications, and to what extent government communications contribute to a lack of trust. The researchers conducted one-on-one interviews over the telephone with all eight Indigenous leaders who participated in the project. The results of these interviews highlighted that a core reason for the lack of effective communication and trust between Indigenous leaders and the government is government policy, driven in part by how relationships have been managed. The results also point towards multiple variables that contribute to communication issues. These issues could be addressed with the right mindset, the right leadership, the right policy, and the right engagement frameworks.

McHugh, Tara-Leigh
University of Alberta
Edmonton, AB
tmchugh@ualberta.ca

File No: 12 410 1032
Region: IN, GW

Licence No: 16632
Location: Inuvik and Tuktoyaktuk.

That was our sport back then: An exploration of the developmental benefits of participating in northern games
No research was conducted under this licence in 2019.

McMahon, Rob
University of Alberta
Edmonton, AB
rdmcmaho@ualberta.ca

File No: 12 410 1091
Region: IN, GW, NS

Licence No: 16552
Location: Tuktoyaktuk, Fort McPherson, and Wekweètì.

DigitalNWT

The goal of this project was to survey NWT residents and find out how to best teach 'digital literacy' in schools using a digital literacy curriculum. Digital literacy refers to how well a student can use computers and online resources to find information. So far the research team has surveyed participants in two communities; Tuktoyaktuk, where they surveyed 69 people, and Inuvik, where they surveyed 62 people. Some of the surveys were filled out by minors who were under the age of 18. They had also planned to survey participants in Fort McPherson, but have postponed that work due to advice from the community. The results from these surveys provided the researchers with some good information about how to write a digital literacy curriculum and what should be in it. The results also helped them test and refine how they surveyed community members, which involved local survey support staff who were hired by project partners such as the Inuvialuit Regional Corporation. The research team will continue to work on this project, and look forward to sharing their results with NWT partner organizations and communities.

Meloche, Chelsea
Simon Fraser University
Burnaby, BC
cmeloche@sfu.ca

File No: 12 410 1138
Region: GW, NS

Licence No: 16543
Location: Yellowknife, Behchokǫ̀, Inuvik, Fort McPherson, and Tsiigehtchic.

Exploring repatriation and its effects

Repatriation is the process of returning ancestors' remains, cultural belongings, and other intangible knowledge and skills to Indigenous communities from museums or other organizations. It can help to address colonial histories and create new and more equal relationships between communities and these organizations. Repatriation has often been described as a healing process, but Indigenous experiences of repatriation vary. The goals of this research project are to ask Indigenous communities about their experiences with repatriation, and to see what happens after a repatriation is completed. The researcher has partnered with the Tłı̨chǫ Government and the Gwich'in Tribal Council Department of Culture and Heritage. The researcher is looking at two examples of repatriation in the NWT with these partners, along with a third example of repatriation in Ontario. The first NWT example is the repatriation of a Tłı̨chǫ caribou skin lodge, and the second is the Gwich'in traditional clothing project. In 2019, the researcher interviewed 15 Tłı̨chǫ and Gwich'in community members, along with four staff members from the Prince of Wales Northern Heritage Centre. The researcher asked each person about their experiences with each project, why they got involved, whether it had affected the community, how it had affected the community, and whether they had been involved in other culturally-based projects since. The knowledge shared during this project will be compiled and returned to each community, along with a repatriation toolkit meant to support future repatriation-related work.

Michaels, Samantha
Pauktuutit Inuit Women of Canada
Ottawa, ON
smichaels@pauktuutit.ca

File No: 12 410 1149
Region: IN, GW

Licence No: 16614
Location: Inuvik

Addressing gendered violence against Inuit women: A review of police policies and practices in Inuit Nunangat

No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Moffitt, Pertice
Aurora Research Institute
Yellowknife, NT
pmoffitt@auroracollege.nt.ca

File No: 12 410 982
Region: IN, GW, SA, DC, NS, SS

Licence No: 16576
Location: Yellowknife, Dettah, Behchokǫ̀, Fort Simpson, Hay River, Délı̨nę, Fort McPherson, and Paulatuk.

Community partnership to create a comprehensive approach to family violence in the NWT
Family violence is defined as the harmful behaviour of a person towards a family member. It includes physical, sexual, psychological, economic, or spiritual abuse, as well as any other behaviour that is threatening or coercive, or that in any way controls or dominates the family member. This research project used a literature search to identify short- and long-term strategies to address family violence in rural and remote areas. It was funded by the Government of the NWT in order to address family violence in the territory, which is a grave concern. The researchers created an operational definition of family violence, and compiled a list of strategies that were recommended to the Government of the NWT. The SPOR Evidence Alliance provided funding for the researchers to validate their findings with community partners, which was done by holding five focus groups with Indigenous participants and one focus group with participants who were new immigrants. The focus groups with Indigenous participants were co-led by community Elders. The focus groups addressed the strategies that were found in the literature and made recommendations. Elders suggested that it was important to “dream big” to resolve violence. Some central themes that emerged from the focus groups included the importance of engaging with community, being guided by Elders, being on the land, harnessing the strength of women, and “planning for the future” that is free of violence.

Morin, Alexandre
Concordia University
Montreal, QC
alexandre.morin@concordia.ca

File No: 12 410 1137
Region: IN, GW, SA, DC, NS, SS

Licence No: 16542
Location: Across the NWT.

Drivers of optimal functioning across the transition into the workforce
No research was conducted under this licence in 2019.

O'Gorman, Melanie
University of Winnipeg
Winnipeg, MB
melanieogorman@gmail.com

File No: 12 410 1083
Region: IN

Licence No: 16536
Location: Tuktoyaktuk

Foundations for student persistence and success in Inuit Nunangat

Over the last ten years, there has been a large increase in the number of graduates from Mangilaluk School in Tuktoyaktuk. The goal of this research project was to ask Tuktoyaktuk residents about the reasons that led to this increase. In May 2019, the research team conducted their work in Tuktoyaktuk, which sits on the edge of the Beaufort Sea. In this community, school competes with traditional activities throughout the year and the legacy of residential schools is still strong; however, a range of efforts are drawing kids to school and helping them thrive there. The report for this research project describes these efforts, and the areas where they could be complemented by increased resources.

O'Rourke, Michael
Prince of Wales Northern Heritage Centre
Toronto, ON
michael.orourke@mail.utoronto.ca

File No: 12 410 1133
Region: IN

Licence No: 16506
Location: Inuvik, Tuktoyaktuk, and Toker Point (69°38'50" N, 132°52'12" W).

The cultural landscapes of Kugmallit Bay: A value-centred approach to heritage management

Of all of the activities that were originally planned for this research project in 2019, only work on the Inuvialuit Place Names Project occurred. The researcher reviewed existing place name resources with the assistance of an Inuvialuit graduate student from the University of Victoria. The researcher wrote about place names and filed a report with the Inuvialuit Regional Corporation's Innovation, Science, and Climate Change division. The researcher also wrote papers and articles for both academic and public audiences, and presented this project at the joint American Anthropological Association/Canadian Anthropological Society annual meeting in Vancouver, during the Aurora Research Institute Summer Speaker Series in Inuvik, and at the December meeting of the Inuvialuit Game Council.

Pacunayen, Jessica
Trinity College
Dublin, Ireland
pacunayj@tcd.ie

File No: 12 410 1143
Region: NS

Licence No: 16582
Location: Yellowknife, Whatì, Gamètì, Wekweètì, Behchokǫ̀, Ray Rock Mine, and the Marian River.

Water quality monitoring in Tłı̨chǫ Region, NWT, Canada

It is important that good decisions are made and good information is available in order to protect and manage water. The goal of this three-month-long project was to understand how decision-making bodies like the Tłı̨chǫ Government can make the best use of data that has been collected during water quality monitoring programs. In the Marian Watershed, a culturally important area for the Tłı̨chǫ, water quality data is collected by various organizations. The researcher reviewed reports and other sources of information, and also conducted interviews, to understand what water quality monitoring programs exist in the region and how the Tłı̨chǫ Government uses water quality data to make decisions. The researcher found that water quality monitoring programs are often designed to address specific interests and concerns, which might make them less useful for the Tłı̨chǫ Government. In addition, water quality monitoring programs and the data they produce are very complex and hard to use. The researcher found that the lack of capacity to understand water quality data makes it even more difficult and time consuming

to use. Although the Tłı̨chǫ Government has several ways to make decisions related to water quality, it was not clear from this study how the existing monitoring programs affect their decision-making.

Pearce, Tristan
University of Guelph
Guelph, ON
tristanpearce@gmail.com

File No: 12 410 650
Region: IN
Licence No: 16514
Location: Ulukhaktok

Cultural education in the Arctic

This project documents and shares how Helen Kalvak Elihakvik (school) in Ulukhaktok is creating a schooling system that is culturally and socially relevant to Inuit students. The research team interviewed 40 Inuit students and educators, spent time with students and educators both in the classroom and at on-the-land activities, and studied how well the students are performing compared to other schools. They found that the school uses two knowledge systems, both Inuit Traditional Knowledge and scientific knowledge. They identified six themes about how Inuit culture is used in the education system. First, Elders and experienced community members have roles as educators. Second, the students and the school give back to the community. Third, scientific knowledge and Inuit Traditional Knowledge are both used to meet curriculum goals. Fourth, Inuit knowledge, skills, and values are relevant for success in a modern education system and world. Fifth, tests and grades are designed to be culturally relevant. Sixth, there are global opportunities that can help Inuit students have a strong cultural identity.

Pearce, Tristan
University of Guelph
Guelph, ON
tpearce@uoguelph.ca

File No: 12 410 650
Region: IN
Licence No: 16521
Location: Ulukhaktok

Importance of sewing to Inuit women

This research project looked at the importance of sewing to Inuit women in Ulukhaktok. The research team interviewed 25 Inuit women between 18 and more than 80 years of age, and invited them to help write the papers and reports for this project as well. They found that sewing continues to be important to younger Inuit women raised in the settlement, but in ways that are different from the ways it was important to Elders. For Elders, sewing was an essential skill, whereas for younger women, sewing is a choice. There was a break in the transmission of sewing skills for many young women, particularly those who attended residential school or were the children of residential school survivors. However, there has been a resurgence of interest in learning traditional skills later in life. Sewing skills continue to be transmitted through stories, observation, and hands-on learning, but there are also new ways to learn sewing – such as community sewing groups – that are changing how people teach and learn these skills. Traditional sewing skills continue to be valued by women as a connection to, and celebration of, their cultural identity. Inuit women are also using new technologies, such as sewing machines, synthetic thread, and synthetic materials. They are also using modern designs that, while 'new' on one hand, are still a continuation of Inuit traditions because they produce a functional garment. Sewing continues to have cultural, health, economic, and practical value to women in Ulukhaktok. This project will help the community develop programs that better reflect and support the needs and aspirations of Inuit women.

Pearce, Tristan
University of Guelph
Guelph, ON
tristanpearce@gmail.com

File No: 12 410 650 **Licence No:** 16533
Region: IN **Location:** Ulukhaktok

Tooniktoyak: A longitudinal approach to community vulnerability and adaptation to climate change
The goals of this research project are to record Inuit knowledge and experiences of climate change, and to document the costs of hunting. This information will then be shared among hunters, researchers, and decision-makers in order to make hunting safer and more succesful, and to help the community of Ulukhaktok make better decisions about how they handle climate change. The Tooniktoyok project was funded by Crown-Indigenous Relations and Northern Affairs Canada, while the Hamlet of Ulukhaktok continues to have administrative and financial control over the project. A local project coordinator was hired to conduct bi-weekly interviews and participatory mapping sessions with a team of ten hunters. The hunters were asked about the costs of hunting, their observations of environmental change, and any challenges they had when they went out on their traditional lands for subsistence hunting. Hunters received a $150 stipend every two weeks for participating in this project. The research team has mapped out 132 trails, and have also recorded hunting information and observations about the trails during the interviews. A graduate student was in Ulukhaktok for four months between May and August to work on the project. The local project coordinator and the graduate student worked together to present the Tooniktoyok project at the Adaptation 2020 conference in Vancouver.

Ritchie, Stephen
Centre for Rural and Northern Health Research, Laurentian University
Sudbury, ON
sritchie@laurentian.ca

File No: 12 410 1130 **Licence No:** 16484
Region: GW **Location:** Tsiigehtchic

Tsiigehtchic community-based emergency care program evaluation
The Community-Based Emergency Care Group visited Tsiigehtchic from 25 February to 1 March in order to teach an emergency care course and see how well the course prepared the community for emergencies. The course was a great success; sixteen participants started the course and all of them completed it. This represents 10% of the total population of Tsiigehtchic. The course curriculum is new and is well-suited to be taught in other remote Indigenous communities in the NWT and beyond. To see how well the course prepared the participants to handle emergencies, the course instructors asked each participant whether they felt capable of meeting the needs of the community several times throughout the course. By the end of the course, the participants' confidence that they could provide emergency care had increased significantly. The participants also indicated that they were very satisfied with the course. In summary, the course seemed to be an exceptional fit for the community of Tsiigehtchic, and a community-based emergency care system would likely do well there in the future. The project team recommends that planners and policymakers do not deliver first aid courses, and instead support community-based first response services in remote communities in the NWT.

Ruttan, Lia
Independent Scholar

Edmonton, AB
lmruttan@shaw.ca

File No: 12 410 575
Region: SS

Licence No: 16503
Location: The Fort Smith area, although former members of Fort Smith firefighter crews who now live elsewhere (for example, Yellowknife, Hay River, and Edmonton) may also be contacted.

We had a good mind to do it: Oral histories of aboriginal forest firefighters, Ft. Smith (NT)
Both Indigenous knowledge holders and western scientists agree that fires, particularly those started by lightning, play an important role in the boreal forest ecosystem. What they disagree on is the nature and value of the land, where agency lies, and how fires should be responded to. The overall goal of this research project is to record, preserve, and share the knowledge, values, experiences, and methods of former Indigenous firefighters who worked on fire crews based out of Fort Smith between 1950 and 2000. The first part of the project involved interviewing the oldest cohort of firefighters, who shared their experiences on fire crews in the 1950s and early 1960s. The information that was gathered during these interviews will help address the lack of research on this topic, including the perceptions and knowledge base held by Indigenous firefighters and how they actively made decisions in response to conditions on the ground. This project uses a community-based approach, such as having advisors who provide information specific to the culture and fire fighting technology. The research team hopes that this project will allow for a broader understanding of both western and Indigenous ideologies on firefighting.

Schonert-Reichl, Kimberly
University of British Columbia
Vancouver, BC
earlylearning@ubc.ca

File No: 12 410 1134
Region: IN, GW, SA, DC, NS, SS

Licence No: 16510
Location: All NWT schools.

The middle years development instrument
The Middle Years Development Instrument is a questionnaire that students in Grade 4 and Grade 7 fill out. It includes questions about social and emotional development, physical health, connectedness to adults and peers, school experiences, and how after-school time is used. The questionnaire was administered throughout the NWT in January and February of 2019. It was administered by the Government of the Northwest Territories Department of Education, Culture, and Employment, along with the Human Early Learning Partnership at the University of British Columbia and other partners. Teachers or school administrators followed standardized training materials to guide the students through the questionnaire during class time. Participation was voluntary; either students or their parents/guardians could opt out of participating. A total of 505 students in Grade 4, and 532 students in Grade 7, completed the questionnaire in the NWT. The information provided by the students was grouped together and reported by school, education authority, community type, and territory. The project team shared summary reports with the Department of Education, Culture, and Employment, and each education authority and school had access to their own report. These reports will guide the decisions made by school administrators, educators, policy makers, and community members, and will help children in the NWT thrive and flourish.

Seguin, Rose
McGill University
Baie d'Urfe, QC
rose.seguin@mail.mcgill.ca

File No: 12 410 1142
Region: IN, GW, SA, DC, NS, SS

Licence No: 16580
Location: Hay River, Yellowknife, Norman Wells, Sachs Harbour, Inuvik, Fort Smith, and Fort Simpson.

Improving the transfer of agricultural knowledge and technology in northern Canada through a technology innovation systems (TIS) approach
No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Shiri, Ali
University of Alberta
Edmonton, AB
ashiri@ualberta.ca

File No: 12 410 1008
Region: IN

Licence No: 16618
Location: Aklavik, Ulukhaktok, Inuvik, Sachs Harbour, Tuktoyaktuk, and Paulatuk.

Inuvialuit voices: Cultural heritage preservation and access through digital storytelling in digital libraries
Inuvialuit Voices is a multi-year research project with the goal of creating a digital storytelling feature for the Inuvialuit Digital Library. The Inuvialuit Digital Library is a website with pictures, exhibits, recordings, and files that are available for anyone to download. The digital storytelling feature could be used to record, preserve, and share oral histories and other stories, and will be a recording button on the website. From 12 to 15 November, the Inuvialuit Voices team held the Inuvialuit Elders Storytelling Workshop at the Inuvialuit Cultural Centre. There were attendees from Inuvik, Aklavik, Paulatuk, Tuktoyaktuk, Ulukhaktok, and Sachs Harbour. There were between nine and twelve participants each day, depending on the flights in and out of the communities. The attendees introduced themselves and their family histories, told stories, and discussed the Inuvialuktun language and the importance of language learning. Most of the stories were told in Inuvialuktun. Recordings of the event will be preserved and made available through the Inuvialuit Digital Library. The workshop was an important first step for the project, and helped the team explore storytelling and how it can be supported by the Inuvialuit Digital Library. A prototype (or a draft version) of the recording feature was developed by the research team, and was tested at both the Storytelling Workshop in November and at team meetings in December. The team will continue to test and develop the prototype in 2020.

Spring, Andrew
Wilfrid Laurier University
Waterloo, ON
aspring@wlu.ca

File No: 12 410 1037
Region: SS

Licence No: 16474
Location: Kakisa and the surrounding lands of the Ka'a'gee Tu First Nation.

Food systems and community well-being in Kakisa, NT

Wilfrid Laurier University, in partnership with the Ka'a'gee Tu First Nation, is studying how to build healthy and resilient northern communities. This research project supports the community of Kakisa in their vision to grow food in community gardens. The research team has finalized the community's waste management and composting programs. Furthermore, they developed several projects on topics such as climate change and health programs, small scale agriculture development, and climate change adaptation planning. This means that the strong partnership between the Ka'a'gee Tu First Nation and Wilfrid Laurier University will continue to develop, and will focus on community-defined research for the foreseeable future.

Spring, Andrew
Wilfrid Laurier University
Waterloo, ON
aspring@wlu.ca

File No: 12 410 1037
Region: IN, SA, DC, SS

Licence No: 16594
Location: Inuvik, Dél̨ı̨nę, Fort Good Hope, Tulít'a, Fort Providence, Fort Simpson, and Kakisa.

On-the-land monitoring, youth engagement, and knowledge sharing of environmental change
In 2019, the research team focused on two projects. One was a Water Knowledge Camp outside of Tulít'a that was run in partnership with the Sahtú Renewable Resources Board. The goal of the Water Knowledge Camp was to build a cross-cultural space where researchers, community members, Elders, and youth could share knowledge about research and monitoring. Focus groups and discussions were held to determine community research needs and priorities, and researchers gave demonstrations and presentations that fostered discussion about how communities can take a leading role in monitoring. The other project was a Youth Ecology and Culture Camp that was operated by the Dehcho First Nations. This project focused on youth engagement. The participating youth were given cameras so they could take pictures of the camp and surrounding landscape. The pictures highlighted the importance of both protecting the land, and involving youth in land stewardship and protection.

Spring, Andrew
Wilfrid Laurier University
Waterloo, ON
aspring@wlu.ca

File No: 12 410 1037
Region: NS

Licence No: 16604
Location: Yellowknife

Sustainable food system research in Yellowknife
In 2019, researchers at Wilfrid Laurier University and the University of Waterloo were contacted by the Yellowknife Farmers Market. The Farmers Market asked the researchers to study how well the market and its programs were doing. The researchers spoke with people from the Yellowknife Farmers Market, and also looked at what was going on at other farmers markets across Canada. The researchers evaluated the social and economic impacts of the Farmers Market on the City of Yellowknife, and also evaluated how the market could do things better. They also looked at how the community would like the Farmers Market to operate as a central organization for local food initiatives in Yellowknife and the surrounding region. In summer 2019 they surveyed market patrons. The researchers were planning to do follow up interviews and an online survey of market vendors in the fall of 2019, but delayed this work until 2020. Wilfred Laurier researchers also helped at the annual Fall Harvest Fair, and contributed to other local food activities in the City of Yellowknife, through their on-going partnership with Ecology North.

Thom, Brian
University of Victoria
Victoria, BC
bthom@uvic.ca

File No: 12 410 1146
Region: IN
Licence No: 16600
Location: Aklavik, Inuvik, and Tuktoyaktuk.

What good consultation with Indigenous peoples means: Inuvialuit research regarding climate change, the Mackenzie Valley Pipeline and the Inuvialuit Land Claim Agreement
No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Tod-Tims, Cahley
Simon Fraser University
Burnaby, BC
cahley_tod-tims@sfu.ca

File No: 12 410 1151
Region: IN, GW
Licence No: 16631
Location: Inuvik

Promoting Inuit food sovereignty: Community perspectives on the commercialization of country foods
No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Underwood, Kathryn
Ryerson University
Toronto, ON
kunderwood@ryerson.ca

File No: 12 410 1125
Region: NS
Licence No: 16558
Location: Yellowknife

Inclusive early childhood service system project: A longitudinal study of familial viewpoints of early childhood disability service
The Inclusive Early Childhood Service System project is a long-term study that follows the same families over a six year period. The families are interviewed once per year starting before the child in question starts school, and finishing when the child is in Grade 3. The interview topics include childhood disability, education, care, and interventions from the point-of-view of Indigenous families. There are two cohorts of participants in this project. The first cohort started their interviews in 2014 and will finish in 2020, and the second cohort started in 2018 and will finish in 2025. This project was developed through a partnership with community, academic, and policy organizations in Ontario, Manitoba, British Columbia, and the NWT. Yellowknife is one of eight communities where participants are being interviewed, and is taking part in the second cohort of the study that will finish in 2025. There are currently five families from Yellowknife participating in this study, out of 47 total families in all eight communities. As this study is still on-going, there is no final report yet.

Wray, Kristine
University of Alberta
Edmonton, AB
kewray@ualberta.ca

File No: 12 410 705
Region: DC, NS, SS

Licence No: 16630
Location: Yellowknife, Fort Resolution, Hay River, Hay River Reserve, and Łútsęlké.

Making a place for Indigenous fishing livelihoods: Navigating cross-scale institutions in Great Slave Lake fishery management

There are seven Dene communities around Great Slave Lake that have relied on fish from the lake and its inflowing rivers for thousands of years. Since 1945, there has also been a commercial fishery in the lake. The goal of this research project is to better understand the role of Indigenous communities in the governance structure of the Great Slave Lake commercial fishery. The researcher interviewed 16 people in Hay River and on the Hay River Dene Reserve between 13 November and 20 December 2019. For the interviews with members of the Kátł'odeeche First Nation (KFN), the researcher was assisted by a KFN band member. The next step is to have the interviewees verify the transcripts of their interviews. After that, the researcher will analyze the data and write final reports and papers.

Wright, David
University of Calgary
Calgary, AB
david.wright2@ucalgary.ca

File No: 12 410 1145
Region: GW

Licence No: 16587
Location: Inuvik

Modern treaty dispute resolution: Lessons & prospects

No summary was submitted for this licence. This project is not in compliance with licensing requirements.

Traditional Knowledge

Gaudry, Adam
University of Alberta
Edmonton, AB
adam.gaudry@ualberta.ca

File No: 12 410 1102
Region: GW
Licence No: 16523
Location: Fort McPherson

Land-based learning in Teetl'it Zheh: A university-community bush camp partnership
The goal of this project is to teach students new skills and knowledge out on the land that are relevant to Indigenous communities. In July 2019, the project team hosted a land-based learning camp on the Peel River in order to test out a new curriculum. The new curriculum included educational activities that took place both on the land and on the water, such as boating, fishing, setting up a camp, and making spruce bark baskets. The curriculum also included decolonial and environmental topics. Team members were able to de-brief after the project was completed and started to plan for a summer 2020 camp, but it has been postponed because of the coronavirus pandemic. Until recently the project team was planning to hold a camp in the summer of 2021, but it looks like it this will not happen either (unless public health restrictions are lifted). On-the-land activities will resume when it is safe to do so. Team members have contacted the Chief Julius School in Fort McPherson to see if the school would like them to help prepare students for post-secondary learning using online teaching. This could be done until the project is able to resume in-person activities.

Giles, Audrey
University of Ottawa
Ottawa, ON
audrey.giles@uottawa.ca

File No: 12 410 582
Region: IN
Licence No: 16505
Location: Inuvik

Project Jewel: Using Inuvialuit ways of knowing to understand how on-the-land programming can foster wellness
Project Jewel is a community-driven, land-based healing program run by the Inuvialuit Regional Corporation in the Inuvialuit Settlement Region. The research team studied Project Jewel to determine how to make on-the-land programs culturally safe and successful. The research team found that centring the land, building relationships, working with words and pictures, and promoting benefits while minimizing harms through aftercare made the program more culturally safe. The team also found that program success came from including Inuvialuit cultural practices, focusing on local programming, creating a distraction-free and judgement-free environment, ensuring confidentiality, and creating a comfortable and supportive space. The benefits of participating in Project Jewel included strengthened systems of social support, enhanced skills and self-esteem, and (re)connection to land, culture, identity, and heritage. These findings will contribute to the further development of land-based programs for

Inuvialuit in a way that is determined and led by Inuvialuit and their values. The team's findings also demonstrate that land-based programs, like Project Jewel, can contribute to the processes of decolonization and healing among Inuit that hold implications for improved health and wellbeing.

Holton, Gary
University of Hawai'i at Manoa
Honolulu, HI, United States
holton@hawaii.edu

File No: 12 410 1038
Region: SA, NS

Licence No: 16476
Location: Délı̨nę, Tulít'a, and Dettah.

Sahtú Dene and Yellowknives Dene astronomy and sky-related knowledge

In 2019, the goal of this project was to expand upon and clarify various aspects of Sahtú'otı̨nę astronomical and sky-related knowledge that had been discussed the previous year. The researcher returned to Délı̨nę from 6 to 11 November for this purpose, and worked with one of the Elders who he had worked with the year before. This work was facilitated by a person from Délı̨nę. As requested by the community, this work also had a community-based aspect that focused on how the knowledge that was documented in Délı̨nę might be used in other programs in the community, such as wellness or cultural programs. On the return trip through Yellowknife, the researcher briefly met with members of the Yellowknives Dene to review Traditional Knowledge information for a paper on how the Dene people use the stars to guide them on their journeys.

Kelly, Allicia
Environment and Natural Resources, Government of the Northwest Territories
Fort Smith, NT
allicia_kelly@gov.nt.ca

File No: 12 410 1150
Region: SS

Licence No: 16616
Location: Fort Resolution, Hay River, Hay River Reserve, and Kakisa.

Identifying habitats that influence body condition and fitness of adult female caribou in the southern Northwest Territories (Traditional Knowledge component)

The goal of this project was to use Traditional Knowledge and field visits to identify what caribou cows need to be healthy. In particular, the research team was interested in identifying the various 'habitats' that caribou need to be healthy. In this context, habitat refers to the plants, animals, weather, soil, and other things that make up the natural environment in an area. In early September 2019, project staff from the Government of the Northwest Territories and the K'atl'odeeche First Nation visited seven different field sites with three Elders/harvesters. The research team wanted to learn about the value of the habitats at those field sites for boreal caribou. The team shared information on why those particular sites had been selected, as well as information from other studies about which plants boreal caribou prefer to eat and which they avoid. The Elders described the vegetation, named specific plants, and related the habitat to the caribou. They also identified plants that the boreal caribou eat. This was primarily done in Slavey, and summaries were provided in English. The conversations were recorded, and the Slavey language will be translated. The information that was collected will be verified at a follow-up meeting, and then the approved information will be included in project reports.

Lantz, Trevor
University of Victoria
Victoria, BC
tlantz@uvic.ca

File No: 12 410 906
Region: IN, GW

Licence No: 16496
Location: Fort McPherson, Tsiigehtchic, Inuvik, Aklavik, Tuktoyaktuk, Sachs Harbour, Paulatuk, and Ulukhaktok.

Using Inuvialuit and Gwich'in observations to monitor environmental change in the Beaufort Delta Region

The Beaufort Delta Region is an ecologically and culturally significant area that is 'dynamic' – in other words, it is constantly changing. This area is experiencing rapid environmental changes that are expected to get worse due to climate change and other man-made 'stressors' such as development. In some areas, the changes are occurring so fast that it is impossible to keep a good record of them. Inuvialuit and Gwich'in land users in the region are in an excellent position to see how the land is changing, and to help further understanding of how all of the impacts of climate change and other stressors are acting together to impact the land. The goal of this research project is to document Inuvialuit and Gwich'in observations of the environment. To accomplish this, the research team interviewed local experts to document their knowledge of the Beaufort Delta Region. In 2018 and 2019, the interviews focused on the abundance of Pacific salmon in the area, and how the delta has changed in ways that have caused Pacific salmon to be found and harvested. The researchers also asked about the effects the salmon may have on other fish, plants, and animals. They partnered with the Hunters and Trappers Committees in each community to tailor their interview questions, identify participants, and hire youth interviewers. Overall, they conducted 48 interviews with 54 individuals. These interviews either took place at fish camps on the land, or in the communities of Aklavik, Ulukhaktok, Inuvik, Paulatuk, Tuktoyaktuk, and Sachs Harbour. The project team found that salmon harvest varies a lot among the communities.

Latta, Alex
Wilfrid Laurier University
Waterloo, ON
alatta@wlu.ca

File No: 12 410 1076
Region: GW

Licence No: 16529
Location: Fort McPherson, Tsiigehtchic, the Peel River and Mackenzie River ferry landings, and/or the research participants' fishing sites.

Ferry landing impacts on the Peel and Mackenzie Rivers: Traditional Knowledge study and fishery survey

Nagwichoonjik (the Mackenzie River) and Teetł'it Gwinjik (the Peel River) are important to the livelihood and culture of the Teetł'it Gwich'in and Gwichya Gwich'in living in the communities of Fort McPherson and Tsiigehtchic. Each year, the Government of the Northwest Territories Department of Infrastructure uses gravel to build landings for the ferries that transport vehicles travelling on the Dempster Highway across these rivers. The addition of gravel sediment from the landings into the rivers has been an on-going concern for the communities, who fear it may affect water quality and fish health, as well as create sand bars that interfere with navigation and fishing. Research was conducted to address these concerns, including scientific water sampling under a different research license. Under this license, 16 Traditional Knowledge holders were interviewed in Fort McPherson and 12 in Tsiigehtchic. They reported their

observations of changes to the water, river, and fish, and also explained any concerns they have about ferry operations. In addition, fishers were asked to complete a survey describing how many fish of different species they caught during the 2019 fishing season. Seventeen fishers in Fort McPherson completed the survey and ten participated in Tsiigehtchic. A final report about this research will be available by the end of 2020.

Parlee, Brenda
University of Alberta
Edmonton, AB
bparlee@ualberta.ca

File No: 12 410 522
Region: IN, GW, SA, DC, NS, SS

Licence No: 16625
Location: Aklavik, Inuvik, Fort McPherson, Tsiigehtchic, Colville Lake, Délı̨nę, Fort Good Hope, Norman Wells, Tulít'a, Fort Simpson, Sambaa K'e, Gamètì, Fort Smith, Hay River, Hay River Reserve, Łútsę̀lké, and Kakisa.

Tracking change...Local and Traditional Knowledge in watershed governance

This is a six-year research program funded by the Social Sciences and Humanities Research Council of Canada. It is led by the University of Alberta, the Mackenzie River Basin Board, and the Government of the Northwest Territories, in collaboration with many valued Indigenous organization partners and universities. The broad goals of this project are to document and share local and Traditional Knowledge about social and ecological changes in three river basins (the Mackenzie River Basin in Canada, the Lower Mekong Basin in Asia, and the Lower Amazon Basin in South America), and to determine the role of this knowledge in watershed governance. In 2017 and 2018, the research team worked with the Fisheries Joint Management Committee in the Inuvialuit Settlement Region, the Gwich'in Renewable Resources Board in the Gwich'in Settlement Area, the Sahtú Renewable Resources Board in Fort Good Hope, the Kátł'odeeche First Nation in the Deh Cho, and the Łutselk'e Dene First Nation. They also worked with other communities that are in the Mackenzie River Basin, but outside the NWT. Community partners shared useful information about broad patterns of change in fishing and fishing livelihoods in their region. This included information about the health of the aquatic environment now and in the past. Information was collected about the water itself, such as its quality, quantity, and flow. Community partners also shared information about the groundwater and permafrost conditions. Information was shared about the fish, such as their populations, movements, and diversity, and the effects of invasive species on the fish. Information about other aquatic species, such as geese and beaver, was also shared. The community partners shared information about fishing livelihoods now and into the future, such as harvesting levels and practices, diet, health, access issues, and changes in the health of valued fish species. They also spoke about governance; for example, how to maintain healthy relationships to the aquatic ecosystem, how to maintain respectful and spiritual relationships, and how to respect treaty rights.

Spring, Andrew
Wilfrid Laurier University
Waterloo, ON
aspring@wlu.ca

File No: 12 410 1037
Region: SA

Licence No: 16475
Location: Délı̨nę

Sahtú Benígodi: Traditional Knowledge of Great Bear Lake and its watershed

Great Bear Lake and its watershed are critically important to the livelihoods, culture, and spiritual well-being of the Sahtú'otı̨nę. Additionally, the region has been designated an international biosphere reserve by UNESCO in recognition of its importance to the world. However, climate change and development are changing Great Bear Lake and the surrounding area. Therefore, the core mandate of the Tsá Tué Biosphere Reserve Stewardship Council is to keep Great Bear Lake and its watershed healthy and developed properly. Traditional Knowledge about the lake can help scientists understand how climate change will affect the lake in the future. The research team will study interviews and previous Traditional Knowledge research, and add the information that they find to a community-controlled online map and interactive website. This website can then be used to make decisions about land use planning, climate change adaptation, and food security. To achieve this goal, the research team hired a graduate student and community researcher, held community meetings, reviewed literature, and searched for sources of Traditional Knowledge in the community. In January 2019, the community researcher began to identify and catalog many of the resources that had been found. The research team also interviewed Elders about Great Bear Lake and the surrounding area. The audio and video files that were recorded during each interview will be transcribed and preserved for future use. The research team also held a results workshop in late February 2019, in order to coincide with a Tsá Tué Biosphere Reserve Stewardship Council meeting.

Wenzel, Abra
Carleton University
Ottawa, ON
soc-anthro@carletonu.ca

File No: 12 410 1132
Region: DC, NS

Licence No: 16499
Location: Two sites at (62°27'22.407" N, 114°22'46.981" W) and (61°21'5.581" N, 117°39'0.978" W).

Métis moose hair tufting: Revival of a tradition

The focus of this research project was to record the history of moose and caribou hair tufting in the NWT, and to document the women who make this art. The project took place during four trips to the NWT in 2019. During these trips, the researcher took photographs of tufted objects at the Prince of Wales Northern Heritage Centre in Yellowknife, and conducted interviews with five artists who specialize in moose and caribou hair tufting. The interviews took place in Yellowknife, Hay River, and Inuvik. This research will be included in a doctoral thesis that will be completed by May 2021.

Wiart, Shelley
Athabasca University
Lloydminster, AB
helley@womenwarriors.club

File No: 12 410 1140
Region: NS

Licence No: 16553
Location: Yellowknife and the surrounding area within a 20 km radius.

Digital storytelling as an Indigenous women's health advocacy tool: Empowering Indigenous women to frame their health stories

There has not been good research on how health care providers can incorporate Indigenous Knowledge and healing practices into patient care in ways that allow Indigenous women to feel respected and safe; the goal of this project is to fill that gap. The health stories of Indigenous women can help teach cultural safety in health care settings. These teachings are community-driven, culturally relevant to Indigenous

people, and based in local knowledge. Moreover, when Indigenous women share their stories, it can improve their health outcomes. These stories are an innovative way to decolonize health care, and can help health care providers build relationships and trust with their patients. The results of this project suggest that digital storytelling (recording videos) can help the storytellers feel a deeper level of self-expression, and can help them advocate more powerfully for their needs. Seeing the videos can help health care professionals think about their own clinical practices, which helps Indigenous women feel safer in health care settings. In community settings, the digital health stories can help community members speak about reconciliation in health care and support community-driven solutions. In the future, Indigenous communities can create their own digital storytelling projects. These stories can feature region-specific healing practices and help people get the quality health care they need. All of the stories shared by Indigenous women are now available on the 'Women Warriors' website. The researcher also wrote and published a paper on this topic.

Archaeology

Balls, Vincent
Golder Associates Ltd.

Permit Number: 2019-012 **Class:** 2
Region: Highway 1 **Location:** Highway 1

Government of the Northwest Territories Highway 1 and 7 borrow pits
The goal of this research project was to check the area around a proposed borrow pit and quarry in order to find and document any archaeological sites that may be present.

Balls, Vincent
Golder Associates Ltd.

Permit Number: 2019-017 **Class:** 2
Region: DC **Location:** Highway 3

Government of the Northwest Territories Highway 3 borrow pit
The goal of this research project was to check the area around a proposed borrow pit in order to find and document any archaeological sites that may be present. Information gathered during this project will be used by the Government of the Northwest Territories Department of Infrastructure to avoid damaging any archaeological sites when the borrow pit is used.

Freeman, Randolph
DownNorth Consulting

Permit Number: 2019-005 **Class:** 1
Region: NS **Location:** North shore of Great Slave Lake from the site of old Fort Rae east to the site of old Fort Reliance and onto Artillery Lake.

Yellowknives' villages project
The goal of this project was to map and document cultural features at log cabin village sites to see if any of them have been disturbed or destroyed.

Kramers, Patrick
De Beers Group of Companies

Permit Number: 2019-001 **Class:** 1
Region: NS **Location:** MacKay Lake to Kennady Lake.

Archaeological monitoring of Gahcho Kue Mine project
Before the Gahcho Kue mine was developed, archaeologists assessed the area to see if it contained any archaeological sites. They found some sites and marked them with stakes, fluorescent paint, and tape.

The sites were marked so that the people who work at the mine know to protect the sites and work around them. This year, the archaeologists visited the sites and checked on the stakes to make sure they were clear and visible. This will prevent any potential impacts on the archaeological sites due to mining activities or the operation of the winter spur road. The archaeologists also checked to make sure that the stakes were in good condition and the sites remained undisturbed. The archaeologists had to repair some of the stakes, and both the stakes and fluorescent paint were in poor enough condition that the archaeologists decided that they need to check the sites yearly to make sure they remain protected.

MacKay, Glen
Prince of Wales Northern Heritage Centre

Permit Number: 2019-004 **Class:** 2
Region: SA **Location:** Mackenzie Mountains

The Shútagot'ıne cultural landscape project
The archaeologists surveyed historic sheep and caribou fences, as well as mountain ice patches.

MacKay, Glen
Prince of Wales Northern Heritage Centre

Permit Number: 2019-006 **Class:** 2
Region: NS **Location:** Yellowknife Bay, Yellowknife River, and the Ingraham Trail.

Yellowknife Bay archaeology project
The goal of this research project was to continue to record archaeological sites in the Yellowknife area. This included several sites found by the researcher on Reid and Tibbit Lakes that have not yet been officially recorded.

Murphy, Brent
Lifeways of Canada Ltd.

Permit Number: 2019-015 **Class:** 2
Region: SA **Location:** Little Smith Creek, Tulít'a District.

Line 21 planned maintenance, KP 158 at Little Smith Creek near Tulít'a, NWT
The objectives of this Archaeological Impact Assessment were to check if there were any archaeological sites in the project location, and if so, to document the location and content of the sites. In addition, the archaeologists provided this information to the developer, so they can either avoid the sites during development or protect the site some other way.

Murphy, Brent
Lifeways of Canada Ltd.

Permit Number: 2019-016 **Class:** 2
Region: DC **Location:** Nahanni Butte region.

Canadian Zinc Corporation phase 1 winter road and geotechnical program

The goal of this Archaeological Impact Assessment for the phase 1 winter road and geotechnical testing program was to search for and record any archaeological sites within the project area that might be disturbed during development.

O'Rourke, Michael
Prince of Wales Northern Heritage Centre

Permit Number: 2019-008 **Class:** 2
Region: IN **Location:** Toker Point, roughly 25km north of Tuktoyaktuk.

Toker Point survey project – 2019
This research project had four goals. First, the archaeologists wanted to see if there have been any changes in the landscape at Toker Point, such as erosion or dune formation, since it was last surveyed. Western Toker Point was last surveyed in 2013, and eastern Toker Point was last surveyed in 2016. Second, the archaeologists wanted to identify cultural and natural features of the Toker Point area through an 'intensive pedestrian survey' of the region. This type of survey is done by walking across most of the area while carefully observing the land. Third, the archaeologists wanted to create an accurate record of archaeological sites and other cultural and natural features on Toker Point. This included archaeological site maps, as well as recording the location of features using high quality GPS and taking air photos using drones. Fourth, the archaeologists examined a tundra pond that had recently breached and drained into the Beaufort Sea. This pond was a source of freshwater and close to an area with current and past land-use. This means that there was a unique opportunity to investigate this drained pond for material evidence of human use.

Smethurst, Naomi
Prince of Wales Northern Heritage Centre

Permit Number: 2019-003 **Class:** 2
Region: DC **Location:** Great Slave Lake and Buffalo River.

Kátł'odeeche First Nation archaeology project
The goal of this research project was to document the 'archaeological record' of the traditional territory of the Kátł'odeeche First Nation. An archaeological record is documented by finding and recording information about an area in order to understand the types and locations of archaeological sites it contains. It also documents information about how the area was used, and whether the use of the area has changed or stayed the same over hundreds and thousands of years. This work was conducted in partnership with Kátł'odeeche First Nation. It builds on previous traditional use studies, as well as previous archaeological work that was conducted in 2017 and 2018.

Smethurst, Naomi
Prince of Wales Northern Heritage Centre

Permit Number: 2019-010 **Class:** 2
Region: NS **Location:** North Arm Territorial Park.

North Arm Park campground
The researchers conducted an Archaeological Impact Assessment of the North Arm Park Campground for the proposed extension to the North Arm Territorial Park.

Young, Patrick
Golder Associates Ltd.

Permit Number: 2019-009 **Class:** 2
Region: NS **Location:** Indin Lake and surrounding area.

Indin Lake gold project AIA
The researchers conducted an Archaeological Impact Assessment of the Indin Lake gold project. The objectives of this work were to survey and find any archaeological sites in the proposed drill areas, and to document any sites that were found.

Young, Patrick
Golder Associates Ltd.

Permit Number: 2019-014 **Class:** 2
Region: SS **Location:** Northeast of Lac de Gras.

Dominion Diamond Mines ULC Glowworm Lake project
The goal of this research project was to check land crossings and portages along proposed winter road routes to see if they contained any archaeological sites. The archaeologists used air photos to identify areas that they needed to check on the ground, and then performed a foot survey of select landforms where they felt there was a higher likelihood of finding an archaeological site.

Fisheries

Clipperton, Casey
Golder Associates Ltd.

Licence Number: S-19/20-3009-YK
Species: All fish species **Location:** Redknife River

Gahcho Kué offsetting – Redknife River baseline data study
This study is being carried out by Golder Associates Ltd. on behalf of DeBeers Canada Inc., as part of the environmental and fisheries responsibilities for the Gahcho Kue Mine. The mine will have an impact on fish-bearing rivers within the development area, and to mitigate this, the mine will create an 'offsetting project'. An offsetting project is a project that finds another way to improve fish habitat or their migration. This offsetting project will improve the upstream fish passage at the Mackenzie Highway bridge crossing. Before the offsetting project can be built, however, the project team must study current fish movement and culvert use, and also study which fish species are present, in what numbers, and their age.

Cunada, Christopher
Department of Environment and Natural Resources

Licence Number: S-19/20-3045-YK
Species: All fish species **Location:** Slave River

Alberta-Northwest Territories transboundary fish monitoring program: Slave River
This fish monitoring project has four main objectives. First, the research team repeated some tests that were originally carried out during historical programs that ran from 1990 to 1995, and from 2011 to 2015. These tests included sampling to see how contaminated the fish were, and to see what fish were present. Second, the team took samples from more types of fish for the Oil Sands Monitoring Program. Third, they identified invasive species and determined whether they are common or not compared to other fish species. Finally, the research team helped plan and build community fish camps in Fort Smith and Fort Resolution.

Darwish, Tamara
Golder Associates Ltd.

Licence Number: S-19/20-3021-YK
Species: All fish species **Location:** Seep Creek, Dam Lake, Fingers Creek, and Fingers Lake.

Lupin Mine phase 6 environmental effects monitoring
The objective of this project is to monitor fish near the Lupin Mine to see whether the mine is impacting the fish or their habitat. The research team checked to see what effects the mine effluent (the liquid waste from the mine) is having on the area that it flows into. To do this the team took samples from 'exposure areas' that received mine effluent, including Seep Creek and Seep Creek Ponds 1 and 2. They also took

samples from 'reference areas' that did not receive effluent and are therefore not affected by the mine, including Reference Area 1, Fingers Creek, Fingers Creek Pond, and Fingers Lake. They then compared the exposure and reference areas. The samples they took and studied included the tiny animals that live at the bottom of the stream or pond, and samples from fish.

Dunmall, Karen
Fisheries and Oceans Canada

Licence Number: S-19/20-3029-YK
Species: Salmon
Location: Beaufort Sea, Great Slave Lake, Great Bear Lake, and the Mackenzie River.

Salmon distribution in the Canadian Arctic
The purpose of this study was to find out where Pacific salmon and Atlantic salmon can be found in the Canadian Arctic. Once the research team has information about where salmon are found in the Arctic, they will be able to monitor the fish caught in the NWT to track how things are changing and how the fish are dispersing. This research is important because a major shift in where the salmon are found could be an indicator of environmental change.

Evans, Marlene
Environment Canada

Licence Number: S-19/20-3031-YK
Species: Lake trout, burbot, northern pike
Location: Great Slave Lake

Spatial and long-term trends in persistent organic contaminants and metals in fish from the Northwest Territories
The purpose of this on-going study is to investigate whether contaminant levels in fish in the NWT are changing, with a focus on fish in Great Slave Lake. The team has studied fish in Great Slave Lake since the early 1990s. The team plans to collect three different types of fish from Great Slave Lake, including lake trout from near Hay River and Łutselk'e, burbot from near Łutselk'e and Fort Resolution, and northern pike from near Fort Resolution.

Evans, Marlene
Environment Canada

Licence Number: S-19/20-3048-YK
Species: Lake trout, cisco
Location: Great Bear Lake area.

Monitoring of mercury, flame retardants and other chemicals in lake trout and cisco from Great Bear Lake
This purpose of this study is to sample lake trout and cisco from Great Bear Lake to check the levels of contaminants of concern in these fish. Previous studies have been done for some of these contaminants, such as mercury, so the research team will be able to see whether the contaminant levels are changing over time.

Gallagher, Colin
Fisheries and Oceans Canada

Licence Number: S-19/20-3022-YK

Species: Dolly Varden, grayling, round whitefish

Location: Little Fish River, Babbage River, Firth River, Joe Creek fish hole (Ivvavik National Park), and Herschel Island.

Big Fish, Babbage and Firth River fisheries study

This study has six goals. First, to catch Dolly Varden in the Big Fish and Babbage Rivers that were tagged in previous years. Re-catching fish that were tagged previously helps the researchers understand the size of the population. The team also tagged 700 Dolly Varden from each of the Big Fish River, Babbage River, Firth River, and Joe Creek, and 500 Dolly Varden from Fish Creek. Second, the project team harvested 20 'resident' Dolly Varden from the Big Fish, Babbage, and Firth Rivers, as well as from Joe Creek. They also harvested 50 'resident' Dolly Varden from Fish Creek near Komakuk Beach. Unlike other Dolly Varden, resident fish do not migrate out to the ocean. Resident fish were harvested in the fall, and used to obtain biological information such as length, weight, age, sex, maturity, and diet. Tissue samples from these fish were also taken for contaminant analysis. Third, the project team harvested 25 'anadromous' Dolly Varden from the Babbage River, Firth River, Joe Creek, and Fish Creek at Komakuk Beach. Anadromous fish live for part of their lives in the ocean, and for part of their lives in fresh-water rivers. Fourth, the team tagged large Dolly Varden from the Firth River drainage basin using satellite tags that allow the researchers to track the fishes' movements. Fifth, the team harvested 50 isolated Dolly Varden from above waterfalls in the Babbage River system. And finally, the researchers took samples from the subsistence catch of Dolly Varden at Herschel Island and Ptarmigan Bay in the Yukon.

Gallagher, Colin
Fisheries and Oceans Canada

Licence Number: S-19/20-3023-YK
Species: All fish species

Location: Shingle Point

Community based monitoring of coastal fish ecology and harvest of Dolly Varden 2019

The goal of this project is to study the ecosystem of Dolly Varden within the Tarium Niryutait Marine Protected Area. The researchers collected samples from fish caught by local fishermen at Shingle Point, and analyzed them to see what the fish ate. Additionally, as part of a harvest monitoring program, the research team recorded the length, weight, sex, maturity, and age of Dolly Varden. They also took samples from the Dolly Varden for genetic analysis and to see what they ate. The results of this project show how the fish and their diet change over the seasons, and also show the harvest levels. This information can be used to evaluate the Dolly Varden mixed stock fishery at Shingle Point. This research project also provided training to support long-term, community-based coastal monitoring and cumulative impact monitoring.

Gallagher, Colin
Fisheries and Oceans Canada

Licence Number: S-19/20-3024-YK
Species: Arctic charr, broad whitefish, starry flounder

Location: Hornaday River and Darnley Bay.

Arctic charr monitoring in Darnley Bay NT, 2019

This project has three goals. The first is to monitor and provide information on the population status and life history of Arctic charr that are captured at the mouth of the Hornaday River and Lasard Creek. The second is to study some fish that are are found near Tippitiuyak (western Darnley Bay) and known locally as 'blue charr'. Local harvesters consider blue charr to be different than Arctic charr. The third goal is for

the research team to continue their work with the community of Paulatuk to provide important information that is needed to fulfill the the Paulatuk Charr Management Plan.

Gallagher, Colin
Fisheries and Oceans Canada

Licence Number: S-19/20-3025-YK
Species: All fish species **Location:** Great Bear Lake

Long-term monitoring of cumulative impacts to fisheries in and the ecosystem of Great Bear Lake
The goal of this long-term monitoring program is to check the health and population sizes of trout and cisco in the Dareli (Keith), Turili (McVicar), Kwit tla (McTavish), Tugacho (Dease), and Tirato (Smith) arms of Sahtú (Great Bear Lake). The researchers recorded the size and age of lake trout and the number of eggs per female, which helps them figure out how productive the fish are (in other words, how many young ones they will have). The research team used this information to see if lake trout numbers are changing, or if the lake trout themselves are changing over time. The researchers also checked whether there are many types of ciscos in Great Bear Lake. To figure this out, they took ciscos that had been caught and frozen in the past seven years, and carefully studied them by measuring their size, scales, fins, and other body parts. Finally, the research team studied the whole living system of Great Bear Lake that supports the fish. This included the plants and small animals that are eaten by fish and the quality of the water, because these things help the fish grow and reproduce (have young ones).

Gallagher, Colin
Fisheries and Oceans Canada

Licence Number: S-19/20-3026-YK
Species: Arctic charr **Location:** Fish Lake

Assessment of Arctic charr stock from Fish Lake
The goals of this project are to collect catch and biological information about Arctic charr in the Kuujjuar River. This information is used to see if the population is stable or changing, and to predict how the population will respond to different levels of harvest.

Gallagher, Colin
Fisheries and Oceans Canada

Licence Number: S-19/20-3027-YK
Species: Dolly Varden charr **Location:** Rat River and Fish Creek.

Biological investigation of Dolly Varden from the Rat River 2019
This on-going project has three main goals. The first goal is to work with local Dolly Varden harvesters. The research team recovered tags that had been previously placed on fish from the harvesters who had caught those tagged fish. The tags were used by the researchers to measure the size of the Dolly Varden population. The team also asked the harvesters how long it took them to catch the fish, which also helps them figure out the size of the population. Samples were taken from these harvested fish, which provided biological information about the Dolly Varden. Second, the research team caught and sampled live Rat River Dolly Varden that were caught in Fish Creek during the fall. These samples were analyzed for biological information. Finally, the research team harvested 'resident' Dolly Varden that do not migrate to the ocean to record their biological information.

Gray, Derek
Wilfrid Laurier University

Licence Number: S-19/20-3028-YK
Species: All fish species **Location:** Mackenzie Delta area water bodies.

How will fish communities in Gwich'in and Inuvialuit lakes respond to climate change?
The goal of this project is to collect 'baseline data' from small-sized and medium-sized lakes within the Mackenzie Delta region. Baseline data gives scientists a snapshot of what conditions are like now, so that future changes in these conditions can be observed and measured. The information recorded in the lakes included fish populations, fish habitat, water quality, and water temperature. Using this information, the researcher tried to predict how suitable the fish habitat in the region will be for coldwater fishes in the future. Finally, the researcher predicted how the distribution of coldwater fishes might change under different climate change scenarios, and assessed how likely it is that 'coolwater fishes' such as walleye will expand into lakes in the Gwich'in Settlement Area and Inuvialuit Settlement Region in future.

Kuchapski, Kathryn
ERM Consultants Canada Ltd.

Licence Number: S-19/20-3014-YK
Species: All fish species **Location:** Great Slave Lake and nearby water bodies.

Ac35 fish ladder monitoring program
In 2017, a new road crossing was constructed over Stream Ac35 in the Great Slave Lake watershed. This crossing consists of a culvert and a fish ladder. Fisheries and Oceans Canada recommended that the crossing be studied in spring 2019 to see if fish, such as Arctic grayling, are able to successfully pass through this road crossing.

Lea, Ellen
Fisheries and Oceans Canada

Licence Number: S-19/20-3003-YK
Species: Sand lance, Greenland cod, Arctic charr, saffron cod, capelin **Location:** Ulukhaktok area coastal marine waters.

Ulukhaktok coastal Arctic charr harvest monitoring 2019 and Greenland cod, sand lance and capelin research
The goal of this project is to collect harvest and biological information about Arctic charr that are harvested by Ulukhaktok community members during the summer subsistence harvest. This information is used to manage fish stocks and fishing through the community fishing management plans. These plans were established between the Olokhaktomiut Hunters and Trappers Committee, the Fisheries Joint Management Committee, and Fisheries and Oceans Canada.

Lea, Ellen
Fisheries and Oceans Canada

Licence Number: S-19/20-3004-YK
Species: Bearded seal, ringed seal **Location:** Safety Channel

Assessment of reproduction, condition disease and contaminants of ringed seals and bearded seals through harvest-based monitoring at Ulukhaktok, NT, 2019

This is a community-based monitoring program that samples and measures ringed seals that are taken in the annual harvest in the Ulukhaktok area. One hundred ringed seals were sampled. The research team looked at the reproductive status and body condition of the seals, which told them how productive the ecosystem is and whether there were any fluctuations in the seal population. The researchers compared the information from the seals to the regional ice conditions, to see if they were related to one another. The researchers also provided samples to other scientists and communities so the diet, population size, and health of seals across Alaska, NWT, Nunavut, and Russia can be understood. Finally, the researchers worked with community-based programs to collect samples and measure any bearded seals that were taken in the annual harvest in the Ulukhaktok area. Ten bearded seals were sampled, with the samples used to understand reproductive rates, growth, body condition, and prey preferences.

Lea, Ellen
Fisheries and Oceans Canada

Licence Number: S-19/20-3040-YK
Species: All fish species **Location:** Tuktoyaktuk Harbour

Tuktoyaktuk Harbour Arctic coastal ecosystem study extension through Sentinel Fishers program

The goal of this project is to study and record the current habitat and diet of coastal fish populations. Once the current conditions are known, any future changes can be tracked using 'key monitoring species', which are fish that are easy to study and that best show the effects of environmental change. This project is an add-on to the Arctic Coastal Ecosystem study taking place at Shingle Point. The goal is to extend the Tarium Niryutait Marine Protected Area fish monitoring program that is already in place to other sub-regions of this marine protected area. The researchers used information from fish collected in Tuktoyaktuk Harbour to estimate what they might find in Kugmallit Bay fish populations.

Liu, William
De Beers Canada Inc.

Licence Number: S-19/20-3012-YK
Species: All species, zooplankton **Location:** Kennady Lake and surrounding water bodies.

Gahcho Kué project – Aquatic effects monitoring program

As part of the environmental review process, the Gahcho Kué mine was required to run an aquatic effects monitoring program. The program includes a monitoring plan that measures any impact of the mine on nearby lakes and rivers, and ensures that these impacts don't go beyond what is allowed in the license for the mine. In 2019, fish habitat, fish health, and fish tissue chemistry were monitored during the open-water period, and samples were taken of the tiny plants and animals that live at the bottom of the lakes and streams. The results were used to document the conditions in lakes that are affected by the mine, as well as in the downstream system between Area 8 (Kennady Lake) and Lake 410.

Loseto, Lisa
Fisheries and Oceans Canada

Licence Number: S-19/20-3000-YK

Species: All fish species

Location: Ulukhaktok area coastal marine waters (70°44' N, 117°45' W).

Acoustic monitoring of fish habitat use in the Ulukhaktok area

The goals of this on-going monitoring project are to capture and surgically implant electronic tags in Greenland cod and Arctic charr. The research team wanted to implant tags in 30 Greenland cod during spring and 50 during summer, and in 50 Arctic charr during summer and 25 in fall and winter. In previous years the project team had placed 'receivers' in the water that can read tag information from nearby fish. These receivers were retrieved and the data on them was downloaded before they were placed back in the water. The team also tagged five Arctic charr with external pop-up satellite 'archival' tags. These archival tags have a tiny computer in them that records information about the water temperature, salt level, and depth. The computer also records information about the fish itself, like its pulse and swimming speed. The team then recorded information about the environment and took samples of the small animals that the fish eat. The samples and other information were collected from both tagged fish and other fish that the researchers had harvested, and will be used to help the researchers understand the life history and diet of the fish. The harvested fish were also sampled to assess the food web and fish diet.

Loseto, Lisa
Fisheries and Oceans Canada

Licence Number: S-19/20-3017-YK
Species: Beluga whale

Location: Hendrickson Island, Shingle Point, Kendall Island, Tuktoyaktuk area, Darnley Bay, Sachs Harbour area, and the Ulukhaktok area.

Health assessment of harvested eastern Beaufort Sea beluga in the Inuvialuit Settlement Region

The overarching goals of this program are to work in partnership with the Fisheries Joint Management Committee and the Oceans Program of Fisheries and Oceans Canada to support long-term monitoring and sampling of beluga in the Tarium Niryutait Marine Protected Area. Specifically, the research team took samples of harvested beluga whales to record their age, sex, length, and diet. They used these samples to assess how healthy they are, what diseases or parasites they have, any contaminants in their tissues, and their overall condition. The project team used this information to determine the current state of beluga health. Understanding how healthy belugas are now will help us understand if their health changes in the future due to the effects of, for example, climate change or oil and gas activities. The project team also worked with the communities in the Inuvialuit Settlement Region to build capacity for science and long-term monitoring of beluga health.

Loseto, Lisa
Fisheries and Oceans Canada

Licence Number: S-19/20-3020-YK
Species: Beluga whale

Location: Kugmallit Bay

Eastern Beaufort Sea beluga tagging program

Participants in the Beluga Summit in February 2016, the Eastern Beaufort Sea (EBS) Beluga Stock Assessment in January 2017, and the Inuvialuit-Inupiat Beluga Whale Commission in August 2017 indicated that there is a knowledge gap about beluga movements in relation to their food sources and their changing environment. The goal of this project is to address this knowledge gap, which requires that wild belugas are live-caught, tagged, and then released. The tagged beluga are tracked and the

researchers chart where the whales go, and when and where they dive. The researchers recorded the dive behaviour of EBS beluga whales during the summer foraging season and identified key areas where beluga travel, rest, and forage for food. They also saw how the environment might change the dive behaviour of the beluga, and attempted to predict how environmental change might affect beluga prey and therefore the whales themselves. Finally, the researchers predicted current and future habitat suitability for EBS beluga whales. Another goal of this project is to develop less invasive whale tagging methods.

Low, George
Dehcho Aboriginal Aquatic Resource and Oceans Management

Licence Number: S-19/20-3001-YK
Species: Lake whitefish, walleye, northern pike
Location: Sanguez Lake (61°15.369' N, 120°29.707' W).

Sanguez Lake fish down study
The longer a fish lives the more mercury it will have in its flesh, so older fish are less safe to eat than younger ones. Some of the fish in Sanguez Lake have too much mercury in their flesh to be safe to eat. Therefore, a number of the large adult fish were removed from Sanguez Lake (a 'fish-down') to make the remaining fish safer to eat. Also, because large adult fish prey on and eat smaller younger fish, removing some adult fish reduced predation and left more young fish that are safe to eat in the lake. In order to carry out the fish-down, the research team estimated the population of walleye in Sanguez Lake using a two year tag and recapture study. The researchers checked the size and age of the walleye after the fish-down to ensure that they left a suitable number of large walleye adults as spawning stock. They also continued to measure mercury concentrations in walleye and pike. In 2013, the mean mercury concentration in walleye was 0.71 mg/kg wet weight, and in pike it was 1.09 mg/kg wet weight. After the fish-down, the researchers checked for mercury concentrations and monitored the population, size, and age of the remaining fish over a ten year period. They tested mercury levels every three years for ten years, and will then test every ten years after that. When stocks have stabilized, a safe harvest level for walleye will be set. The researchers checked if the fish-down method may work in other lakes in the region that have fish with high levels of mercury. Finally, the project provided a Traditional Knowledge and science experience for youth in the Dehcho.

Low, George
Dehcho Aboriginal Aquatic Resource and Oceans Management

Licence Number: S-19/20-3002-YK
Species: All fish species
Location: McGill Lake, Kakisa Lake, Tathlina Lake, Fish Lake, Greasy Lake, and Cli Lake.

The bio-magnification of mercury within fish species of the Deh Cho and their varying levels among lakes
This project has three goals. First, the research team wants to figure out why mercury levels in fish vary among lakes in the Dehcho region. Second, the team wants to identify the best predictors of fish mercury levels. And third, the research team wants to determine which fish have the lowest levels of mercury and the highest levels of micro-nutrients and fatty acids, and are therefore the healthiest fish for Dehcho community members to eat.

Machtans, Hilary
Golder Associates Ltd.

Licence Number: S-19/20-3038-YK
Species: Benthos **Location:** Yellowknife Bay

Con Mine 2019 supplemental benthic invertebrate sampling study (Miramar Northern Mining Ltd)
In 2018, Con Mine conducted the sixth phase of their environmental effects monitoring program, which was a requirement of their environmental licence. They continued this work in 2019 with the goal to take new samples of 'benthic invertebrates', or the tiny animals that live in and near the bottom of waterbodies. These samples were taken from Jackfish Bay, both near and far away from the mine, and Kam Bay, which is not impacted by the mine. The samples were used to confirm the results from 2018, and to see if treated effluent from Con Mine is affecting the benthic community in Jackfish Bay. As much as possible, this study uses the same methods that were used in previous program phases so that the research team can make comparisons between years. In 2019, however, they did add some new sampling locations that were further from the mine so they could see how far the mine's impacts extend.

Majewski, Andrew
Fisheries and Oceans Canada

Licence Number: S-19/20-3037-YK
Species: Icthyoplankton, benthos, zooplankton **Location:** Amundsen Gulf

Canadian Beaufort Sea – Marine ecosystem assessment
The goal of this project is to address knowledge gaps about offshore marine fish and their supporting ecosystems. The research team started an inventory of Beaufort Sea marine resources to increase our understanding of offshore marine fish, with the intention of conserving arctic biodiversity through science-based decision making. The team also wants to reduce the impact of marine shipping corridors by studying the potential impact of shipping on fish and marine mammals. The information collected by the researchers may also help ensure that there are abundant arctic fisheries into the future, and that the impacts of oil and gas development, and other marine resource development in the region, can be assessed using good scientific knowledge.

Markey, Andrea
Crown-Indigenous Relations and Northern Affairs Canada

Licence Number: S-19/20-3007-YK
Species: All fish species **Location:** Horseshoe Island, Yellowknife River, Tartan Rapids, and Baker Creek.

Giant Mine phase 6 - Environmental effects monitoring
Giant Mine is in the sixth phase of their environmental effects monitoring program, which is a requirement under the Metal and Diamond Mining Effluent regulations. There are two components to this monitoring program. One is a lethal survey of slimy sculpin, and the other is a non-lethal survey of ninespine stickleback. These surveys are used to determine if the treated mine effluent is affecting fish in nearby waterbodies.

McKennirey, Emma
Crown-Indigenous Relations and Northern Affairs Canada

Licence Number: S-19/20-3005-YK

Species: All fish species

Location: Yellowknife Bay, Great Slave Lake, and Baker Creek.

Giant Mine large-bodied fish tissue chemistry 2019

As part of the Giant Mine Closure and Reclamation Plan, Baker Creek and the nearby shoreline of Yellowknife Bay in Great Slave Lake were 'remediated'. This means that a contaminated or damaged area was cleaned up and returned to its natural state. In the future, there will be a community-based monitoring program related to the remediation activities. To support this future program, the project team took samples from large-bodied fish in Yellowknife Bay that were studied to determine their tissue chemistry. The future monitoring program will be able to compare their results to the samples from this project to see how fish tissue chemistry changes over time.

McKennirey, Emma

Crown-Indigenous Relations and Northern Affairs Canada

Licence Number: S-19/20-3011-YK

Species: All fish species

Location: Baker Creek and Yellowknife Bay.

Giant Mine fish use and habitat assessment 2019

As part of the Giant Mine Closure and Reclamation Plan, Baker Creek and the nearby shoreline of Yellowknife Bay in Great Slave Lake were 'remediated'. This means that a contaminated or damaged area was cleaned up and returned to its natural state. Before the remediation started, the project team checked these areas to confirm that fish use them. As well, the project team took samples of fish that were less than a year old in the spring to see how Arctic grayling and longnose sucker use Baker Creek for spawning and rearing their young. Fishing methods included electrofishing, seine netting, gill netting, dip netting, kick netting, block netting, minnow traps, and snorkeling.

Miller, Matthew

Northwest Territories Power Corporation

Licence Number: S-19/20-3041-YK

Species: Lake trout, northern pike, lake whitefish

Location: Trudel Creek, Taltson River, Nonacho Lake, Rutledge Lake, and Lady Gery Lake.

Taltson Twin Gorges hydro generating facility aquatic effects monitoring program

The Northwest Territories Power Corporation (NTPC) must conduct an aquatic effects monitoring program under the terms of their water license. As part of the program, NTPC monitored mercury concentrations in sediment and fish tissue, and checked whether flow regulation is changing the littoral (shore) and riparian (bank) habitats.

Sharpe, Rainie

Diavik Diamond Mines (2012) Inc.

Licence Number: S-19/20-3042-YK

Species: All fish species

Location: Lac de Gras area.

Diavik Diamond Mines (2012) Inc. (DDMI) 2019 slimy sculpin aquatic effects monitoring program

As part of their current water licence, Diavik Mine must conduct field work and monitor for any effects of the mine on nearby aquatic ecosystems. A fish health program that sampled slimy sculpin was conducted

on Lac de Gras. Slimy sculpin were sampled both lethally and non-lethally, and the samples were analyzed for overall fish health and contaminants. In addition, the project team took samples of plankton and benthic invertebrates, the tiny plants, animals, and organisms that live in the water or at the bottom of lakes and rivers.

Stevens, Cameron
Golder Associates Ltd.

Licence Number: S-19/20-3006-YK
Species: Northern pike, longnose sucker, white sucker, burbot
Location: Pine Creek

Lynx project – Post-remediation monitoring for Pike Creek offsetting measure
The proposed Lynx Offsetting Plan will create new fish habitat to make up for habitat that was impacted by the Lynx Project. The plan is one of the conditions of the fisheries authorization for the Lynx Project. To do this, the project team monitored northern pike as they passed through Pike Creek near Łutselk'e. The project team monitored the size and timing of the spawning run, and checked for improvements in the condition of the creek that allowed fish to pass through it easily.

Stevens, Cameron
Golder Associates Ltd.

Licence Number: S-19/20-3043-YK
Species: All fish species
Location: Russel Lake

Tłı̨chǫ aquatic ecosystem monitoring project (TAEMP) – Russell Lake fish sampling
The goals of this study were to catch both lake whitefish and a predatory species, such as walleye or northern pike, in Russell Lake in order to conduct a fish health assessment. The assessment included collecting muscle tissue for later analysis and determining the age of each fish. Up to 20 of each target fish species were sampled. This was the third year of data collection in Russell Lake, and the information that was collected allows the project team to understand current conditions and measure future changes. The fish are being collected under the Tłı̨chǫ aquatic ecosystem monitoring project, which is a community-led, community-based monitoring program that builds community capacity while determining fish health over time in lakes in the Tłı̨chǫ territory.

Stevens, Cameron
Golder Associates Ltd.

Licence Number: S-19/20-3044-YK
Species: All fish species
Location: Marian Lake

Fish sampling and tissue analysis at Marian Lake for the Marian watershed stewardship program (MWSP)
The goals of this study were to catch both lake whitefish and a top predatory species, such as inconnu or coney, in Marian Lake in order to conduct a fish health assessment. The assessment included collecting muscle tissue for later analysis and determining the age of each fish. Up to 20 individuals from each species were sampled. This is the second year that baseline data were collected in Marian Lake; the first year was 2015. The fish were collected under the Marian watershed stewardship program, which is a

community-led, community-based monitoring program that builds community capacity while determining fish health over time in lakes in the Marian River watershed in the Tłı̨chǫ territory.

Stevens, Cameron
Golder Associates Ltd.

Licence Number: S-19/20-3047-YK
Species: All fish species
Location: Tartan Rapids and Yellowknife River closed area.

Yellowknife River cisco monitoring
This monitoring project achieved two goals. First, the project team found out when the spawning migration of cisco happens in the Yellowknife River, and how long it lasts. Second, they found out the size of the spawning migration of cisco using snorkel survey methods. The team also collected a sample of spawning cisco during the migration, and used the samples to determine fish health, length, weight, and age. In 2019, Golder will follow the same methods for their fish surveys and processing that were used in previous years at Tartan Rapids and Bluefish Rapids on the Yellowknife River. This on-going project will help Fisheries and Oceans Canada develop an integrated management plan for river-run cisco in the Yellowknife River, in cooperation with the Yellowknives Dene First Nation.

Tuktoyaktuk HTC

Licence Number: S-19/20-3039-YK
Species: All species
Location: Tuktoyaktuk area.

Tuktoyaktuk peninsula charr project 2019
There are several types of charr in the Tuktoyaktuk peninsula area. To date, scientists have not yet mapped out all the locations where charr live. They also have not determined which population is which when it comes to the Dolly Varden charr, Arctic charr, and lake trout species of charr. To help address these questions, sampling crews hired by the Tuktoyaktuk Hunters and Trappers Committee used gill nets of various sizes at McKinley Bay, Charr Point, and other locations along the Tuktoyaktuk peninsula that are ideal for fishing. They collected samples on up to 14 days in July and August 2019.

Van Veen, Catelyn
Dillon Consulting Limited

Licence Number: S-19/20-3046-YK
Species: All fish species
Location: Dehcho region water bodies near the Enbridge Pipeline.

Enbridge pipeline monitoring
In the future, the Enbridge pipeline may be upgraded. The area that would be upgraded is upriver from several water bodies that might contain bull trout. In order to protect the bull trout, researchers must first identify whether the water bodies have bull trout habitat and if bull trout are present in them. To do this, the project team mapped out fish habitat, took samples to see what types of fish were present, and determined the number of fish. Specifically, they recorded whether bull trout were present or not. This allowed the project team to identify potential risks that are associated with future upgrades to upland gas mains.

Wilcockson, John
Hatfield Consultants

Licence Number: S-19/20-3015-YK
Species: Slimy sculpin, Arctic grayling **Location:** Sundog Creek

Prairie Creek all-season road baseline data collection
The purpose of this project is to study the current conditions in Sundog Creek prior to the development of the Prairie Creek all-season road. The road will encroach on the creek in some places. With an understanding of the current conditions in the creek, it will be possible to see if there are any changes caused by the road construction or use in the future.

Yamin Janjua, Muhamad
Fisheries and Oceans Canada

Licence Number: S-19/20-3010-YK
Species: All fish species **Location:** Great Slave Lake and Buffalo River area.

Buffalo River inconnu spring sampling
The goal of this study is to continue the long-term annual spring monitoring of inconnu at the mouth of the Buffalo River. The project team asked people who harvest fish at this location how long it takes to catch enough fish. This helps the researchers understand the size of the population and determine the lowest safe population levels. The researchers also gathered fresh biological samples.

Zhu, Xinhua
Fisheries and Oceans Canada

Licence Number: S-19/20-3019-YK
Species: All fish species **Location:** Great Slave Lake

Monitoring and assessing the cumulative impacts on important fish population productivity and community diversity in Great Slave Lake
The first goal of this multi-year study is to monitor cumulative impacts on major fish populations. To do this, the project team created methods to monitor changes in fish populations and the aquatic ecosystem that followed the Cumulative Impacts Monitoring Program Pathways Approach to Protocol Development. The project team also gathered information on the natural systems in Great Slave Lake, along with information about how the community uses the lake. These tasks were done in partnership with other researchers, resource users, Indigenous communities, and decision-makers. The second project goal is to make sure that Great Slave Lake isn't being over-fished. This is done by studying the fisheries in Great Slave Lake and looking at how the ecosystem is changing. The project team conducted 55 standard gill net sets that lasted at least one day and one night. They compared fish nets with different mesh sizes to see what size of fish were caught in each of them. They used all of the information they collected to predict sustainable fish harvest numbers, including some optional management suggestions. As part of this project, the research team studied 'biological reference points' that are useful in fisheries management, such as the total allowable catch, the maximum surplus production, and overfishing limits.

Wildlife

Cannings, Syd
Canadian Wildlife Service
syd.cannings@canada.ca

Permit Number: 500721
Region: IN, GW
Species Studied: Hudsonian godwit, whimbrel
Location: Outer Mackenzie Delta

Status of Hudsonian godwit and whimbrel in the Mackenzie Delta and Yukon North Slope
This work was not fully funded, so no work took place in 2019 and no work is planned for 2020.

Carriere, Suzanne
Environment and Natural Resources
suzanne_carriere@gov.nt.ca

Permit Number: 500335
Region: All NWT
Species Studied: Hare and small mammals
Location: All NWT

Northwest Territories small mammal survey and hare survey
Small mammals and hare play an important role in both arctic and boreal ecosystems because many other animals and plants depend on them to stay alive. Small mammals and hare are a major food source for foxes, marten, raptors, lynx, and other carnivores. The populations of small mammals and hares fluctuate in a cycle, which is reflected in similar fluctuations in the populations of their predators. Scientists can predict the population trends of economically important furbearing animals by tracking the populations of small mammals and hares that they eat, and by monitoring predator/prey relationships. This on-going project includes two surveys that take place in the NWT. One is the Small Mammal Survey, which monitors changes in small mammal populations across five ecological zones. The other is the Hare Survey, which monitors changes in hare populations across three forest zones and one tundra zone. These surveys are unique in Canada, and record natural fluctuations in many species of small mammals and hare over a large geographical scale. This project supports impact assessments and the detection of wildlife diseases, and also helps trappers predict the number of furbearing animals. It is linked to the furbearer program, and hence to the traditional economy. These surveys also serve as an early warning system for hantavirus detection, and help researchers who are studying contaminants and diseases. Finally, the surveys help researchers distinguish between natural and human-caused disturbances and variations. They could be expanded to other communities, especially through community-based monitoring initiatives. The survey results are provided to the communities annually through an information poster, or upon request.

Carter, Laurence
McGill University
laurence.carter@mail.mcgill.ca

Permit Number: 500740
Species Studied: Caribou, muskox

Region: IN, GW

Location: Yukon North Slope including Ivvavik National Park, and the northern foothills of the Richardson Mountains.

Muskox resource selection and interactions with caribou in the Yukon North Slope

The goals of this project are to study muskox and caribou, to see whether they use the same areas, and to see if they compete with one another. The research team is still analyzing the information they collected during the 2019 field season. Early results indicate that muskox and caribou share the same areas mostly during the spring and summer seasons. The research team is studying where the muskox and caribou go and what resources they use in their environments. For example, they are studying where the muskox and caribou go to eat, what they are eating, and where they go to escape insects. The researchers will use this information to study how often caribou and muskox encounter one other on the land.

Catling, Paul
170 Sanford Avenue
brenda.kostiuk@gmail.com

Permit Number: 500732
Region: SA, IN, GW

Species Studied: Vascular plants, insects, snails, leeches
Location: Tulít'a, Inuvik, and Fort McPherson areas.

Investigation of arthropods, plants and snail distributions in the NWT

The overall goal of this project was to study where different types of 'arthropods', plants, and snails are found in the NWT. Arthropods are a type of animal that includes insects, spiders, and crabs. To meet this project goal, the researchers carried out many different tasks. They recorded information about five land-based snails and three species of leeches in the Tulít'a area. While they were in Tulít'a, they also helped host a community event with Parks Canada about the plants found in Nááts'ihch'oh National Park Reserve. The researchers found some plants and butterflies that live in Nááts'ihch'oh and the Nahanni National Park Reserve that were not known to scientists before. The researchers took samples from 50 plants in the Richardson Mountains along the Dempster Highway, and found several species that were new to the southern Richardson Mountains. In the Inuvik and Fort McPherson areas, the researchers studied how Alaskan wild rhubarb is pollinated. They collected 60 insects that were pollinating these plants, and found that most were hoverflies. The researchers also collected 100 plants along the Inuvik-Tuktoyaktuk Highway and found a variety of interesting plants that may be a relic of ancient Pleistocene grasslands. Some of the plants that were found in the area are separated from a more continuous distribution of the same plants several hundred kilometres to the south, while other plants were recorded for the first time in the Arctic. This project increased knowledge about the arctic plants of the NWT.

Croft, Bruno
Environment and Natural Resources
bruno_croft@gov.nt.ca

Permit Number: 500576
Region: NS

Species Studied: Barren-ground caribou
Location: Délı̨nę, south of Great Bear Lake, Keller Lake, and Grandin Lake, and all areas between the communities of Behchokǫ̀, Whatì, Gamètì, Wekweètì, Dettah, and Łutselk'e. Also the area between Great Slave Lake and the Snap Lake and Kennady Lake Mines.

Monitoring of the Bathurst, Bluenose-East and Beverly caribou herds

Summary of work was not provided at the time of publication.

Davison, Tracy
Environment and Natural Resources
tracy_davison@gov.nt.ca

Permit Number: 500584
Region: IN, GW
Species Studied: Barren-ground caribou
Location: In the range of the Tuktoyaktuk Peninsula, Cape Bathurst, and Bluenose-West caribou herds.

Collaring, monitoring and population estimates of Tuktoyaktuk Peninsula, Cape Bathurst, and Bluenose-West barren-ground caribou

The goal of this research project was to estimate the population of the Tuktoyaktuk, Cape Bathurst, and Bluenose-West caribou herds in the NWT. In 2018, the research team surveyed these herds after calving, and took air photos to help estimate their populations. In order to know where to look for the caribou, the researchers put collars on 103 caribou in the three herds in March and April of 2018. The researchers used the air photos they took to calculate a population estimate for each herd, along with a range (a minimum and maximum population) that is likely to include the true population of caribou. The population estimate for the Tuktoyaktuk Peninsula herd was 1,499 non-calf caribou, although the actual population may be between 873 and 2,125 caribou. The population estimate for the Bluenose-West herd was 21,011 non-calf caribou, although the actual population may be between 16,409 and 25,613 caribou. The population estimate for the Cape Bathurst herd was 4,521 caribou, although the actual population may be between 4,446 and 4,596 caribou. The estimate for the Cape Bathurst herd may be higher than the true number of caribou, however, because a lot of the collared caribou in this herd were solitary and not grouped together.

Desmarais, Danielle
University of Toronto
danielle.desmarais@utoronto.ca

Permit Number: 500714
Region:
Species Studied:
Location:

The archaeology of Inuvialuit skin clothing production in the past

Summary of work was not provided at the time of publication.

Elkin, Brett
Environmnent and Natural Resources
brett_elkin@gov.nt.ca

Permit Number: 500481
Region: All NWT
Species Studied: Wildlife
Location: All NWT

Wildlife health, condition, stress and genetic monitoring

Summary of work was not provided at the time of publication

Fontaine, Alain
EDI Environmental Dynamics Inc.
afontaine@edynamics.com

Permit Number: 500651
Species Studied: Thinhorn sheep, mountain goat

Region: IN, GW

Location: Areas adjacent to the Macmillan pass region of the Yukon.

Macmillan Pass Project - Aerial early-winter sheep and goat survey

The goal of this research project was to see if there were any sheep or goats in the Macmillan Pass region of the Yukon and the adjacent areas of the NWT. The research team surveyed the alpine and subalpine zones in the area for sheep and goats, as well as any cliff or bluff areas. The researchers did not find any thinhorn sheep or mountain goats over the course of the survey, including in any key sheep and goat areas that had been identified by Environment Yukon. They also didn't find any sheep or goat tracks during the survey. The researchers studied the key sheep and goat areas to see if they were suitable to support sheep or goats over the winter. They checked for snowfall accumulation, whether there were good areas for the animals to escape predators, and whether there was enough food for the animals to eat. Except for the northern-most ridgeline in one key sheep area, the researchers found that sheep and goats could not survive over winter in any of the key areas. Specifically, the combination of deep snow and limited availability of suitable food means that these areas cannot support sheep and goats through a typical winter. Furthermore, large parts of the key goat areas are low elevation hills and ridges without 'escape terrain' that the animals can use to escape from predators. This means that these key areas are entirely unsuitable for sheep or goats in any season.

Fronczak, David
U.S. Fish and Wildlife Service
dave_fronczak@fws.gov

Permit Number: 500753

Species Studied: Waterfowl

Region:

Location: Mackenzie River and Mills Lake.

Western Canada cooperative preseason waterfowl banding program - Mills Lake Station, NWT

The goal of this on-going research project is to put leg bands on waterfowl in order to study these birds and their movements as they migrate. In 2019, water levels were extremely low compared to previous years, which meant that the research team could only work along the Mackenzie River banks and within a small area at the lower end of Mills Lake. They did not catch a single duck to band. There were many waterfowl around, including American wigeon and northern shoveler, but these were not the types of birds that the researchers wanted to band. The weather was cooler in August, with mid-day temperatures averaging 19°C and night-time temperatures averaging 10°C. It rained more and was windier throughout August than in previous years, which made catching the ducks difficult. Approximately 2,500 pounds of whole corn were used to bait up to seven trap sites each day. The researchers speculated that their inability to catch a single duck was due to the large number of ducks that don't eat grain, competition with natural foods for waterfowl, and the low water conditions.

Hache, Samuel
Canadian Wildlife Service
samuel.hache@canada.ca

Permit Number: 500717

Species Studied: Vultures, hawks, grouse, doves, cuckoos, owls, nighthawks, swifts, hummingbirds, kingfishers, woodpeckers, passerines

Region: SS, DC

Location: Edéhzhíe National Wildlife Area

Edéhzhie landbird monitoring program

Summary of work was not provided at the time of publication.

Hache, Samuel
Canadian Wildlife Service
samuel.hache@canada.ca

Permit Number: 500745
Region: NS
Species Studied: Blackpoll warbler, common nighthawk
Location: The boreal forest within or near Yellowknife.

Understanding the migratory connectivity and genetic structure of forest birds breeding in the boreal forest

The goal of this research project is to study blackpoll warblers and common nighthawks, which are birds that breed in the boreal forest. The researchers caught four adult male common nighthawks and took samples of their blood and feathers. The information from the blood and feather samples was sent to a researcher at the University of Alberta. The researchers also caught six blackpoll warblers in the Yellowknife area and placed 'light-level geolocators' on them. These light-level geolocators are tiny instruments that measure the amount of light; this information can be used to figure out where the birds have traveled. The researchers will need to catch the birds wearing the geolocators again next year in order to retrieve the light data they collected. Once the geolocators are recovered, the location of each bird will be calculated for every day that the instrument was recording.
at the time of publication.

Kelly, Allicia
Environment and Natural Resources
allicia_kelly@gov.nt.ca

Permit Number: 500680
Region:
Species Studied:
Location:

Fort Providence moose population survey

Summary of work was not provided at the time of publication.

Langlois, Karla
Tetra Tech Canada Inc.
karla.langlois@tetratech.com

Permit Number: 500708
Region: DC
Species Studied: Woodland caribou, collared pika, grizzly bear, black bear, raptors
Location: Along and near the proposed Prairie Creek Mine road corridor from the Prairie Creek Mine to Highway 7.

Environmental baseline studies for the proposed Prairie Creek Mine all-season access road

The goal of this research project is to study the state of wildlife before the proposed Prairie Creek Mine is developed, so any future changes to the wildlife in the area can be noted. The research team surveyed caribou using remote cameras, and also by plane in the winter. During the winter aerial survey in late March 2019, air temperatures were unseasonably warm (between -2°C and +15°C) and the snow cover had started to melt. No caribou were seen in the region during the aerial survey, which covered more than 4,000 km^2. In June, the researchers put 46 remote cameras along the 5 km length of the proposed all-season road, and also within a 5 km buffer surrounding it. These cameras will take pictures of passing

wildlife, and the research team will collect the cameras and photos next year. In addition to caribou, the researchers also studied collared pika, bear dens, and raptors. They surveyed a total of 41 talus (rocky) patches within 300 m of the proposed all-season access road because these areas were more likely to have pika. The researchers found fresh haypiles left by collared pika in 21 of the talus patches. In late October they checked for bear dens and raptor nests within 800 m of the proposed road, and within 1.5 km of a proposed blast area. They found one active grizzly bear den and one unoccupied raptor nest within 200 m of the proposed road. Road clearing and construction did not proceed.

Larter, Nic
Environment and Natural Resources
nic_larter@gov.nt.ca

Permit Number: 500660
Region: DC
Species Studied: Boreal woodland caribou
Location: A 90,000 km^2 study area in the Dehcho Region.

Deployment of GPS collars on boreal caribou throughout the Dehcho

The purpose of this research project is to put collars on caribou in the Dehcho in order to study their movements. In 2019, extremely low temperatures limited the amount of time that work could be done safely in the field. Fifteen of the 17 collars were placed on caribou; two collars still need to be placed on females. The project team did meet two goals from the Dehcho Boreal Caribou Study that was established in March 2004. The first goal is that a minimum of 30 females had active collars during the May 2019 calving period, and the second goal is that a minimum of 10 males had active collars in 2019.

Larter, Nic
Environment and Natural Resources
nic_larter@gov.nt.ca

Permit Number: 500661
Region: DC
Species Studied: Boreal woodland caribou
Location: North from Wrigley to the Sahtú border, and east from the Mackenzie River to 122ºW longitude.

Deployment of GPS collars on boreal caribou in Wrigley and North Dehcho

The purpose of this research project is to study caribou movements in the Wrigley area and the north Dehcho. The research team flew in a fixed-wing plane to survey the area and find caribou to place collars on. They located places where caribou had been present; however, many of these places were in areas where they could not safely capture caribou, or where only male caribou were present. After two days of searching they did capture one female caribou and place a collar on her. The warm weather and lack of snowfall for over two weeks made tracking conditions extremely challenging. As a result, the research team made the decision to postpone further collaring work until the winter of 2019/2020.

Lausen, Cori
Wildlife Conservation Society Canada
clausen@wcs.org

Permit Number: 500648
Region: SS
Species Studied: *Myotis* lucifugus (little brown myotis), *Myotis septentrionalis*, *Eptesicus fuscus*
Location: Little Buffalo Territorial Park

Using hibernation biology and bioenergetics of northern bats to assess risk of white-nose syndrome and prioritize conservation action

Little brown myotis bats can survive over the winter only in specific conditions; both their own health and other outside factors matter to their survival. The research team came up with a new way to predict where this species hibernates over the winter by including elevation, latitude, and the number of frost-free days that the area has each year. They found that their new method works better than the old method that was used to predict where bats hibernate. They measured the climates where the bats hibernate, and also studied how the bats use the energy from their food to stay alive. Previously, it was thought that these bats could not hibernate in northern locations such as the South Slave region and Nahanni National Park; we know now that they do hibernate in these locations. The research team also found that, due to cooler hibernation conditions, a slower metabolism, and high levels of fat storage, bats that hibernate further north have more fat stores at the end of winter. This is the case even if the bats are affected by white-nose syndrome, which is a disease that is threatening bat populations. This suggests that there might be a higher survival rate for this disease in the far northern reaches of the bats' North American range. For this reason, bat hibernation areas in the NWT could be extremely important to help save bats from this disease.

Martin, Pam
Environment and Climate Change Canada
pamela.martin2@canada.ca

Permit Number: 500587
Region: NS

Species Studied: Herring gull
Location: The north shores of the North Arm of Great Slave Lake, from Baker Island west to Frank Channel.

Chemicals management plan national wildlife monitoring program - Great Slave Lake

The goal of this research project is to study herring gull eggs from across Canada to check for contaminants. In the NWT, eggs are collected from Great Slave Lake. The contaminant levels in these eggs reflect the contamination in the lake and the surrounding area. No eggs were collected in 2018 due to complications in securing local assistance. However, eggs that were collected from Great Slave Lake between 2008 and 2017 had levels of flame retardants (PBDEs, which are chemicals found in many consumer items including furniture and electronics) and perfluorinated compounds (PFSAs, which are chemicals found in many consumer items as well as oils and greases) that were similar to the levels in eggs collected from island colonies on the Atlantic and Pacific coasts of Canada. However, gull eggs from the Great Lakes, St. Lawrence, and prairie areas have much higher levels of contaminants. This annual monitoring program continued to track chemical compounds in all components of the environment, including wildlife, from all across Canada in 2019.

Obst, Joachim
obst100@gmail.com

Permit Number: 500716
Region: NS

Species Studied: All birds
Location: Daring Lake Tundra Ecosystem Research Station

Climate change impacts on the habitats, breeding densities and population trends of tundra birds at Daring Lake, Northwest Territories, and accumulation of mercury in loons

The goal of this research project is to study how climate change is affecting birds on the tundra. The research team surveyed breeding birds on foot from 4 to 28 June. They found that strong northeast winds in the spring had blown tens of thousands of Ross's geese from Nunavut to Daring Lake Tundra Ecosystem

Research Station and the tree line. A thousand Ross's geese were stranded at Daring Lake until mid-June. The researchers also counted nesting songbirds and shorebirds around the reseach station. Starting in 2013, the researchers found that the number of breeding songbirds has declined by about a third, and the areas used by shorebirds have declined by about two-thirds. Population declines have been observed in birds that breed on the open tundra and in meadows, such as the American pipit (55% decline), horned lark (50% decline), Lapland longspur (44% decline), least sandpiper (40% decline), and semipalmated plover (75% decline). These population declines are believed to be mostly caused by increasing periods of bad weather on the tundra during the breeding season. This results in fewer young birds hatching. In contrast, from 2000 to 2019, the populations of 'forest' songbirds such as white-crowned sparrows and yellow warblers increased by more than 500 percent. There are more forest songbirds because there are more tall shrubs growing in the area now, which provide more habitat for these species along shorelines and in wind-protected areas. However, persistent bad weather in 2019 meant that most of the songbirds at the research station did not reproduce.

O'Keefe, Harry
Dominion Diamond Mines ULC
harry.o'keefe@ddcorp.ca

Permit Number: 500636

Species Studied: Caribou, grizzly bear, wolf, wolverine, fox, Arctic ground squirrel, Arctic hare, upland breeding birds, raptors

Region: NS

Location: Ekati Diamond Mine

Wildlife effects monitoring program

The goals of this research project are to monitor wildlife around the Ekati Diamond Mine, and to see what effects the mine is having on the wildlife. In 2018, mine employees or research team members kept track of how many times they saw different wildlife. They saw caribou 205 times in 102 days, totaling 3,347 caribou. They saw grizzly bears 145 times in 80 days, totaling 210 grizzly bears. They saw wolves 79 times in 59 days, totaling 139 wolves. They saw foxes 138 times in 99 days, totaling 146 foxes. During a breeding bird survey, they saw 437 individuals from 28 different species of migratory birds, along with 76 other individual birds from various species. Over 13 days the research team made 15 observations of raptors; they saw a total of 23 individual raptors of five different species during this time. In addition to counting animals when they were seen around the mine, the research team observed caribou behaviour to see if they were startled or upset by the mine activities. They found that the caribou around the Ekati Diamond Mine spent the majority of their time either feeding or bedded. On average, caribou spent less than 5% of their time looking alert. Three Arctic hares and one ptarmigan were struck and killed by vehicles around the mine.

Panayi, Damian
Golder Associates Ltd.
dpanayi@golder.com

Permit Number: 500689

Species Studied: Migratory birds, boreal caribou, bison, moose, wolves, bears, wolverine

Region: NS

Location: The Tłı̨chǫ all-season road.

Tłı̨chǫ all-season road wildlife studies

The Government of the Northwest Territories Department of Infrastructure is planning to build a new all-season road in the Tłı̨chǫ region. The road will generally follow the Old Airport Road, a historic winter road that connects Whatì to Highway 3. The project team studied migratory birds and wildlife in the area

around the proposed road between March and October 2019; they wanted to identify species at risk within the project boundary. They installed 60 devices to record bird songs and ten remote wildlife cameras along the proposed road alignment. The bird song recorders were active during the month of June and recorded a total of 69 bird species, including four species at risk; the common nighthawk, evening grosbeak, olive-sided flycatcher, and rusty blackbird. Wood bison, gray wolf, and black bear were frequently photographed by the wildlife cameras, along with Canada lynx, red fox, wolverine, common porcupine, moose, and woodland caribou. Cameras also confirmed that the road is still used frequently by people hunting and collecting firewood, and by recreational off-road vehicles. The project team have prepared a Wildlife Management and Monitoring Plan, which includes ways that they will reduce the impact of the project on people and wildlife. The results of this study will help design a plan that will work.

Panayi, Damian
Golder Associates Ltd.
dpanayi@golder.com

Permit Number: 500758
Region: NS
Species Studied: Red-backed voles, deer mice, shrews
Location: The Giant Mine site.

Giant Mine small mammal sampling program
The goal of this research project is to support the closure of Giant Mine by monitoring small mammals such as mice and voles at the mine site. The research team collected 78 small mammals from ten survey transects within the study area. Around half of the mammals that they captured were deer mice. When they collected a small mammal, they also took samples of the plants and soil nearby. The small mammals, soil, and plant samples have been sent to a lab to measure the levels of metal they contain. These measurements will be used to guide remediation planning at the Giant Mine site.

Parker, Lori
Parks Canada
lori.parker@canada.ca

Permit Number: 500704
Region: SS
Species Studied: Wood bison
Location: Wood Buffalo National Park

WBNP wood bison population surveys (Slave River lowlands)
Summary of work was not provided at the time of publication.

Rausch, Jennie
Canadian Wildlife Service
jennie.rausch@canada.ca

Permit Number: 500730
Region: NS
Species Studied: Lesser yellowlegs
Location: Sites accessed by Highway 3 between the communities of Yellowknife and Behchokǫ̀.

Boreal shorebird monitoring program
Lesser yellowlegs are a type of shorebird that nests in boreal areas across North America. It has been identified as a species of concern because of a significant population decline across its range. The cause if this decline is not well understood, but the research team thinks it may be due to conditions at their wintering grounds or during their migration. In order to better understand the migratory routes and

wintering areas used by birds from the NWT, the researchers banded and put tracking tags on lesser yellowlegs near Yellowknife. The tracking tags are small devices that record a set number of GPS waypoints before uploading them to a satellite, where the GPS waypoints can be downloaded by researchers. The researchers captured and put leg bands on 15 lesser yellowlegs during June 2019, ten of which also received a tracking tag. The birds were captured using recordings of chick calls to lure them into a mist net. The location data will not be uploaded to the satellite until the tags have finished recording the GPS waypoints, so the researchers do not yet know where these birds have travelled. They are not planning to use any more tracking devices on lesser yellowlegs in 2020.

Reed, Eric
Canadian Wildlife Service
eric.reed@canada.ca

Permit Number: 500517
Region: IN, GW

Species Studied: Lesser snow geese, Pacific black brant
Location: Sik Sik Lake, Banks Island (75.38333 N, 125.06667 W).

Western Arctic snow goose management: Banding lesser snow geese in the western Canadian Arctic to monitor fall/winter distribution, survival and harvest rates

The goal of this research project is to use leg bands to study the annual migration of snow geese and other species of geese. The research team captured more than 2,500 geese to do this. Most of the geese that they captured were snow geese, although about 10 to 15% were Pacific black brants. The researchers banded almost all of the captured geese, but 106 individuals were recaptures and therefore already had leg bands from previous years. Of the 106 recaptures, 34 were black brants and 72 were snow geese. Most of the recaptured birds (90 of the 106 total birds) were originally banded on Banks Island between 2015 and 2017. Amongst the other recaptured snow geese, seven were originally banded in Alaska, two in Nunavut (one in Iqaluit and one at Johnson Point), and one in Russia. Amongst the 34 recaptured black brants, five were banded in Alaska and the other 29 were banded by this research team in 2017. One of the brants that they banded was a grey-bellied brant. A snow goose that was recaptured was banded as a gosling in 2007, meaning it was 11 years old. They also recaptured a black brant that was web-tagged as a gosling in 2006, meaning it was 12 years old. When the recaptures were calculated as a percentage of the total number of each type of goose that was captured, the researchers recaptured four times more black brant (12% of the black brants were recaptures) than snow geese (3% of the snow geese were recaptures).

Reed, Eric
Canadian Wildlife Service
eric.reed@canada.ca

Permit Number: 500718
Region: NS

Species Studied: Surf scoters, black scoters, white-winged scoters, greater scaup, lesser scaup, red-breasted merganser, long-tailed duck, all other waterfowl
Location: Two areas (each approximately 22 km^2) located north and south of the lodge that together included habitats ranging from boreal forest to subarctic tundra.

Integrating fixed-wing and helicopter surveys to improve detection and species identification of breeding scoters

The goals of this research project are to monitor ducks and other waterfowl in the boreal forest and taiga regions of Canada, and to see whether helicopters or fixed-wing planes are better suited to this purpose.

This was the third and final year of the project. During the helicopter surveys, the main species encountered were black scoters, surf scoters, white-winged scoters, long-tailed ducks, greater scaup, and lesser scaup. The researchers found a high density of waterfowl, and overall, their surveys have shown that the numbers of breeding scoters in the boreal and taiga regions of the southeastern NWT and northern Manitoba are much higher than the numbers in other regions of Canada (including Labrador, the Hudson Bay Lowlands of Ontario, and northern Quebec). In addition to helicopter surveys, the researchers also flew transects over their study areas using fixed-wing aircraft. They found that each type of aircraft has different advantages and disadvantages when doing waterfowl monitoring surveys. The research team is working to integrate information from both survey types in order to develop a useful and cost-effective monitoring program.

Singer, Claire
Environment and Natural Resources
claire_singer@gov.nt.ca

Permit Number: 500727
Region: NS
Species Studied: Bees, other arthropods
Location: Yellowknife and Daring Lake.

Bee monitoring in the Northwest Territories

The goals of this research project are to monitor bees around Yellowknife and Daring Lake, to see what species of bees are present, to estimate their populations, and to see if they are healthy. The research team used blue vane traps to do this, which are bottles with a blue plastic top that are baited to attract certain insects. The research team set three traps in Yellowknife, three on the 'edge' of Yellowknife, and three in outlying areas that were accessible by road. The specific locations where the traps were set included Parker Park, Rat Lake, Frame Lake near the Legislative Assembly, the sand pits, the Yellowknife Ski Club, the Folk on the Rocks site, Prelude East, Pontoon Lake, and Prelude Main. The traps were set for one week each month between May and September, but at the request of the Wildlife Care Committee, one additional trap was set near Niven Lake in July in order to monitor for disease. The traps contained food-grade propylene glycol, which preserved the bees so they could be studied later. The insects that were caught in the traps are still being processed and identified, but the researchers did find a type of bee that is very rarely collected in traps in one of the Daring Lake traps. This bee is known as *Osmia maritima*, and there were six females and three males collected. Males of this species have not been previously recorded or observed in the 'nearctic' (a huge area that includes most of North America).

Villeneuve, Carol-Anne
University of Montreal
carol-anne.villeneuve@umontreal.ca

Permit Number: 500733
Region: NS, IN, GW
Species Studied: Mosquitoes
Location: Yellowknife and Hendrickson Island.

Vector-borne pathogens transmitted by mosquitoes in the Canadian Arctic

The goal of this research project was to identify the diseases that are carried by mosquitoes in the Canadian Arctic. Over a seven day period, the research team caught 284 mosquitoes at Hendrickson Island and 1,158 mosquitoes in Yellowknife. The low number of mosquitoes captured at Hendrickson Island may be due to cold temperatures and windy days during the sampling period in early July. The research team has not yet identified the mosquito species that were captured, or the viruses that were present in the mosquitoes.

Selwyn Chihong Mining Ltd.

Permit Number: 500731

Species Studied: Songbirds, crepuscular birds, bats, sheep, goats, caribou, grizzly bears

Region: DC

Location: Nahanni Butte

Howards Pass access road proposed baseline programs

The goal of this research project was to study and record the wildlife in an area where a proposed road will be built. The purpose of this project is to track any changes in the wildlife that occur while the road is built. The data are currently being analyzed and final results should be available soon.

Glossary

Abiotic – Not living

Active layer -The area where the soil continually freezes and thaws above the permafrost

Adaptation - A process by which a living organism (human, animal or plant) changes to become better suited to a new environment. This generally on an evolutionary timescale however, in the human context, it may be over a short period.

Adipose - Of, relating to, or composed of animal fat; fatty

Aerial - In the air

Aeromagnetic survey - Surveys from aircraft that make use of the magnetic field caused by magnetized rocks in the Earth's crust to make estimates about underlying geology of a given area such as distribution of potential resources

Algae - Simple living aquatic single or multi celled plant organisms that contains chlorophyll

Algorithm - A procedure or formula for solving a problem

Alkali - A basic substance that can range in strength

Analytical - A detailed examination of the structure or some other parameter of a substance or thing

Anoxic - A situation where oxygen is present in very low amounts or not at all, common in water

Annual - Occurs every year

Anthropogenic - Caused by a human action

Anthropology - The study of the human beings including their origins, cultures, evolution

Aquatic - Of water

Aquatic Biota - All living organisms in the aquatic environment

Arable - Land fit to be cultivated

Archaeology - The study of past human life and culture by looking at remains and artifacts like tools

Archean - A period of geologic time from about 3.9 billion years to 2.5 billion years ago

Archival - Pertaining to a collection of documents, normal over long periods of time

Arsenic - A chemical element that is gray in color and that is highly poisonous with no taste

Artifact - A historical tool, weapon or other human-made object that can be studied

Asexual - An organism that reproduces without the aid of a partner and who passes on all of its genetic information

Atmosphere - The layers of gases that surround and protect the Earth

Attributed - To explain by indicating a cause

Avifauna - the birds of a particular region or period

Bacteria - A large and varied group of single-celled microorganisms

Baseline - A set of information and data serving as a basis for comparison into the future

Bathymetry - Underwater topography. Mapping the underwater contours of the bottoms of water bodies

Beaufort Gyre - The major ice and ocean current circulation of the Arctic Ocean

Benthos - The bottom of the ocean or body of water

Biochemistry - The study of chemical processes in living organisms

Biodiversity - Pertaining to the variety of species in an area

Biogenic - Produced by living organisms or biological processes

Biogeography – The study of the geographical distribution of organisms

Biomass - The total amount of all living material within a specific volume of the environment

Biomes - Distinct areas of the Earth that are common in climate conditions, life forms and physical features like the tundra or woodland

Biostratigraphy - Identification and differentiation of rocks based on the types of fossils they contain

Biotic - Having to do with living organisms

Boreal - Relating to the forest areas of the Northern Temperate Zone that are dominated by coniferous trees such as spruce, fir and pine

Brachiopods - Any of various marine invertebrates of the phylum Brachiopoda, having bivalve dorsal and ventral shells enclosing a pair of tentacled, armlike structures that are used to sweep minute food particles into the mouth. Also called *lampshell*.

Breccia - Rock composed of sharp-angled fragments embedded in a fine-grained matrix

Brunisol Soil - soil type that is associated with forest vegetation. It is usually poorly developed and immature

Carbon^{14} – A radioactive isotope of carbon used to date ancient rocks and artifacts

Carnivore - A flesh/meat eating animal

Characterized - To describe an object or idea

Chlorophyll A - A pigment in plants that give them their green color and which absorb energy from the sun. Plants use Chlorophyll to change carbon dioxide and water into food and oxygen

Classification - Organize into groups or categories

Climate – Typical weather patterns of a region over long time periods

Community - All organisms in a particular environment

Comprehend - Being able to understand

Comprehensive - Conveying or including everything or almost everything

Coniferous woodland - A wooded area that is dominated by evergreen trees

Conifers - A group of woody plant commonly known as evergreen trees such as pine, spruce or fir that bears cones

Connectivity - As something is able to connect or relate with another thing

Core - A part removed from the interior of a mass especially to determine the interior composition

Correlated - A mutual relation between two comparable things

Cretaceous - Of or belonging to the geologic time, system of rocks and sedimentary deposits of the third and last period of the Mesozoic Era, characterized by the development of flowering plants and ending with the sudden extinction of the dinosaurs and many other forms of life

Crustacean - any mainly aquatic arthropod usually having a segmented body and chitinous exoskeleton

Cryosols - Cryosols are characterized by frozen soil within 1 metre (39 inches) of the land surface and by waterlogging during periods of thaw. They often show disrupted soil layers, cracks, or patterned surface features such as frost mounds, caused by the physical actions of ice formation and melting. Cryosols may be either mineral soils or humus-rich materials

Cryosphere - frozen water in the form of snow, permanently frozen ground (permafrost), floating ice and glaciers

Cumulative - Objects or ideas that add together

Cyanobacteria - predominantly photosynthetic prokaryotic organisms containing a blue pigment in addition to chlorophyll; occur singly or in colonies in diverse habitats; important as phytoplankton

Deciduous – A plant that lose their leaves during one season, usually winter

Deducing – To draw a conclusion

Deformation - A measurable change in structure, normally for the worse

Degradation - To reduce something or to place something at a lower level

Delta – The land formed where a river deposited silt as it enters into a larger water body, classic example, the Mackenzie Delta

Dendrochronology - A system of dating wooden objects by studying the tree growth rings

Density - A quantity of mass per unit volume

Devonian - Of or belonging to the geologic time, system of rocks, or sedimentary deposits of the fourth period of the Paleozoic Era, characterized by the development of lobe-finned fishes, the appearance of amphibians and insects and the first forests

Discontinuous – Not continuing or linked

Diurnal - Relating to or occurring in a 24-hour period; daily. Occurring or active during the daytime rather than at night

Diversion - A changing of the direction an object is going

Ecology - The science that deals with how living organisms live in relation to each other and their environment

Ecological integrity - Ensuring the relationship in plant and animal communities remains healthy

Ecosystem – The organisms present in a defined area and how they interact with the non-living surrounding (the biotic and the abiotic)

Effluent - A pollutant that flows out from a main source, such as sewage or waste matter

Ekman Grab - A box core type of sediment sampling device.

ELC data - Ecological Land Classification data

Electrofishing - Using electricity to stun and kill fish, usually used during scientific scenarios

Electromagnetic - Magnetism that is caused by electricity

Emissions - A water product that is radiated outward or discharged from a source

Endocrine – 1) designating or of any gland producing one or more hormones 2) designating or of such a hormone

Endophyte - An organism, especially a fungus or microorganism, that lives inside a plant, in a parasitic or mutualistic relationship

Environment – An organism's physical surroundings

Epoch - A period of time during which something important developed or happened

Erosion - Group of natural processes (weathering, disintegration, abrasion, corrosion, transportation) where the Earth's surface is worn away and removed

Eskers - A long, narrow ridge of coarse gravel deposited by a stream flowing under a decaying glacial sheet of ice

Estuary - A place where coastal seawater comes into contact with the current of a freshwater stream

Eukaryote - any member of the *Eukarya*, a domain of organisms having cells each with a distinct nucleus within which the genetic material is contained. Eukaryotes include protoctists, fungi, plants and animals

Eutrophication – The enrichment of aquatic systems, promoting dense algal and plant growth in a body of water, depriving the water of oxygen and forcing change in species composition

Evaporites A sedimentary deposit that results from the evaporation of seawater

Evolution - A process where different species come into existence by differentiation and genetic mutations from common ancestors over a long period of time.

Excavated - Extracting or revealing something by removal of the surrounding earth

Fauna - Animal life of a particular region, environment, or geological period

Fault - A fracture in a rock along which the rocks move; the place of origination of seismic activity; types include: strike-slip and thrust

Fecundity - Ability to reproduce

Fen - Low, flat, swampy land; a bog or marsh

Flora - The plants of a particular region, environment or geological region

Fluvial - Pertaining to something's existence or growth around a stream or river

Fossil -Trace of an organism of a past age, embedded and preserved in the Earth's crust

Fry – Infant fish

Fungi - A kingdom of heterotrophic organisms that produce spores

Fyke - A long, bag-shaped fishing net held open by hoops

Gas hydrates (clathrates) – Crystalline water based solids physically resembling ice, in which small non polar molecules (typically gases) are trapped inside "cages" of hydrogen bonded water molecules

Gender - One's characteristics or traits determined socially as a result of one's sex

Genetic - Pertaining to an organism's traits or characters being linked to genes

Genera - A group of organisms that share common characteristics

Geochemistry - The science that deals with the chemical composition of and chemical changes in the solid matter of the Earth

Geochronological - The chronology of the earth's history as determined by geologic events and not by human history

Geomorphologic - Pertaining to the physical features of the Earth's surface

Glauconite - A greenish mineral of the mica group, a hydrous silicate of potassium, iron, aluminum, or magnesium

Gonad - a gland in which gametes (sex cells) are produced

Grams (g) - A unit of measurement for mass

Habitat - A place where organisms live

Hepatic – (Anatomy) of or relating to the liver; (Botany) *botany* of or relating to the liverworts

Heterogeneous - A situation where something is in a mixed composition

Holocene - The most recent 11,000 years of the Earth's history starting at the end of the last major ice age, which has been relatively warm

Hydraulic - Pertaining to movement caused by water

Hydroacoustic survey - An echo-sounding (SONAR) survey used for measuring such things as fish stocks, water velocity, etc.

Hydrocarbon – A molecule containing hydrogen and carbon, often petroleum, natural gas and coal

Hydrograph - A graph showing the water level, discharge, or other property of river volume with respect to time

Hydrology - Science dealing with the properties, distribution and circulation of water

Isotope - Atoms that have nuclei with the same number of protons (as the atomic number) but different numbers of neutrons

Igneous - A rock or mineral that solidified from molten or partly molten material, i.e. from magma; one of three rock types with metamorphic and sedimentary

Implement - To put into effect

Iron - A metallic element used for making tools and essential for all living organisms' survival

Jarosite - a yellow to brown secondary mineral consisting of basic hydrated sulphate of iron and potassium in masses or hexagonal crystals

Kimberlite – An igneous that forms in volcanic pipe, an indicator of diamond deposits

Larvae - A premature stage for an insect where it feeds before becoming a pupa

Latitude - A measurement of the from the equator to a given point on the Earth's surface in the north and south direction

Laurentide Ice Sheet - Principal glacial cover of North America during the Pleistocene Epoch (2.6 million – 11,700 years ago). At its maximum extent it spread as far south as latitude 37° N and covered an area of more than 5 million sq mi (13 million sq km). In some areas its thickness reached 8,000 – 10,000 ft (2,400 – 3,000 m) or more

Ligotrophic (oligotrophic) - The opposite of eutrophic. Waters having very low levels of primary productivity and (usually) low concentrations of nutrients; good, clear water quality

Limestone - A sedimentary rock that contains mostly calcium carbonate and can be formed by either inorganic or organic processes

Limnology - The scientific study of the life and phenomena of fresh water, especially lakes and ponds

Lithic - Of, like, or made of stone. Archaeological artifacts made of stone

Meristic - Having or composed of segments; segmented

Mesic - Of, characterized by, or adapted to a moderately moist habitat

Metabolism - The chemical processes occurring within a living cell or organism that are necessary for the maintenance of life. In metabolism some substances are broken down to yield energy for vital processes while other substances, necessary for life, are synthesized

Metamorphic rock - Any rock derived from pre-existing rocks by changes in response to environmental factors such as temperature and pressure over a long period of time; one of three types of rocks with igneous and sedimentary

Methane - The simplest hydrocarbon that is the main ingredient in natural gas (CH_4)

Microclimate - The climate of a small area that is different due to changes in geography

Microorganisms - Organisms that must be viewed under a microscope, such as bacteria or a virus

Migration - The long range movement of a group of animals based on the seasons

Molecular analysis - A detailed look at the chemical structure and properties of a molecule

Moraine - A mound of rock debris carried and deposited by a glacier

Multicellular – Composed of more than one cell

Nutrient – Any chemical that an organism removes from the environment to aid with growth and development; common nutrients include nitrogen and phosphorus

Otolith – A part of a fish's inner ear, often used to determine the age fish

Organic - Material pertaining to plants or animals

Outcrop - A portion of bedrock or other stratum protruding through the soil level

Overlie - Sedimentary or volcanic rock that lies on top of older rock

Paleoecological - A relationship or study of ancient organisms and how they related to their ancient environment

Paleoenvironmental - An environment that existed in the past

Parr - a juvenile fish

Parameter - One set of measurable factors, such as the temperature and pressure that define a system and determine its behavior and are varied in an experiment

Pelagic - Relating to or living in or on oceanic waters. The pelagic zone of the ocean begins at the low tide mark and includes the entire oceanic water column

Permafrost – The permanently frozen layer of soil that characterizes the Arctic's ground; there are two various types: continuous and discontinuous

Pertinent – An object, idea or concept that is relevant to the topic

Phylogeography - the study of the historical processes that may be responsible for the contemporary geographic distributions of individuals

Phylum – (Biology) a major taxonomic division of living organisms that contain one or more classes. An example is the phylum *Arthropoda* (insects, crustaceans, arachnids, etc., and myriapods)

Physiological - Pertaining to the physical structures and functions of living organisms

Phytoplankton - A group of plant-like plankton that all sea animals depend on either directly or indirectly

Pingo – A large frozen mound covered with vegetation in permafrost areas

Pleistocene - An age of notable ice ages and development of humans between 2,000,000 and 10,000 years ago

Postglacial - Relating to or occurring during the time following a glacial period

ppm – An abbreviation of parts per million

Precipitation – Water (in the form of rain, snow hail, etc.) falling from the atmosphere

Prokaryote - An organism of the kingdom Monera (or Prokaryotae), comprising the bacteria and cyanobacteria, characterized by the absence of a distinct, membrane-bound nucleus or membrane-bound organelles, and by DNA that is not organized into chromosomes. Also called *moneran*

Qualitative – A complete detailed descriptions usually taken from a small sample that allows for distinctions to be drawn from the data

Quantitative - Use of large amounts of data where statistics can be applied to interpret the data

Quaternary - Of or belonging to the geologic time, system of rocks, or sedimentary deposits of the second period of the Cenozoic Era, from the end of the Tertiary Period through the present, characterized by the appearance and development of humans and including the Pleistocene and Holocene epochs

Qiviuq - The soft downy undercoat of muskoxen

Radiocarbon dating - The determination of the approximate age of an ancient object, such as an archaeological specimen, by measuring the amount of carbon^{14} it contains

Raptor - A bird of prey such as an eagle, falcon or osprey

Regolith - The layer of loose rock resting on bedrock, constituting the surface of most land. Also called *mantle rock*

Regosol - a type of azonal soil consisting of unconsolidated material derived from freshly deposited alluvium or sands

Remote Sensing – A technique used to study locations using technology that does not require the researcher to be in the field

Revitalization - To give new life or vitality to something

Riffle – a) A rocky shoal or sandbar lying just below the surface of a waterway b) A stretch of choppy water caused by such a shoal or sandbar; a rapid

Satellite imagery - Computer images generated by a satellite which allow researchers to look at a specific area and monitor surface features such as vegetation

Sediment - Solid fragment material that occurs from the weathering of rocks. In water it is material that has settled from a state of suspension

Sedimentary rock - Rock derived from loose particles that have accumulated over time

Sedimentation - The process where small particles are moved and deposited to accumulate into layers

Seine - A large fishing net made to hang vertically in the water by weights at the lower edge and floats at the top

Seismic - Pertaining to vibrations in the Earth, both natural and induced

Shovel testing - A simple test where a sample of ground is taken by use of a shovel and examined

Species - A group of organisms that share common characteristics that group them together and also distinguish them from others

Stone flakes/chards - debris left over from a rock while making tools

Stratified - A system that is set up in layers or strata

Stratigraphic - Formation of rock where different layers can be picked out based on type and age of the rock

Subsidence - The shifting of the Earth's surface downwards (compared normally to sea-level)

Succession - A progressive change in the biological community as a result of a response from species to the changing environment

Surficial - Pertaining to something that is on the surface

Suspension - A situation where the medium is able to support the weight of the particles trapped inside it, example: silt in a river.

Symbioses – An interaction between two or more organisms that usually benefits both

Sympatric - Occupying the same or overlapping geographic areas without interbreeding. Used of populations of closely related species

Systematic - Done according to a plan

Taxonomy - The classification of organisms in an ordered system that indicates natural relationships

Thermokarst - Sinking holes, caves and underground drainage that are produced in regions with permafrost

from melting of ground ice and settling of the remaining ground

Theodolite - a surveying instrument for measuring vertical and horizontal angles. Also called (in the US and Canada) ***transit***

Thermocline - Layer in a large body of water that sharply separates regions differing in temperature. An abrupt temperature gradient in a lake

Topography - A description of the surface of a given area

Trace metals - A metal that is not essential in the sample but is found in small quantities

Transect - An imaginary line across a surface where observations are made

Tributary - A stream or river which feeds into a larger body of water

Turbid - Stirred up material suspended in a medium leaving it unclear and opaque

Ungulate - Hoofed animals

Velocity - Rate of change of position; quickness of motion

Volatile - Unstable; a substance that easily vaporizes

Watershed - A region draining into a river, river system, or other body of water

Weather – Daily variable changes in temperature, precipitation, wind and other atmospheric conditions

Zooplankton - Microscopic animal organisms floating in water

210-Pb Method - is used to determine the accumulation rate of sediments in lakes, oceans and other water bodies. It is used for over a period of 100 - 200 yea

Author Index

Social Sciences

Traditional Knowledge

Archaeology

Fisheries

Wildlife

Index

Government of Northwest Territories
Gouvernement des Territoires du Nord-Ouest

Canada

WWW.NWTRESEARCH.COM